GENERAL TOLLING REQUIREMENTS

PART 2 – DESIGN CRITERIA

OCTOBER 2025



FDOT

FLORIDA'S TURNPIKE

200 Toll Site

200.1 Toll Site Categorization

Toll sites are categorized as follows:

(1) **TEB Site:** Toll site which includes a TEB that houses electronic equipment associated with toll collection from one or more toll gantries.

(2) **RTC Site:** Toll site without a TEB, including infrastructure for RTC(s) to support toll collection from one or more toll gantries.

See ***GTR 120.2*** for use of RTC toll sites.

200.1 Toll Site

A typical component set for toll sites with a TEB includes the site, toll equipment building, and toll gantry subcomponents. A typical component set for toll sites with a RTC includes the site and toll gantry subcomponents.

The RTC is furnished and installed by the Department's TEC and therefore does not require its own subcomponent plans. The infrastructure for the RTC is incorporated into the toll site subcomponent.

200.1.1 Toll Site Subcomponents

A typical toll site includes toll pavement, roadside elements (barrier, guardrail etc.), sidewalk, equipment foundation slabs, access driveway, and electrical infrastructure for the site including connections between toll site, gantry and the TEB or RTC(s).

Toll site subcomponent set includes the following disciplines:

(1) Civil

(2) Structural

(3) Geotechnical

(4) Electrical

200.1.2 Toll Equipment Building

TEB subcomponent set includes the following disciplines:

(1) Architectural

(2) Structural

(3) Mechanical with associated plumbing

(4) Electrical

200.1.3 Toll Gantry

Toll gantry subcomponent set includes the following disciplines:

(1) Structural

(2) Geotechnical

(3) Electrical

201 Design Criteria

201.1 Toll Site Design Requirements

(1) Provide a complete toll site design that conforms to the ***GTR*** written criteria and criteria provided in the exhibits. Project-specific adaptation of each exhibit's criteria is required for a complete design.

(2) Each toll site must be designed for all interim and ultimate roadway configurations for the following:

  (a) Lane widths, shoulders, buffers, profiles, and cross sections within the toll loop pavement area.

  (b) Gantry mounted toll equipment layout(s).

(3) The ***GTR*** must not be referenced in plan notes or specification language. Plan notes must not conflict with or duplicate standard language in ***Standard Plans*** or ***Standard Specifications***.

(4) The ***GTR*** alone does not contain all requirements for a toll site. See ***GTR 102.1*** for additional information resources.

(5) Coordinate with Roadway Design to confirm toll site environmental impacts are included appropriately in the project environmental assessments at each Phase submittal.

201.2 UL Requirements

Infrastructure used at a toll site must be listed by UL or otherwise approved by the United States Department of Labor, under the requirements of ***29 CFR 1910.7***.

202 Toll Siting

202.1 Introduction

Many critical elements must be evaluated to identify a prospective toll site location that satisfies the design criteria as described herein. Given the numerous elements to consider, a detailed investigation is required for the selection of the proposed site. This study is documented in the Toll Siting Technical Memorandum (TSTM).

202.2 PD&E Toll Siting

During alternatives development, as part of the PD&E, a sketch level toll site must be included in each alternative. Sketch level toll sites must apply the appropriate toll site exhibit onto each concept alternative to confirm the basic geometry. The concept plans must have sufficient detail to show that the proposed location can support a viable toll site. They must also illustrate potential infrastructure conflicts that must be mitigated.

Perform the following for sketch level toll site development:

(1) Assume a separate toll site for each toll gantry during alternatives development.

(2) Use a GTR TEB site as a sketch for alternatives development.

(3) Coordinate with Turnpike Tolls Design where a GTR TEB site layout is not feasible.

(4) Identify and include justification for any required GTR Deviations.

(5) Coordinate with Turnpike Tolls Design and Turnpike Tolls Maintenance for mainline gantry type.

A preliminary TSTM must be prepared for the preferred alternative in accordance with ***GTR 202.3***.

202.3 Toll Siting Technical Memorandum

(1) Provide an evaluation of each specific toll site compared to each of the siting requirements for all interim and ultimate conditions based on the TSTM template identified in ***GTR 111***. Summarize the findings of the site analysis and provide recommendations regarding the acceptability of each site and why other sites were not selected. Include the station and milepost values of each recommended toll site location and Turnpike mile marker (MM) values for Turnpike projects.

(2) Identify the probable source for primary power (point of presence) and provide a figure showing the routing to the recommended toll site.

(3) Describe the urban/rural classification and commercial/residential land use around the proposed toll sites. Provide a figure showing the aerial view of the toll

site location with the 200-foot radius and the 500-foot radius surrounding the proposed toll site envelope. These circled areas identify criteria as described in ***GTR 230.3*** and ***GTR 230.4*** respectively.

(4) Provide “to-scale” interim and ultimate Express Lane Diagrams for the corridor in projects that have existing and / or new express lanes.

(5) Include an analysis of the impacts of correcting any substandard conditions at each recommended site, and if correcting the impact is not feasible, then identify the deviations needed for each site. See ***GTR 110*** for details regarding the request for GTR Deviations.

(6) Include the analysis of criteria other than those set forth in the ***GTR*** for locating toll sites. Examples include criteria associated with ponds, environmental permitting, roadway, suitability of soils for foundations, maintenance of traffic constructability, right-of-way constraints, utility constraints (high pressure gas transmission lines, electric transmission systems), Federal Aviation Administration requirements, and availability of communications to the site.

(7) Analyze each toll site design to identify possible maneuvers that may be available to vehicles attempting to avoid toll payment. Provide methods to discourage evasive maneuvers, such as earth berms, landscape, fencing, bollards, barrier, and/or guardrail.

(8) The final TSTM must be signed and sealed.

(9) The toll site location(s) in the final TSTM must be incorporated into the construction documents. A toll site re-analysis is required for any revised site locations. Request approval from the Turnpike Design Engineer if toll site relocation is needed after the final TSTM.

Modification for Non-Conventional Projects:
Replace Item (9) above with the following: (9) During the ATC process, revise the RFP TSTM to include any ATC modifications that directly or indirectly impact existing or proposed toll sites. A revised TSTM is not required if toll sites are not impacted through the ATC process. (10) After notice to proceed: (a) Sign and seal TSTM revisions previously approved during the ATC modifications process. (b) Request approval from the Turnpike Design Engineer if toll site relocation is needed. (11) The toll site location(s) in the RFP including all approved ATC modifications must be incorporated into the construction documents.

210 Technical Special Provisions

Turnpike Tolls Design has coordinated with FDOT Office of Program Management (Specifications and Estimates) regarding the approach related to the tolls facilities TSP(s). The ***Standard Specifications*** do not address all requirements, components, and systems associated with toll sites. Therefore, specific, individual TSPs / TSP sections are required for toll facilities.

210.1 General Requirements

The TSPs for toll site work discussed in this section address specific needs, components, and systems required for toll sites. The final, signed and sealed TSPs must meet the criteria set forth in the ***GTR***.

TSPs that are applicable to both TEB and RTC Tolls Sites are included in ***GTR Part 2,*** appendices as follows:

(1) For projects that include both TEB and RTC toll sites, ***Appendix 1***, ***Appendix 2***, and ***Appendix 3*** specifications are required.

(2) For projects with only toll sites with TEB ***Appendix 1*** and ***Appendix 2*** specifications are required.

(3) For projects with only RTC toll sites ***Appendix 1*** and ***Appendix 3*** specifications are required.

(4) The TSP and TSP sections for products used in toll site construction are classified into one of the following three levels:

(a) **Level 1:** The TSP section describes products based on performance and does not list manufacturers.

(b) **Level 2:** The TSPs or TSP sections identified as Level 2 include complex products or equipment (not easily defined, has many parts or components, or performance is not easily described, etc.). The TSPs or TSP sections is both prescriptive (includes manufacturer's names) and performance based which must include three or more manufacturers with an "or approved equal" statement. Two manufacturers are permitted for products or equipment that are not readily available.

(c) **Level 3**: The TSPs or TSP sections identified as Level 3 include sole sourced products that are required. The TSPs or TSP sections include specific products or equipment. The AOR/EOR must obtain approval for each Level 3 specification per ***FDM 110.4.1***.

210.2 Development of AASHTO Formatted Technical Special Provisions for All Toll Sites

The AASHTO formatted TSPs in ***Appendix 1*** for all toll sites (TEB and RTC) typically include:

(1) Fiber Reinforced Concrete for Toll Loop Pavement

(2) Toll Site Foundations and Equipment Slabs

(3) Bollards (Permanent / Removable)

(4) Accessible Gantry Gear Boxes

(5) Toll Gantries (Non-Accessible / Accessible)

(6) Cable Trays for Toll Gantries

(7) Surface Raceways and Wire Troughs at Toll Gantries

210.3 TSP Sections Development for TEB Sites

(1) The TSP for TEB includes multiple sections for toll site construction.

(2) The TSP sections in ***Appendix 2*** must meet the following criteria:

  (a) The TSP sections must follow the CSI Masterformat®/AIA MASTERSPEC® format.

  (b) A cover and table of contents must be provided for the toll facility's TSP package.

(3) Guidance for AIA Format Technical Special Provision Sections in ***GTR Part 2, Appendix 2***:

  (a) Some TSP sections include guidance for usage in hidden text.

  (b) Contains criteria for construction of toll sites. The EOR and the AOR must include all necessary project specific TSP sections in the contract documents. TSP sections must be modified to meet current code requirements prior to signing, sealing or releasing for construction.

  (c) See ***GTR 307*** for additional requirements.

210.4 Technical Special Provisions for Roadside Tolling Cabinet Sites

The AASHTO formatted TSPs in ***Appendix 3*** for RTC toll sites typically include:

(1) Acceptance Procedures for Toll Facilities at RTC Toll Sites

(2) Dry Well and Accessories at RTC Toll Sites

(3) Fire Extinguishers and Accessories at RTC Toll Sites

(4) General Requirements for Toll Facilities Electrical Infrastructure at RTC Toll Sites

(5) Low Voltage Electrical Cables and Power Conductors at RTC Toll Sites

(6) Grounding and Bonding for Electrical Systems at RTC Toll Sites

(7) Hangers and Supports for Electrical Systems at RTC Toll Sites

(8) Identification For Electrical Systems at RTC Toll Sites

(9) Lightning Protection System at RTC Toll Sites

(10) Emergency Generator at RTC Toll Sites

(11) Electricity Metering and Utility Service Entrance at RTC Toll Sites

(12) Panelboards at RTC Toll Sites

(13) Wiring Devices at RTC Toll Sites

(14) Automatic Transfer Switch at RTC Toll Sites

(15) Surge-Protective Devices, 1kv or Less at RTC Toll Sites

(16) Lighting Fixtures and Lamps at RTC Toll Sites

(17) Static Uninterruptible Power Supply Systems for Outdoor Communication Cabinets at RTC Toll Sites

(18) SCADA System at RTC Toll Sites

(19) Outdoor Communication Cabinet at RTC Toll Sites

211 Modified Special Provision

Modified Special Provisions (MSPs) are required to address the specific needs of toll sites. The latest updated standard specification language must be requested from Specifications and Estimates Office for each section to be modified.

Sample MSPs have been developed for various standard specification sections. These samples are available upon request from Turnpike Tolls Design and must be modified to meet the latest standard specification language and project-specific requirements prior to signing, sealing or releasing for construction.

211.1 Modified Special Provisions for Toll Site Construction

MSPs required for projects with proposed toll sites or impacts to existing toll site infrastructure include the following as applicable:

(1) Toll Site Construction Scheduling

(2) Toll Site Construction Maintenance of Traffic

(3) Express Lanes Construction Scheduling

(4) Express Lanes Maintenance of Traffic

(5) Express lanes “End-to-End Testing”

211.2 Modified Special Provisions for Projects with Toll Sites within Project Limits

MSPs are required for projects with toll sites within project limits where no work is anticipated at the existing toll sites. Include the following MSPs as applicable for MOT within toll site limits:

(1) Toll Site Construction Scheduling

(2) Toll Site Construction Maintenance of Traffic

220 Toll Site Roadway

220.1 General Requirements

(1) Each toll site must be designed to prevent toll avoidance maneuvers as described in ***GTR 202.3*** and the final TSTM.

(2) Roadway cross sections must be provided at the beginning and end of the toll loop pavement area and at the centerline of the gantry.

220.2 Roadway Requirements for Toll Sites

(1) The preferred location of the toll gantry is on a tangent segment of roadway. If a tangent roadway section is not feasible, then the toll gantry can be located on a curve with a radius greater than or equal to 3,000 feet as measured from edge of toll loop pavement area closest to center of curve.

(2) The centerline of the gantry must be perpendicular to the final striping of the toll loop pavement area for tangent alignments.

(3) The centerline of the gantry must be radial to the final striping of the toll loop pavement area for curved alignments.

(4) Toll loop pavement area may be located within sag and crest vertical curves only when the vertical grade is at least 0.3% at any point within the toll loop pavement area.

(5) The lane, shoulder, and buffer widths must be constant in the toll loop pavement area.

(6) At the toll loop pavement area, a minimum 10 foot separation is required between equipped lanes/shoulders and any adjacent non-tolled lanes as shown in Schemes 3 and 4 of ***Exhibit 220.2-1***, except where express lane buffers are used.

(7) The toll loop pavement is prohibited from being located within super-elevation transitions or any cross-slope transition areas, except for shoulder rocking.

(8) Toll sites must not be located within queuing areas as identified by the design year traffic analysis.

(9) Toll sites must not be located within areas where weaving, merging or diverging traffic is likely.

(10) In a merge area, the gantry centerline must be located a minimum of 200 feet upstream of the first lane drop sign or 50 feet beyond the end of the merge area.

(11) The gantry centerline must be located a minimum of 200 feet from nearby sign structures, bridges, or toll plaza canopies. Considerations that would increase this minimum distance include the following:

(a) The taper of the maintenance pull-off area must tie into the shoulder a minimum of 25’ before bridges or similar roadside features.

(b) MOT for bridge/sign structure inspection and maintenance that may extend into the toll site.

(c) MOT for bridge widening and/or replacements that may extend into the toll site.

(12) The difference between elevations used to calculate the APE must not exceed 26 inches.

(13) Express lane toll facilities require the following:

(a) Gantries must be located within one (1) mile downstream from the express lane ingress.

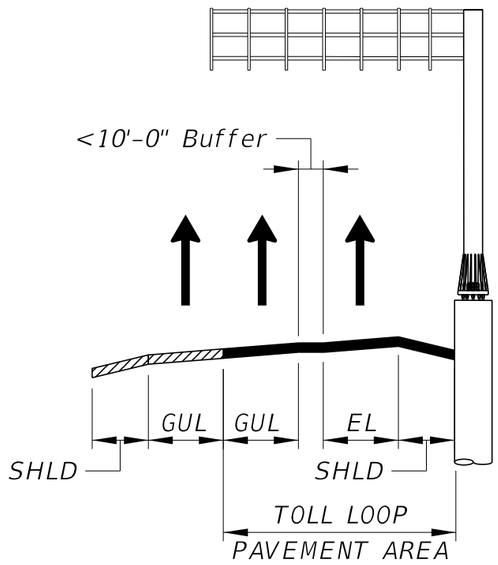
(b) Gantries must be located within one (1) mile to the last Toll Amount Sign within the EL segment before continuing to the next set of destinations.

(c) Ingress to each EL segment must be designed without the need for “data” gantries.

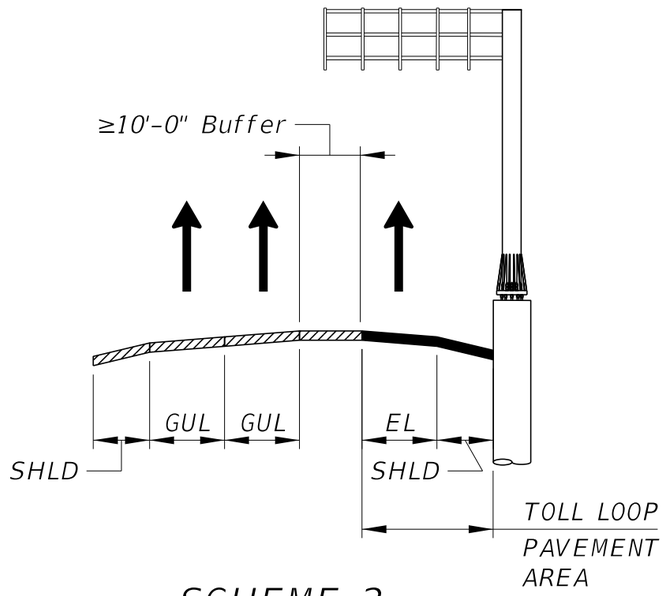
(d) The toll site must be coordinated with all existing, interim, and ultimate express lane ingress and egress locations.

(14) Toll gantries must not block an overhead sign. Minimum distance should be 800 feet for static panels and 1000 feet for dynamic message signs.

Exhibit 220.2-1 Toll Loop Pavement Area Separation Layouts



SCHEME 1

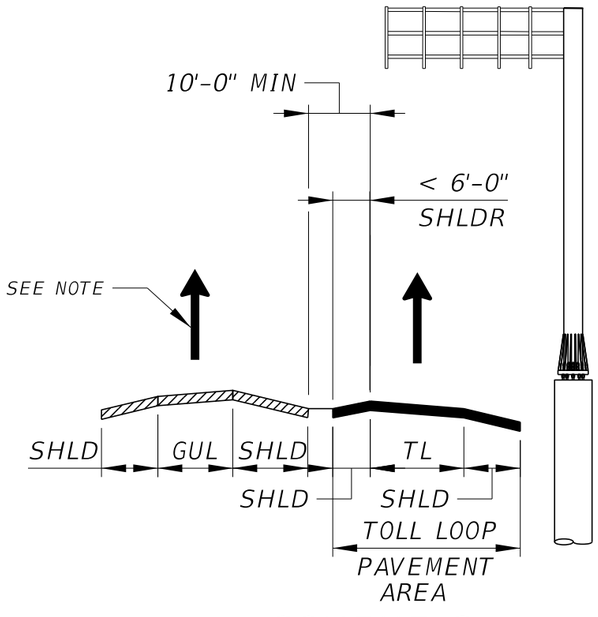


SCHEME 2

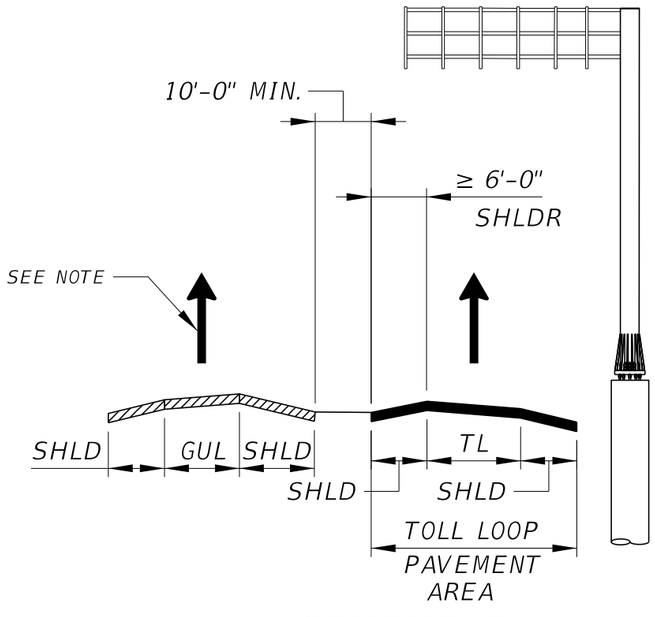
STANDARD PAVEMENT

TOLL LOOP PAVEMENT AREA

NOTE: DIRECTION OF TRAVEL MAY BE IN SAME OR OPPOSITE DIRECTION OF TOLL LANES.



SCHEME 3



SCHEME 4

220.3 Existing Toll Site Requirements

(1) When milling and resurfacing at an existing toll site, for any cross-slope corrections, barrier replacement and/or changes to the roadway surface within the toll loop pavement area, the following is required:

(a) The toll loop pavement must be analyzed to determine that all roadway criteria and vertical clearance criteria over the roadway is not impacted.

(b) Changes to lane striping or non-conformance to vertical clearance criteria and roadway criteria within the toll loop pavement area will require a redesign of the toll site plans which meets all criteria.

(c) Evaluate if paving operations would damage existing toll loop conduits which would result in the need for installing toll header curb.

(2) Toll sites adjacent to a roadway improvement project must be analyzed to determine if the impacts to the existing sites can be mitigated or if new toll sites are required.

221 Toll Pavement Design

221.1 Toll Loop Pavement Area Dimensions

221.1.1 Pavement Length

(1) Toll loop pavement is 100 feet in length with the gantry located at the midpoint, splitting the 100-foot length into equal 50-foot segments.

(2) When the toll loop pavement area is located on a curve, the 100-foot minimum length is measured along the outside edge of shoulder pavement closest to the center of curvature.

221.1.2 Pavement Width

The pavement width encompasses TLs, ELs, with all adjacent shoulders and buffers. The toll loop pavement width includes the lane adjacent to the buffer in accordance with (1) below.

(1) Where the buffer is less than 10 feet at the toll loop pavement area, the GUL adjacent to the express lane buffer must be designed as a toll lane and be provided with toll equipment and toll loop pavement as shown in Schemes 1 and 2 of ***Exhibit 220.2-1***.

(2) Shoulder widths within the toll loop pavement area must comply with the following:

(a) The tolling shoulder must match the approach and departure roadway shoulder widths except for the following conditions:

(i) When the median barrier is widened to accommodate toll gantry supports and/or median toll loop pull boxes.

(ii) Single lane ramps must have at least one shoulder with a minimum width of 10 feet.

(iii) When the maintenance pull-off area is located adjacent to the shoulder, shoulder width must be 10 feet minimum. This shoulder requirement ends at the trailing edge of the maintenance pull-off area and must be of sufficient length to allow deceleration to a stop condition of maintenance vehicles.

(b) The paved shoulder width at the tolling loop pavement must match the total minimum roadway shoulder widths (paved and unpaved).

(c) Where guardrail is present, the paved shoulder width must extend to the face of the adjacent guardrail.

(3) The maximum lane width within the toll loop pavement area must not exceed 15 feet.

(4) The maximum shoulder width within the toll loop pavement area must not exceed 15 feet.

221.1.3 Pavement Depth

Pavement design for the toll shoulders must match the full depth pavement design of the toll loop lane.

221.2 Flexible Pavement Design

(1) The structural asphalt thickness for the toll loop pavement area must not be less than the approach and departure roadway structural asphalt thickness.

(2) The finished elevation of the pavement base must match between the tolling pavement section and the approach and departure roadway pavement sections.

(3) Pavement design calculations must be prepared to determine if a greater pavement design is required when the resilient modulus of the soil is less than 10,000 psi, or the accumulative 20-year equivalent single axle load (ESAL) values exceed 25 million for mainline traffic or 6 million for ramp traffic.

(4) A 12-inch wide toll header curb must extend the full length of the toll loop pavement, adjacent to the concrete barrier with loop conduit stub-ups. The toll header curb must be poured after installation of loop conduit stub-ups. See ***Exhibit 232.3-2*** and ***Exhibit 232.3-4***.

(5) Each lane and shoulder within the toll loop pavement area must not have any transverse construction joints in frictional courses and structural pavement courses. Longitudinal construction joints are only permitted at the edges between lanes and between lanes and shoulders.

221.2.1 Mainline Travel Lanes

The minimum flexible pavement design for new construction of mainline travel lanes and shoulders must comply with the ***Flexible Pavement Design Manual*** with the following additional requirements within the toll loop pavement area:

(1) Stabilized subgrade, 12-inch thick

(2) Optional base group (OBG) 11 (7-inch Type B-12.5)

(3) 4-inch Type SP Structural Course (PG 76-22 in top lift)

(4) 1.5-inch FC-12.5 with PG 76-22

221.2.2 Ramp Travel Lanes

The minimum flexible pavement design for new construction of ramp travel lanes and shoulders must comply with the ***Flexible Pavement Design Manual*** with the following additional requirements within the toll loop pavement area:

(1) Stabilized subgrade, 12-inch thick

(2) OBG 9 (6-inch, Type B-12.5)

(3) 3-inch Type SP Structural Course (PG 76-22 in top lift)

(4) 1.5-inch FC-12.5 with PG 76-22

221.3 Resurfacing, Restoration and Rehabilitation for Existing Flexible Pavement Toll Sites

Pavement rehabilitation must comply with the ***Flexible Pavement Design Manual*** with the following additional requirements within the toll loop pavement area:

(1) Pavement rehabilitation within the toll loop pavement area must include milling of sufficient depth to remove any existing loop saw cuts and existing distress.

(2) Milling and resurfacing existing pavement for a new toll loop pavement area is only permitted when the existing lanes and shoulders meet or exceed the new construction minimum pavement design criteria identified in ***GTR 221.2***.

(3) The new structural pavement layer must be at a minimum 3 inches thick, inclusive of 1.5 inches of FC-12.5 with PG 76-22.

(4) When plans call for phased milling and resurfacing for a portion of the toll loop pavement area, the limits of milling activities must not extend past the centerline of the stripe of the adjacent lane / shoulder with loops remaining active in that phase.

(5) See ***GTR 223.3*** for MOT requirements.

221.4 Rigid Pavement Design

Rigid pavement must meet the requirements of the ***Rigid Pavement Design Manual*** and the following additional criteria:

(1) Metals must not be embedded in the concrete pavement (reinforcement, dowels, tie bars, dowel chairs, etc.). Alternatives such as glass-fiber-reinforced-polymer (GFRP) reinforcement, dowels, tie-bars, and non-metallic chairs may be used.

(2) Rigid pavement must contain polymeric fibers. The concrete mix design must meet ASTM C1116 and have an average residual strength of no less than 215 psi.

(3) Rigid pavement must be a minimum of 12-inch thick.

(4) Rigid pavement must be poured after installation of loop conduit stub-ups as identified in ***Exhibit 232.3-1*** and ***Exhibit 232.3-3***. Loop conduits and loop conduit stub-ups must be positionally secured and protected from physical damage during concrete pavement installation including the concrete pouring operation.

221.5 Toll Loop Pavement Area Restrictions

(1) Rumble strips are not permitted within the toll loop pavement area.

(2) The toll loop pavement area must be free of metal objects at or below grade.

(3) Curb and gutter, and shoulder gutter as shown in ***Standard Plans***, ***Index 520-001*** must not be installed within the toll loop pavement area limits except:

(a) When the toll header curb is required.

(b) When toll loop infrastructure does not cross the curb and gutter and / or shoulder gutter.

See ***GTR 220***, ***GTR 230***, and ***GTR 231*** for additional requirements for the toll loop pavement area.

221.6 Shoulders Approaching and Departing the Toll Loop Pavement Area

221.6.1 Grading and Drainage

At the shoulder transitions approaching and departing the toll loop pavement area:

(1) Avoid abrupt elevation and cross slope changes.

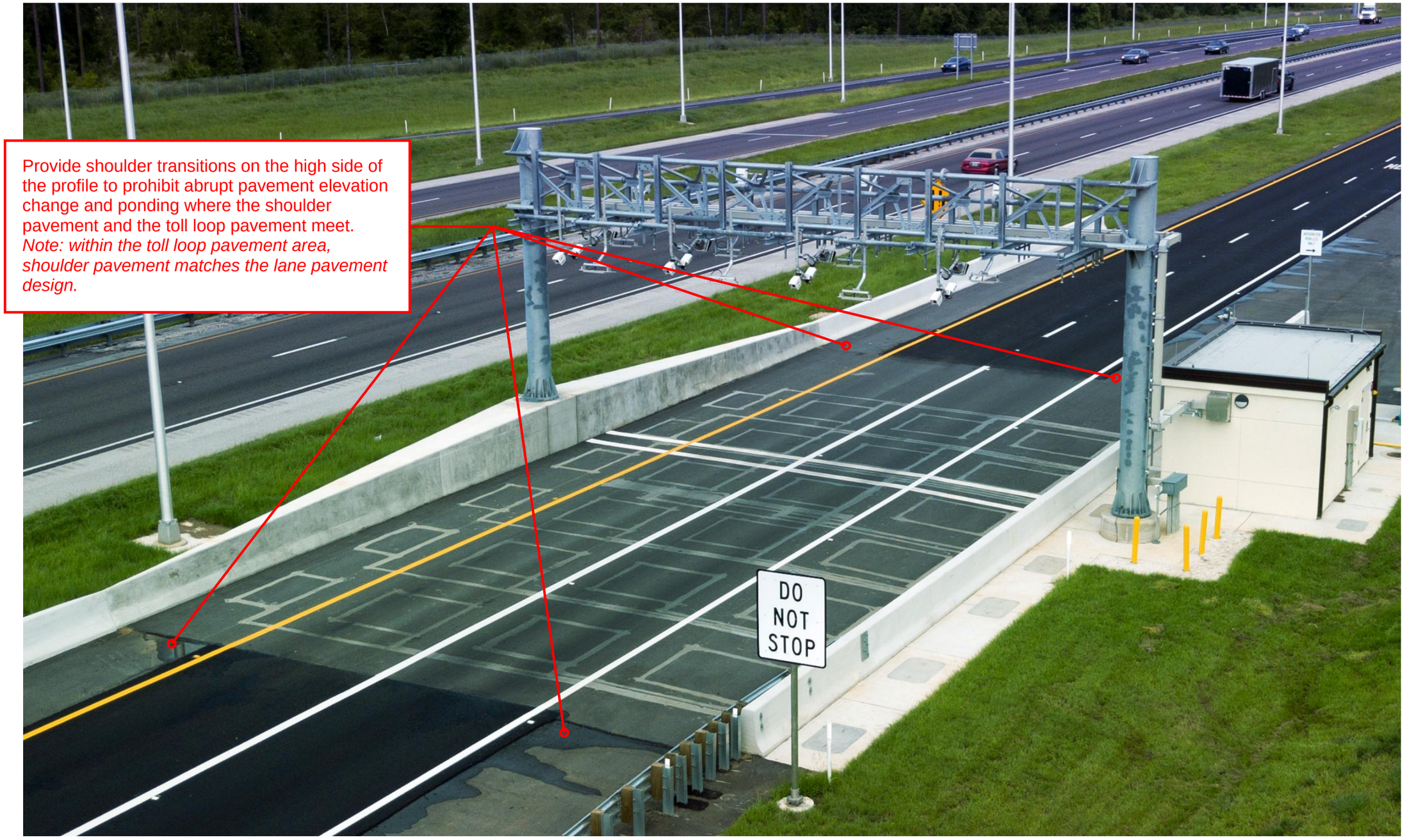
(2) Provide positive drainage to prevent ponding.

(3) See ***Exhibit 221.6-1*** for typical ponding issues to avoid.

221.6.2 Single Lane Ramps

Toll equipment centered over a single lane ramp needs periodic maintenance that requires widened shoulders per ***GTR 221.1.2***. Therefore, the width and length of the shoulders approaching and departing the toll loop pavement area must be designed to support using the widened shoulder under the gantry as a travel lane for this maintenance activity to avoid closing the entire ramp.

Exhibit 221.6-1 Approach and Departure Shoulder Transition Drainage Concerns



222 Toll Site Signs and Pavement Markings

222.1 Signs at the Toll Site

Signage of any kind must not be attached to the toll gantry.

See ***Appendix 4*** for signage within new or existing toll sites.

222.2 Sign TOL-7 "Do Not Stop"

(1) Sign TOL-7 must be located at least 50 feet from the centerline of the gantry. See ***Appendix 4*** or additional information.

(2) Sign TOL-7 location must be coordinated to avoid conflict with pull boxes or other obstructions.

(3) Sign TOL-7 is not required at toll sites on managed lanes.

222.3 Sign TOL-8 "Authorized Vehicles Only"

(1) Sign TOL-8 is required at all maintenance pull-off areas.

(2) Sign TOL-8 must be ground-mounted and located within 12-inches from the end of the concrete barrier adjacent to the maintenance pull-off area access point. See the ***TEB Site Plans*** and the ***RTC Site Plans*** in ***GTR 231.***

222.4 Pavement Markings at the Toll Site

(1) See ***Appendix 4*** for pavement marking requirements at the toll site. See the ***Traffic Engineering Manual*** (TEM) for pavement marking and EL marker requirements at express lanes.

(2) Pavement marking must be centered at the edge of travel way within the toll loop pavement area. Transition the pavement marking over a 25-feet distance beyond the limits of the toll loop pavement area from the layout shown in ***Standard Plans***, ***Index 546-010***.

223 Toll Site Construction Phasing Requirements

The plans and specifications must be prepared to account for the following construction phase requirements.

223.1 General Requirements

(1) Demolition at existing toll site can only begin after the new toll system on the replacement toll site is installed, commissioned, tested and activated such that it is collecting tolls.

(2) Include in the contract documents schedules for notification and salvage time frames at existing toll sites to be demolished and/or renovated.

(3) See ***GTR 250.1*** for gantry types. Lane closure requirements for gantries are as follows:

- (a) Non-Accessible – Lane closures are required at the toll loop pavement area to perform tolling equipment installation and must be included in the TTCP.
- (b) Accessible – While some of the activities associated with toll equipment installation can be performed from the gantry, lane closures are required for other activities and must be included in the TTCP. Coordinate with Turnpike Tolls Design for project specific activities requiring lane closure.

(4) The construction stage phasing must be designed to accommodate the following:

- (a) Utility relocations, removal of piping, metal objects, etc. within the toll site must be complete and the final riding surface of the pavement with final striping in its final alignment must be constructed at all equipped lanes and shoulders and the site turned over to the Department before the TEC begins toll equipment installation.
- (b) The TEC must have 21 consecutive TEC working days of exclusive and uninterrupted access per movement, at each toll site for their installation commissioning and testing work.
- (c) The Department must have 35 consecutive TEC working days of access to the project for End-to-End testing for express lanes.
- (d) The TEC working days must not include weekends, holidays, special events, and work period shutdowns.
- (e) See ***GTR Part 2*** appendices for additional requirements on the Primary Walk-throughs and Operational Testing Walk-throughs:
  - i. **TEB Sites:** ***GTR Part 2*** ***Appendix 2***, TSP Section for ***Project Closeout for TEB Sites***.
  - ii. **RTC Sites:** ***GTR Part 2*** ***Appendix 3*** for TSP ***Acceptance Procedures for Toll Facilities at RTC Toll Sites***.

(5) See ***GTR 260.7*** for communications criteria during construction phasing.

(6) Maintain all existing toll operations with no interruption to toll collection during construction.

(7) Maintain toll operations during construction for express lanes, including dynamic rate setting systems, consistent with the existing tolling plan and operations.

223.2 Maintenance of Traffic (MOT)

The traffic control plans and specifications must detail the MOT required for work associated with constructing a toll site including lane and roadway closures and detours to facilitate the following:

(1) Construction of the gantry.

(2) TEC's installation, commissioning, and testing for each movement at each toll site.

(3) Department's End-to-End testing for express lanes.

223.3 Toll Site Temporary Traffic Control

223.3.1 Temporary Traffic Control Plan (TTCP)

(1) Develop a TTCP (in accordance with ***FDM 240*** through ***FDM 243***) for all work associated with the toll site construction, TEC activities, and express lanes commissioning and testing activities.

(2) The installation of the toll gantry foundations must be identified in the construction phasing as early as possible to allow sufficient time for foundation surveys to be included in the toll gantry shop drawings. Additional subphases may be required to accommodate the construction of the toll gantry foundations prior to the construction of the remainder of the toll site.

(3) TTCP for installation of toll gantry foundations cannot be changed without written consent by Turnpike Design Engineer.

(4) TTCP must develop detailed phasing for all activities associated with toll equipment installation, commissioning, and testing which typically requires partial or full closures at all ramp and mainline tolling movements as follows:

   (a) Separate phasing must be provided in the TTCPs for each tolling movement along with the details and quantities for the MOT at each tolling point.

   (b) Typical sections for all traffic control sub-phases must be shown for each toll site.

(c) The phasing must be coordinated with The Turnpike to determine whether toll equipment installation can be scheduled during off-peak hours, weekends or only at night.

(d) Maintain existing toll sites in operation as identified in ***GTR 223.3.3*** and ***GTR 223.4*** and while construction of new toll sites is undertaken.

(5) Lane closure analysis must be provided to determine if the toll site or tolling movements require one MOT setup for the duration of the toll equipment installation, commissioning, and testing period or if nightly MOT setups are required during the toll equipment installation, commissioning, and testing period.

(6) Proposed detours that avoid increased tolling through the detour are preferred. Where such increases cannot be avoided, a Detour Toll Analysis Memorandum (DTAM) with options to address the impact to customers is required. The following scenarios would require an analysis and memorandum to be submitted:

(a) The detour sends users to a toll site with a higher toll or through multiple toll sites.

(b) The detour closes tolled lanes with a cash-only option and sends users to a SunPass only lane.

(c) The detour reduces the number of tolled lanes.

(7) During toll equipment installation, commissioning, and testing, approach and departure roadway segments must be available to allow testing vehicles to accelerate to the final roadway condition posted speed prior to entering the tolling loop pavement area and decelerate upon departure. Approach and departure pavement limits are as follows:

(a) 3,500 feet of roadway at each mainline tolling gantry (2,000 feet of approach and 1,500 feet of departure).

(b) 2,500 feet of roadway at each ramp tolling gantry (1,500 feet of approach and 1,000 feet of departure) or as length of ramp permits for the TEC testing activities' posted speed.

223.3.2 Tolling Sub-Phase Requirements

(1) Partial closures must be designed to allow a full lane or full shoulder in a single sub-phase for TEC installation activities.

(2) Full closures are required to allow the TEC to test and commission the equipment at each ramp tolling movement.

(3) Express Lane End-to-End Testing:

(a) The phase at which the express lane End-to-End testing takes place must be clearly identified.

(b) If existing express lanes are extended or are being concurrently constructed, the End-to-End testing may require full closures of the express lanes beyond the limits of the project. Coordination with The

Turnpike must take place to determine the need for closing express lanes beyond the project limits.

223.3.3 AET Toll Sites in Production

Traffic control at toll sites that are collecting revenue must comply with the following:

(1) Lane and shoulder widths must not be modified.

(2) Shoulders must not be used as travel lanes.

(3) Vehicle straddling between two lanes or between a lane and a shoulder is not permitted.

(4) Do not pin temporary barriers within the limits of the toll loop pavement area.

223.4 Existing Toll Site Traffic Control

The traffic control at toll sites must accommodate the current lane operation schedule. Consult with The Turnpike for the latest toll site lane operation schedules for all toll sites that are impacted by the project.

Comply with the requirements of ***GTR 223*** for Projects where no work is anticipated at existing tolls sites.

223.4.1 General Requirements

(1) Coordinate with Turnpike Tolls Design prior to Phase II submission for any traffic control phase that includes lane closures at a toll site.

Modification for Non-Conventional Projects:
Replace Item (1) above with the following: (1) Coordinate with Turnpike Tolls Design prior to the 90% submission for any traffic control phase that includes lane closures at a toll site.

(2) Traffic control plans must include specific measures to prevent tolling loops and tolling pavement from being damaged when paving equipment or other heavy equipment is at any toll site.

(3) When milling and resurfacing the toll loop pavement area, the TTCP phasing and schedule must include the TEC installation, commissioning, and testing periods for the affected toll site.

(4) When any lane at an existing toll plaza is scheduled to be converted from cash/violations operational mode to “Toll by Plate” operational mode (also known as AET-Lite), the TTCPs must include the traffic control (phasing notes, plans, and details) required during and after AET-Lite conversion.

223.4.2 Non-AET Facilities

Traffic control must comply with the following for all lanes at non-AET toll sites:

(1) The toll collection type (cash or electronic toll collection) must not be changed.

(2) Electronic toll collection lanes and cash toll lanes must available in all phases; however, the number of each type of toll lanes needed must be submitted to Turnpike Toll Systems Project Manager for approval by Toll Systems Program Manager with enough total tolled lanes to process current traffic volumes. Written documentation (email or meeting notes documentation) of concurrence from the Toll Systems Program Manager or designee is acceptable.

230 Toll Site Design

230.1 General Requirements

Toll facility site plans must be coordinated with all other drawings and component sets. Toll site design restrictions include:

(1) **RTC Sites:** RTCs can only be utilized for up to five (5) equipped lanes and shoulders per tolling movement. Each RTC can support only one tolling movement. See ***GTR 120.2*** for use of RTC toll sites and associated criteria.

(2) **TEB Sites:** TEBs are required for mainline toll sites with TLs and all toll sites where an RTC Cabinet design is not feasible. See ***GTR 242.1*** for maximum lane requirements.

230.2 Infrastructure Placement

The following infrastructure that interferes with toll equipment operations must not be located at or near a toll site:

(1) Electromagnetic field emitting sources must be located at least 5 feet from the toll site envelope and loop infrastructure.

(2) Except for gantry mounted power conductors and secondary power conductors for the toll facility electrical service, low voltage power lines (120/240 V or 480V) AC or DC power must be located at least 5 feet from the toll site envelope. This includes roadway light poles, conduits, conductors, etc.

(3) Low voltage circuits (120/240 V or 480V) AC or DC power must be located at least 5 feet from the loop conduit(s).

(4) Pipes carrying or intending to convey fluids must be located at least 10 feet from the toll site envelope and at least 5 feet from the loop conduit(s).

(5) Existing and proposed utilities, mechanically stabilized earth (MSE) metallic wall straps, drainage structures, box culverts, or bridge foundations must be located at least 5 feet from the toll site envelope.

(6) When MSE walls with non-metallic wall straps are proposed, these wall plans must require that strap layout and associated slabs must not conflict with toll site infrastructure (conduits and foundations).

(7) Walls and wall foundations with metallic reinforcement must not be located within the toll site envelope.

230.3 High Voltage Circuits

(1) Overhead circuits or conductors that operate at high voltage (> 600VAC RMS or VDC) must be located at least 200 feet from the toll site envelope.

(2) If existing high voltage lines are unavoidable within 200 feet of a proposed toll site envelope, provide the following information for Turnpike Tolls Design to evaluate the site for toll system interference.

(a) The line's voltage and location relative to the toll site.

(b) The northing and easting of all four corners of the toll loop pavement area.

230.4 Wireless Communication Devices

(1) Toll sites must be located at least 500 feet from any devices operating within the 902 MHz to 928 MHz frequency band.

(2) If there is existing FDOT equipment, such as travel time system readers, operating in the ISM/LMS Frequency Band 902MHz-928MHZ within 1 mile of an existing or proposed toll site, develop a remediation approach in conjunction with Turnpike Tolls Design. Include the identified remediation in the plans.

(3) ISM/LMS Frequency Band 902MHz–928MHz wireless two-way communication devices licensed or unlicensed (Spread Spectrum) emitters are not permitted within any distance in which the referenced emitter produces an in-band signal interference level greater than -68dBm at the input to the toll site gantry antennas.

230.5 Existing Toll Sites

New toll sites must be located such that existing toll facilities continue to operate until the new toll sites are commissioned and collecting tolls.

230.5.1 General Requirements

See ***GTR 223.1*** for additional requirements for scheduling of existing toll site demolition.

230.5.2 Building Demolition Plans and Permits

(1) Demolition permits are required for each location and must be separate from building permits required for new, modified, and renovated buildings.

(2) All building roof systems identified to remain must be protected from damage and water intrusion caused by required demolition and any additional new work to retain roof integrity and warranty.

(3) Repairs to existing roof systems must be accomplished by using materials of the original system and repair procedures as required by the original roof system manufacturer and performed by an authorized roof system installer.

(4) All total demolition, selective demolition, and renovation activities must consider results of asbestos and/or paint testing reports.

(5) Dispose all hazardous materials per all applicable State and hazardous materials handling guidelines.

230.5.3 Salvage and Disposal

Coordinate with the Turnpike Toll Systems Project Manager for identifying:

(1) All items that are desired to be salvaged and identified as such in the contract documents.

  (a) All existing fire extinguishers and brackets must be returned to the FTE for all buildings to be demolished.

  (b) All flag poles and associated up lighting must be removed. Flags must be returned to the Turnpike.

  (c) Other equipment to be salvaged and returned to the Turnpike.

(2) Existing equipment to be salvaged by the Turnpike.

  (a) Salvage of existing equipment may be required at non-AET toll sites, TEB sites, and at RTC sites.

  (b) Traffic control phasing must include time for salvage.

  (c) Salvage of existing equipment includes equipment located on the gantry. Equipment removal/salvage will require coordination with the traffic phasing.

230.5.4 Proposed Infrastructure with Potential Frequency Interference Near Existing Toll Sites

New infrastructure not related to toll equipment, that operates within the 902 MHz to 928 MHz frequency band must be located at least 1,000 feet from existing toll sites.

231 Toll Site Layout

231.1 General Requirements

(1) Unless otherwise noted, all new toll sites must comply with the site elements, layout, and detailing of the typical site plans in their entirety. Typical site plan layouts are shown in:

(a) **TEB Site Plans:** ***Exhibit 231.1-1***, ***Exhibit 231.1-2***, ***Exhibit 231.1-3***, ***Exhibit 231.1-4***, and ***Exhibit 231.1-12***.

(b) **RTC Site Plans**: ***Exhibit 231.1-5***, ***Exhibit 231.1-6***, ***Exhibit 231.1-7***, ***Exhibit 231.1-8***, ***Exhibit 231.1-9***, ***Exhibit 231.1-10***, and ***Exhibit 231.1-12***.

(c) **Toll Sites on a Horizontal Curve**:

i. Use the following distances for each toll site element measured to the front edge of the barrier at the gutter line:

I. TEBs: 7 feet at narrowest point

II. RTC toll site equipment slabs: 7 feet at narrowest point

III. Each pull box: 3 feet at the narrowest point

ii. The array of loop pull boxes can follow the roadway's horizontal curve

iii. The parallel portion of the maintenance driveway that does not taper back to the shoulder must follow the roadway's horizontal curve.

iv. Concrete sidewalks and toll site equipment slabs must be perpendicular or parallel to the TEB or RTC as applicable. Maintain a minimum of 18 inches between loop pull boxes and the back edge of the sidewalk.

(2) The design of the toll site, inclusive of all exterior components except gantries, must comply with the requirements of the high velocity hurricane zone for Miami-Dade County, regardless of project location. For gantry design requirements see ***GTR 251.1***.

(3) When toll loop infrastructure does not extend through a wall / barrier, the toll site envelope terminates at the gutter line of the wall / barrier adjacent to the toll loop pavement area.

(4) Concrete barrier in accordance with ***Standard Plans***, ***Index 521-001*** must be installed as follows:

(a) Adjacent to the loop pull boxes along the toll loop pavement area.

(b) GFRP reinforcement must be provided for all concrete barrier within the toll site envelope.

(c) Concrete barrier free end and thrie-beam connection, as applicable, must be located beyond the toll loop pavement area.

(d) To protect the maintenance vehicle parking.

(e) See the ***TEB Site Plans*** and the ***RTC Site Plans*** for their respective site specific barrier wall layouts.

(5) Concrete median barrier in accordance with ***Standard Plans***, ***Index 521-005*** must be installed to accommodate median loop pull box installations and median gantry uprights. Use of Developmental Standard Plans requires approval by the FDOT Central Office.

(6) The finish floor elevation of the TEB and exterior equipment slabs must be at least 18 inches higher than the following:

(a) The highest 100-year floodplain elevation within 500 feet of the toll site.

(b) 100-year design stage of all adjacent stormwater management facilities.

(7) There must be an unobstructed perimeter of at least 5 feet around the TEB and exterior wall mounted equipment.

(8) See the ***TEB Site Plans*** and the ***RTC Site Plans*** for additional critical clearance dimensions.

(9) At toll sites supported on walls:

(a) Provide traffic barrier, wall coping, and associated junction slabs along the maintenance pull-off area up to the toll site envelope. See ***Standard Plans***, ***Index 521-512, and Index 521-610.***

(b) Provide pedestrian railing on top of the wall in accordance with ***Standard Plans***, ***Index 515-052*** or ***Index 515-062*** along the perimeter of the toll site envelope that is not subject to vehicle impacts.

(c) See ***Standard Plans***, ***Index 521-611*** for FRP concrete barrier / junction slab wall coping.

(10) Strut channel frames for ground-mounted equipment must be installed as follows:

(a) Maintenance access/clearance must be provided per NEC and manufacturer's requirements. The more stringent criteria must be used for site layout design.

(b) See ***Exhibit 231.1-13*** for the various frame layout details.

(c) See ***GTR Part 2*** appendices for the requirements for frames as follows:

- **TEB Sites:** ***GTR Part 2 Appendix 2***, TSP Section for ***Metal Fabrications for TEB Sites***.
- **RTC Sites:** ***GTR Part 2 Appendix 3***, TSP for ***Hangers and Supports for Electrical Systems at RTC Toll Sites*.**

(11) The fuel tanks must be located to allow refueling by fuel trucks with up to 100-foot-long hoses.

(12) ADA compliant slopes and grades must be provided for all concrete sidewalks, slabs, and paved walkways within the toll site.

(13) The generator/fuel tank must be a minimum of 8 feet from the front edge of the barrier at the gutter line.

(14) The dry well must be located as shown in the ***TEB Site Plans*** and the ***RTC Site Plans***.

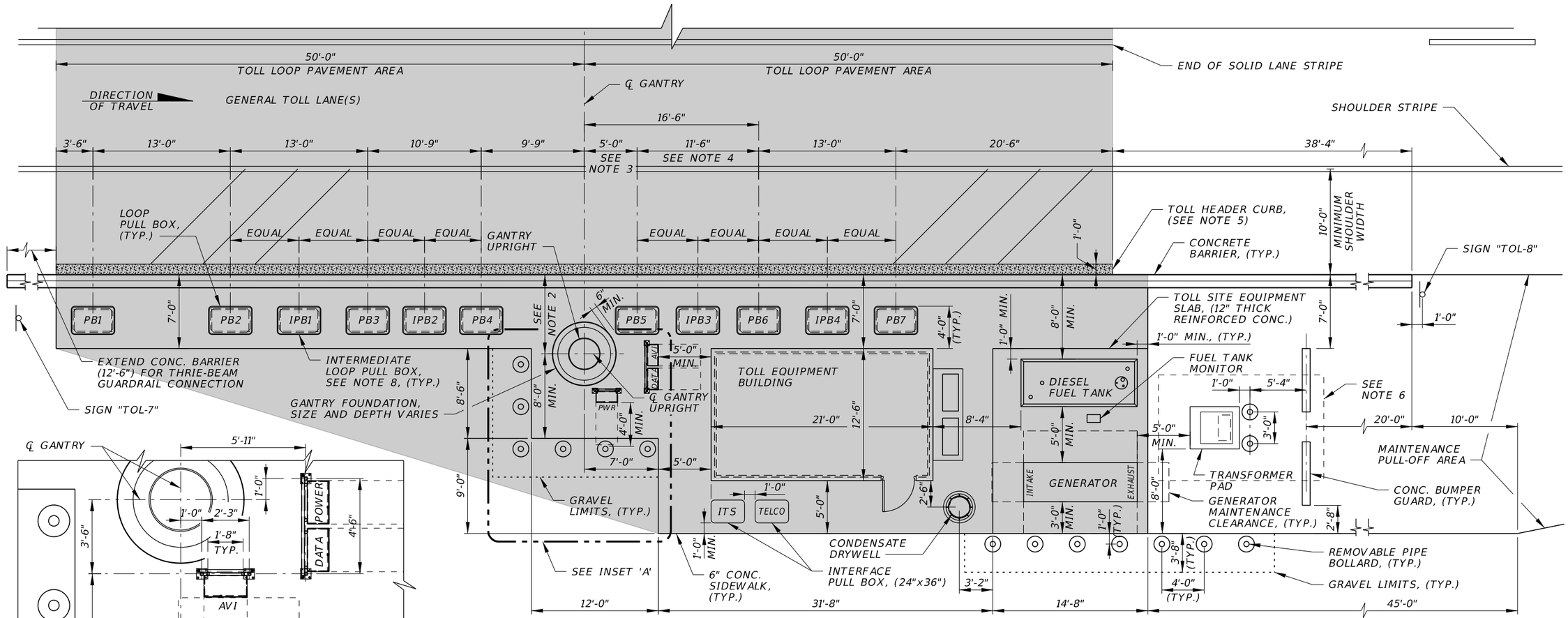
(a) **TEB Sites:** Connect condensate piping from each AC unit in accordance with ***Exhibit 244.3-1***. Route the condensate piping from each AC unit in accordance with ***Exhibit 244.2-1***.

(b) **RTC Sites:** Provide a condensate receptor with air gap in accordance with ***Exhibit 244.3-1*** at each cabinet AC unit. Each cabinet AC unit, as shown in the ***RTC Site Plans***, must be provided with condensate piping that connects to the dry well in accordance with the layouts shown in ***Exhibit 231.1-11***. Include condensate piping for the future RTC cabinet.

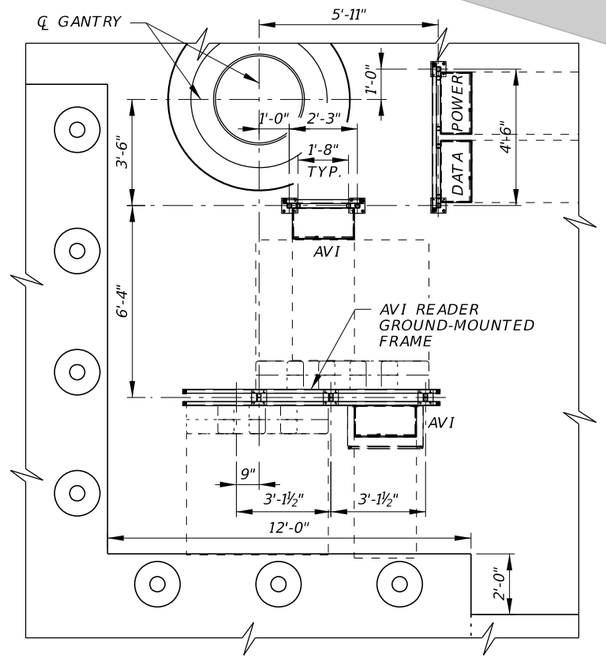
(15) At least 100 feet of sodding must be provided beyond the toll pavement area around each toll site. Sodding must be extended to the right-of-way lines for all areas that are disturbed by construction activities. Sodding limits must be shown on the appropriate roadway component plans.

1 TEB Site Plans

Exhibit 231.1-1 Non-Accessible Gantry TEB Standard Site Plan



NON-ACCESSIBLE GANTRY TEB STANDARD SITE PLAN
N.T.S.



INSET 'A' - AVI READER GROUND-MOUNTED FRAME
N.T.S.

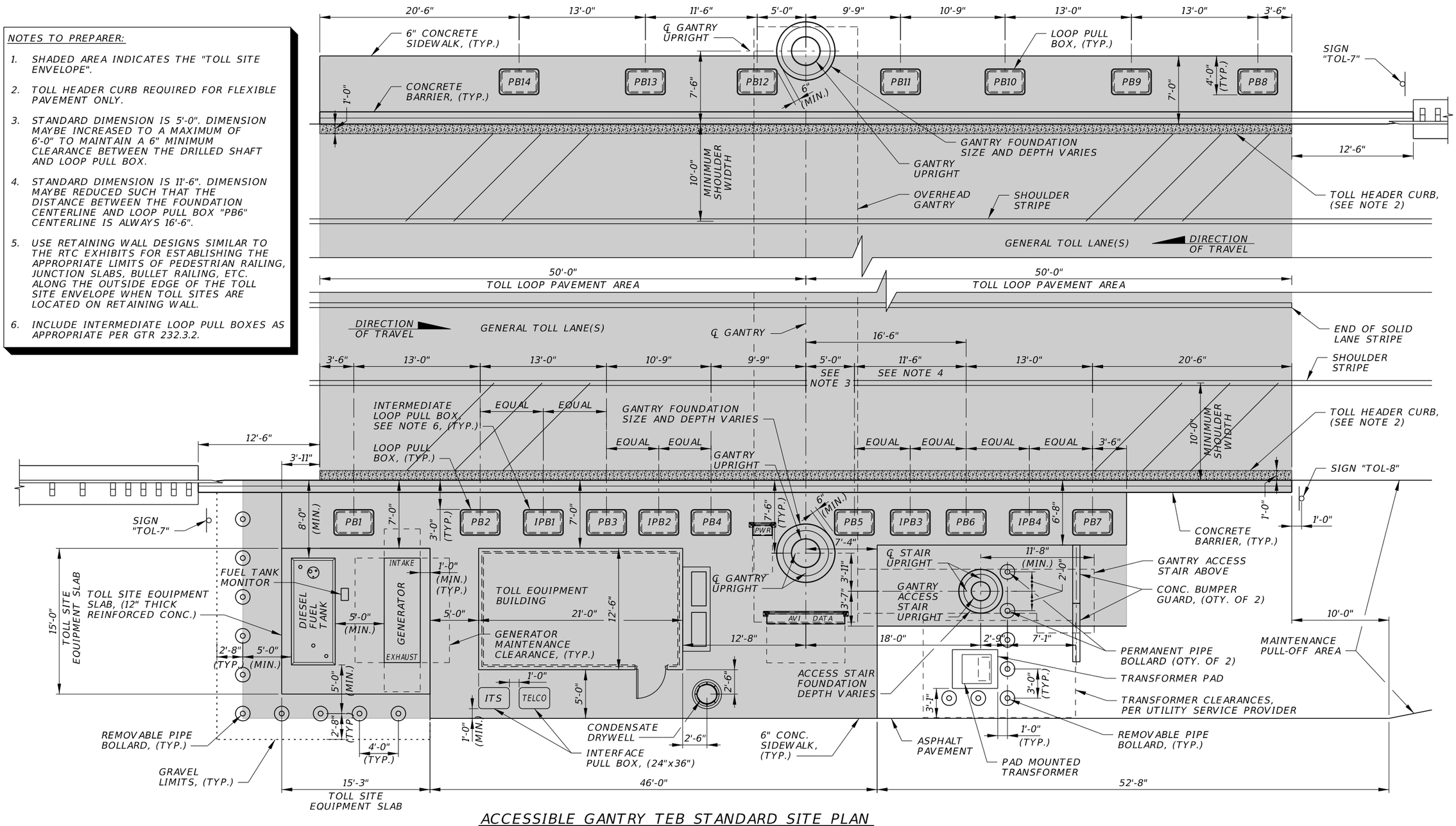
NOTES TO PREPARER:

1. *SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".*
2. *7'-6" MINIMUM FOR SPAN GANTRY. 6'-0" MINIMUM FOR CANTILEVER GANTRY.*
3. *STANDARD DIMENSION IS 5'-0". DIMENSION MAYBE INCREASED TO A MAXIMUM OF 6'-0" TO MAINTAIN A 6" MINIMUM CLEARANCE BETWEEN THE DRILLED SHAFT AND LOOP PULL BOX.*
4. *STANDARD DIMENSION IS 11'-6". DIMENSION MAYBE REDUCED SUCH THAT THE DISTANCE BETWEEN THE FOUNDATION CENTERLINE AND LOOP PULL BOX "PB6" CENTERLINE IS ALWAYS 16'-6".*
5. *TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.*
6. *VERIFY TRANSFORMER MAINTENANCE ACCESS CLEARANCE AND METER LOCATION WITH UTILITY PROVIDER.*
7. *USE RETAINING WALL DESIGNS SIMILAR TO THE RTC EXHIBITS FOR ESTABLISHING THE APPROPRIATE LIMITS OF PEDESTRIAN RAILING, JUNCTION SLABS, BULLET RAILING, ETC. ALONG THE OUTSIDE EDGE OF THE TOLL SITE ENVELOPE WHEN TOLL SITES ARE LOCATED ON RETAINING WALL.*
8. *INCLUDE INTERMEDIATE LOOP PULL BOXES AS APPROPRIATE PER GTR 232.3.2.*

Exhibit 231.1-2 Accessible Gantry TEB Standard Site Plan

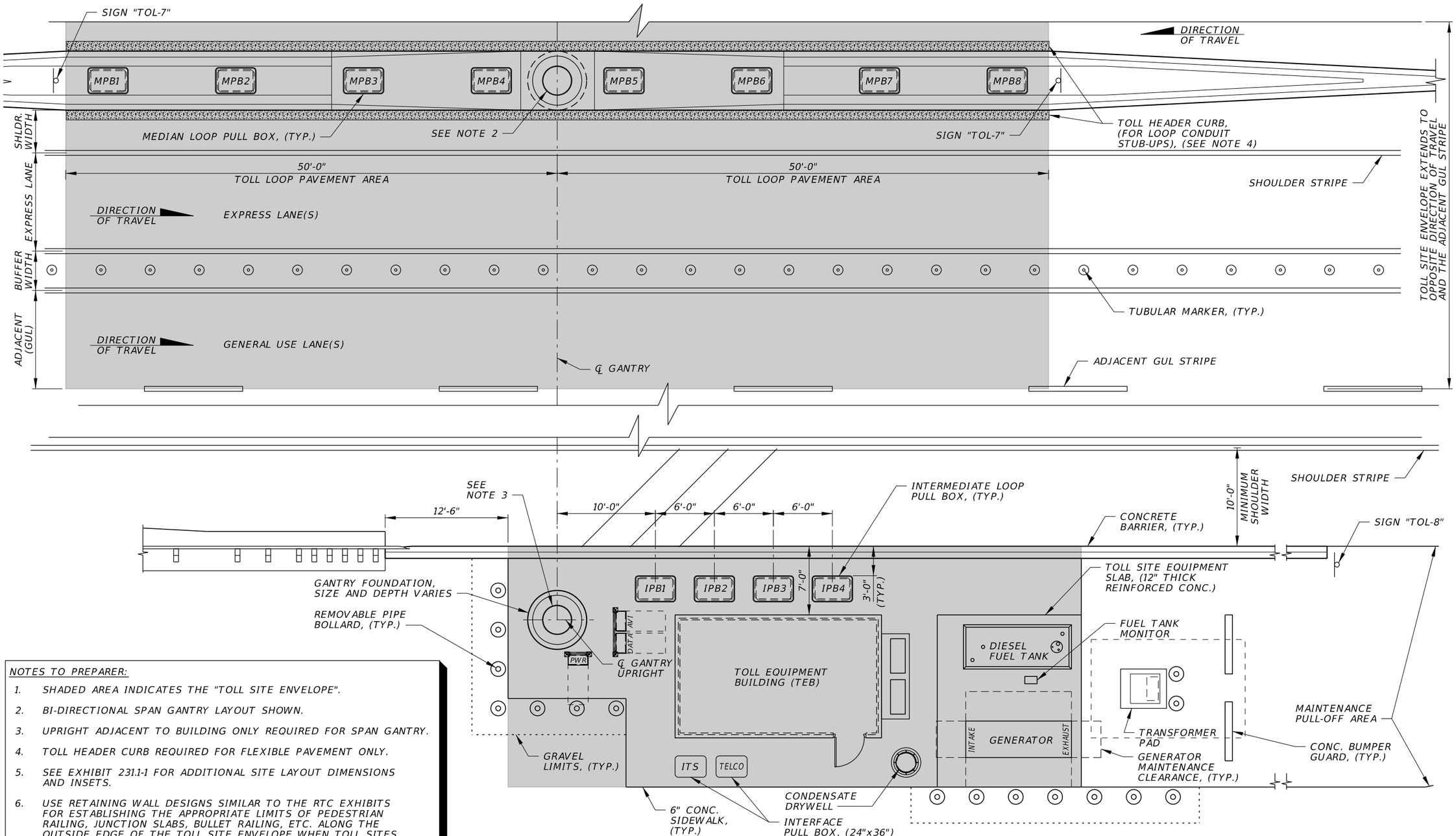
NOTES TO PREPARER:

1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
3. STANDARD DIMENSION IS 5'-0". DIMENSION MAYBE INCREASED TO A MAXIMUM OF 6'-0" TO MAINTAIN A 6" MINIMUM CLEARANCE BETWEEN THE DRILLED SHAFT AND LOOP PULL BOX.
4. STANDARD DIMENSION IS 11'-6". DIMENSION MAYBE REDUCED SUCH THAT THE DISTANCE BETWEEN THE FOUNDATION CENTERLINE AND LOOP PULL BOX "PB6" CENTERLINE IS ALWAYS 16'-6".
5. USE RETAINING WALL DESIGNS SIMILAR TO THE RTC EXHIBITS FOR ESTABLISHING THE APPROPRIATE LIMITS OF PEDESTRIAN RAILING, JUNCTION SLABS, BULLET RAILING, ETC. ALONG THE OUTSIDE EDGE OF THE TOLL SITE ENVELOPE WHEN TOLL SITES ARE LOCATED ON RETAINING WALL.
6. INCLUDE INTERMEDIATE LOOP PULL BOXES AS APPROPRIATE PER GTR 232.3.2.



ACCESSIBLE GANTRY TEB STANDARD SITE PLAN
N.T.S.

Exhibit 231.1-3 Non-Accessible Gantry TEB Detached Site Plan



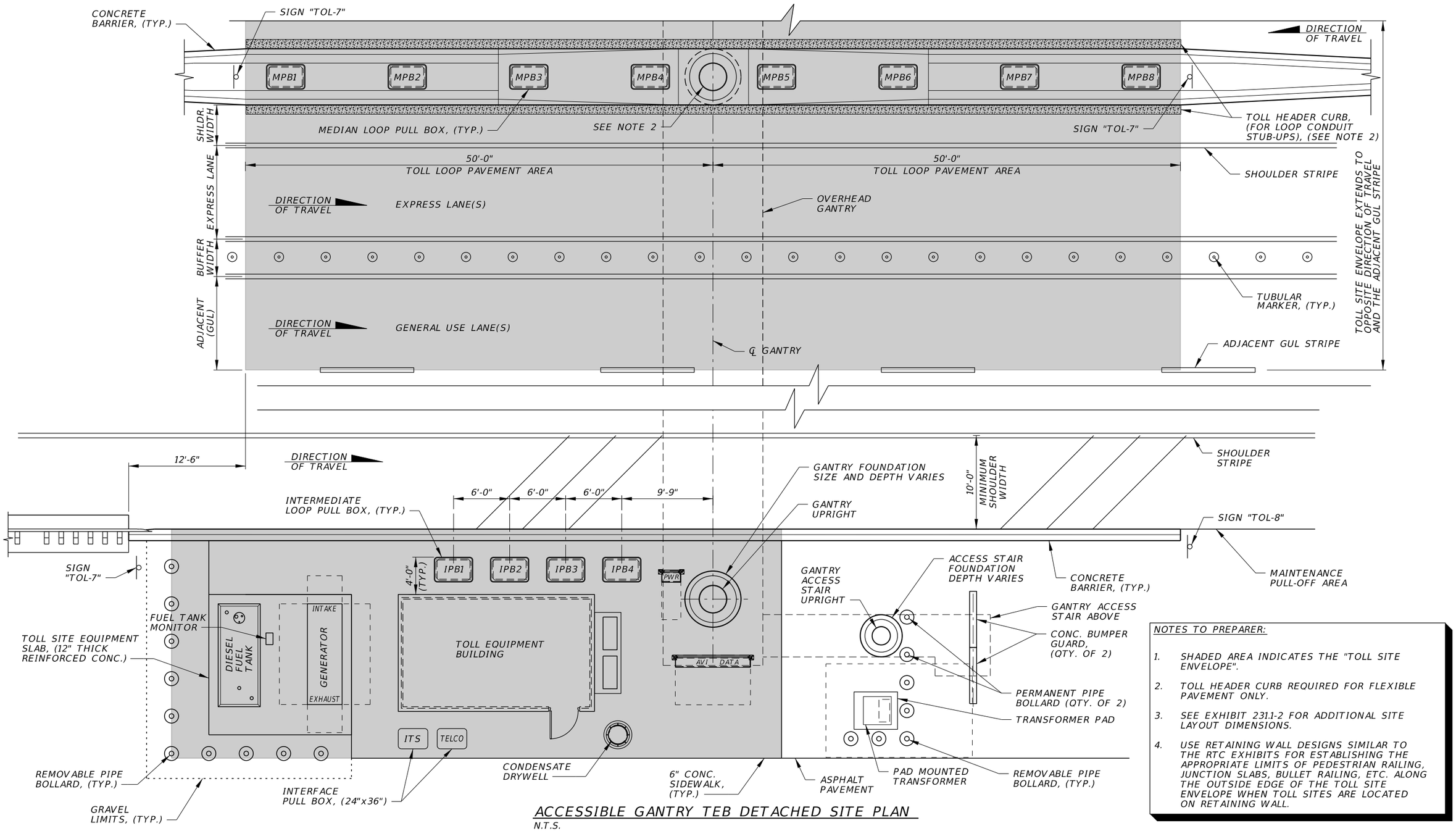
NOTES TO PREPARER:

1. *SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".*
2. *BI-DIRECTIONAL SPAN GANTRY LAYOUT SHOWN.*
3. *UPRIGHT ADJACENT TO BUILDING ONLY REQUIRED FOR SPAN GANTRY.*
4. *TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.*
5. *SEE EXHIBIT 231.1-1 FOR ADDITIONAL SITE LAYOUT DIMENSIONS AND INSETS.*
6. *USE RETAINING WALL DESIGNS SIMILAR TO THE RTC EXHIBITS FOR ESTABLISHING THE APPROPRIATE LIMITS OF PEDESTRIAN RAILING, JUNCTION SLABS, BULLET RAILING, ETC. ALONG THE OUTSIDE EDGE OF THE TOLL SITE ENVELOPE WHEN TOLL SITES ARE LOCATED ON RETAINING WALL.*

NON-ACCESSIBLE GANTRY TEB DETACHED SITE PLAN

N.T.S.

Exhibit 231.1-4 Accessible Gantry TEB Detached Site Plan

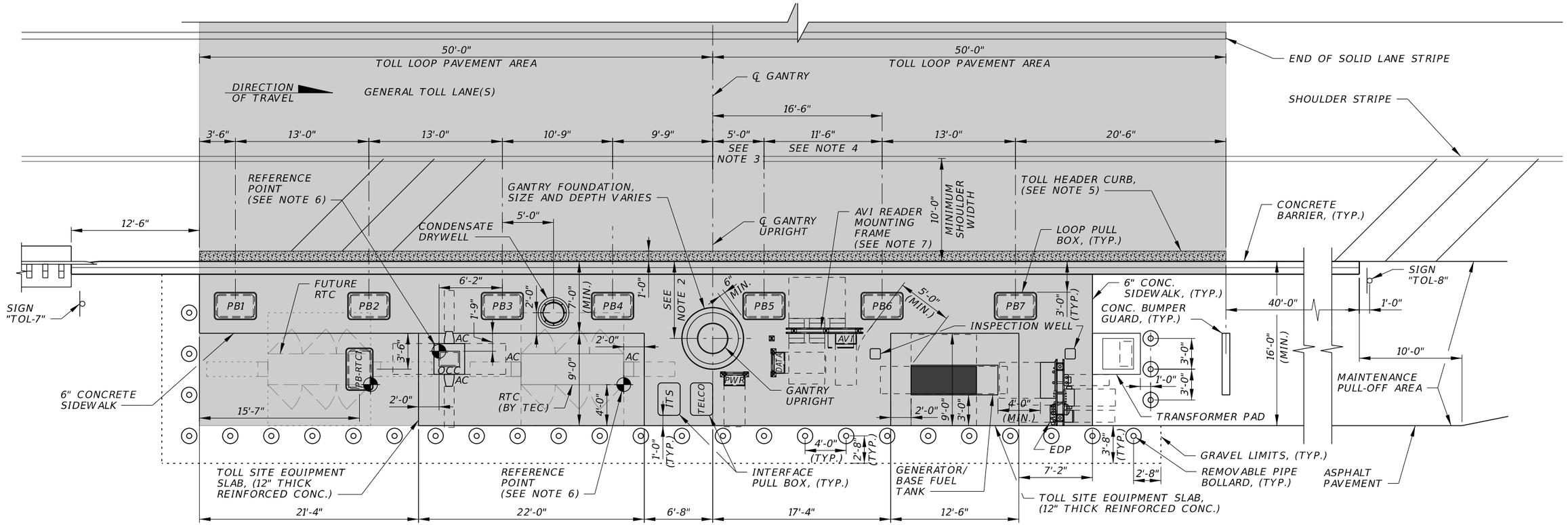


ACCESSIBLE GANTRY TEB DETACHED SITE PLAN
N.T.S.

NOTES TO PREPARER:

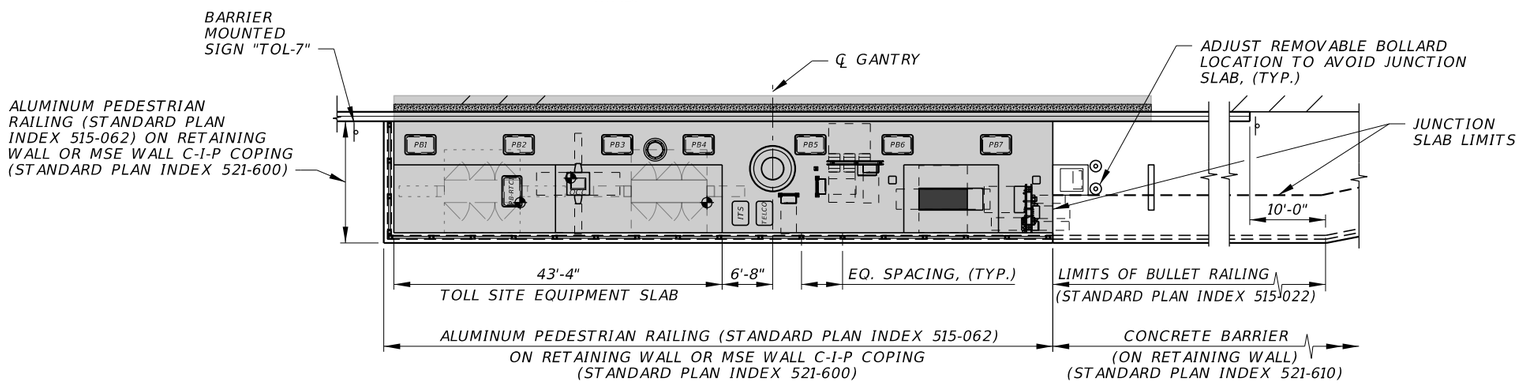
1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
3. SEE EXHIBIT 231.1-2 FOR ADDITIONAL SITE LAYOUT DIMENSIONS.
4. USE RETAINING WALL DESIGNS SIMILAR TO THE RTC EXHIBITS FOR ESTABLISHING THE APPROPRIATE LIMITS OF PEDESTRIAN RAILING, JUNCTION SLABS, BULLET RAILING, ETC. ALONG THE OUTSIDE EDGE OF THE TOLL SITE ENVELOPE WHEN TOLL SITES ARE LOCATED ON RETAINING WALL.

Exhibit 231.1-5 Single Movement Gantry RTC Standard Site Plan – On-Site Power Service



SINGLE MOVEMENT RTC STANDARD SITE PLAN (AT GRADE) - ON-SITE POWER

N.T.S.



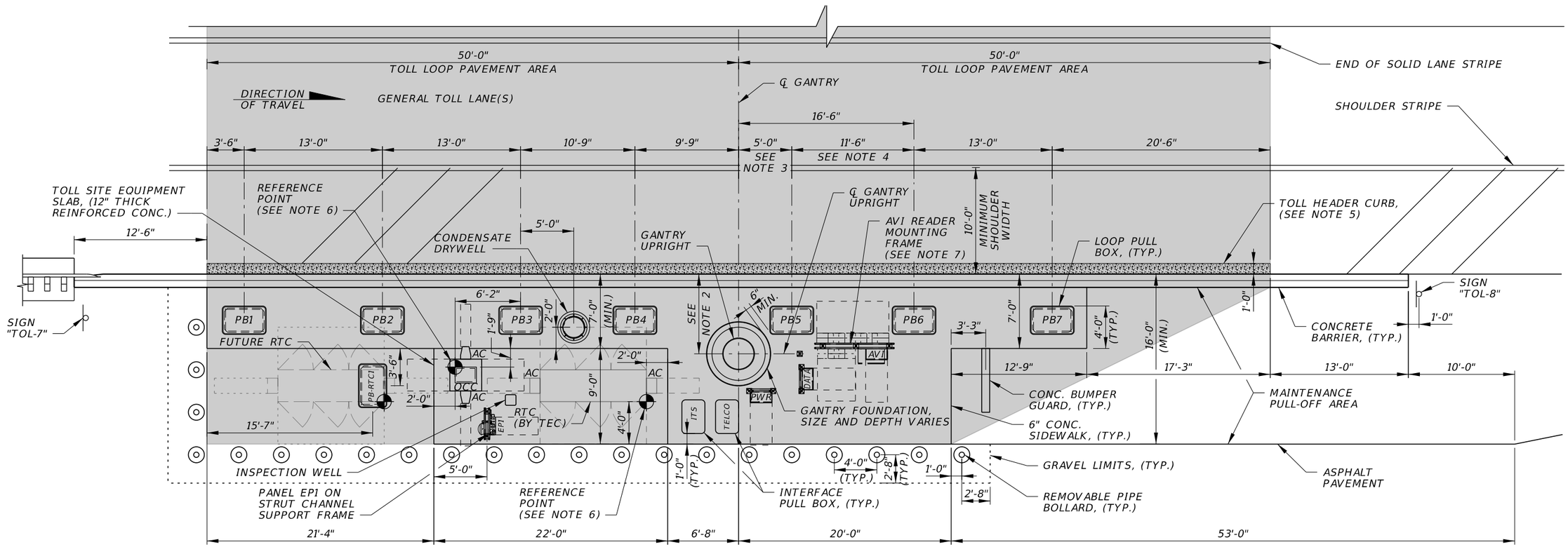
SINGLE MOVEMENT RTC STANDARD SITE PLAN (ON RETAINING WALL) - ON-SITE POWER

N.T.S.

NOTES TO PREPARER:

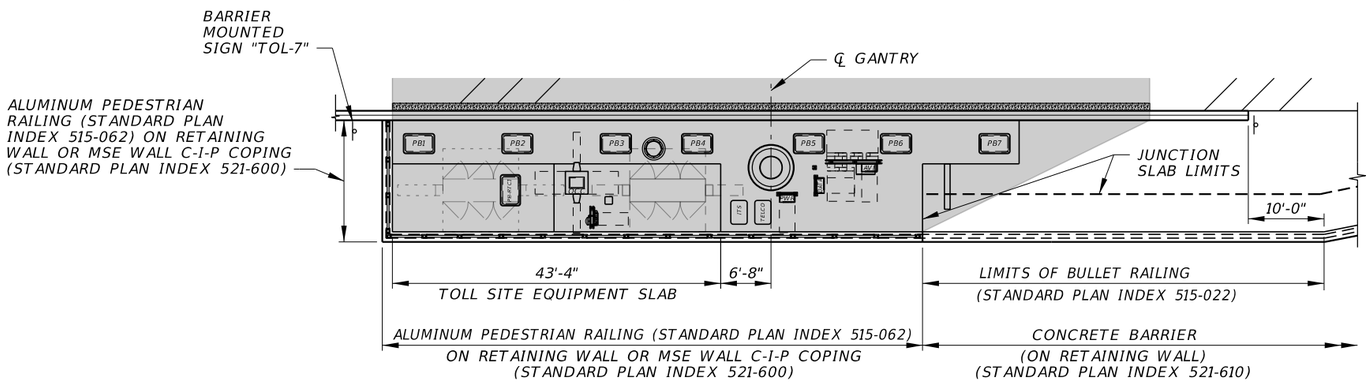
1. *SHADED AREAS INDICATES THE "TOLL SITE ENVELOPE".*
2. *7'-6" MAXIMUM FOR SPAN GANTRY. 6'-0" MINIMUM FOR CANTILEVER GANTRY.*
3. *STANDARD DIMENSION IS 5'-0". DIMENSION MAYBE INCREASED TO A MAXIMUM OF 6'-0" TO MAINTAIN A 6" MINIMUM CLEARANCE BETWEEN THE DRILLED SHAFT AND LOOP PULL BOX.*
4. *STANDARD DIMENSION IS 11'-6". DIMENSION MAY BE REDUCED SUCH THAT THE DISTANCE BETWEEN THE FOUNDATION CENTERLINE AND LOOP PULL BOX "PB6" CENTERLINE IS ALWAYS 16'-6".*
5. *TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.*
6. *REFERENCE POINT DENOTES THE CONTROL POINT FOR CONDUIT STUB-UP LOCATIONS.*
7. *AVI READERS MUST NOT BE INSTALLED ABOVE PULL BOXES, MAINTAIN A MINIMUM 6" DISTANCE HORIZONTALLY.*

Exhibit 231.1-6 Single Movement Gantry RTC Standard Site Plan – Off-Site Power Service



SINGLE MOVEMENT RTC STANDARD SITE PLAN (AT GRADE) - OFF-SITE POWER

N.T.S.



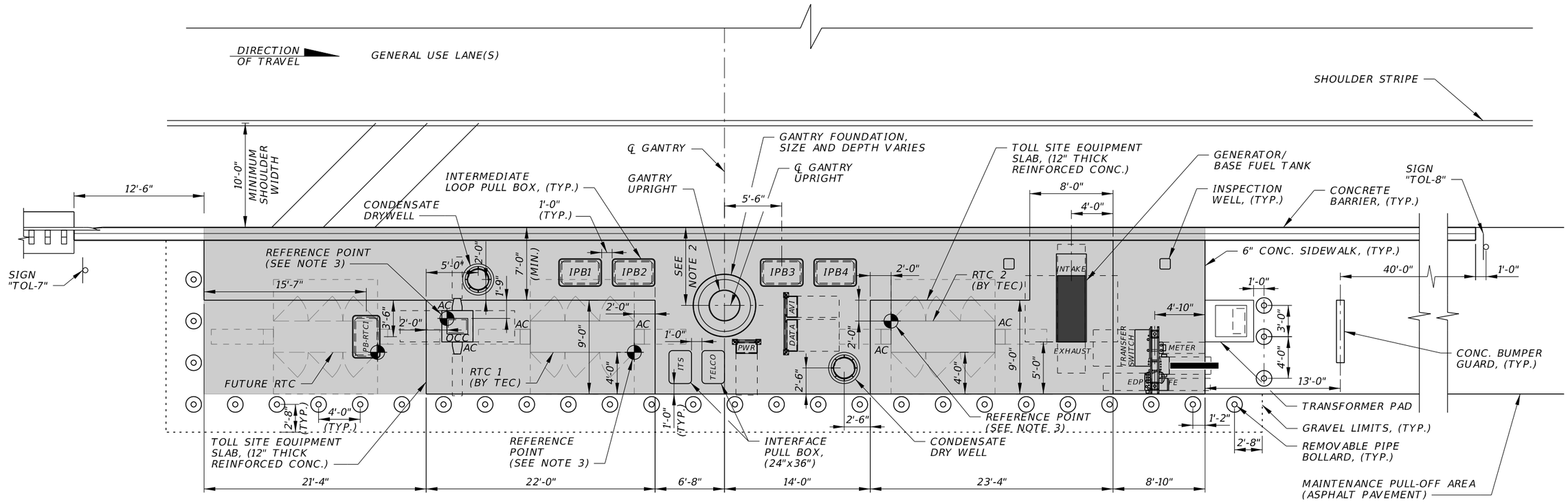
SINGLE MOVEMENT RTC SITE PLAN (ON RETAINING WALL) - OFF-SITE POWER

N.T.S.

NOTES TO PREPARER:

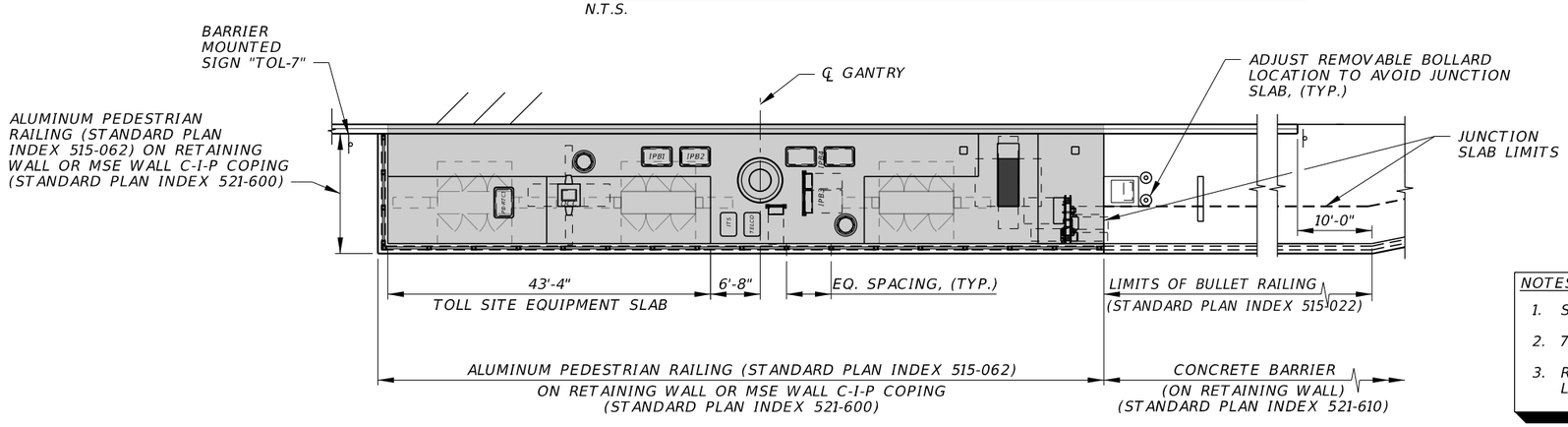
1. SHADED AREAS INDICATES THE "TOLL SITE ENVELOPE".
2. 7'-6" MAXIMUM FOR SPAN GANTRY. 6'-0" MINIMUM FOR CANTILEVER GANTRY.
3. STANDARD DIMENSION IS 5'-0". DIMENSION MAYBE INCREASED TO A MAXIMUM OF 6'-0" TO MAINTAIN A 6" MINIMUM CLEARANCE BETWEEN THE DRILLED SHAFT AND LOOP PULL BOX.
4. STANDARD DIMENSION IS 11'-6". DIMENSION MAY BE REDUCED SUCH THAT THE DISTANCE BETWEEN THE FOUNDATION CENTERLINE AND LOOP PULL BOX "PB6" CENTERLINE IS ALWAYS 16'-6".
5. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
6. REFERENCE POINT DENOTES THE CONTROL POINT FOR CONDUIT STUB-UP LOCATIONS.
7. AVI READERS MUST NOT BE INSTALLED ABOVE PULL BOXES, MAINTAIN A MINIMUM 6" DISTANCE HORIZONTALLY.

Exhibit 231.1-7 Dual Movement RTC Detached Site Plan



DUAL MOVEMENT RTC DETACHED SITE PLAN (AT GRADE)

N.T.S.



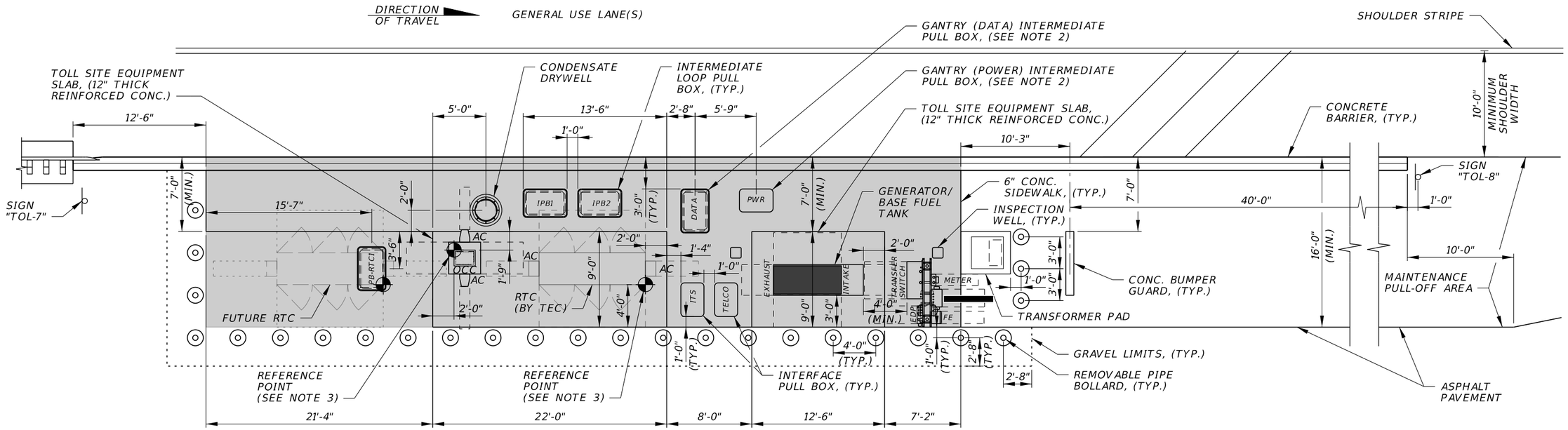
DUAL MOVEMENT RTC DETACHED SITE PLAN (ON RETAINING WALL)

N.T.S.

NOTES TO PREPARER:

1. SHADED AREAS INDICATES THE "TOLL SITE ENVELOPE".
2. 7'-6" MAXIMUM FOR SPAN GANTRY. 6'-0" MINIMUM FOR CANTILEVER GANTRY.
3. REFERENCE POINT DENOTES THE CONTROL POINT FOR CONDUIT STUB-UP LOCATIONS.

Exhibit 231.1-8 Single Movement RTC Remote Site Plan - On-Site Power Service

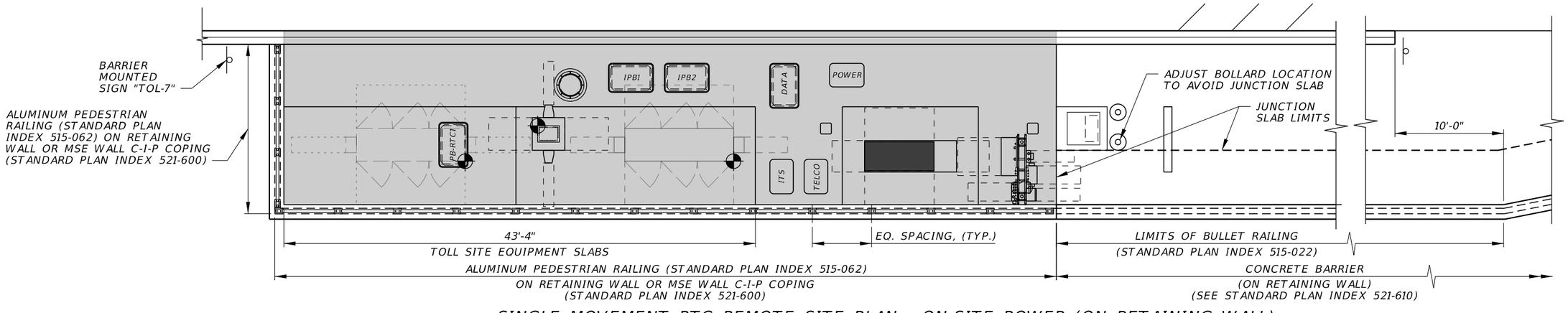


SINGLE MOVEMENT RTC REMOTE SITE PLAN - ON-SITE POWER (AT GRADE)

N.T.S.

NOTES TO PREPARER:

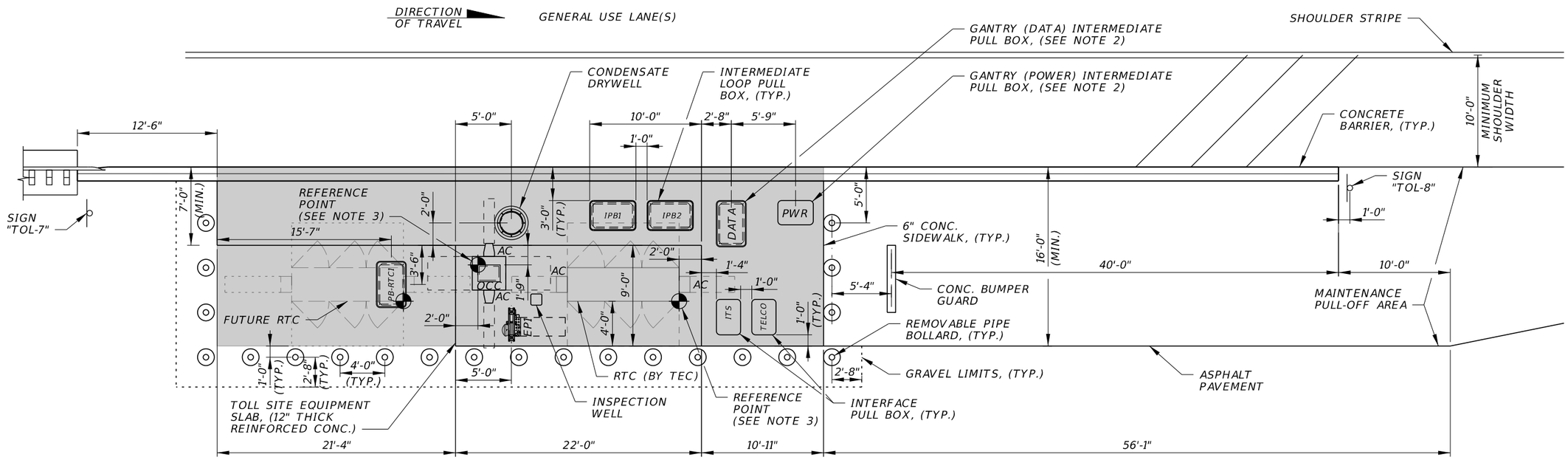
1. *SHADED AREAS INDICATES THE "TOLL SITE ENVELOPE". TOLL LOOP PAVEMENT AREA NOT SHOWN.*
2. *SIZE PULL BOX BASED ON QUANTITY AND SIZE OF CONDUIT.*
3. *REFERENCE POINT DENOTES THE CONTROL POINT FOR CONDUIT STUB-UP LOCATIONS.*



SINGLE MOVEMENT RTC REMOTE SITE PLAN - ON-SITE POWER (ON RETAINING WALL)

N.T.S.

Exhibit 231.1-9 Single Movement RTC Remote Site Plan - Off-Site Power Service

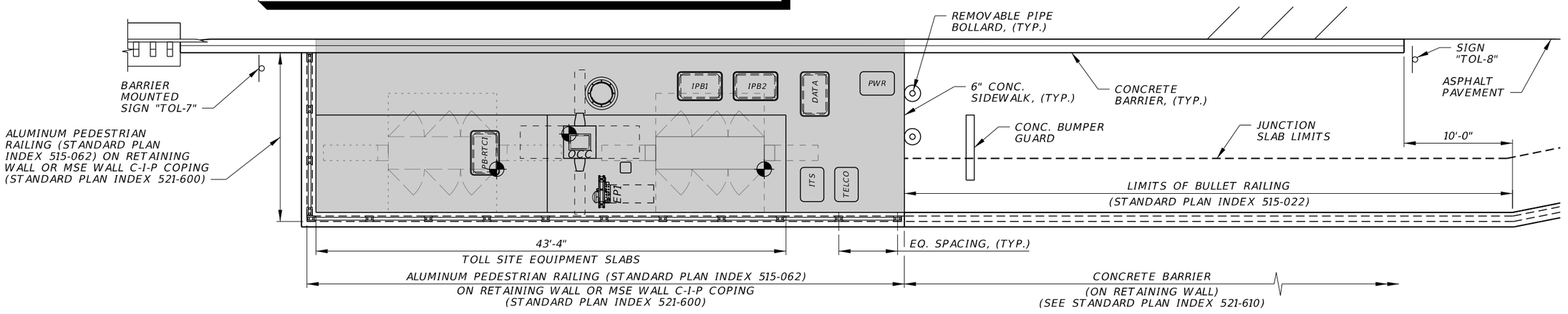


SINGLE MOVEMENT RTC REMOTE SITE PLAN - OFF-SITE POWER SERVICE (AT GRADE)

N.T.S.

NOTES TO PREPARER:

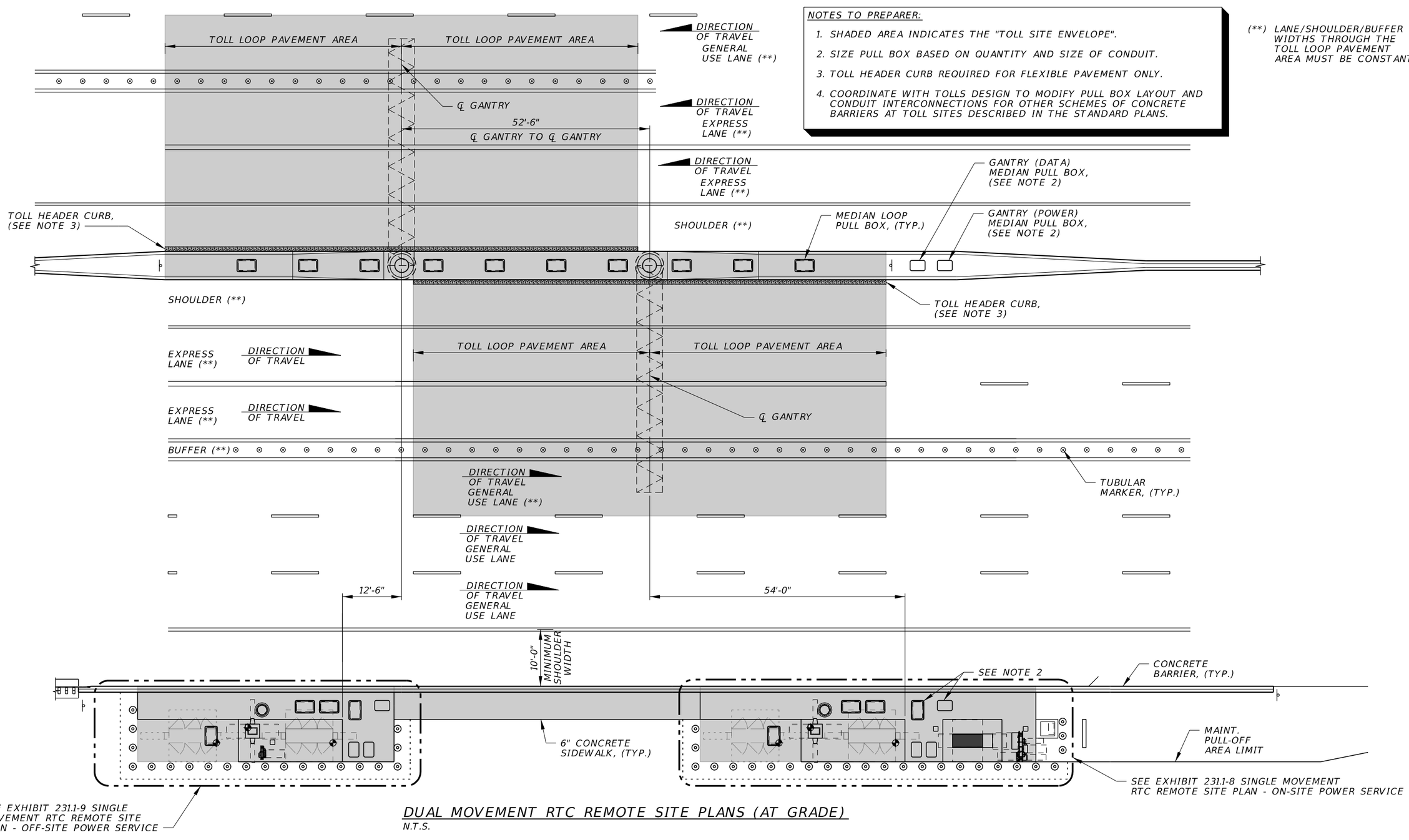
1. SHADED AREAS INDICATES THE "TOLL SITE ENVELOPE". TOLL LOOP PAVEMENT AREA NOT SHOWN.
2. SIZE PULL BOX BASED ON QUANTITY AND SIZE OF CONDUIT.
3. REFERENCE POINT DENOTES THE CONTROL POINT FOR CONDUIT STUB-UP LOCATIONS.



SINGLE MOVEMENT RTC REMOTE SITE PLAN - OFF-SITE POWER SERVICE (ON RETAINING WALL)

N.T.S.

Exhibit 231.1-10 Dual Movement RTC Remote Site Plans



NOTES TO PREPARER:

1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. SIZE PULL BOX BASED ON QUANTITY AND SIZE OF CONDUIT.
3. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
4. COORDINATE WITH TOLLS DESIGN TO MODIFY PULL BOX LAYOUT AND CONDUIT INTERCONNECTIONS FOR OTHER SCHEMES OF CONCRETE BARRIERS AT TOLL SITES DESCRIBED IN THE STANDARD PLANS.

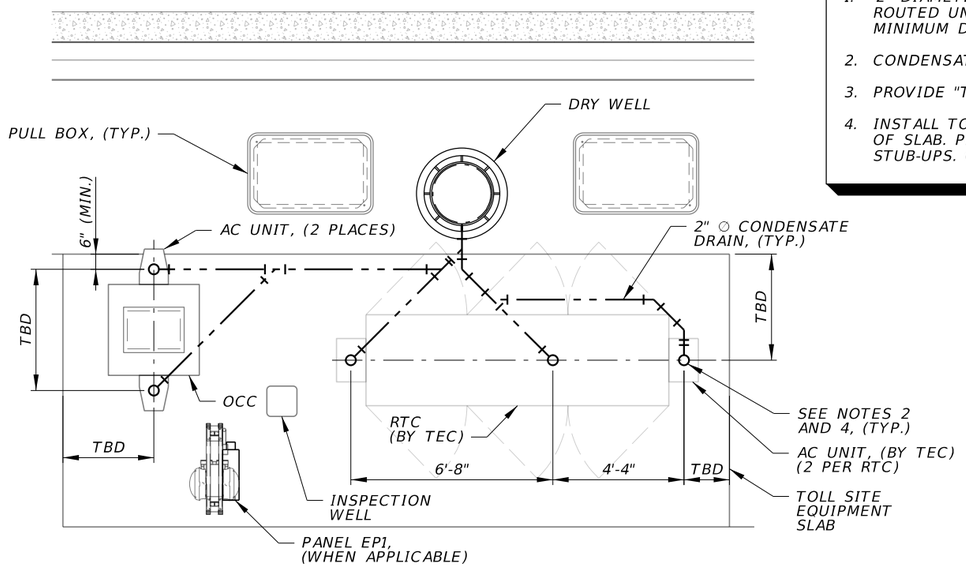
(**) LANE/SHOULDER/BUFFER WIDTHS THROUGH THE TOLL LOOP PAVEMENT AREA MUST BE CONSTANT.

DUAL MOVEMENT RTC REMOTE SITE PLANS (AT GRADE)
N.T.S.

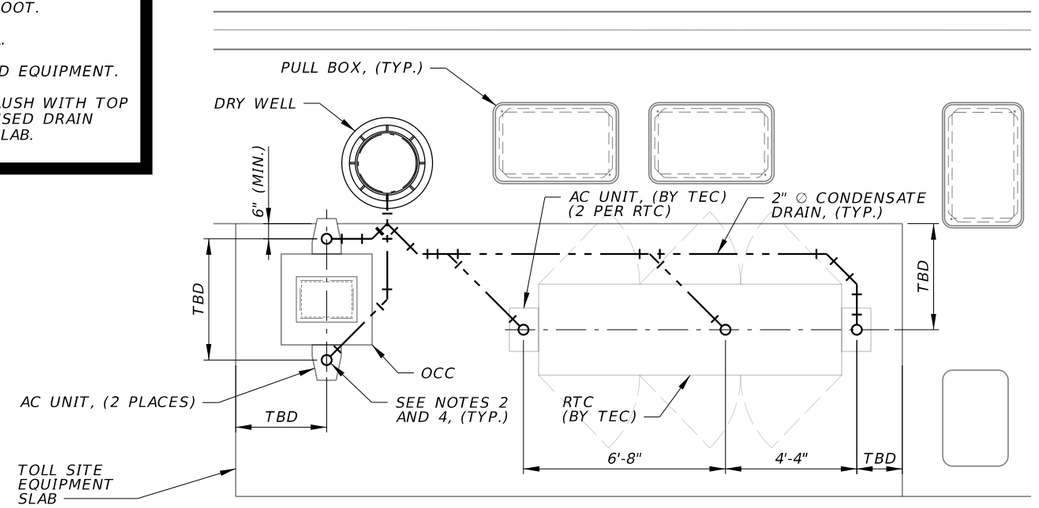
Exhibit 231.1-11 RTC Condensate Piping Plans and Details

NOTES TO PREPARER:

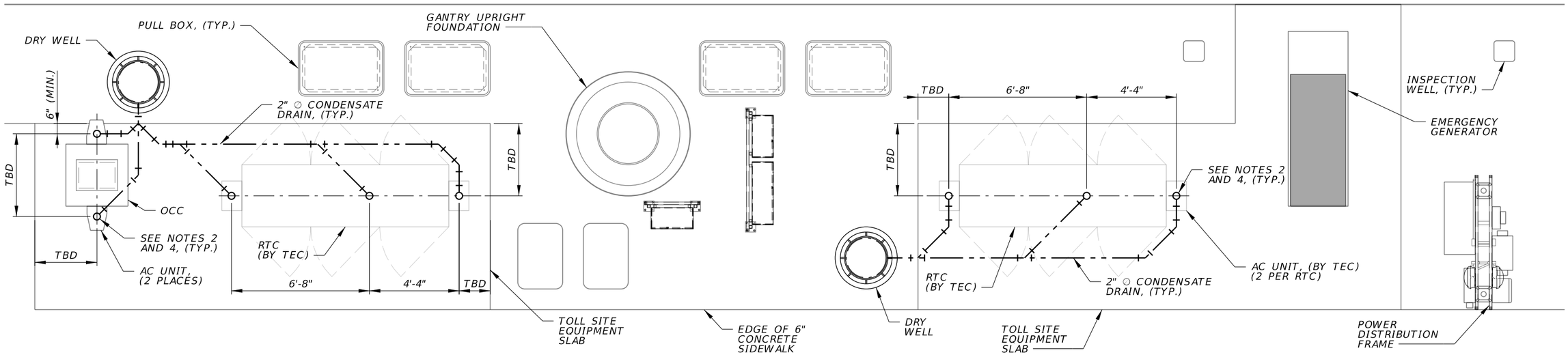
1. *2" DIAMETER SCHEDULE 40 PVC CONDENSATE DRAIN LINE ROUTED UNDERGROUND TO IN-GROUND CONDENSATE DRY WELL. MINIMUM DRAIN LINE SLOPE MUST BE 1/8" PER FOOT.*
2. *CONDENSATE DRAIN STUB-UP LOCATION, TYPICAL.*
3. *PROVIDE "TBD" DIMENSIONS BASED ON SPECIFIED EQUIPMENT.*
4. *INSTALL TOP OF CONDENSATE DRAIN STUB-UP FLUSH WITH TOP OF SLAB. PROVIDE REMOVABLE CAPS ON ALL UNUSED DRAIN STUB-UPS. CAPS MUST BE FLUSH WITH TOP OF SLAB.*



SINGLE MOVEMENT RTC STANDARD SITE PLAN - CONDENSATE PIPING LAYOUT
ON-SITE / OFF-SITE POWER
N.T.S.

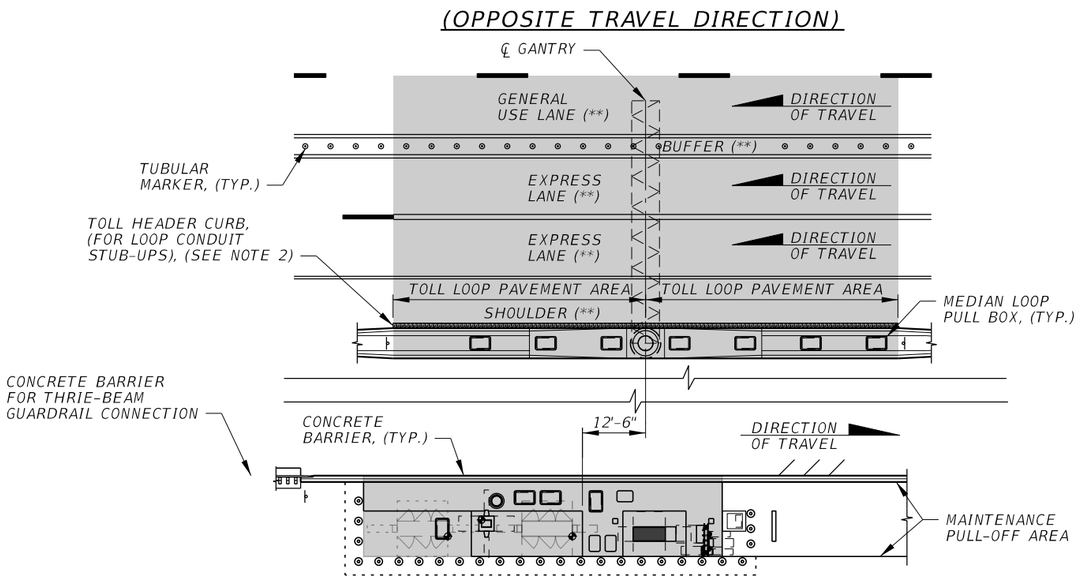


SINGLE MOVEMENT RTC REMOTE SITE PLAN - CONDENSATE PIPING LAYOUT
ON-SITE / OFF-SITE POWER
N.T.S.

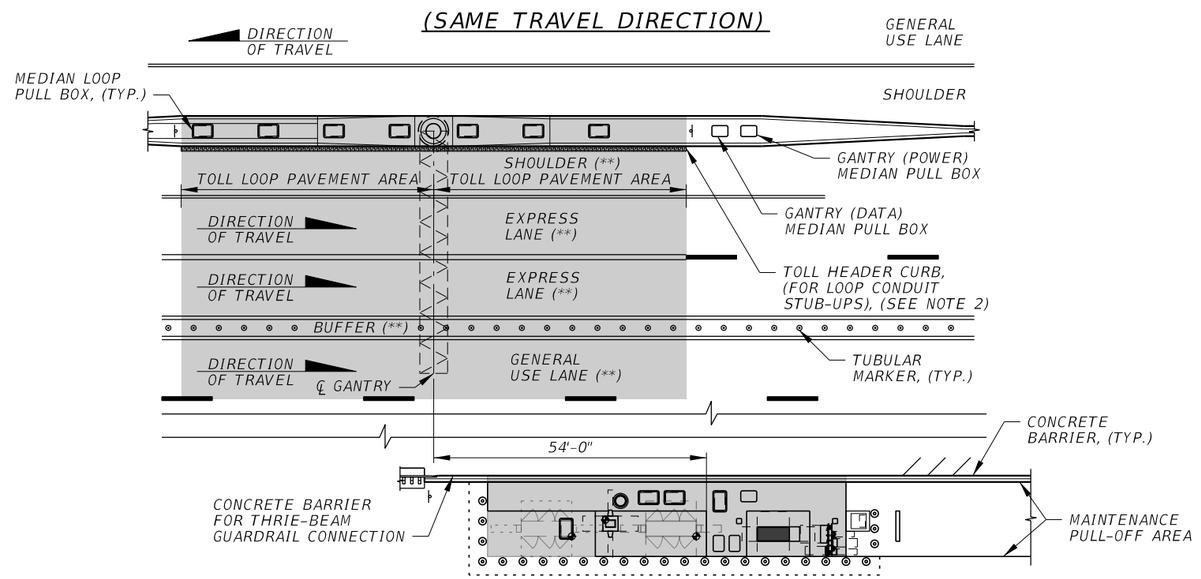


DUAL MOVEMENT RTC DETACHED SITE PLAN - CONDENSATE PIPING LAYOUT
N.T.S.

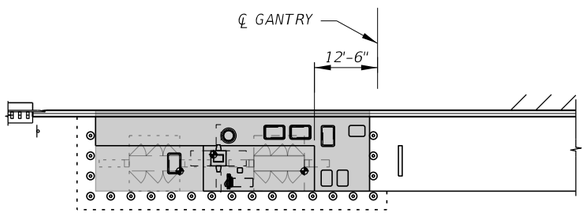
Exhibit 231.1-12 Single Movement TEB and RTC Remote Site Plan(s)



SINGLE MOVEMENT RTC REMOTE SITE PLAN - ON-SITE POWER SERVICE
N.T.S.



SINGLE MOVEMENT RTC REMOTE SITE PLAN - ON-SITE POWER SERVICE
N.T.S.

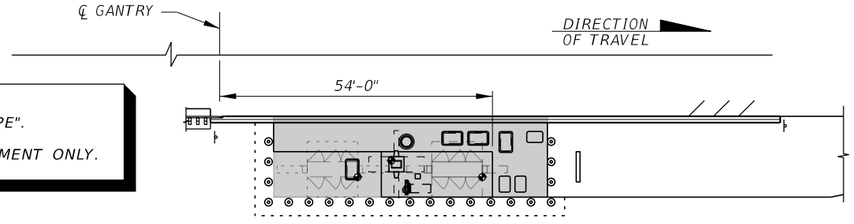


(**) LANE/SHOULDER/BUFFER WIDTHS THROUGH THE TOLL LOOP PAVEMENT AREA MUST BE CONSTANT.

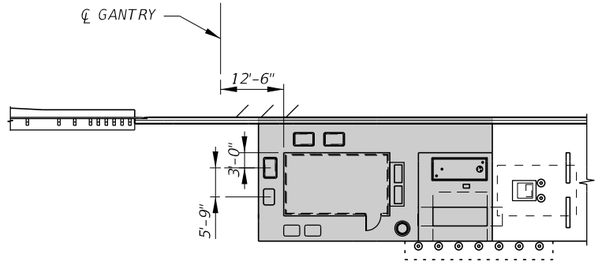
NOTES TO PREPARER:

1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.

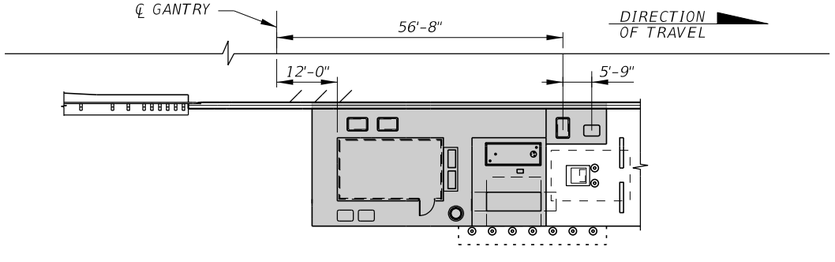
SINGLE MOVEMENT RTC REMOTE SITE PLAN - OFF-SITE POWER SERVICE
N.T.S.



SINGLE MOVEMENT RTC REMOTE SITE PLAN - OFF-SITE POWER SERVICE
N.T.S.

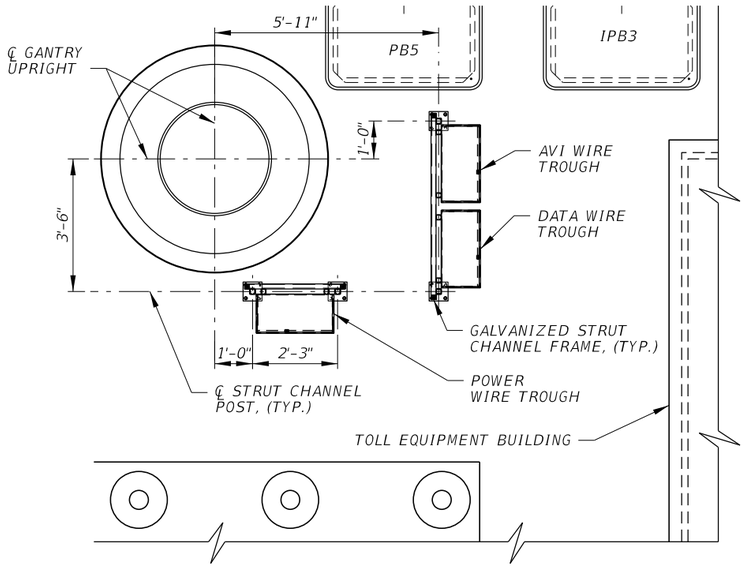


SINGLE MOVEMENT TEB REMOTE SITE PLAN - (OPTION 1)
N.T.S.

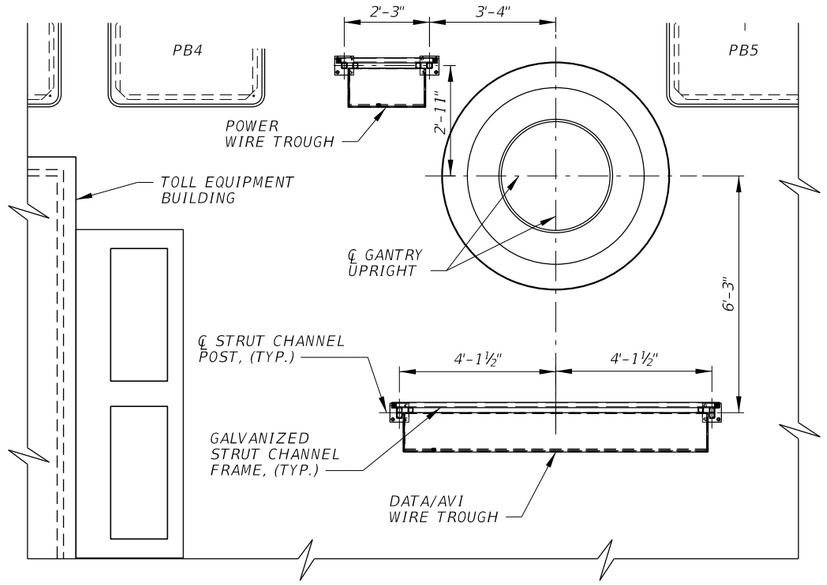


SINGLE MOVEMENT TEB REMOTE SITE PLAN - (OPTION 2)
N.T.S.

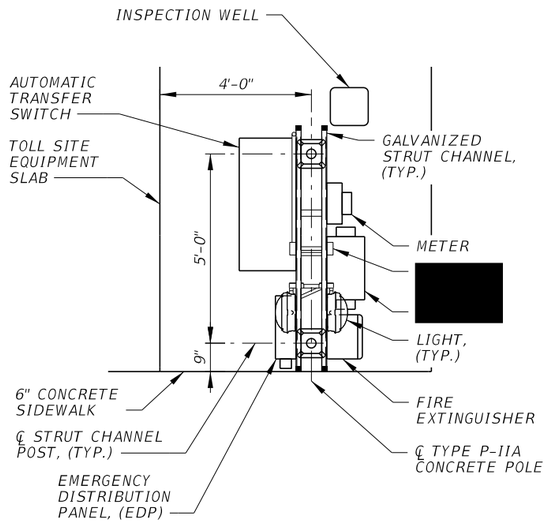
Exhibit 231.1-13 TEB and RTC Ground-Mounted Strut Channel Frame Layouts



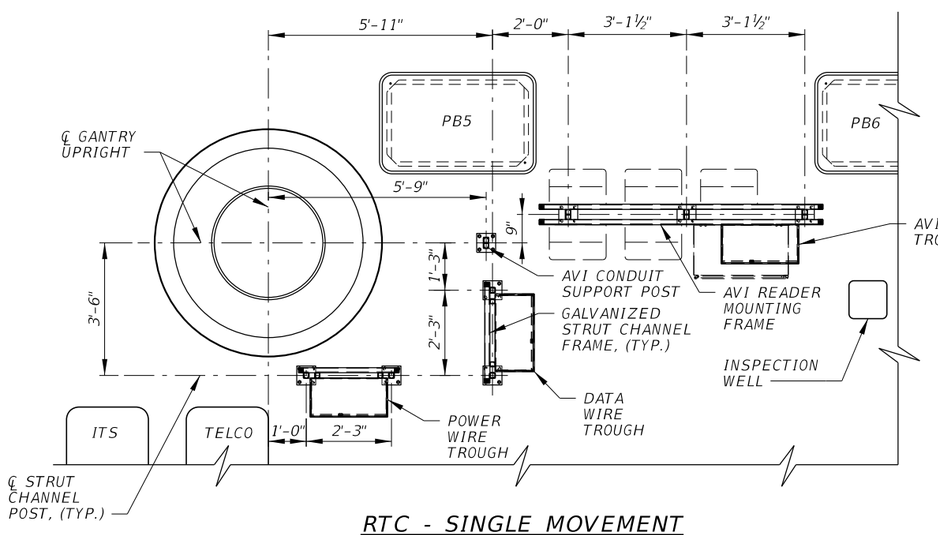
TEB NON-ACCESSIBLE GANTRY - SINGLE MOVEMENT
N.T.S.



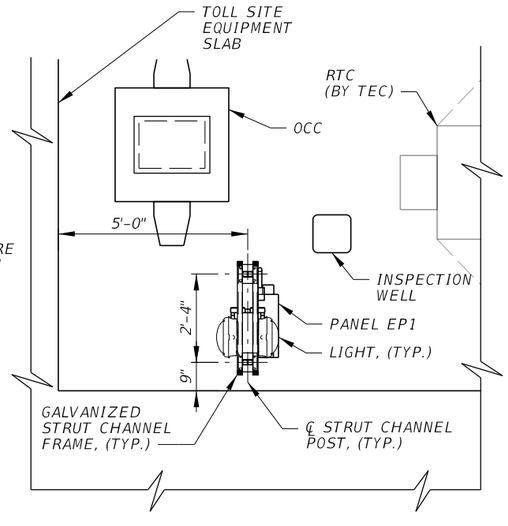
TEB ACCESSIBLE GANTRY
N.T.S.



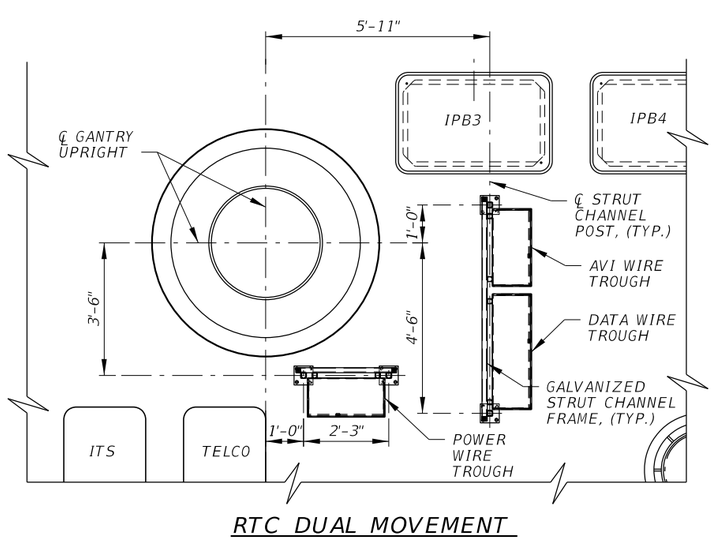
RTC ON-SITE POWER SERVICE POWER DISTRIBUTION FRAME
N.T.S.



RTC - SINGLE MOVEMENT
N.T.S.



RTC OFF-SITE POWER SERVICE POWER DISTRIBUTION FRAME
N.T.S.



RTC DUAL MOVEMENT
N.T.S.

231.2 Maintenance Access

Maintenance pull-off areas must be provided for access of roadside ground mounted toll infrastructure, except when only pull boxes and / or gantry uprights are present.

231.2.1 Maintenance Pull-Off Area

(1) Maintenance pull-off areas must be provided for access to the TEB and RTC.

(2) The maintenance pull-off areas must allow for entry and exit, maintenance vehicle parking, and staging of at least two maintenance vehicles with concrete bumper guard(s).

(3) Maintenance vehicles include box vans, lift trucks, bucket trucks, scissor lift trucks, etc. with a design size of 100 inches wide x 300 inches long.

(4) The maintenance pull-off areas must be stabilized and physically protected from traffic by concrete barrier. See ***Standard Plans***, ***Index 521-001***.

(5) At a minimum, the maintenance pull-off pavement must match the pavement design of the adjacent paved roadway shoulder, beyond the toll loop pavement area. See ***GTR 221*** for pavement design requirements.

(6) See the ***TEB Site Plans*** and the ***RTC Site Plans*** for additional geometric requirements regarding pull-off areas and site related details.

(7) The maintenance pull-off parking must be dedicated to Tolls use only and must not be designed as a shared access for any other maintenance vehicles.

(8) Maintenance pull-off areas must be designed to allow for vehicle outriggers of the bucket truck or scissor lift truck to be deployed adjacent to the accessible gantry access stair structure.

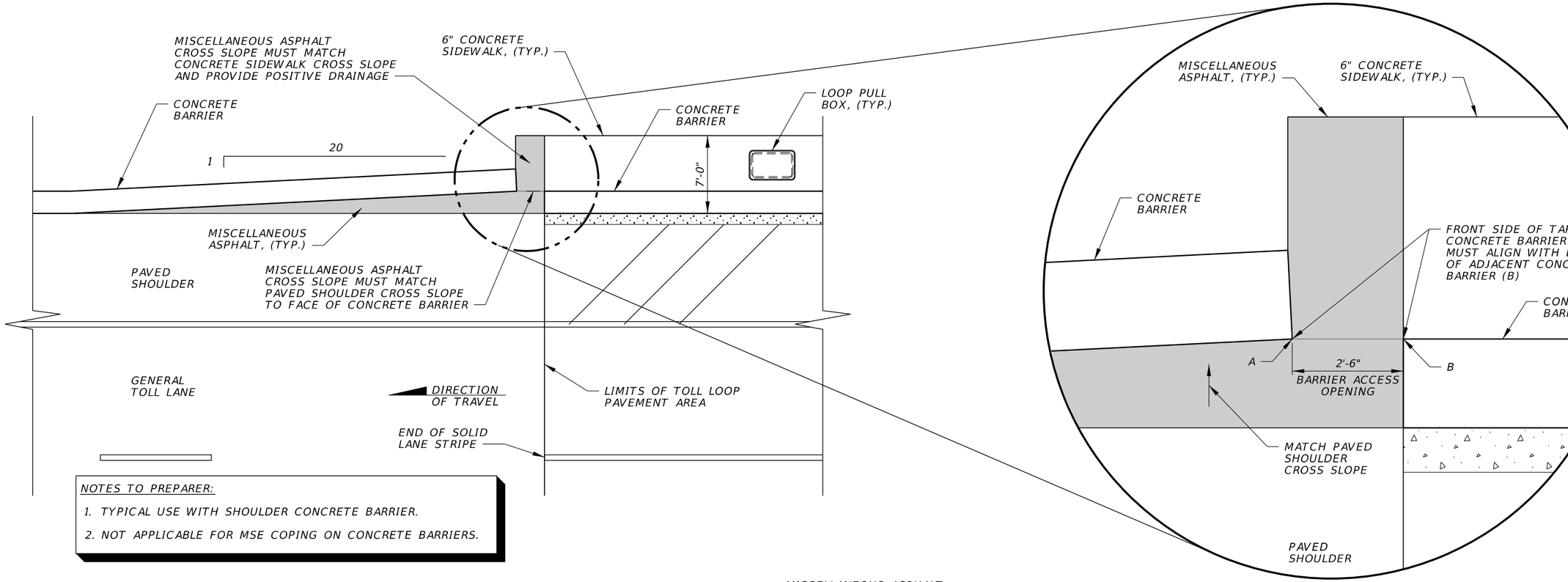
231.2.2 Barrier Access

Provide barrier access at the departure end of the toll loop pavement area as follows:

(1) When continuous traffic barriers are present and extend beyond the limits of the toll loop pavement area, use Case I or Case II in ***Exhibit 231.2-1***.

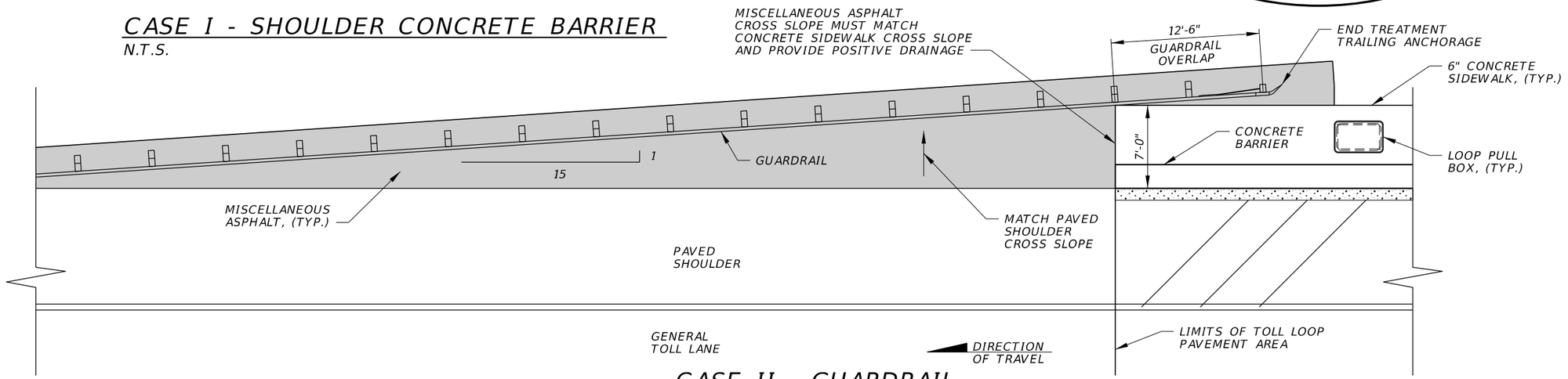
(2) When the traffic barrier ends at the limits of the toll loop pavement area, use Case III in ***Exhibit 231.2-2***.

Exhibit 231.2-1 Toll Site Barrier Access (1 of 2)



CASE I - SHOULDER CONCRETE BARRIER

N.T.S.



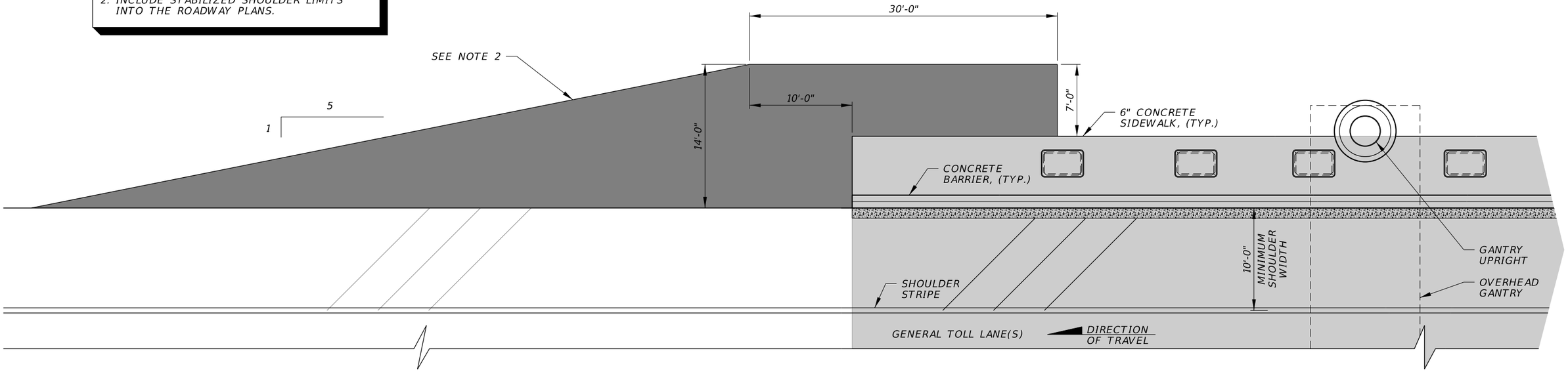
CASE II - GUARDRAIL

N.T.S.

Exhibit 231.2-2 Toll Site Barrier Access (2 of 2)

NOTES TO PREPARER:

1. *SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".*
2. *INCLUDE STABILIZED SHOULDER LIMITS INTO THE ROADWAY PLANS.*



CASE III - TOLL SITE BARRIER ACCESS
N.T.S.

231.3 Sidewalks

(1) All concrete sidewalk must be 6-inch thick minimum.

(2) The concrete sidewalk encircling a TEB must be a minimum 5-foot wide.

(3) Sidewalk must be continuous and not contain any curbs or abrupt elevation differences in its path.

(4) Asphalt pavement elevation must be flush with the adjacent sidewalk.

(5) At a minimum, a 5-foot wide clear path of must be available from the maintenance pull-off area to TEBs and RTCs unless noted otherwise in the ***RTC Site Plans***.

(6) Sidewalk must be flush with the adjacent equipment slabs within the toll site envelope.

(7) TEB finished floor elevation must be ½-inch higher than the sidewalk at the door threshold.

(8) Concrete sidewalk joints must be constructed in accordance with ***Standard Plans***, ***Index 522-001.***

(9) Expansion joints must be installed between concrete sidewalk and the following:

- (a) Equipment concrete slabs
- (b) Gantry foundations
- (c) Concrete barriers
- (d) Drywells
- (e) TEB
- (f) Pull boxes

(10) Sidewalk joints are not permitted at the same location as loop pull boxes except along the edge. Coordinate sidewalk joints with site infrastructure locations, loop pull boxes, and other site features, including dry well, communications and ITS pull boxes, and surface mounted equipment.

231.4 Pipe Bollards

(1) Removable pipe bollards must be provided around any items exposed to vehicles or maintenance equipment and as required to protect above-ground utilities and site infrastructure.

(2) See ***Exhibit 231.4-1*** and ***Exhibit 231.4-2*** for additional requirements for removable pipe bollards.

(3) Pipe bollards must be spaced no more than 4 feet apart around all generators, fuel tanks, AVI reader ground mounted frame, gantry stair foundation, and wire troughs. Pipe bollards must be placed 3 feet apart around the utility transformer pad. See the ***TEB Site Plans*** and the ***RTC Site Plans*** for bollard layouts.

(4) Pipe bollards must be located to allow for unobstructed access and operation of the AVI reader ground mounted frames and wire troughs.

(5) See ***Exhibit 231.4-3*** for requirements for permanent pipe bollards.

Exhibit 231.4-1 Removable Pipe Bollards in Gravel

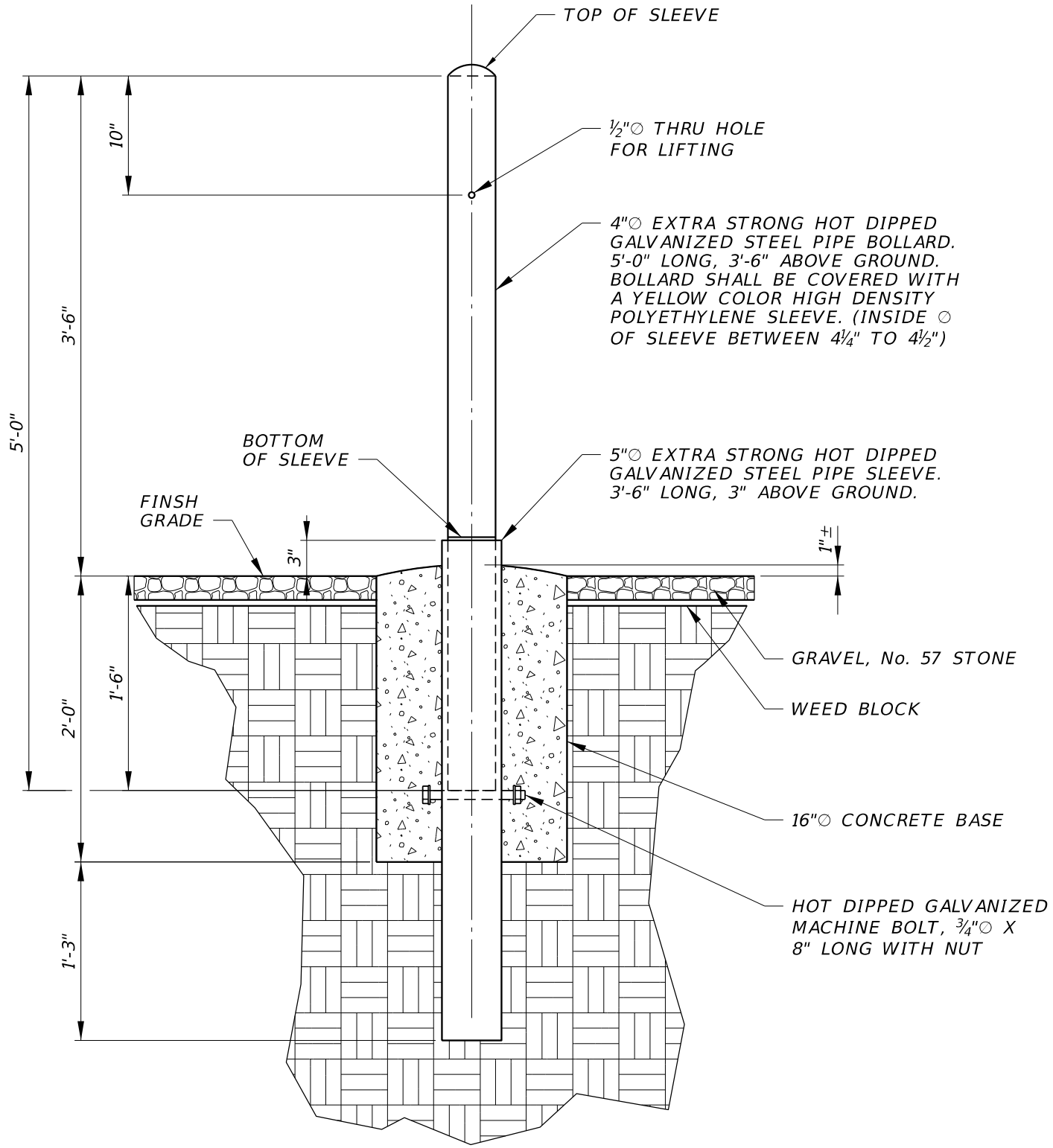


Exhibit 231.4-2 Removable Pipe Bollards in Asphalt

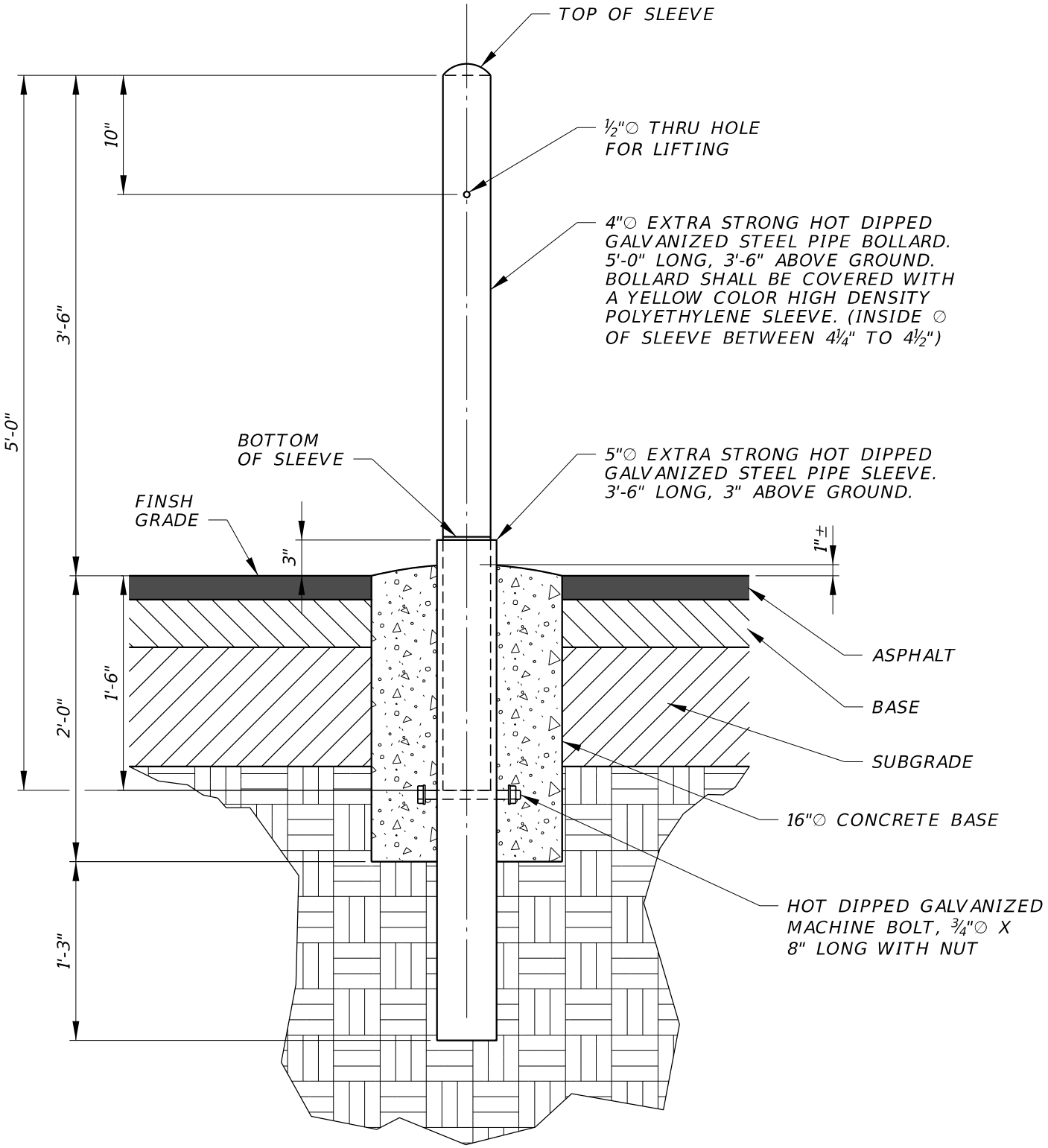
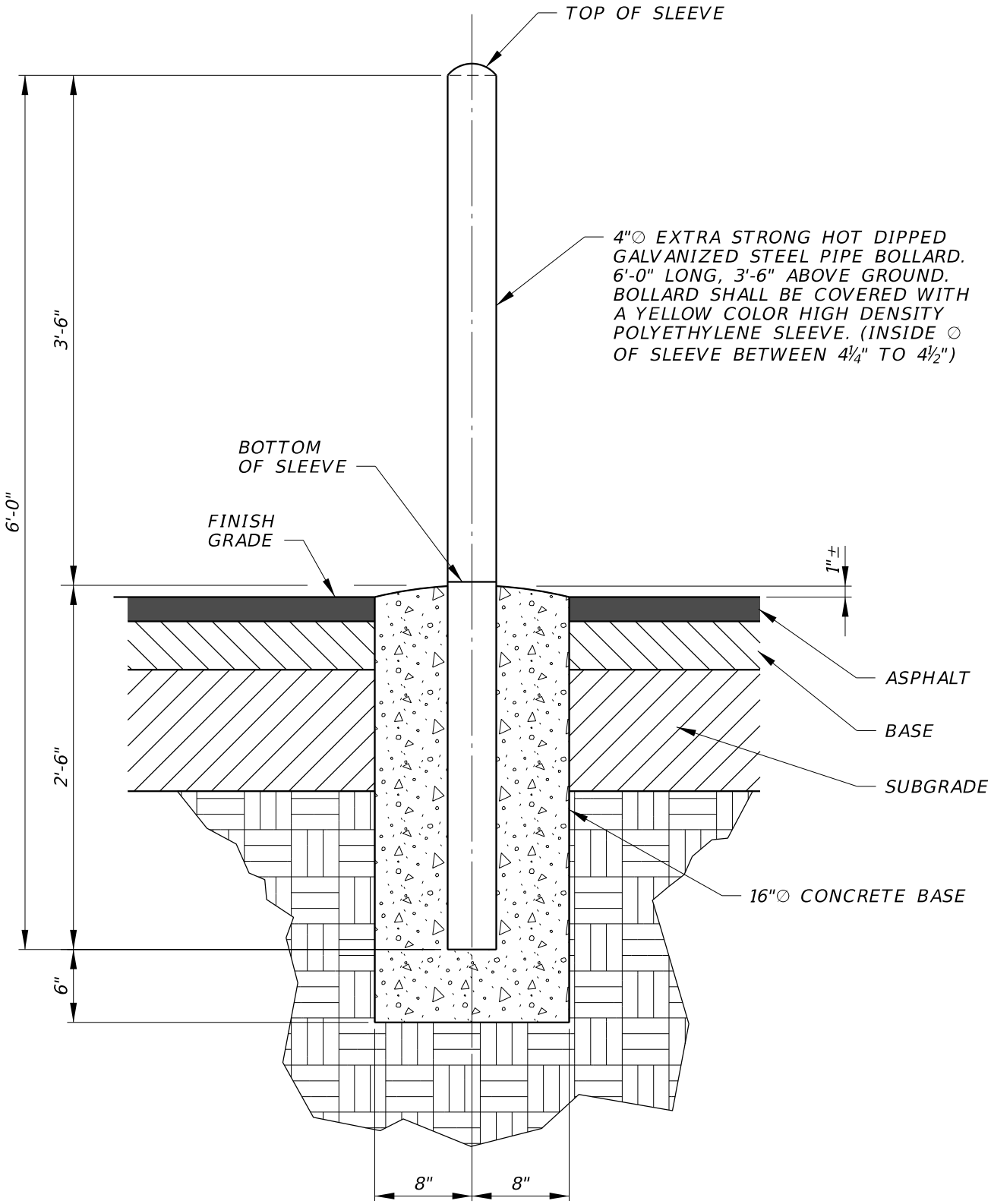


Exhibit 231.4-3 Permanent Pipe Bollards



231.5 Toll Site Equipment Slabs and Toll Equipment Building Foundations

(1) The transformer pad must be designed in compliance with the utility company requirements.

(2) **TEB Sites**: A single slab must be designed for the generator and fuel tank as follows:

(a) The slab must be a reinforced monolithic concrete slab designed for the bearing conditions at each site and for the wind load criteria specified in ***GTR 241***.

(b) The slab must be flush with the adjacent sidewalk/pavement and allow for positive drainage away from the TEB.

(c) See ***Exhibit 231.5-1*** for fuel tank hold-down details.

(d) Geotechnical investigation must be in accordance with ***GTR 280.2***.

(3) See ***GTR 241.3*** for additional TEB foundation requirements.

(4) **RTC Sites**: See the ***RTC Site Plans*** for limits of equipment slabs and the layout of the RTC, OCC and other site components.

(a) Utilize the following equipment loads and areas for equipment slab design:

	Dead Load lbs	Footprint SF	Front Elevation SF	Side Elevation SF
RTC	2700	30	84	22
OCC	625	9	20	20
Generator with Fuel Tank	Site specific – Coordinate with Electrical EOR			

(5) **RTC Sites**: Slab(s) must be designed as reinforced concrete for the bearing conditions at each site and for the wind load criteria specified in ***GTR 241***.

(a) The slab must be flush with the adjacent sidewalk/pavement and allow for positive drainage of the site.

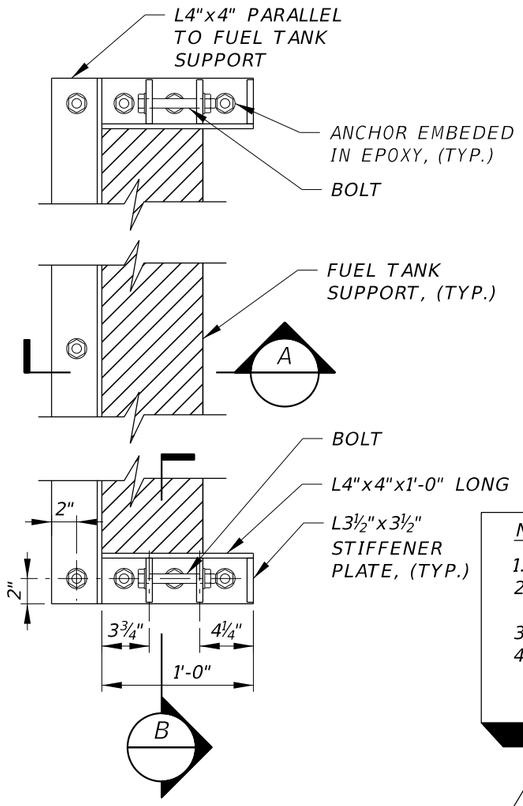
(b) Geotechnical investigation must be in accordance with ***GTR 280.1***.

(c) The generator slab must be a minimum of 12 inches thick.

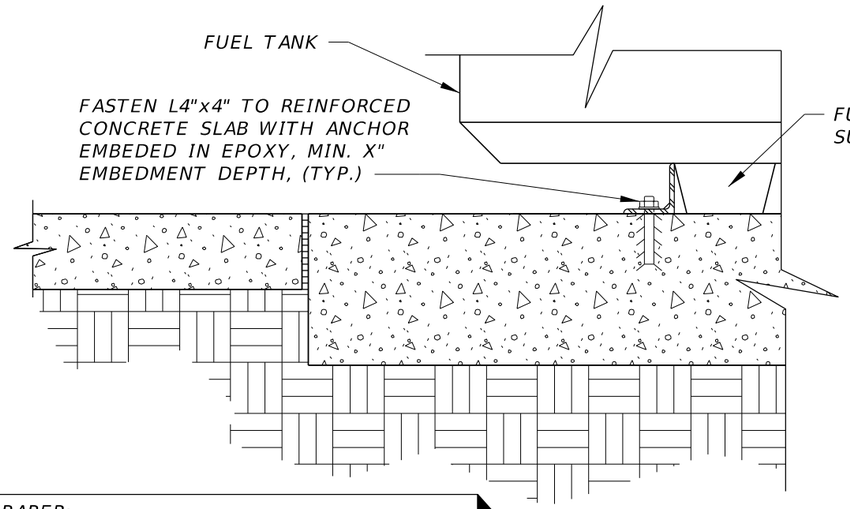
(d) A minimum 6-inch (unless noted otherwise) concrete slab must be provided under all other above grade electrical infrastructure .

(6) The slab must include provisions for the concrete encased electrode conductor as shown in ***Exhibit 232.4-1***.

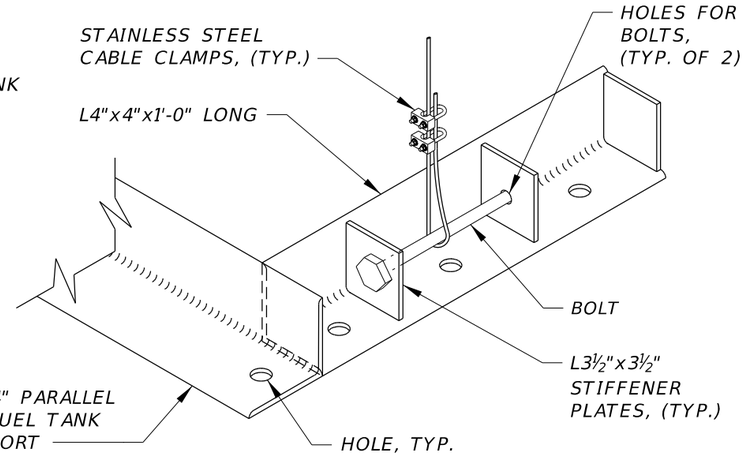
Exhibit 231.5-1 Fuel Tank Hold-Down Details



PLAN VIEW
N.T.S.



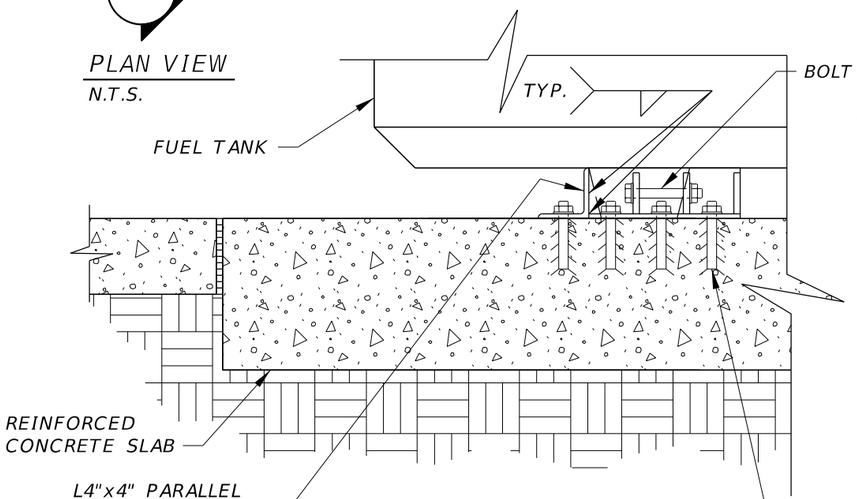
A SECTION
N.T.S.



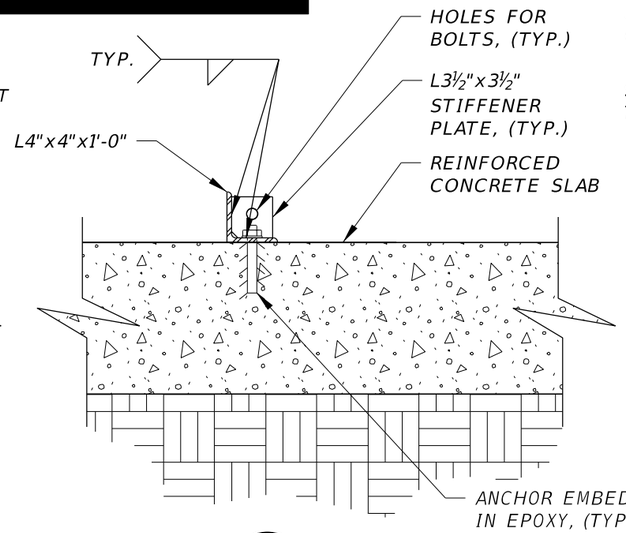
FUEL TANK HOLD DOWN CABLES, ENLARGED VIEW
N.T.S.

NOTES TO PREPARER:

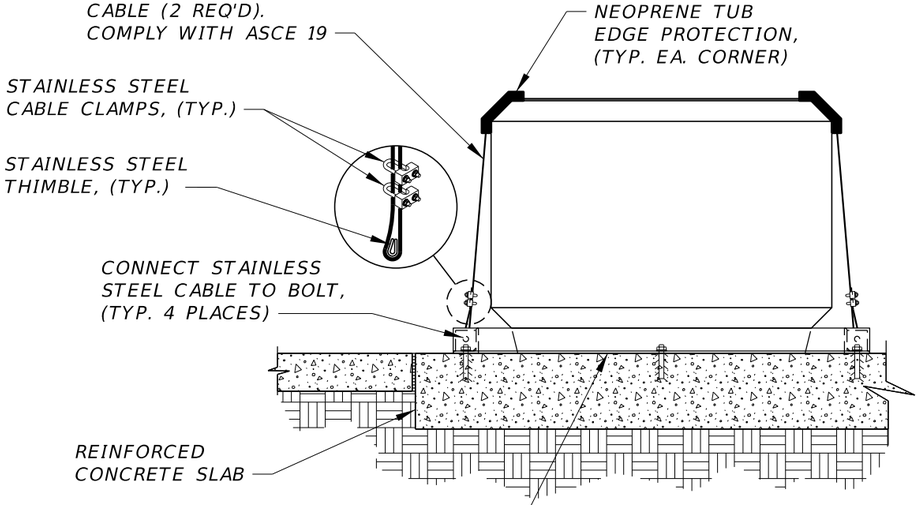
1. STRUCTURAL STEEL SHALL CONFORM TO ASTM A36.
2. ALL WELDS SHALL IN ACCORDANCE WITH AWS CODE AND ELECTRODE SHALL BE E70XX.
3. BOLTS SHALL CONFORM TO ASTM A325.
4. PAINT ALL EXPOSED STEEL WITH GRAY COLD GALVANIZED PAINT.



ELEVATION
N.T.S.



B SECTION
N.T.S.



FUEL TANK HOLD DOWN CABLE DETAIL
N.T.S.

231.6 Toll Site Grading

(1) Sites must be graded to maintain positive drainage. Grading details must be provided for the entire site.

(2) The elevation of adjacent concrete walks and driveways surrounding TEBs, generators, fuel tanks, equipment concrete pads, power distribution frames, and gantry foundations must be designed to allow positive drainage away from these elements.

(3) Site grading within the gravel limits surrounding the bollards must be 1:6 or flatter.

(4) Adjacent top of ditches and swales must be at least 5 feet from toll site envelope.

(5) A minimum grade slope of 0.3% must be provided for concrete sidewalks and slabs.

(6) Site must be graded to set the elevation of the toll loop pull boxes and intermediate pull boxes lower than the following:

  (a) TEB finished floor

  (b) RTC / OCC concrete slab(s)

(7) Median pull boxes are not subject to the requirements of item (6) above.

231.7 Fencing for Toll Sites

Fencing must be provided if there are pedestrian facilities adjacent to a toll site or if a toll site is located outside of limited access right-of-way.

(1) The toll site must be fenced using ***Standard Plans***, ***Index 550-002***, fence Type B. The fence must enclose the perimeter of the toll site infrastructure including generators, fuel tanks, AVI reader ground mounted frames, equipment concrete pads, and power distribution frames. Locate the pad-mounted transformer and power meter outside the fence.

(2) The fenced area must be gated and allow for opening safely within the maintenance pull-off area. The clear opening for the gate must be at least 5 feet wide.

232 Toll Site Electrical

232.1 Toll Site Electrical Layout

(1) The electrical infrastructure between gantries, generators, fuel tanks, pull boxes, TEBs, RTCs, OCCs, and miscellaneous equipment must be provided. Electrical equipment must be accessible for operation and maintenance activities.

(2) Design site conduit routing in accordance with the enlarged electrical site plans below:

(a) **TEB Sites**: ***Exhibit 232.1-1***, ***Exhibit 232.1-2***, ***Exhibit 232.1-3***, and ***Exhibit 232.1-4***.

(b) **RTC Sites**: ***Exhibit 232.1-5***, ***Exhibit 232.1-6***, ***Exhibit 232.1-7***, ***Exhibit 232.1-8***, ***Exhibit 232.1-9***, ***Exhibit 232.1-10***, and ***Exhibit 232.1-11***.

(c) See ***GTR 232.3*** for additional applicable exhibits for both TEB and RTC sites.

(3) Underground duct banks must be encased in concrete. Encasement is not required if the duct bank is routed underneath concrete sidewalks, equipment concrete slabs or pavement.

(4) See ***Standard Plans***, ***Index 630-001*** for minimum conduit burial depths unless noted otherwise.

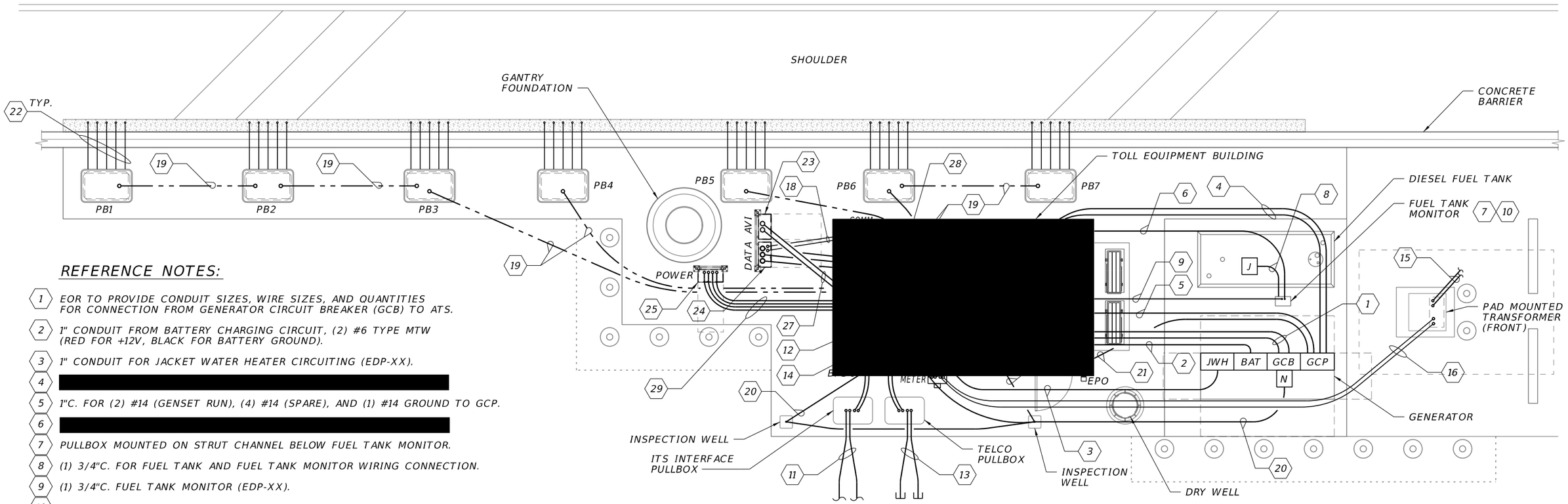
(5) Conduits under the guardrail must be installed at least 2 feet below the guardrail post burial depth. For guardrail post burial depths, see ***Standard Plans***, ***Index 536-001.***

(6) Pull boxes for gantry power and gantry data as shown in, ***Exhibit 232.1-3***, ***Exhibit 232.1-4***, ***Exhibit 232.1-6***, ***Exhibit 232.1-7***, ***Exhibit 232.1-8***, ***Exhibit 232.1-9***, and ***Exhibit 232.1-10*** and must be detailed as follows:

(a) All at-grade power and data pull boxes must be set on a foundation of pea rock having a minimum thickness of 12 inches as shown in ***Exhibit 232.3-1***, and ***Exhibit 232.3-2***.

(b) All raised median pull boxes must be set on a foundation of concrete with drainage per the loop pull box detail as shown in ***Exhibit 232.3-3***, and ***Exhibit 232.3-4***.

Exhibit 232.1-1 Single Movement Non-Accessible Gantry TEB Electrical Standard Site Plan



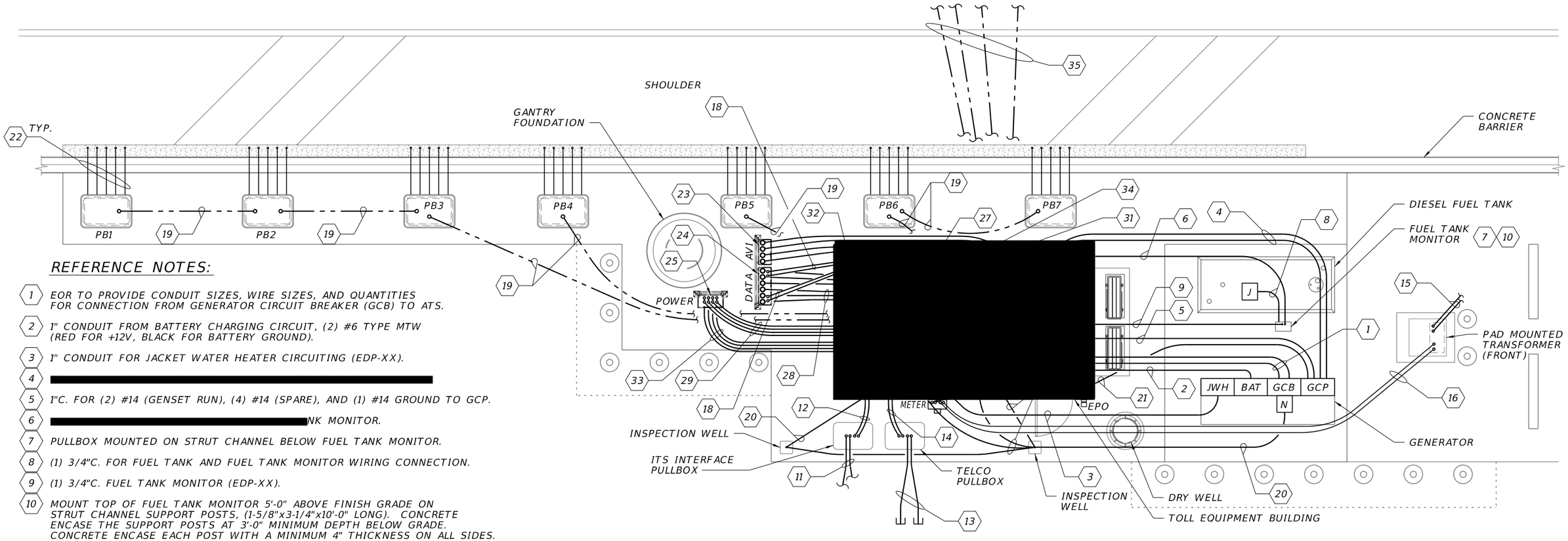
REFERENCE NOTES:

1. EOR TO PROVIDE CONDUIT SIZES, WIRE SIZES, AND QUANTITIES FOR CONNECTION FROM GENERATOR CIRCUIT BREAKER (GCB) TO ATS.
2. 1" CONDUIT FROM BATTERY CHARGING CIRCUIT, (2) #6 TYPE MTW (RED FOR +12V, BLACK FOR BATTERY GROUND).
3. 1" CONDUIT FOR JACKET WATER HEATER CIRCUITING (EDP-XX).
4. [redacted]
5. 1"C. FOR (2) #14 (GENSET RUN), (4) #14 (SPARE), AND (1) #14 GROUND TO GCP.
6. [redacted]
7. PULLBOX MOUNTED ON STRUT CHANNEL BELOW FUEL TANK MONITOR.
8. (1) 3/4"C. FOR FUEL TANK AND FUEL TANK MONITOR WIRING CONNECTION.
9. (1) 3/4"C. FUEL TANK MONITOR (EDP-XX).
10. MOUNT TOP OF FUEL TANK MONITOR 5'-0" ABOVE FINISH GRADE ON STRUT CHANNEL SUPPORT POSTS, (1-5/8"x3-1/4"x10'-0" LONG). CONCRETE ENCASE THE SUPPORT POSTS AT 3'-0" MINIMUM DEPTH BELOW GRADE. CONCRETE ENCASE EACH POST WITH A MINIMUM 4" THICKNESS ON ALL SIDES.
11. CONDUITS FROM ITS SPLICE VAULT, PROVIDED BY ITS CONTRACTOR. COORDINATE WITH ITS CONTRACTOR FOR LATERAL ROUTING AND FIBER OPTIC CABLE MARKER INSTALLATION LOCATIONS.
12. (2) 2"C. STUBBED UP BELOW THE WALL MOUNTED TOLLS COMMUNICATIONS CABINET FROM THE ITS INTERFACE PULLBOX (FOC FOR NETWORK CONNECTIONS). FOC INSTALLED BY ITS CONTRACTOR.
13. (2) 2"C. FROM TELCO PULLBOX TO FIVE FEET BEYOND EDGE OF CONRETE SIDEWALK FOR FUTURE "LEASED LINE" CIRCUIT.
14. (2) 2"C. FROM TELCO PULLBOX TO AREA BELOW COMMUNICATIONS BACKBOARD.
15. UTILITY COMPANY PRIMARY FEEDER. COORDINATE WITH UTILITY PROVIDER FOR ROUTING FROM POINT OF PRESENCE TO PAD MOUNTED TRANSFORMER. SEE SHEET SE#-XXX FOR CONTINUATION.
16. SERVICE LATERAL TO MDP VIA METER. SEE POWER RISER DIAGRAM FOR DETAILS.
17. TOLL EQUIPMENT MOUNTING FRAME.
18. [redacted]
19. (1) 3"C. FOR LOOP WIRING.
20. GROUNDING ELECTRODE SYSTEM.
21. (1) 3/4"C. FROM EMERGENCY POWER OFF (EPO) TO GCP.
22. (X) 1"C. FOR LOOP WIRING.
23. 12"x12"x2'-0" NEMA 3R AVI WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
24. 12"x12"x2'-0" NEMA 3R DATA WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
25. 12"x12"x2'-0" NEMA 3R POWER WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
26. "TRAVEL DIRECTION", TOLL EQUIPMENT WORKING SPACE.
27. (2) 4"C. ("TRAVEL DIRECTION" AVI)
28. (3) 4"C. ("TRAVEL DIRECTION" DATA)
29. (4) 2"C. ("TRAVEL DIRECTION" POWER)

NOTES TO PREPARER:

1. CONDUIT ROUTING MAY VARY DEPENDING ON THE SITE SPECIFIC LAYOUT. VERIFY CONDUIT ROUTING MATCHES THE OVERALL SITE CONDUIT PLANS AND IDENTIFY ANY INSTALLATION REQUIREMENTS OTHER THAN OPEN TRENCH.
2. EOR TO PROVIDE SITE SPECIFIC "TRAVEL DIRECTION", e.g., "NB, SB, EB, OR WB".
3. EXTEND CONDUITS FROM REFERENCE NOTE 13 TO THE TELCO POINT OF SERVICE WHEN A LEASED LINE CIRCUIT IS REQUIRED.
4. EXCHANGE POWER AND AVI WIRE TROUGHS, CONDUITS, AND CABLE TRAY POSITIONS FOR TEB SITES WITH AVI READER GROUND-MOUNTED FRAMES.

Exhibit 232.1-2 Dual Movement Non-Accessible Gantry TEB Electrical Standard Site Plan



REFERENCE NOTES:

1. EOR TO PROVIDE CONDUIT SIZES, WIRE SIZES, AND QUANTITIES FOR CONNECTION FROM GENERATOR CIRCUIT BREAKER (GCB) TO ATS.
2. 1" CONDUIT FROM BATTERY CHARGING CIRCUIT, (2) #6 TYPE MTW (RED FOR +12V, BLACK FOR BATTERY GROUND).
3. 1" CONDUIT FOR JACKET WATER HEATER CIRCUITING (EDP-XX).
4. [redacted]
5. 1"C. FOR (2) #14 (GENSET RUN), (4) #14 (SPARE), AND (1) #14 GROUND TO GCP.
6. [redacted]NK MONITOR.
7. PULLBOX MOUNTED ON STRUT CHANNEL BELOW FUEL TANK MONITOR.
8. (1) 3/4"C. FOR FUEL TANK AND FUEL TANK MONITOR WIRING CONNECTION.
9. (1) 3/4"C. FUEL TANK MONITOR (EDP-XX).
10. MOUNT TOP OF FUEL TANK MONITOR 5'-0" ABOVE FINISH GRADE ON STRUT CHANNEL SUPPORT POSTS, (1-5/8"x3-1/4"x10'-0" LONG). CONCRETE ENCASE THE SUPPORT POSTS AT 3'-0" MINIMUM DEPTH BELOW GRADE. CONCRETE ENCASE EACH POST WITH A MINIMUM 4" THICKNESS ON ALL SIDES.
11. CONDUITS FROM ITS SPLICE VAULT, PROVIDED BY ITS CONTRACTOR. COORDINATE WITH ITS CONTRACTOR FOR LATERAL ROUTING AND FIBER OPTIC CABLE MARKER INSTALLATION LOCATIONS.
12. (2) 2"C. STUBBED UP BELOW THE WALL MOUNTED TOLLS COMMUNICATIONS CABINET FROM THE ITS INTERFACE PULLBOX (FOC FOR NETWORK CONNECTIONS). FOC INSTALLED BY ITS CONTRACTOR.
13. (2) 2"C. FROM TELCO PULLBOX TO FIVE FEET BEYOND EDGE OF CONRETE SIDEWALK FOR FUTURE "LEASED LINE" CIRCUIT.
14. (2) 2"C. FROM TELCO PULLBOX TO AREA BELOW COMMUNICATIONS BACKBOARD.
15. UTILITY COMPANY PRIMARY FEEDER. COORDINATE WITH UTILITY PROVIDER FOR ROUTING FROM POINT OF PRESENCE TO PAD MOUNTED TRANSFORMER. SEE SHEET SE#-XXX FOR CONTINUATION.
16. SERVICE LATERAL TO MDP VIA METER. SEE POWER RISER DIAGRAM FOR DETAILS.
17. TOLL EQUIPMENT MOUNTING FRAME.
18. [redacted]
19. (1) 3"C. FOR LOOP WIRING.
20. GROUNDING ELECTRODE SYSTEM.
21. (1) 3/4"C. FROM EMERGENCY POWER OFF (EPO) TO GCP.
22. (X) 1"C. FOR LOOP WIRING.
23. 12"x12"x2'-0" NEMA 3R AVI WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
24. 12"x12"x3'-0" NEMA 3R DATA WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
25. 12"x12"x2'-0" NEMA 3R POWER WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
26. "TRAVEL DIRECTION 1", TOLL EQUIPMENT WORKING SPACE.
27. (2) 4"C. ("TRAVEL DIRECTION 1" AVI)
28. (3) 4"C. ("TRAVEL DIRECTION 1" DATA)
29. (4) 2"C. ("TRAVEL DIRECTION 1" POWER)
30. "TRAVEL DIRECTION 2", TOLL EQUIPMENT WORKING SPACE.
31. (2) 4"C. ("TRAVEL DIRECTION 2" AVI)
32. (3) 4"C. ("TRAVEL DIRECTION 2" DATA)
33. (4) 2"C. ("TRAVEL DIRECTION 2" POWER)
34. (2) 1"C. FROM BPS-2 TO EDP. SEE POWER RISER DIAGRAM FOR DETAILS.
35. PROVIDE THE FOLLOWING CONDUITS FROM THE "TRAVEL DIRECTION 2" TOLL EQUIPMENT WORKING SPACE TO THE LOOP PULL BOXES INDICATED BELOW:

    (1) 3" CONDUIT TO PB9
    (1) 3" CONDUIT TO PB11
    (1) 3" CONDUIT TO PB12
    (1) 3" CONDUIT TO PB13

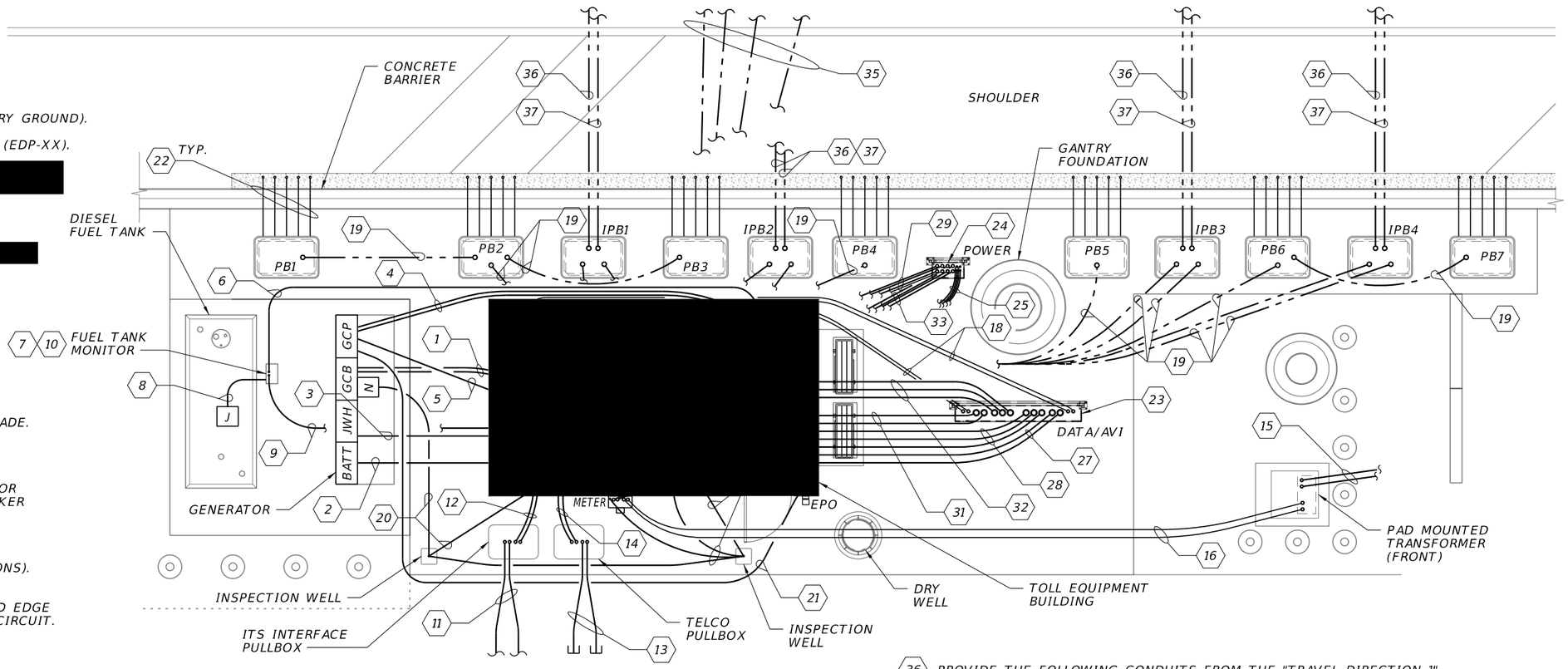
NOTES TO PREPARER:

1. CONDUIT ROUTING MAY VARY DEPENDING ON THE SITE SPECIFIC LAYOUT. VERIFY CONDUIT ROUTING MATCHES THE OVERALL SITE CONDUIT PLANS AND IDENTIFY ANY INSTALLATION REQUIREMENTS OTHER THAN OPEN TRENCH.
2. EOR TO PROVIDE SITE SPECIFIC "TRAVEL DIRECTION", e.g., "NB, SB, EB, OR WB".
3. CONDUIT ROUTING FROM " TRAVEL DIRECTION 2" TOLL EQUIPMENT WORKING SPACE IS DEPENDENT UPON TOP OF LOOP PULLBOXES ARE LOWER THAN TEB FINISH FLOOR ELEVATION.
4. EXTEND CONDUITS FROM REFERENCE NOTE 13 TO THE TELCO POINT OF SERVICE WHEN A LEASED LINE CIRCUIT IS REQUIRED.
5. EXCHANGE POWER AND AVI WIRE TROUGHS, CONDUITS, AND CABLE TRAY POSITIONS FOR TEB SITES WITH AVI READER GROUND-MOUNTED FRAMES.

Exhibit 232.1-3 Dual Movement Accessible Gantry TEB Electrical Standard Site Plan

REFERENCE NOTES:

1. EOR TO PROVIDE CONDUIT SIZES, WIRE SIZES, AND QUANTITIES FOR CONNECTION FROM GENERATOR CIRCUIT BREAKER (GCB) TO ATS.
2. 1" CONDUIT FROM BATTERY CHARGING CIRCUIT, (2) #6 TYPE MTW (RED FOR +12V, BLACK FOR BATTERY GROUND).
3. 1" CONDUIT FOR JACKET WATER HEATER CIRCUITING (EDP-XX).
4. [redacted]
5. 1"C. FOR (2) #14 (GENSET RUN), (4) #14 (SPARE), AND (1) #14 GROUND TO GCP.
6. [redacted]
7. PULLBOX MOUNTED ON STRUT CHANNEL BELOW FUEL TANK MONITOR.
8. (1) 3/4"C. FOR FUEL TANK AND FUEL TANK MONITOR WIRING CONNECTION.
9. (1) 3/4"C. FUEL TANK MONITOR (EDP-XX).
10. MOUNT TOP OF FUEL TANK MONITOR 5'-0" ABOVE FINISH GRADE ON STRUT CHANNEL SUPPORT POSTS, (1-5/8"x3-1/4"x10'-0" LONG). CONCRETE ENCASE THE SUPPORT POSTS AT 3'-0" MINIMUM DEPTH BELOW GRADE. CONCRETE ENCASE EACH POST WITH A MINIMUM 4" MINIMUM CLEARANCE ON ALL SIDES.
11. CONDUITS FROM ITS SPLICE VAULT, PROVIDED BY ITS CONTRACTOR. COORDINATE WITH ITS CONTRACTOR FOR LATERAL ROUTING AND FIBER OPTIC CABLE MARKER INSTALLATION LOCATIONS.
12. (2) 2"C. STUBBED UP BELOW THE WALL MOUNTED TOLLS COMMUNICATIONS CABINET FROM THE ITS INTERFACE PULLBOX (FOC FOR NETWORK CONNECTIONS). FOC INSTALLED BY ITS CONTRACTOR.
13. (2) 2"C. FROM TELCO PULLBOX TO FIVE FEET BEYOND EDGE OF CONRETE SIDEWALK FOR FUTURE "LEASED LINE" CIRCUIT.
14. (2) 2"C. FROM TELCO PULLBOX TO AREA BELOW COMMUNICATIONS BACKBOARD.
15. UTILITY COMPANY PRIMARY FEEDER. COORDINATE WITH UTILITY PROVIDER FOR ROUTING FROM POINT OF PRESENCE TO PAD MOUNTED TRANSFORMER. SEE SHEET SE#-XXX FOR CONTINUATION.
16. SERVICE LATERAL TO MDP VIA METER. SEE POWER RISER DIAGRAM FOR DETAILS.
17. TOLL EQUIPMENT MOUNTING FRAME.
18. [redacted]
19. (1) 3"C. FOR LOOP WIRING.
20. GROUNDING ELECTRODE SYSTEM.
21. (1) 3/4"C. FROM EMERGENCY POWER OFF (EPO) TO GCP.
22. (X) 1"C. FOR LOOP WIRING.
23. 12"x12"x8'-0" NEMA 3R DATA/AVI WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
24. 12"x12"x2'-0" NEMA 3R POWER WIRE TROUGH. MOUNT 4'-0" ABOVE FINISH GRADE ON A STRUT CHANNEL FRAME.
25. (4) 1"C. FOR GANTRY LIGHTING AND RECEPTACLE CIRCUITING, (EDP-XX, XX, AND XX).



26. "TRAVEL DIRECTION 1", TOLL EQUIPMENT WORKING SPACE.
27. (2) 4"C. ("TRAVEL DIRECTION 1" AVI)
28. (3) 4"C. ("TRAVEL DIRECTION 1" DATA)
29. (4) 2"C. ("TRAVEL DIRECTION 1" POWER)
30. "TRAVEL DIRECTION 2", TOLL EQUIPMENT WORKING SPACE.
31. (2) 4"C. ("TRAVEL DIRECTION 2" AVI)
32. (3) 4"C. ("TRAVEL DIRECTION 2" DATA)
33. (4) 2"C. ("TRAVEL DIRECTION 2" POWER)
34. (2) 1"C. FROM BPS-2 TO EDP. SEE POWER RISER DIAGRAM FOR DETAILS.
35. PROVIDE THE FOLLOWING CONDUITS FROM THE "TRAVEL DIRECTION 2" TOLL EQUIPMENT WORKING SPACE TO THE LOOP PULL BOXES INDICATED BELOW:

    (1) 3" CONDUIT TO PB9
    (1) 3" CONDUIT TO PB11
    (1) 3" CONDUIT TO PB12
    (1) 3" CONDUIT TO PB13

36. PROVIDE THE FOLLOWING CONDUITS FROM THE "TRAVEL DIRECTION 1" TOLL EQUIPMENT WORKING SPACE TO THE LOOP PULL BOXES INDICATED BELOW:

    (1) 3" CONDUIT TO MPB2 VIA IPB1
    (1) 3" CONDUIT TO MPB4 VIA IPB2
    (1) 3" CONDUIT TO MPB5 VIA IPB3
    (1) 3" CONDUIT TO MPB7 VIA IPB4

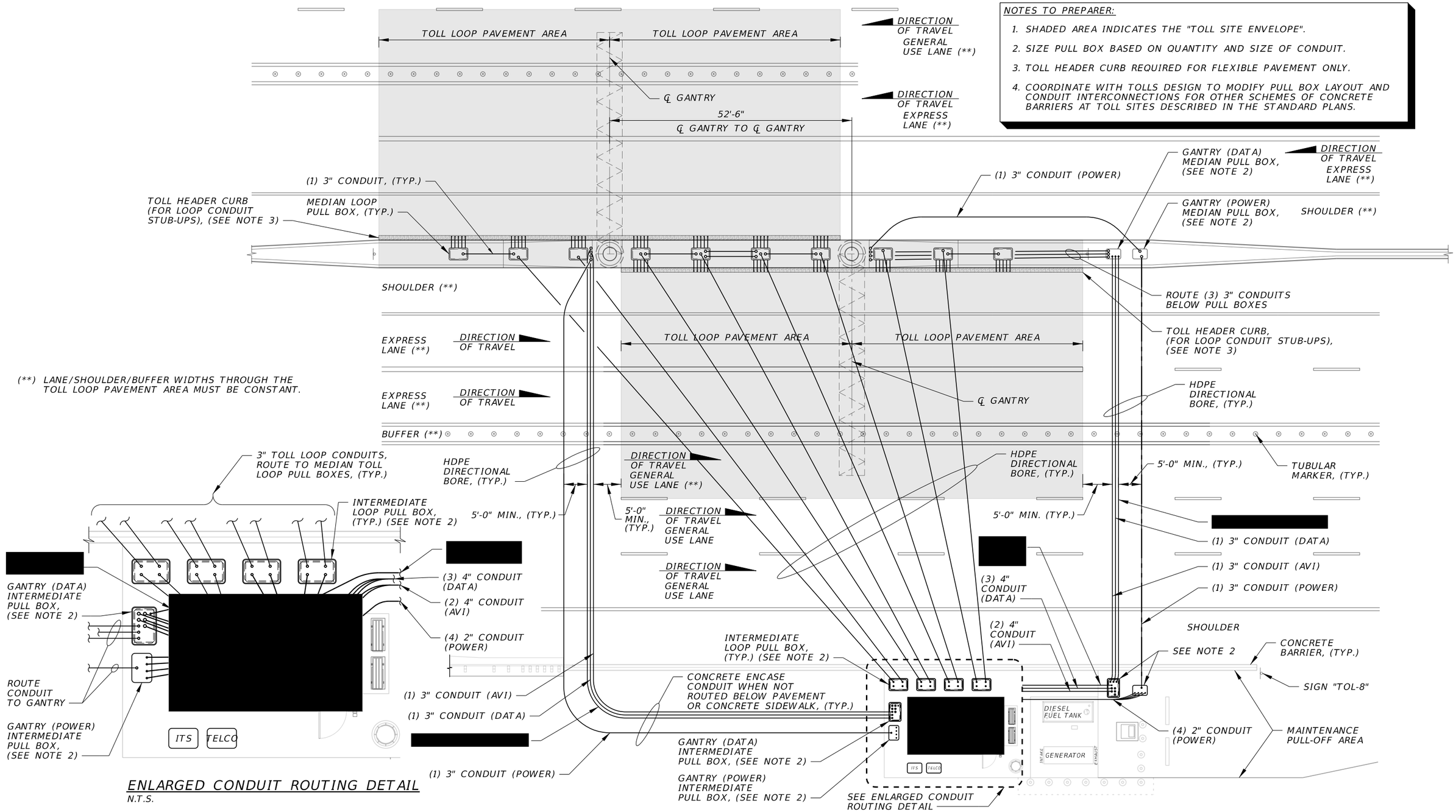
37. PROVIDE THE FOLLOWING CONDUITS FROM THE "TRAVEL DIRECTION 2" TOLL EQUIPMENT WORKING SPACE TO THE LOOP PULL BOXES INDICATED BELOW:

    (1) 3" CONDUIT TO MPB2 VIA IPB1
    (1) 3" CONDUIT TO MPB4 VIA IPB2
    (1) 3" CONDUIT TO MPB5 VIA IPB3
    (1) 3" CONDUIT TO MPB7 VIA IPB4

NOTES TO PREPARER:

1. CONDUIT ROUTING MAY VARY DEPENDING ON THE SITE SPECIFIC LAYOUT. VERIFY CONDUIT ROUTING MATCHES THE OVERALL SITE CONDUIT PLANS AND IDENTIFY ANY INSTALLATION REQUIREMENTS OTHER THAN OPEN TRENCH.
2. EOR TO PROVIDE SITE SPECIFIC "TRAVEL DIRECTION", e.g., "NB, SB, EB, OR WB".
3. CONDUIT ROUTING FROM " TRAVEL DIRECTION 2" TOLL EQUIPMENT WORKING SPACE IS DEPENDENT UPON TOP OF LOOP PULLBOXES ARE LOWER THAN TEB FINISH FLOOR ELEVATION.
4. EXTEND CONDUITS FROM REFERENCE NOTE 13 TO THE TELCO POINT OF SERVICE WHEN A LEASED LINE CIRCUIT IS REQUIRED.

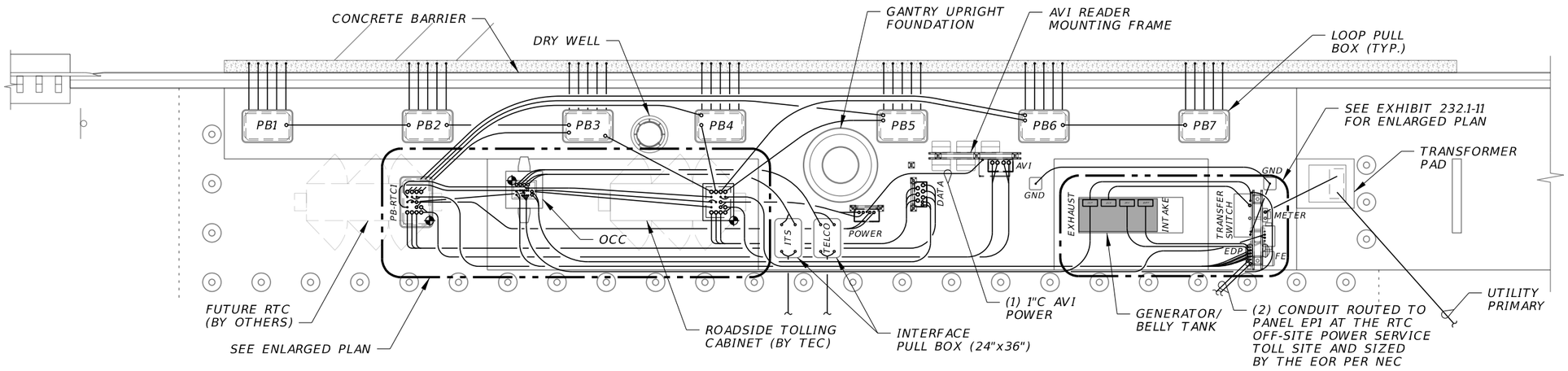
Exhibit 232.1-4 Dual Movement TEB Electrical Remote Site Plan



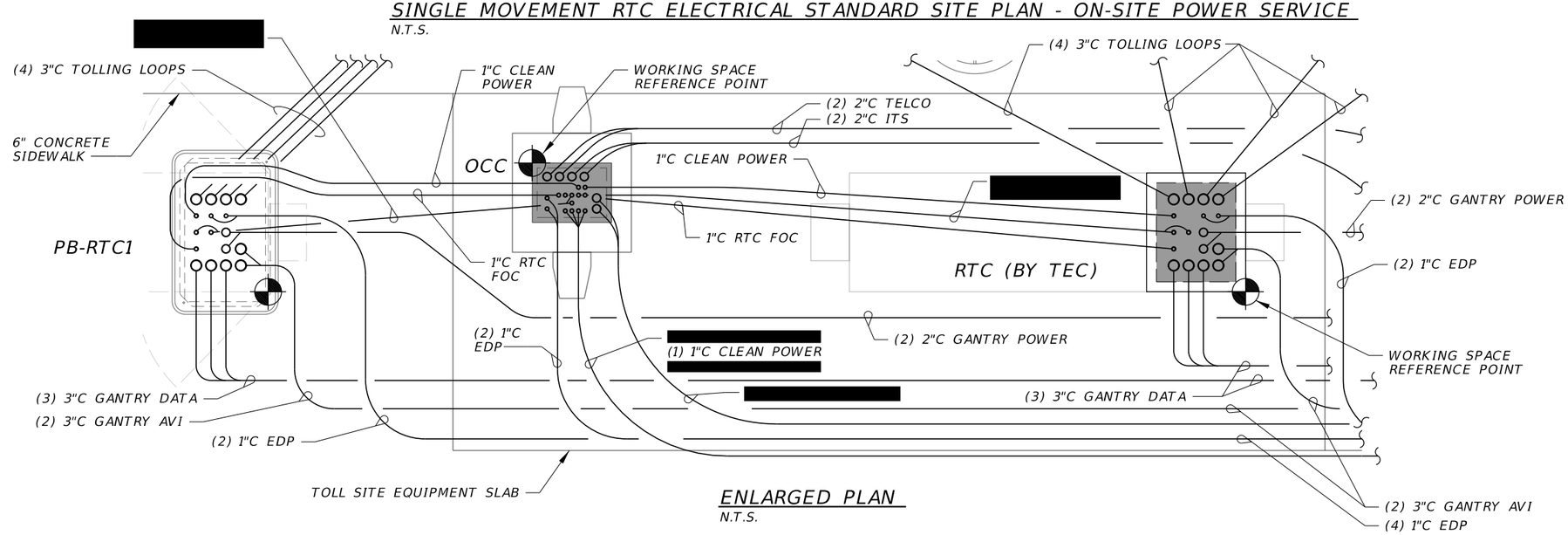
ENLARGED CONDUIT ROUTING DETAIL

N.T.S.

Exhibit 232.1-5 Single Movement RTC Electrical Standard Site Plan – On-Site Power Service

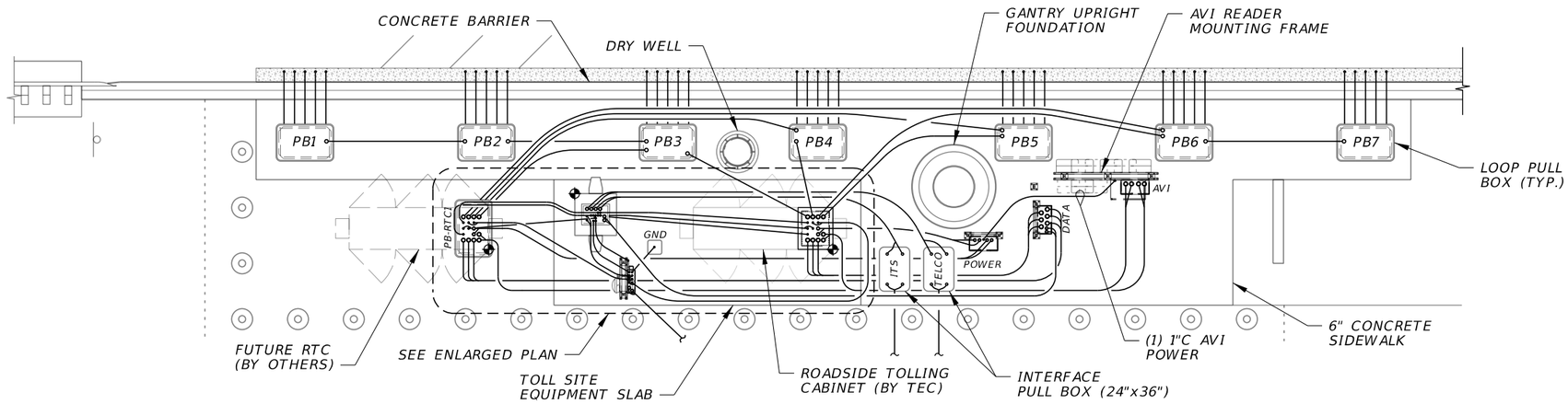


SINGLE MOVEMENT RTC ELECTRICAL STANDARD SITE PLAN - ON-SITE POWER SERVICE
N.T.S.

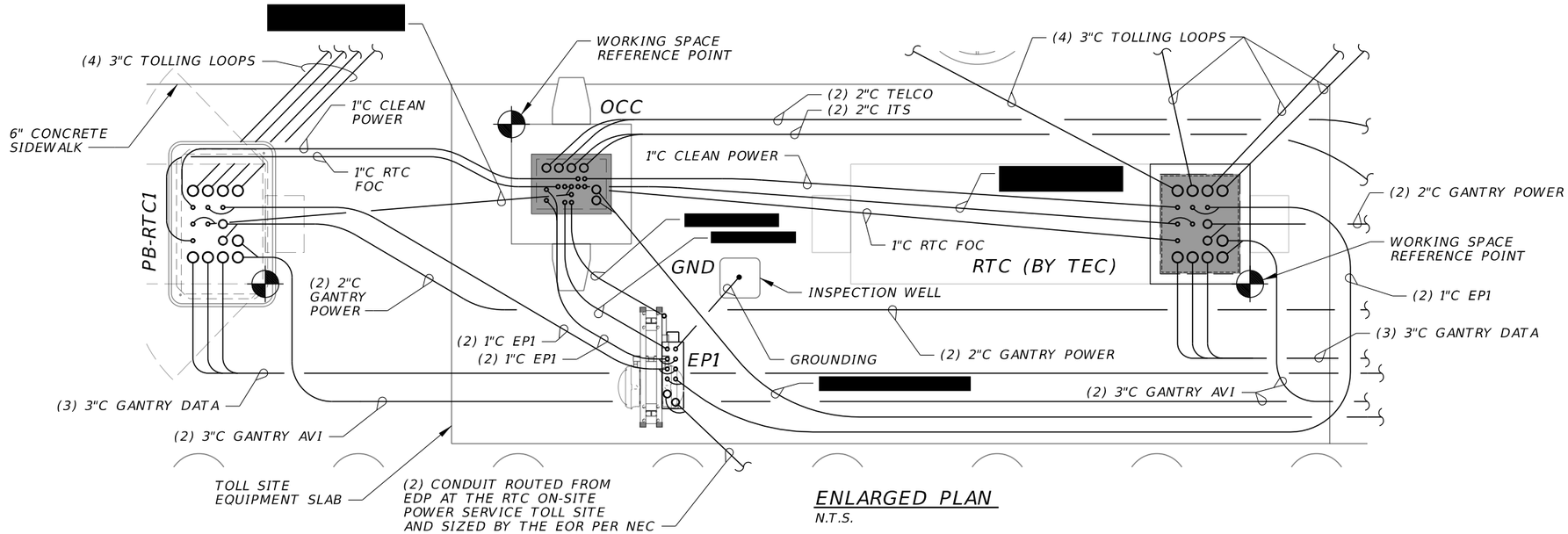


ENLARGED PLAN
N.T.S.

Exhibit 232.1-6 Single Movement RTC Electrical Standard Site Plan – Off-Site Power Service

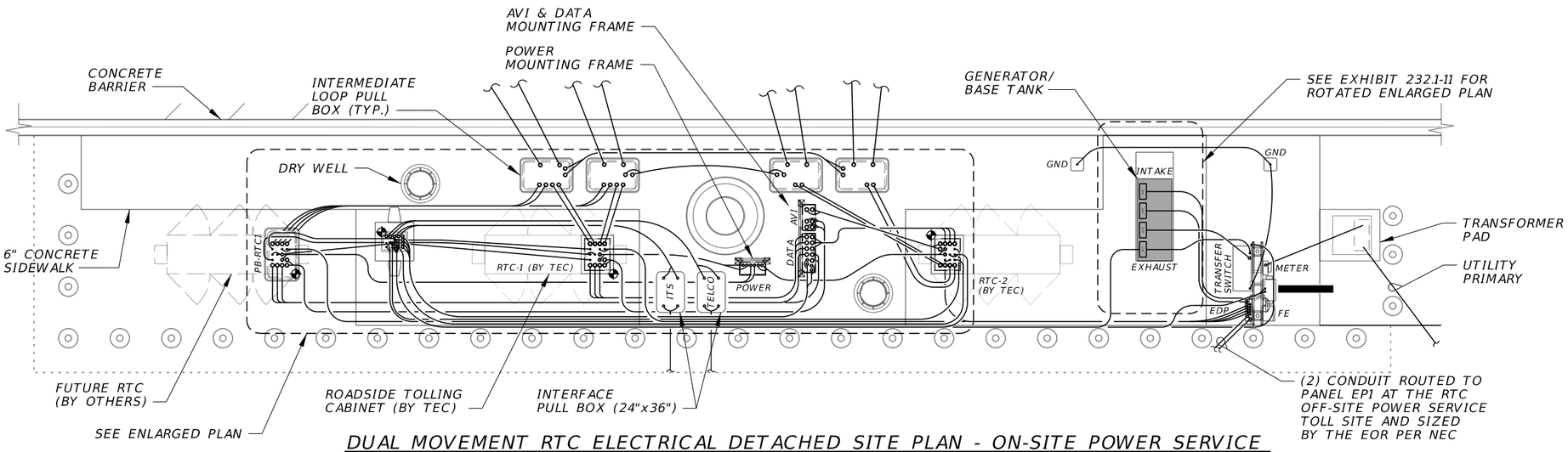


SINGLE MOVEMENT RTC ELECTRICAL STANDARD SITE PLAN - OFF-SITE POWER SERVICE
N.T.S.



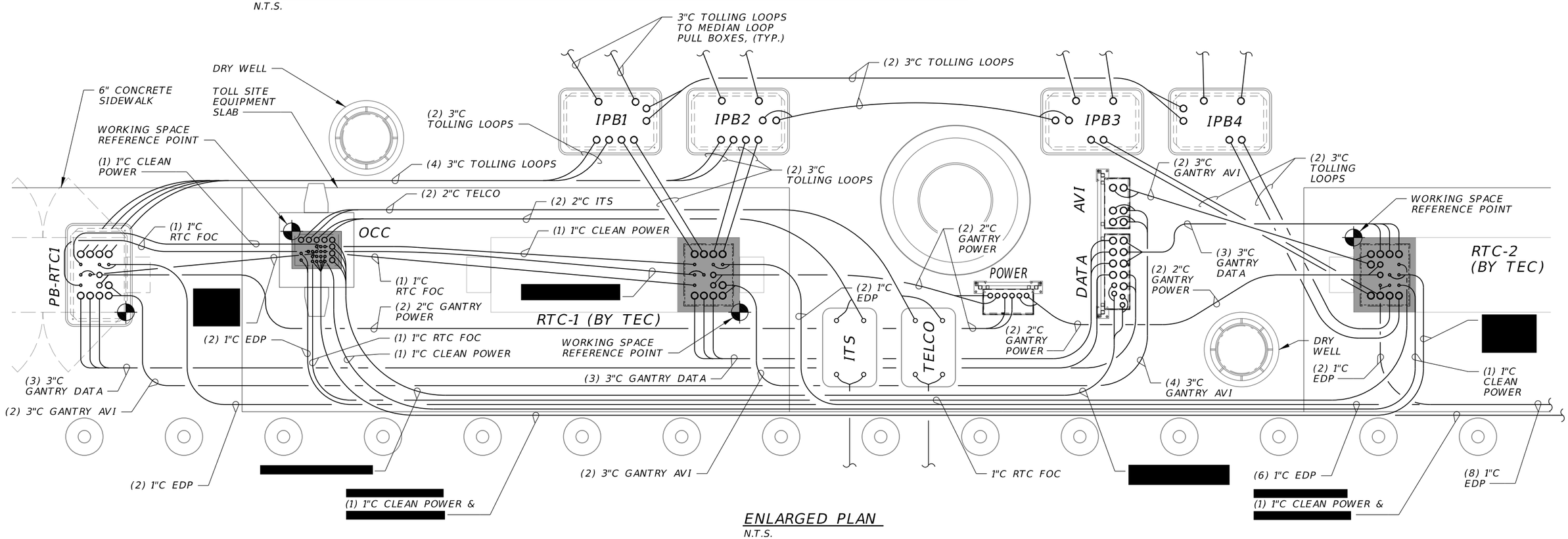
ENLARGED PLAN
N.T.S.

Exhibit 232.1-7 Dual Movement RTC Electrical Detached Site Plan – On-Site Power Service



DUAL MOVEMENT RTC ELECTRICAL DETACHED SITE PLAN - ON-SITE POWER SERVICE

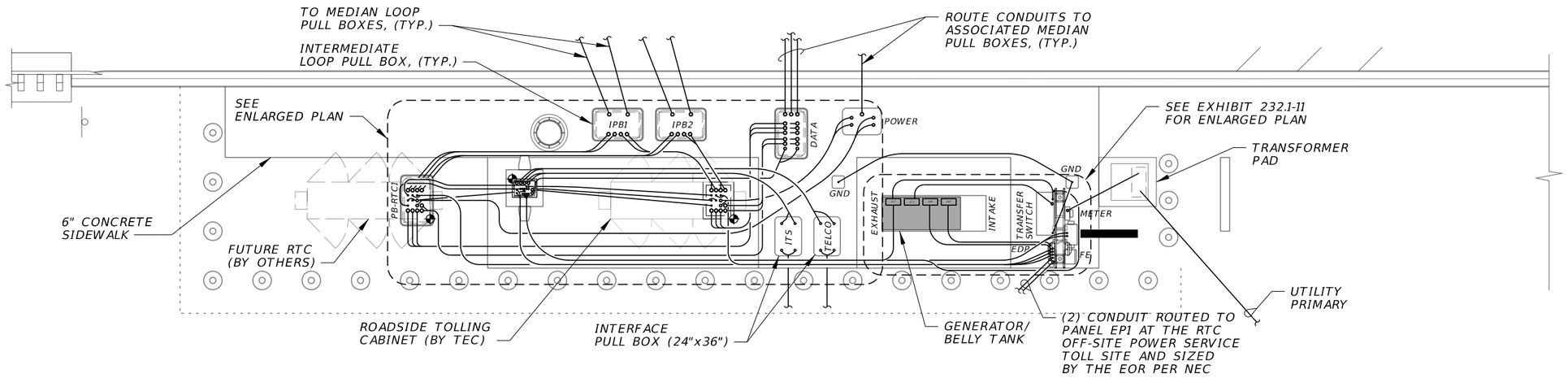
N.T.S.



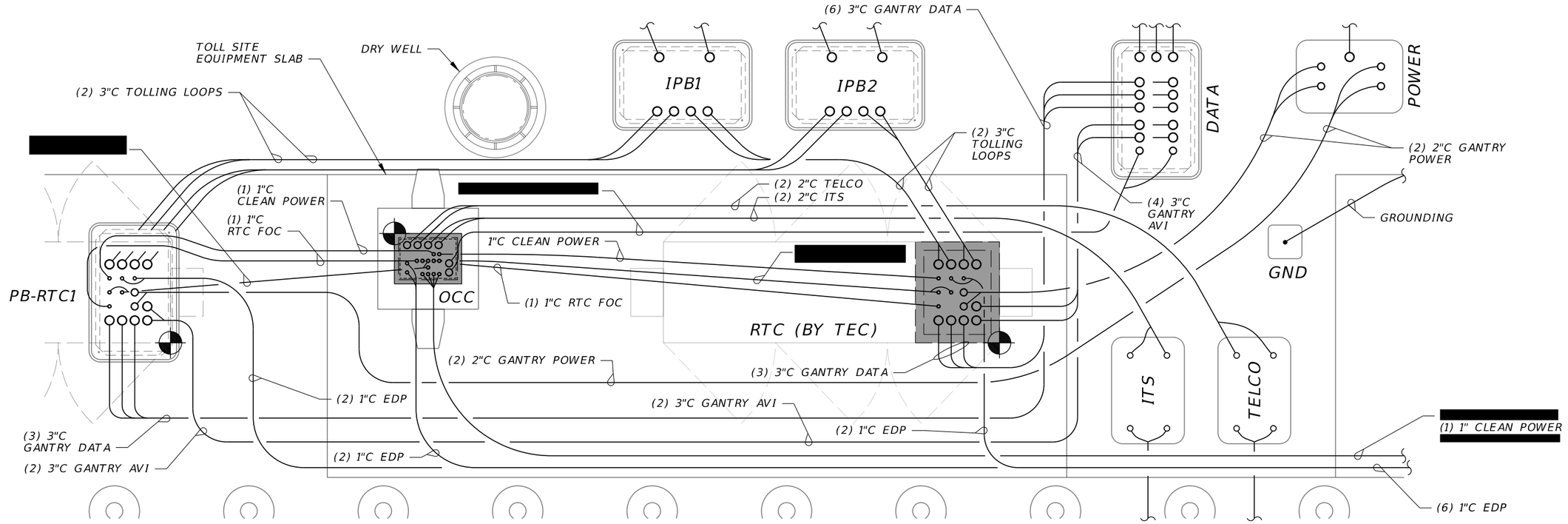
ENLARGED PLAN

N.T.S.

Exhibit 232.1-8 Single Movement RTC Electrical Remote Site Plan – On-Site Power Service

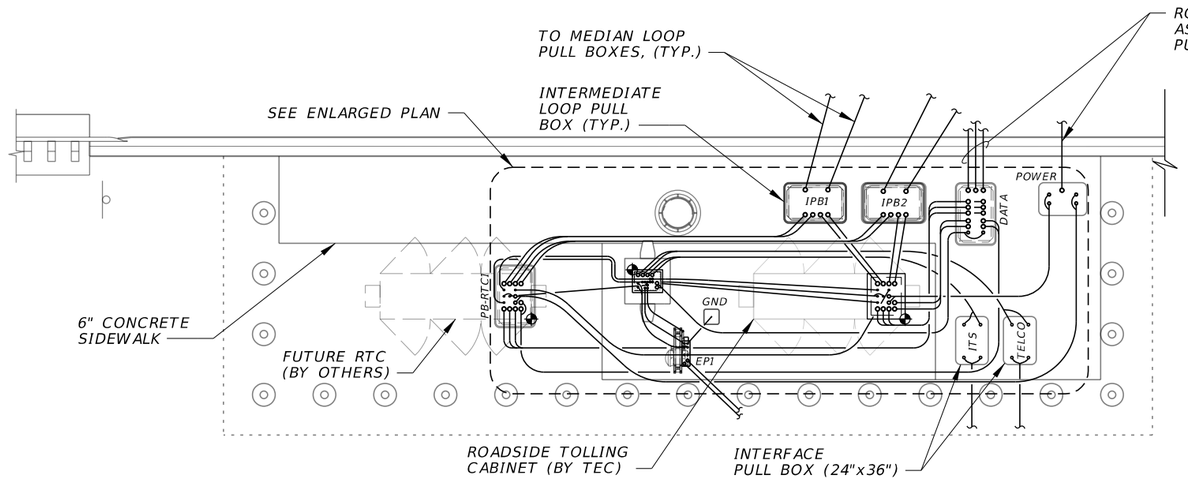


SINGLE MOVEMENT RTC ELECTRICAL REMOTE SITE PLAN - ON-SITE POWER SERVICE
N.T.S.



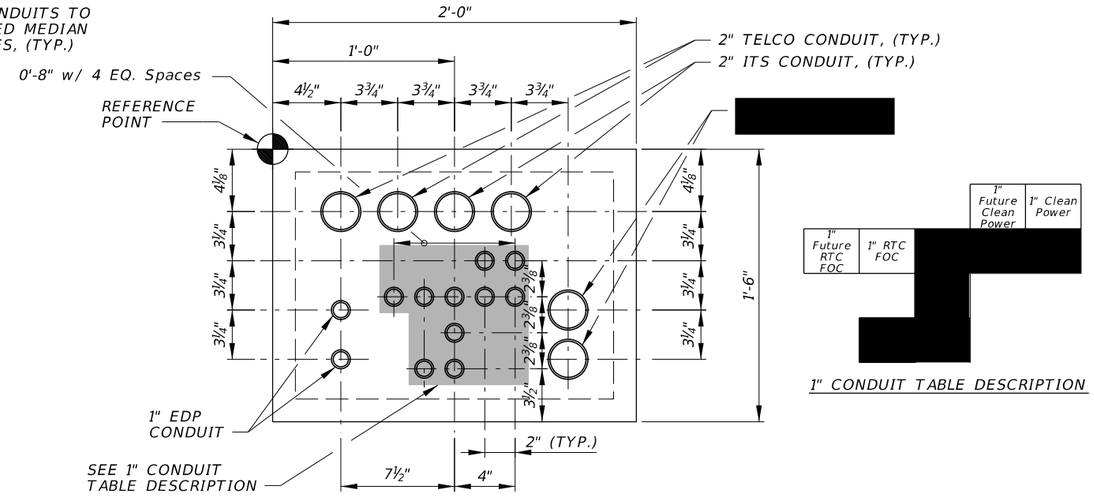
ENLARGED PLAN
N.T.S.

Exhibit 232.1-9 Single Movement RTC Electrical Remote Site Plan – Off-Site Power Service



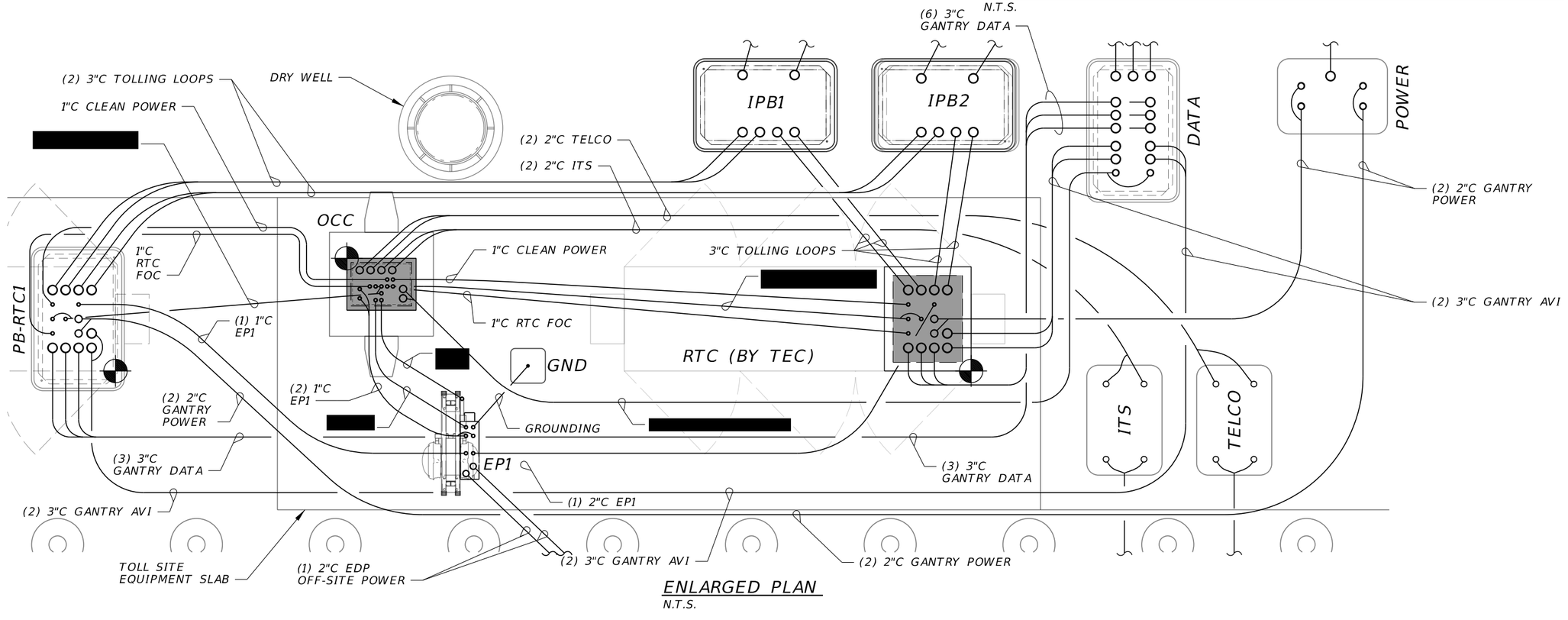
SINGLE MOVEMENT RTC ELECTRICAL REMOTE SITE PLAN - OFF-SITE POWER SERVICE

N.T.S.



DETAILED CONDUIT STUB-UP PLAN - OCC WORKING SPACE

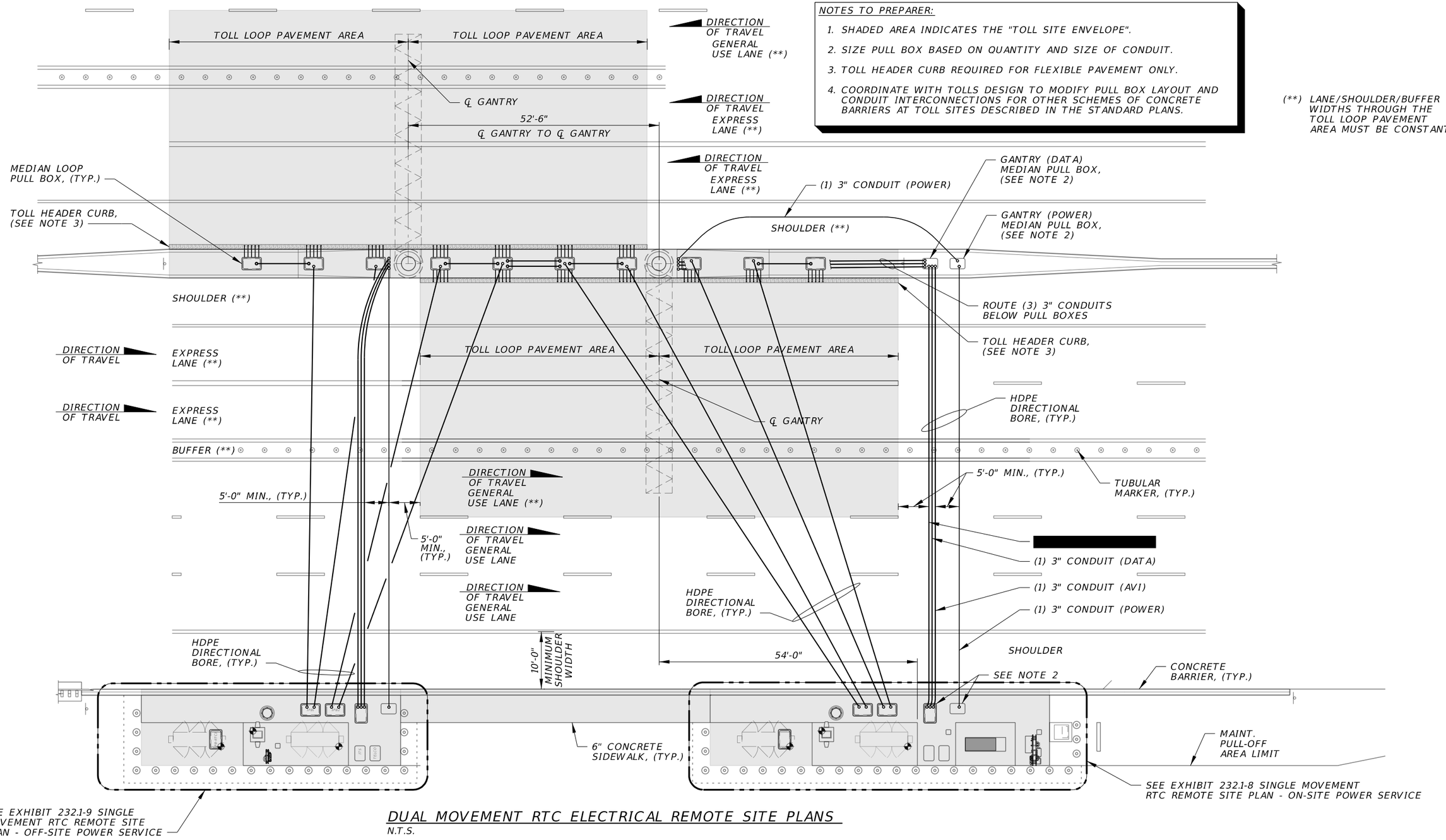
N.T.S.



ENLARGED PLAN

N.T.S.

Exhibit 232.1-10 Dual Movement RTC Electrical Remote Site Plans



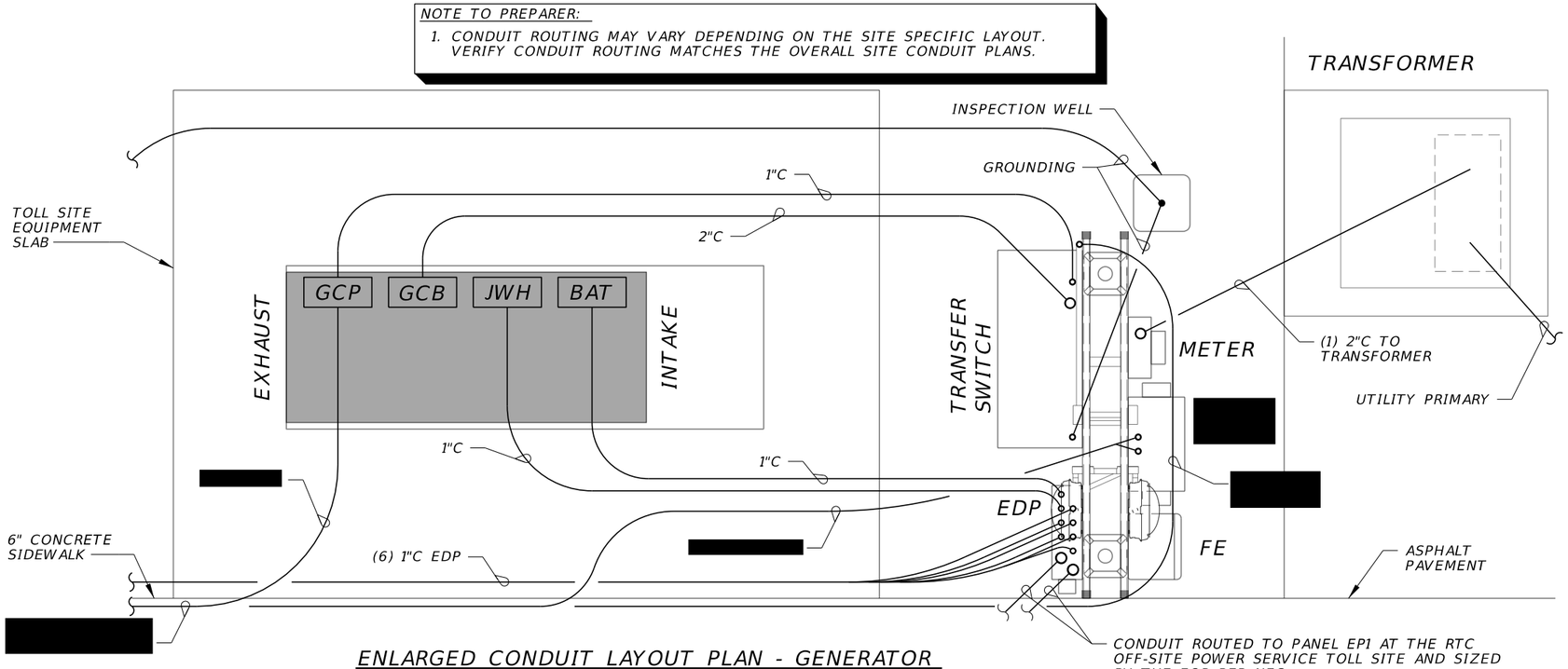
NOTES TO PREPARER:

1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. SIZE PULL BOX BASED ON QUANTITY AND SIZE OF CONDUIT.
3. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
4. COORDINATE WITH TOLLS DESIGN TO MODIFY PULL BOX LAYOUT AND CONDUIT INTERCONNECTIONS FOR OTHER SCHEMES OF CONCRETE BARRIERS AT TOLL SITES DESCRIBED IN THE STANDARD PLANS.

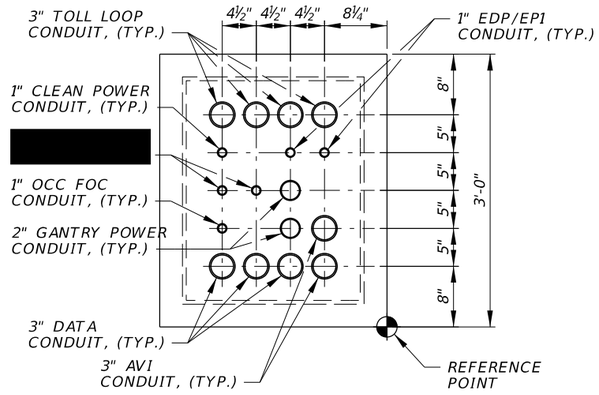
(**) LANE/SHOULDER/BUFFER WIDTHS THROUGH THE TOLL LOOP PAVEMENT AREA MUST BE CONSTANT.

DUAL MOVEMENT RTC ELECTRICAL REMOTE SITE PLANS
N.T.S.

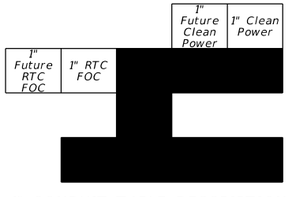
Exhibit 232.1-11 RTC Site Generator and Working Space Details



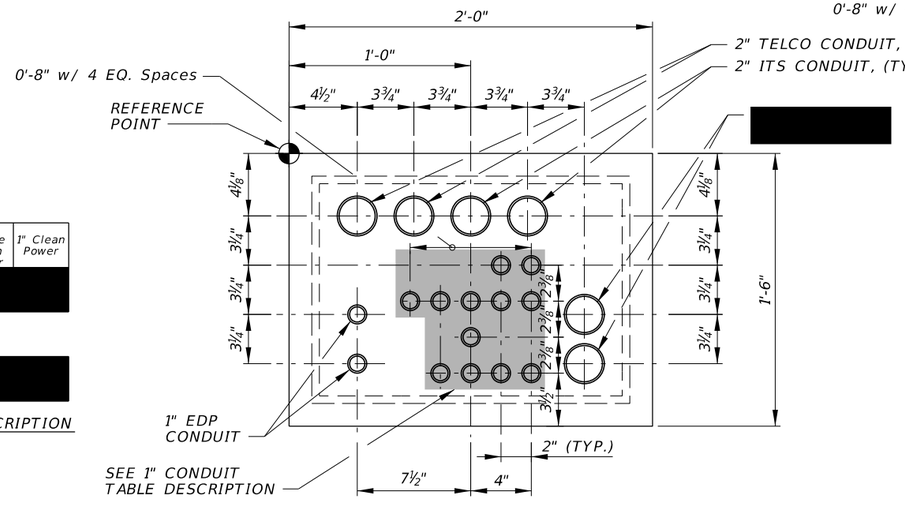
ENLARGED CONDUIT LAYOUT PLAN - GENERATOR
N.T.S.



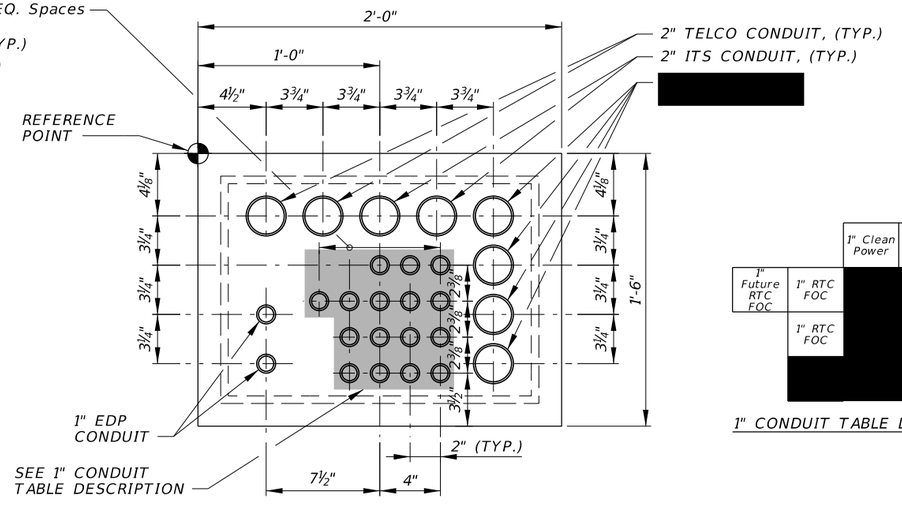
DETAILED CONDUIT STUB-UP PLAN - RTC WORKING SPACE
N.T.S.



1" CONDUIT TABLE DESCRIPTION



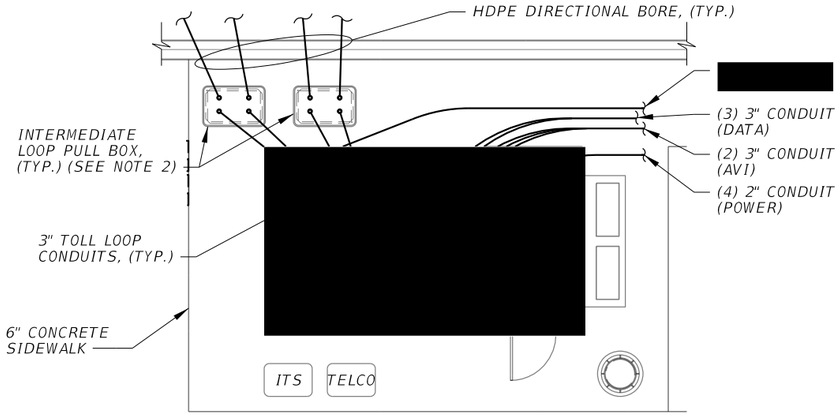
DETAILED CONDUIT STUB-UP PLAN - SINGLE MOVEMENT OCC WORKING SPACE
N.T.S.



1" CONDUIT TABLE DESCRIPTION

DETAILED CONDUIT STUB-UP PLAN - DUAL MOVEMENT OCC WORKING SPACE
N.T.S.

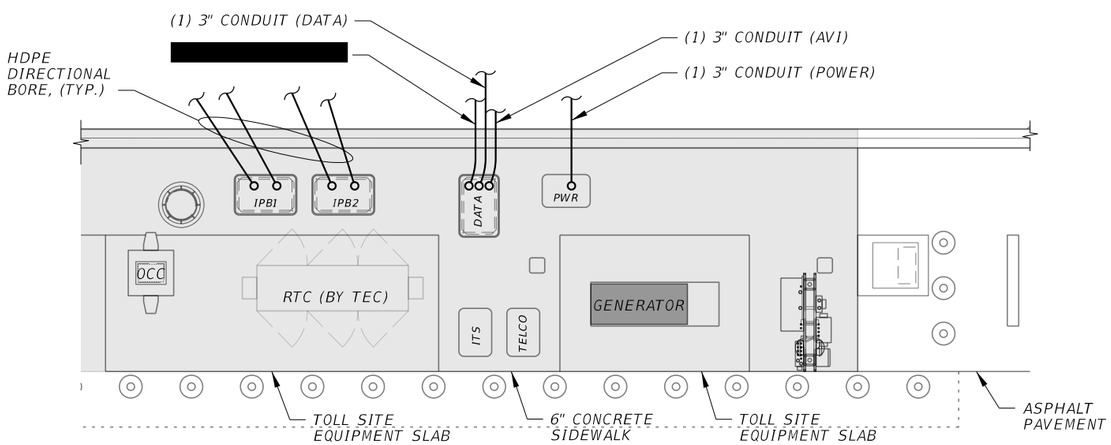
Exhibit 232.1-12 Single Movement TEB and RTC Electrical Remote Site Plan (1 of 2)



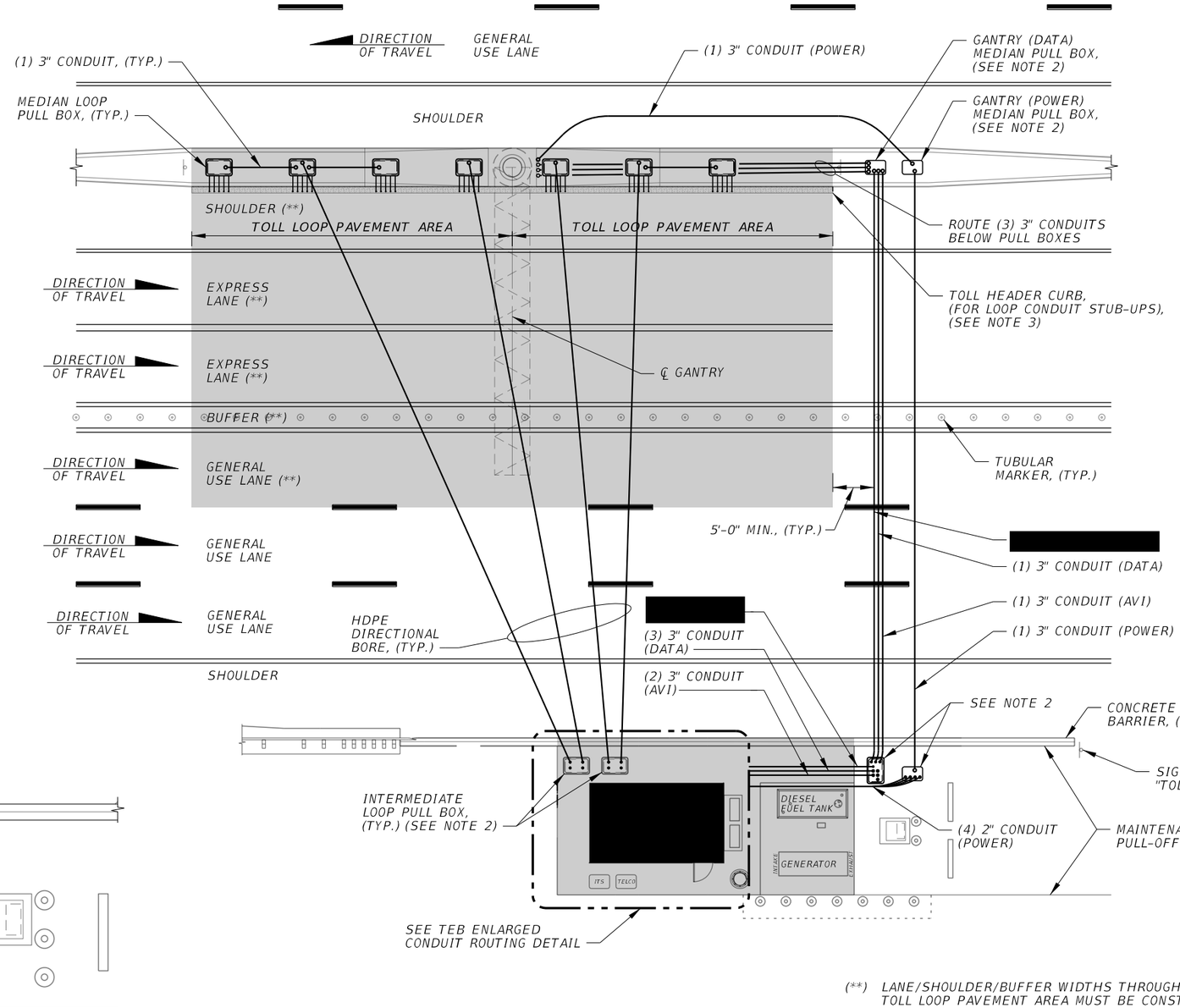
TEB ENLARGED CONDUIT ROUTING DETAIL
N.T.S.

NOTES TO PREPARER:

1. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
2. SIZE PULL BOX BASED ON CONDUIT SIZE AND QUANTITY.
3. TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENT ONLY.
4. COORDINATE WITH TOLLS DESIGN TO MODIFY PULL BOX LAYOUT AND CONDUIT INTERCONNECTIONS FOR OTHER SCHEMES OF CONCRETE BARRIERS AT TOLL SITES DESCRIBED IN THE STANDARD PLANS.



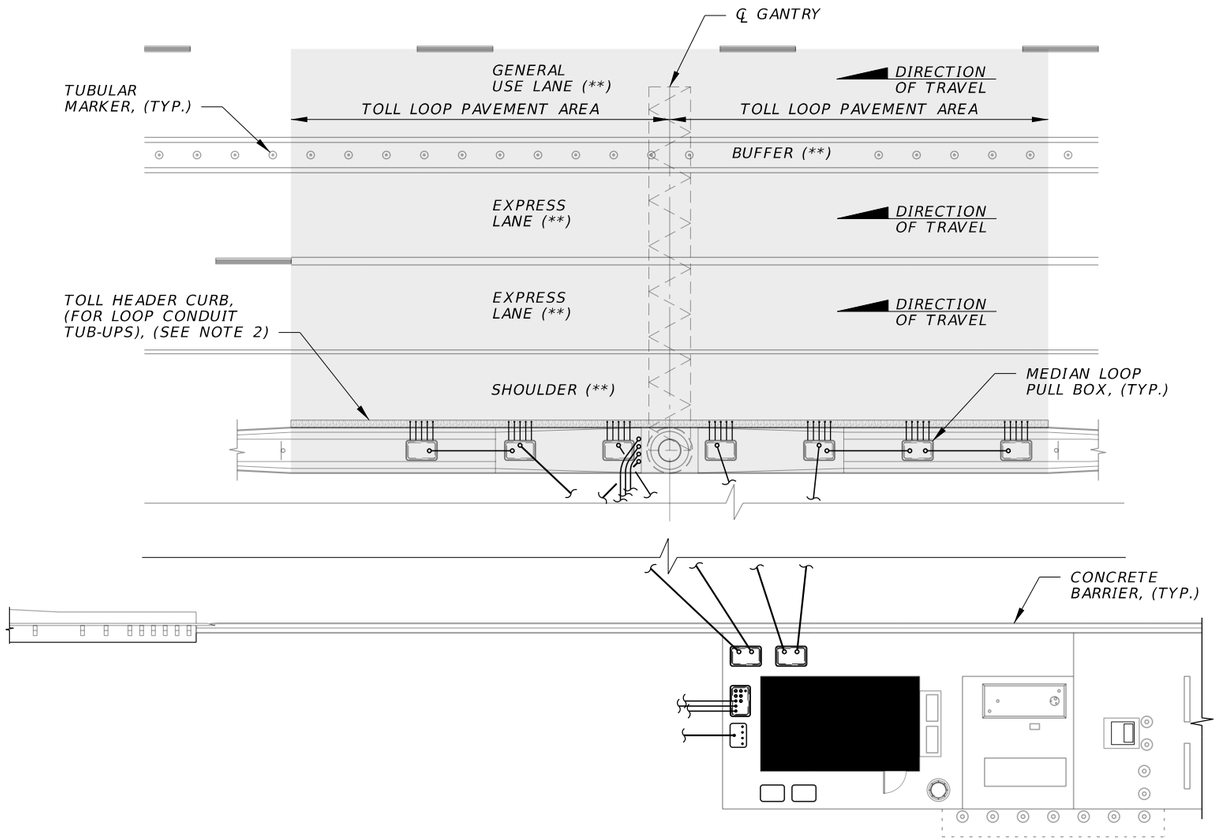
RTC ENLARGED CONDUIT ROUTING DETAIL
N.T.S.



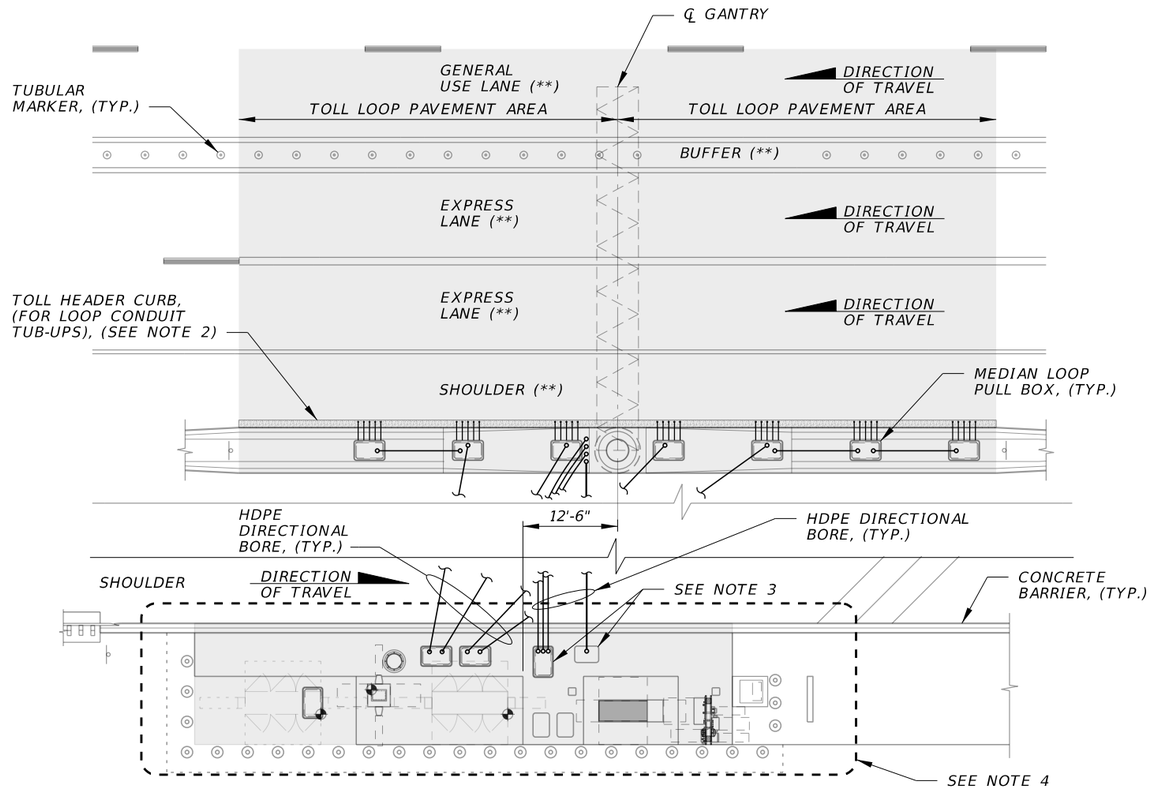
(**) LANE/SHOULDER/BUFFER WIDTHS THROUGH THE TOLL LOOP PAVEMENT AREA MUST BE CONSTANT.

SINGLE MOVEMENT TEB ELECTRICAL REMOTE SITE PLAN
N.T.S.

Exhibit 232.1-13 Single Movement TEB and RTC Electrical Remote Site Plan (2 of 2)



SINGLE MOVEMENT TEB ELECTRICAL REMOTE SITE PLAN
N.T.S.



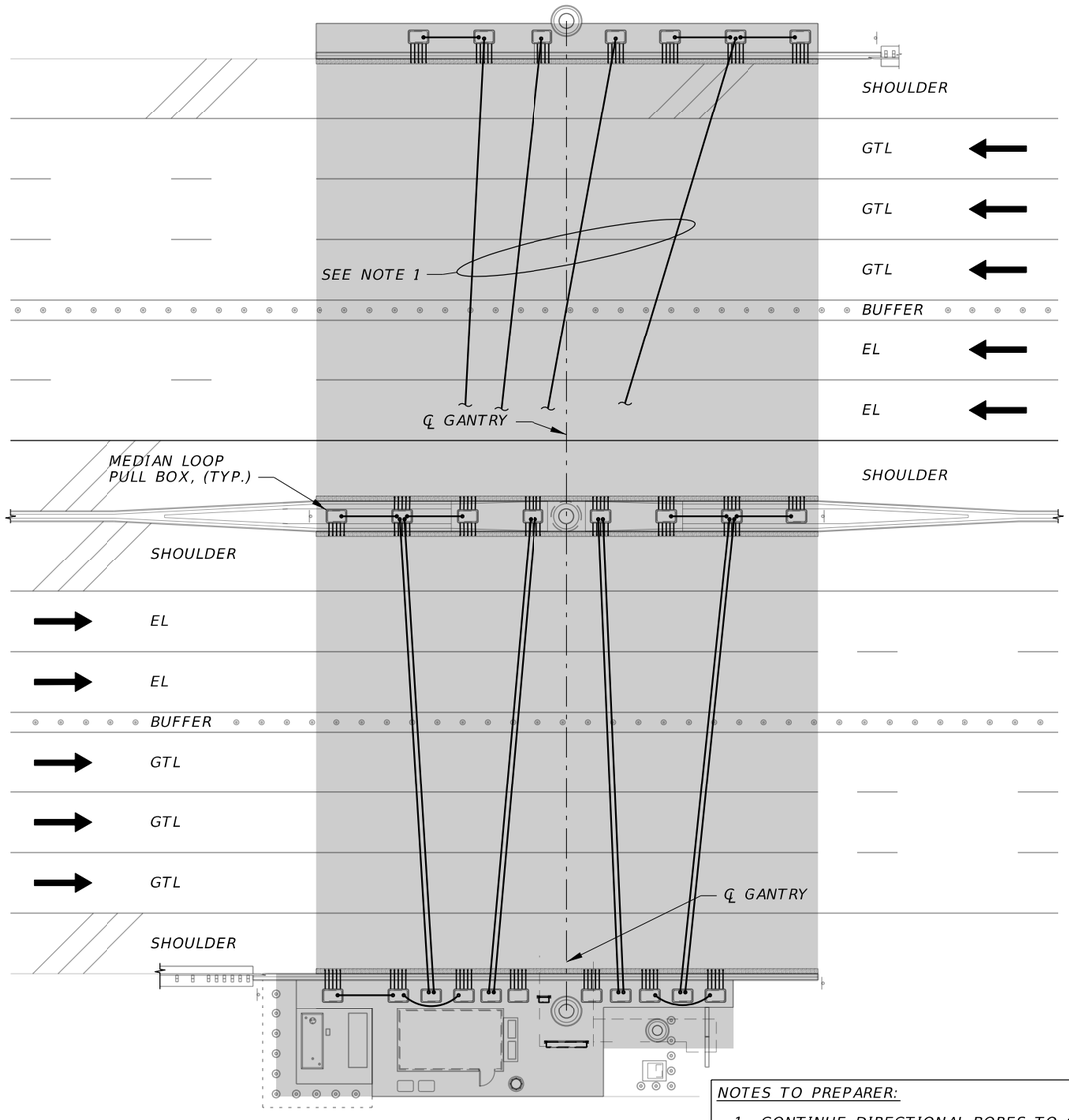
SINGLE MOVEMENT RTC ELECTRICAL REMOTE SITE PLAN
N.T.S.

NOTES TO PREPARER:

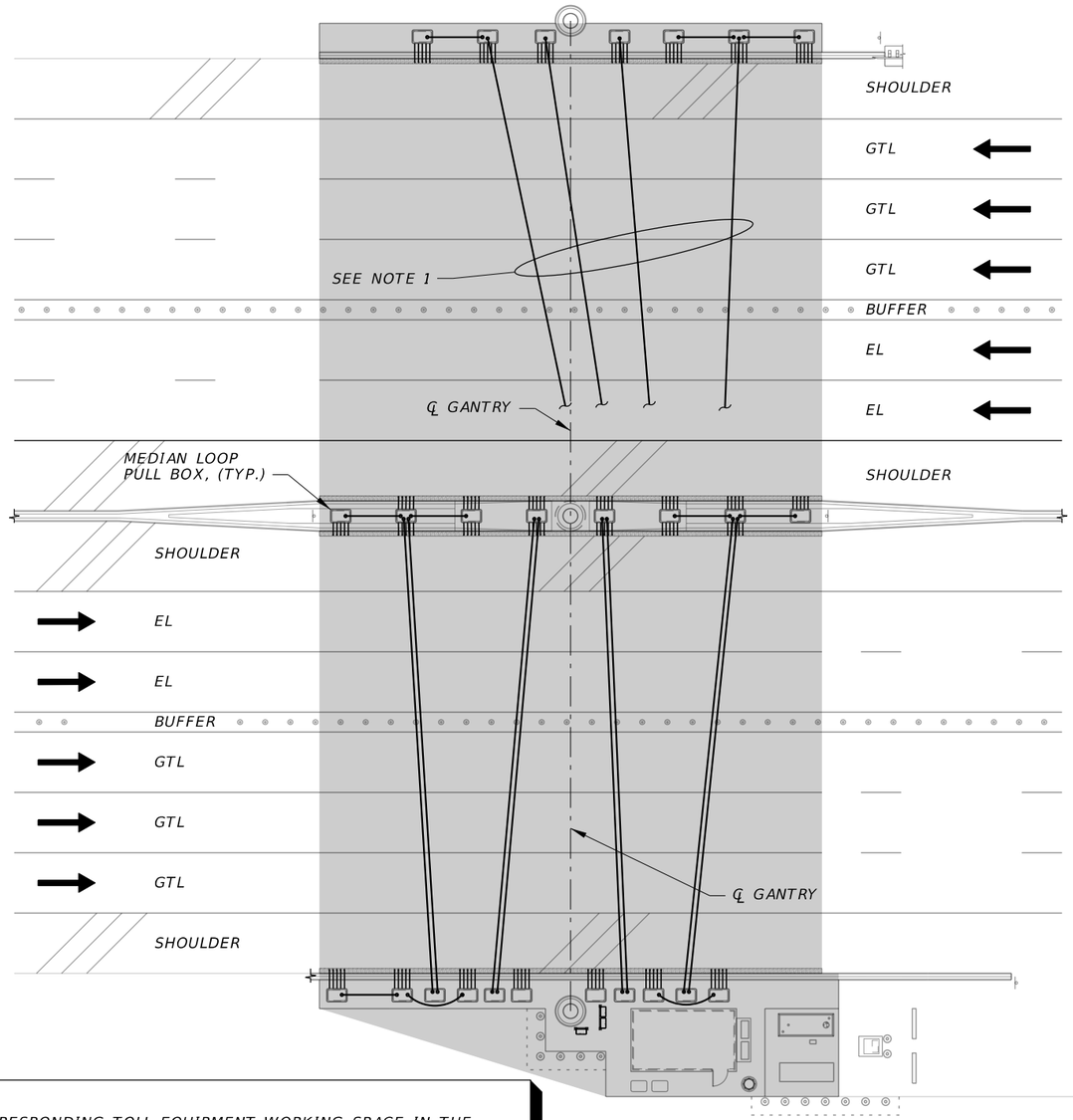
1. *SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".*
2. *TOLL HEADER CURB REQUIRED FOR FLEXIBLE PAVEMENTONLY.*
3. *SIZE PULL BOX BASED ON QUANTITY AND SIZE OF CONDUIT.*
4. *SEE EXHIBIT 232.1-8 FOR ENLARGED CONDUIT ROUTING PLAN.*

(**)LANE/SHOULDER/BUFFER WIDTHS THROUGH THE TOLL LOOP PAVEMENT AREA MUST BE CONSTANT.

Exhibit 232.1-14 TEB Standard Loop Conduit Routing Plans



ACCESSIBLE GANTRY
LOOP CONDUIT PLAN



NON-ACCESSIBLE GANTRY
LOOP CONDUIT PLAN

NOTES TO PREPARER:

1. CONTINUE DIRECTIONAL BORES TO CORRESPONDING TOLL EQUIPMENT WORKING SPACE IN THE TOLL EQUIPMENT BUILDING (TEB), PROVIDED THE TEB FINISH FLOOR ELEVATION IS HIGHER THAN THE TOLL LOOP PULL BOXES
2. ALL LOOP PULL BOXES SHALL BE ANSI/SCTE 77, TIER 15, AND UL LISTED UNLESS OTHERWISE NOTED.
3. NUMBER OF LANES AND SHOULDERS MAY VARY. SEE ROADWAY PLANS FOR TYPICAL SECTION, SHOULDERS, LANES AND BUFFER WIDTHS.
4. SHADED AREA INDICATES THE "TOLL SITE ENVELOPE".
5. COORDINATE WITH TOLLS DESIGN TO MODIFY PULL BOX LAYOUT AND CONDUIT INTERCONNECTIONS FOR OTHER SCHEMES OF CONCRETE BARRIERS AT TOLL SITES DESCRIBED IN THE STANDARD PLANS.

232.2 Toll Site Power Utilities

(1) New and/or modifications to existing underground electrical power service, electric meter, meter base, and all associated components must be provided for each toll site with on-site power service.

(2) Toll sites must have dedicated electric power services on site except for RTC sites with off-site power services.

(3) Toll sites must have dedicated secondaries from the utility transformer to the utility power meter and must not be shared with non-tolling electrical loads.

(4) Coordination must take place with the utility power service providers for the primary power extension from the utility power point of presence to each toll site.

(5) Coordination with electrical power service provider for each toll site includes:

  (a) Cost estimate and schedule for new service connection.

  (b) Written commitment to provide electrical service to each toll site.

(6) All power service lines in FDOT right-of-way must be underground.

(7) The power service conduits must be as specified by the power service providers as required for the completion of electrical service to each site.

(8) **TEB Sites:** Power services must be 400 Amp, 120/240 Volt, single phase, 3-wire, grounded.

(9) **RTC Sites with On-Site Power Service:** Power services must be 200 Amp, 120/240 Volt, single phase, 3-wire, grounded.

232.3 Toll Loop Infrastructure

The design of toll loop infrastructure must account for TEC furnishing and installing the loop wiring and cabling from the pavement to the TEB or RTC. The loop infrastructure is installed by the TEC after toll site acceptance.

232.3.1 Toll Loop Conduits

(1) Provide one 1-inch toll loop conduit stub-up for each equipped lane/shoulder, to each toll loop pull box from the toll loop pavement area, with a minimum of five loop conduit stub-ups per loop pull box. See ***Exhibit 250.2-1*** and ***Exhibit 250.2-2***, for determining the number of equipped lanes and shoulders.

  (a) Rigid Pavement

    i. At least one loop conduit must stub up in each slab segment bounded by pavement joints of any type. Coordination with the Turnpike must take place for vendor specific toll loop conduit stub-up locations.

ii. The longitudinal and lateral positioning of all conduit layouts in the pull boxes must comply with ***Exhibit 232.3-1*** and ***Exhibit 232.3-3*** and must be stubbed up in the lanes as stated above.

(b) Flexible Pavement

i. The 1-inch toll loop conduits from the loop pull boxes must stub up in the 12-inch wide toll header curb adjacent to the concrete barrier. See ***Exhibit 232.3-2*** and ***Exhibit 232.3-4***.

ii. Coordinate with Turnpike Tolls Design for conduit stub-up locations along the concrete barrier to avoid future TEC loop conflicts.

(2) See ***Exhibit 232.3-1***, ***Exhibit 232.3-2***, ***Exhibit 232.3-3***, and ***Exhibit 232.3-4*** for the toll loop conduit layout details.

(3) At toll sites with no ELs, loop conduit must be routed as follows:

(a) Two or fewer lanes – Route to toll loop pull boxes adjacent to either the inside or outside shoulder.

(b) Three or more lanes – Provide toll loop pull boxes adjacent to the outside and inside shoulders and route loop conduits to the nearest side.

(4) At toll sites where, TLs and ELs are tolled at the same location, loop conduit must be routed as follows:

(a) TLs – Route to toll loop pull boxes adjacent to the TL shoulder.

(b) ELs – Route to toll loop pull boxes adjacent to the EL shoulder.

(5) When only express lanes are tolled, toll loop conduit must be routed as follows:

(a) ELs – Route to toll loop pull boxes adjacent to the EL shoulder.

(b) GULs and TLs adjacent to the buffer – Route to toll loop pull boxes adjacent to the EL shoulder.

232.3.2 Toll Loop Pull boxes

(1) Seven (7) toll loop pull boxes must be provided per tolling direction.

(2) Additional toll loop pull boxes are required for remote, bi-directional or reversible tolling sites depending on the home run conduit routing design. See ***Exhibit 232.1-3***, ***Exhibit 232.1-4***, ***Exhibit 232.1-7***, ***Exhibit 232.1-8***, ***Exhibit 232.1-9***, and ***Exhibit 232.1-10*** for additional information.

(3) Coordination with Turnpike Tolls Design must take place for a pull box layout for any tolling movement supporting more than six equipped lanes and shoulders.

(4) The toll loop pull boxes must be located behind concrete barriers. The use of guardrail in place of concrete barrier is not permitted when adjacent to toll loop pull boxes. See ***GTR 231.1*** for additional requirements regarding the concrete barrier.

(5) The toll loop pull box must be positioned as follows:

(a) See the ***TEB Site Plans*** and the ***RTC Site Plans*** in ***GTR 231*** for toll loop pull box layouts.

(b) Toll loop pull boxes must not be located in roadway pavement lanes or shoulders.

(c) If cable distances cannot be met, coordination with Turnpike Tolls Design must take place for alternative toll loop pull box locations.

(d) At ramp toll sites with a single tolling movement, the toll loop pull boxes must be located on the TEB or RTC side of the roadway, behind the shoulder and concrete barrier.

(e) Toll loop pull boxes placed within median barrier must be elevated to align with the tops of the walls as shown in the ***Standard Plans***, ***Index 521-005.***

(6) The toll loop conduits entering the median toll loop pull boxes must be coordinated with the gantry foundation(s), concrete barrier, and the reinforcement placement in these elements. See ***Exhibit 232.3-3*** and ***Exhibit 232.3-4*** for additional requirements.

(7) The toll loop pull boxes for each tolling movement must be encased in concrete that encompasses all toll loop pull boxes as a group for that tolling movement. Individual toll loop pull box concrete encasements are not permitted.

(8) A minimum of 6-inch separation between the toll loop conduits inside the pull box must be provided.

(9) Provide in-grade intermediate pull boxes or hand holes lower than the following floor / slab elevations:

(a) At TEB sites when the top of any in-grade pull box or hand hole that directly connects to the TEB is located at a higher elevation than the TEB finished floor elevation.

(b) At RTC sites when the top of any in-grade pull box or hand hole that directly connects to the OCC and / or RTC is located at a higher elevation than the toll site equipment slab elevation at the reference points to the OCCs and / or RTCs.

(c) See ***TEB Site Plans*** and ***RTC Site Plans*** in ***GTR 231*** for intermediate pull box placement where required above.

(10) Toll loop and intermediate pull boxes must be 30-inches wide x 48-inches long x 24-inches deep. They must have an open bottom and include a one-piece cover.

(a) All at-grade pull boxes must be set on a foundation of pea rock having a minimum depth of 12 inches. See ***Exhibit 232.3-1*** and ***Exhibit 232.3-2***.

(b) All raised median pull boxes must be set on a foundation of concrete as shown in ***Exhibit 232.3-3*** and ***Exhibit 232.3-4***.

232.3.3 Toll Loop Home Runs

(1) See ***Exhibit 232.1-1***, ***Exhibit 232.1-2***, ***Exhibit 232.1-3***, and ***Exhibit 232.1-4***, for the routing of 3-inch conduits between pull boxes and for home runs to TEBs.

(2) See ***Exhibit 232.1-5***, ***Exhibit 232.1-6***, ***Exhibit 232.1-7***, ***Exhibit 232.1-8***, ***Exhibit 232.1-9***, and ***Exhibit 232.1-10*** for the routing of 3-inch conduits between pull boxes and for all home runs to RTCs.

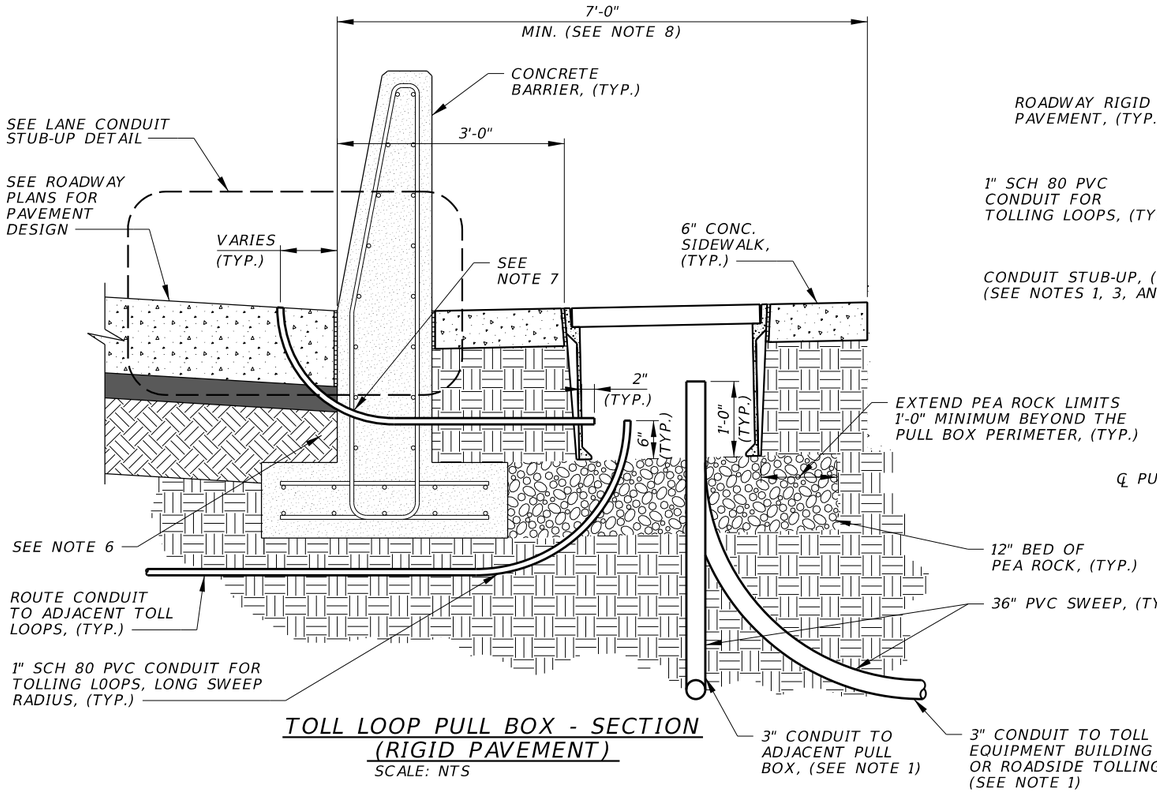
(3) See ***Exhibit 232.3-1***, ***Exhibit 232.3-2***, ***Exhibit 232.3-3***, and ***Exhibit 232.3-4*** for the toll loop home run details at the pull box locations.

(4) When one set of toll loop pull boxes serves two directions of travel, toll loop home runs for each direction of travel must run in separate conduits.

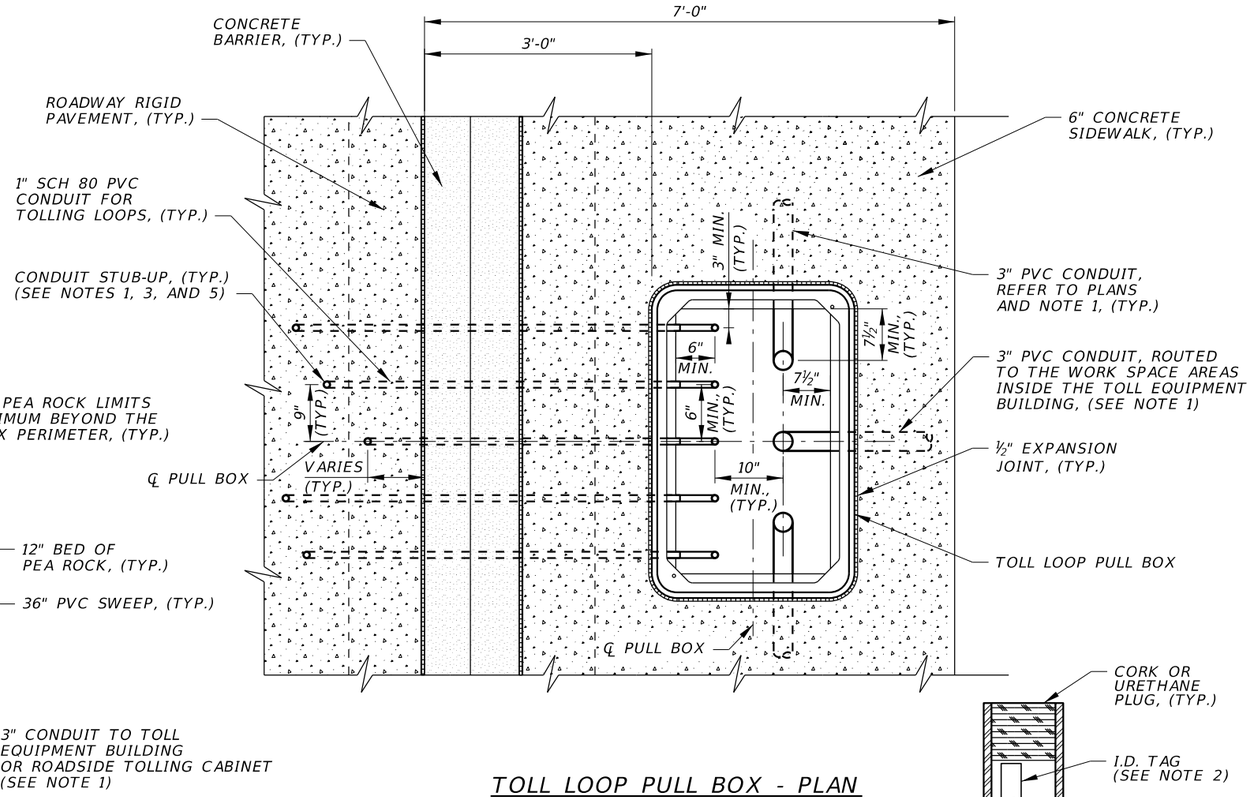
(5) Home runs must be routed to the TEB or RTC via underground duct banks, directional bores, pull boxes, splice vaults, wireways, conduits, and building or cabinet penetrations.

(6) See ***GTR 232.1*** for conduit burial depth requirements.

Exhibit 232.3-1 Toll Loop Pull Box Details for Rigid Pavement

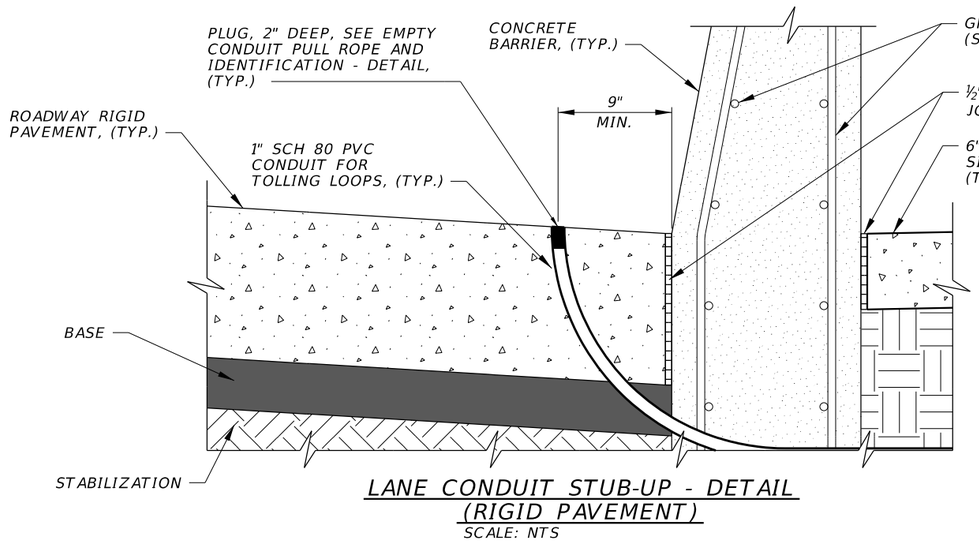


TOLL LOOP PULL BOX - SECTION
(RIGID PAVEMENT)
SCALE: NTS



TOLL LOOP PULL BOX - PLAN
(RIGID PAVEMENT)
SCALE: NTS

EMPTY CONDUIT PULL ROPE
AND IDENTIFICATION - DETAIL
SCALE: NTS

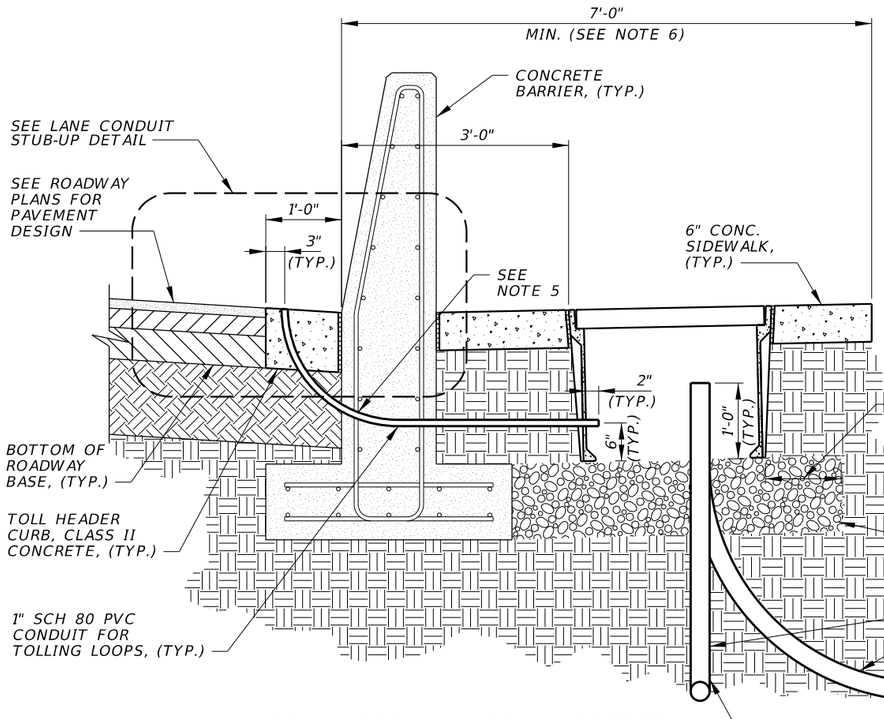


LANE CONDUIT STUB-UP - DETAIL
(RIGID PAVEMENT)
SCALE: NTS

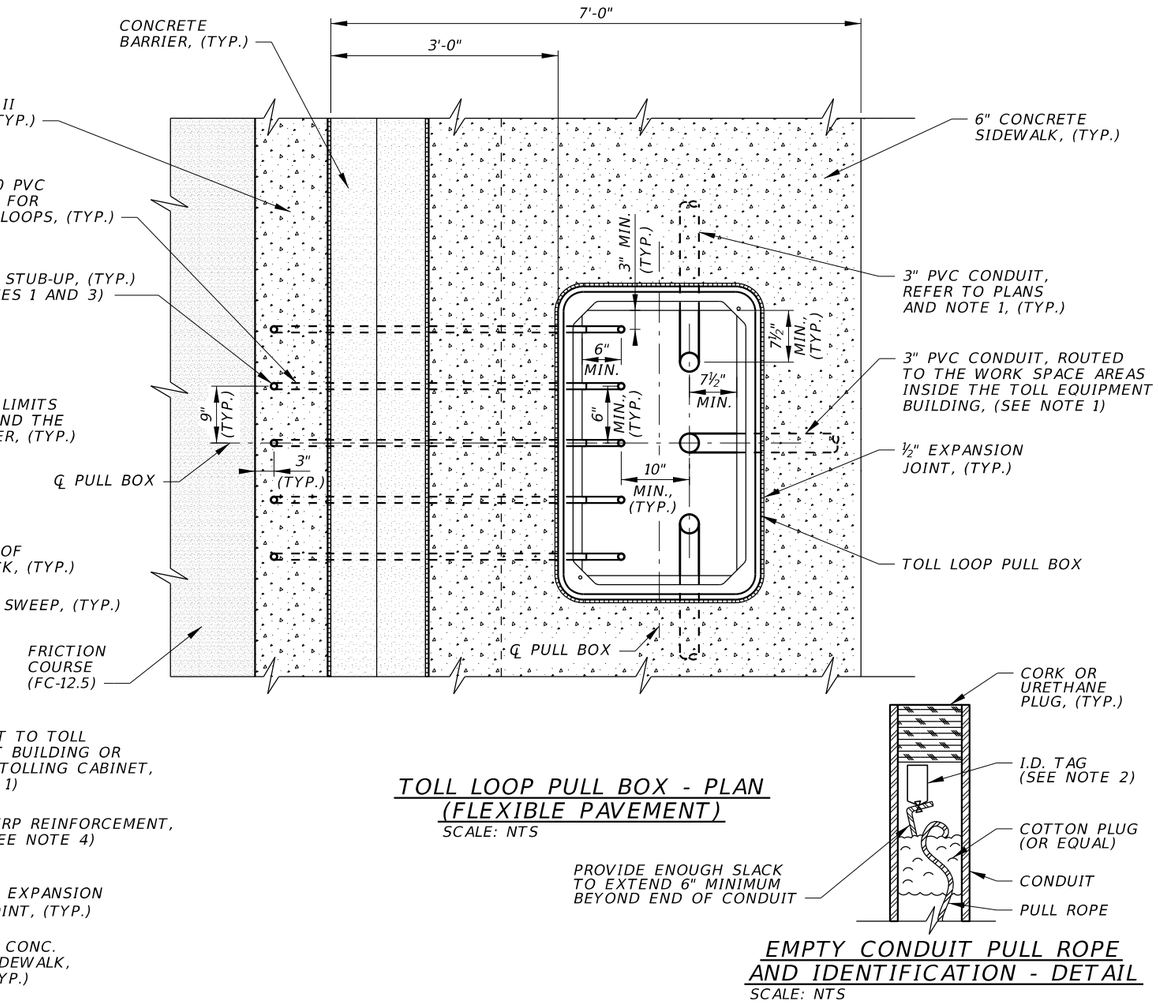
NOTES TO PREPARER:

1. SEAL BOTH ENDS OF CONDUIT WITH NON-CONDUCTING SEALING COMPOUND MANUFACTURED FOR THAT PURPOSE. PROVIDE PULL ROPE WITH ID TAG.
2. I.D. TAG T0 INCLUDE FOLLOWING INFORMATION: NAME OF CONDUIT SYSTEM INTENDED, EQUIPMENT OR DEVICE SERVED, AND LOCATION OF OTHER END OF RUN.
3. PROVIDE ONE (1) 1-INCH STUB-UP CONDUITS FOR EACH EQUIPPED LANE AND SHOULDER AT EACH TOLL LOOP PULL BOX. PROVIDE A MINIMUM OF FIVE (5) 1-INCH STUB-UP CONDUITS AT EACH TOLL LOOP PULL BOX.
4. USE GFRP REINFORCEMENT IN LIEU OF STEEL IN ACCORDANCE WITH THE STANDARD PLANS.
5. COORDINATE STUB-UP LOCATIONS WITH THE DEPARTMENT PRIOR TO DESIGN.
6. EDGE DRAINS ARE NOT PERMITTED WITHIN THE TOLL LOOP PAVEMENT AREA.
7. A MINIMUM CLEARANCE OF TWO INCHES MUST BE PROVIDED BETWEEN THE CONDUIT AND REINFORCEMENT.
8. A MINIMUM CLEARANCE TO THE FACE OF BUILDING OR BACK OF SIDEWALK, AS SHOWN IN PLANS.

Exhibit 232.3-2 Toll Loop Pull Box Details for Flexible Pavement

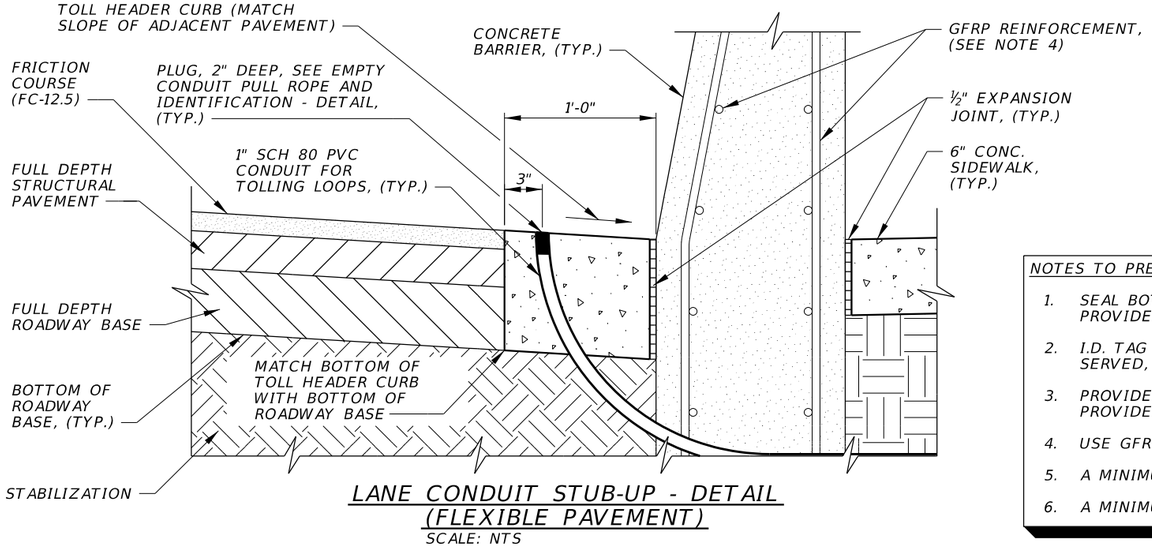


TOLL LOOP PULL BOX - SECTION
(FLEXIBLE PAVEMENT)
SCALE: NTS



TOLL LOOP PULL BOX - PLAN
(FLEXIBLE PAVEMENT)
SCALE: NTS

EMPTY CONDUIT PULL ROPE
AND IDENTIFICATION - DETAIL
SCALE: NTS

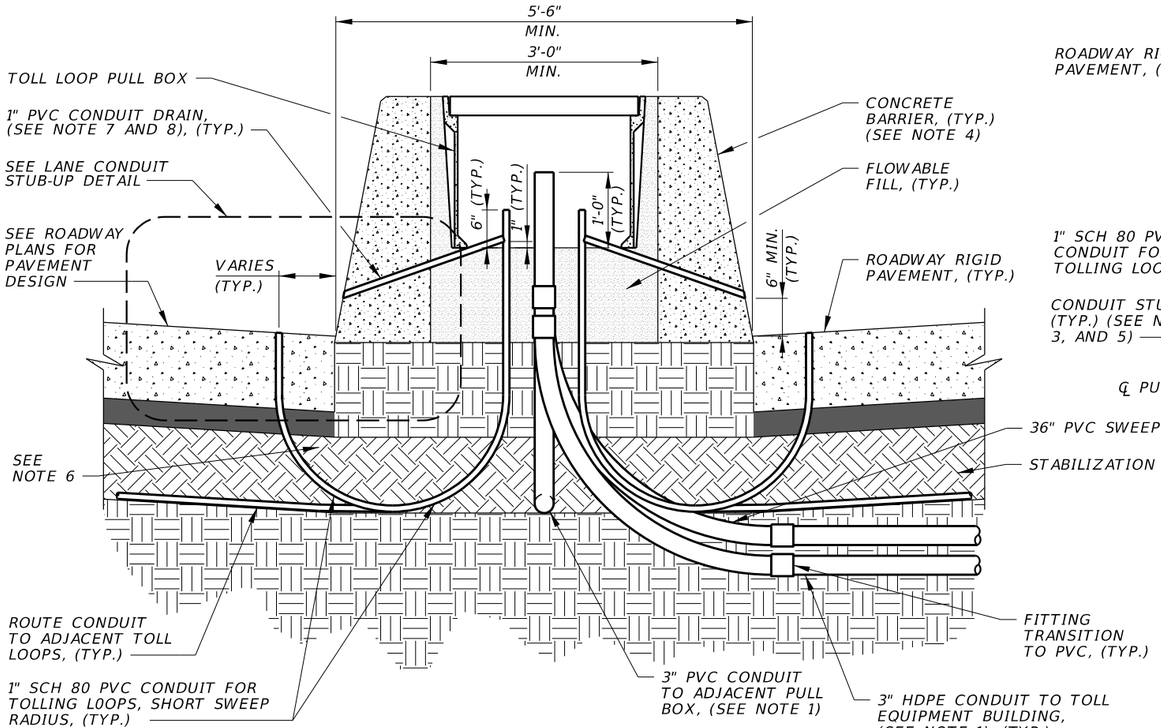


LANE CONDUIT STUB-UP - DETAIL
(FLEXIBLE PAVEMENT)
SCALE: NTS

NOTES TO PREPARER:

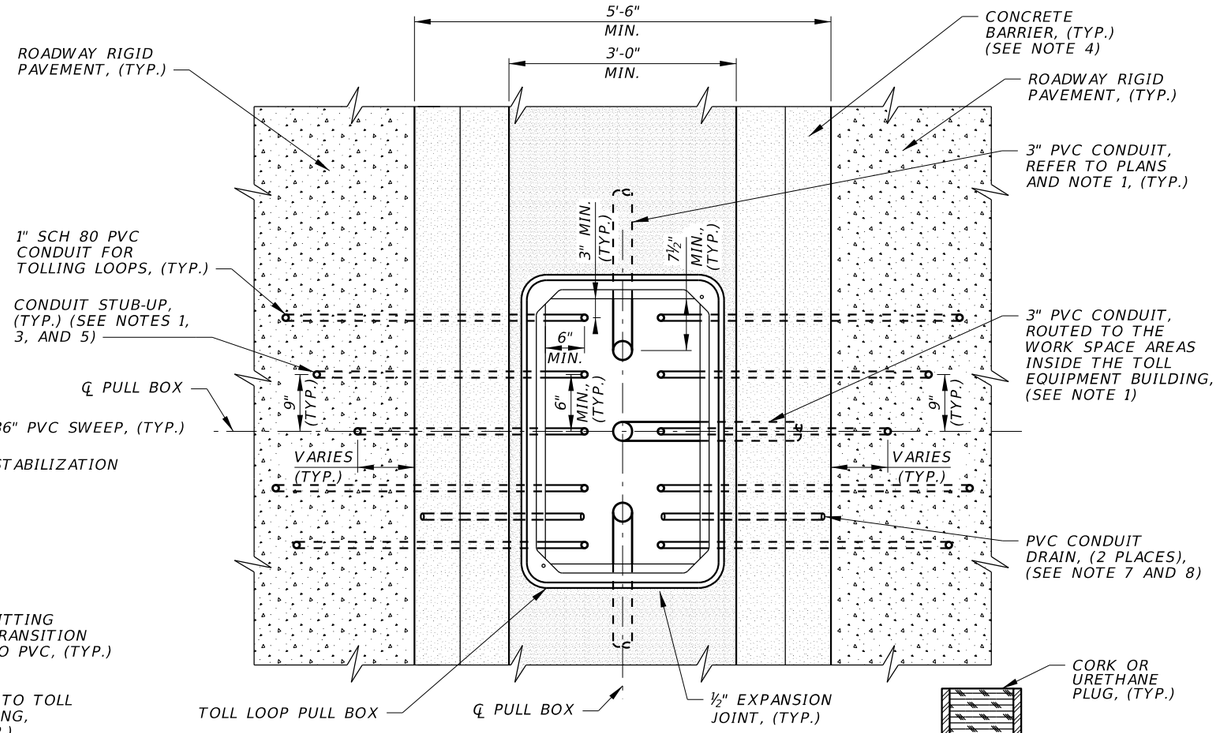
1. SEAL BOTH ENDS OF CONDUIT WITH NON-CONDUCTING SEALING COMPOUND MANUFACTURED FOR THAT PURPOSE. PROVIDE PULL ROPE WITH ID TAG.
2. I.D. TAG T0 INCLUDE FOLLOWING INFORMATION: NAME OF CONDUIT SYSTEM INTENDED, EQUIPMENT OR DEVICE SERVED, AND LOCATION OF OTHER END OF RUN.
3. PROVIDE ONE (1) 1-INCH STUB-UP CONDUITS FOR EACH EOUPPED LANE AND SHOULDER AT EACH TOLL LOOP PULL BOX. PROVIDE A MINIMUM OF FIVE (5) 1-INCH STUB-UP CONDUITS AT EACH TOLL LOOP PULL BOX.
4. USE GFRP REINFORCEMENT IN LIEU OF STEEL IN ACCORDANCE WITH THE STANDARD PLANS.
5. A MINIMUM CLEARANCE OF TWO INCHES MUST BE PROVIDED BETWEEN THE CONDUIT AND REINFORCEMENT.
6. A MINIMUM CLEARANCE TO THE FACE OF BUILDING OR BACK OF SIDEWALK, AS SHOWN IN PLANS.

Exhibit 232.3-3 Elevated Toll Loop Pull Box Details for Rigid Pavement



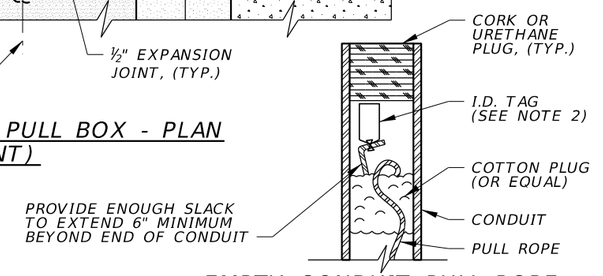
ELEVATED MEDIAN TOLL LOOP PULL BOX - SECTION (RIGID PAVEMENT)

SCALE: NTS



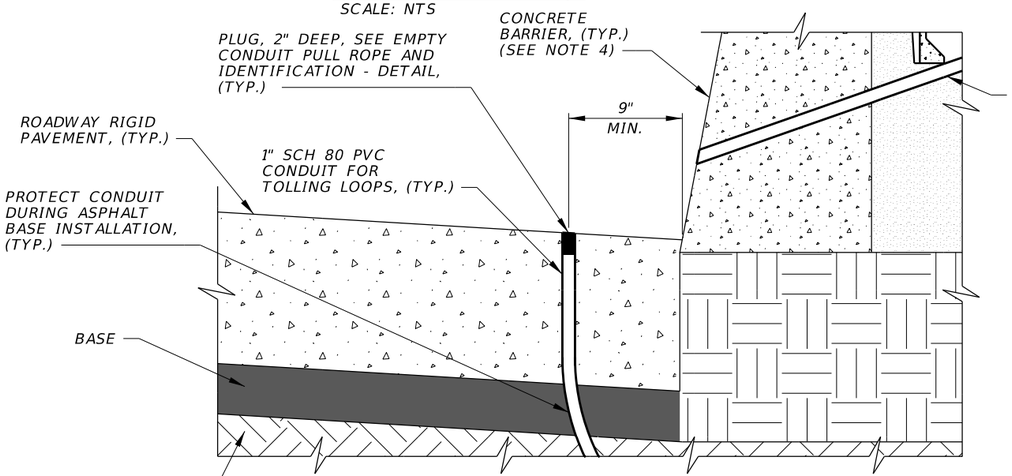
ELEVATED MEDIAN TOLL LOOP PULL BOX - PLAN (RIGID PAVEMENT)

SCALE: NTS



EMPTY CONDUIT PULL ROPE AND IDENTIFICATION - DETAIL

SCALE: NTS



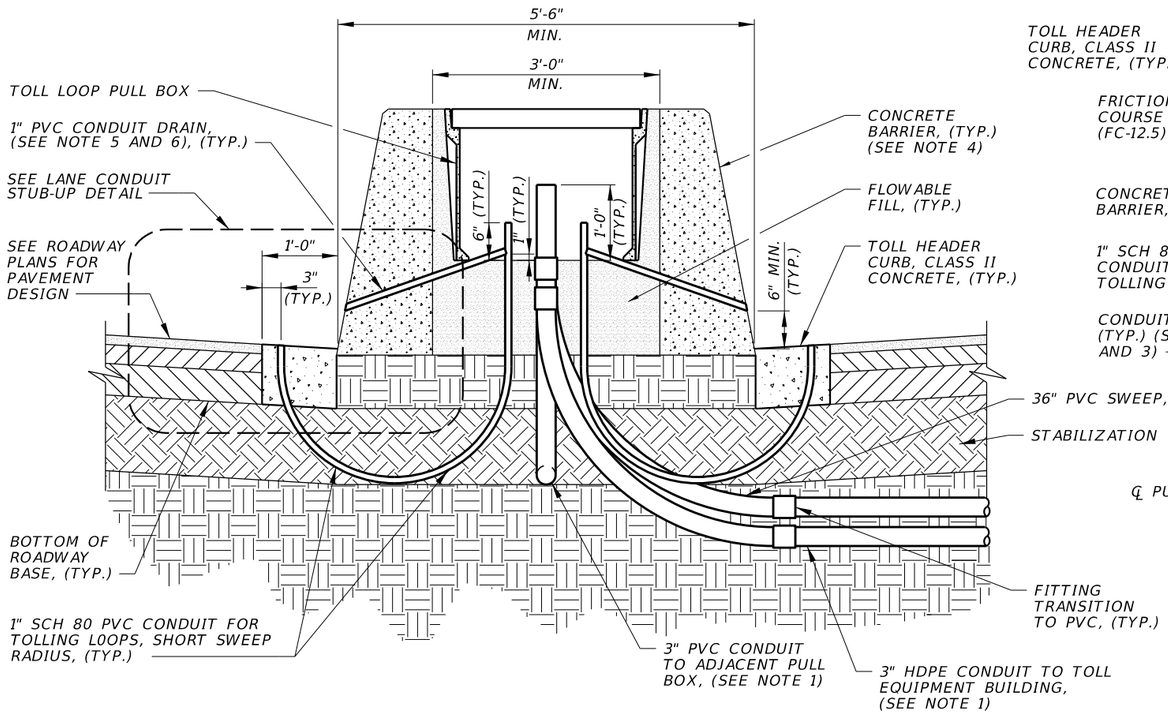
LANE CONDUIT STUB-UP - DETAIL (RIGID PAVEMENT)

SCALE: NTS

NOTES TO PREPARER:

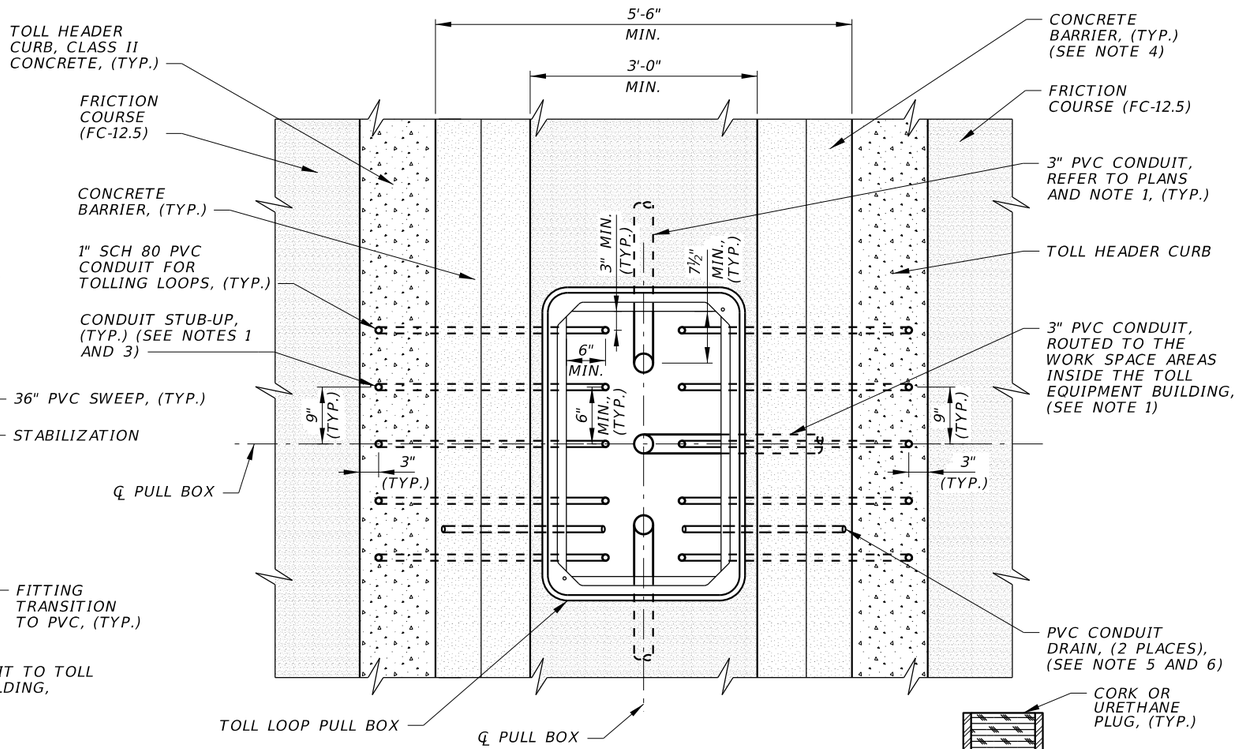
1. SEAL BOTH ENDS OF CONDUIT WITH NON-CONDUCTING SEALING COMPOUND MANUFACTURED FOR THAT PURPOSE. PROVIDE PULL ROPE WITH ID TAG.
2. I.D. TAG T0 INCLUDE FOLLOWING INFORMATION: NAME OF CONDUIT SYSTEM INTENDED, EQUIPMENT OR DEVICE SERVED, AND LOCATION OF OTHER END OF RUN.
3. PROVIDE ONE (1) 1-INCH STUB-UP CONDUITS FOR EACH EQUIPPED LANE AND SHOULDER AT EACH TOLL LOOP PULL BOX. PROVIDE A MINIMUM OF FIVE (5) 1-INCH STUB-UP CONDUITS AT EACH TOLL LOOP PULL BOX.
4. USE GFRP REINFORCEMENT.
5. COORDINATE STUB-UP LOCATIONS WITH TURNPIKE TOLLS PRIOR TO DESIGN.
6. EDGE DRAINS ARE NOT PERMITTED WITHIN THE TOLL LOOP PAVEMENT AREA.
7. PROVIDE TWO (2) 1-INCH PVC CONDUIT DRAINS PER LOOP PULL BOX. TERMINATE EACH DRAIN CONDUIT SIX (6) INCHES ABOVE GUTTER LINE. STUB EACH DRAIN CONDUIT UP 1-INCH MAXIMUM ABOVE THE BOTTOM OF THE TOLL LOOP PULL BOX. LOCATE EACH DRAIN CONDUIT IN THE LOW POINT OF THE TOLL LOOP PULL BOX AND SLOPE FOR POSITIVE DRAINAGE.
8. A MINIMUM CLEARANCE OF TWO INCHES MUST BE PROVIDED BETWEEN THE CONDUIT AND REINFORCEMENT.

Exhibit 232.3-4 Elevated Toll Loop Pull Box Details for Flexible Pavement



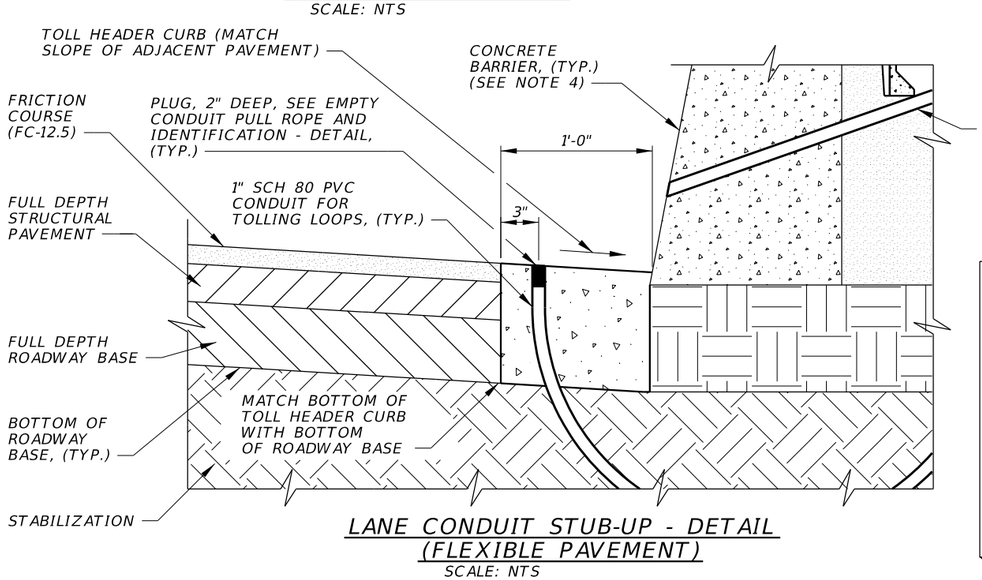
ELEVATED MEDIAN TOLL LOOP PULL BOX - SECTION (FLEXIBLE PAVEMENT)

SCALE: NTS



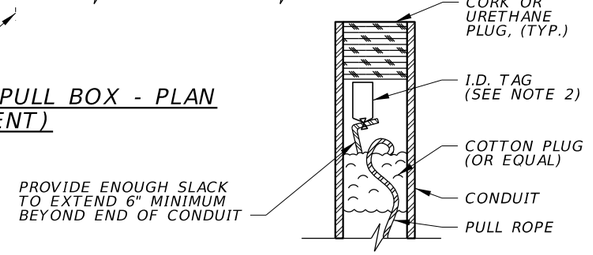
ELEVATED MEDIAN TOLL LOOP PULL BOX - PLAN (FLEXIBLE PAVEMENT)

SCALE: NTS



LANE CONDUIT STUB-UP - DETAIL (FLEXIBLE PAVEMENT)

SCALE: NTS



EMPTY CONDUIT PULL ROPE AND IDENTIFICATION - DETAIL

SCALE: NTS

NOTES TO PREPARER:

1. SEAL BOTH ENDS OF CONDUIT WITH NON-CONDUCTING SEALING COMPOUND MANUFACTURED FOR THAT PURPOSE. PROVIDE PULL ROPE WITH ID TAG.
2. I.D. TAG T0 INCLUDE FOLLOWING INFORMATION: NAME OF CONDUIT SYSTEM INTENDED, EQUIPMENT OR DEVICE SERVED, AND LOCATION OF OTHER END OF RUN.
3. PROVIDE ONE (1) 1-INCH STUB-UP CONDUITS FOR EACH EQUIPPED LANE AND SHOULDER AT EACH TOLL LOOP PULL BOX. PROVIDE A MINIMUM OF FIVE (5) 1-INCH STUB-UP CONDUITS AT EACH TOLL LOOP PULL BOX.
4. USE GFRP REINFORCEMENT.
5. PROVIDE TWO (2) 1-INCH PVC CONDUIT DRAINS PER LOOP PULL BOX. TERMINATE EACH DRAIN CONDUIT SIX (6) INCHES ABOVE GUTTER LINE. STUB EACH DRAIN CONDUIT UP 1-INCH MAXIMUM ABOVE THE BOTTOM OF THE TOLL LOOP PULL BOX. LOCATE EACH DRAIN CONDUIT IN THE LOW POINT OF THE TOLL LOOP PULL BOX AND SLOPE FOR POSITIVE DRAINAGE.
6. A MINIMUM CLEARANCE OF TWO INCHES MUST BE PROVIDED BETWEEN THE CONDUIT AND REINFORCEMENT.

232.4 Toll Site Power Distribution

(1) Toll site power panels distribute power to the toll site and must be dedicated to toll site loads only. They must not be shared with non-tolling electrical loads.

(2) **TEB Sites:** See ***GTR 242.4*** for power panel requirements.

(3) **RTC Sites with on-site power:**

(a) Provide one new emergency distribution panel (EDP) rated 200 amps, 120/240 volts, along with associated components. See ***Exhibit 232.4-1*** for the RTC power riser diagram.

(b) See ***GTR 232.4.1*** for all circuits to be fed by panel EDP.

(c) The electrical loads used in load calculations must be rated full load of the equipment.

(4) **RTC sites with off-site power:**

(a) Review the cost efficiency of using off-site power for an RTC site by comparing costs of installing copper feeder conductors versus cost of an on-site generator and utility connection (typical viable distances are at approximately 750 feet).

(b) Power must be fed from a RTC site with an on-site power service. See ***Exhibit 232.4-1*** for the RTC power riser diagram.

(c) Provide one new emergency panel (EP1) rated 100 amps, 120/240 volts, along with associated components.

(d) See ***GTR 232.4.2*** for all circuits to be fed by panel EP1.

(5) Panelboards must comply with the requirements in ***GTR Part 2,*** appendices as follows:

(a) **TEB Sites:** ***GTR Part 2 Appendix 2***, TSP Section for ***Panelboards for TEB Sites***.

(b) **RTC Sites:** ***GTR Part 2 Appendix 3***, TSP for ***Panelboards at RTC Toll Sites***.

232.4.1 Circuits from Roadside Tolling Cabinet On-Site Power Panel EDP

(1) Provide circuit breakers in panel EDP:

(a) Two (2) 15A, 240V branch circuits, one for each air-conditioner in the OCC.

(b) One (1) 20A, 240V feeder for the 2 KVA UPS in the OCC for the OCC components.

(c) One (1) 30A, 240V feeder for the 5 KVA UPS in the OCC for each RTC.

(d) One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures in the OCC.

(e) For each RTC:

i. Two (2) 20A, 240V branch circuits, one for each air-conditioner.

ii. One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures.

(f) For the Future RTC:

i. Two (2) 20A, 240V branch circuits, one for each air-conditioner.

ii. One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures.

(2) Provide circuit breakers in panel EDP, and associated conductors for the following:

(a) Generator:

i. One (1) 20A, 120V branch circuits, for the battery charger.

ii. One (1) 20A, 120V branch circuit for the jacket water heater.

(b) Lighting: One (1) 20A, 120V branch circuit on the power distribution frame.

232.4.2 Circuits from Roadside Tolling Cabinet Off-Site Power Panel EP1

(1) Provide circuit breakers in panel EP1:

(a) Two (2) 15A, 240V branch circuits, one for each air-conditioner in the OCC.

(b) One (1) 20A, 240V feeder for the 2 KVA UPS in the OCC for the OCC components.

(c) One (1) 30A, 240V feeder for the 5 KVA UPS in the OCC for each RTC.

(d) One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures in the OCC.

(e) For the RTC:

i. Two (2) 20A, 240V branch circuits, one for each air-conditioner.

ii. One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures.

(f) For the Future RTC:

i. Two (2) 20A, 240V branch circuits, one for each air-conditioner.

ii. One (1) 20A, 120V branch circuit for the convenience receptacle and light fixtures.

(2) Provide circuit breakers in panel EP1, and associated conductors for the lighting with one (1) 20A, 120V branch circuit on the power distribution frame.

232.4.3 Circuits from OCC

(1) For components in the OCC: Provide power output ports from the 2 KVA UPS for the following OCC components:

(a) [redacted]

(b) Network Video Recorder (NVR): cord and plug connection, 120V 15A

(c) WAN Switch: two (2) cord and plug connections, 120V 20A

(2) For each RTC: Provide one 30A 240V hard-wired power circuit from each 5 KVA UPS.

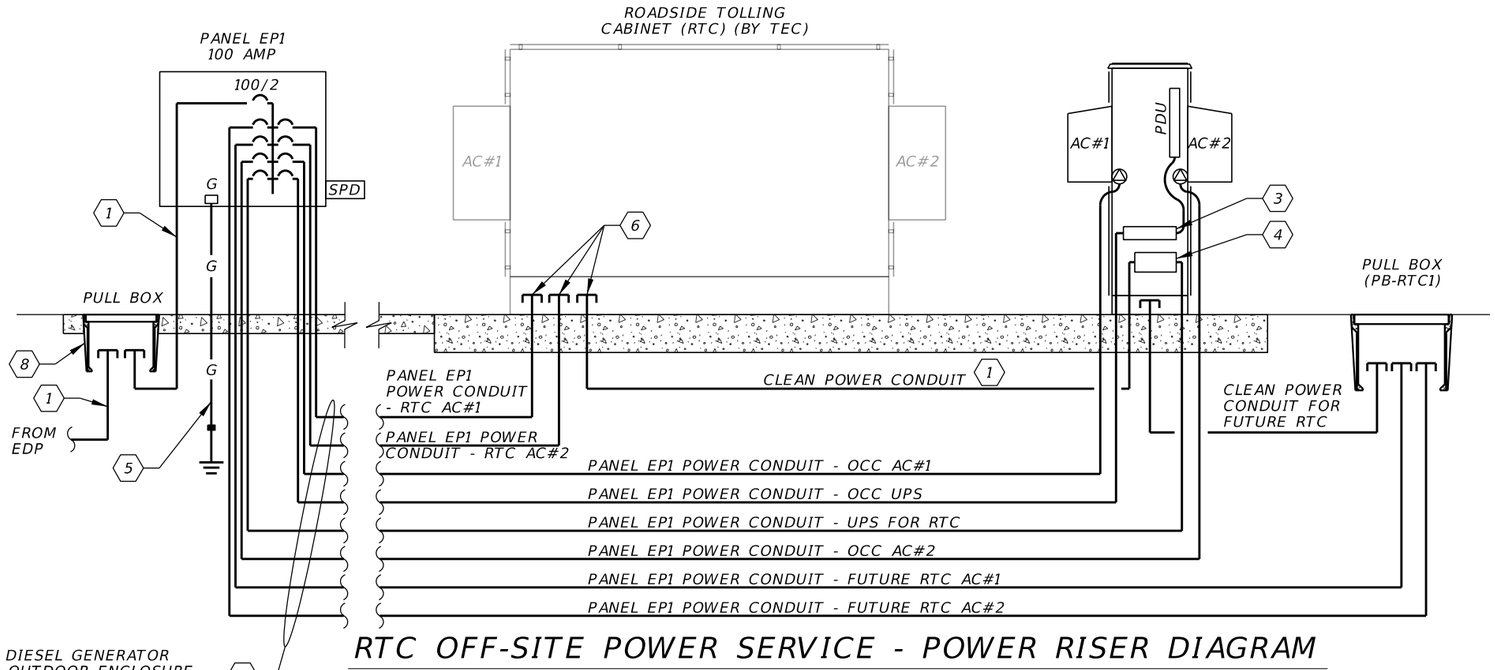
Exhibit 232.4-1 RTC Power Riser Diagram

NOTES TO PREPARER:

1. *SEE RTC CONDUIT ROUTING PLAN EXHIBITS FOR CONDUIT ROUTING LAYOUT AND SIZES.*
2. *ONLY CONDUIT SHOWN. PROVIDE ADDITIONAL BRANCH CIRCUIT POWER CONNECTIONS FOR THE EQUIPMENT SHOWN. SEE GTR 232.4.1 FOR ALL CIRCUITS FROM EDP AND 232.4.2 FOR ALL CIRCUITS FROM PANEL EP1.*

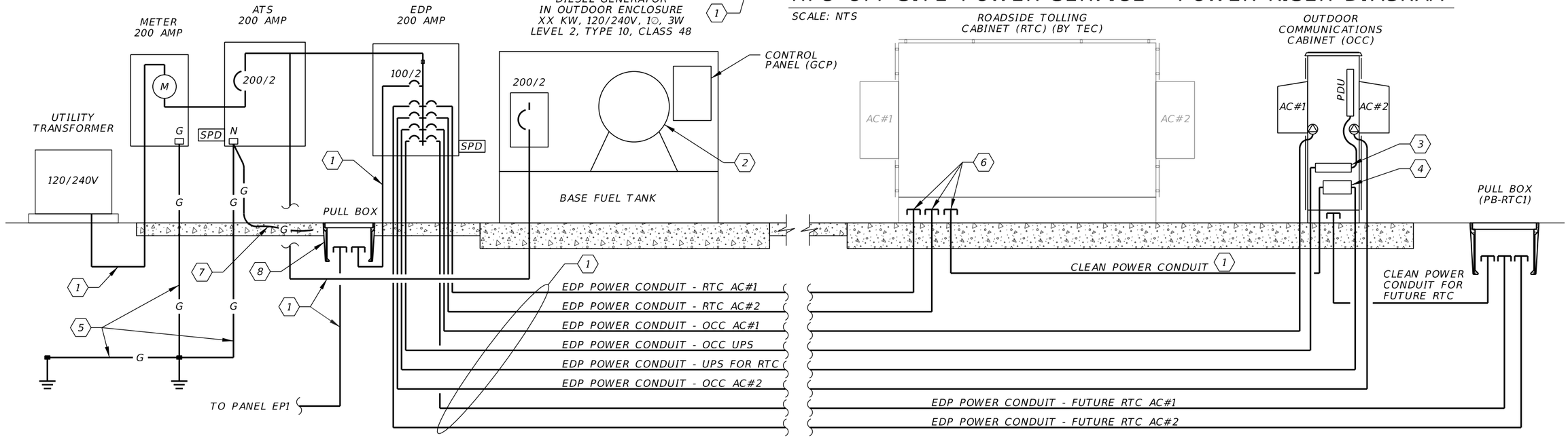
REFERENCE NOTES:

1. *SIZE CONDUCTORS BASED ON NEC VOLTAGE DROP ALLOWANCES.*
2. *40 kW GENERATOR IS BASIS OF DESIGN. FINAL GENERATOR SIZE PROVIDED BY EOR.*
3. *PROVIDE (1) 120V 2 KVA UPS FOR EACH OUTDOOR COMMUNICATIONS CABINET (OCC).*
4. *PROVIDE (1) 120/240V 5 KVA UPS FOR EACH ROADSIDE TOLLING CABINET (RTC).*
5. *GROUNDING CONDUCTORS SIZED BY THE EOR.*
6. *PROVIDE (3) 1" CONDUITS WITH PULL STRINGS ONLY AND STUB UP 6" ABOVE FINISH GRADE WITHIN THE WORKING SPACES AS SHOWN IN EXHIBIT 232.1-11. COVER THE STUBBED UP OPEN END OF EACH CONDUIT WITH ELECTRICAL TAPE. LABEL EACH CONDUIT END WITH "UPS", "AC#1", AND "AC#2" AS APPLICABLE. POWER CONDUCTORS TO BE SIZED AND INSTALLED BY THE TOLL EQUIPMENT CONTRACTOR.*
7. *CONCRETE ENCASED ELECTRODE.*
8. *PROVIDE PULL BOX WITH CONCRETE APRON FOR OFF-SITE POWER RTC TOLL SITES.*



RTC OFF-SITE POWER SERVICE - POWER RISER DIAGRAM

SCALE: NTS



RTC ON-SITE POWER SERVICE - POWER RISER DIAGRAM

SCALE: NTS

232.5 Electrical Equipment Frame Layout

There are multiple types of strut-channel frames supporting the electrical equipment needed for toll sites.

See ***GTR 231.1*** for site layout requirements of the ground-mounted frames.

232.5.1 Equipment Mounted to AVI Reader Ground-Mounted Frame

(1) See ***GTR 255.5.6*** for determining when AVI reader ground-mounted frames must be used.

(2) See ***Exhibit 232.5-2*** for the AVI reader fiberglass NEMA 4 enclosure layouts.

(3) Provide a NEMA 3R, 12-inch H x 12-inch W x 24-inch L wire trough.

(4) See ***Exhibit 250.2-3*** for equipment loads

232.5.2 Roadside Tolling Cabinet Equipment Mounted to Power Distribution Frames

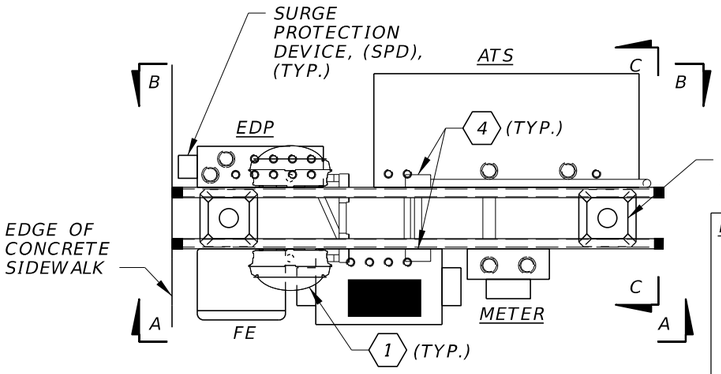
(1) Provide toll site power panels and associated SPDs.

(2) Provide lighting on each face.

(3) [redacted]

(4) See ***Exhibit 232.5-1*** f or the details of both On-Site Power Service and Off-Site Power Service, power distribution frames.

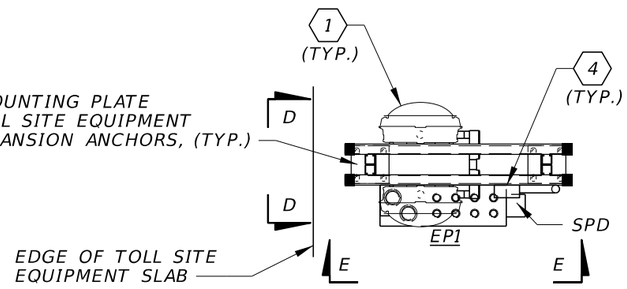
Exhibit 232.5-1 RTC Power Distribution Frame Layouts



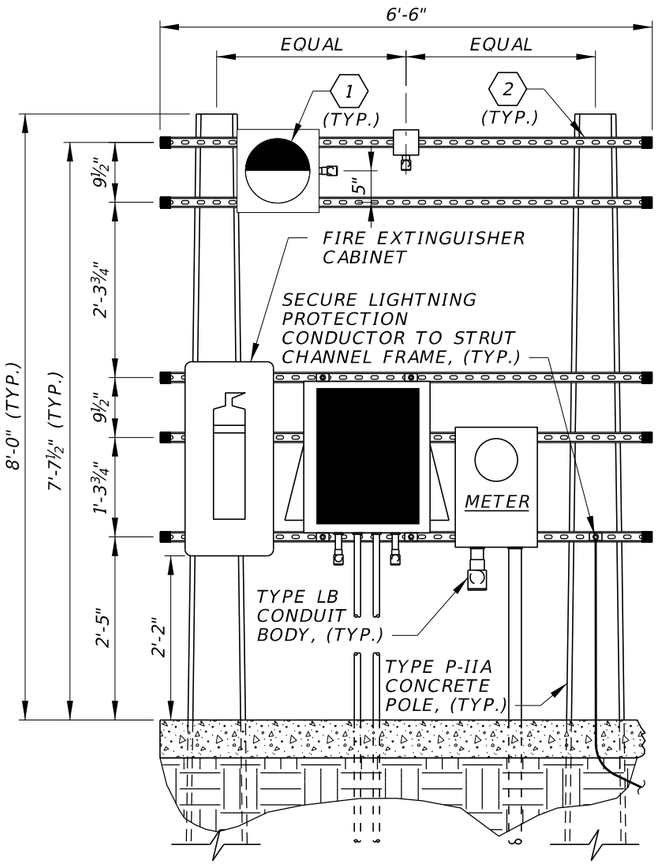
PLAN - ON-SITE POWER SERVICE

NOTES TO PREPARER:

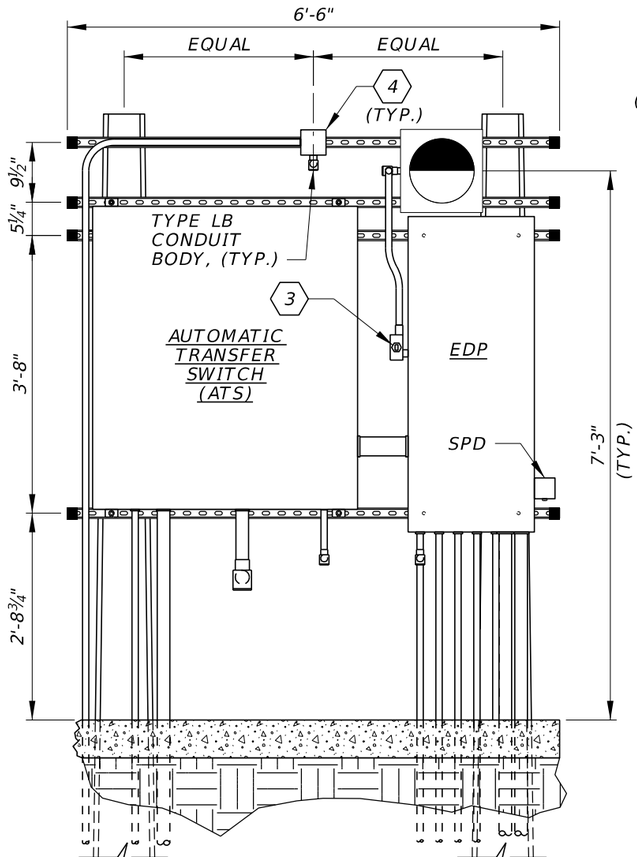
1. TYPE "B" FIXTURE WITH SURFACE ADAPTER (JUNCTION BOX) MOUNTED TO SS PLATE, (TYP.)
2. SECURE STRUT CHANNEL TO SUPPORT FRAME WITH MANUFACTURER APPROVED FASTENERS.
3. WEATHERPROOF LIGHTING OVERRIDE SWITCH
4. [redacted]



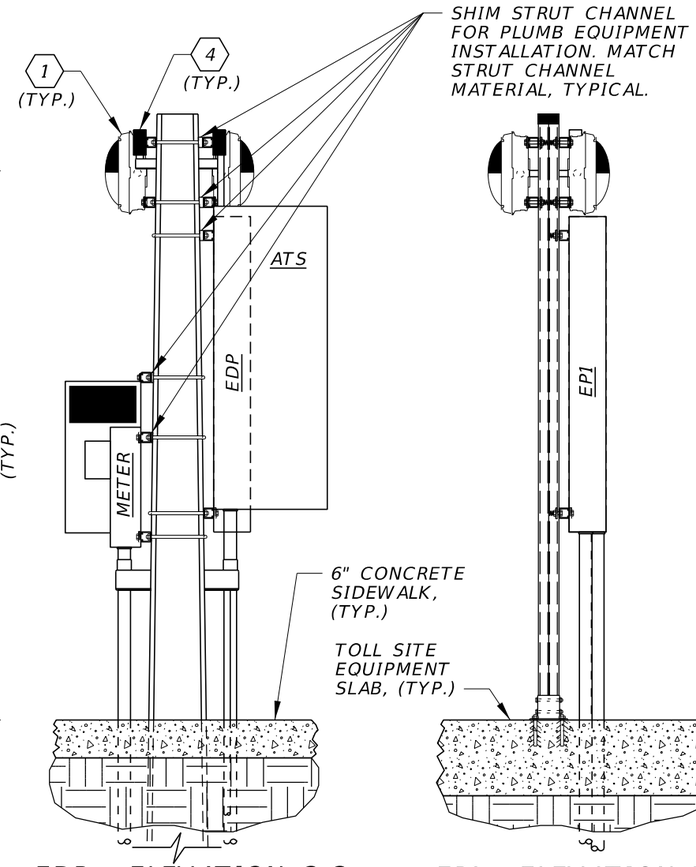
PLAN - OFF-SITE POWER SERVICE



EDP - ELEVATION A-A

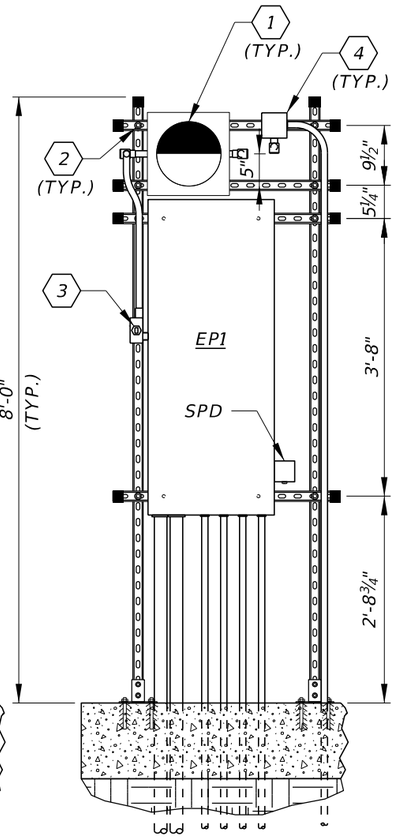


EDP - ELEVATION B-B



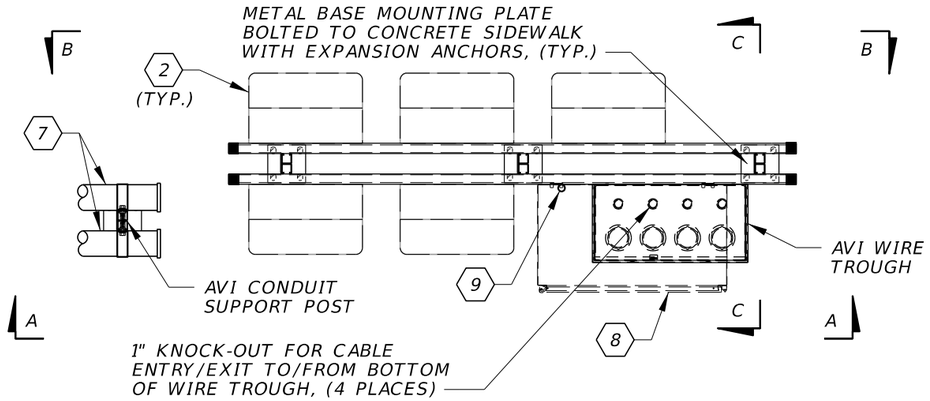
EDP - ELEVATION C-C

EP1 - ELEVATION D-D



EP1 - ELEVATION E-E

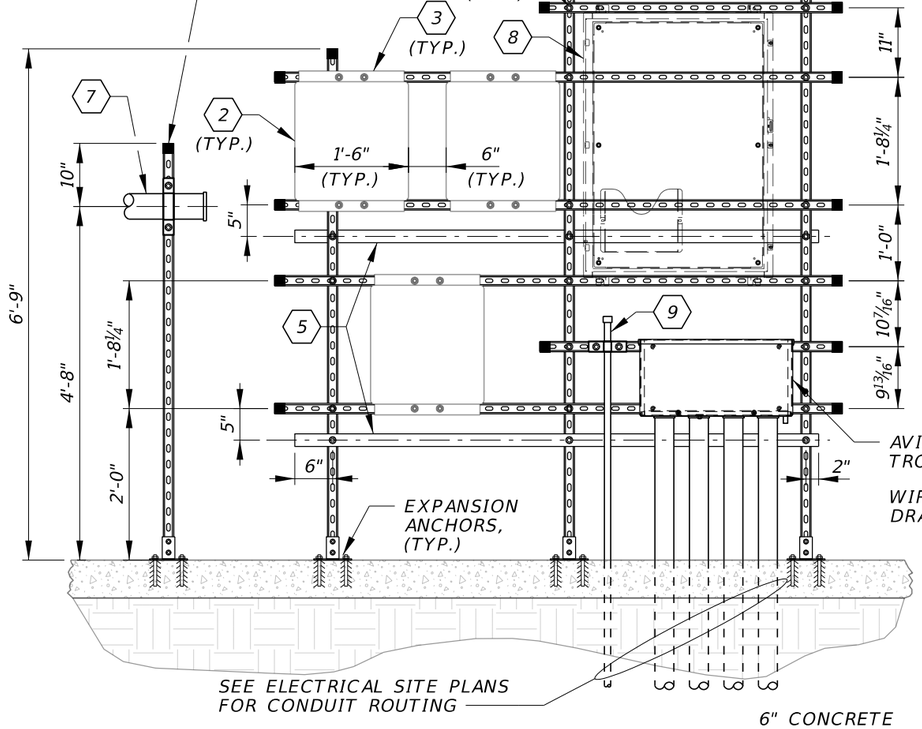
Exhibit 232.5-2 AVI Reader Ground-Mounted Frame Layouts



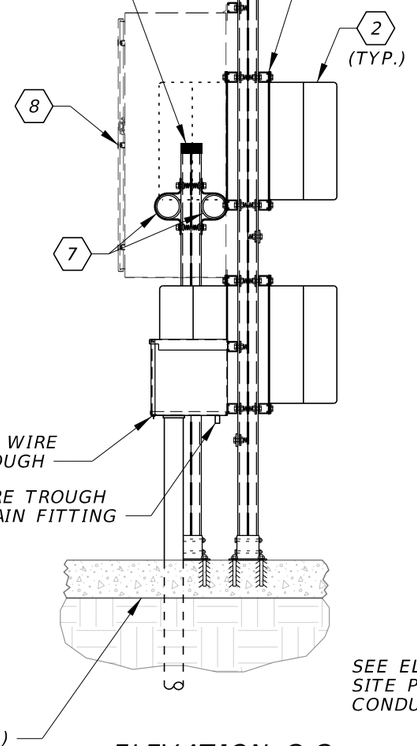
AVI READER GROUND-MOUNTED FRAME - PLAN

NOTES TO PREPARER:

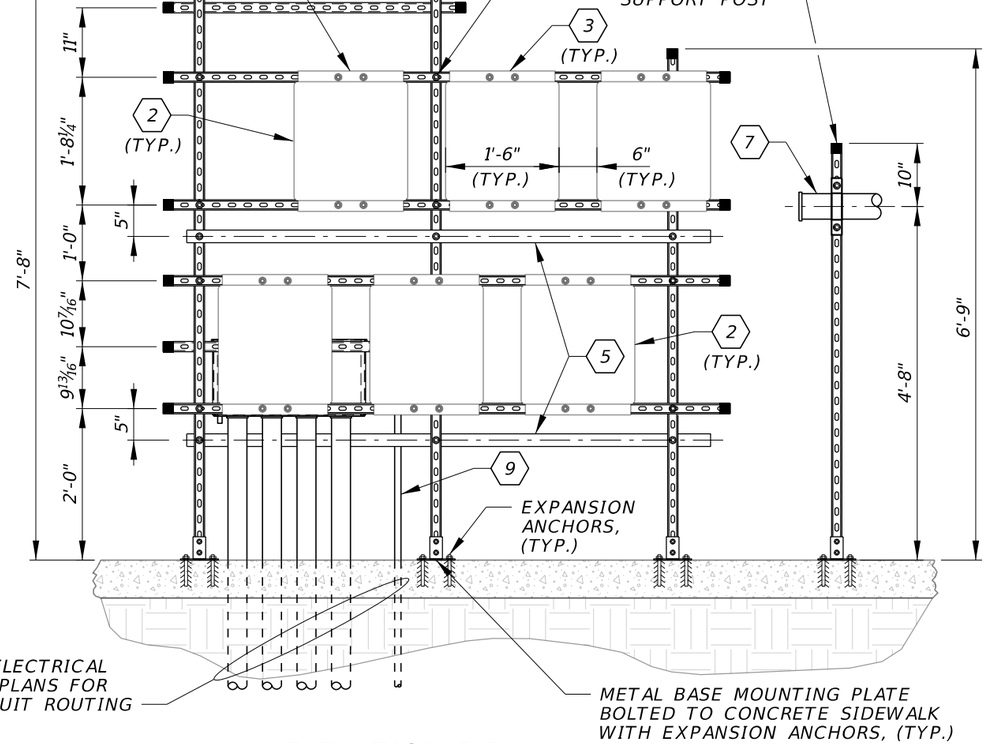
1. ONE AVI READER IS REQUIRED FOR EACH GANTRY MOUNTED ANTENNA AND HOUSED INSIDE AN AVI ENCLOSURE.
2. AVI ENCLOSURE, (PROVIDED BY TEC)
3. AVI ENCLOSURE MOUNTING PLATE, (PROVIDED BY TEC)
4. SECURE STRUT CHANNEL TO SUPPORT FRAME WITH MANUFACTURER APPROVED FASTENERS.
5. COPPER GROUND BUS BAR MOUNTED BELOW AVI READERS. BOLT DIRECTLY TO STRUT CHANNEL. BUS BAR MUST BE 1/4" THICK, 2" HIGH, AND LENGTH AS REQUIRED. SUPPORT GROUND BUS BAR AT EACH VERTICAL STRUT CHANNEL POST.
6. SEE EXHIBIT 231.1-13 FOR GROUND-MOUNTED STRUT CHANNEL POST LAYOUT DIMENSIONS.
7. 4"C FOR AVI ROUTED TO AVI SECTION OF UPRIGHT CABLE TRAY.
8. AVI CABINET, (PROVIDED BY TEC)
9. STUB AND CAP 1" CONDUIT FOR AVI POWER TO TEC EQUIPMENT.



ELEVATION A-A



ELEVATION C-C



ELEVATION B-B

232.6 Lighting at Toll Sites

(1) See ***GTR 242.2*** for TEB lighting requirements.

(2) See ***GTR Part 2, Appendix 2***, TSP Section for ***Lighting Fixtures, Lamps, and Ballasts at TEB Sites*** for additional requirements.

(3) Lighting requirements for RTC Sites:

(a) An exterior lighting system must be provided consisting of at least two strut channel-mounted light fixtures with integral photocells.

(b) Light fixtures must be installed at 87-inches above finished grade to the center of the fixture.

(c) Use Type B fixture from ***Exhibit 242.2-1*** light fixture schedule.

(d) See ***Exhibit 232.5-1*** for fixture location mounting details.

(e) See ***GTR 232.4.1*** and ***GTR 232.4.2*** for lighting circuit requirements.

(f) See ***GTR Part 2 Appendix 3***, TSP for ***Lighting Fixtures and Lamps at RTC Toll Sites*** for additional requirements.

232.7 Generators, Fuel Tanks, and Automatic Transfer Switches

(1) Diesel emergency generator packages, automatic transfer switches, and fuel tanks must be provided at all toll sites except RTC sites with off-site power service.

(2) The toll site emergency power system must not serve non-tolling related electrical loads such as ITS systems, roadway lighting, etc.

(3) See ***GTR 231.1*** for additional generator and fuel tank requirements.

(4) **TEB Sites:**

(a) Provide separate fuel tank and generator as shown on the ***TEB Site Plans*** in ***GTR 231***.

(b) See ***GTR Part 2, Appendix 2***,TSP Section for ***Automatic Transfer Switches at TEB Sites*** and ***Emergency Generator at TEB Sites*** for additional requirements.

(5) **RTC Sites:**

(a) Provide a generator with integral base tank as shown on the ***RTC Site Plans*** in ***GTR 231***.

(b) See ***GTR Part 2 Appendix 3***, TSP for ***Automatic Transfer Switches at RTC Tolls Sites*** and ***Emergency Generator at RTC Tolls Sites*** for additional requirements.

232.8 Surge Protection Devices (SPDs)

(1) **TEB Sites:** See ***GTR 242.10*** for SPD requirements.

(2) **RTC Sites:**

(a) SPDs must be provided for all power panels and transfer switch.

(b) See ***GTR Part 2 Appendix 3***, TSP for ***Surge Protective Devices 1KV or less at RTC Toll Sites*** for additional requirements.

232.9 Toll Site Security

232.9.1 Closed Circuit Television (CCTV) System

(1) Conduit, junction boxes, fittings, connections, power cabling, pull ropes and other infrastructure required for the Turnpike installed CCTV equipment must be provided.

(2) See ***Exhibit 232.9-1*** and ***Exhibit 232.9-2*** for quantity and layout of boxes to support the CCTV cameras.

(3) The Turnpike will furnish and install the security system, cabling and all cameras on the site.

(4) **TEB Sites:** Raceways to the data side of the ceiling mounted cable tray for each building mounted CCTV surveillance camera must be provided in accordance with ***Exhibit 242.1-6*** and ***Exhibit 242.1-7***.

(5) **RTC Sites:** See ***Exhibit 232.5-1*** for CCTV mounting details.

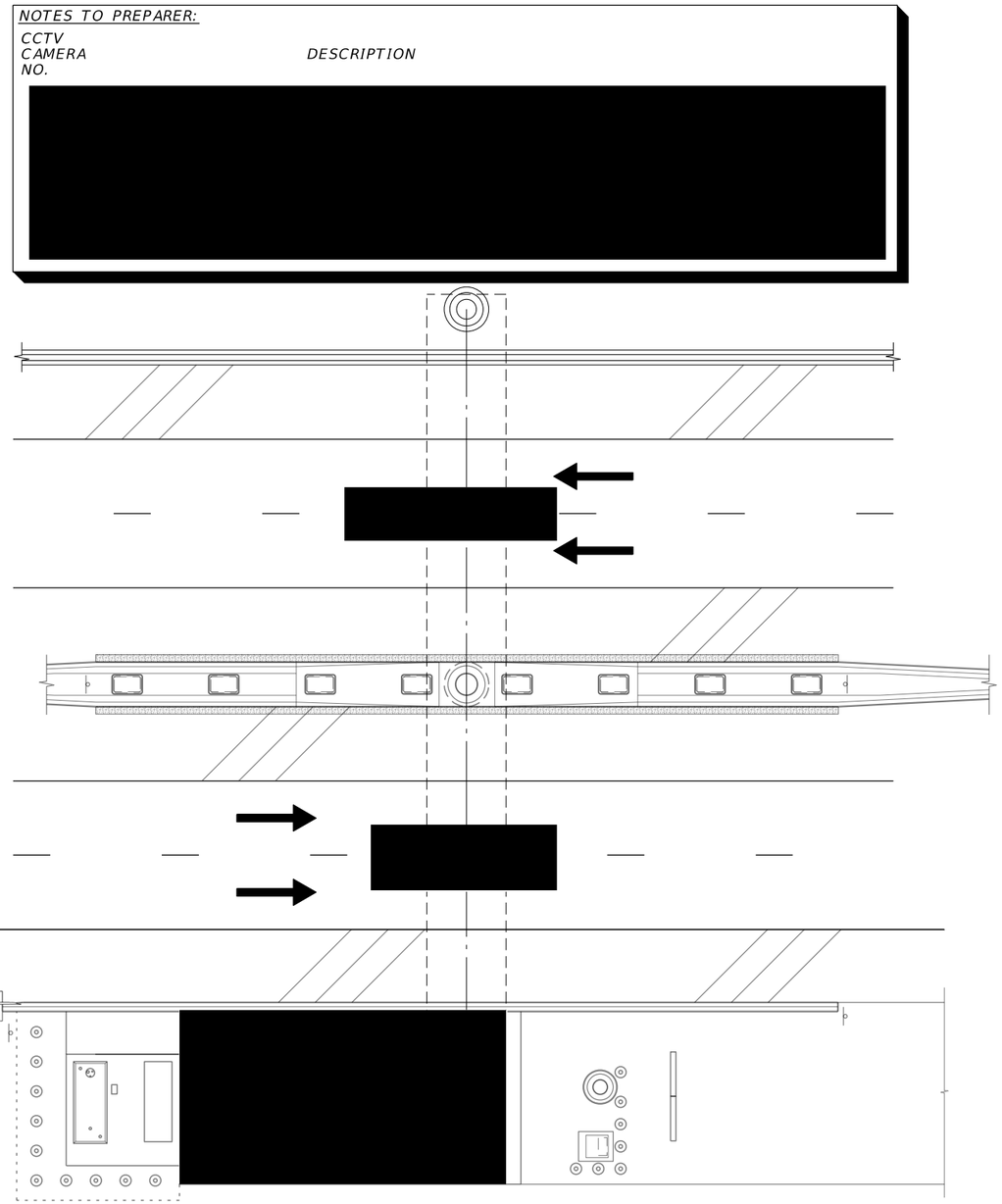
232.9.2 Site Access Control

When toll site fencing and gates are required per ***GTR 231.7***:

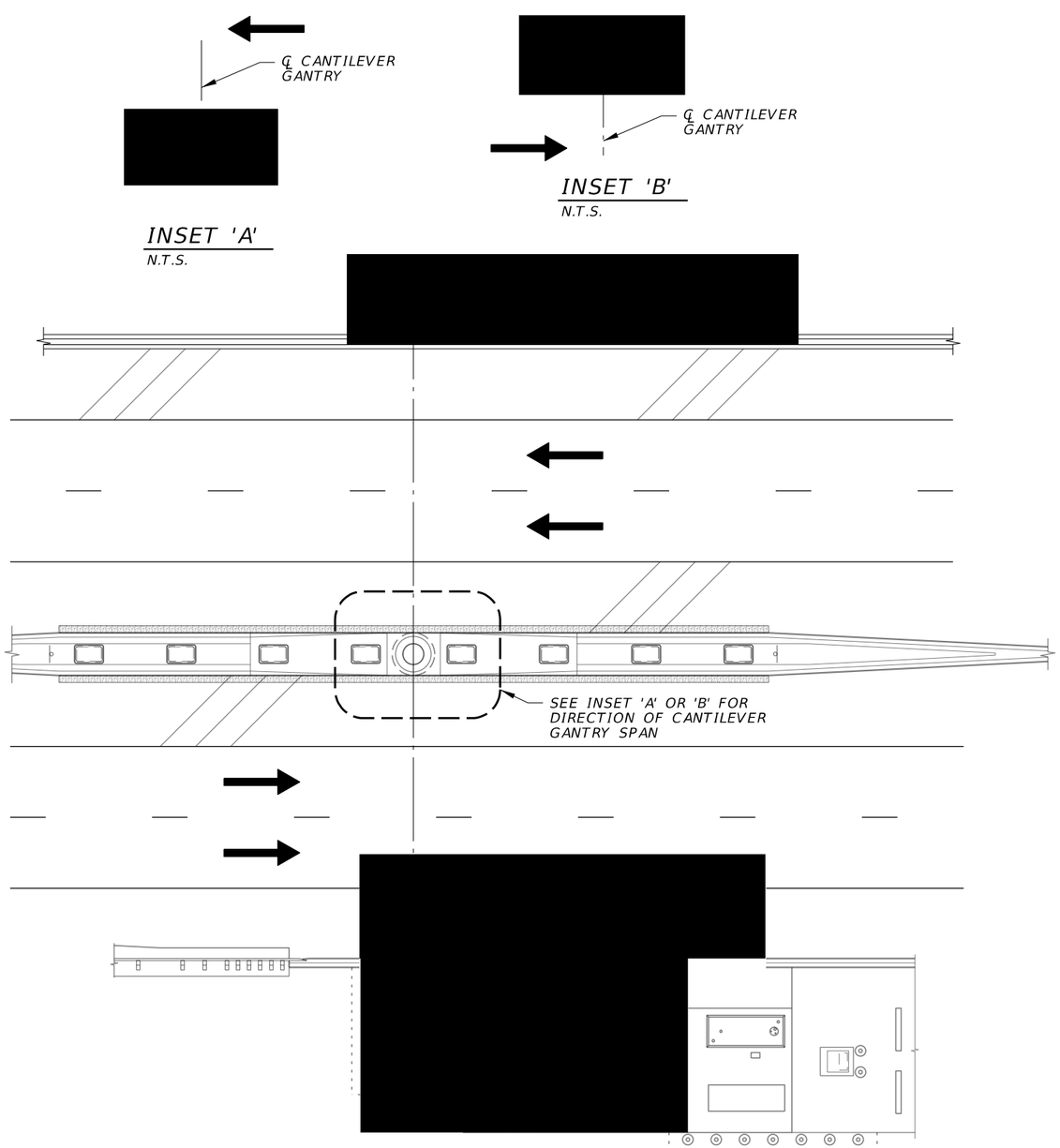
(1) All necessary conduit, junction boxes, fittings, connections, and miscellaneous hardware must be provided for power and data cabling required for the access control system.

(2) Coordinate with Turnpike Toll Systems Department and Turnpike Tolls Design for determination of owner furnished devices.

Exhibit 232.9-1 CCTV Camera Site Locations for TEB Sites



TYPICAL ACCESSIBLE GANTRY TOLL SITE
N.T.S.



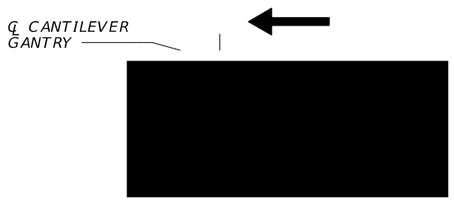
TYPICAL NON-ACCESSIBLE GANTRY TOLL SITE
N.T.S.

Exhibit 232.9-2 CCTV Camera Site Locations for RTC Sites

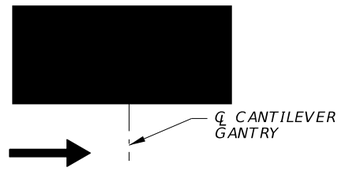
NOTES TO PREPARER:

CCTV CAMERA NO. | DESCRIPTION

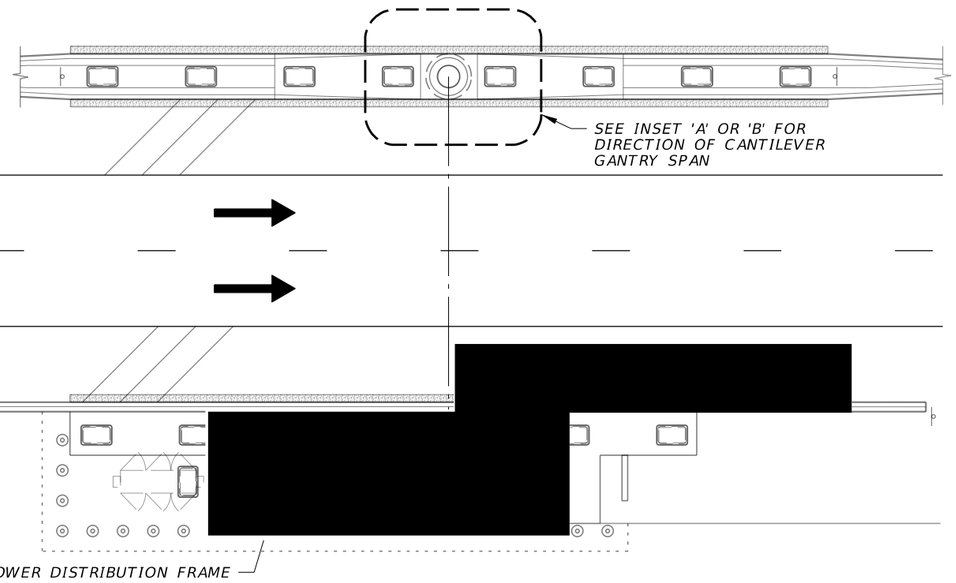
[redacted]



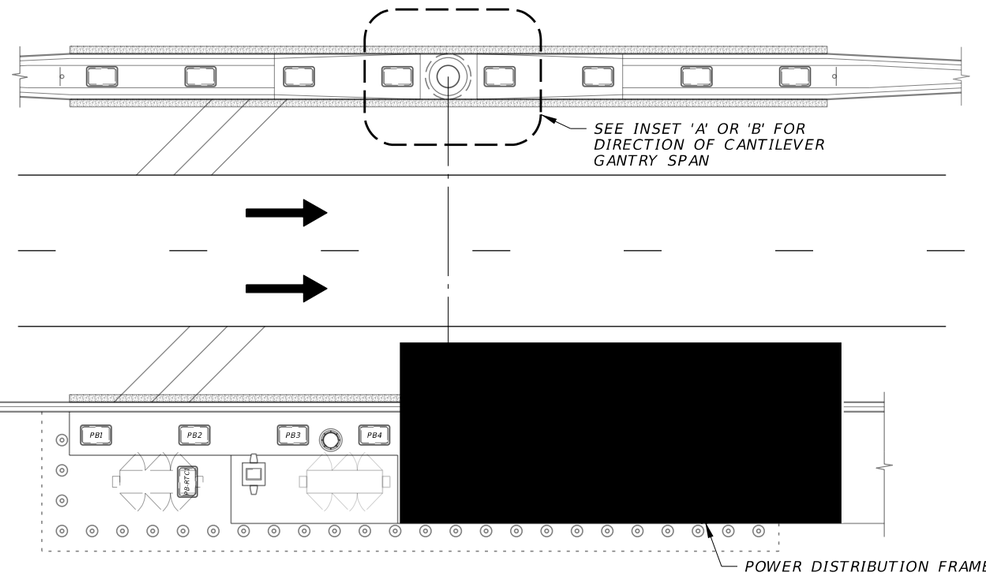
INSET 'A'
N.T.S.



INSET 'B'
N.T.S.



TYPICAL NON-ACCESSIBLE GANTRY TOLL SITE WITH OFF-SITE POWER SERVICE
N.T.S.



TYPICAL NON-ACCESSIBLE GANTRY TOLL SITE WITH ON-SITE POWER SERVICE
N.T.S.

232.10 Toll Site Supervisory Control and Data Acquisition (SCADA) Systems

(1) One SCADA control panel must be provided for each toll site.

(2) **TEB Sites:** See ***GTR 242.6*** for TEB sites SCADA system requirements.

(3) **RTC Sites:** SCADA system for RTC sites must be in accordance with the following:

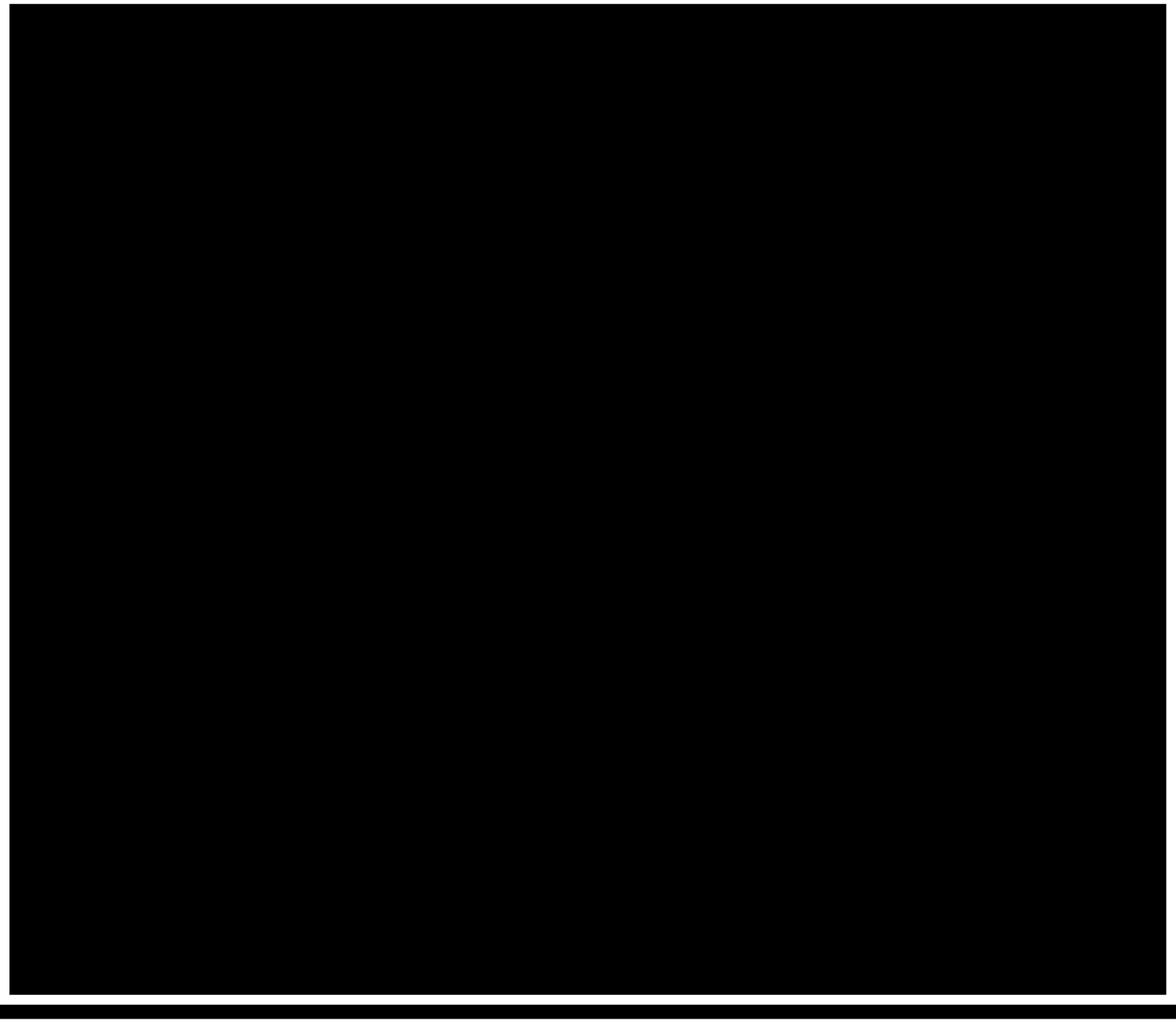
(a) The SCADA system must connect to the toll site assets as shown in ***Exhibit 232.10-1***, ***Exhibit 232.10-2***, and

(b) For electrical power to the SCADA panel refer to ***GTR 232.4.3***.

Exhibit 232.10-1 RTC SCADA Riser Diagram (1 of 3)

DIAGRAM NOTES TO PREPARER:

1
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ABBREVIATIONS:

ATS	*AUTOMATIC TRANSFER SWITCH*
BRGW	*BLUE, RED, GREEN, WHITE*
CR	*ACCESS CONTROL CARD READER*
DC/EC	*ACCESS CONTROL DOOR CONTROLLER/ EXPANSION CARD*
DPDT	*DOUBLE POLE DOUBLE THROW*
GCB	*GENERATOR CIRCUIT BREAKER*
GCP	*GENERATOR CONTROL PANEL*
MCB	*MAIN CIRCUIT BREAKER*
ML	*ACCESS CONTROL MAG LOCK*
NIC	*NETWORK INTERFACE CARD*
OCC	*OUTDOOR COMMUNICATIONS CABINET*
PLC	*PROGRAMMABLE LOGIC CONTROLLER*
PM-N	*POWER METER - UTILITY*
PM-G	*POWER METER - GENERATOR*
PMs	*POWER METERS ENCLOSURE*
RTC	*ROADSIDE TOLLING CABINET*
SCADA	*SUPERVISORY CONTROL AND DATA ACQUISITION*
SPD	*SURGE PROTECTION DEVICE*
UPS	*UNINTERRUPTIBLE POWER SUPPLY*

NOTES TO PREPARER:

1. *ALL CABLES AND CONDUCTORS INSTALLED IN CONDUIT BELOW GRADE SHALL BE LISTED FOR USE IN WET LOCATIONS OR LISTED FOR DIRECT BURIAL INSTALLATION.*
2. *DATA WIRING AND POWER WIRING MUST BE RUN IN SEPARATE CONDUITS.*
3. *THE CONTRACTOR-INSTALLED SCADA ROUGH-IN MUST BE INSPECTED BY THE DEPARTMENT PRIOR TO ACCEPTANCE.*
4. *WIRING ROUTING IS DIAGRAMMATIC.*
5. *EQUIPMENT SHOWN AS SCREENED IS FOR REFERENCE ONLY. EQUIPMENT SHOWN AS SCREENED AND DASHED IS PART OF THE ACCESS CONTROL SYSTEM AND IS PROVIDED AND INSTALLED BY THE DEPARTMENT.*

Exhibit 232.10-2 RTC SCADA Riser Diagram (2 of 3)



Exhibit 232.10-3 RTC SCADA Riser Diagram (3 of 3)



232.11 Electrical Infrastructure for Roadside Tolling Cabinet Sites

(1) Vertical raceways that originate from the gantry must terminate as described in ***GTR 255.5.1***.

(2) See ***Exhibit 232.1-11*** for working space details and conduit layouts under the site equipment.

(3) Loop pull box raceways must be routed to the stub up, under the appropriate working spaces under the RTCs and the future RTC pull box.

(4) All conduits must be stubbed up to 1-inch above the finished equipment slab elevation with a cable ground bushing installed at both ends of all metallic conduits.

(5) Conduits from each wire trough must terminate as follows:

(a) [redacted]

(b) Data: Three 3-inch data conduits (not associated with CCTV) must be routed from data wire trough to the appropriate working spaces of each RTC and the future RTC pull box.

(c) AVI Readers on ground-mounted frame:

i. Two 4-inch rigid conduits must be routed from the bottom of the upright and terminate at the AVI reader frame as shown in ***Exhibit 232.5-2***.

ii. Two 3-inch rigid conduits must be routed from the bottom of the AVI reader frame wire trough and stub up in the appropriate working spaces of each RTC and the future RTC pull box.

iii. See ***GTR 255.5.6*** for additional requirements.

(d) AVI Readers mounted on the gantry: Two 3-inch rigid conduits must be routed from the bottom of the AVI reader wire trough and stub up in the appropriate working spaces of each RTC and the future RTC pull box.

(e) Power: Two 2-inch rigid conduits must be routed to the appropriate working spaces of each RTC and the future RTC pull box.

(6) Generator underground cable routing must be as follows:

(a) One 2-inch conduit for the generator power feeders to the ATS.

(b) One 1-inch conduit to the ATS for generator control wiring.

(c) [redacted]

(d) One 1-inch conduit to EDP for engine jacket heater circuit.

(e) One 1-inch conduit to the BCU for the generator battery circuit.

(7) See ***GTR 255.5.8*** and **GTR 255.5.9** for cantilever gantry conduit routing requirements.

232.12 Department Provided Infrastructure for Roadside Tolling Cabinet Sites

232.12.1 Equipment

The following components are provided by the Department:

(1) Within the OCC:

(a) [redacted]

(b) WAN ethernet switch

(c) [redacted]

(2) RTC(s) provided via the Department's TEC

(a) TEC equipment

(b) Dual air conditioners and related controls

(c) In-cabinet lighting

(d) Cable management

(e) PDUs

(f) [redacted]

(3) [redacted]

232.12.2 Conductor and Cable Terminations

(1) Provide coiled conductors with sufficient slack to allow the Department to terminate power conductors between:

(a) EDP and RTC(s)

(b) EP1 and RTC

(c) OCC and RTC(s)

(2) Provide coiled cables with sufficient slack to allow the Department to terminate data cables between the OCC and the RTC(s) (SCADA, FOC, and Access Control)

233 Toll Site Lightning Protection

233.1 Lightning Protection for Site Infrastructure

Lightning protection must bond to each applicable toll site element listed below:

(1) TEB counterpoise loop (provide additional ground rods)

(2) OCC

(3) RTC(s) (provide additional ground rods adjacent to the RTC(s) and future RTC)

(4) Generator and fuel tank (provide additional ground rod)

(5) Gantry uprights counterpoises (provide additional ground rods)

(6) Toll site ground-mounted strut channel frames

(7) Any additional metallic site elements

233.2 Lightning Protection Separation Distances

(1) The underground lightning protection system conductors must be at least 36 inches vertical or horizontal, from conduits that serve the tolling equipment.

(2) Lightning conductors must not be routed under the toll pavement area. The underground lightning protection system conductors must be at least 36 inches horizontally from the toll loop pavement area limits except as allowed in the item below.

(3) The lightning conductors for median barrier gantry uprights must be routed to maximize the distance between the toll loop pavement area(s) and the conductor.

234 Cable Distance Limitations

234.1 Definitions and Measurement

Calculated cable distance is the distance between the originating and terminating devices of a cable run including all bends, turns, and elevation differences.

The following must be added to the calculated cable distance as measured in plan and elevation:

(1) 15 percent for cable runs that are in directional bores or drills.

(2) 10 percent for cable runs that are not in directional bores or drills.

234.2 Boosters and Amplifiers

The use of cable signal boosters or amplifiers (boosters) is not permitted.

234.3 Cable Distance Limitations

(1) The cable distance between an AVI antenna and its corresponding AVI reader must not exceed 100 feet.

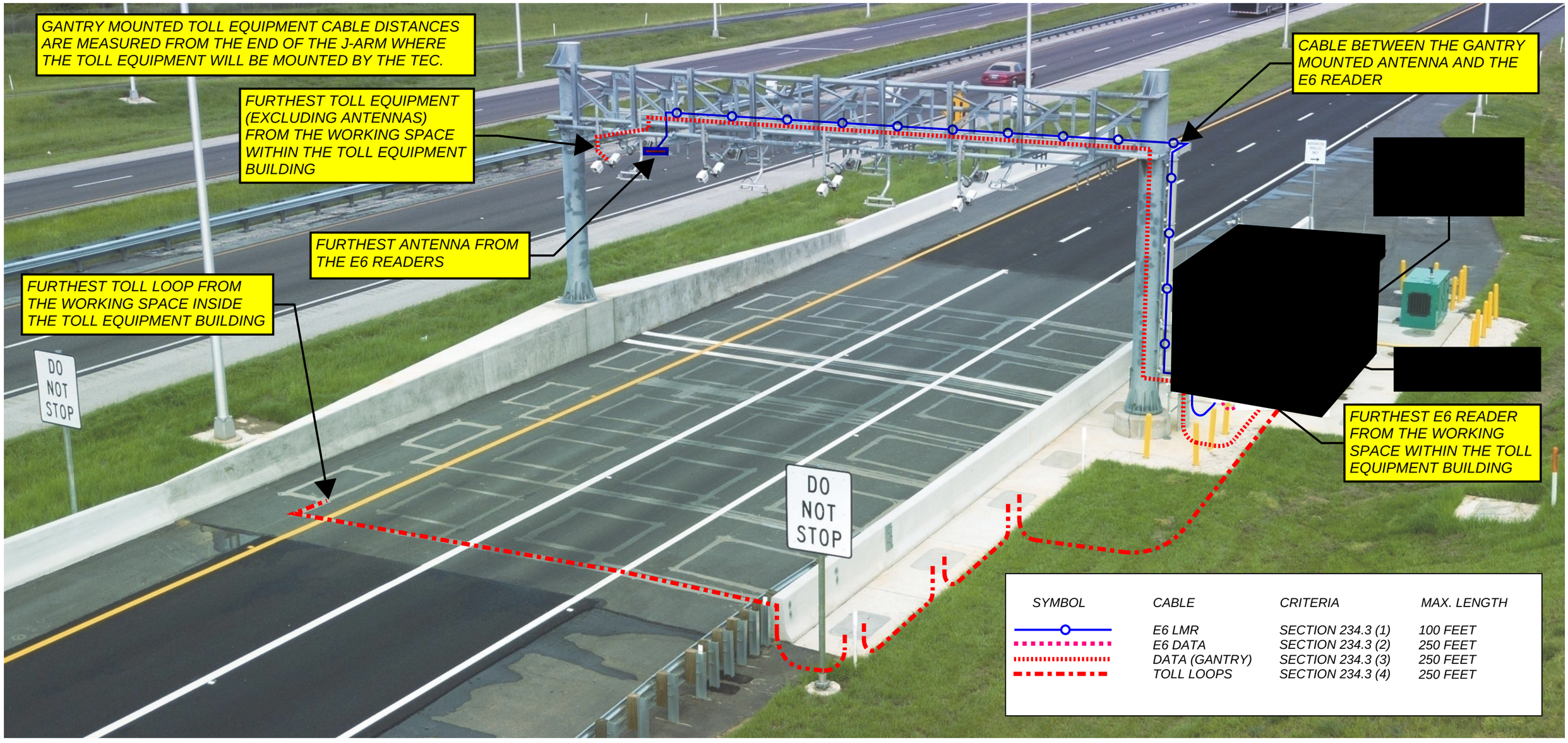
(2) The ethernet cable distance between the AVI reader and the toll equipment working spaces inside the TEB or RTC must not exceed 250 feet.

(3) The cable distance between any remaining toll equipment mounted to the J-arms and the toll equipment working spaces inside the TEB or RTC must not exceed 250 feet.

(4) The cable distance between any tolling loop and the toll equipment working spaces inside the TEB or RTC must not exceed 250 feet.

(5) See ***Exhibit 234.3-1*** for an example how to calculate cable distance for each toll equipment for toll sites with TEBs. The cable distances for toll sites with RTCs are calculated in a similar manner to toll sites with TEBs.

Exhibit 234.3-1 Calculated Cable Distances



240 Toll Equipment Building Design

240.1 General Requirements

(1) The term “building” refers to the TEB.

(2) Design of buildings and building sites (not including RTC sites) including all plans, specifications, and other contract documents must comply with the latest adopted edition and supplements of the FBC at the time of permitting. Under no circumstances must the requirements be reduced because of code changes that occur during design.

241 Toll Equipment Building Architectural

241.1 General Requirements

TEBs must be designed as follows:

(1) Provide a building that is a six-sided pre-engineered precast concrete box structure.

(2) The building must be 21 feet long by 12 feet, 6 inches (12'-6") wide measured from exterior faces.

(3) A new interior fire extinguisher and bracket must be provided in all new buildings.

(4) See ***GTR 241.6*** for additional architectural requirements related to the prefabricated building.

241.2 Toll Equipment Building Structural Design

TEB structural design must include:

(1) The design layout of the TEB including overall building size, form, and locations and sizes of all penetrations.

(2) Requirements for the TEB manufacturer to develop signed and sealed shop drawings and calculations for a complete TEB design.

(3) The foundation design for the TEB.

241.2.2 Hurricane Wind Requirements

(1) The design must comply with Risk Category IV buildings per ***FBC***, ***Section 1620*** "High Velocity Zones - Wind Loads" for Miami-Dade County, regardless of project location.

(2) See ***GTR 231.1*** for additional wind design requirements.

241.2.3 Live Load

(1) The minimum roof load must be 65 pounds per square foot (PSF).

(2) The minimum floor load must be 125 PSF.

241.3 Foundation Slab

(1) Geotechnical investigation for the TEB foundation must be in accordance with ***GTR 280.2***.

(2) Design calculations for bearing capacity and settlement analyses for TEB foundation design must be provided.

(3) The floor penetration locations must be designed as shown in ***Exhibit 241.6-1***.

(4) A monolithic slab with a turned down edge designed for the allowable bearing conditions must be provided at each precast concrete building and for the wind load criterion specified above.

(5) Set the precast concrete building in a notch-troweled grout or mortar bed with a minimum thickness of ¼ inch over the entire foundation slab surface to create a uniform bearing between the precast concrete floor slab and the foundation slab.

(6) Provide a notch troweled mortar bed min. ¼" the entire cast-in-place foundation surface prior to setting the precast building in plaza.

(7) The foundation reinforcement layout must be designed to accommodate tolling and electrical conduit stub-up locations.

(8) The foundation design must include provisions for the concrete encased electrode conductor as required in ***GTR 242.13*** and shown in ***Exhibit 241.6-1***.

(9) Steel plate connections must be provided to tie the precast concrete building to the foundation slab. See ***Exhibit 241.6-1*** for additional requirements.

241.4 Toll Equipment Building Roof

The TEB roof system must be designed per the following:

(1) Styrene-Butadiene-Styrene (SBS) modified bitumen roof system and associated items must have State of Florida or Miami-Dade County product control Notice of Acceptance (NOA) and comply with requirements for high velocity hurricane zone Miami-Dade County regardless of location.

(2) The side of the building closest to and parallel to the roadway must be the high roof side of the building. The roof must slope to the side of the building furthest from the roadway.

(3) The high roof side and the two ends of the building must have parapets topped with a prefinished fluoropolymer coating metal coping system.

(4) R-19 minimum (aged value) tapered roof insulation must be provided. Roofing base and flashing material must be extended over top of parapet.

(5) Two roof penetrations must be provided for lightning protection at opposite corners of the roof 24 inches from the exterior faces.

(6) The roof parapet must be detailed in accordance with ***Exhibit 241.4-1***.

(7) A continuous gutter along the low roof side of the building with downspouts on each end must be provided. The gutter assembly must be secured with anchors sized and spaced to withstand the design wind loads. See ***Exhibit 241.4-1*** below for additional criteria.

Exhibit 241.4-1 TEB Wall Sections



241.5 Exterior Equipment

(1) New fire extinguisher and bracket must be provided near the generator and fuel storage tank area.

(a) The fire extinguisher must be in an area hidden from general public view.

(b) An appropriate weather resistant enclosure must be provided with mounting hardware, and signage.

(2) Fire extinguisher and electrical meter must not be located over building reveals.

241.6 Pre-Engineered Precast Concrete Toll Equipment Buildings

(1) All exposed concrete floors in interior spaces must be coated with a clear coat sealer to reduce concrete dust.

(2) All block outs must be designed to accommodate tolling and electrical conduit stub-up locations. See ***Exhibit 241.6-1*** for additional layout and size criteria.

(3) All wall penetrations through the TEB must be coordinated with the electrical devices for which they serve. See ***Exhibit 241.6-2*** for additional layout criteria.

(4) Vertical and horizontal reveals must be provided on the exterior of all building walls. See ***Exhibit 241.6-2*** and ***Exhibit 241.6-3*** for additional requirements.

(5) Door and Frame

(a) Exterior door frame and door must have State of Florida or Miami-Dade County product control NOA and comply with requirements for high velocity hurricane zones in Miami-Dade County requirements regardless of location.

(b) The TEBs must have one door made of steel with a steel frame cast in the wall. All door and conduit openings must be suitably protected and sealed to prevent the ingress of water, moisture, dust, and wind driven rain.

(c) The TEB door must swing open at least 170 degrees and be unobstructed to provide access for maintenance technicians and tolling equipment.

(d) Door jamb guards, kick plates, and other items must be provided as shown in the ***Exhibit 241.6-4***.

(6) Interior Walls and Ceilings

(a) See ***Exhibit 241.4-1*** for basis of design.

(b) Interior wall and ceiling system (not inclusive of the precast concrete) must not exceed 21/8-inch in thickness.

(c) Design of the insulation system must satisfy the Florida Building Code – Energy Conservation.

(d) Design the wall and ceiling systems with the capacity to support TEB wall and ceiling mounted equipment.

(e) Calculations must be provided for the type, size, length, and minimum embedment depth of fasteners required to support all wall mounted equipment without compromising the precast wall.

(f) Design the wall and ceiling with a painted or equivalent surface finish.

(g) Design the wall to include resilient base.

(7) Exterior and interior color schedule must be as follows:

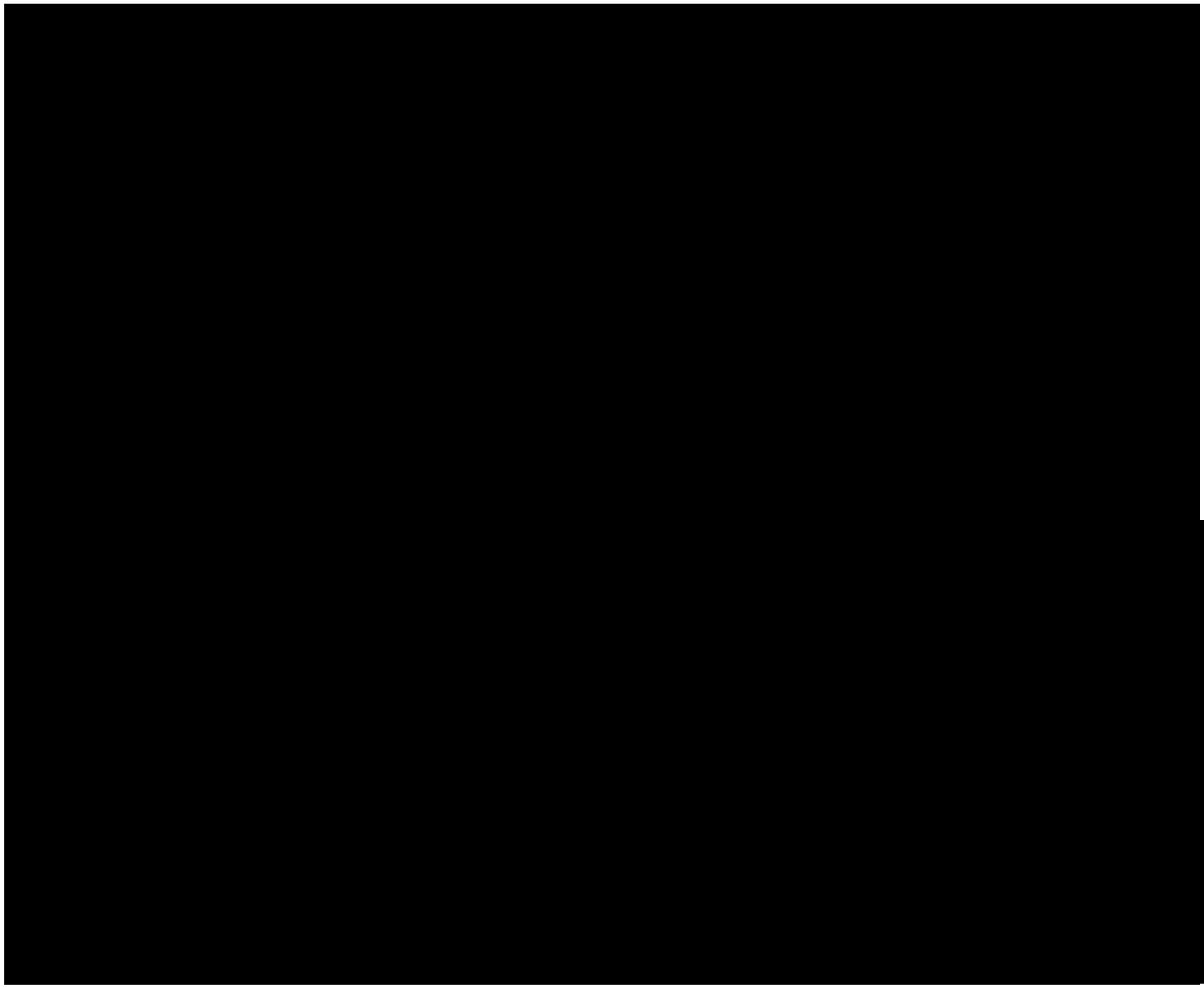
(a) Exterior walls, door, and AC pipe chases: Federal Standard 595 No. 17886.

(b) Exterior metal coping, gutter, and downspout: Brown – Federal Standard No. 20062.

(c) Interior walls, interior door frame, interior door: White Federal Standard 595 No. 17925.

(d) Interior ceiling: White Federal Standard 595 No. 17925.

Exhibit 241.6-1 TEB Foundation



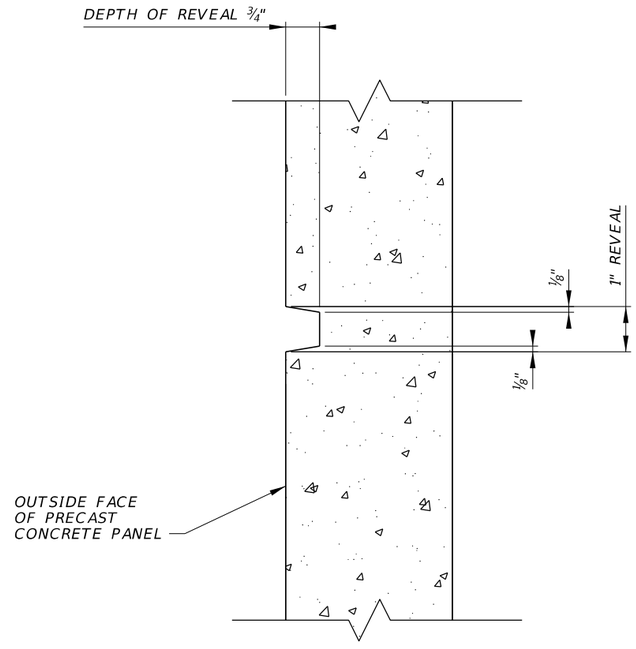
NOTES TO PREPARER:

1. *TOP OF CONCRETE FOUNDATION MUST BE CONSTRUCTED WITHIN A ±1/4" TOLERANCE TO ALLOW FOR AN EVEN BEARING SURFACE FOR THE PRECAST CONCRETE BUILDING. GALVANIZED STEEL SHIMS MUST BE USED TO ENSURE THAT ALL LOAD BEARING SURFACES ARE AT THE SAME ELEVATION (WITHIN A TOLERANCE OF ±1/16"). IT IS RECOMMENDED BY THE PRECAST BUILDING MFR. THAT SHIMS BE COMPLETELY ENCASED IN GROUT. WHEN THE BUILDING IS SET WITH THE CORRECT SHIMS IN PLACE, GROUT THE PERIMETER OF THE FOUNDATION AT THE BOTTOM OF THE SHELTER TO PREVENT WATER INTRUSION. A NON-SHRINK, HIGH-STRENGTH GROUT RECOMMENDED BY THE PRECAST CONCRETE BUILDING MFR. MUST BE USED. REFER TO THE PRECAST CONCRETE BUILDING MFR. FOR ADDITIONAL INFORMATION.*
2. *PROVIDE A NOTCH TROWELED MORTAR BED MIN. ¼" THICK TO THE ENTIRE CAST-IN-PLACE FOUNDATION SURFACE PRIOR TO SETTING THE PRECAST BUILDING IN PLACE.*
3. *COORDINATE LOCATION AND SIZE OF FLOOR PENETRATIONS WITH ELECTRICAL PLANS TO ENSURE THE PENETRATION ACCOMMODATES THE QUANTITY OF CONDUITS SERVING ELECTRICAL EQUIPMENT.*
4. *INSTALL WATERPROOFING SYSTEM AROUND JOINT OF PRECAST BUILDING AND FOUNDATION FOUNDATION PER MANUFACTURER'S REQUIREMENTS.*
5. *PROVIDE ADDITIONAL REBAR AT MID-DEPTH OF POURED SLAB FOR ALL RE-ENTRANT CORNERS. (TYP.)*

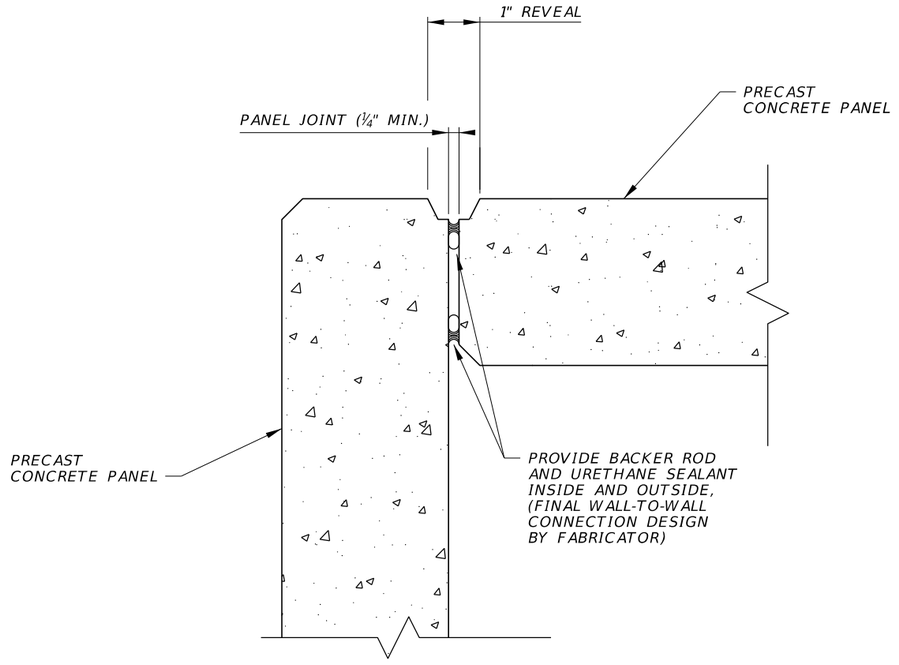
Exhibit 241.6-2 TEB Exterior Elevations



Exhibit 241.6-3 TEB Reveal Details



2 SECTION
SCALE: NTS



1 PLAN
SCALE: NTS

Exhibit 241.6-4 TEB Door Details



241.7 Equipment Support Frames

241.7.1 Toll Equipment Support Frame

A raised aluminum cabinet support frame must be provided to support the TEC provided tolling equipment in each TEB. The raised aluminum cabinet support frames must meet the following requirements:

(1) Raised aluminum cabinet support frames must be 159 inches long x 36 inches wide x 8 inches high.

(2) The frame area where the cabinets sit must be a minimum 2.5 inches wide or as required to allow for all cabinets to be properly placed over the frame.

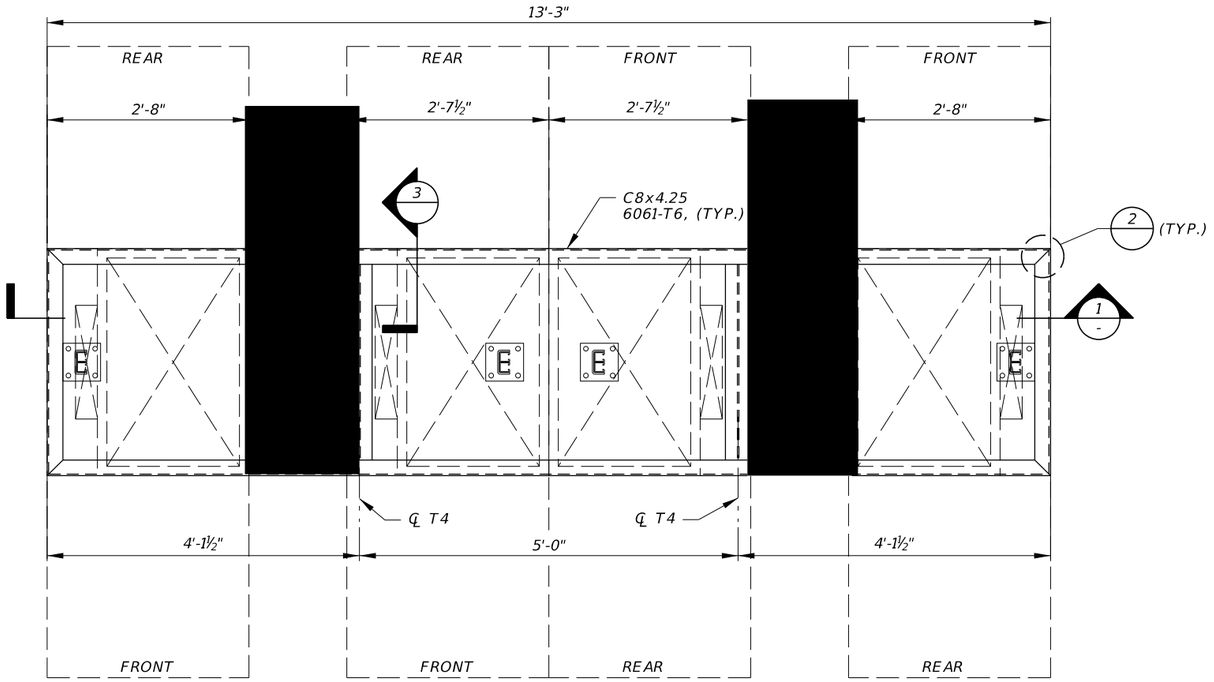
(3) The frame must have two (2) aluminum cross ribs. The cross ribs shall be 4 inches wide and provide a minimum of 4 inches clear between the finish floor and cross rib bottom. See ***Exhibit 241.7-1*** for additional requirements.

241.7.2 Condensing Units Support Frame

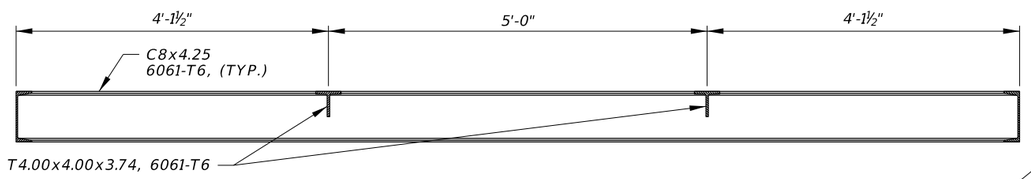
(1) Provide stainless steel angle equipment support frame shop welded. Coordinate exact size and clearance requirements with the specified condensing unit.

(2) See ***Exhibit 241.7-2*** for frame design intent.

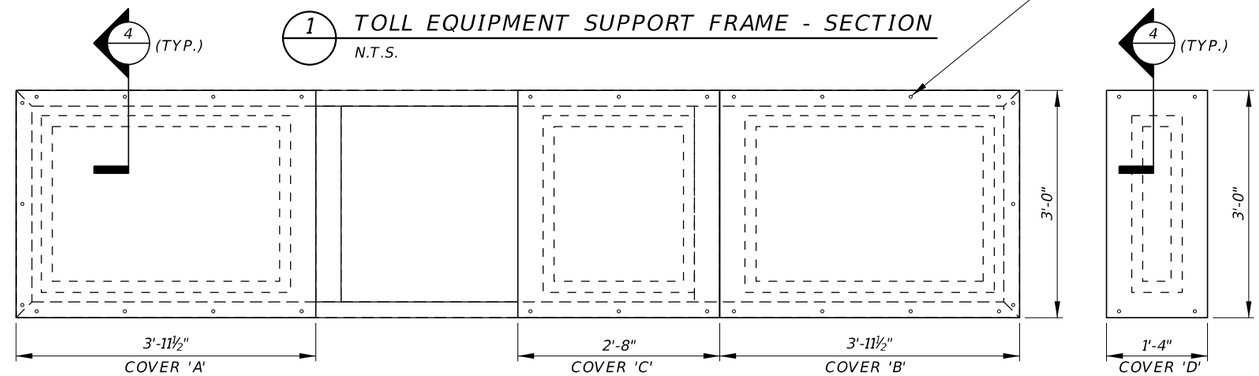
Exhibit 241.7-1 Toll Equipment Support Frame



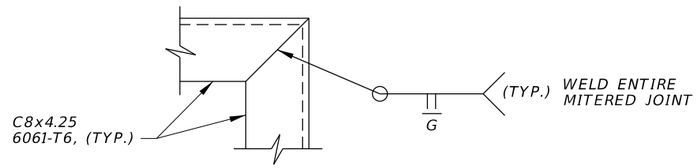
TOLL EQUIPMENT SUPPORT FRAME - PLAN
N.T.S.



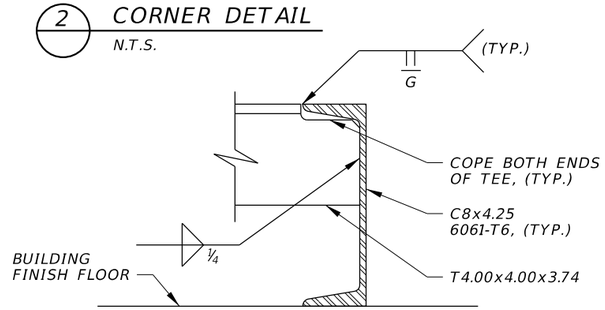
1 TOLL EQUIPMENT SUPPORT FRAME - SECTION
N.T.S.



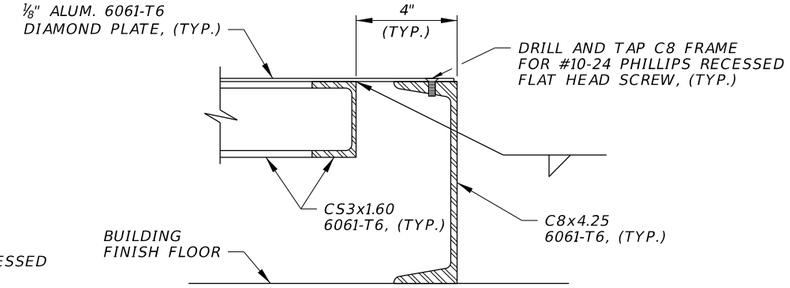
IN-FILL COVER PLATES PLAN
N.T.S.



2 CORNER DETAIL
N.T.S.



3 SECTION
N.T.S.



4 DIAMOND PLATE DETAIL
N.T.S.

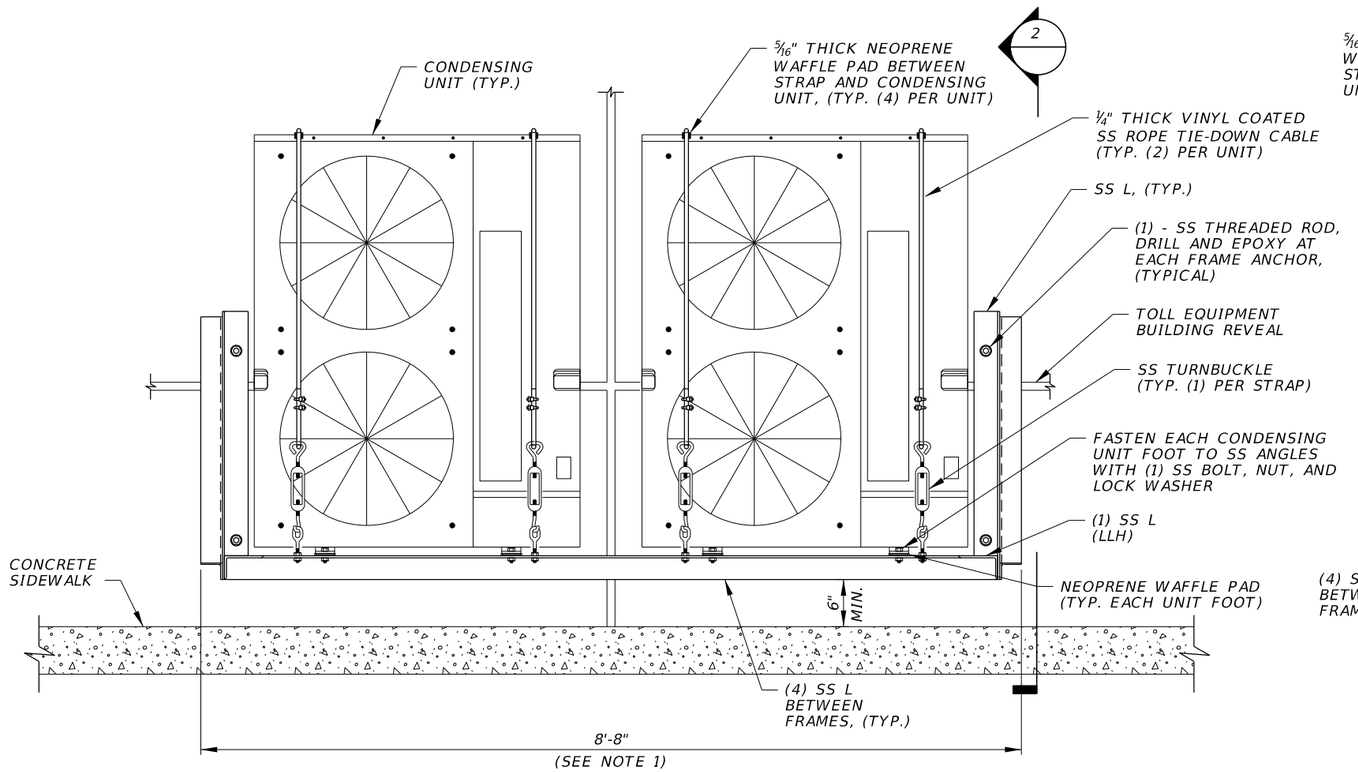
NOTES TO PREPARER:

1. THE BUILDING WILL BE FABRICATED OFF SITE. CONDUIT STUB-UP LOCATIONS MUST BE COORDINATED WITH BUILDING FABRICATOR PRIOR TO SHOP DRAWING SUBMITTAL.
2. PROVIDE WIDTH AS REQUIRED TO COVER ALL OPENINGS BETWEEN TEC EQUIPMENT.
3. PROVIDE COVERS 'A', 'B', AND 'C' FOR A SINGLE TOLL MOVEMENT.
4. PROVIDE COVERS 'A' AND 'B' FOR TWO TOLL MOVEMENTS.
5. PROVIDE COVERS 'B' AND 'D' FOR THREE TOLL MOVEMENTS.
6. PROVIDE (2) COVERS 'D' FOR FOUR TOLL MOVEMENTS.

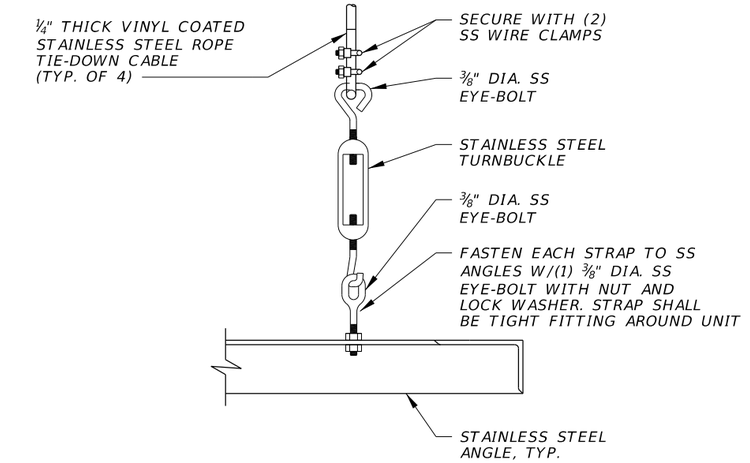
Exhibit 241.7-2 Condensing Units Support Frame

NOTE TO PREPARER:

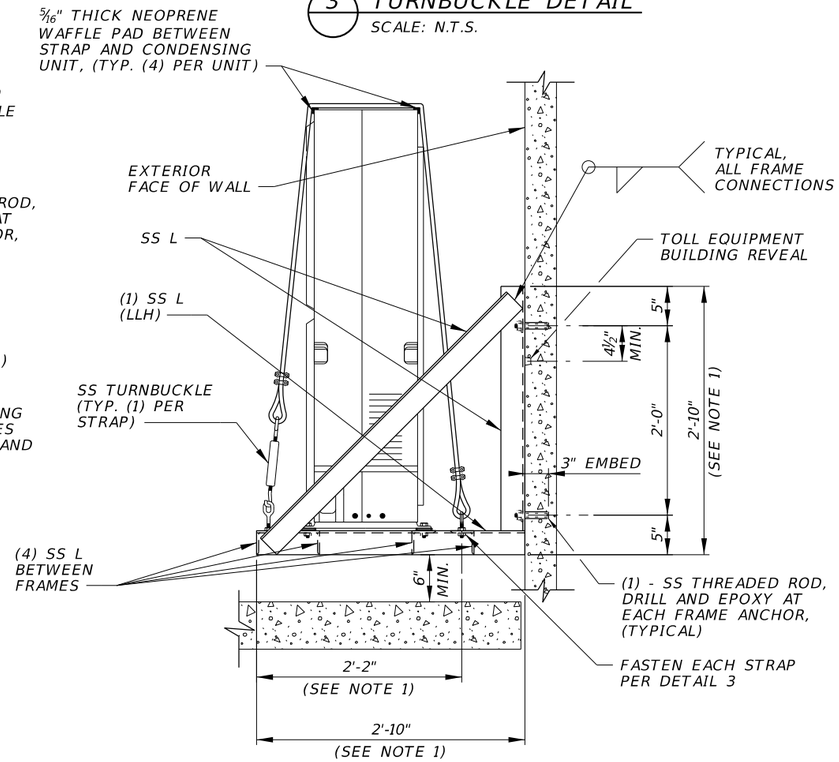
1. *COORDINATE WALL MOUNTED FRAME SIZE WITH CONDENSING UNIT MANUFACTURER'S REQUIREMENTS.*



1 *WALL MOUNTED CONDENSING UNIT FRAME - FRONT VIEW*
SCALE: N.T.S.



3 *TURNBUCKLE DETAIL*
SCALE: N.T.S.



2 *WALL MOUNTED CONDENSING UNIT FRAME - SECTION*
SCALE: N.T.S.

242 Toll Equipment Building Electrical

This section applies to all TEBs (new or existing) unless noted otherwise.

242.1 General Requirements

(1) The TEB electrical components layout and interconnections must be provided as shown in ***Exhibit 242.1-1***, ***Exhibit 242.1-2***, ***Exhibit 242.1-3***, ***Exhibit 242.1-4***, ***Exhibit 242.1-5***, and ***Exhibit 242.1-6***, except as modified by ***GTR 242.5***, ***GTR 242.7***, and ***(2)*** below.

(2) One toll equipment space is required for each tolling movement up to maximum of 6 equipped lanes and shoulders per tolling movement.

(3) All cables and conductors must be installed in raceways.

(4) All wall-mounted wiring devices must be provided in accordance with ***Exhibit 242.1-7***.

(5) Power cables from the critical power panel(s) must route to the power side of the ceiling mounted cable tray. See ***Exhibit 242.3-1*** for additional requirements.

Exhibit 242.1-1 TEB Power Riser Diagram



Exhibit 242.1-2 TEB Electrical Layout



1 PLAN
SCALE: NTS

Exhibit 242.1-3 Interior Electrical Elevations (1 of 4)



Exhibit 242.1-4 Interior Electrical Elevations (2 of 4)

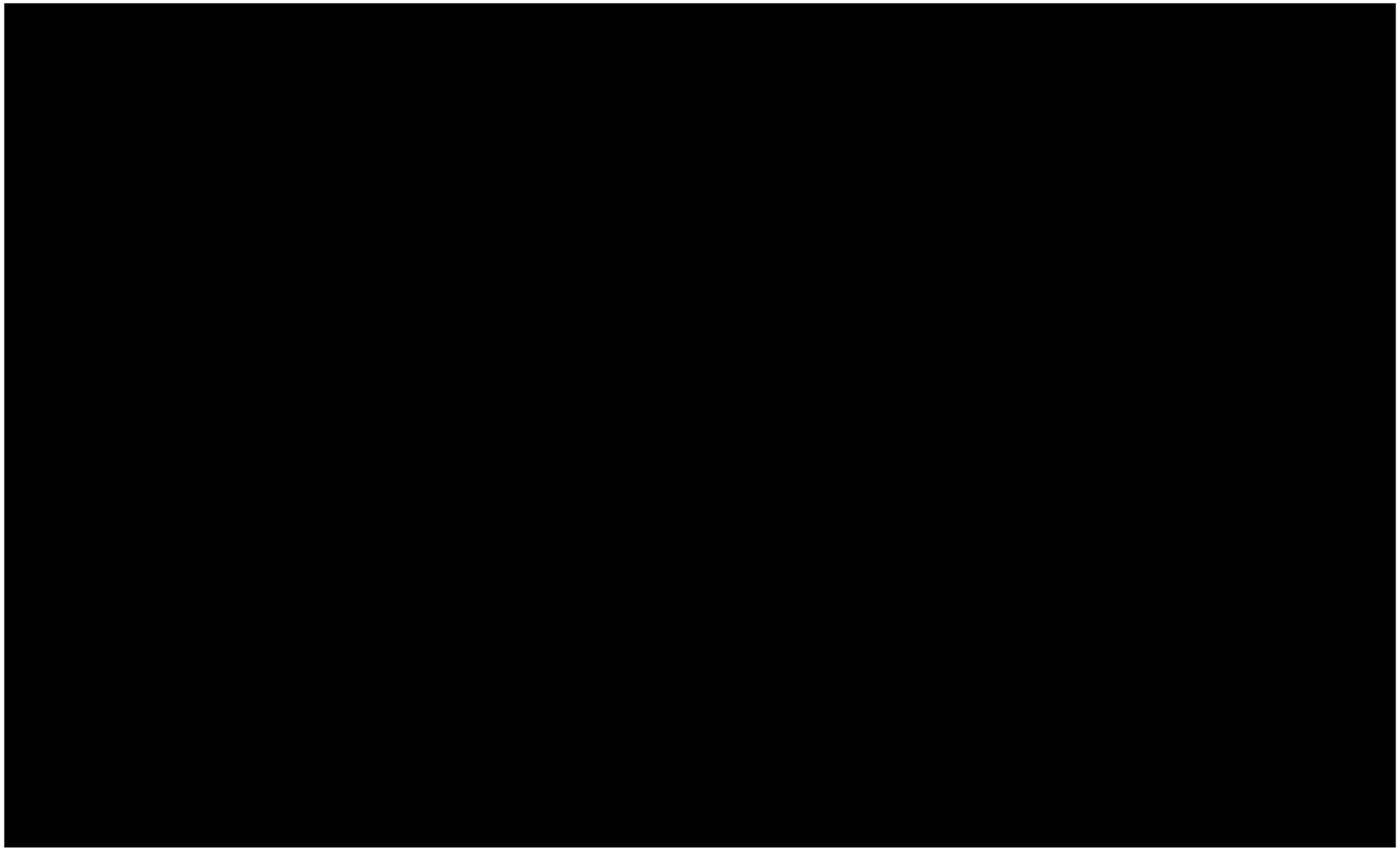


Exhibit 242.1-5 Interior Electrical Elevations (3 of 4)

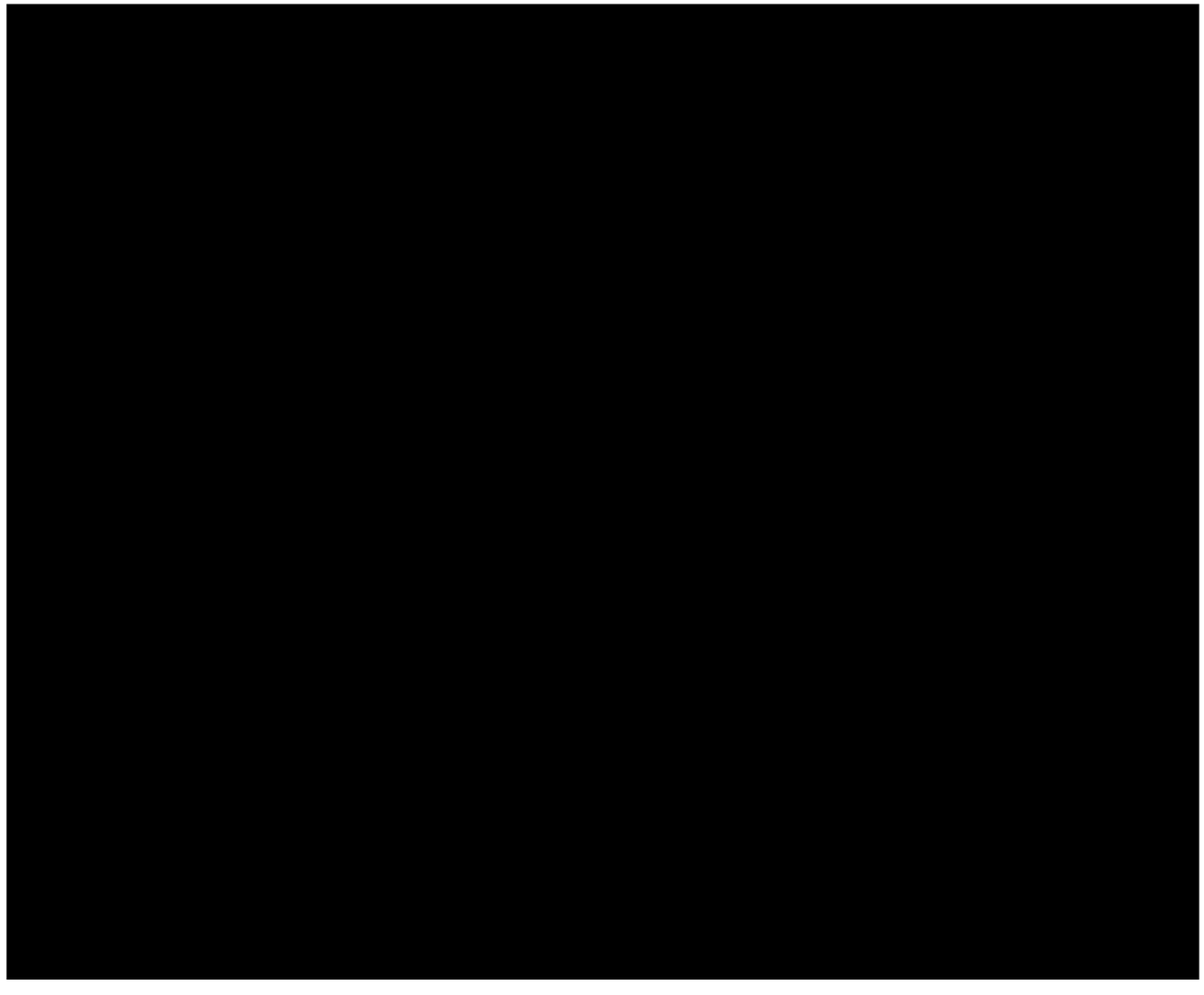
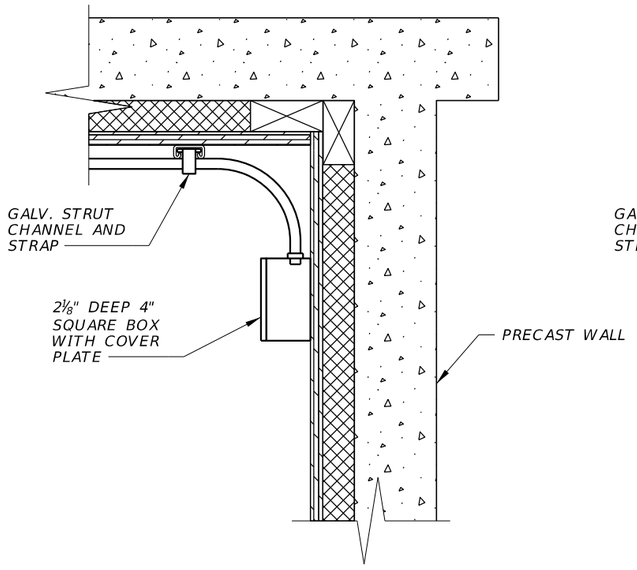


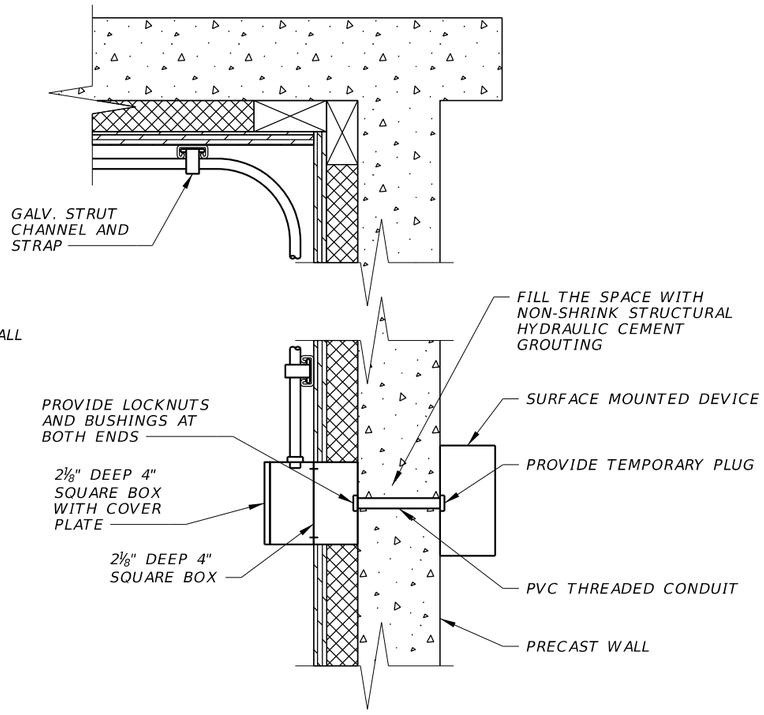
Exhibit 242.1-6 Interior Electrical Elevations (4 of 4)



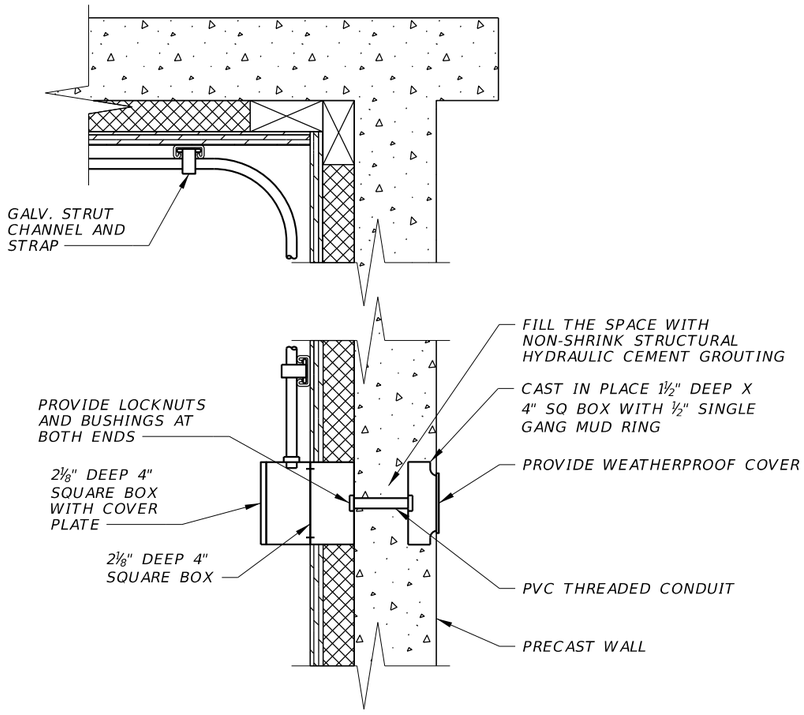
Exhibit 242.1-7 Wall Mounted Wiring Device Details



1 SURFACE MOUNTED INTERIOR DEVICE
SCALE: NTS



2 SURFACE MOUNTED EXTERIOR DEVICE
SCALE: NTS



3 RECESSED MOUNTED EXTERIOR DEVICE
SCALE: NTS

242.2 Toll Equipment Building Lighting

(1) An interior lighting system must be provided consisting of at least six pendant mounted light fixtures to maintain average lighting levels of 40 foot-candles.

(2) Light fixtures must be installed at 96-inches above finished floor to the bottom of the fixture.

(3) See ***GTR Part 2, Appendix 2***, TSP Section for ***Lighting Fixtures, Lamps, and Ballasts for TEB Sites*** for additional requirements.

(4) Lights must be provided on the exterior of all four walls of the TEB.

(5) See ***Exhibit 242.2-1*** for additional requirements for interior and exterior lighting.

Exhibit 242.2-1 TEB Lighting



NOTES TO PREPARER:

1. *BUILDING-MOUNTED LIGHT FIXTURE TYPE 'B' MUST HAVE AN INTEGRAL PHOTOCELL.*
2. *CONNECT EMERGENCY LIGHTS TO LOCAL AREA LIGHTING CIRCUIT AHEAD OF ALL SWITCHING DEVICES.*
3. *COORDINATE LOCATION AS TO NOT INTERERE WITH INSTALLATION OF CABLE TRAY.*

LIGHTING FIXTURE SCHEDULE

Type/Mark	MANUFACTURER AND CATALOG NO.	DESCRIPTION	VOLTAGE	LAMPS	MOUNTING	REMARKS
A	LITHONIA #LBL4-4000LM-80CRI-40K-NODIM OR COLUMBIA LIGHTING #LAW4-40MW-EU OR APPROVED EQUAL	LITHONIA - 4' LENGTH LED WRAPAROUND 32W OR COLUMBIA - 4' LENGTH LED WRAPAROUND 31W OR APPROVED EQUAL	120	4000K	8'-6" AFF TO BOTTOM OF FIXTURE PENDANT MOUNTED	COORDINATE MOUNTING HEIGHT WITH TOP OF TOLLING CABINET
B	KENNALL #MR13EL-PP-DB-10L35K-120-BPC OR APPROVED EQUAL	HIGH ABUSE DIECAST ALUMINUM WALL MTD, 10W, 3500K LED, DARK BRONZE FINISH OR APPROVED EQUAL	120	10L35K	WALL SURFACE MTD 9'-0" AFF	FOR WET LOCATION SEE ARCHITECTURAL ELEVATIONS
C	LITHONIA ELMLT W LP06VS LTP SD, OR HUBBELL DUAL-LITE EV-2 OR APPROVED EQUAL	LITHONIA BATTERY PACK EMERGENCY LIGHT, 5.4W, LED, WHITE OR HUBBELL BATTERY PACK EMERGENCY LIGHT, (2) 1W LED HEADS OR APPROVED EQUAL	120	W/UNIT	WALL SURFACE 2'-0" BELOW CEILING	

242.3 Critical Power Receptacles

(1) Dedicated 20A twist-lock receptacles and associated circuits must be provided from the critical power panel(s) and mounted to the power side of the cable tray above the toll equipment and toll communication cabinet.

(2) See ***Exhibit 242.3-1*** for critical power receptacle layout requirements except as modified by ***GTR 242.5***, ***GTR 242.7***, and ***GTR 242.1 (2)***.

(3) See ***GTR Part 2, Appendix 2***, TSP Section for ***Wiring Devices for TEB Sites*** for additional requirements.

Exhibit 242.3-1 Receptacles Over Tolling Equipment

[redacted]

2 TOLL COMMUNICATIONS CABINET (CRITICAL POWER)
SCALE: NTS

[redacted]



1 TOLL EQUIPMENT (CRITICAL POWER)
SCALE: NTS

242.4 Electrical Power Panels

(1) One new main distribution panel (MDP) must be provided for all TEBs. New MDPs must be rated 400 amps, 120/240 volts, and comply with the requirements in ***GTR Part 2, Appendix 2***, TSP Section for ***Panelboards for TEB Sites***.

(2) One new emergency distribution panel (EDP) must be provided, rated 400 amps, 120/240 volts, along with associated components for all TEBs. The EDP must comply with the requirements in ***GTR Part 2, Appendix 2***, TSP Section for ***Panelboards for TEB Sites***.

(a) The indoor and outdoor lighting, fuel tank monitor, UPS, UPS by-pass, AC units, generator battery charger, generator engine jacket heater, and [redacted]

(b) The electrical loads used in load calculations must be rated full load of the equipment.

242.5 Critical Power Panels

(1) Critical power panels and panel breakers must be as specified in ***GTR Part 2, Appendix 2***, TSP Section for ***Toll Equipment Critical Power Panelboard for TEB Sites***.

(2) One critical power panel must be provided for TEBs supporting a single tolling equipment enclosure and two critical power panels for TEBs supporting two to four tolling equipment enclosures.

(3) The critical power panel must be rated for 100A, 42 circuits, 120/240V, 1-phase, 3-wire.

(4) The critical power panel must only serve the following systems: tolling, communications [redacted]

(5) The following dedicated circuits must be provided from Panel C1 if only one critical panel is provided:

(a) 2 circuits for PDU-A

(b) 2 circuits for PDU-B

(c) 2 circuits for WAN Switch

(d) 8 circuits for each instance of toll equipment

(e) 1 circuit for TELCO, if required

(6) The following dedicated circuits must be provided if two critical panels are provided:

(a) 1 circuit from panel C1 and 1 circuit from panel C2 for PDU-A

(b) 1 circuit from panel C1 and 1 circuit from panel C2 for PDU-B

(c) 1 circuit from panel C1 and 1 circuit from panel C2 for WAN switch

(d) 4 circuits from panel C1 and 4 circuits from panel C2 for each instance of toll equipment

(e) 1 circuit from panel C1 for TELCO, if required

242.6 SCADA System

(1) One SCADA control panel must be provided for each TEB.

(2) The SCADA control panel must meet the requirements of ***GTR Part 2, Appendix 2***, TSP Section for ***SCADA System for TEB Sites***.

(3) The SCADA system must connect to the toll site assets as shown in ***Exhibit 242.6-1***, ***Exhibit 242.6-2***, and ***Exhibit 242.6-3*** as applicable. See ***GTR Part 2, Appendix 2***, TSP Section for ***SCADA System for TEB Sites*** for additional requirements.

(4) For electrical power to the SCADA panel refer to ***GTR 242.5.***

Exhibit 242.6-1 SCADA Riser Diagram (1 of 2)

NOTES TO PREPARER:

1. *ALL CABLES AND CONDUCTORS INSTALLED IN CONDUIT BELOW GRADE SHALL BE LISTED FOR USE IN WET LOCATIONS OR LISTED FOR DIRECT BURIAL INSTALLATION.*

2. *DATA WIRING AND POWER WIRING MUST BE RUN IN SEPARATE CONDUITS.*

3. *THE CONTRACTOR-INSTALLED SCADA ROUGH-IN MUST BE INSPECTED BY THE DEPARTMENT PRIOR TO ACCEPTANCE.*

NOTES TO PREPARER (CONTINUED):

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12

[redacted]

NOTES TO PREPARER (CONTINUED):

13
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20
21
22

[redacted]

Exhibit 242.6-2 SCADA Riser Diagram (2 of 2)



Exhibit 242.6-3 TEB SCADA and Security System Plan



PLAN
SCALE: NTS

KEY NOTES TO PREPARER:

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3
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8
9

NOTE TO PREPARER:

WALL-MOUNTED EQUIPMENT MUST BE SECURED TO WALL VIA UNISTRUT SUPPORTS.

242.7 UPS

(1) One UPS must be provided for TEBs supporting a single tolling instance and two UPSs for TEBs supporting two to four tolling instances.

(2) UPS must be sized for the total connected critical power panel load. UPSs must be 15 KVA at a minimum.

(3) One ¾-inch conduit must be provided from each UPS communication port card area to the pendant mounted cable tray.

(4) Refer to ***GTR Part 2, Appendix 2***, TSP Section for ***Static Uninterruptible Power Supplies for TEB Sites*** for additional UPS requirements.

242.8 UPS Maintenance By-pass Switches (BPS)

(1) A wall mounted external manual maintenance BPS must be provided for each new UPS.

(2) The BPS must be fed by two separate power sources (two separate breakers, two separate feeders, and two separate conduits) from the appropriate power panel.

(3) The feeders must not be spliced or routed through any disconnects prior to terminating in the BPS.

(4) Other devices or equipment must not be located directly under the BPS.

(5) The BPS must not cause a power outage to the critical power panel when it is put in either by-pass mode and/or UPS mode.

(6) See ***GTR Part 2, Appendix 2***, TSP Section for ***Static Uninterruptible Power Supplies for TEB Sites*** for additional requirements.

(7) See ***Exhibit 242.8-1*** and ***Exhibit 242.8-2*** for additional details and requirements.

Exhibit 242.8-1 UPS and BPS Riser Diagram (1 of 2)

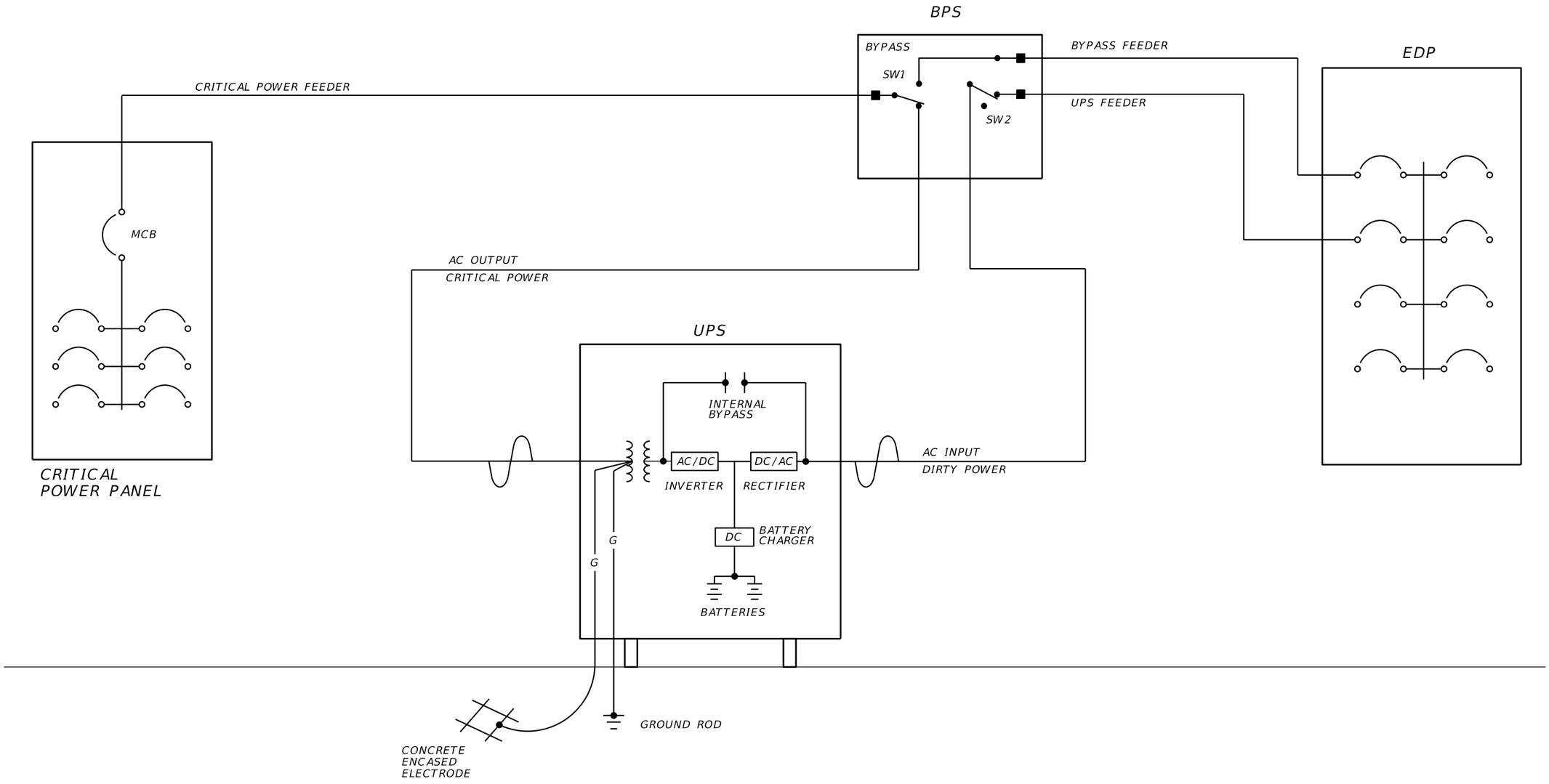
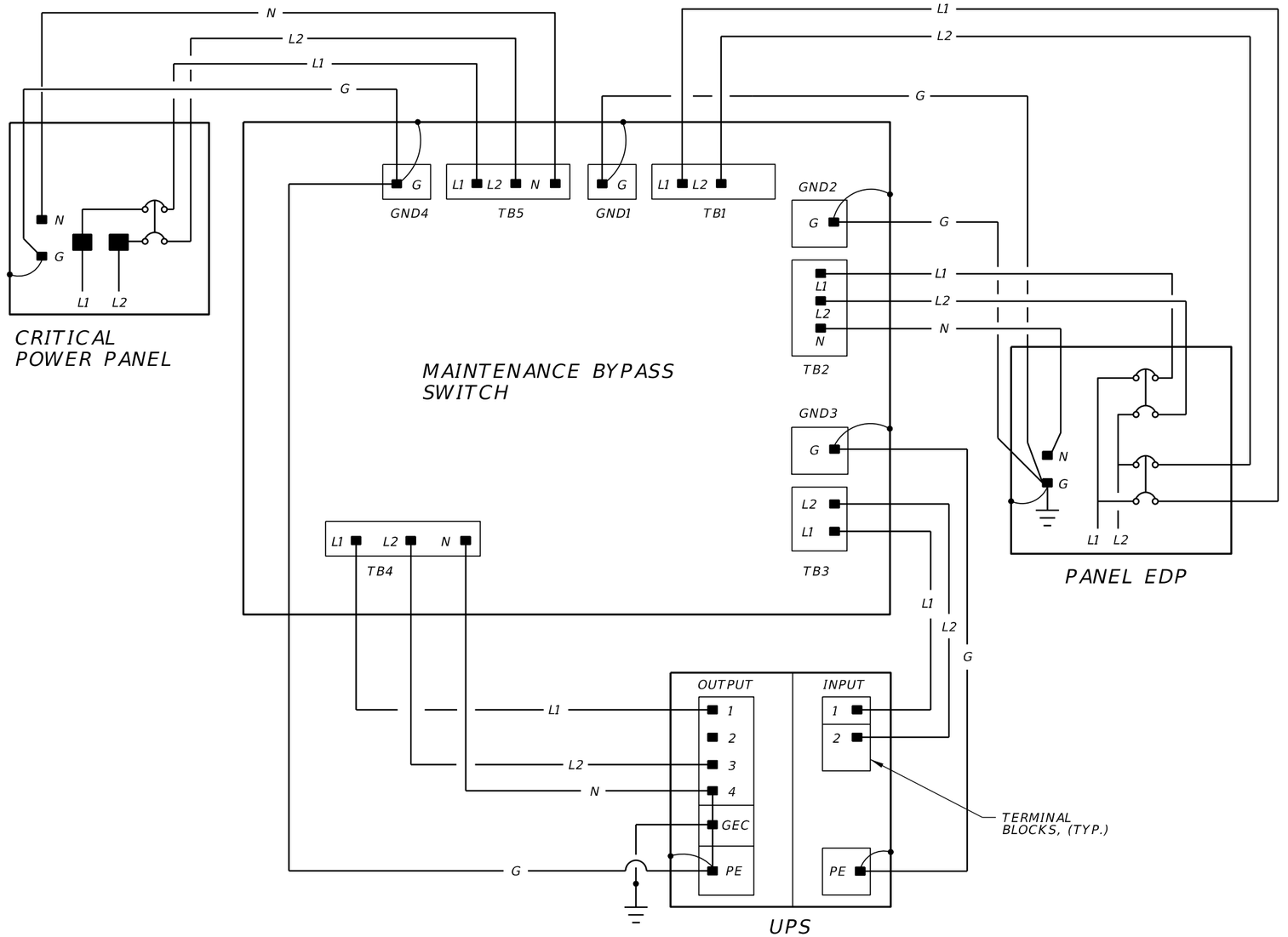


Exhibit 242.8-2 UPS and BPS Riser Diagram (2 of 2)



242.9 Cable Trays

(1) Pendant mounted ladder type cable trays must be provided to accommodate data and power cables.

(2) The cable tray length must be as follows:

(a) At minimum, the “main core” of the cable tray must run the entire length of the largest dimension (length or width) of the room.

(b) For any buildings requiring wall penetrations, the cable tray must span between the wall penetration points and the main core of the cable tray

(c) The cable tray must be located above the toll equipment spaces and also the communication cabinet inside the TEB.

(3) Transition fittings, attachments, and supports must be provided for all conduits terminating in the cable tray.

(4) Bond the cable tray and each metal conduit with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor that originates from the critical power panel(s) in the TEB.

(5) See ***GTR Part 2, Appendix 2***, TSP Section for ***Cable Trays for TEB Sites*** for additional requirements.

242.10 Surge Protection Devices (SPDs)

(1) SPDs must be provided for all conductive cabling that originates outside the TEB walls and terminates within the building.

(2) See ***GTR Part 2, Appendix 2***, TSP Section for ***Surge Protective Devices for TEB Sites*** for additional requirements.

242.11 Emergency Power Off (EPO) Stations

(1) EPO stations must be provided.

(2) See ***GTR Part 2, Appendix 2***, TSP Section for ***Emergency Generator for TEB Sites*** for additional requirements.

(3) See ***Exhibit 242.11-1*** for additional requirements.

Exhibit 242.11-1 EPO Riser and Wiring Diagram



EMERGENCY POWER OFF WIRING DIAGRAM
SCALE: NTS

NOTES TO PREPARER:

1. *EPO STATION MOUNTED 6 FT ABOVE GRADE ON THE OUTSIDE WALL ADJACENT TO THE TOLL EQUIPMENT BUILDING DOOR.*
2. *INSTALL AN ALUMINUM SIGN WITH RED FIELD DIRECTLY ABOVE THE EPO STATION.*
3. *(1) PAIR OF #18AWG SHIELDED CABLE IN 1"C TO EPO.*
4. *EMERGENCY POWER OFF TERMINALS ON THE GENERATOR.*



EMERGENCY POWER OFF RISER DIAGRAM
SCALE: NTS

242.12 Access Control System

(1) Access control and security system devices and wiring must be provided. See ***GTR Part 2, Appendix 2***, TSP Section for ***Door Hardware and Access Control System for TEB Sites*** for additional requirements.

(2) All necessary conduit, junction boxes, fittings, connections, and miscellaneous hardware must be provided for power and data cabling required for the access control system.

(3) See ***Exhibit 242.12-1*** for additional requirements.

Exhibit 242.12-1 Access Control Details



242.13 Grounding and Bonding

(1) See ***Exhibit 242.13-1*** and ***Exhibit 242.13-2*** for grounding and bonding requirements.

(2) See ***GTR Part 2, Appendix 2***, TSP Section for ***Grounding and Bonding for Electrical Systems for TEB Sites*** for additional requirements.

Exhibit 242.13-1 TEB Grounding Details

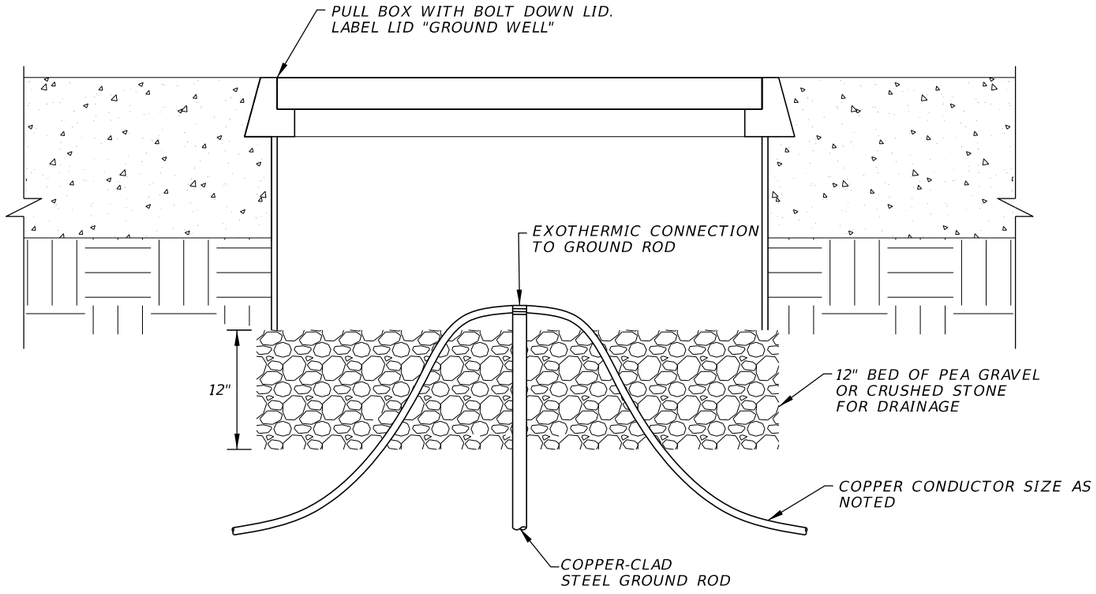


1 SERVICE ENTRANCE, UPS AND GENERATOR GROUND REQUIREMENTS
SCALE: N.T.S.

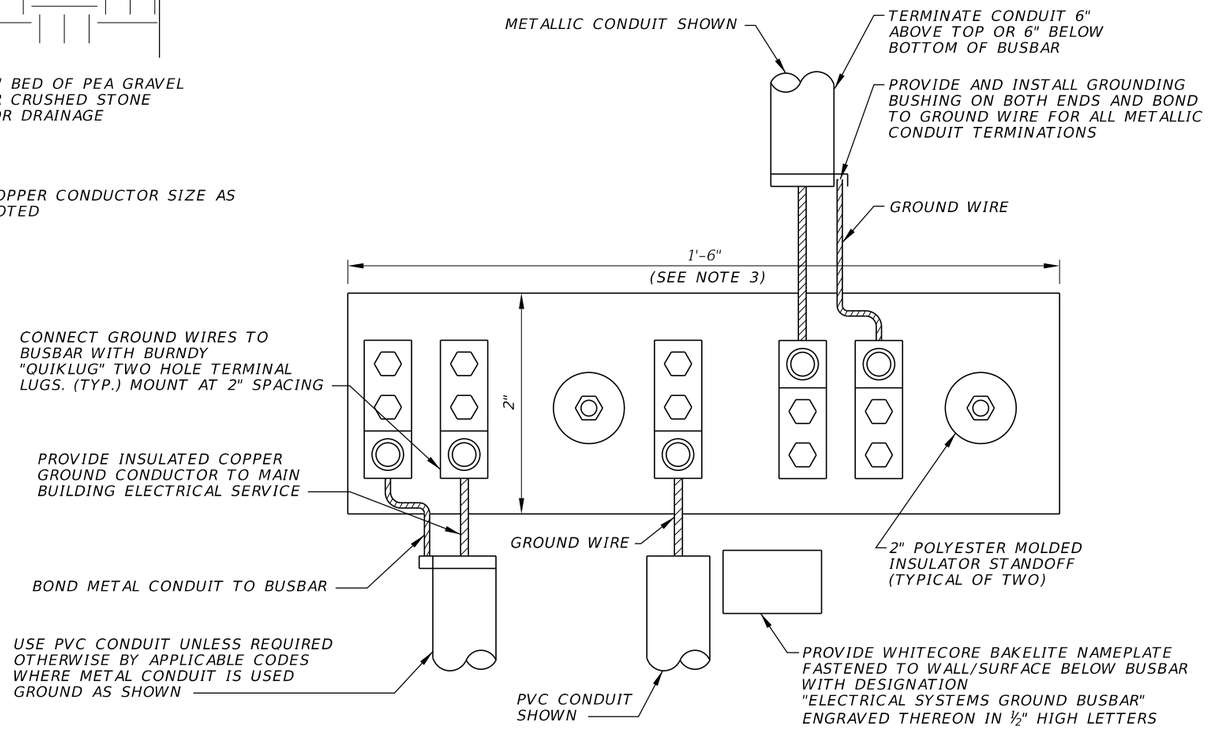


2 GROUND DETAIL
SCALE: N.T.S.

Exhibit 242.13-2 Grounding Details



2 GROUND INSPECTION WELL DETAIL
SCALE: NTS



1 AUXILIARY GROUND BUSBAR DETAIL
SCALE: NTS

NOTES TO PREPARER:

1. ALL HARDWARE BOLTS, NUTS, WASHERS, ETC. MUST BE SOLID COPPER OR BRONZE.
2. COPPERPLATING IS NOT ACCEPTABLE. BUSBAR MUST BE FLAT COPPER.
3. INCREASE LENGTH AS REQUIRED FOR NUMBER OF CONNECTIONS. PROVIDE 2" SPACING BETWEEN LUGS.

242.14 Electrical Raceways from Site to New TEBs

(1) Vertical raceways that originate from the gantry must terminate as described in ***GTR 255.5.1*** and ***255.6.4.***

(2) Working space 1 is the area between the toll equipment spaces 1 and 3. Working space 2 is the area between toll equipment spaces 2 and 4. See ***Exhibit 241.7-1***.

(3) Loop pull box raceways must be routed to the stub up, under the appropriate working spaces in the TEB.

(4) All conduits must be stubbed up through the building floor slab and cut to 1-inch above the building finished floor elevation with a cable ground bushing installed at both ends of all metallic conduits.

(5) See ***Exhibit 242.14-1*** for the conduit stub-ups below the toll equipment support frame for each working space inside the TEB.

(6) Conduits from each wire trough must terminate as follows:

(a) [redacted]

(b) AVI reader conduits routed as follows:

- AVI Reader Mounted in the Building: Two 4-inch rigid conduits must be routed from the bottom of the AVI reader wire trough and stub up under the wall mounted AVI reader backplane. See ***Exhibit 242.1-6***.
- AVI Readers Ground Mounted Frame: Two 4-inch rigid conduits must be routed from the bottom of the upright and terminate at the AVI reader frame. See ***Exhibit 232.5-2***.
- AVI Readers Mounted on the Gantry: For each direction of travel served by the wire trough, two 4-inch rigid conduits must be routed from the bottom of the AVI reader wire trough and stub up in the appropriate working spaces in the TEB. For additional information see ***Exhibit 241.7-1*** and ***Exhibit 242.14-1***.

(c) Data not associated with CCTV must be routed to stub-up under the appropriate working space in the TEB. For additional information, see ***Exhibit 241.7-1*** and ***Exhibit 242.14-1***.

(d) Power must be routed to stub up under the appropriate working space in the TEB except as stated in (e) below. For additional information, see ***Exhibit 241.7-1*** and ***Exhibit 242.14-1***.

(e) Power to the receptacles and lighting on the gantry must be routed to stub up under the EDP in the TEB.

(7) The underground cable routing for AVI readers that are located on a ground-mounted frame, must be as follows:

(a) Two 4-inch conduits per direction of movement must be routed to the toll equipment working spaces.

(b) See ***GTR 255.5.6*** for additional requirements.

(8) Generator underground cable routing must be as follows:

(a) Conduits sized by the EOR for the generator power feeders must be routed to the ATS.

(b) One 1-inch conduit must be routed to the ATS for generator control wiring and EPO wiring.

(c) [redacted]

(d) One 1-inch conduit to EDP for engine jacket heater circuit.

(e) One 1-inch conduit to the battery charging unit for the generator battery circuit.

(9) Fuel tank monitor underground cable routing must be as follows:

(a) [redacted]

(b) One 3/4-inch conduit to EDP for fuel tank monitor circuit.

(10) See ***GTR 255.5.8*** and ***GTR 255.5.9*** for cantilever gantry conduit routing requirements.

Exhibit 242.14-1 Working Space Conduit Stub-up

NOTES TO PREPARER:

1. *CONDUIT BELOW CABINETS MUST BE STUBBED UP 1" AFF.*
2. *PROVIDE END BELL FITTINGS ON ALL PVC (LOOP) CONDUITS STUBBED UP IN THE WORKING SPACE.*



242.15 Electrical Raceways from Site to Existing TEBs

The Turnpike Toll Systems can elect to re-use an existing building to house the new tolling system provided by the TEC.

Coordination must take place with Turnpike Tolls Design on the termination point of the conduits incoming from the gantry and roadside during the gantry and site design. Written documentation (email or meeting notes documentation) of concurrence from the Turnpike Tolls Design Administrator or designee is acceptable.

(1) The wall penetrations for raceways at existing buildings must be from wall-mounted enclosures as follows:

(a) The enclosures must be mounted to the exterior side of the wall at the ceiling level such that cabling transitions to the ceiling mounted cable trays in the interior of the building.

(b) The enclosures must be stainless steel NEMA 4X. The enclosures must be attached to the wall with stainless steel galvanized strut channel supports and labeled “Data” or “Power” depending on the conduits it serves.

(c) The enclosures and associated conduits must be painted to match the adjacent surfaces.

(d) The number of conduit penetrations must match the number of incoming conduits from the gantry and roadside.

(e) The conduit penetration design must maintain the structural integrity of the wall.

(f) The seal around each conduit penetration must provide a waterproof and dust proof wall penetration. The conduit penetrations and enclosures must be constructed to prevent dirt intrusion and water intrusion from rain, and hose-down water test. See ***GTR Part 2, Appendix 2***, TSP Section for ***Cutting and Patching for TEB Sites*** for additional requirements.

(2) The conduits must be sloped away from the building interior such that water originating from the outside or from condensation does not make its way inside of the building.

(3) All wireways, wire troughs, enclosures, conduit, chases, pull boxes, and cable trays must be terminated and supported using the appropriate hardware and fittings in accordance with ***GTR 210*** and the NEC.

243 Toll Equipment Building Lightning Protection

243.1 General Requirements

(1) A lightning protection system must be provided for all new toll sites and associated toll site infrastructure.

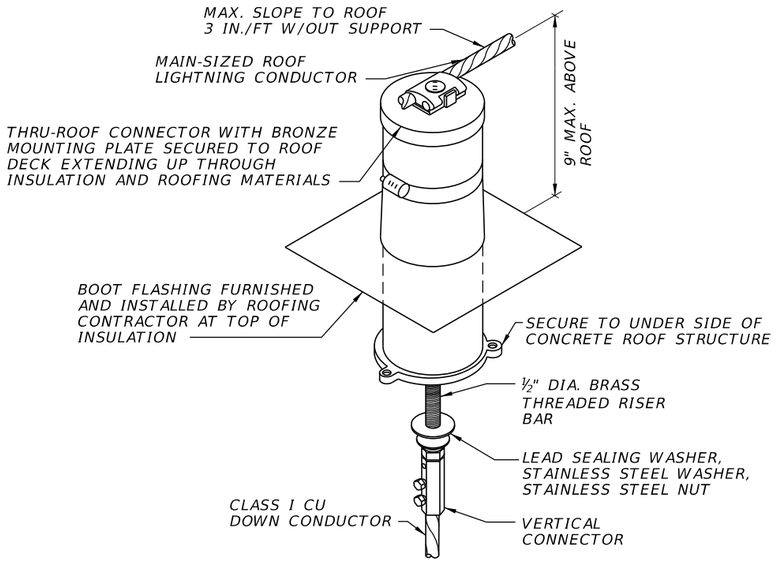
(2) Each TEB lightning protection system must be connected to the applicable site elements identified in ***GTR 233.1***.

(3) See ***GTR 233.2*** for lightning protection separation distance requirements.

(4) Lightning protection conduit penetrating the exterior wall must not be exposed. See ***Exhibit 243.1-1***and ***Exhibit 243.1-2*** for additional criteria.

(5) See ***GTR Part 2, Appendix 2***, TSP Section for ***Lightning Protection for TEB Sites*** for additional requirements.

Exhibit 243.1-1 Down Conductor Conduit

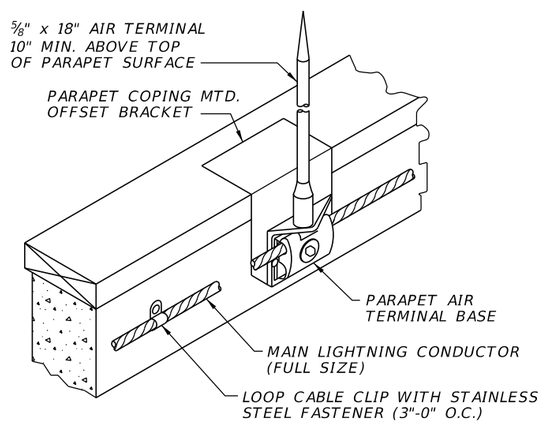


1 THRU ROOF CONNECTOR WITH FLASHING TUBE AND CABLE BASE
SCALE: NTS

[redacted]

2 DOWN CONDUCTOR THRU ROOF ENLARGED WALL SECTION
SCALE: NTS

[redacted]

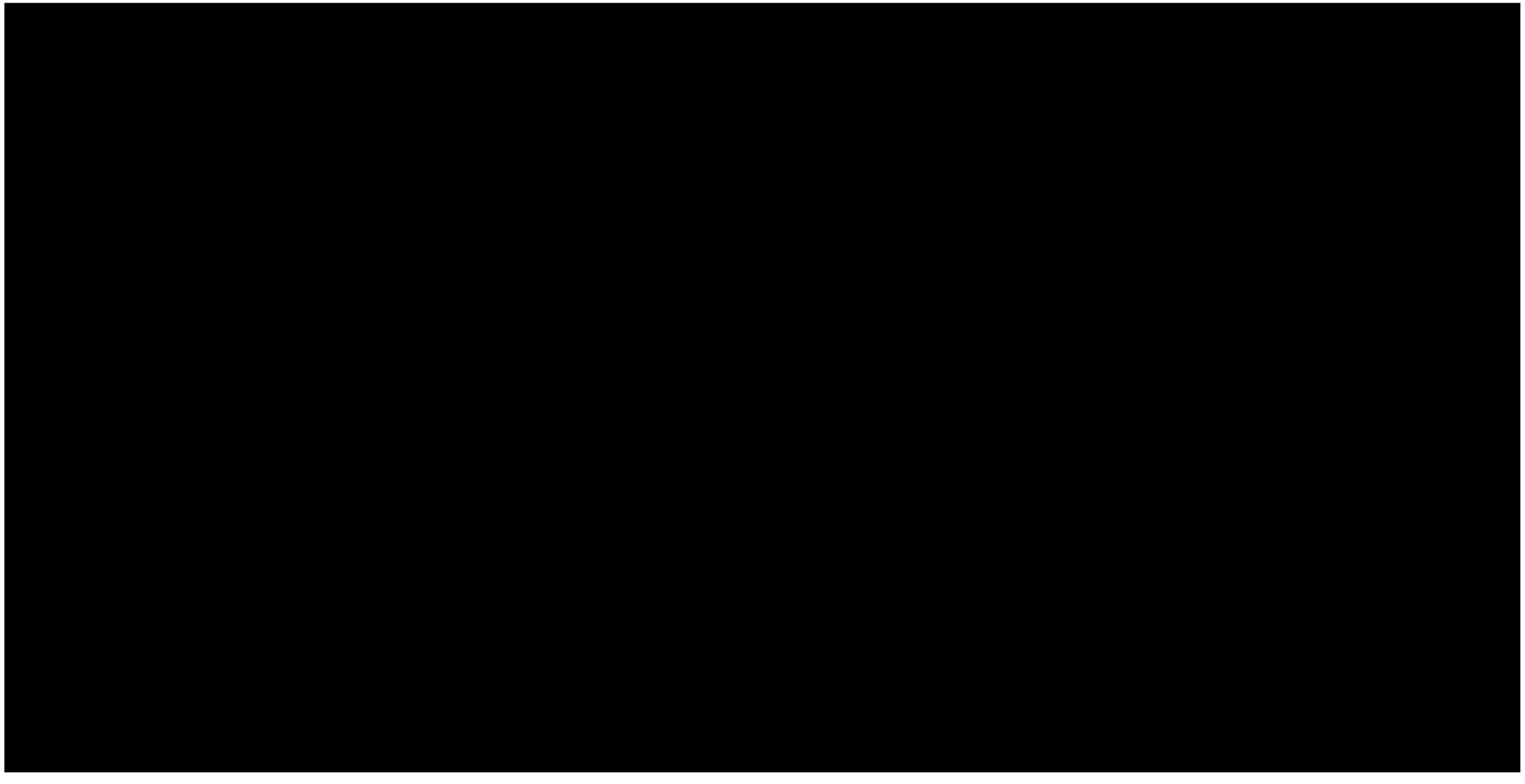


3 PARAPET AIR TERMINAL DETAIL
SCALE: NTS

4 DOWN CONDUCTOR CONDUIT ENLARGED WALL SECTION
SCALE: NTS

5 DOWN CONDUCTOR BUILDING WALL SECTION
SCALE: NTS

Exhibit 243.1-2 TEB Lightning Protection Plan



244 Toll Equipment Building Mechanical

244.1 General Requirements

(1) Fuel tank and fuel oil piping must be provided to support the emergency generator .

(2) Two ductless split AC systems with wall mounted air handling units (AHUs) and outdoor condensing units (CUs) with inverter-driven twin rotary compressors and CUs with seacoast protection must be provided for each TEB. See ***Exhibit 244.2-1*** for additional requirements.

(3) Outdoor condensing units must be wall mounted in accordance with ***GTR 241.7.2***.

244.2 Air Conditioning (AC) System

(1) The AC system must be sized to account for all design factors including TEB size, equipment normal operation, temperature and humidity requirements, heat loads, etc.

(2) Each unit must be sized for 100% of the building load and be redundant to the other unit. Coordination must take place with Turnpike Tolls Design if the cooling capacity of a single unit is insufficient to satisfy 100% of the building load.

(3) Cooling load calculations must account for 100% of the building load, including electrical equipment, ultimate tolling equipment, and the building envelope. Each AC system's cooling capacity must maintain 75ºF with 50% relative humidity when the outside air temperature is at design conditions.

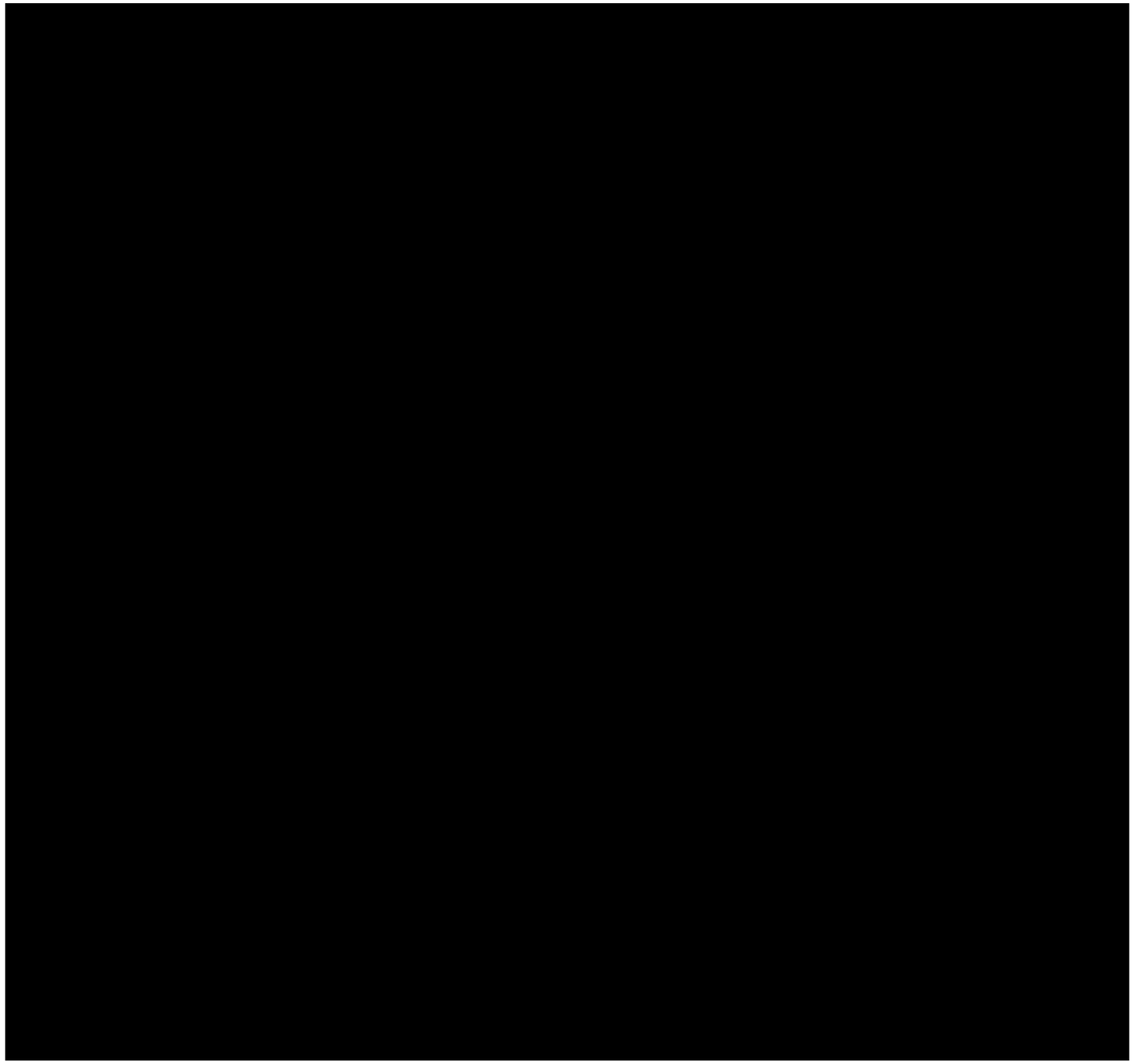
(4) Building minimum and maximum operating parameters: A single AC unit shall maintain the interior temperature of the building between 73 degrees (dry bulb) Fahrenheit, and 77 degrees (dry bulb) Fahrenheit, and maintain the humidity in the building of not more than 55%.

(5) The AC system must be equipped with a remote controller for the dual unit control system and thermostat, to periodically and automatically switch between the primary and secondary units. See ***GTR Part 2, Appendix 2***, TSP Sections for ***Ductless Split System AC for TEB Sites*** and ***Dual Air Conditioner Control System and Sequence of Operations for TEB Sites*** for additional requirements.

(6) The sensible heat gain calculations must take into account the following:

- (a) The heat output of each tolling equipment space and toll communications cabinet must be included in the calculation at a rate of 1.0kW.
- (b) Refer to ***GTR 242*** for the number of tolling equipment spaces per TEB.
- (c) See ***Exhibit 244.2-1*** for additional requirements for AC infrastructure.

Exhibit 244.2-1 AC Infrastructure



NOTES TO PREPARER:

1. *CONDENSING UNIT IS WALL MOUNTED AND SUSPENDED ABOVE THE FINISHED GRADE.*
2. *AC UNIT CONDENSATE DRAIN LINE. UNIT PROVIDED WITH INTERNAL DRAIN TRAP, EXTERNAL TRAP NOT REQUIRED. INDIRECT WASTE TO 2" CONDENSATE RECEPTOR WITH AIR GAP, TYPICAL OF 2.*
3. *2 INCH DIAMETER SCHEDULE 40 PVC CONDENSATE DRAIN LINE ROUTED UNDERGROUND TO IN-GROUND CONDENSATE DRYWELL. MINIMUM SLOPE MUST BE ⅛" PER FOOT.*
4. *DUAL UNIT CONTROLLER WITH INTEGRAL THERMOSTAT AND TIMER. INSTALL CONTROLLER AT 84" AFF TO TOP. COORDINATE ALL THERMOSTAT SEQUENCING AND ALARM SET-POINTS WITH FTE REPRESENTATIVE.*
5. *CONTRACTOR MUST FIELD COORDINATE WITH CIVIL SITE AND GRADING PLANS, UTILITY PLANS AND ALL OTHER TRADES FOR THE EXACT LOCATION OF THE CONDENSATE DRYWELL. SEE CIVIL SITE FOR DRYWELL LOCATION.*
6. *WALL SLEEVE FOR REFRIGERANT AND CONDENSATE PIPING. MOUNT BOTTOM OF SLEEVE AT APPROXIMATELY 80" AFF. COORDINATE PENETRATION WITH AC UNIT MANUFACTURER'S REQUIREMENTS PRIOR TO CASTING THE SLEEVE. FILL ANY SLEEVE SPACE ONCE PIPING IS INSTALLED WITH EXPANDABLE FOAM TO SEAL PENETRATION AIR TIGHT. TRIM FOAM EVEN WITH SLEEVE EDGES.*
7. *PIPING COVER PLATE TO CONCEAL PIPING FROM SOFFIT ABOVE DOWN TO 24" A.F.G. ENSURE ALL REVEAL CROSSINGS AND FITTING ENDS ARE SEALED TO PREVENT WATER INTRUSION.*
8. *INSULATED REFRIGERANT LIQUID, SUCTION LINE, AND ELECTRICAL INTERCONNECT TO CONDENSING UNIT.*
9. *BACnet/MODBUS INTERFACE CONTROLLER BOARD.*

244.3 Condensate Piping and Dry Well

(1) Dry well for AC condensate must be provided.

(2) See ***Exhibit 244.3-1*** for additional requirements.

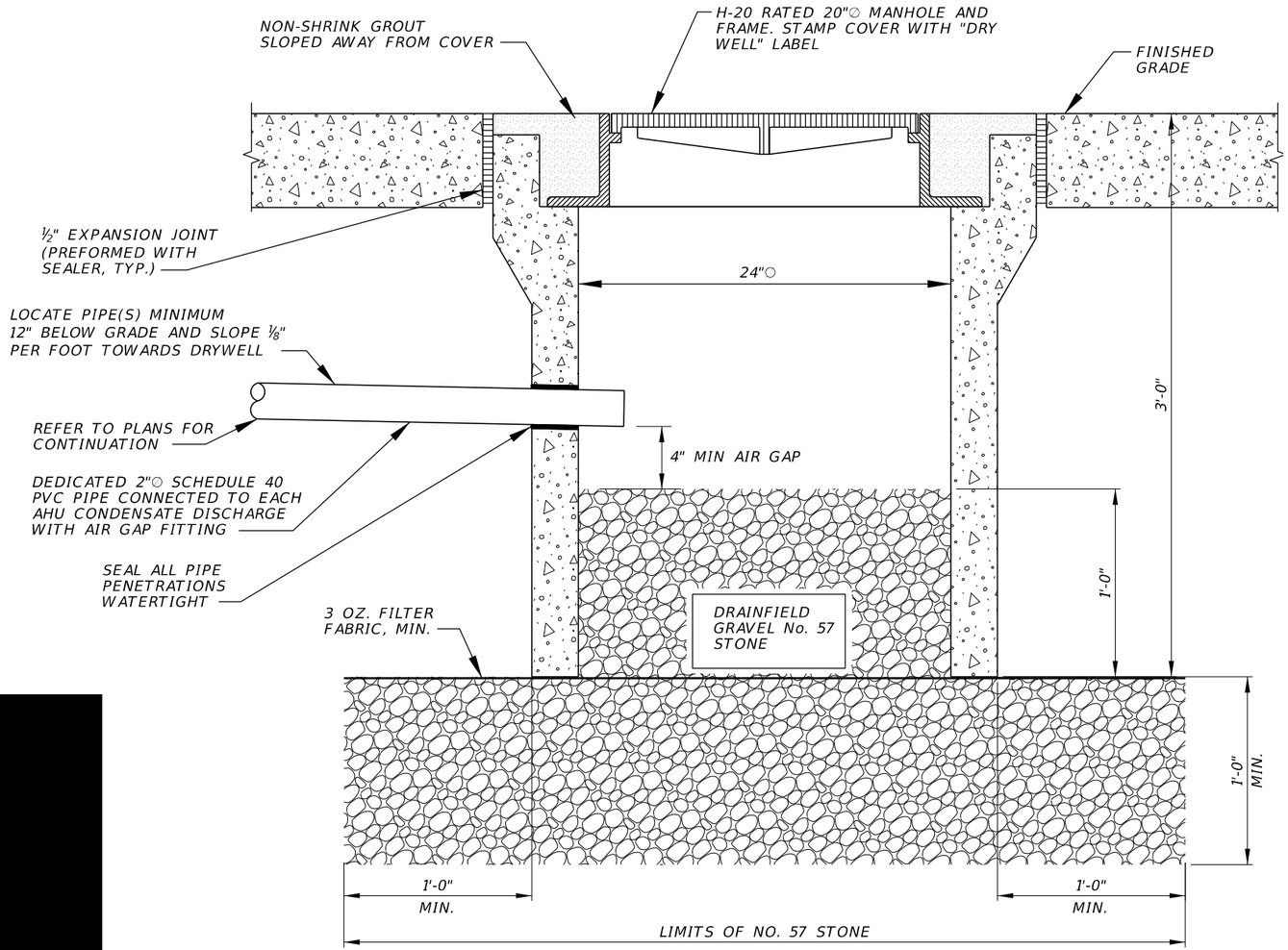
(3) See ***GTR Part 2, Appendix 2***, TSP Section for ***Piping and Specialties for TEB Sites***.

Exhibit 244.3-1 Dry Well and AC Condensate Piping Details

[redacted]

1 AC EQUIPMENT AND CONDENSATE PIPING DETAIL
SCALE: NTS

[redacted]



2 CONDENSATE DRYWELL DETAIL
SCALE: NTS

NOTES TO PREPARER:

1. ALL HARDWARE MUST BE STAINLESS STEEL AND SUPPORT FRAME SHALL BE CONSTRUCTED OF STAINLESS STEEL. (BOLTS, NUTS, STRAPS, ANCHORS, SUPPORT FRAME, ETC.)
2. MOUNT BOTTOM OF CONDENSING UNIT FRAME AT A MINIMUM OF 6" A.F.G.
3. COORDINATE FINAL LENGTHS OF ALL SUPPORT FRAME COMPONENTS WITH FINAL DIMENSIONS OF MECHANICAL EQUIPMENT.

244.4 Fuel Storage Tanks, and Fuel Oil Piping

(1) See ***Exhibit 244.4-1*** and ***Exhibit 244.4-2*** for fuel oil piping routing and accessories.

(2) See ***Exhibit 231.5-1*** for fuel tank hold-down details.

(3) See ***GTR Part 2, Appendix 2***, TSP Sections for ***Concrete Protected Above-Ground Fuel Storage Tank for TEB Sites*** and ***Fuel Oil Piping for TEB Sites*** for additional requirements.

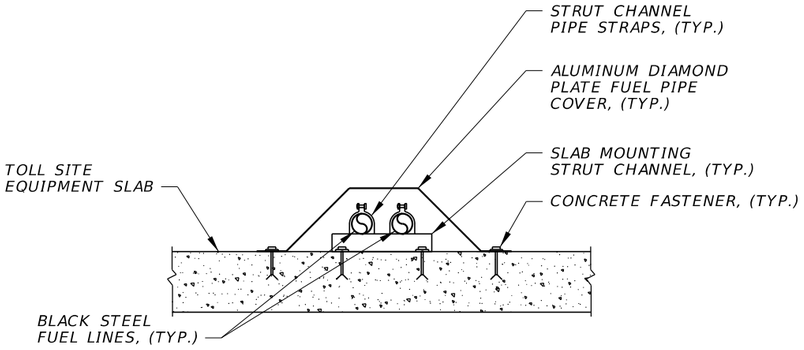
Exhibit 244.4-1 Generator Fuel Tank Piping



PLAN
SCALE: NTS

NOTE TO PREPARER:

1. FUEL PIPE COVER PLATE MUST BE PROVIDED FOR ALL EXPOSED PIPING ROUTED WITHIN SERVICE WALKWAYS OR PATHS.



1 FUEL PIPING COVER PLATE DETAIL
SCALE: NTS

Exhibit 244.4-2 Fuel Tank Details



250 Toll Gantries

250.1 Gantry Types

(1) Non-accessible gantries – See ***GTR 251.4.*** The two types of non-accessible gantries are:

(a) Non-accessible cantilever – See ***GTR 251.5***

Non-accessible cantilever gantries may be installed at ramp toll sites and express lane toll sites, only where the design satisfies the span limitations identified in ***GTR 250.2***, ***GTR 251*** and ***GTR 253,*** and cable distances identified in ***GTR 234*** can be met.

(b) Non-accessible span – See ***GTR 251.6***

Non-accessible span gantries may be installed at ramp toll sites, and express lane toll sites.

See ***Exhibit 250.1-1*** to identify the various elements of a non-accessible gantry.

(2) Accessible gantries (span only) – See ***GTR 251.7***

A detailed investigation is required for the selection of the gantry type. Mainline toll gantries are assumed to be accessible gantries. A study must include justification that shall be documented in the Toll Siting Technical Memorandum (TSTM), to determine when a mainline toll site will be a non-accessible gantry. Investigation considerations should include but are not limited to existing and proposed site conditions, manufacturing limitations, maintainability, site safety, and project costs. The gantry type shall be determined during the PD&E phase in accordance with ***GTR 202.2***.

The accessible gantry provides a deck (walkway) to install and maintain equipment over live traffic and allows for secured access to the deck via an elevated platform and connecting stairway accessible by maintenance vehicles such as scissor lift or bucket truck. See ***Exhibit 250.1-2***, ***Exhibit 250.1-3***, ***Exhibit 250.1-4***, ***Exhibit 250.1-5***, ***Exhibit 250.1-6***, ***Exhibit 250.1-7***, and ***Exhibit 250.1-8*** to identify the various elements of an accessible gantry.

Exhibit 250.1-1 Non-Accessible Gantry Elements

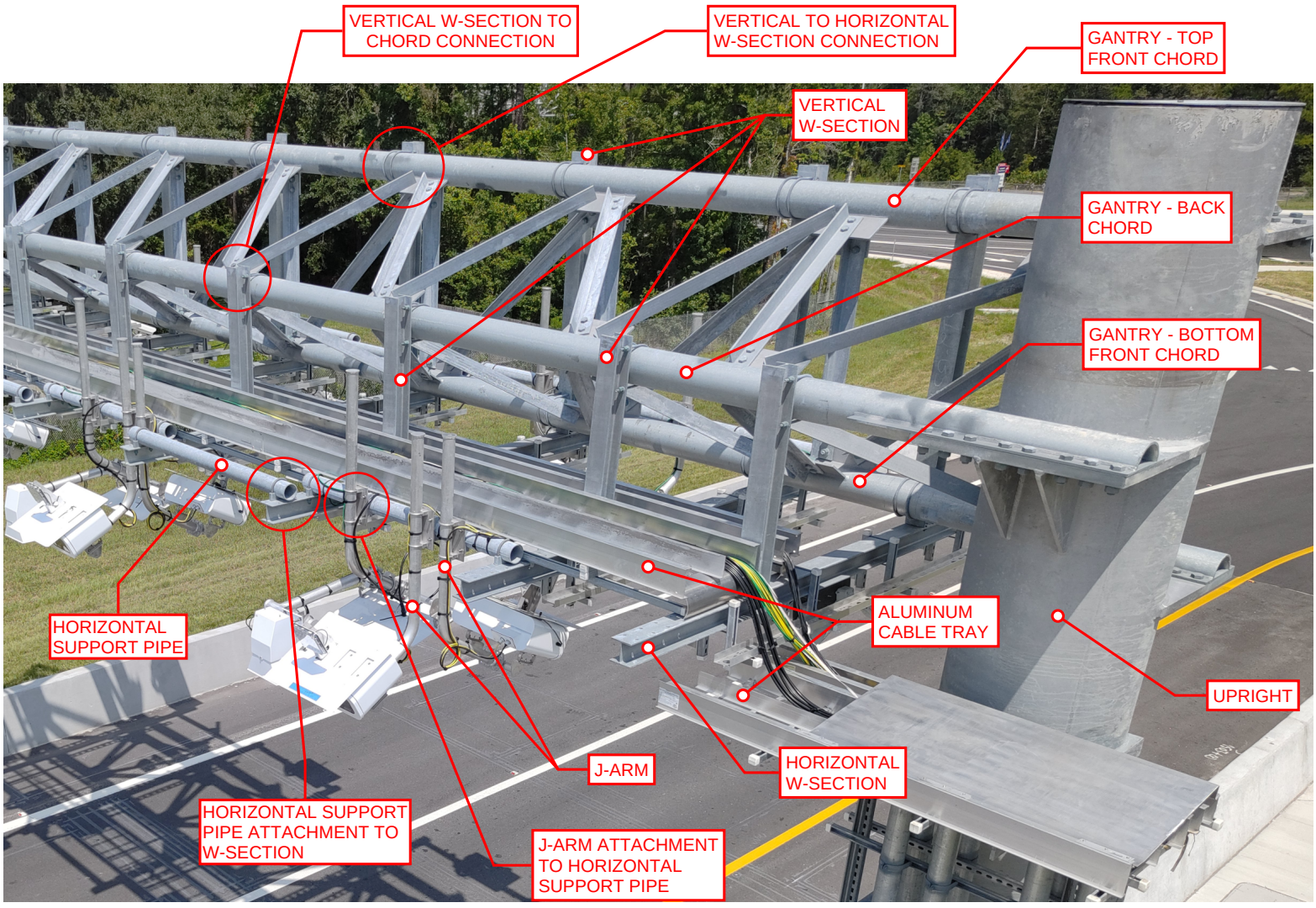


Exhibit 250.1-2 Accessible Gantry Elements

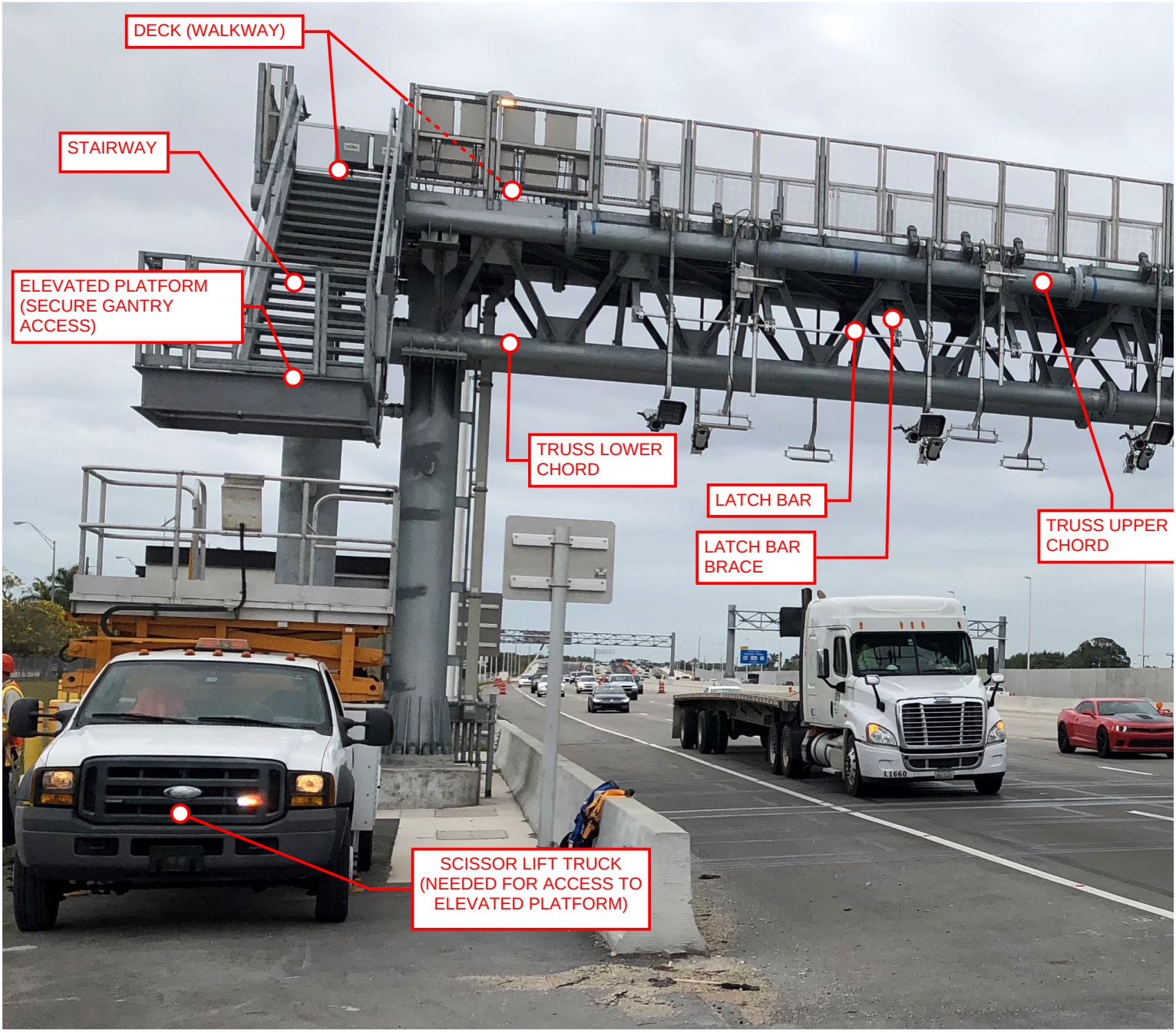


Exhibit 250.1-3 Accessible Gantry Swing Gate and Grating

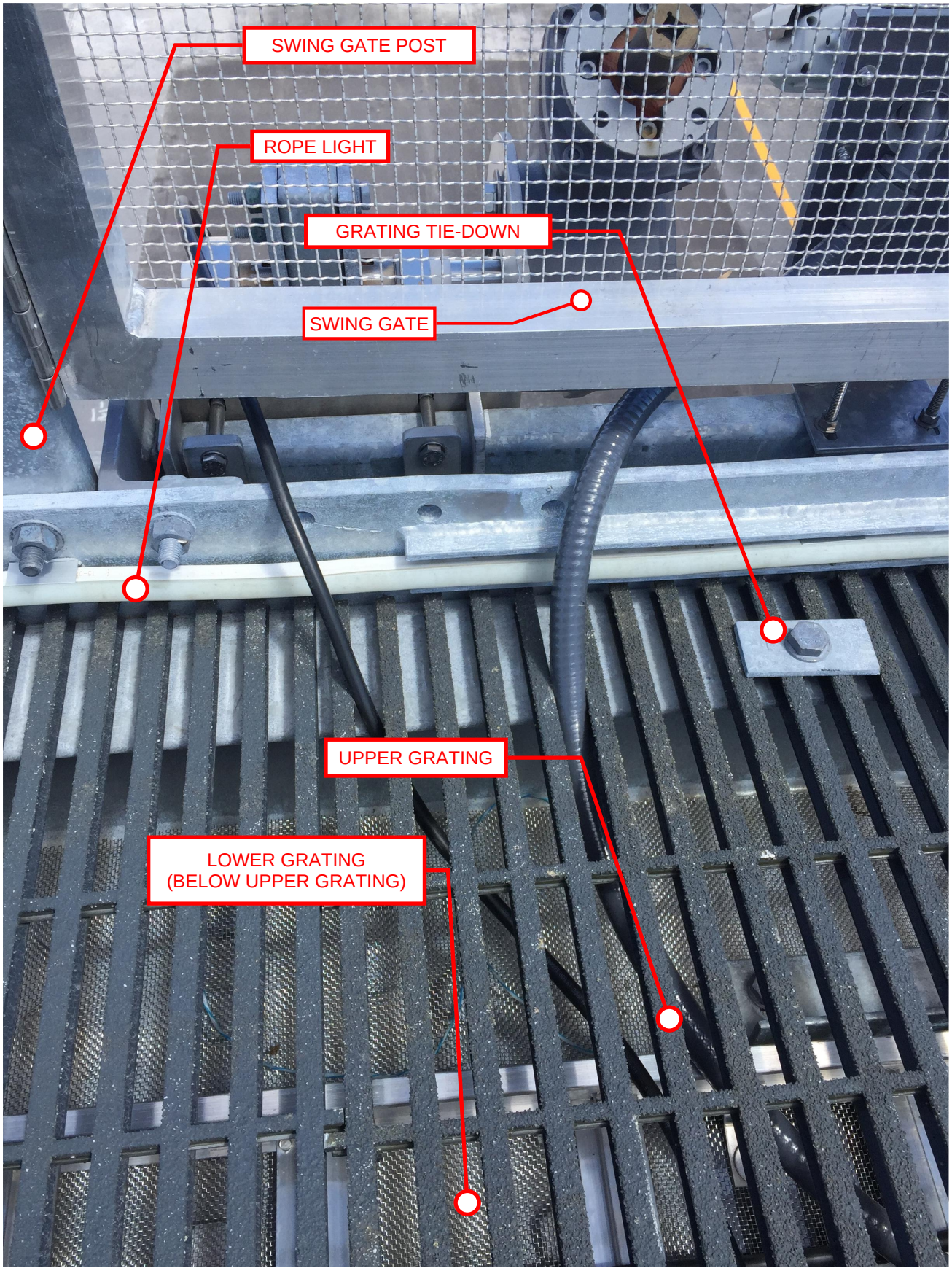


Exhibit 250.1-4 Accessible Gantry Stair Platform Landing

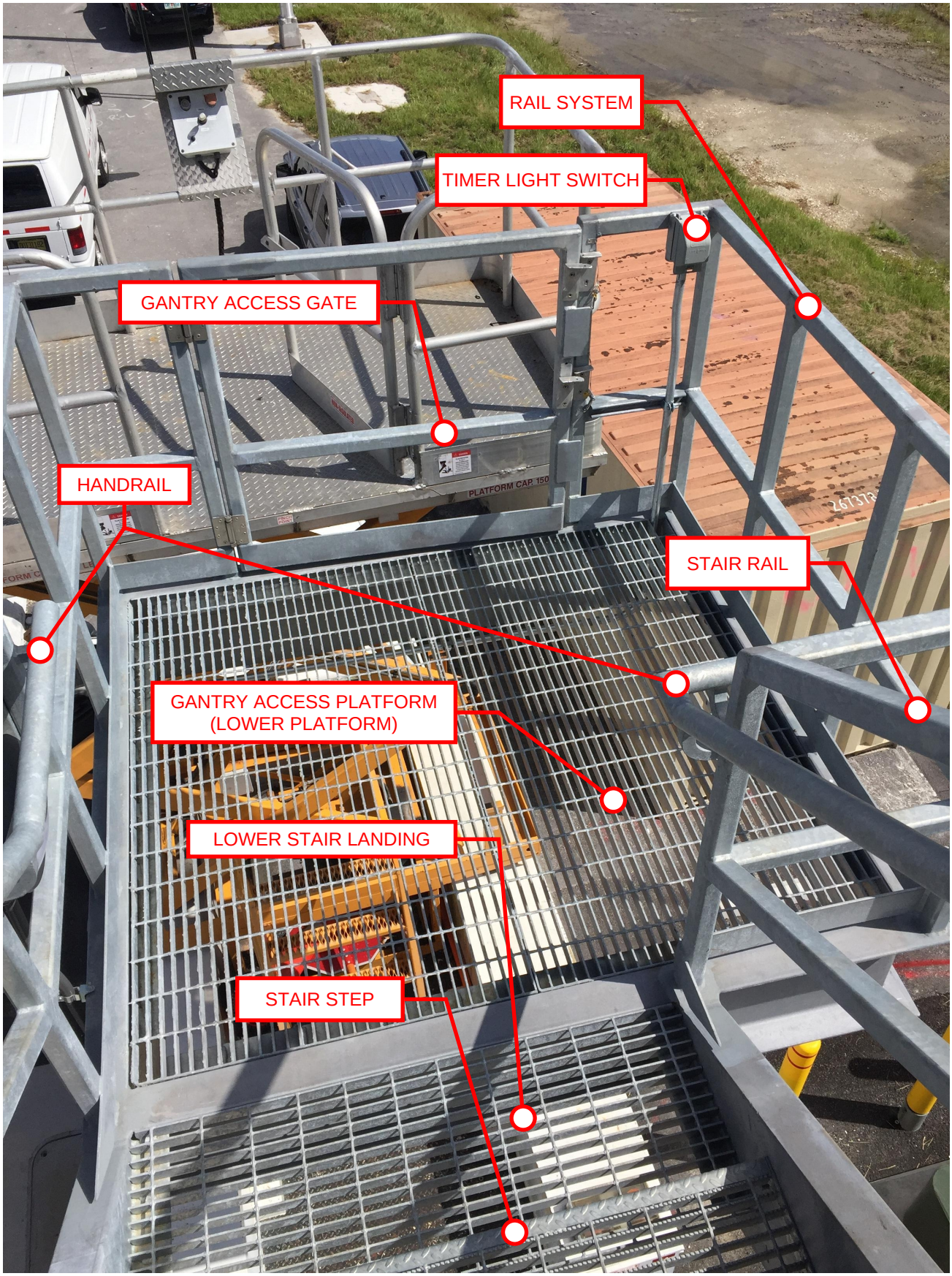


Exhibit 250.1-5 Accessible Gantry J-Arm Retraction Assembly

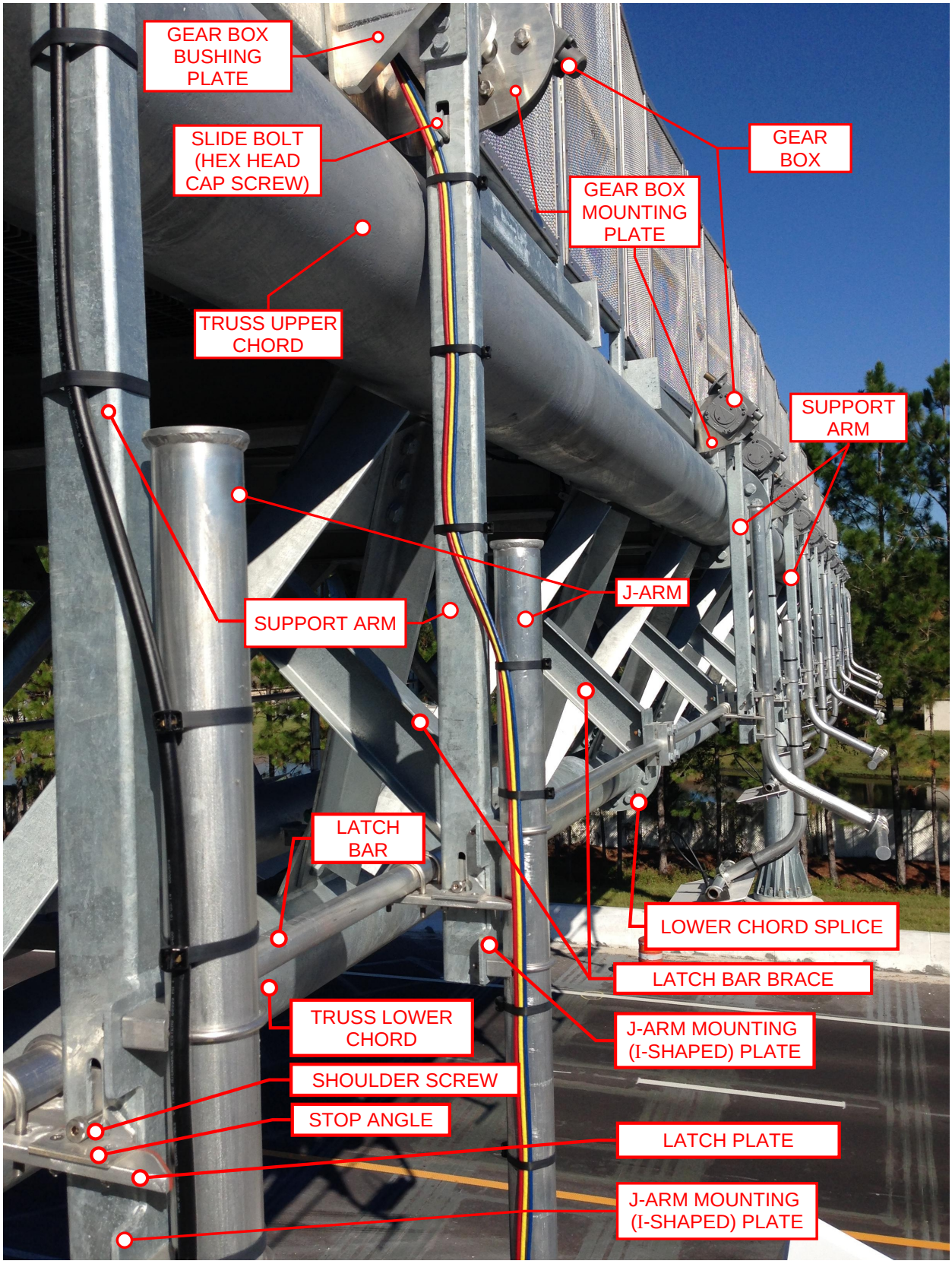


Exhibit 250.1-6 Accessible Gantry Gear Box and Mounting

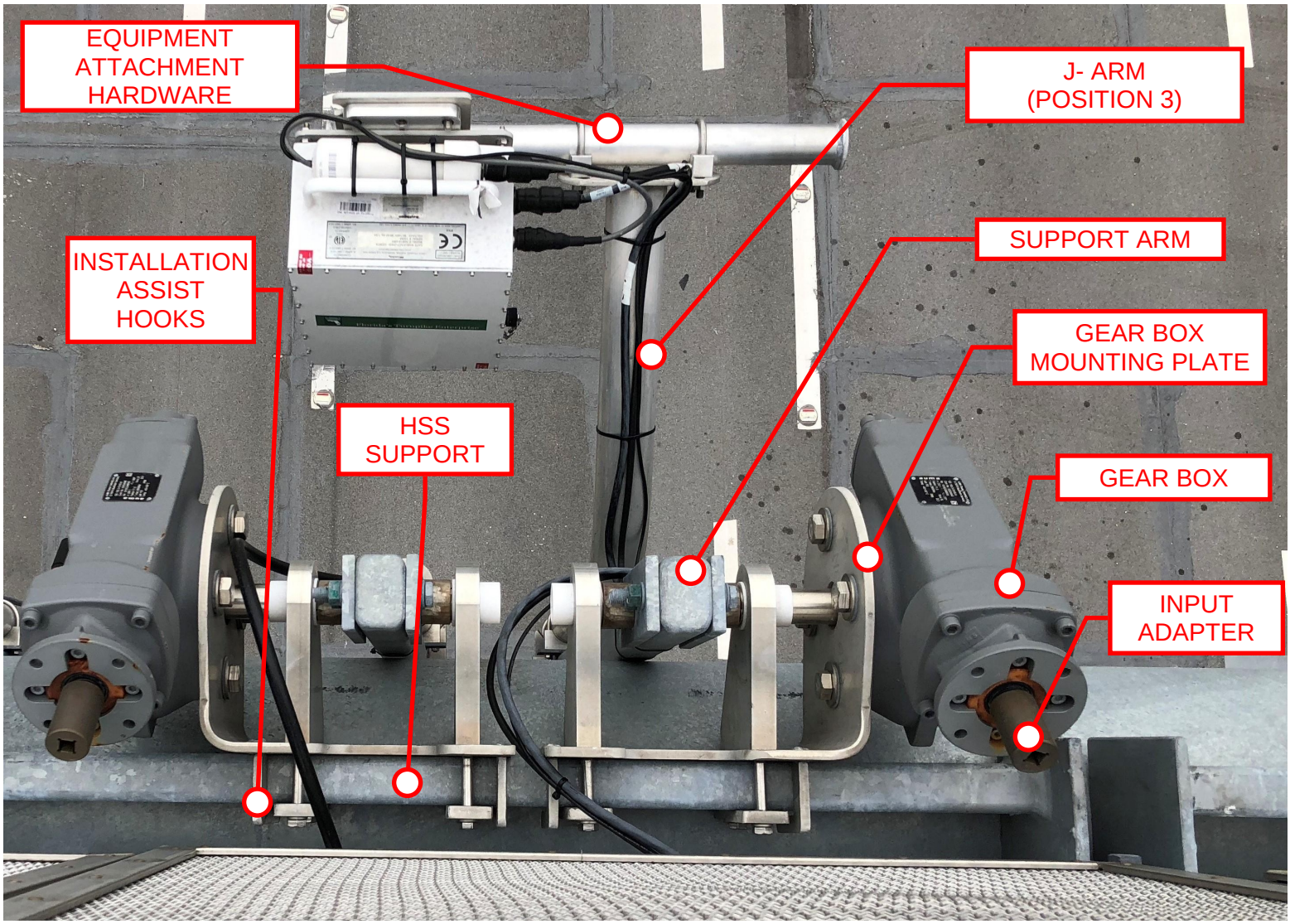


Exhibit 250.1-7 Accessible Gantry Access Stair Structure

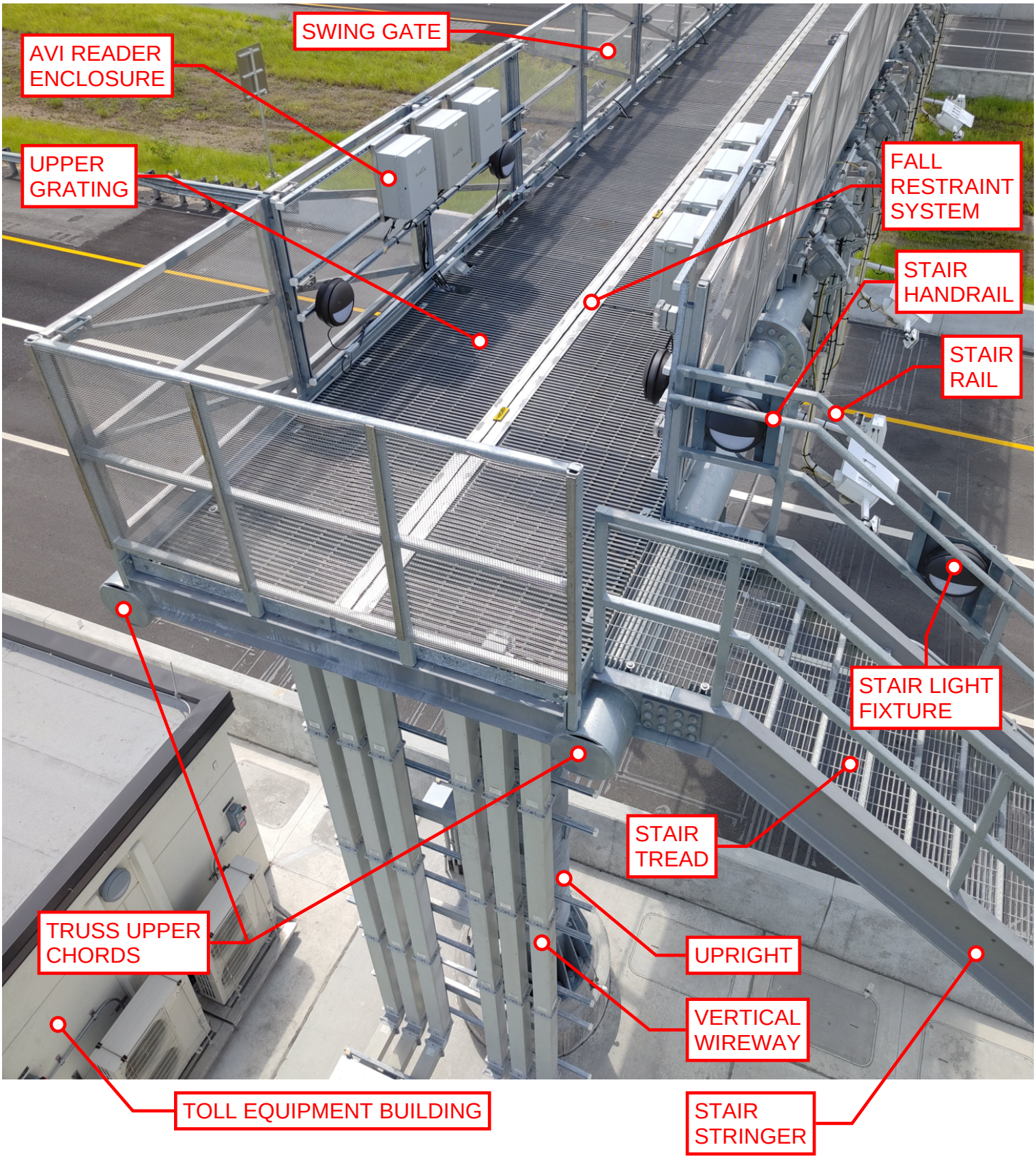
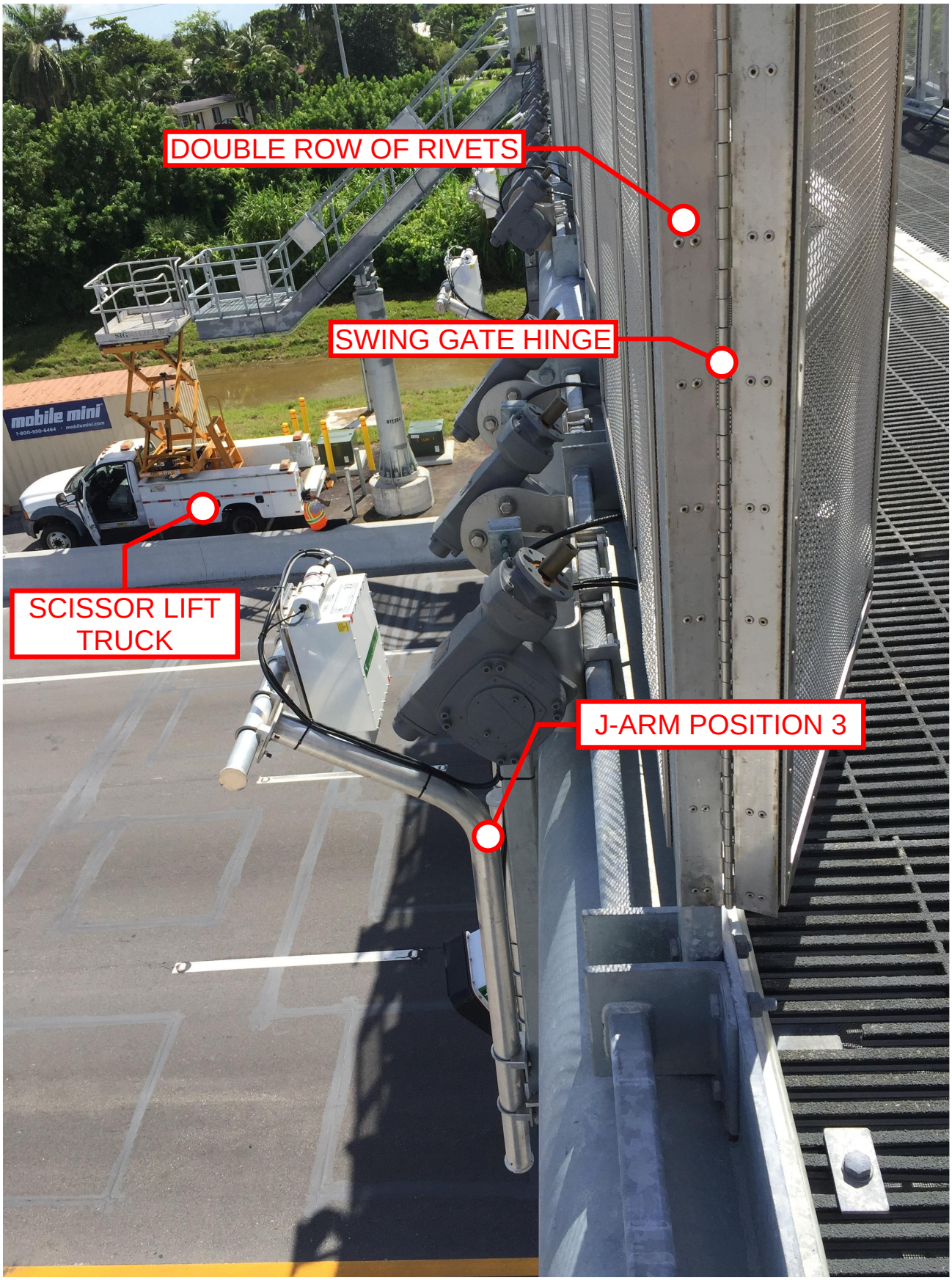


Exhibit 250.1-8 Accessible Gantry Swing Gate Post



250.2 Gantry Design Criteria based on Toll Equipment Requirements

(1) See ***GTR 220.2*** for gantry positioning requirements.

(2) The tolling equipment positioning depends on the TEC and the roadway configuration at the gantry. See ***Exhibit 250.2-1*** and ***Exhibit 250.2-2*** for toll equipment layout and positioning over the lanes for each gantry type. See ***Exhibit 250.2-3*** for equipment loading.

(3) All lanes and shoulders within the toll loop pavement area must receive toll equipment as identified in ***Exhibit 250.2-1*** and ***Exhibit 250.2-2***.

(4) The gantry must be designed to accommodate the TEC requirements for the following roadway configurations:

- (a) Each interim condition
- (b) The ultimate condition
- (c) Each potential MOT phase required to transition from the interim to the ultimate condition

(5) A single gantry structure design must allow the J-arms to be installed laterally along the gantry to accommodate all vendor equipment layouts for all interim and ultimate configurations.

(6) Gantry design must take into account layout for the following:

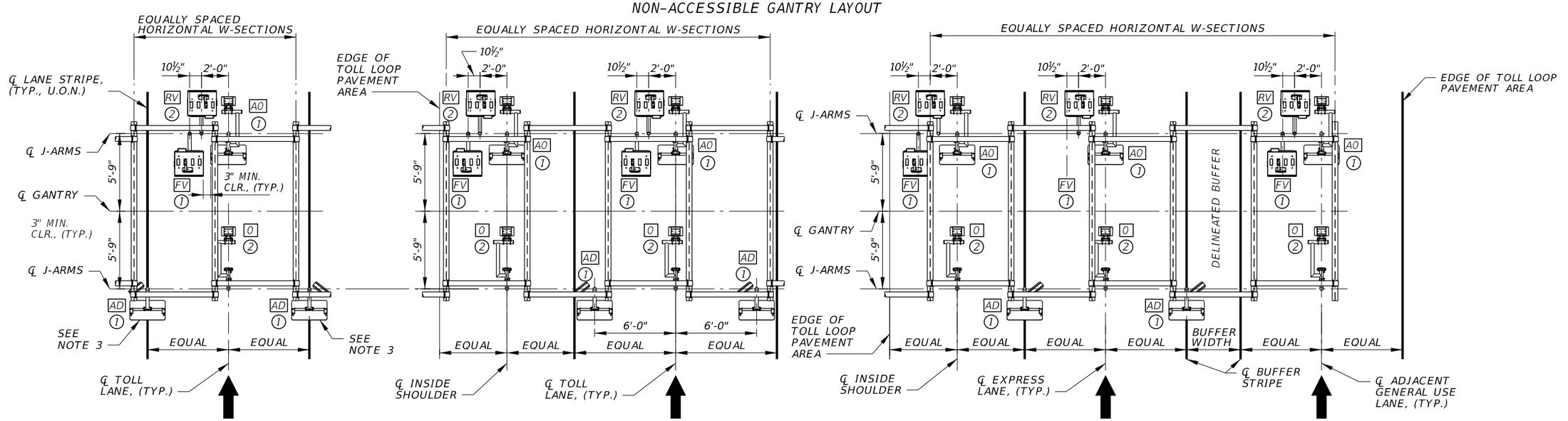
- (a) Horizontal and vertical supports
- (b) Raceways and wiring
- (c) Toll equipment clearances
- (d) J-arm adjustments
- (e) Equipment positioning, and separation
- (f) Line-of-sight of illuminators, auditing cameras, Violation Enforcement System (VES) cameras, and lasers/sensors
- (g) AVI Readers and their enclosures/cabinets
- (h) All associated equipment mounting hardware

(7) Cantilever Gantry must extend a minimum one foot beyond:

- (a) **Express Lane Sites**: the centerline of the adjacent GUL
- (b) **All other Sites**: the centerline of the far shoulder

Exhibit 250.2-1 TransCore Gantry Toll Equipment Layout

NON-ACCESSIBLE GANTRY LAYOUT



TYPICAL TOLL LANE / SHOULDER (TRANSCORE)

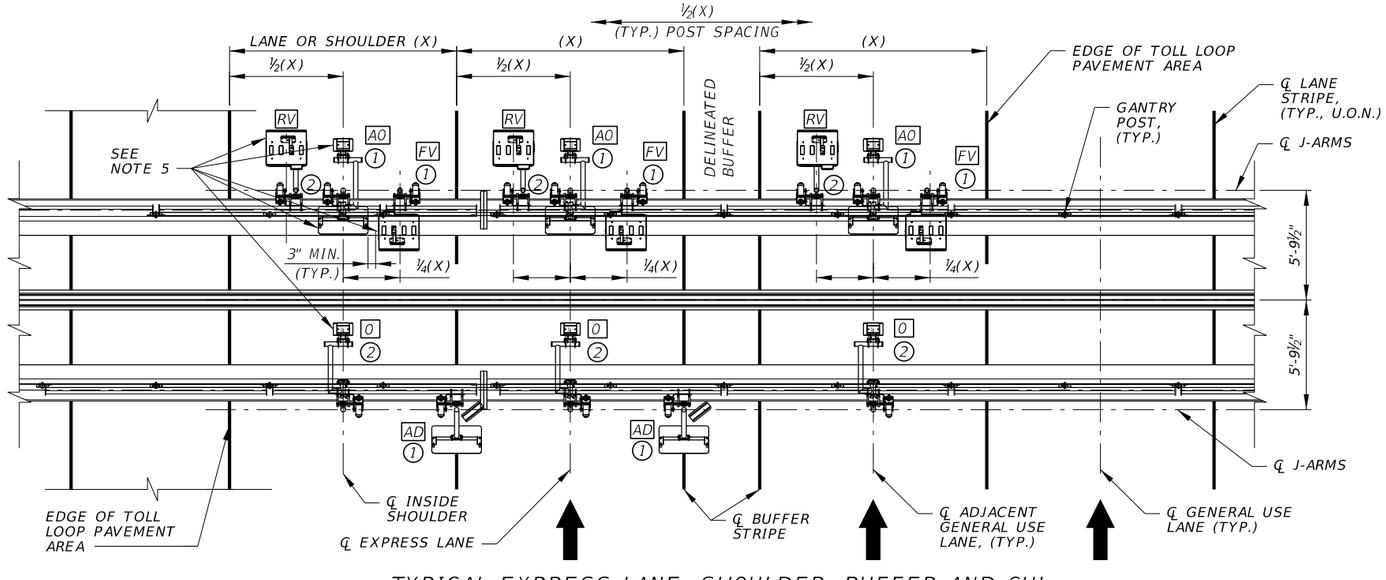
TYPICAL SINGLE LANE RAMP AND SHOULDER (TRANSCORE)

TYPICAL EXPRESS LANE, SHOULDER, BUFFER AND GUL (TRANSCORE)

NOTES TO PREPARER:

1. TOLL EQUIPMENT LOCATION IS BASED ON THE CENTER OF THE EQUIPPED LANE / SHOULDER.
2. J-ARM LOCATION IS BASED ON THE MOUNTING REQUIREMENTS OF THE TOLL EQUIPMENT.
3. ANTENNAS AND DVAS ARE NOT REQUIRED OVER THE EDGE OF THE TOLL LOOP PAVEMENT AREA.
4. TOLL EQUIPMENT CAN BE MIRRORED ABOUT THE CENTER ON THE LANE.
5. THE ANTENNAS, OPUS, AND VCARS J-ARM CONNECTION POINTS MAY BE SHIFTED HORIZONTALLY WITHIN THE LIMITS OF THE MOUNTING HARDWARE TO MITIGATE CONFLICT WITH STRUCTURAL ELEMENTS. SEE EXHIBITS 252.1-3 AND 252.1-4.
6. TOLL EQUIPMENT IS NOT REQUIRED FOR SHOULDER WIDTHS LESS THAN 6 FEET.

ACCESSIBLE GANTRY LAYOUT



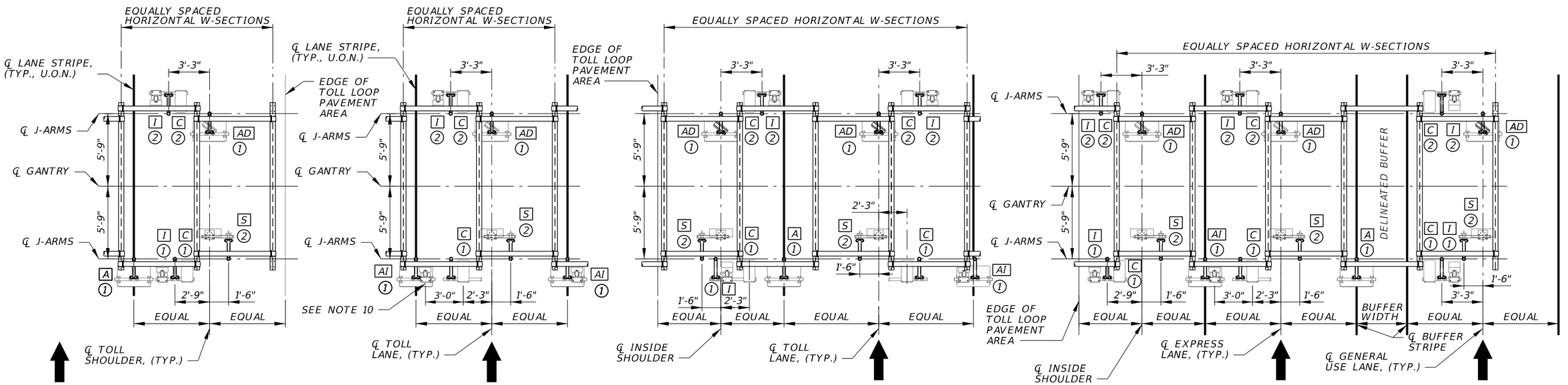
TRANSCORE LEGEND:

- [A] ANTENNA
- [AD] ANTENNA / DVAS
- [AO] ANTENNA / OPUS
- [0] OPUS
- [FV] FRONT VCAR
- [RV] REAR VCAR
- (#) J-ARM POSITION TYPE

TYPICAL EXPRESS LANE, SHOULDER, BUFFER AND GUL (TRANSCORE)

Exhibit 250.2-2 Conduent Gantry Toll Equipment Layout

NON-ACCESSIBLE GANTRY LAYOUTS



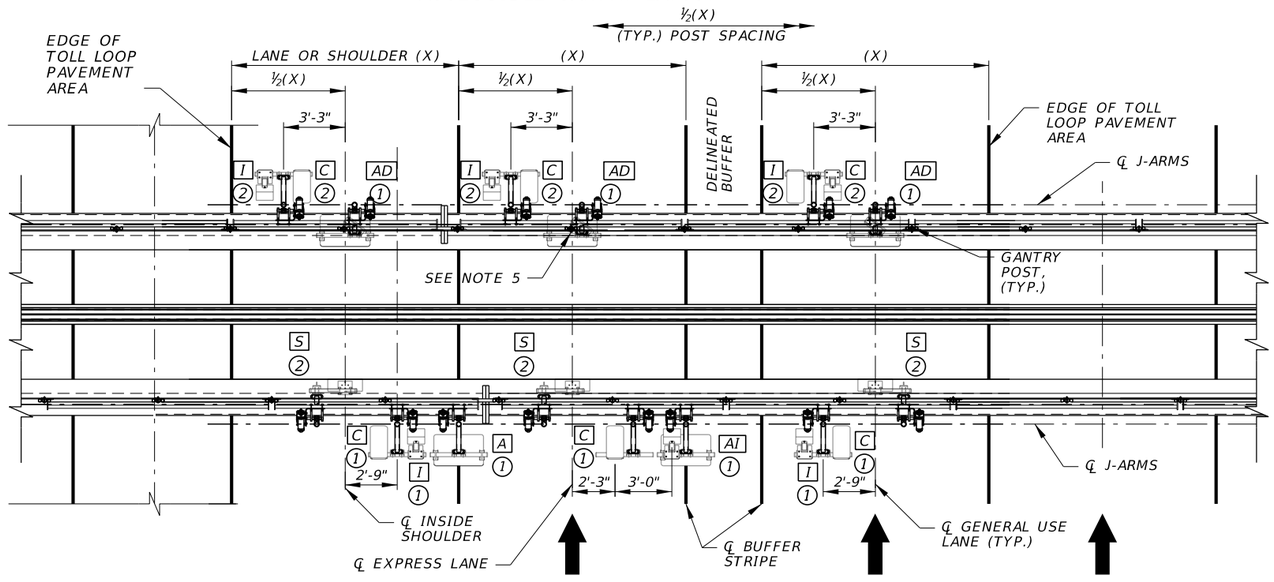
TYPICAL TOLL SHOULDER (CONDUENT)

TYPICAL TOLL LANE (CONDUENT)

TYPICAL SINGLE LANE RAMP AND SHOULDER (CONDUENT)

TYPICAL EXPRESS LANE, SHOULDER, BUFFER AND GUL (CONDUENT)

ACCESSIBLE GANTRY LAYOUT



TYPICAL EXPRESS LANE, SHOULDER, BUFFER AND GUL (CONDUENT)

CONDUENT LEGEND

- A — ANTENNA
- C — CAMERA
- I — ILLUMINATOR
- S — SICK LASER
- AD — ANTENNA/DVAS
- AI — ANTENNA/ILLUMINATOR
- (#) — J-ARM POSITION TYPE

NOTES TO PREPARER:

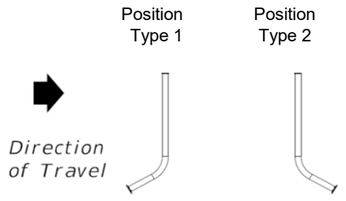
1. TOLL EQUIPMENT LOCATION IS BASED ON THE CENTER OF THE EQUIPPED LANE / SHOULDER.
2. J-ARM LOCATION IS BASED ON THE MOUNTING REQUIREMENTS OF THE TOLL EQUIPMENT.
3. ANTENNAS ARE NOT REQUIRED OVER EDGE OF PAVEMENT SHOULDER.
4. TOLL EQUIPMENT CAN BE MIRRORED ABOUT THE CENTER OF THE LANE.
5. THE EQUIPMENT J-ARM CONNECTION POINT MAY BE SHIFTED HORIZONTALLY WITHIN THE LIMITS OF THE MOUNTING HARDWARE TO MITIGATE CONFLICT WITH STRUCTURAL ELEMENTS. SEE EXHIBIT 252.1-3.
6. FOR THE ACCESSIBLE GANTRY, THE J-ARM FOR THE REAR ANTENNA MUST BE SHIFTED 8" FROM THE CENTER IN ORDER FOR THIS ASSEMBLY TO CLEAR THE REAR CAMERA EQUIPMENT DURING RETRACTION.
7. TOLL EQUIPMENT IS NOT REQUIRED FOR SHOULDER WIDTHS LESS THAN 6 FEET.
8. "AD" ARE NOT REQUIRED AT SINGLE LANE RAMP SHOULDERS OR EDGE OF SHOULDER PAVEMENT
9. ONE DVAS REQUIRED FOR EACH EXPRESS AND ADJACENT GENERAL USE LANE.
10. PROVIDE A MINIMUM OF 3'-0" SEPARATION BETWEEN ℄ OF VES CAMERA AND ℄ OF ILLUMINATOR. REQUIREMENT APPLIES TO TOLLED LANES ONLY.
11. ON THE APPROACH SIDE OF THE GANTRY, INSTALL A/I OVER TRAVEL LANES AND C/I OVER SHOULDERS.

Exhibit 250.2-3 Toll Equipment Loads

TRANSCORE SYSTEMS - TOLL EQUIPMENT ARM POSITIONS, WIND LOAD AREAS AND WEIGHTS

J-Arm Mounting Gantry Location	Clearance from Bottom of J-arm to Final Riding Surface of Pavement	J-Arm Mounting Position Type (See Below)	Equipment / Device	Longitudinal Area to be Used for Wind Load (sq. in.) (Does not include the coefficient of drag) (Direction of Travel)	Transverse Area to be Used for Wind Load (sq. in.) (Does not include the coefficient of drag) (Perpendicular to Direction of Travel)
Approach	18'-6"	2	OPUS	250	234
Departure	18'-6"	1	Front VCAR	681	217
Departure	18'-6"	2	Rear VCAR	681	217
Approach	18'-6"	1	ANTENNA/DVAS	630+68 = 698	74+68 = 142
Departure	18'-6"	1	ANTENNA/OPUS	630 + 250 = 880	74 + 234 = 308
Approach/Departure	19'-6"	1/2	Illuminator (Toll Zone)	368	266
			AVI Enclosure	335	198

Toll Equipment J-Arm Mounting Positions



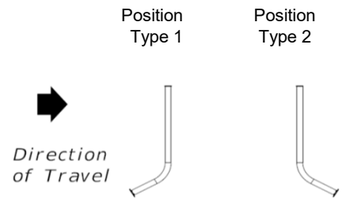
Weight of Equipment and Attachment Hardware	
VCAR	55 lbs
OPUS	20 lbs
Antenna	31 lbs
Illuminator	80 lbs
DVAS	20 lbs
AVI Enclosure	32 lbs

Note: Refer to GTR ***251.1*** for minimum design dead loads.

CONDUENT SYSTEMS - TOLL EQUIPMENT ARM POSITIONS, WIND LOAD AREAS AND WEIGHTS

J-Arm Mounting Gantry Location	Clearance from Bottom of J-arm to Final Riding Surface of Pavement	J-Arm Mounting Position Type (See Below)	Equipment / Device	Longitudinal Area to be Used for Wind Load (sq. in.) (Does not include the coefficient of drag) (Direction of Travel)	Transverse Area to be Used for Wind Load (sq. in.) (Does not include the coefficient of drag) (Perpendicular to Direction of Travel)
Approach	18'-6"	1	CAMERA/ILLUMINATOR	356	175
Approach	18'-6"	2	SICK w/ Shroud	457	128
Approach	18'-6"	2	ANTENNA/ILLUMINATOR	774	133
Approach	18'-6"	1	ANTENNA	630	74
Departure	18'-6"	2	CAMERA/ILLUMINATOR	356	175
Departure	18'-6"	1	ANTENNA/DVAS	630+68=698	74+68=142
			AVI ENCLOSURE	335	198
			AVI CABINET	1260	672

Toll Equipment J-Arm Mounting Positions



Weight of Equipment and Attachment Hardware	
Camera	14 lbs
Illuminator	12 lbs
Antenna	31 lbs
SICK w/ Shroud	30 lbs
DVAS	20 lbs
AVI Enclosure	32 lbs
AVI Cabinet	120 lbs

Note: Refer to GTR ***251.1*** for minimum design dead loads.

250.2.1 J-arm Positioning on the Gantry

The approach and departure J-arm centerlines must be equidistant from the gantry centerline as per the following:

(1) Non-accessible gantry – 5 feet, 9 inches

(2) Accessible gantry – 5 feet, 9½ inches

250.2.2 Vertical Clearance

(1) The following vertical clearances must be provided within the toll loop pavement area, for all interim and ultimate conditions:

  (a) Eighteen feet, six inches (18’-6”) to the bottom of the J-arm for all gantry-mounted toll equipment devices except the vehicle detection and classification system (VDAC) laser unit. The VDAC laser unit system must be twenty four feet, six inches (24’-6”) to the top of the J-arm. This clearance is the distance above the traffic lane or shoulder directly below.

  (b) A minimum of 18-feet for any gantry structural element. This clearance is the least distance between the lowest point of any structural element (gantry or support framing) and the traffic lane or shoulder directly below.

(2) Use the APE to set the truss elevation to ensure that the J-arm adjustability above the roadway surface as defined in ***GTR 252.1.2*** is not exceeded along the cross slope of the toll loop pavement area. See ***GTR 220.2*** for additional information.

  (a) The truss elevation must be a constant across each gantry span.

  (b) For a single span across both directions of travel, a single APE must be calculated using both directions of travel.

  (c) The APE is applied separately to each direction of travel for non-accessible span gantries, when a center column is used.

  (d) A single APE must be calculated using both directions of travel, for accessible gantries, when a center column is used and the truss elevation must be constant across both gantry spans.

250.2.3 Toll Equipment Operation and Maintenance

(1) The toll equipment operation and maintenance must not be compromised by any mounting hardware or gantry element.

(2) Non-accessible gantry elements must allow the J-arms to be located anywhere along the horizontal support pipes.

(3) Non-accessible gantry W-section member spacing must be as follows:

  (a) Equipment layout conflicts: Avoid physical conflicts with Toll Equipment layout for all vendors.

(b) Multiple equipped lanes at span gantries: ½ the width of the equipped lane. When equipped lane and shoulder widths under the gantry are not identical, the width of the majority of the equipped lanes and shoulders must be used.

(c) Single lane ramps: Gantry W-section member spacing must be 6 feet.

(d) Truss web angle connection plates: W-section members must not be located in the same longitudinal position with truss web angle connection plates.

(e) W-section members closest to the upright may deviate from the spacing described in (b) and (c) above to ensure there are no conflicts per (a) and (d) above.

(f) W-section members are required where needed to support all longitudinal cable trays along the gantry over equipped and non-equipped lanes.

(4) Accessible gantry swing gate post spacing must be:

(a) Evenly spaced except as noted in item (c) below.

(b) No greater than 6 feet from centerline of post to centerline of post.

(c) Adjusted as necessary to avoid equipment conflicts.

(5) There must be a 5/8-inch minimum vertical clearance between any gantry element and any gantry-mounted toll equipment in both operation and maintenance positions. See exhibits from ***GTR 254.2*** for toll equipment operation and maintenance positions at an accessible gantry.

(6) Field splices must be located to avoid conflicts for all interim and ultimate conditions as follows:

(a) Non-accessible gantry W-section member layout

(b) Accessible gantry equipment retraction assembly inclusive of gate posts, gear box layout, etc.

(7) See ***GTR 254.3 (3)*** for additional layout requirements for accessible gantries.

251 Toll Gantry Structural

251.1 General Structural Requirements

(1) Gantries must be treated as sign structures when applying the requirements of the current ***Standard Plans***.

(2) Gantries must be designed as per LRFD LTS-1 and applicable interims, and ***Structures Manual***, ***Volume 3*** for the 700-year Extreme Event Limit State wind speed based on location.

(3) Gantries must be designed as per LRFD LTS-1 and applicable interims, and ***Structures Manual***, ***Volume 3*** fatigue requirements.

(4) See exhibits from ***GTR 250.2*** for the toll equipment type, position, and wind areas for all TEC systems. See ***GTR 250.2.3*** for additional requirements.

(5) Tolling Equipment Dead Load:

Gantries must be designed to carry all attached items (toll equipment, toll equipment structure mounting hardware, retraction assemblies, raceways, strut channel supports, etc.):

(a) The design dead load of the tolling equipment mounted on each toll equipment arm must be at least 55 pounds or the actual weight of the equipment, whichever is greater. The 55-pound allowance does not include the weight of the toll equipment support arm, J-arm, and latch mechanism or retraction assemblies.

(b) Gantries must support a minimum uniform superimposed dead load of 200 pounds per linear foot across the entire structure, divided as appropriate among the superstructure chords, to account for the self-weight of the raceways, and other associated electrical items.

(6) The horizontal truss element for each span of a two-span gantry must be designed as simply supported independent spans.

(7) Gantry foundations must use steel reinforcing.

(8) Signs of any type must not be attached to the gantry.

(9) Gantries must be detailed as per the ***Structures Manual***.

(10) All gantries must be hot-dipped galvanized. No other coatings (paint, etc.) can be applied unless approved by the District Materials Office. Written documentation (email or meeting notes documentation) of concurrence from the District Materials Office is acceptable.

(11) Toll gantries must be designed to meet the following fabrication restrictions:

(a) If field welding is permitted by the CEI in accordance with the ***Standard Specifications***, the welding procedures shall be reviewed and approved by Turnpike Materials Office.

(b) Shop welded splices of main chords are not permitted.

(c) Shop welded splices of uprights are not permitted except as allowed in ***Standard Plans*** ***Index 700-041***. If splices are required, they must be detailed in the structural plans for the gantry subcomponent.

251.2 Gantry Superstructure

(1) Gantries must have a multi-chord truss superstructure system for the horizontal element.

(2) The gantry truss must be horizontal and level (not parallel to the cross slope of the roadway).

(3) The natural frequency of any element that supports the equipment must be less than 500 Hz. Equipment is defined as any electronic device that is mounted to the gantry.

(4) Movements due to wind loads must meet the following criteria for the averaged effect on the top and bottom truss chords:

(a) Span gantries subject to wind speed of 30 mph:

- Movement of any point along the chords must not exceed 1.25 inches relative to the position of any other point along the chords.
- Rotational orientation of any point along the chords must not exceed 8 milliradians (0.47 degrees) relative to the rotational orientation of that point at rest, for all three rotational axes.

(b) Cantilever gantries subject to wind speeds between 25 and 45 mph:

- Movement of any point along the chords must not exceed 2.2 inches relative to the position of any other point along the chords.
- Rotational orientation of any point along the chords must not exceed 14 milliradians (0.80 degrees) relative to the rotational orientation of that point at rest, for all three rotational axes.

(5) All structural elements supporting gantry-mounted electronic devices must:

(a) Meet all rigidity/frequency requirements indicated above for the gantry.

(b) Attach to the gantry with a redundant connection system.

251.3 Minimum Material Requirements

Include protection against galvanic corrosion when dissimilar materials are used. Dissimilar metals must be separated by inert dielectric material.

251.3.1 Steel

(1) Upright and Truss Chords (Steel Pipe): API 5L X42 PSL2, 42 ksi yield or ASTM A500, Grade B (Min.).

(2) Steel Angles, Structural Plates and Bars: ASTM A709 grade 36 or 50 (as required by design).

(3) Bolts, Nuts and Washers:

- (a) High Strength Bolts: ASTM F3125, Grade A325 Type 1
- (b) Nuts: ASTM A563 Grade DH Heavy-Hex Nuts
- (c) Washers: ASTM F436 Type 1, one under turned element.

(4) Anchor Bolts, Nuts and Washers:

- (a) Anchor Bolts: ASTM F1554, Grade 55
- (b) Nuts: ASTM A563 Grade DH heavy-hex, 5 per bolt
- (c) Plate Washers: ASTM F436, Type 1, 2 per bolt.

(5) U-Bolt Assemblies

- (a) U-Bolts: ASTM A193
- (b) Nuts: ASTM A194, 4 per bolt
- (c) Washers: ASTM F436, Type 1, 2 per bolt

(6) Galvanization: Components must meet the requirements of ***Standard Specifications*** **Section 962-11**.

251.3.2 Aluminum

(1) Components must meet the requirements of ***Standard Specifications*** ***Section 965***.

(2) Bars, Plates, Stiffeners, Backing Ring, Shims, Shapes must be Alloy 6061-T6.

251.3.3 Stainless Steel

(1) Plates: Type 304L per ASTM A240

(2) Structural Shapes and U-bolt Assemblies: Type 316L per ASTM A276

(3) Stainless Steel Screws, Bolts, Washers and Nuts: Grade 18-8, unless otherwise noted.

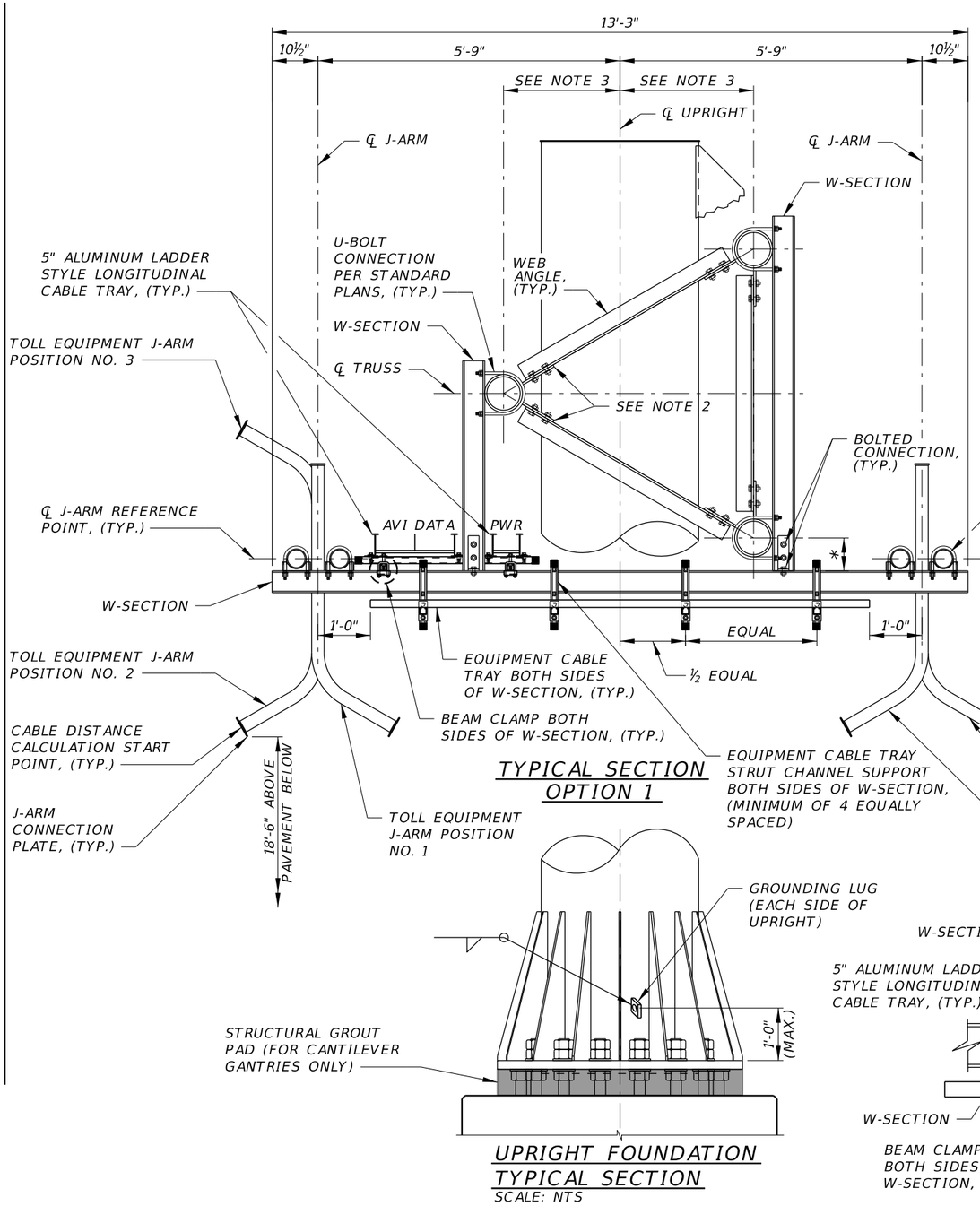
251.4 Non-Accessible Gantries

(1) Non-accessible gantries must be a tri-chord truss as shown in ***Exhibit 251.4-1***.

(2) A channel assembly must be used to support the vertical conduit routing along the upright for gantry power, data, and AVI cables. See ***Exhibit 251.4-2*** and ***Exhibit 251.4-3***.

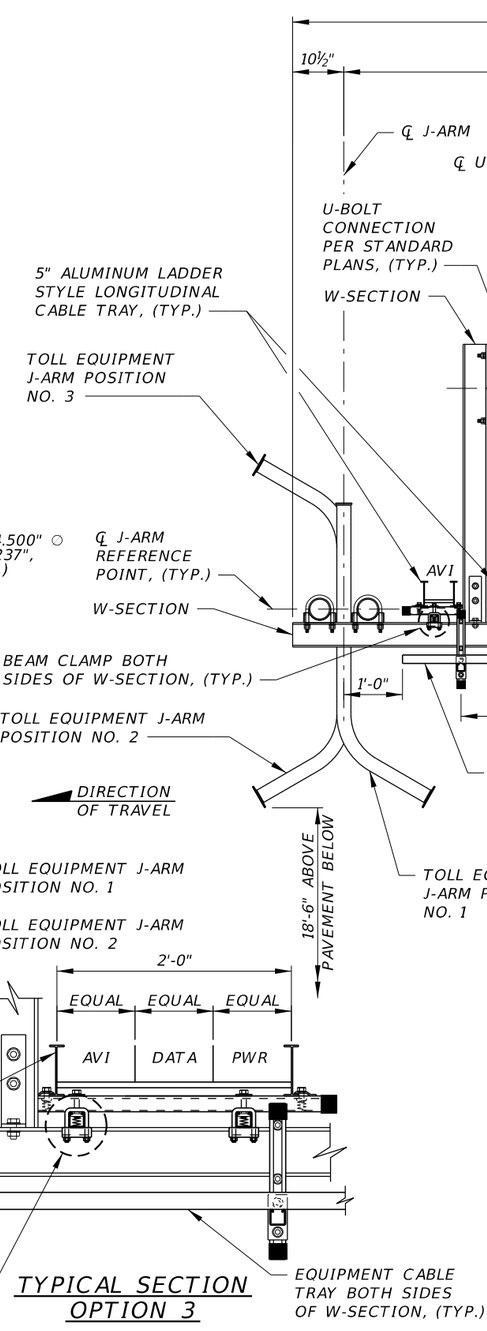
(3) Bent plates must be used to connect the vertical and horizontal W-Section members as shown in ***Exhibit 251.5-2***.

Exhibit 251.4-1 Non-Accessible Gantry Typical Section



TYPICAL SECTION OPTION 1

UPRIGHT FOUNDATION TYPICAL SECTION
SCALE: NTS



TYPICAL SECTION OPTION 2

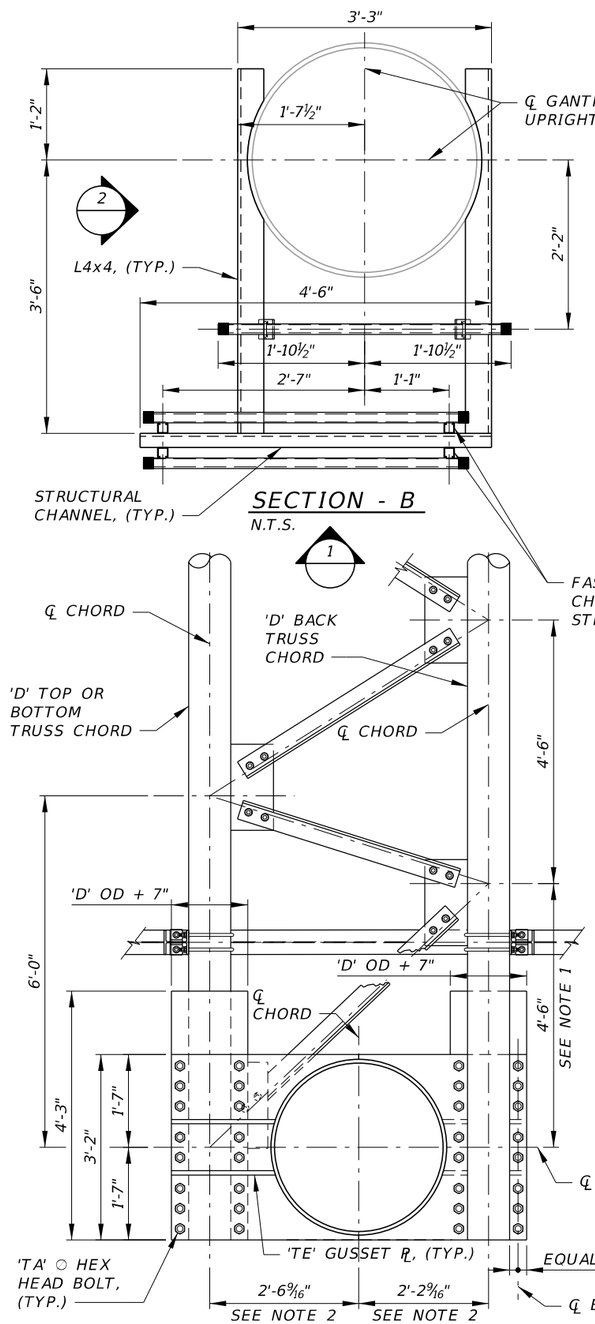
TYPICAL SECTION OPTION 3

NOTES TO PREPARER:

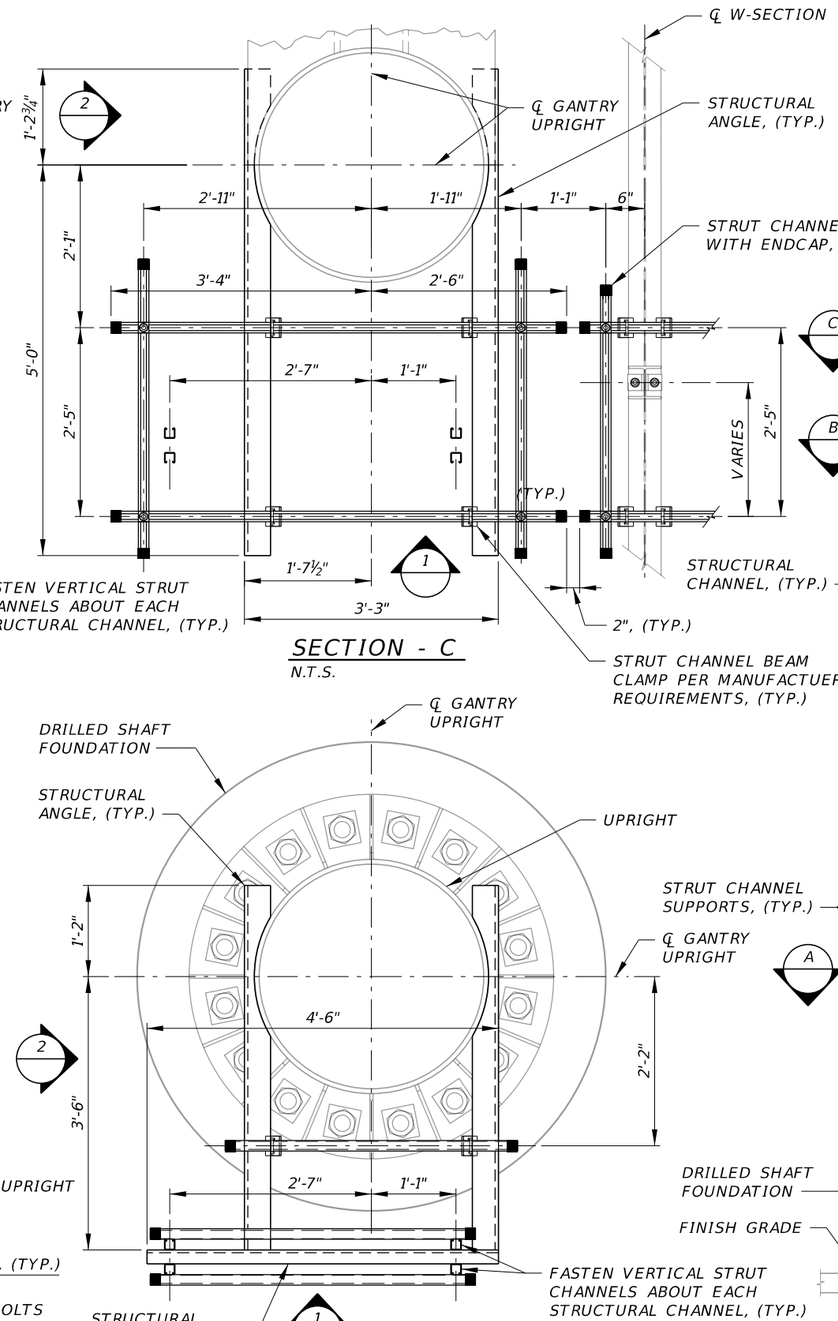
1. *SEE "TABLE OF STRUCTURE VARIABLES" FOR ADDITIONAL INFORMATION.*
2. *FOR CANTILEVER GANTRIES, ADJUST LOCATION OF GUSSET PLATE ON THE MIDDLE CHORD CLOSEST TO THE UPRIGHT TO AVOID CONFLICT BETWEEN UPRIGHT AND WEB ANGLE.*
3. *FOR CANTILEVER GANTRIES, OFFSET TRUSS TO ENSURE NO CONFLICTS BETWEEN UPRIGHT AND WEB ANGLE.*
4. *THE DISTANCE FROM THE BOTTOM OF THE J-ARM CONNECTION PLATE TO THE CENTERLINE OF THE HORIZONTAL SUPPORT PIPES (HSS 4.500) WHEN THE J-ARM IS LOCATED IN THE NOMINAL POSITION IS 3'-4⅜".*
5. *DIMENSION PER STANDARD PLANS 0700-041.*
6. *REFER TO FDM 261 FOR ADDITIONAL REQUIREMENTS.*

∗ = 6" MINIMUM, 1'-0" MAXIMUM.

Exhibit 251.4-2 Cantilever Plan and Upright Structural Details for Conduit Support

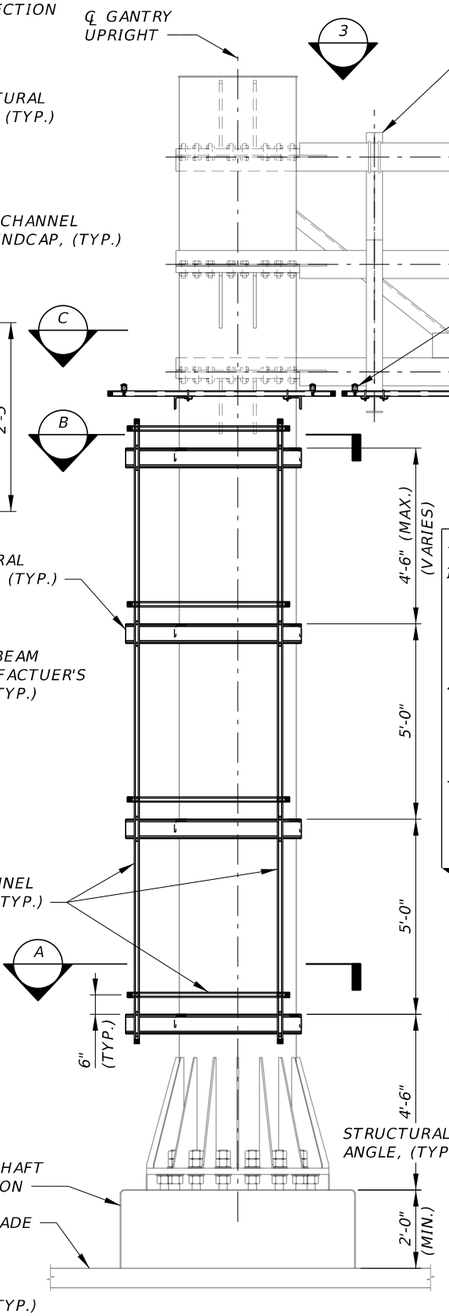


3 WEB ANGLE CONNECTION - PLAN
N.T.S.



SECTION - C
N.T.S.

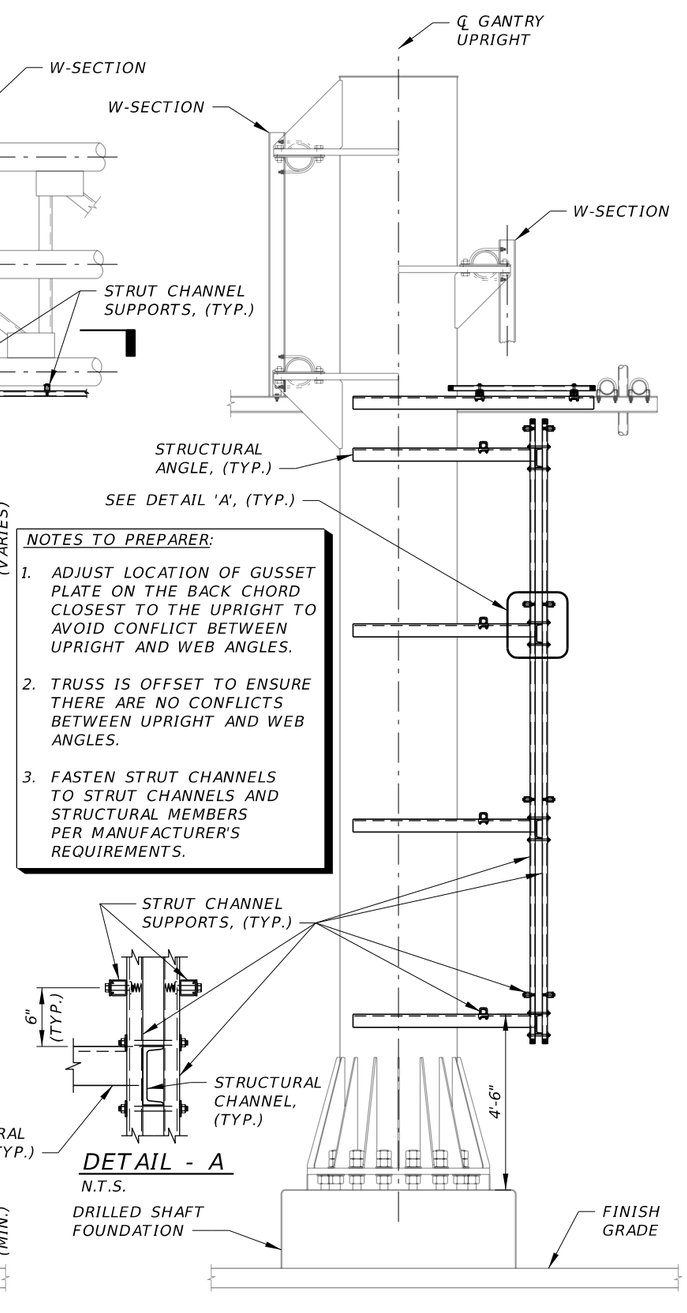
SECTION - A
N.T.S.



1 GANTRY UPRIGHT - VIEW
N.T.S.

NOTES TO PREPARER:

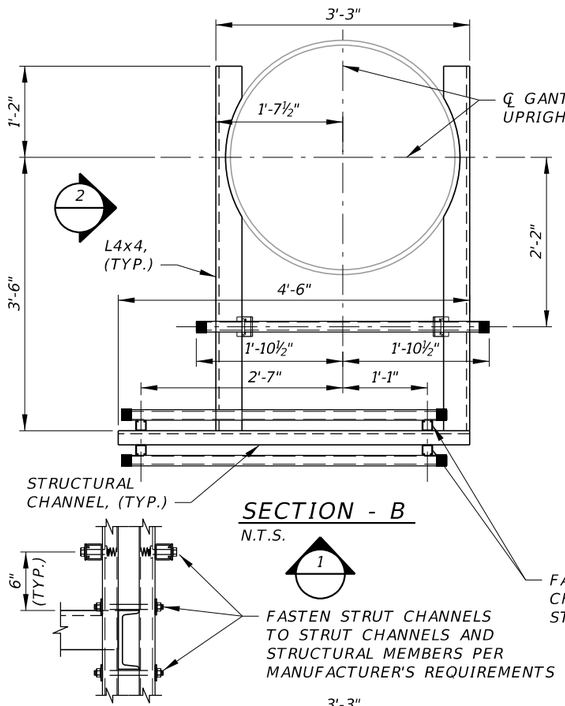
1. ADJUST LOCATION OF GUSSET PLATE ON THE BACK CHORD CLOSEST TO THE UPRIGHT TO AVOID CONFLICT BETWEEN UPRIGHT AND WEB ANGLES.
2. TRUSS IS OFFSET TO ENSURE THERE ARE NO CONFLICTS BETWEEN UPRIGHT AND WEB ANGLES.
3. FASTEN STRUT CHANNELS TO STRUT CHANNELS AND STRUCTURAL MEMBERS PER MANUFACTURER'S REQUIREMENTS.



DETAIL - A
N.T.S.

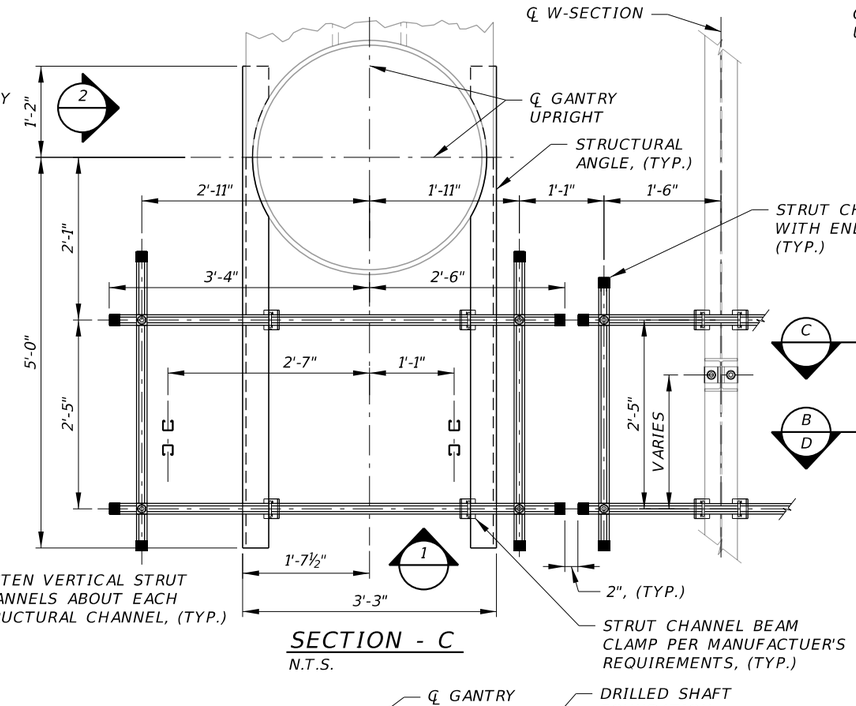
2 GANTRY UPRIGHT - VIEW
N.T.S.

Exhibit 251.4-3 Span Upright Structural Details for Conduit Support

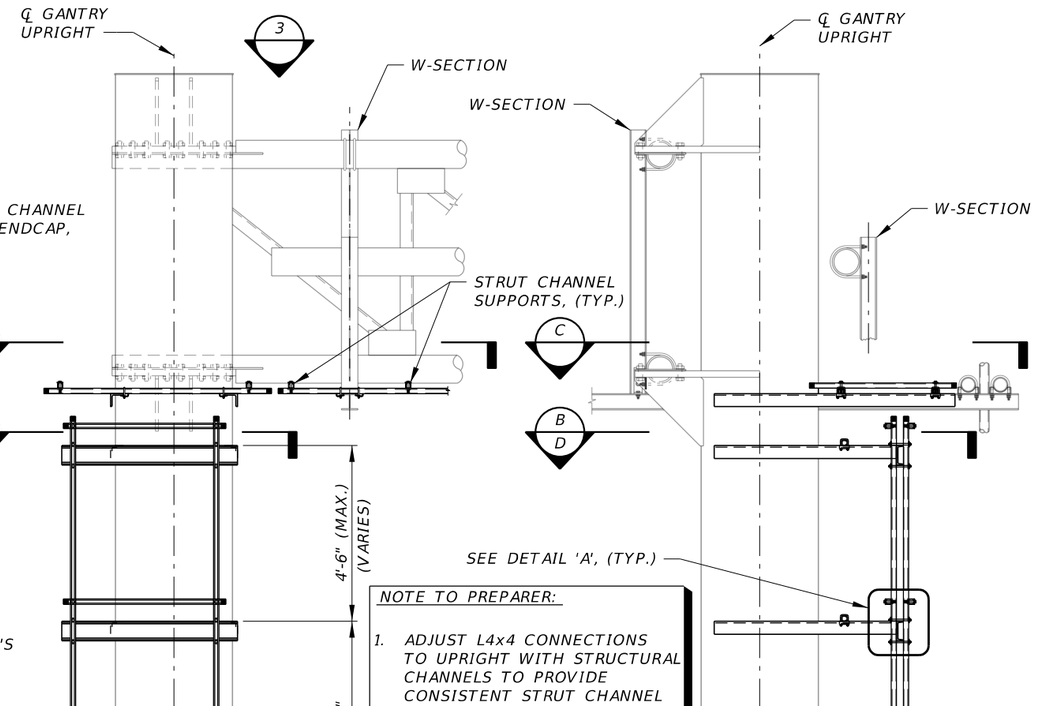


SECTION - B
N.T.S.

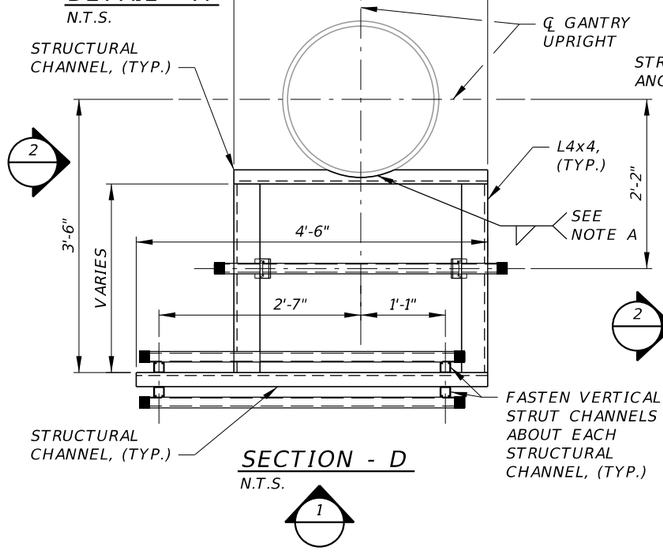
DETAIL - A
N.T.S.



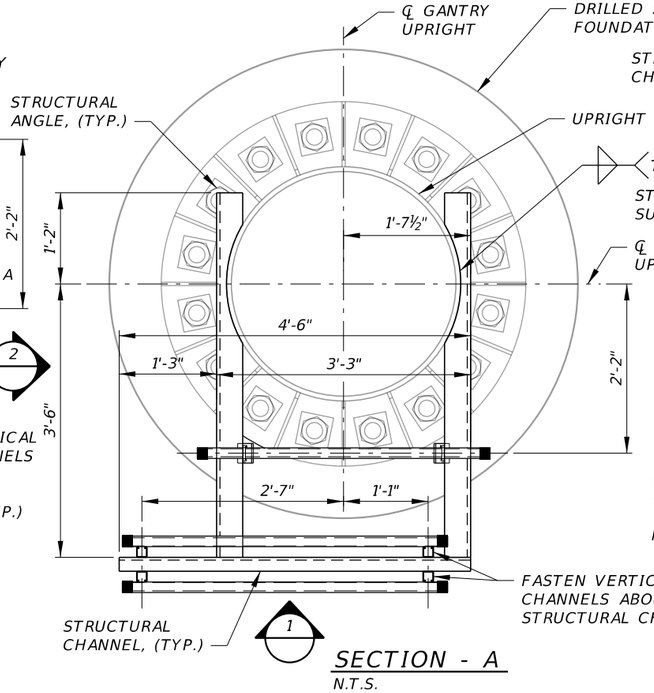
SECTION - C
N.T.S.



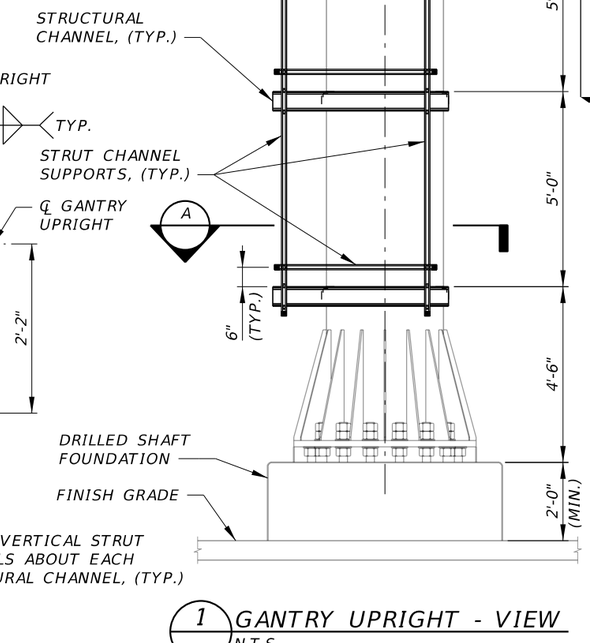
1 GANTRY UPRIGHT - VIEW
N.T.S.



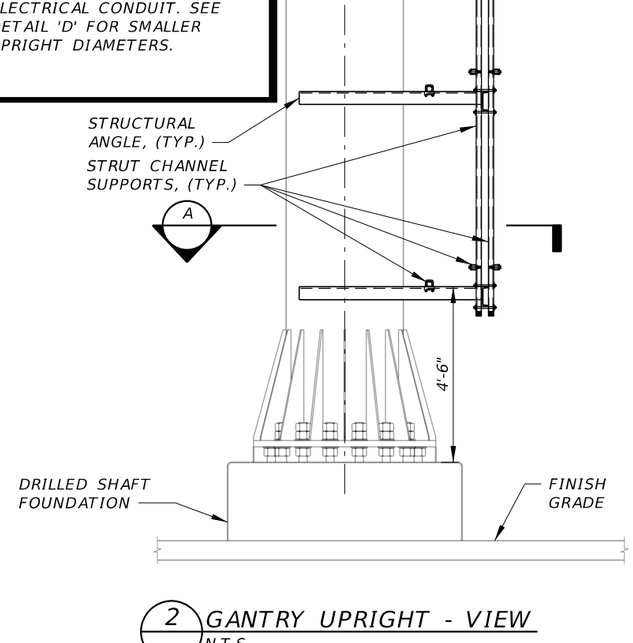
SECTION - D
N.T.S.



SECTION - A
N.T.S.



1 GANTRY UPRIGHT - VIEW
N.T.S.



2 GANTRY UPRIGHT - VIEW
N.T.S.

NOTE A:

WELD TOP AND BOTTOM FLANGES OF STRUCTURAL CHANNEL TO FACE OF UPRIGHT.

251.5 Non-Accessible Cantilever Gantry Structural Requirements

(1) Structural configuration of cantilever gantries must be based on the ***Standard Plans*** ***Index 700-040,*** Cantilever Sign Structure, except for the offsets between the centerline of upright and centerline of truss chords and the location of the back chord gusset plates closest to the upright as shown in ***Exhibit 251.4-1*** and ***Exhibit 251.4-2***. These modifications provide space for longitudinal cable trays as described in ***GTR 255.5.2***. and ensure there is no conflict between the upright and web members.

(2) Cantilever gantries must have three (3) truss chords with a single upright in a cantilever configuration.

(3) Cantilever truss span lengths must be 30, 36, 42, or 48 feet.

(4) Toll equipment layout and horizontal support pipe requirements may control the cantilever span length by increasing to the next allowable span length. See ***GTR 250.2*** and ***GTR 253*** and item (3) above.

(5) When a chord splice is required and permitted by the ***Standard Plans***, an alternate splice connection detail (bolted flange connection), similar to the connection shown ***Standard Plans*** ***Index 700-041,*** Span Sign Structure must be provided. No other type of splice connections for the truss chords are permitted.

(6) The gantry must be designed for one future sign panel, 12 feet wide by 10 feet high, centered over the combined travel lanes. Other future signs (as defined in ***Volume 3*** of the ***Structures Manual***,) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

(7) Toll equipment support elements including but not limited to horizontal support pipe, J-arms and mounting hardware must not extend beyond the end of the longest truss chord.

(8) The upright must be filled with concrete for the full height. Upright handholes are not required.

(9) Provide an angle along the upright to mitigate the effects of vortex shedding as shown in ***Exhibit 251.5-3***.

(10) Use ***Exhibit 251.5-1*** to confirm compliance with strength and fatigue requirements for the site-specific cantilever gantry conditions. If compliance cannot be demonstrated, then a non-accessible span gantry is required.

(11) The structural element requirements noted below provide compliance with vibration, rotation, natural frequency and other dynamic effects. Use ***Exhibit 251.5-1*** and ***Exhibit 251.4-2*** for the structural element requirements as follows:

(a) The upright height (A) is a site-specific dimension, not to exceed 24 feet.

(b) The remaining element sizes and dimensions must not be changed and must be as shown in the Table of Variables in ***Exhibit 251.5-1*** and ***Exhibit 251.4-2***.

(c) Calculate the back rake (G) for the site-specific conditions.

Exhibit 251.5-1 Table of Structure Variables

CANTILEVER GANTRY STRUCTURES DATA TABLE									
GANTRY	STATION	DIMENSIONS				PANELS	MEMBER SIZES			BACKRAKE
		A *	B		C	N	D (CHORD)	E (WEB)	F (UPRIGHT)	G
		ft	ft	in	in	#	O. D. x Wall Thk. (in)	Angle (in)	O. D. x Wall Thk. (in)	in
48'-0"	##+##.##	24.000	6	0	66	8	8.625 x 0.500	4 x 4 x 0.500	36.000 x 0.750	#
42'-0"	##+##.##	24.000	6	0	66	7	8.625 x 0.500	4 x 4 x 0.500	36.000 x 0.750	#
36'-0"	##+##.##	24.000	6	0	66	6	6.625 x 0.500	4 x 4 x 0.500	36.000 x 0.750	#
30'-0"	##+##.##	24.000	6	0	66	5	6.625 x 0.500	4 x 4 x 0.500	36.000 x 0.750	#

* 24'-0" is a maximum value.

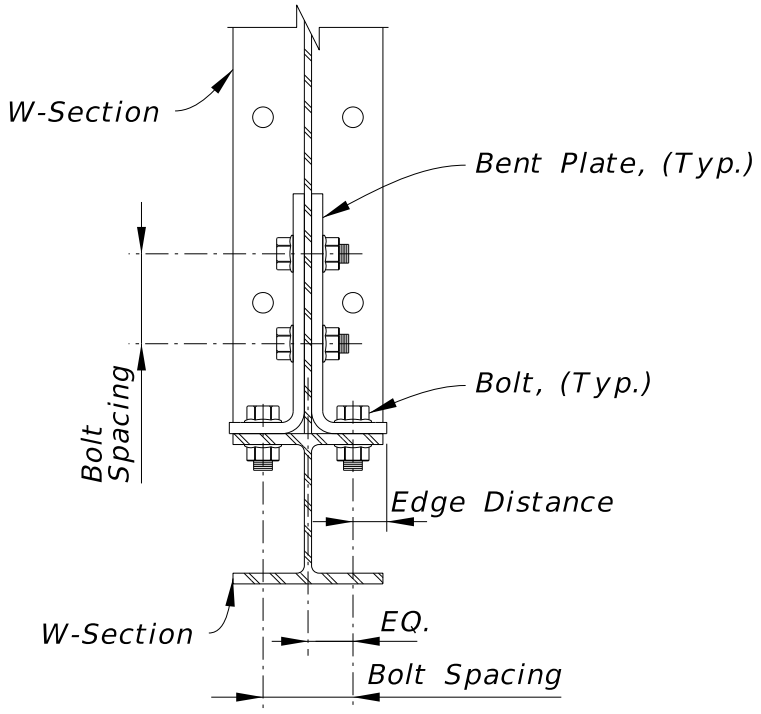
CANTILEVER GANTRY STRUCTURES DATA TABLE (CONTINUED)																													
GANTRY	GUSSET PLATES																TRUSS CONNECTION									ALTERNATE SPLICE					
	GA	GB	GC		GD		GE		GF		GG		GH		GJ		GK	TA	TB	TC	TD	TE	TF	TG	TH	TJ	PA	PB	PC	PD	PE	PF
	in	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	in	in	#	#	in	in	in	in	in	in	in	in	in	in	in	#
48'-0"	½	1	1	5⅝	0	8⅛	1	2½	0	7⅝	1	5⅝	1	5⅝	0	11	⅜	1¼	16	16	2	⅞	¾	½	½	½	1⅜	2	⅜	⅜	1	9
42'-0"	½	1	1	5⅝	0	8⅛	1	2½	0	7⅝	1	5⅝	1	5⅝	0	11	⅜	1¼	16	16	2	⅞	¾	½	½	½	1⅜	2	⅜	⅜	1	9
36'-0"	½	⅞	1	3¼	0	7½	1	0⅜	0	7¼	1	3¼	1	3¼	0	9⅜	5⁄16	1¼	16	16	1¼	9⁄16	5⁄16	5⁄16	5⁄16	5⁄16	NA	NA	NA	NA	NA	NA
30'-0"	½	⅞	1	3¼	0	7½	1	0⅜	0	7¼	1	3¼	1	3¼	0	9⅜	5⁄16	1¼	16	16	1¼	9⁄16	5⁄16	5⁄16	5⁄16	5⁄16	NA	NA	NA	NA	NA	NA

CANTILEVER GANTRY STRUCTURES DATA TABLE (CONTINUED)																								
GANTRY	BASE CONNECTION										ANCHOR		FOOTING - DRILLED SHAFT											
	BA	BB	BC	BD	BE		BF	BG	BH	BJ	BK		FA		FB		FC	FD	FE		FF	FG		
	in	#	in	in	ft	in	in	in	in	in	ft	in	ft	in	ft	in	# / Size	#	#	in	#	in		
48'-0"	2¾	16	2	⅞	3	2	5⁄16	5⁄16	5⁄16	5⁄16	#	#	#	#	#	#	#	#	#	#	#	#		
42'-0"	2¾	16	2	⅞	3	2	5⁄16	5⁄16	5⁄16	5⁄16	#	#	#	#	#	#	#	#	#	#	#	#		
36'-0"	2¼	16	2	⅝	2	7	¼	¼	¼	¼	#	#	#	#	#	#	#	#	#	#	#	#		
30'-0"	2¼	16	2	⅝	2	7	¼	¼	¼	¼	#	#	#	#	#	#	#	#	#	#	#	#		

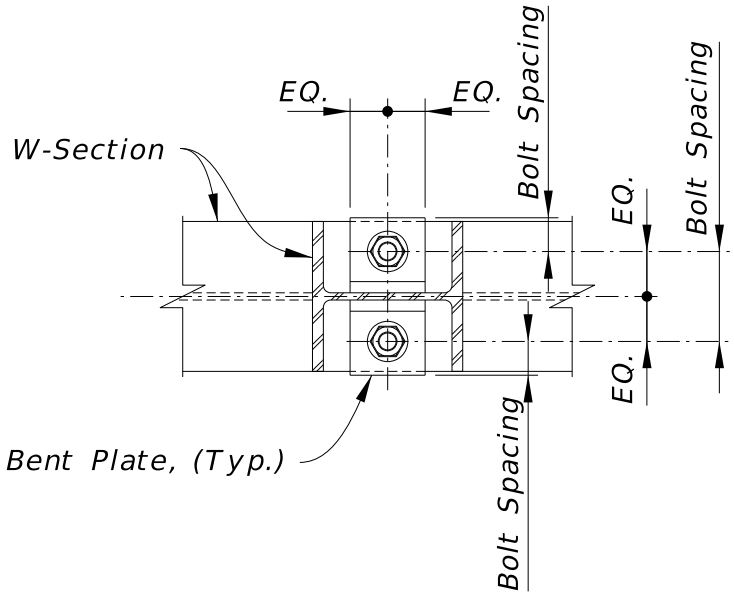
NOTES TO PREPARER:

1. The variables in this Exhibit referenced the 2021-22 Standard Plans 700-040, except for the variables for the splice, which is based on the "Alternate Splice" shown on 2021-22 Standard Plans 700-041.
2. Design Wind Speed = ### mph.
3. # = Site Specific Value.

Exhibit 251.5-2 Non Accessible Gantry Bent Plate Detail

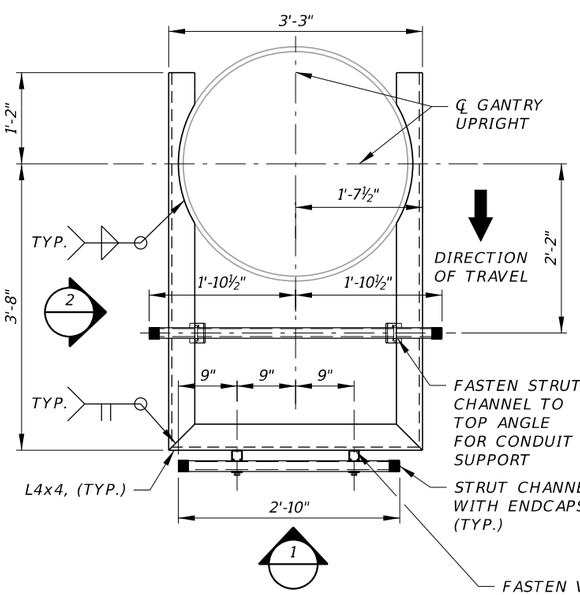


SECTION
SCALE: NTS

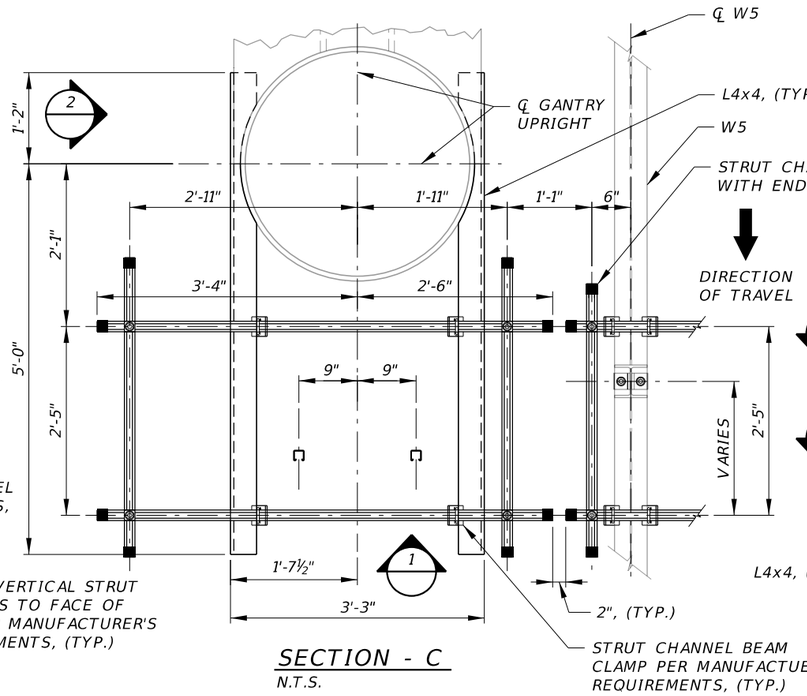


PLAN
SCALE: NTS

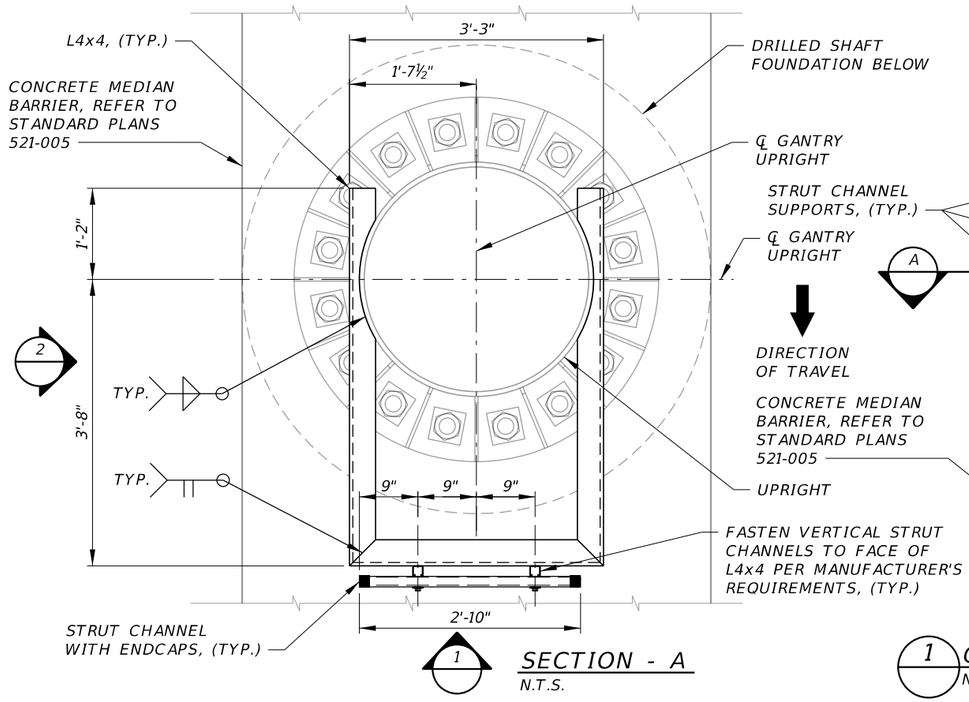
Exhibit 251.5-3 Cantilever Median Upright Structural Details for Conduit Support



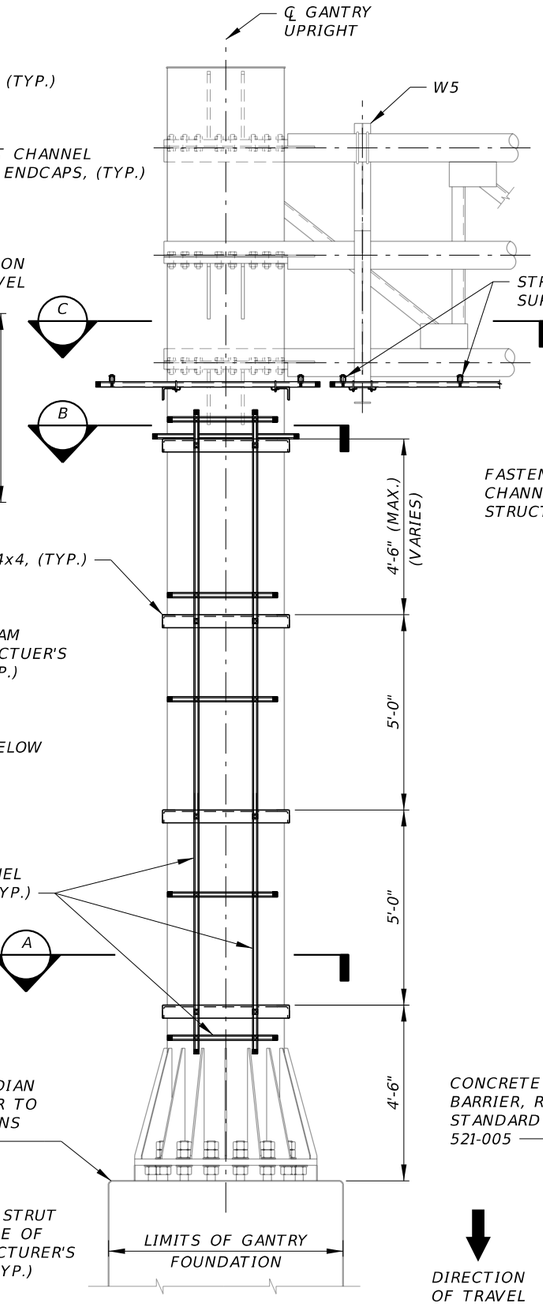
SECTION - B
N.T.S.



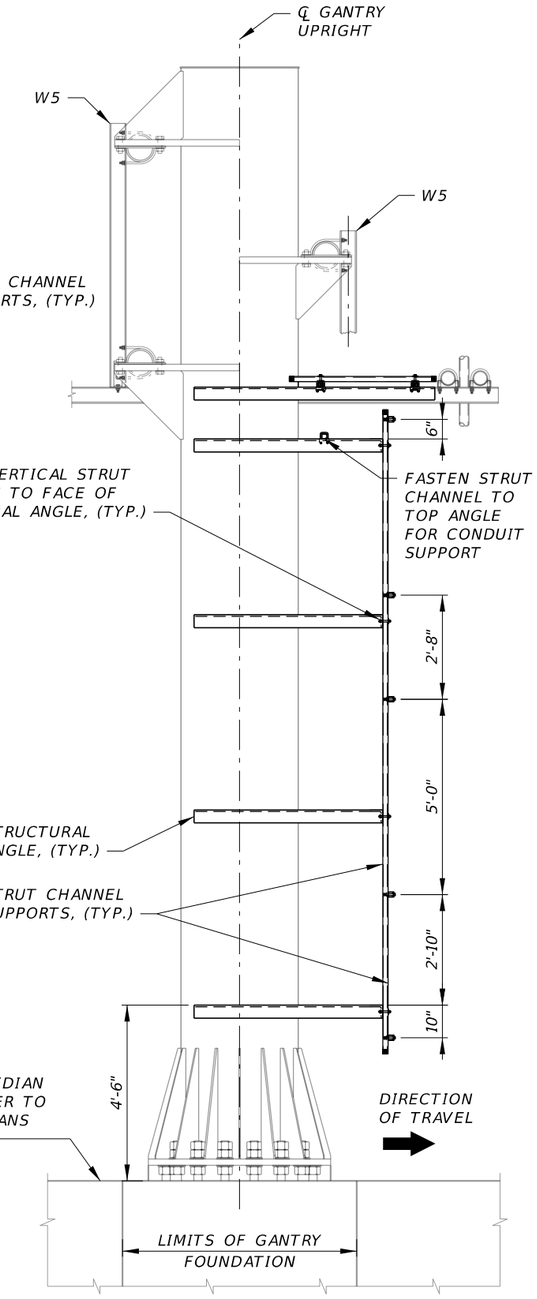
SECTION - C
N.T.S.



SECTION - A
N.T.S.



1 GANTRY UPRIGHT - VIEW
N.T.S.



2 GANTRY UPRIGHT - VIEW
N.T.S.

251.6 Non-Accessible Span Gantry Structural Requirements

(1) Structural configuration of non-accessible span gantries must be based on the ***Standard Plans*, *Index 700-041,*** Span Sign Structure**.**

(2) When a chord splice is required, and permitted by the ***Standard Plans***, an alternate splice connection detail (bolted flange connection), as shown in ***Standard Plans*, *Index 700-041***, must be provided. No other type of splice connections for the truss chords are permitted.

(3) Truss depth must meet the span-to-depth requirements for DMS structures as specified in the ***Structures Manual*, *Volume 3.***

(4) Maximum span length and truss depth must be as specified for sign structures in the ***FDM 261.1***.

(5) The gantry must be designed for one future sign, 12 feet wide by 10 feet high, centered over the combined travel lanes in each direction of travel. Other future signs (as defined in the ***Structures Manual*, *Volume 3***) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

(6) Gantry panel layout must be adjusted to accommodate W-section member spacing as described in ***GTR 250.2.3(3)(b).***

251.7 Accessible Span Gantry Structural Requirements

(1) The accessible gantry is a trapezoidal quad-chord truss supported on two (2) uprights as a span configuration. See ***Exhibit 251.7-1***.

(2) The site-specific structural items that can be changed include: foundation size, length and reinforcement, upright height, and thickness (not diameter) of structural elements.

(3) The accessible gantry design must allow the J-arm retraction assembly system elements to be located anywhere along the horizontal support members.

(4) Configuration of truss chord splice must be in accordance with ***Exhibit 251.7-22***.

(5) Gantry must be designed for future signs, 12 feet wide by 10 feet high, one on each upright at the height of the truss. Other future signs (as defined in the ***Structures Manual*, *Volume 3***) need not be considered. The gantry design must always account for the toll equipment simultaneously with load cases with and without the future sign panel to produce the worst-case loading effect.

(6) Access Elements

Gantry design must include a deck (upper platform) to maintain equipment over live traffic. This allows for secured access to the deck via a lower platform and connecting stairway accessible by maintenance vehicles such as a scissor lift or bucket truck. See ***Exhibit 251.7-2*** for additional requirements.

(7) See exhibits below for required accessible gantry elements:

(a) Truss Connections – ***Exhibit 251.7-3***, ***Exhibit 251.7-4***

(b) Lower Chord Connection – ***Exhibit 251.7-5***

(c) Upper Chord Connection – ***Exhibit 251.7-6***

(d) Upright Structural Details for Wireway Support – ***Exhibit 251.7-7***

(e) Lower Grating – ***Exhibit 251.7-8***

(f) Upper Grating – ***Exhibit 251.7-9***

(g) Stairs and Platforms – ***Exhibit 251.7-10***, ***Exhibit 251.7-11***, ***Exhibit 251.7-12***, ***Exhibit 251.7-13***

(h) Swing Gates and Latches – ***Exhibit 251.7-14***, ***Exhibit 251.7-15***, ***Exhibit 251.7-16***, ***Exhibit 251.7-17***

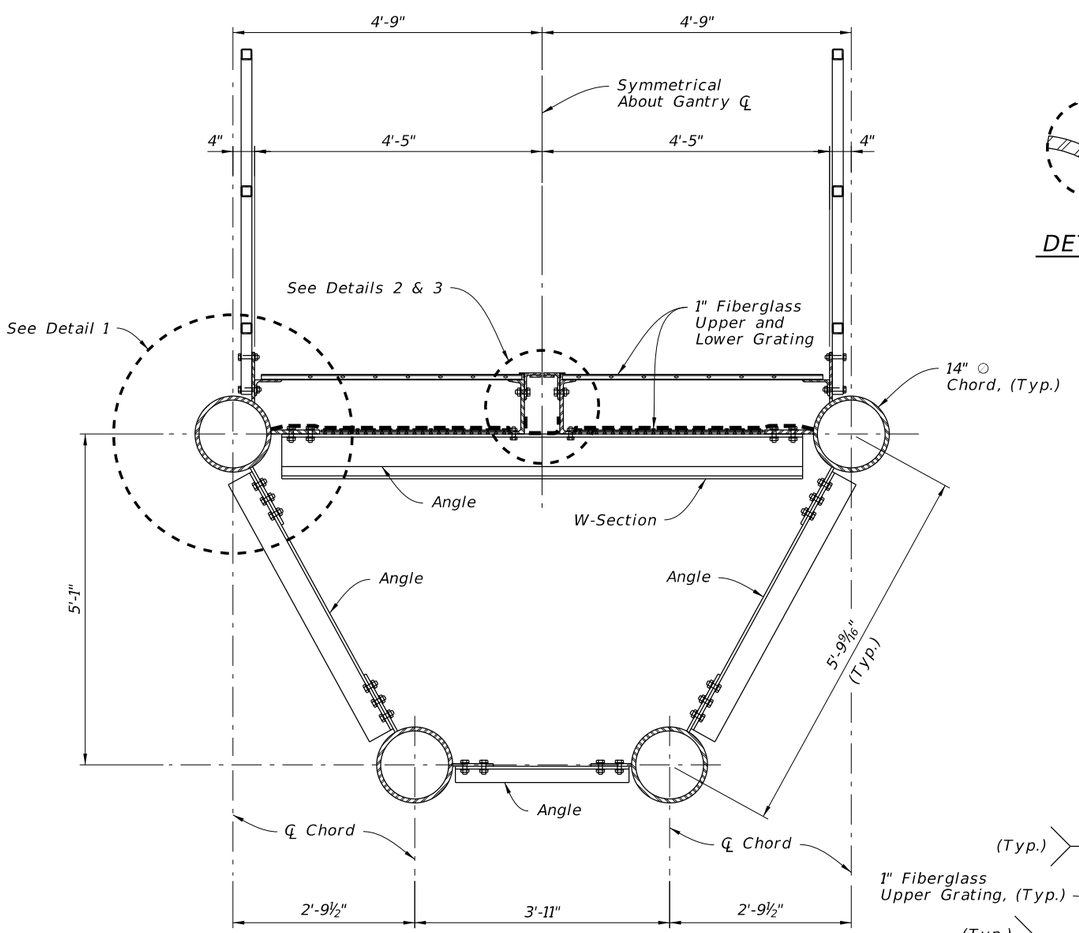
(i) Platform Panels – ***Exhibit 251.7-18***, ***Exhibit 251.7-19***

(j) Fall Restraint System – ***Exhibit 251.7-20***

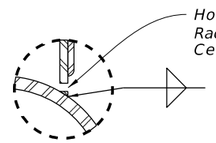
(k) Reinforced Opening in Channels for Cable Tray Pass Thru - ***Exhibit 251.7-21***

(l) Camber and Splice Details - ***Exhibit 251.7-22***

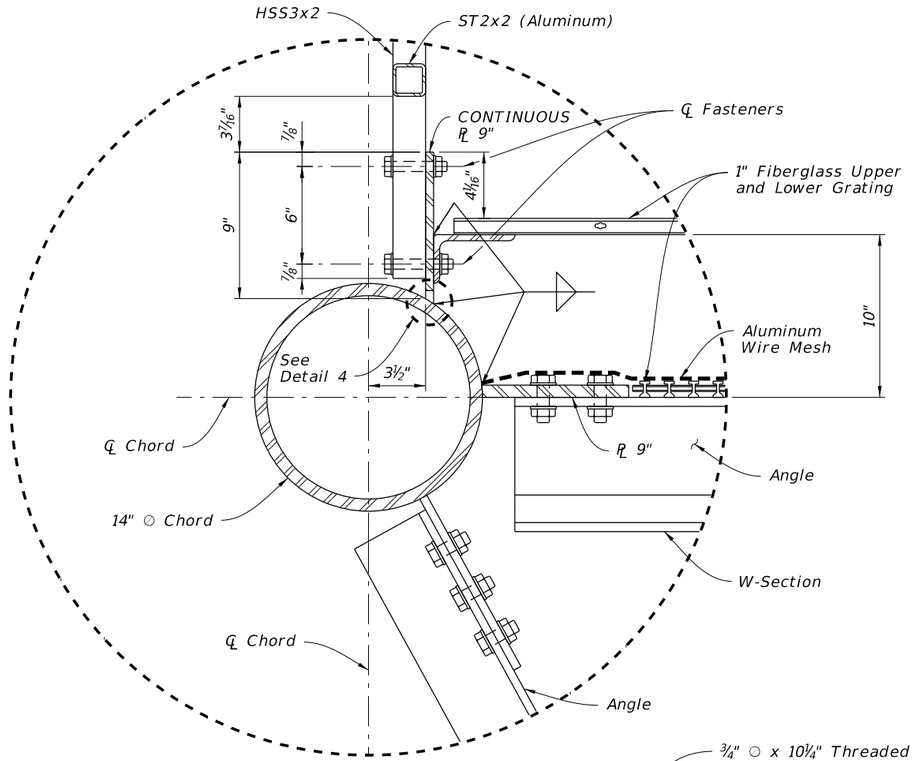
Exhibit 251.7-1 Accessible Gantry Typical Section



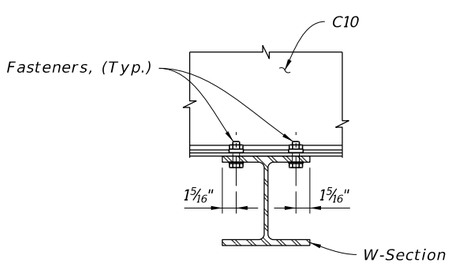
TYPICAL SECTION



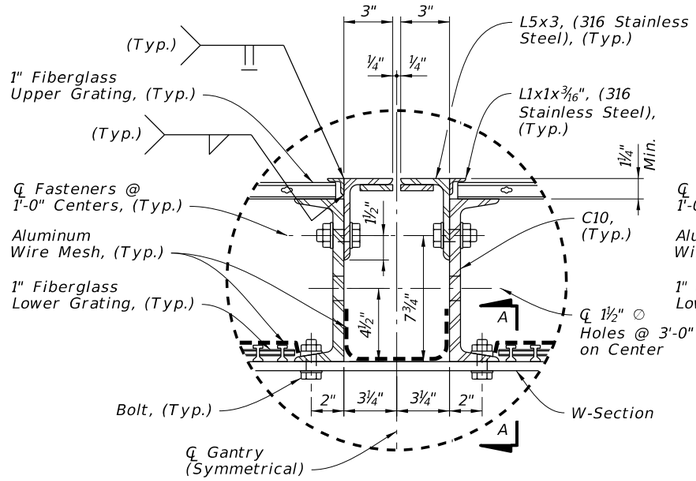
DETAIL 4



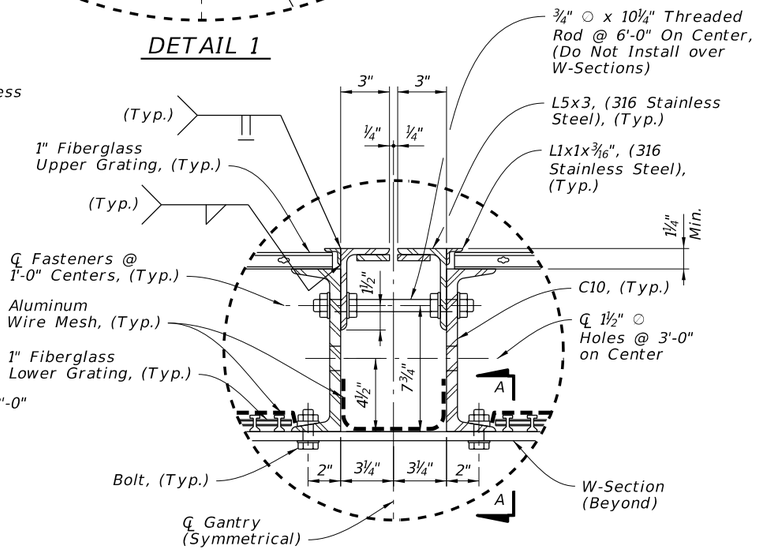
DETAIL 1



SECTION A-A

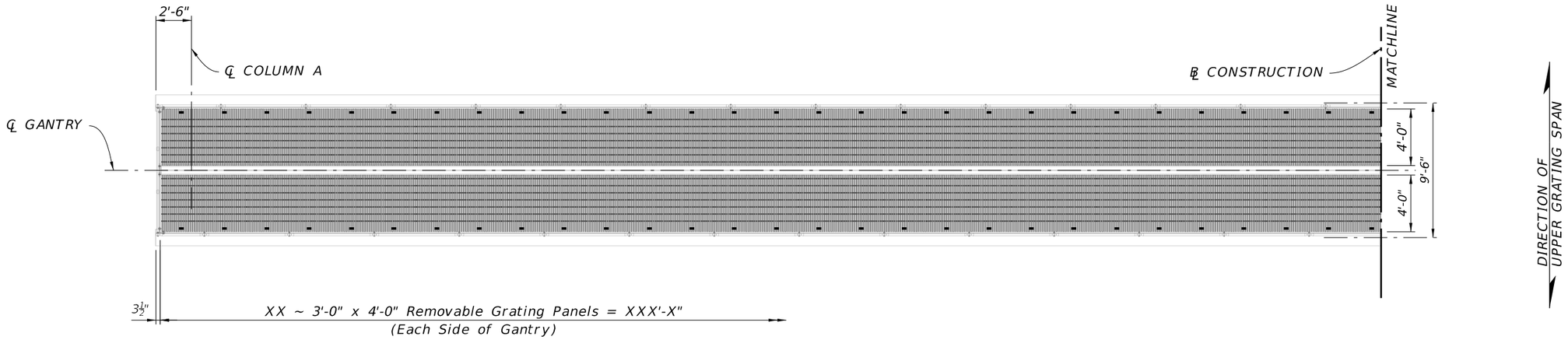


DETAIL 2



DETAIL 3

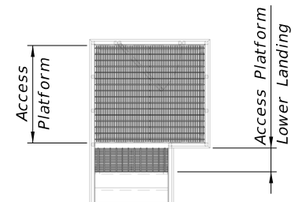
Exhibit 251.7-2 Accessible Gantry Deck and Access Stairway

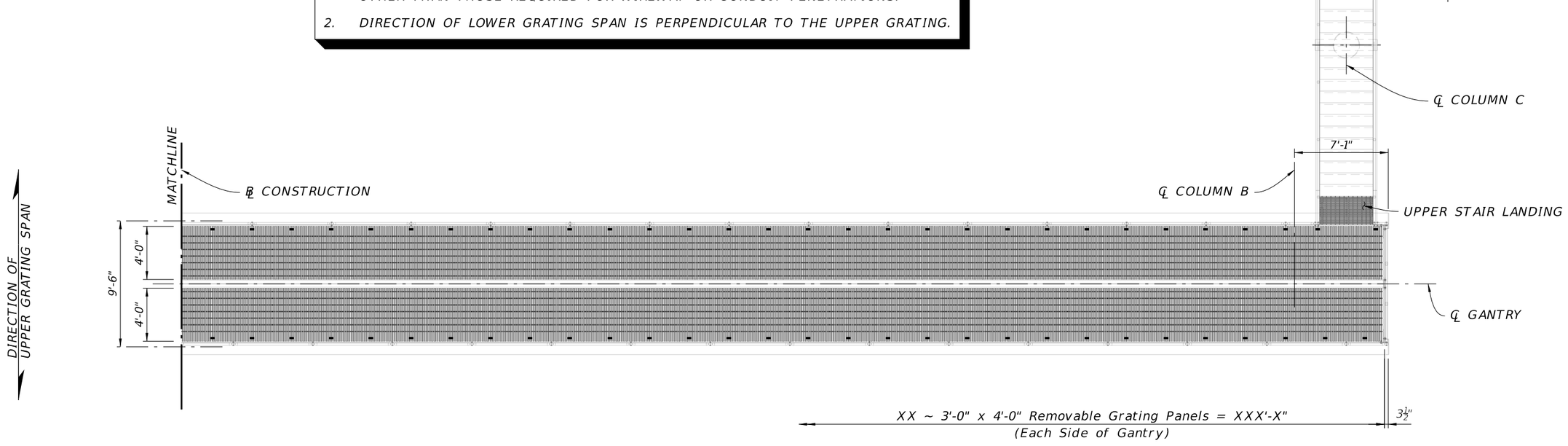


UPPER GRATING PLAN

NOTES TO PREPARER:

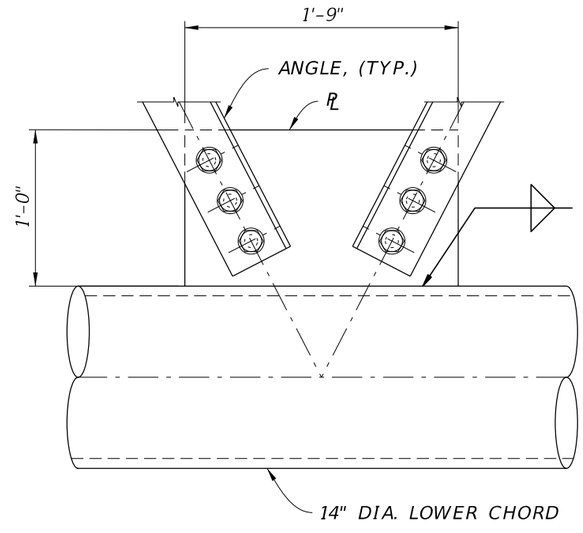
1. LOWER GRATING SHALL BE CONTINUOUS AND WITHOUT OPENINGS OTHER THAN THOSE REQUIRED FOR WIREWAY OR CONDUIT PENETRATIONS.
2. DIRECTION OF LOWER GRATING SPAN IS PERPENDICULAR TO THE UPPER GRATING.



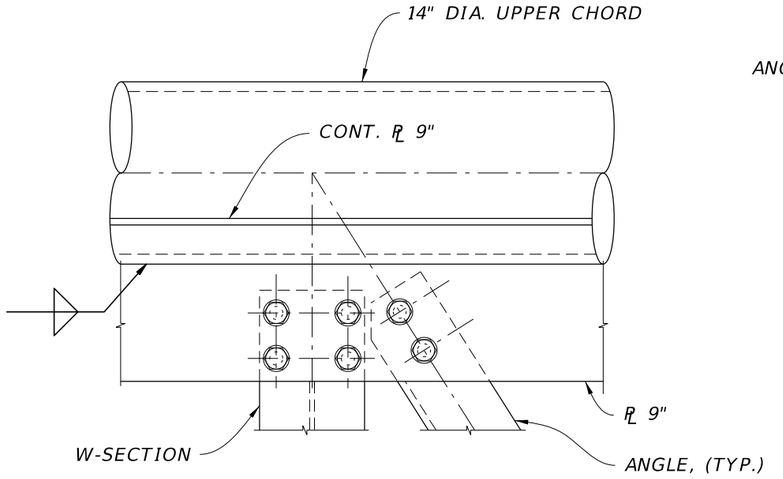


UPPER GRATING PLAN

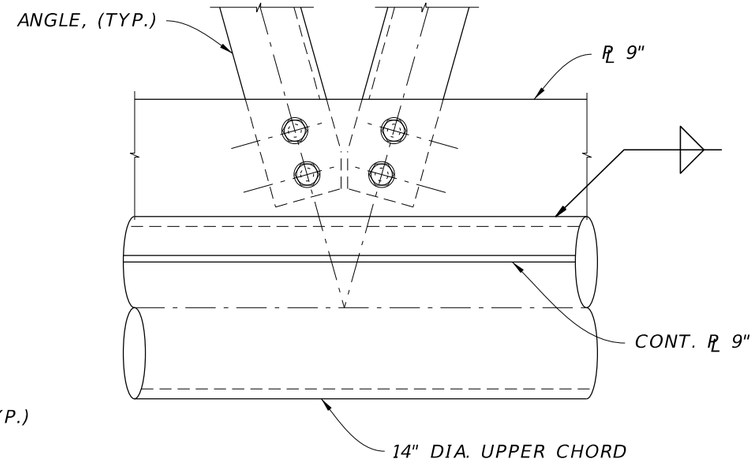
Exhibit 251.7-3 Truss Connection Details (1 of 2)



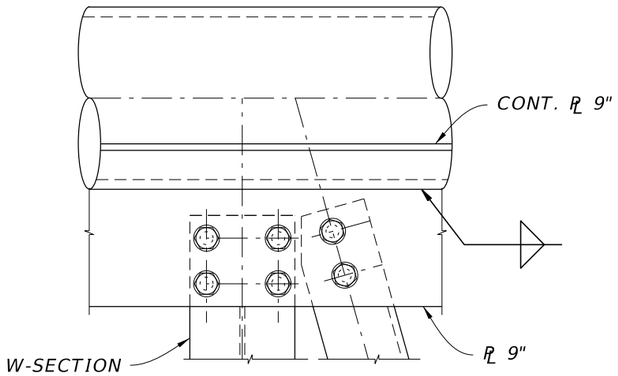
ELEVATION - DETAIL 1



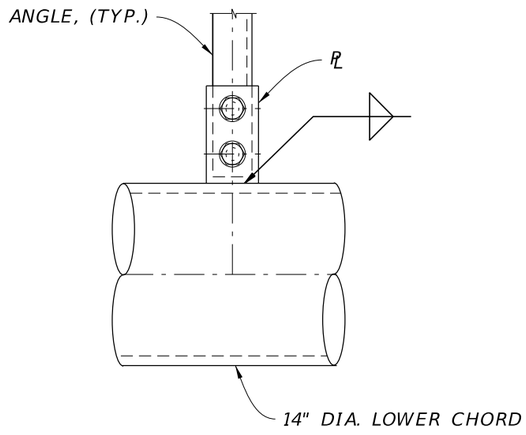
PLAN - DETAIL 2



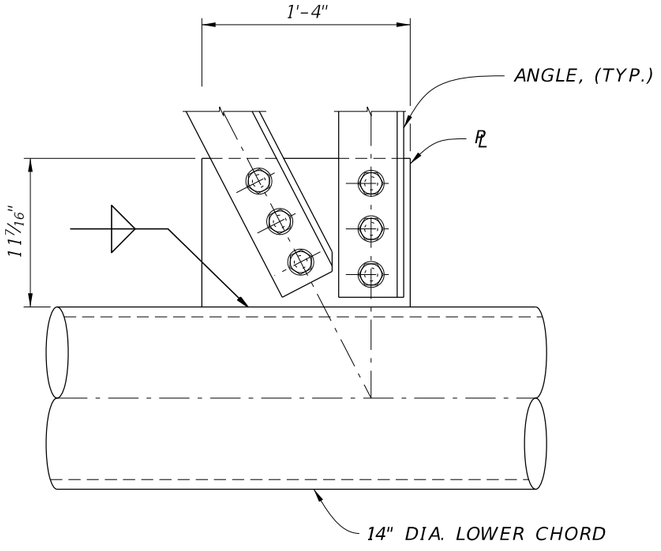
PLAN - DETAIL 3



PLAN - DETAIL 4

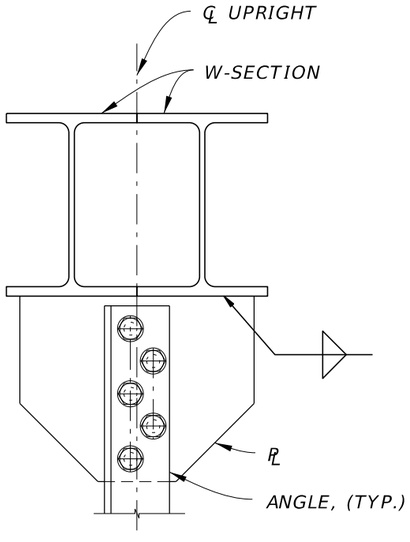


ELEVATION - DETAIL 5

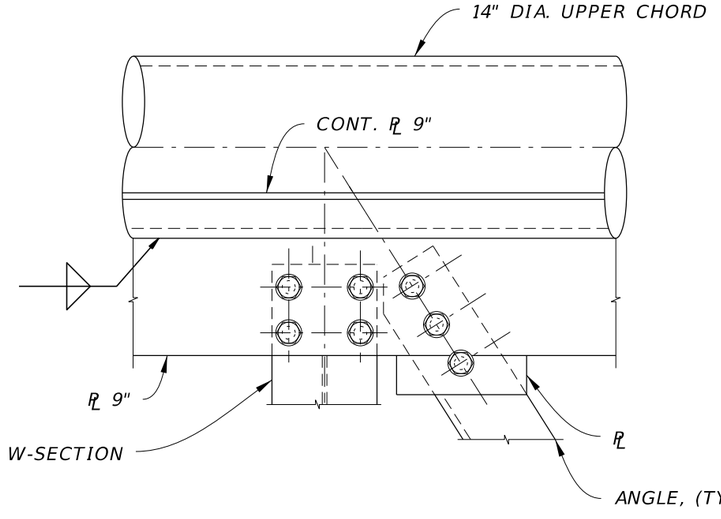


ELEVATION - DETAIL 6

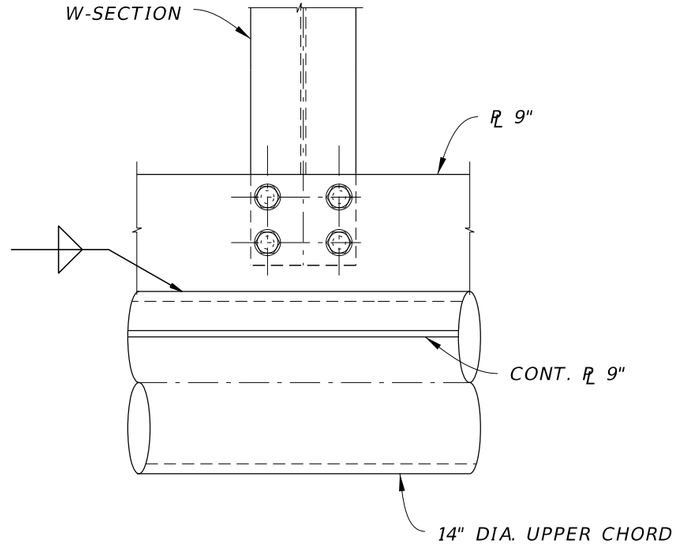
Exhibit 251.7-4 Truss Connection Details (2 of 2)



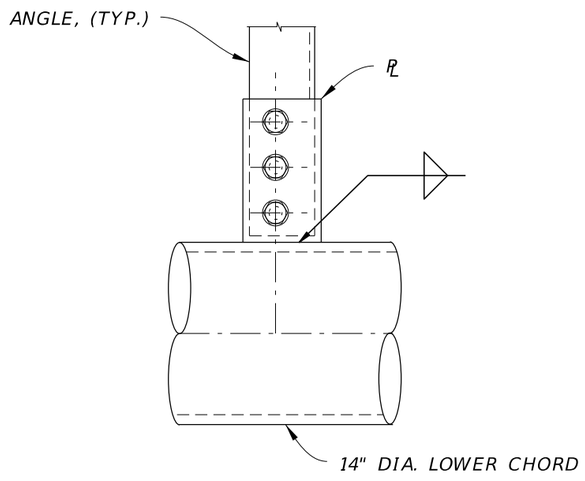
ELEVATION - DETAIL 7



PLAN - DETAIL 8

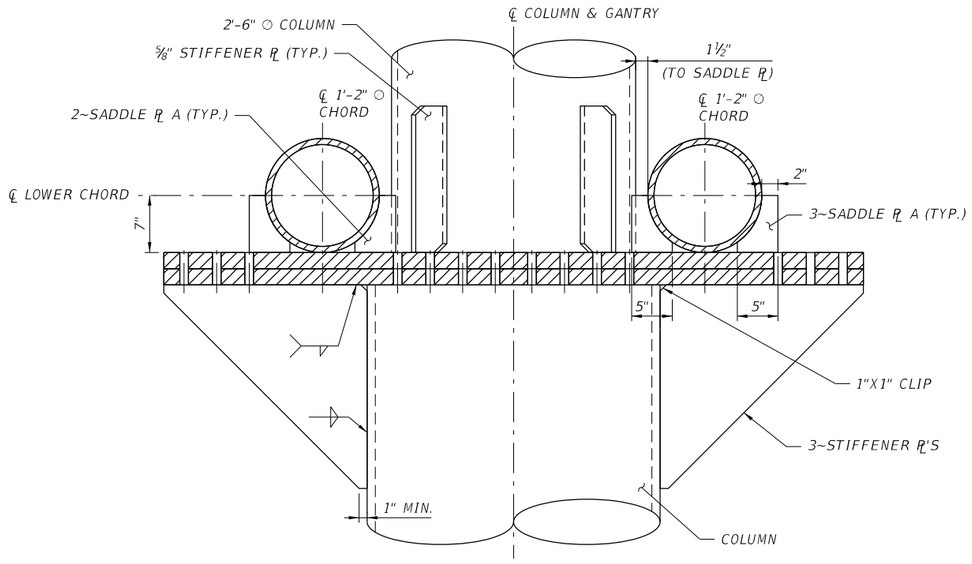


PLAN - DETAIL 9

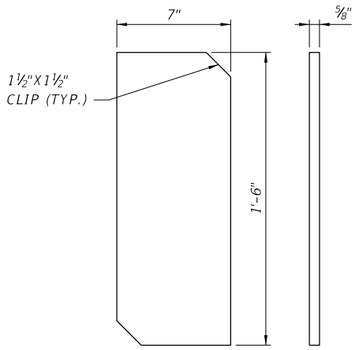


ELEVATION - DETAIL 10

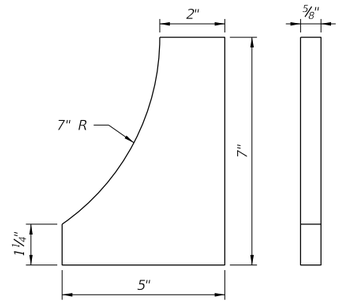
Exhibit 251.7-5 Lower Chord Connection



SECTION A-A



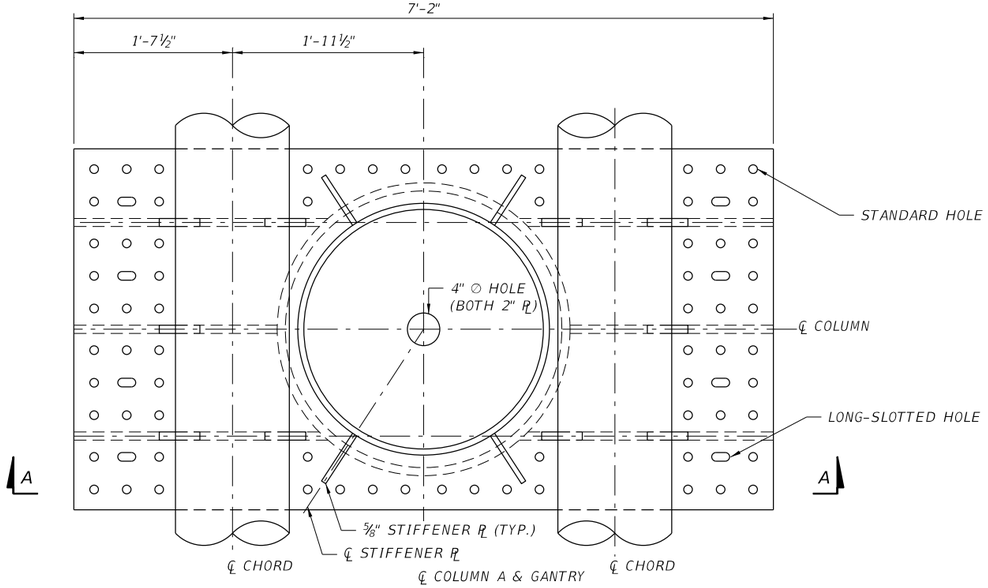
⅝" STIFFENER PL DETAIL



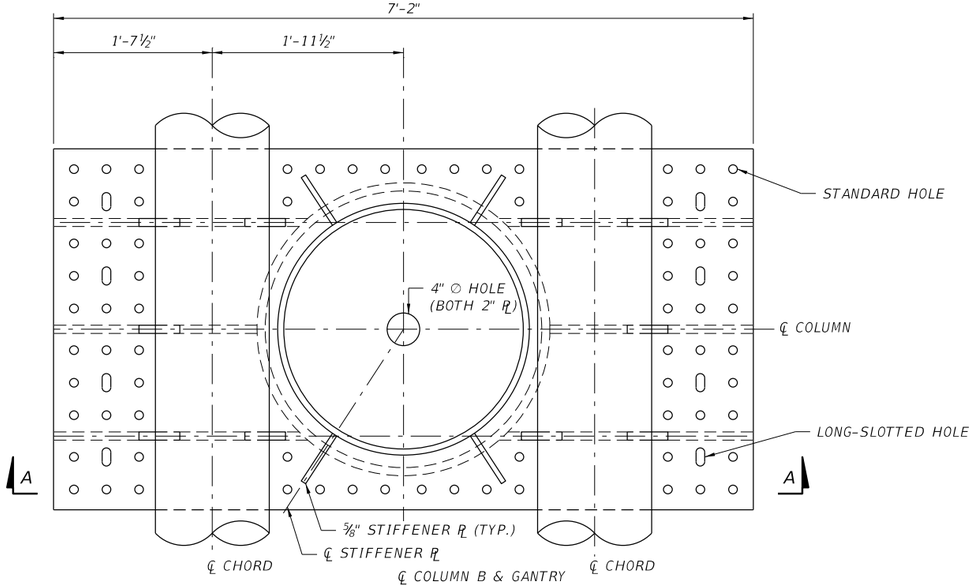
SADDLE PL A DETAIL

NOTES TO PREPARER:

1. *ENSURE MINIMUM QUANTITY OF BOLTS ARE UTILIZED PER STANDARD SPECIFICATION 460-7.7 DURING GANTRY INSTALLATION PRIOR TO CRANE RELEASE.*
2. *CONNECTION IS SYMMETRICAL ABOUT ℄ OF GANTRY.*
3. *THIS DETAIL IS NOT APPLICABLE AT MEDIAN UPRIGHTS. A PROJECT-SPECIFIC DESIGN IS REQUIRED.*



PLAN- COLUMN A

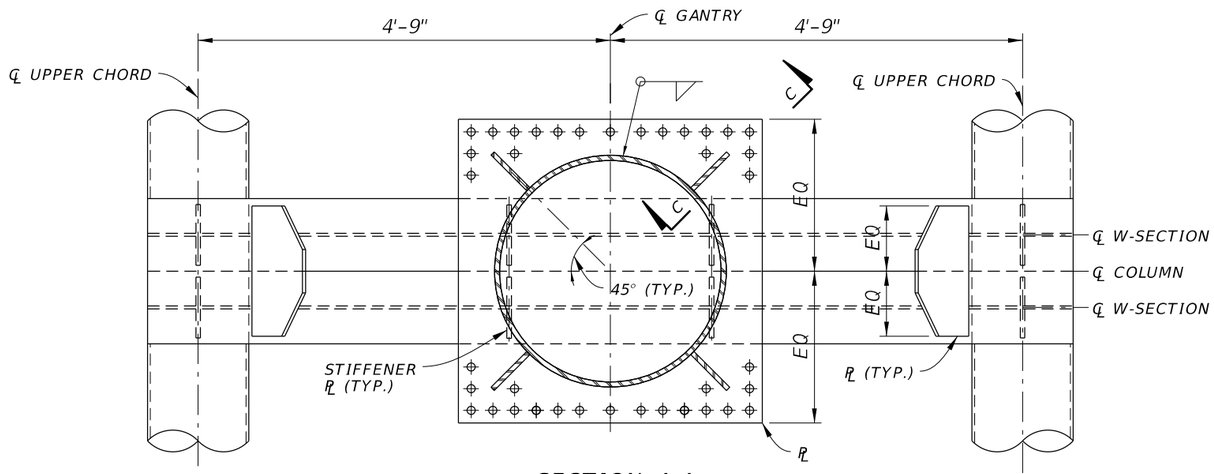


PLAN- COLUMN B

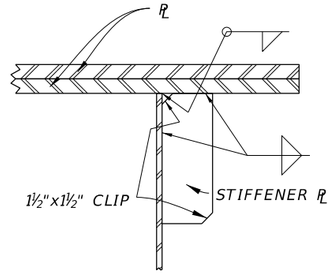
Exhibit 251.7-6 Upper Chord Connection

NOTES TO PREPARER:

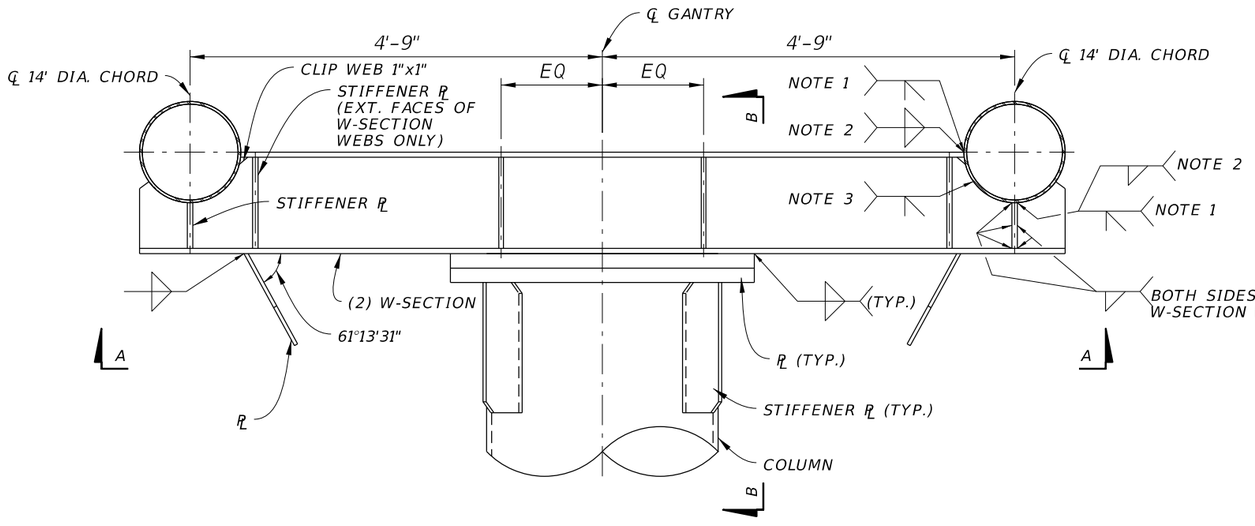
1. *PROVIDE PARTIAL PENETRATION GROOVE WELD IN BETWEEN THE WEBS OF THE W-SECTION.*
2. *PROVIDE FILLET WELDS ON THE FLANGES OUTSIDE OF THE WEBS OF THE W-SECTION.*
3. *PROVIDE PARTIAL PENETRATION GROOVE WELD OUTSIDE THE WEBS OF THE W-SECTION.*
4. *THIS DETAIL IS NOT APPLICABLE AT MEDIAN UPRIGHTS. A PROJECT-SPECIFIC DETAIL IS REQUIRED.*



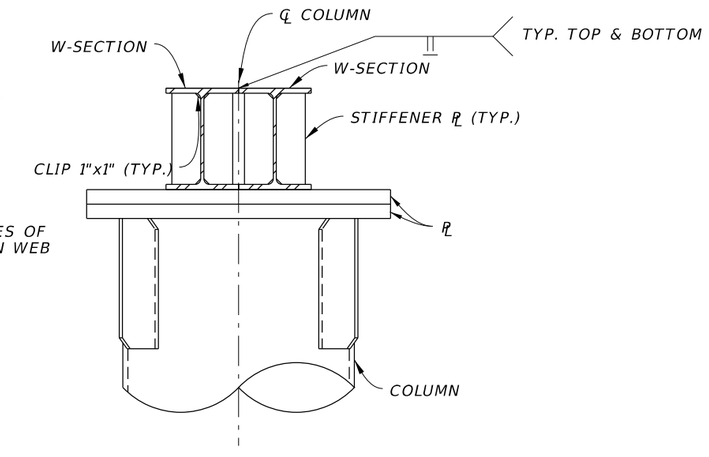
SECTION A-A



SECTION C-C

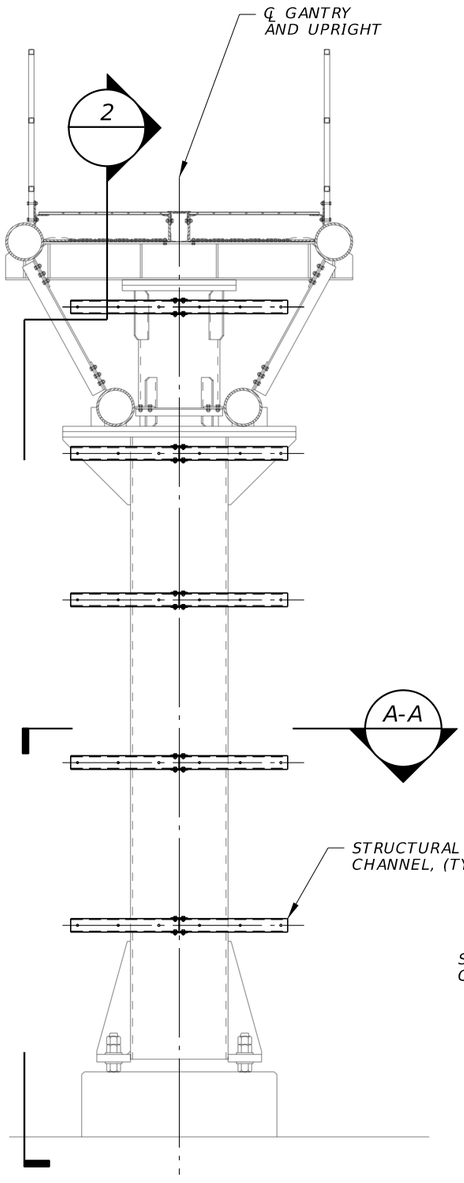


ELEVATION
COLUMN TO UPPER CHORD CONNECTION

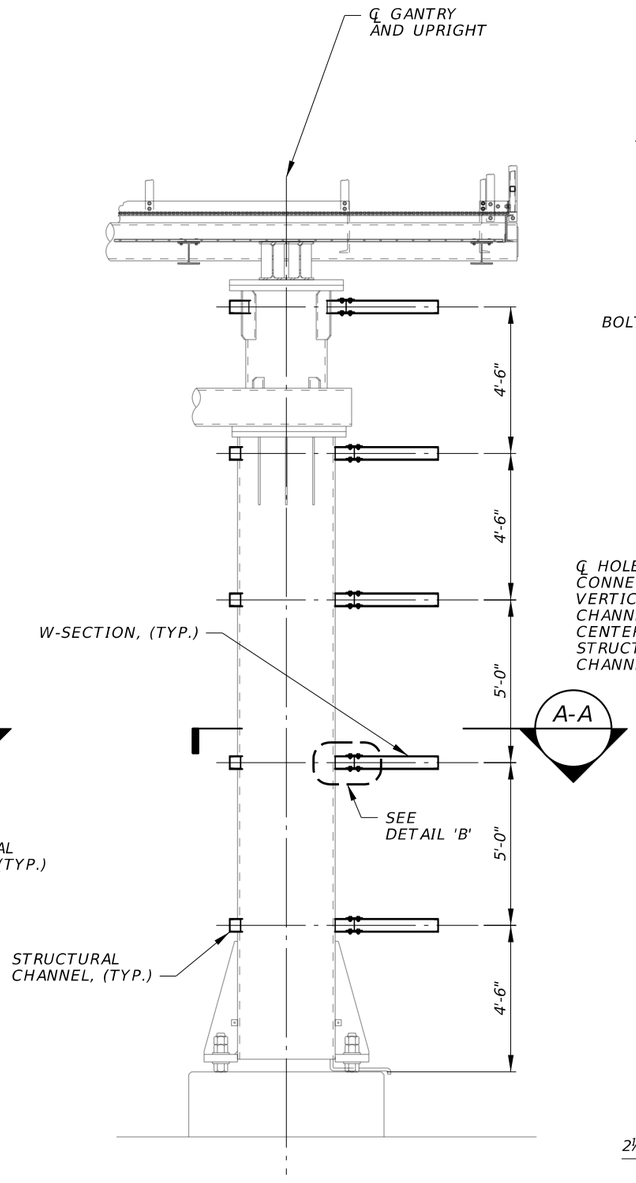


SECTION B-B

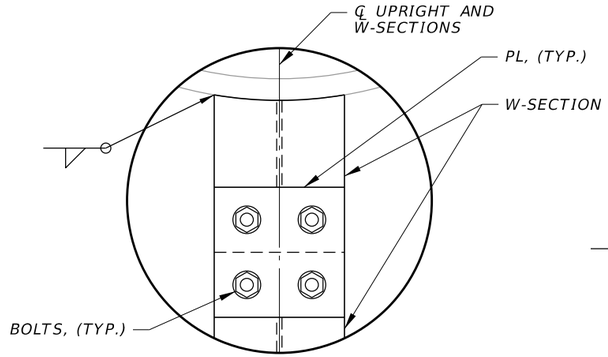
Exhibit 251.7-7 Upright Structural Details for Wireway Support



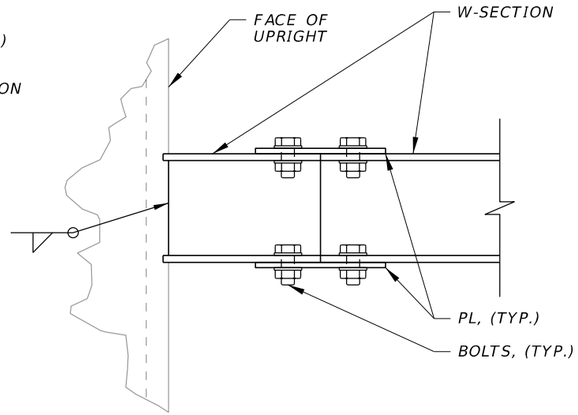
1 VERTICAL WIREWAY END ELEVATION
SCALE: NTS



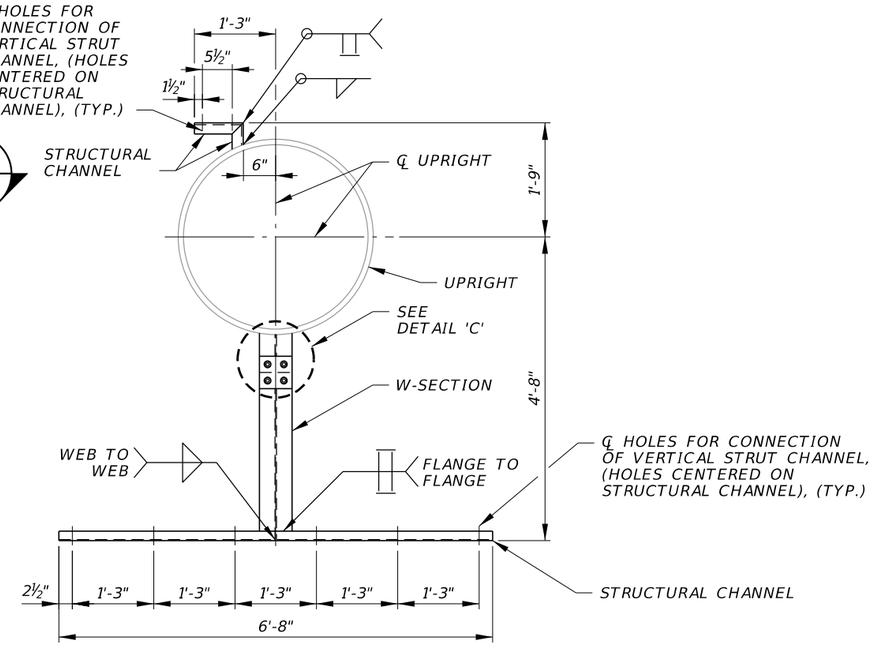
2 VERTICAL WIREWAY SECTION
SCALE: NTS



DETAIL 'C'
SCALE: NTS

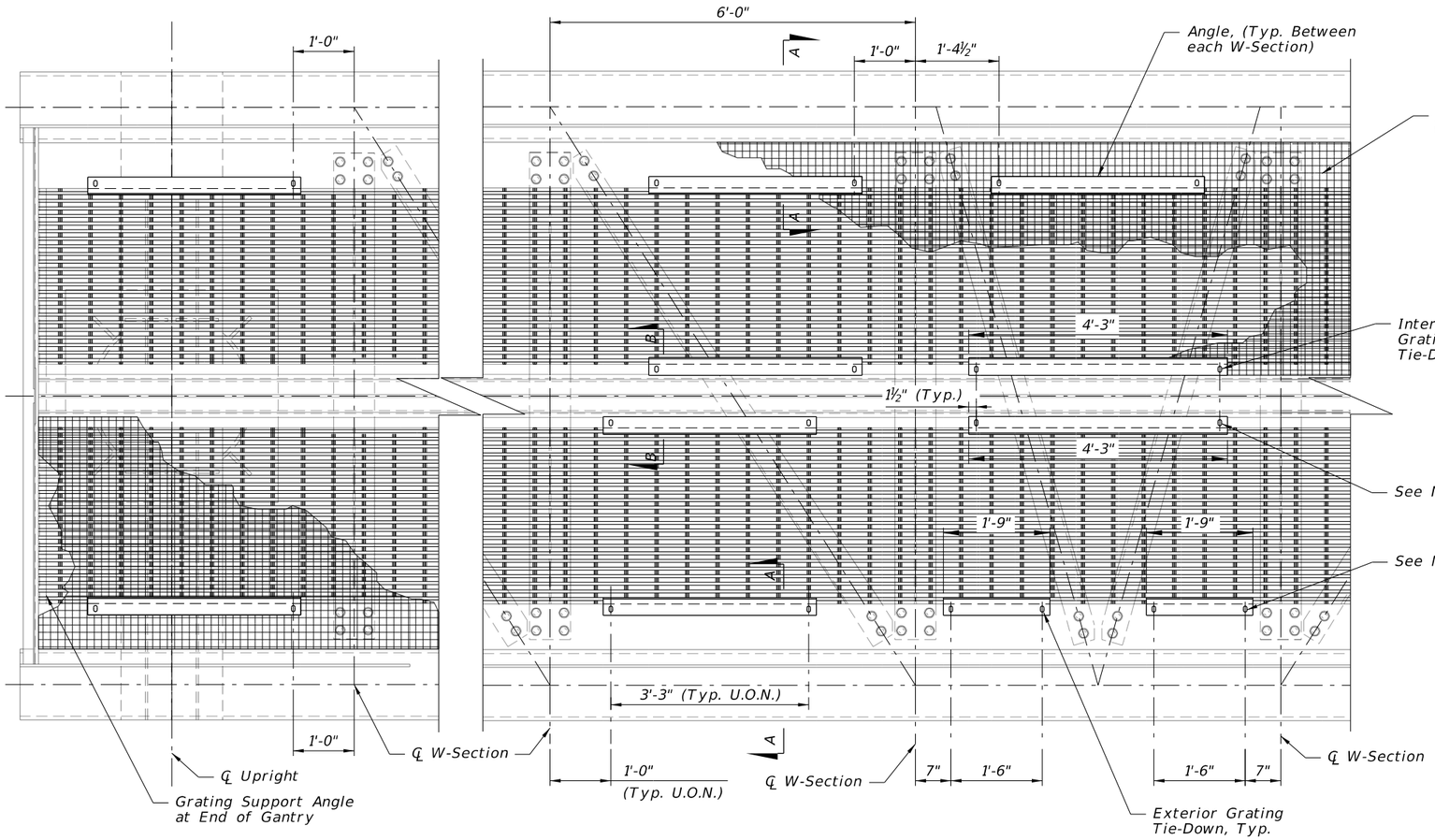


UPRIGHT DETAIL 'B'
SCALE: NTS

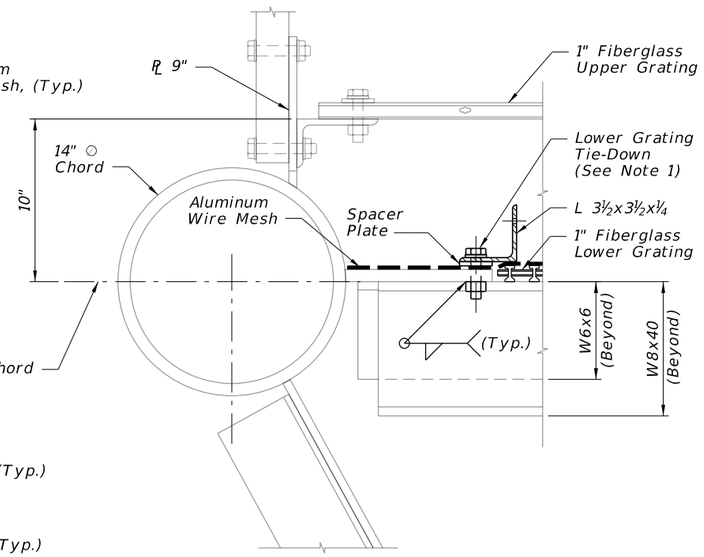


SECTION A-A
SCALE: NTS

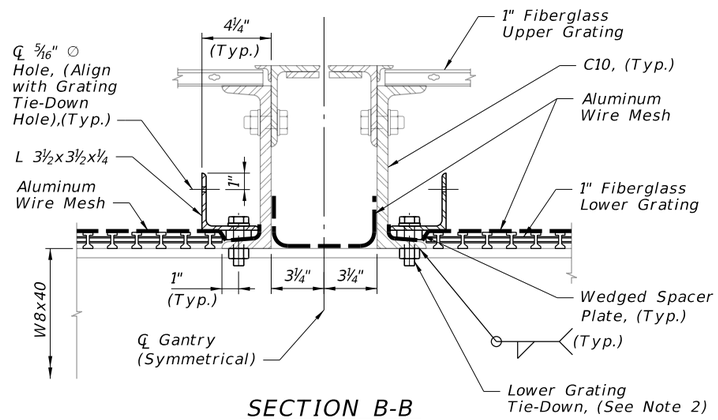
Exhibit 251.7-8 Lower Grating Detail



TYPICAL LOWER GRATING PLAN
(RAILING AND TOLL EQUIPMENT NOT SHOWN)



SECTION A-A

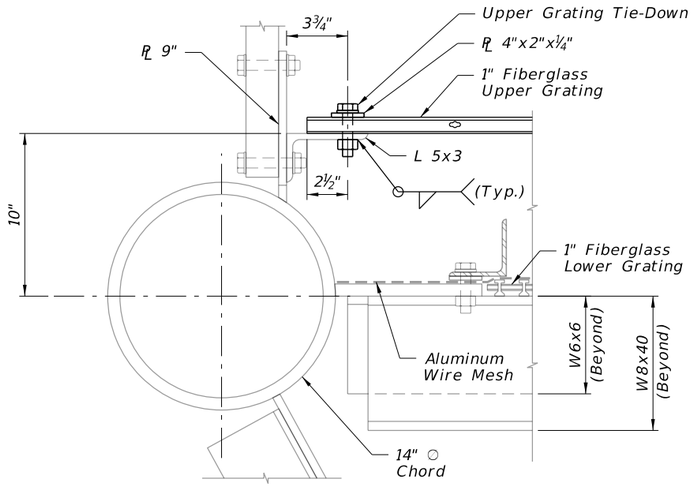


SECTION B-B

NOTES TO PREPARER:

1. *BOLT WITH WASHERS, NUT AND 1½"x1½" SPACER PLATE. PROVIDE SLOTTED HOLES IN L3½x 3½ AND HOLES IN 9" PLATE AND SPACER PLATE. THE SLOTTED HOLE IN THE ANGLE SHALL BE PERPENDICULAR TO THE LENGTH OF THE ANGLE. NUT SHALL BE SHOP WELDED TO THE BOTTOM OF 9" PLATE.*
2. *BOLT WITH WASHERS, NUT AND 1½"x1½" WEDGED SPACER PLATE. PROVIDE HOLES IN L3½x 3½, C10 AND WEDGED SPACER PLATE. NUT SHALL BE SHOP WELDED TO THE BOTTOM OF C10.*
3. *PROVIDE 1⁄32" THICK NEOPRENE PAD BETWEEN ANGLE AND ALUMINUM CABLE TRAY.*
4. *PROVIDE SHOP FABRICATED NOTCHES IN LOWER GRATING TO CLEAR BOLTS AT MEMBER CONNECTIONS.*

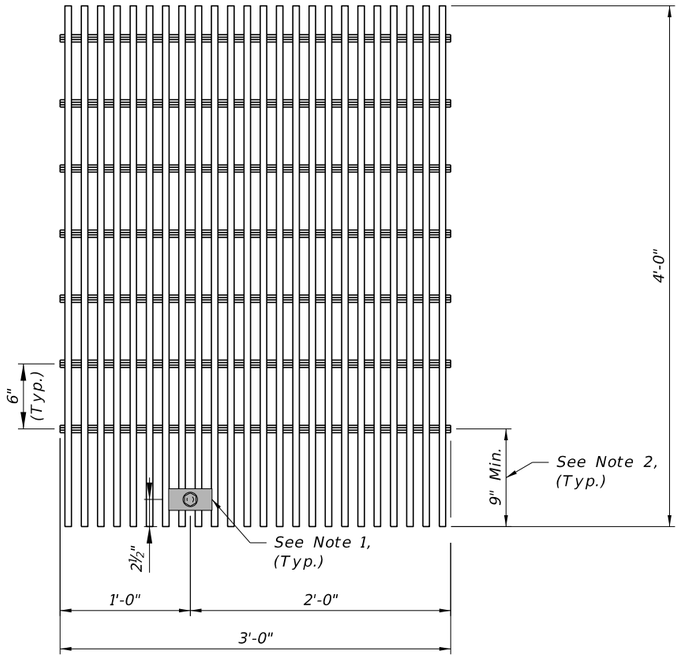
Exhibit 251.7-9 Upper Grating Detail



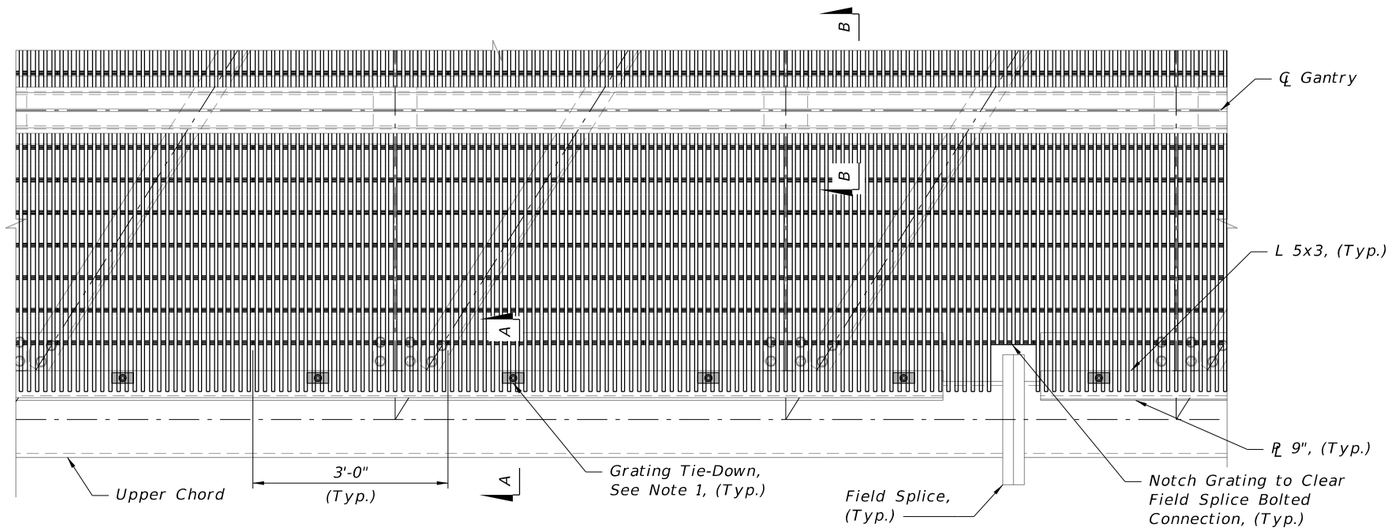
SECTION A-A

NOTES TO PREPARER:

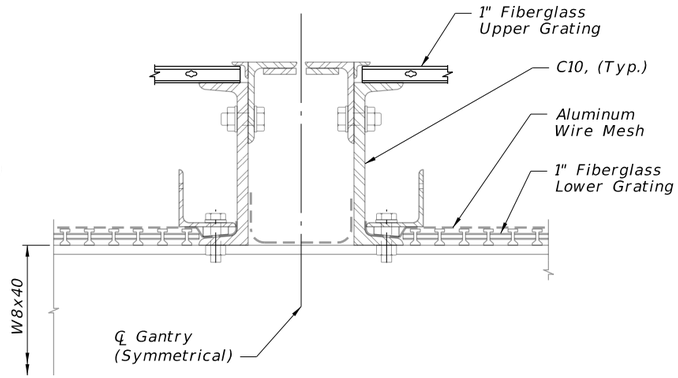
1. 2"x4" PLATE WITH BOLT WITH WASHERS AND NUT. PROVIDE HOLES IN L5x3 FOR UPPER GRATING. NUT MUST BE SHOP WELDED TO BOTTOM OF L5x3.
2. SHOP FABRICATE EACH GRATING PANEL SUCH THAT NO BARS OR PHYSICAL BARRIERS CONFLICT WITH ANY CABLE ROUTING BETWEEN THE CABLE TRAYS AND THE GANTRY MOUNTED EQUIPMENT. EACH GRATING PANEL MUST BE ABLE TO BE REMOVED WITHOUT DAMAGING OR DISCONNECTING ANY INSTALLED CABLES ON THE GANTRY.



TYPICAL UPPER GRATING PANEL

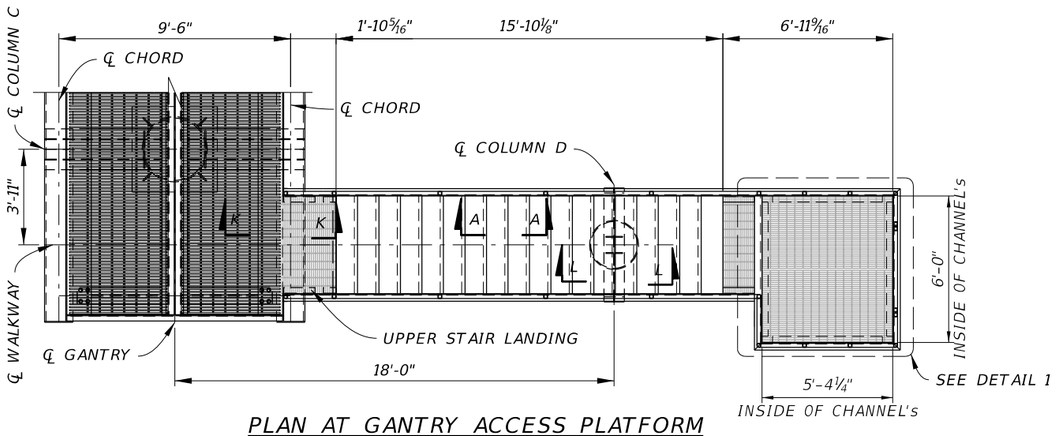


TYPICAL UPPER GRATING PLAN
(ONLY ONE SIDE SHOWN, OTHER SIDE TYPICAL)

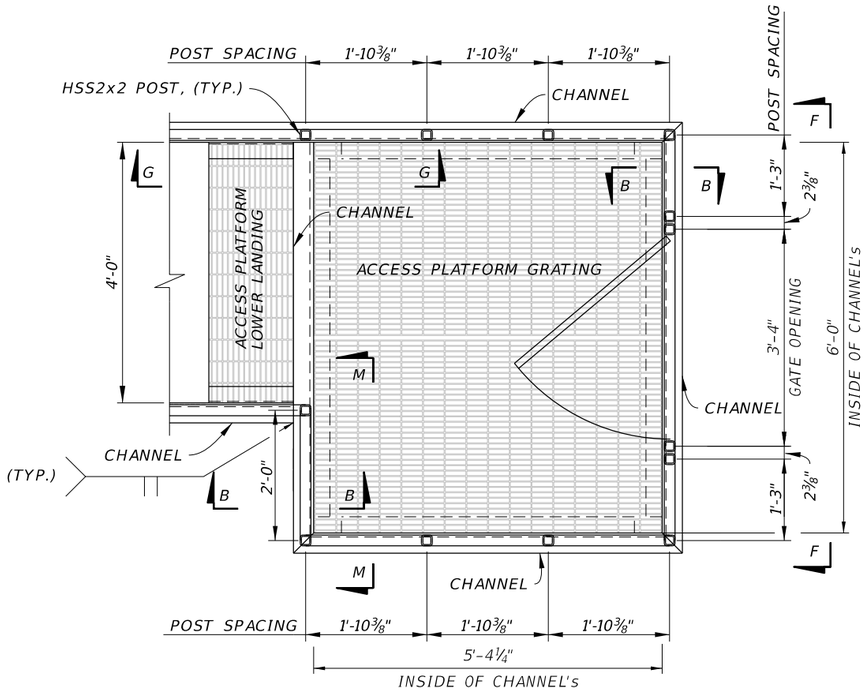


SECTION B-B

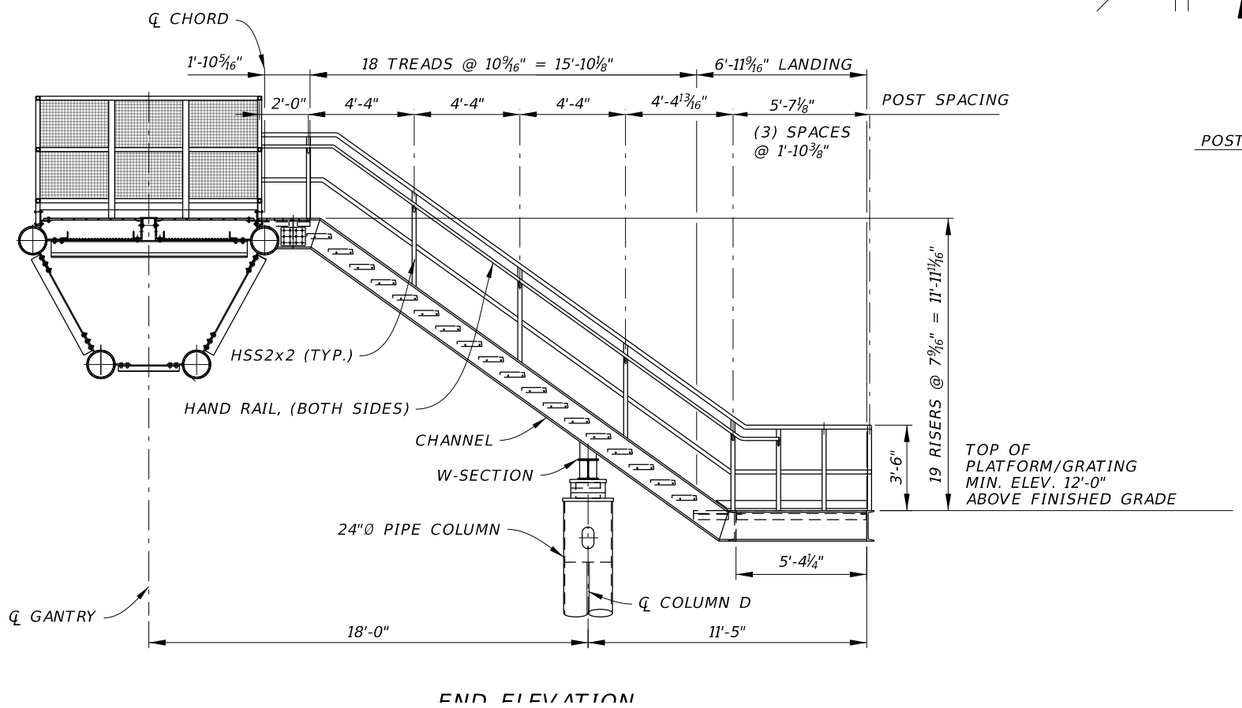
Exhibit 251.7-10 Stair and Platforms



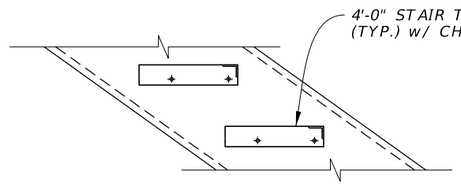
PLAN AT GANTRY ACCESS PLATFORM



DETAIL 1
FRAMING PLAN ACCESS PLATFORM

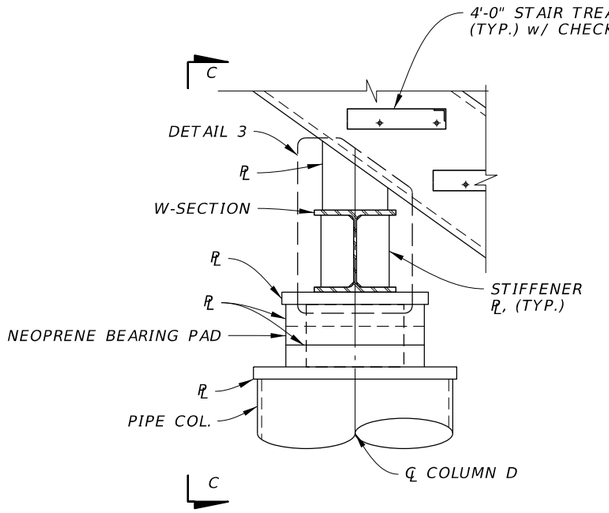


END ELEVATION

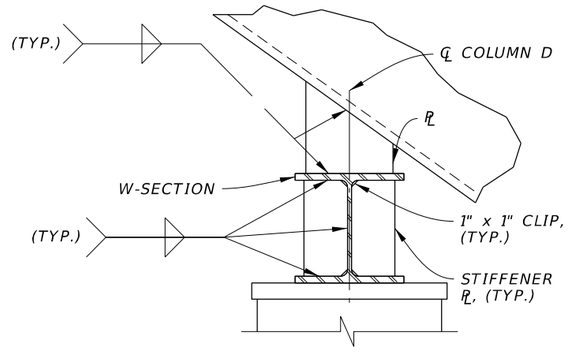


SECTION A-A
TYPICAL TREAD DETAIL

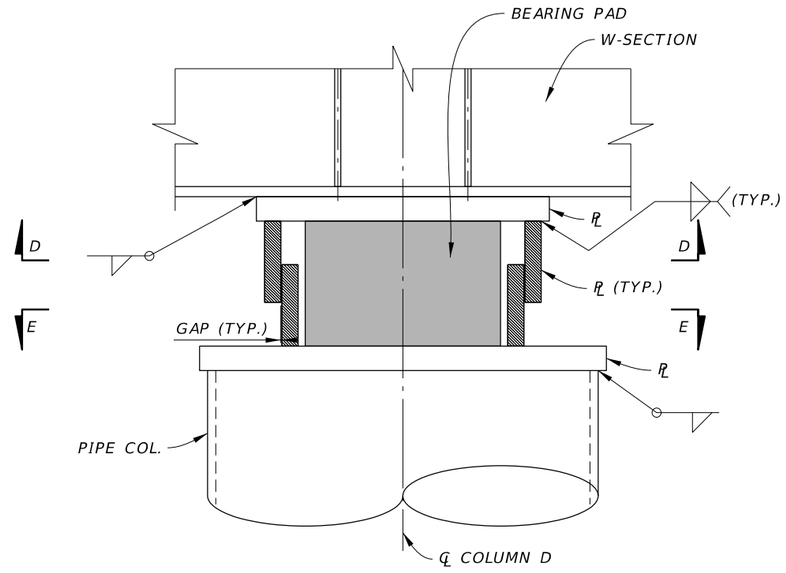
Exhibit 251.7-11 Stair Column Details



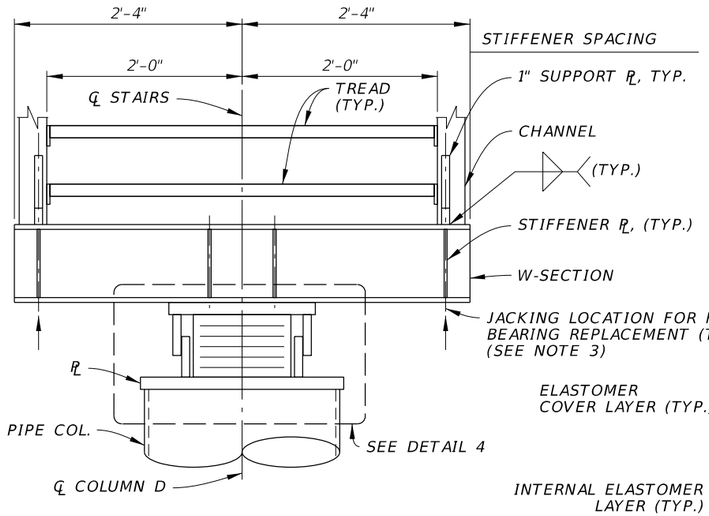
SECTION L-L



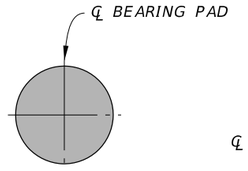
DETAIL 3



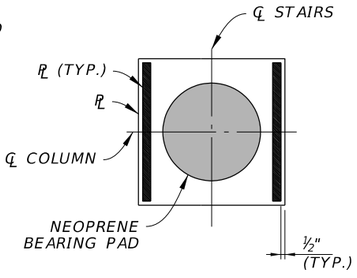
DETAIL 4



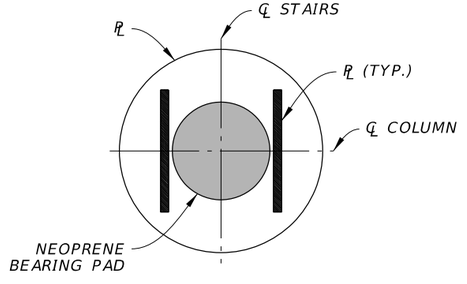
SECTION C-C



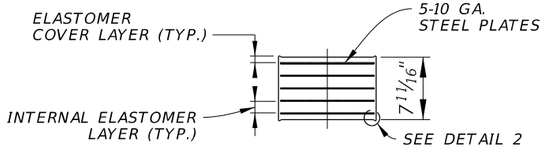
PLAN



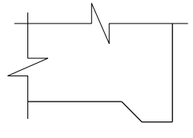
SECTION D-D



SECTION E-E



ELEVATION - BEARING PAD

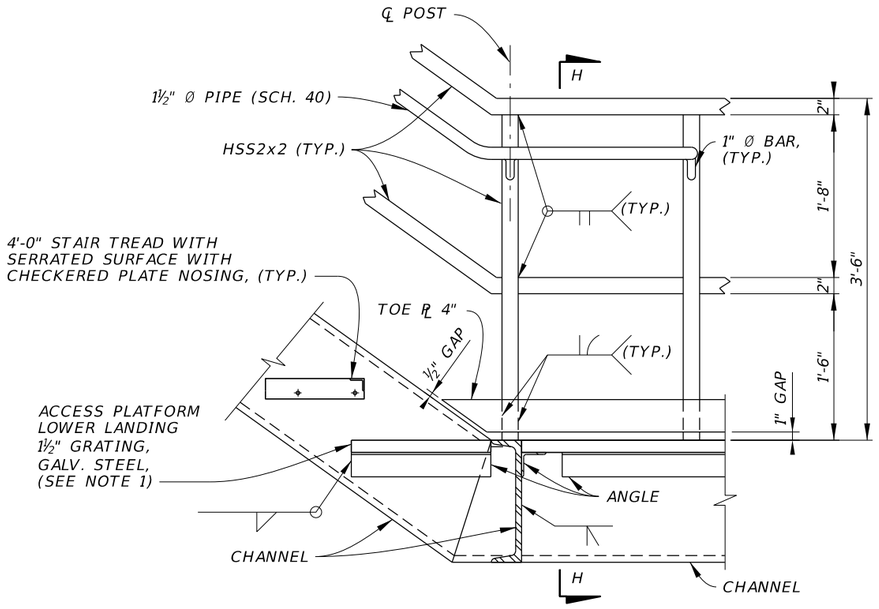


DETAIL 2

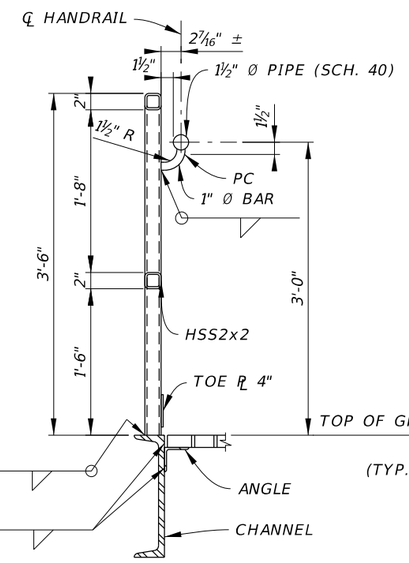
NOTES TO PREPARER:

1. NEOPRENE BEARING PAD MUST HAVE A SHEAR MODULUS (G) OF 110 PSI.
2. STEEL PLATES IN BEARING PADS MUST CONFORM TO ASTM A1011 GRADE 36, TYPE 1.
3. FOR FUTURE BEARING REPLACEMENT, PLACE JACKS AT LOCATIONS SHOWN. MINIMUM SERVICE JACKING LOADS ARE 1.2 KIP.

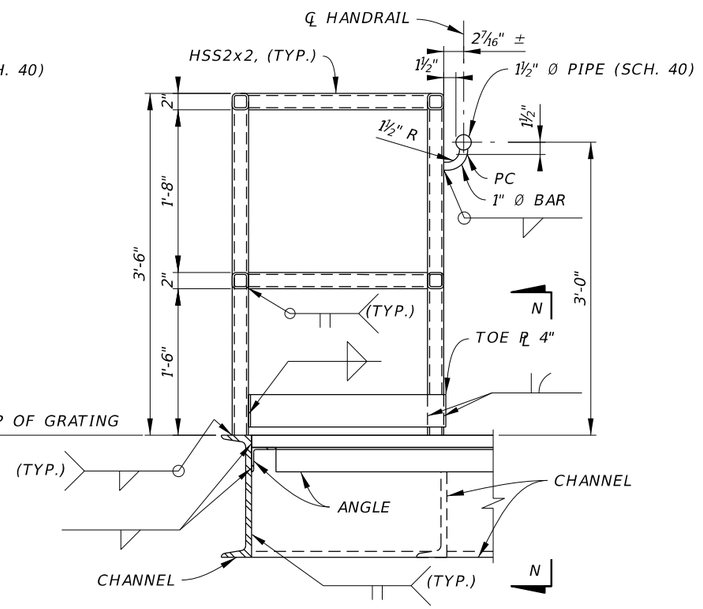
Exhibit 251.7-12 Platform Details



SECTION G-G



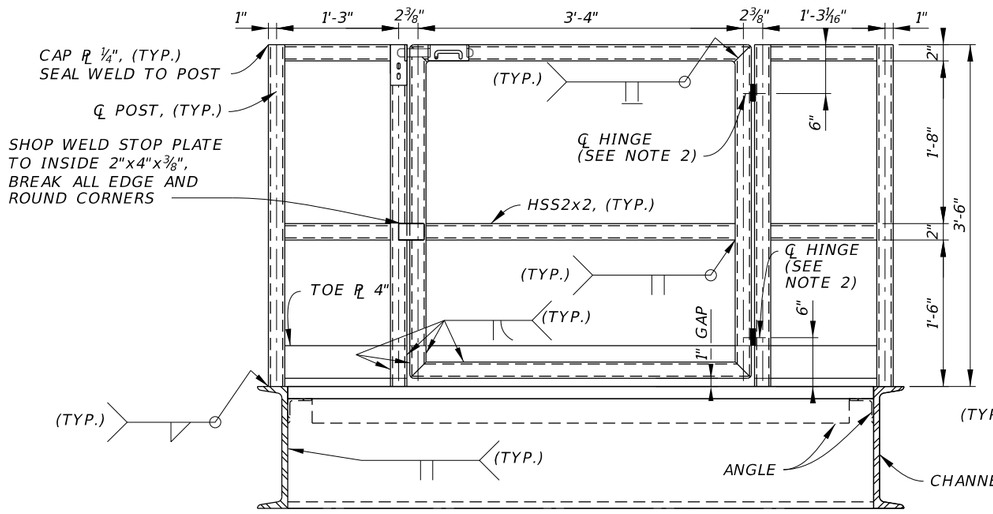
SECTION H-H



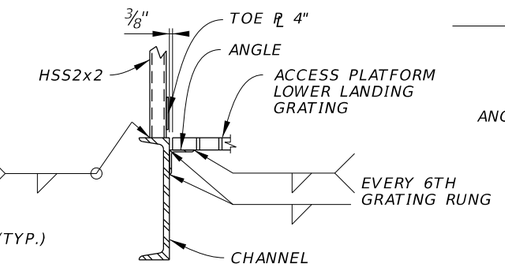
SECTION M-M

NOTES TO PREPARER:

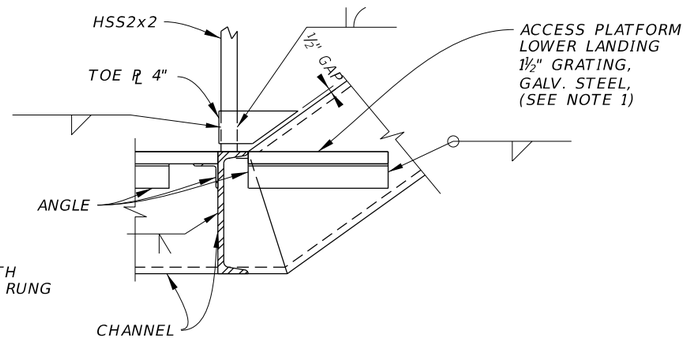
1. WELD GRATING RUNGS TO ANGLE AT A MINIMUM OF THREE LOCATIONS ON EACH SIDE.
2. HINGE MUST BE SELF-CLOSING STAINLESS STEEL HINGE, FASTEN WITH STAINLESS STEEL SCREWS, PROVIDE NEOPRENE PAD BETWEEN HINGE AND BOTH HSS2x2 ALONG HEIGHT OF HINGE.



SECTION F-F

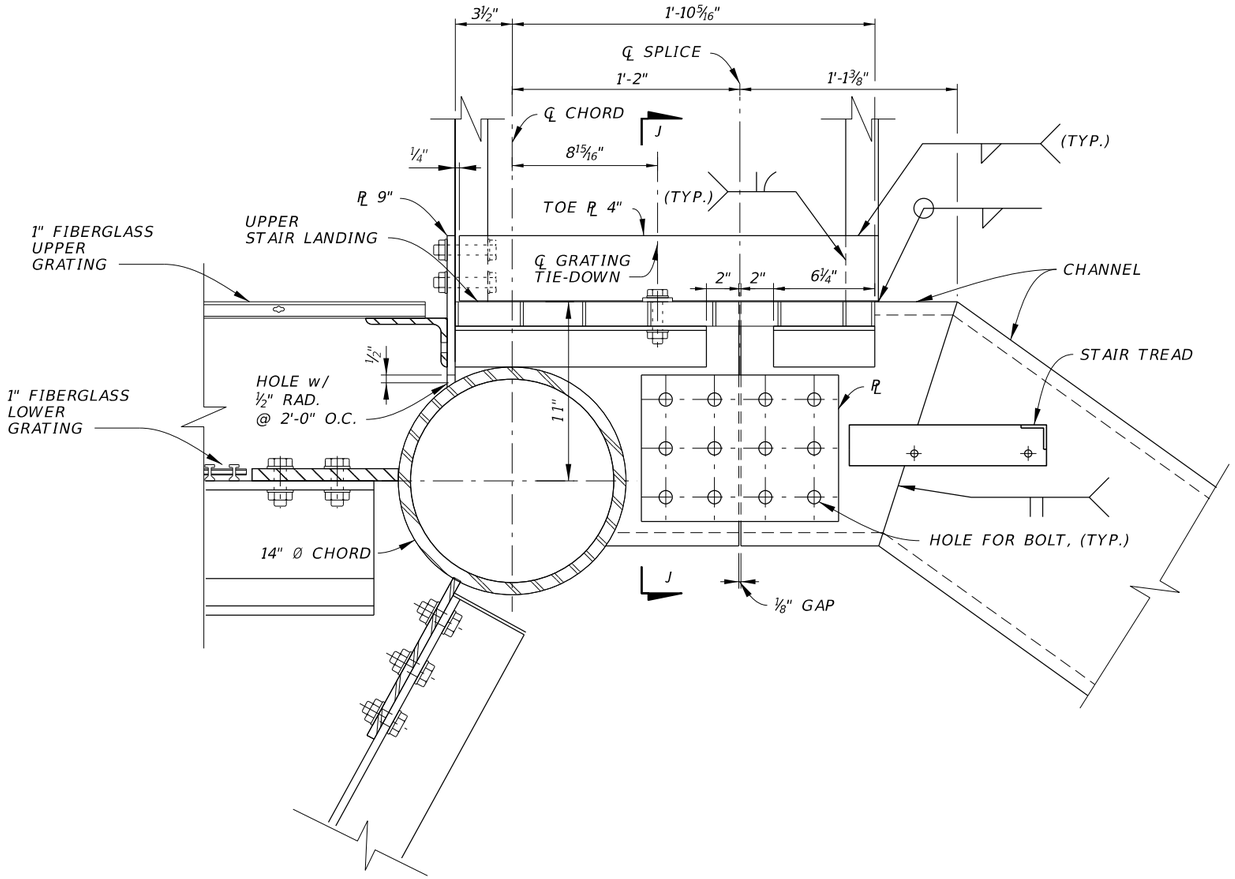


SECTION B-B

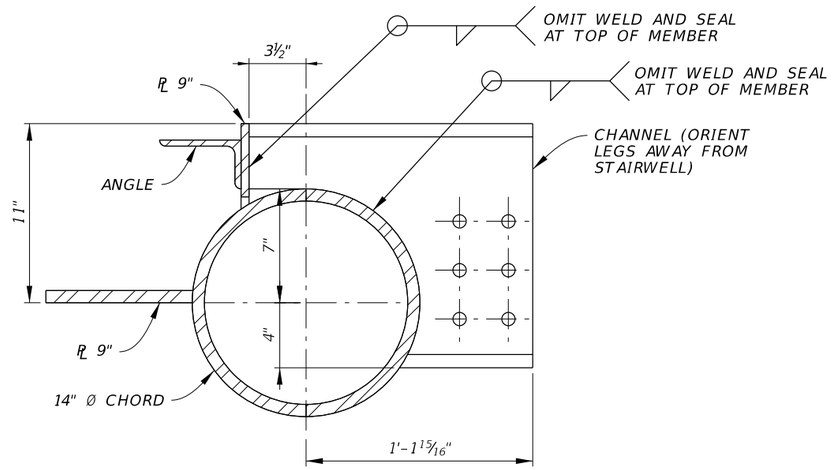


SECTION N-N

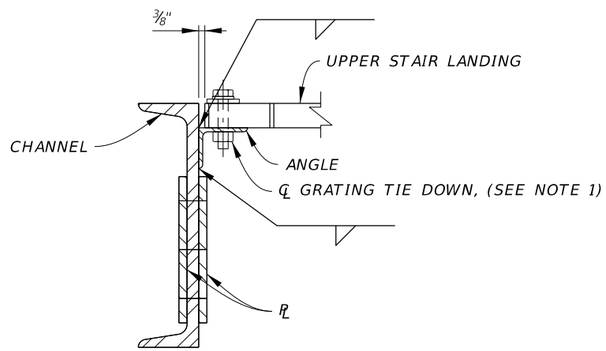
Exhibit 251.7-13 Upper Stair Landing Detail



SECTION K-K
STAIRWAY SUPPORT/CONNECTION



14" Ø CHORD TO CHANNEL CONNECTION DETAIL

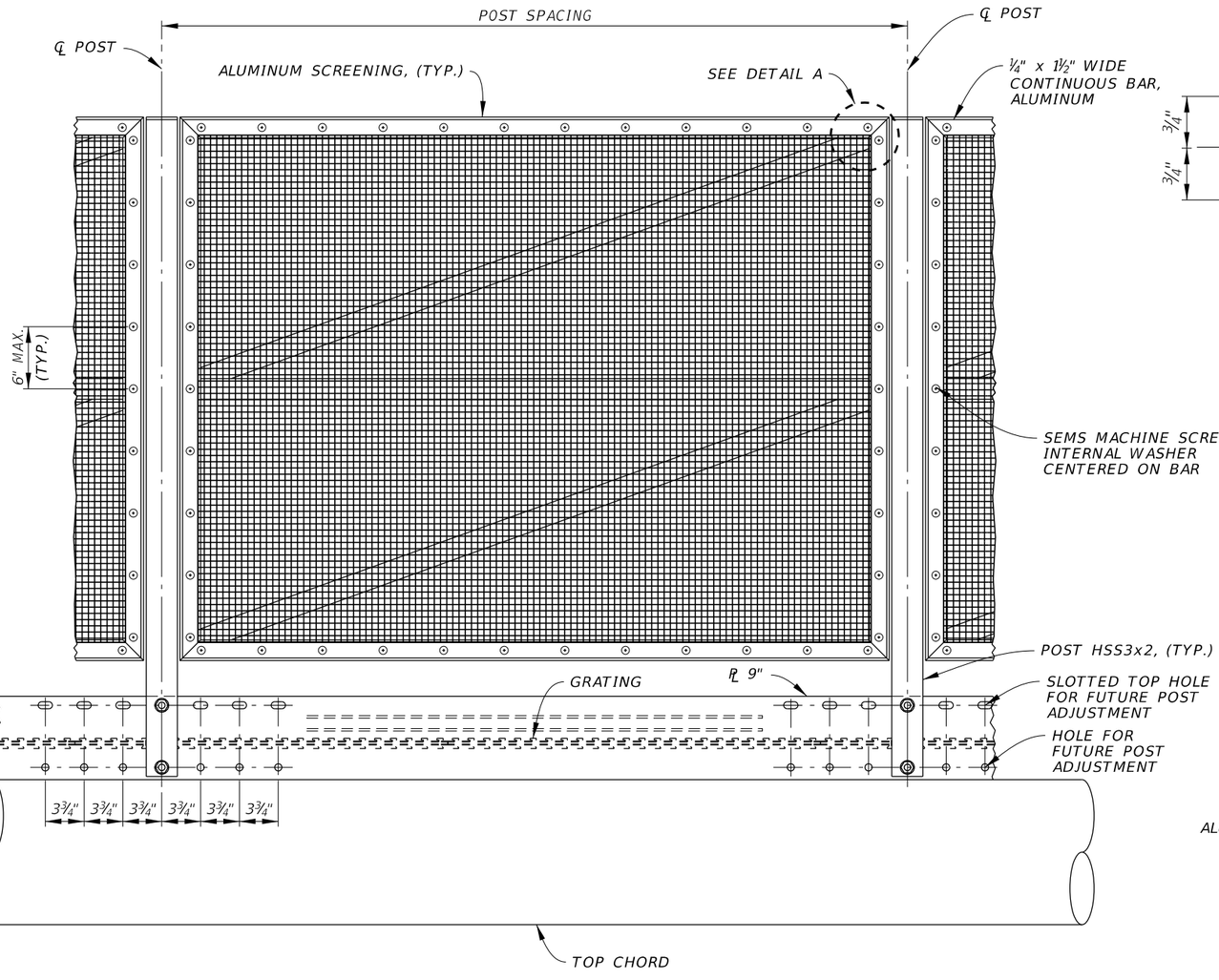


SECTION J-J

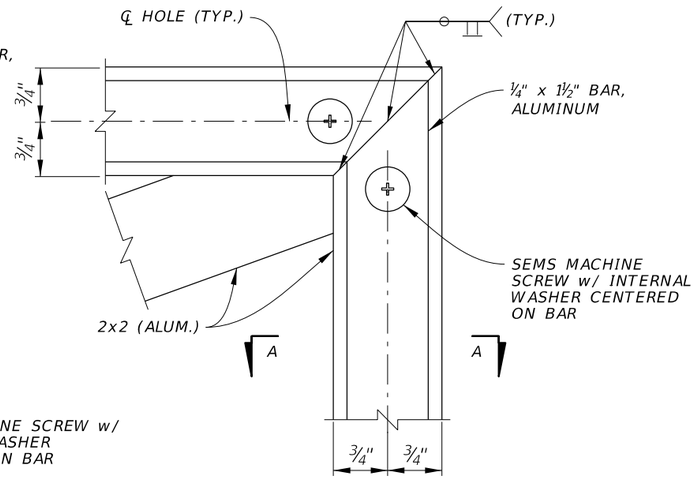
NOTE TO PREPARER:

1. 2"x4" PLATE WITH BOLT WITH WASHER AND NUT. PROVIDE HOLES IN ANGLE FOR GRATING. NUT MUST BE SHOP WELDED TO BOTTOM OF ANGLE.

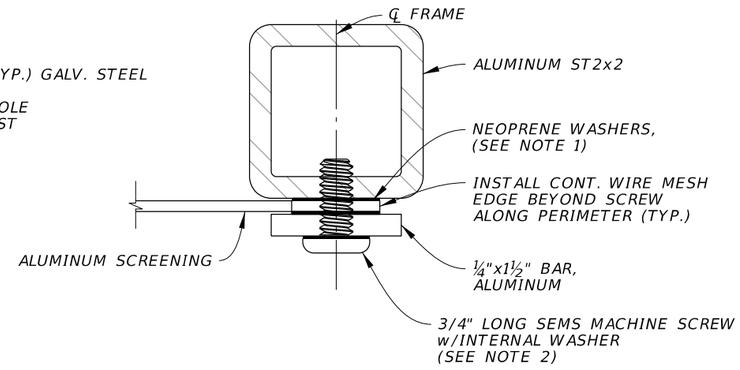
Exhibit 251.7-14 Swing Gate (1 of 2)



TYPICAL ELEVATION - OUTSIDE OF GANTRY
(PANEL TYPES A, B, AND C SHOWN, OTHERS SIMILAR)



DETAIL A
(ALUMINUM SCREENING NOT SHOWN)

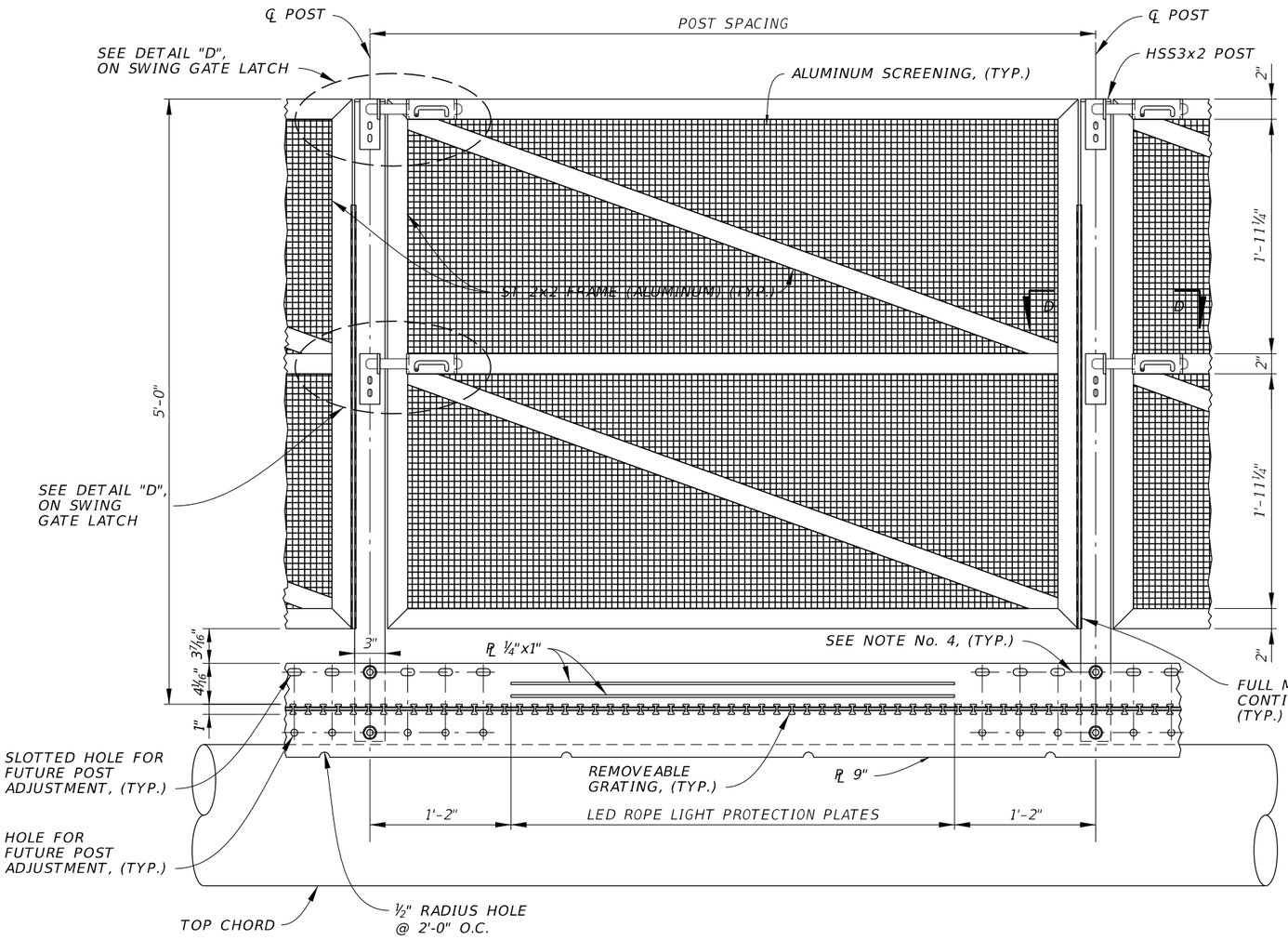


SECTION A-A

NOTES TO PREPARER:

1. *PROVIDE 1/32" x ¾" Ø NEOPRENE WASHER BETWEEN BOTH FACES OF THE ALUMINUM SCREENING AT EACH FASTENER LOCATION.*
2. *PROVIDE ANTI-SEIZE LUBRICANTS FOR ALL FASTENERS REQUIRED FOR SCREEN PANEL ASSEMBLY.*

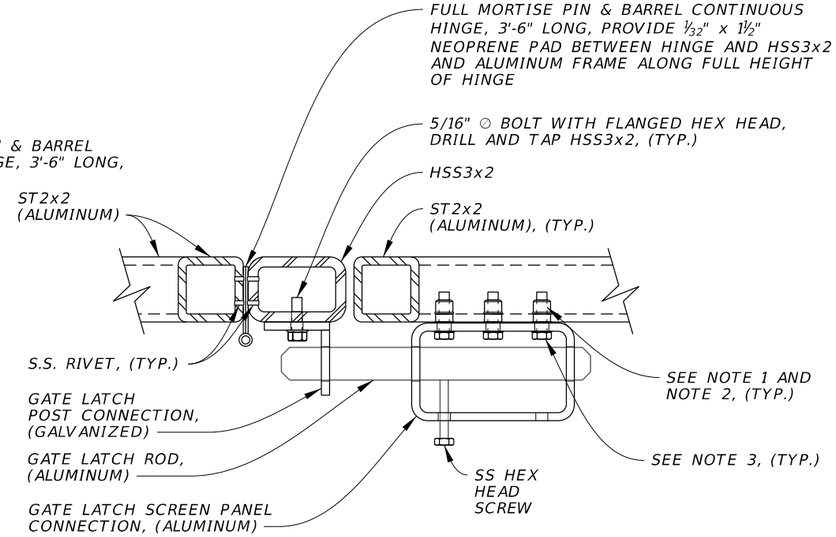
Exhibit 251.7-15 Swing Gate (2 of 2)



TYPICAL ELEVATION - INSIDE OF GANTRY

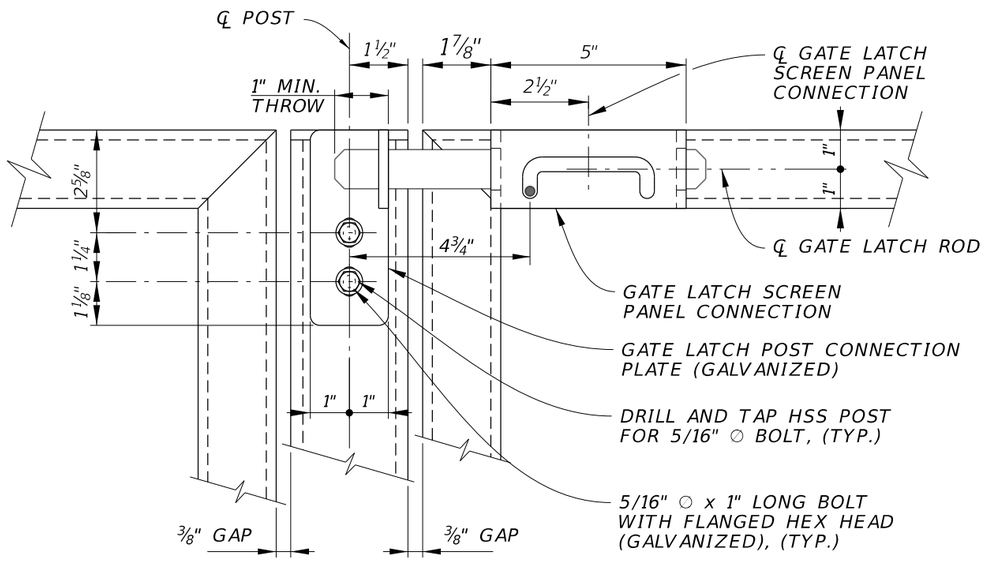
NOTES TO PREPARER:

1. PROVIDE ANTI-SEIZE LUBRICANTS FOR ALL FASTENERS REQUIRED FOR SCREEN PANEL LATCH ASSEMBLY.
2. PROVIDE ALUMINUM RIVET NUT 3/8" - 16 OF SUFFICIENT LENGTH TO FASTEN THE LATCH ASSEMBLY TO THE ST2x2, (TYP. OF 3).
3. PROVIDE 1"L X 3/8" - 16 STAINLESS STEEL HEX HEAD SCREW, (TYP. OF 3).
4. USE THE SLOTTED HOLES TO ADJUST THE SWING GATE LATCH POST CONNECTIONS AS NEEDED TO ACCOUNT FOR FINAL GANTRY CAMBER ONCE THE GANTRY IS SELF-SUPPORTING THE FULL WEIGHT OF THE STRUCTURE.

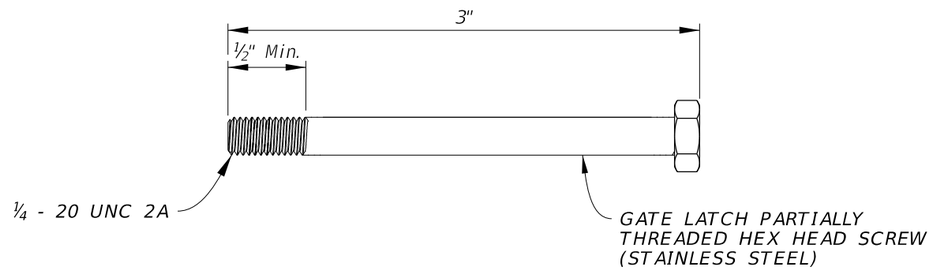


SECTION D-D

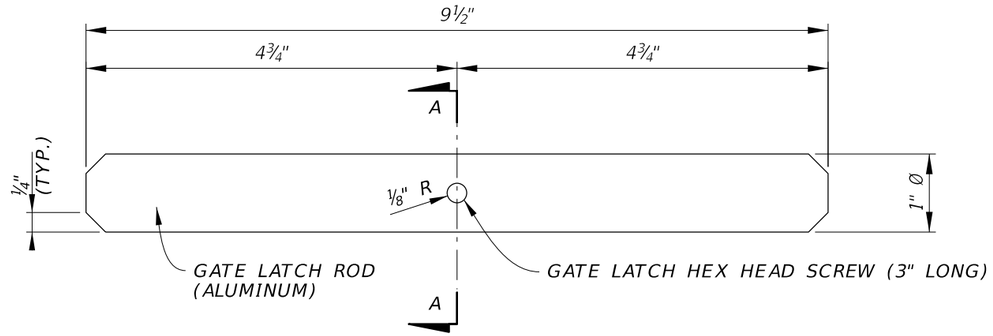
Exhibit 251.7-16 Swing Gate Latch (1 of 2)



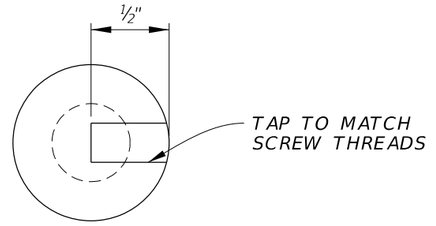
DETAIL D



GATE LATCH HEX HEAD SCREW DETAIL



GATE LATCH ROD DETAIL

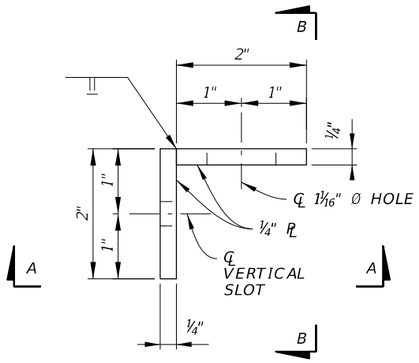


SECTION A-A

NOTE TO PREPARER:

1. USE THE SLOTTED HOLES TO ADJUST THE SWING GATE LATCH POST CONNECTIONS AS NEEDED TO ACCOUNT FOR FINAL GANTRY CAMBER ONCE THE GANTRY IS SELF-SUPPORTING THE FULL WEIGHT OF THE STRUCTURE.

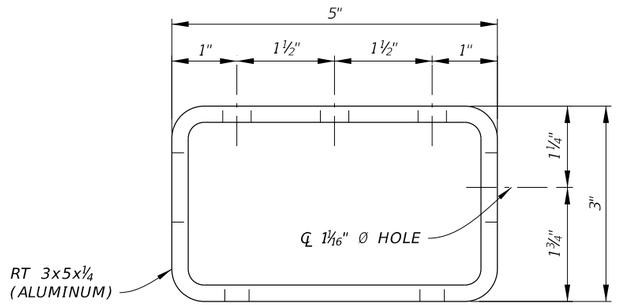
Exhibit 251.7-17 Swing Gate Latch (2 of 2)



PLAN

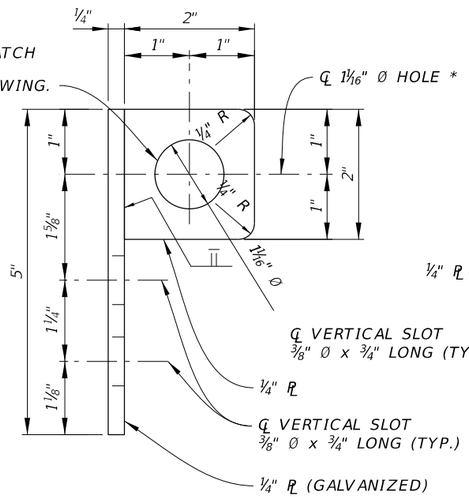
NOTES TO PREPARER:

1. BREAK ALL EDGES.
2. GATE LATCH POST CONNECTION PLATES TO BE GALVANIZED.

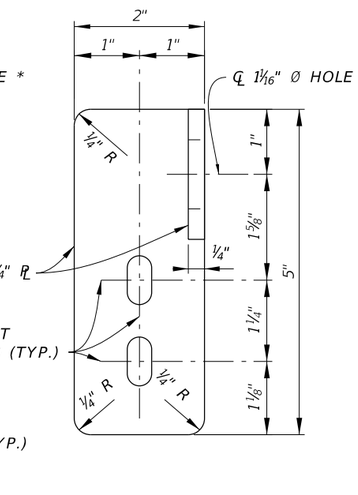


PLAN

PROVIDE A PLASTIC TORSION BUSHING FOR A 1" BAR. TRIM DEPTH AS NECESSARY SUCH THAT BUSHING DOES NOT EXCEED LATCH ROD THROW. INCLUDE DETAILS IN SHOP DRAWING.



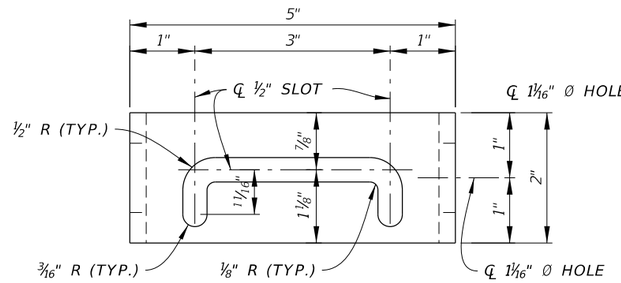
VIEW A-A



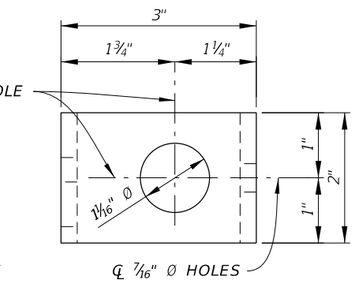
VIEW B-B

GATE LATCH DETAILS - POST CONNECTION

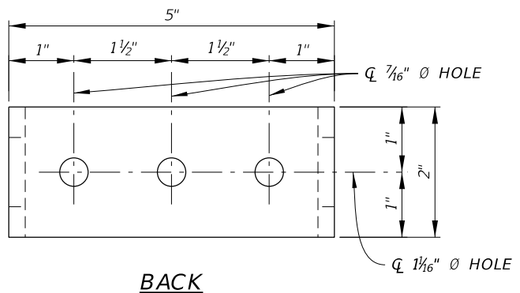
* ADJUST DIAMETER OF HOLE TO FIT ROD WITH A SNUG FIT



FRONT



SIDE

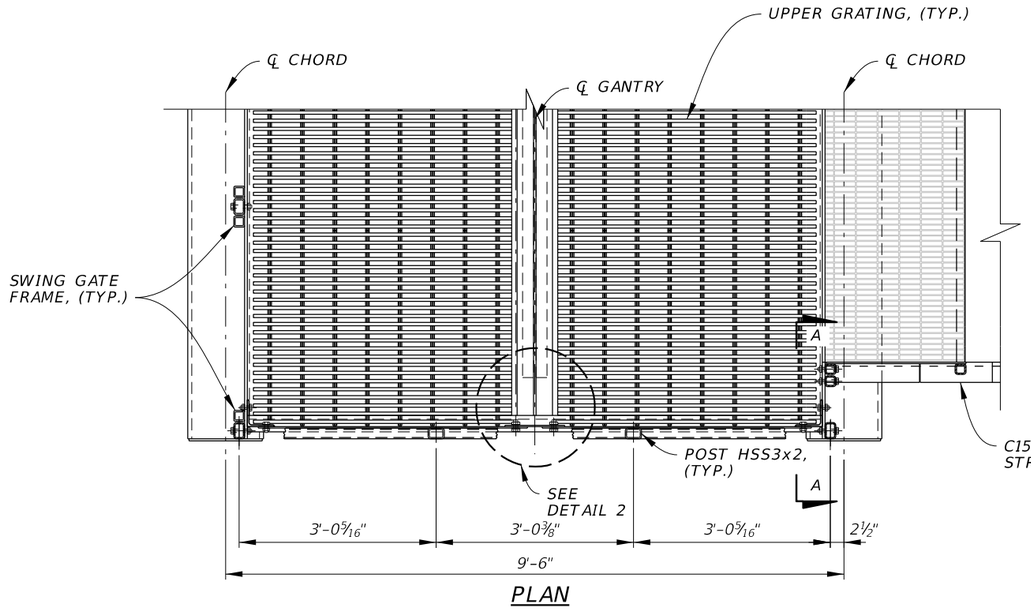


BACK

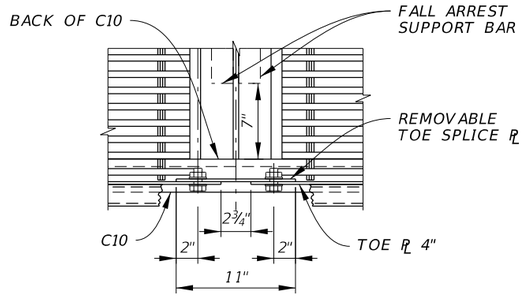
GATE LATCH DETAILS - SCREEN PANEL CONNECTION

(SCREEN PANEL BEYOND NOT SHOWN FOR CLARITY)

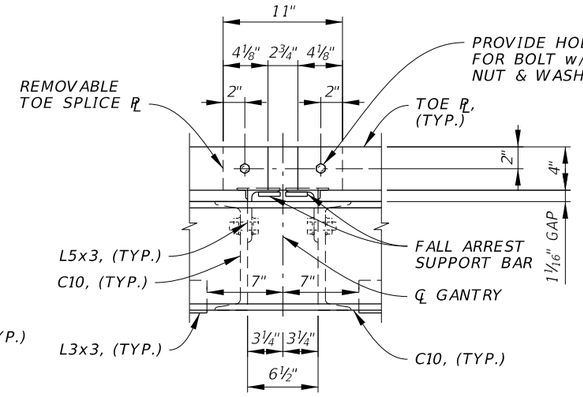
Exhibit 251.7-18 Upper Platform End Panels



PLAN



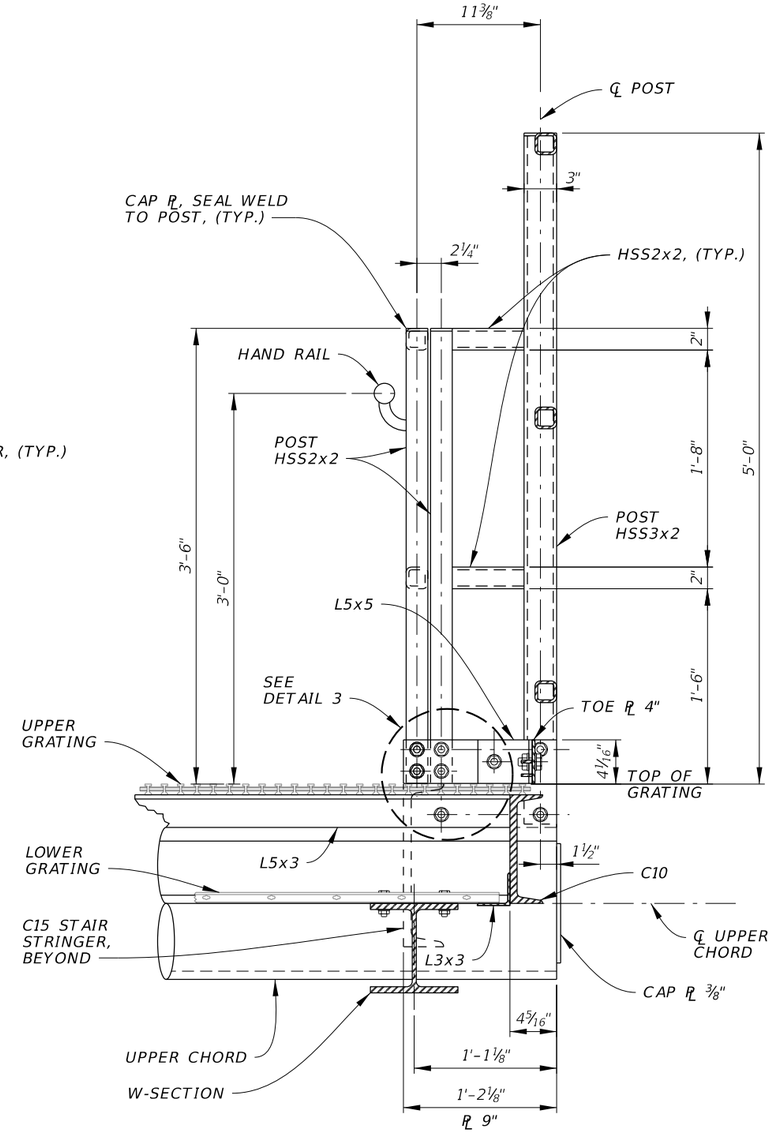
DETAIL 2



DETAIL 1

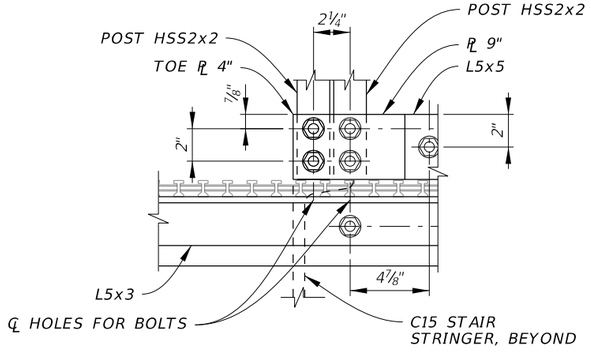
END ELEVATION

(TYPICAL BOTH ENDS OF GANTRY)
(GRATING AND GRATING CONNECTION NOT SHOWN FOR CLARITY)
(FOR SECTIONS B-B, C-C, AND D-D, SEE UPPER PLATFORMS PANELS)

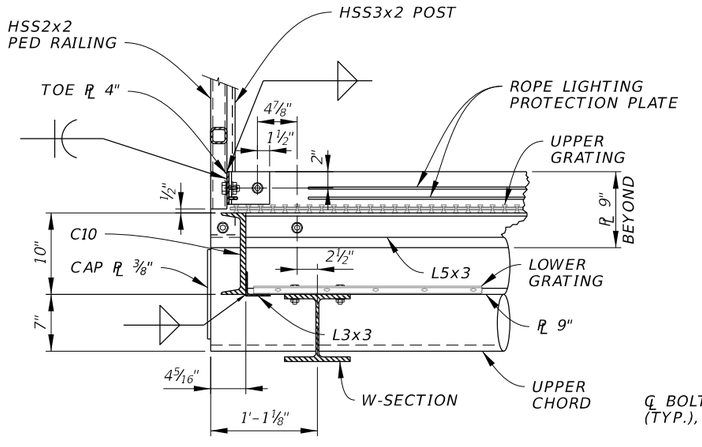


SECTION A-A

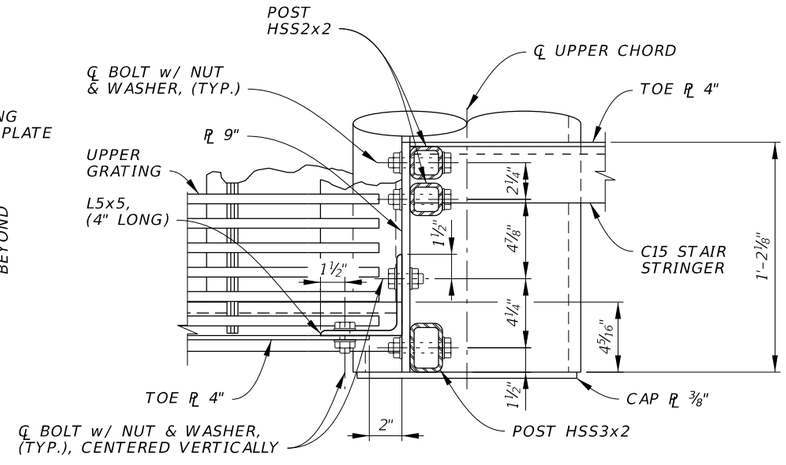
Exhibit 251.7-19 Upper Platform Panels



DETAIL 3



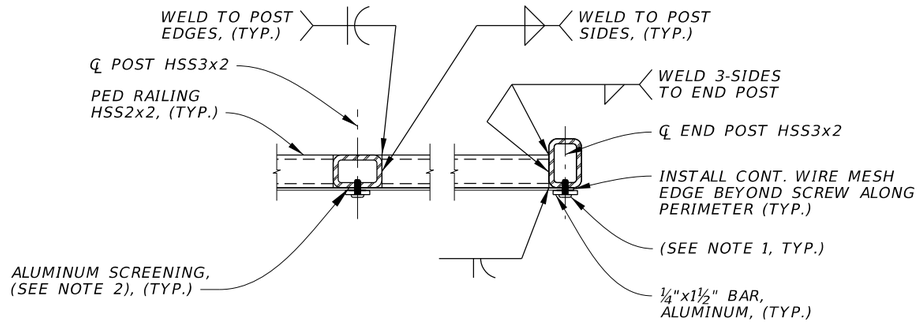
SECTION D-D



SECTION B-B

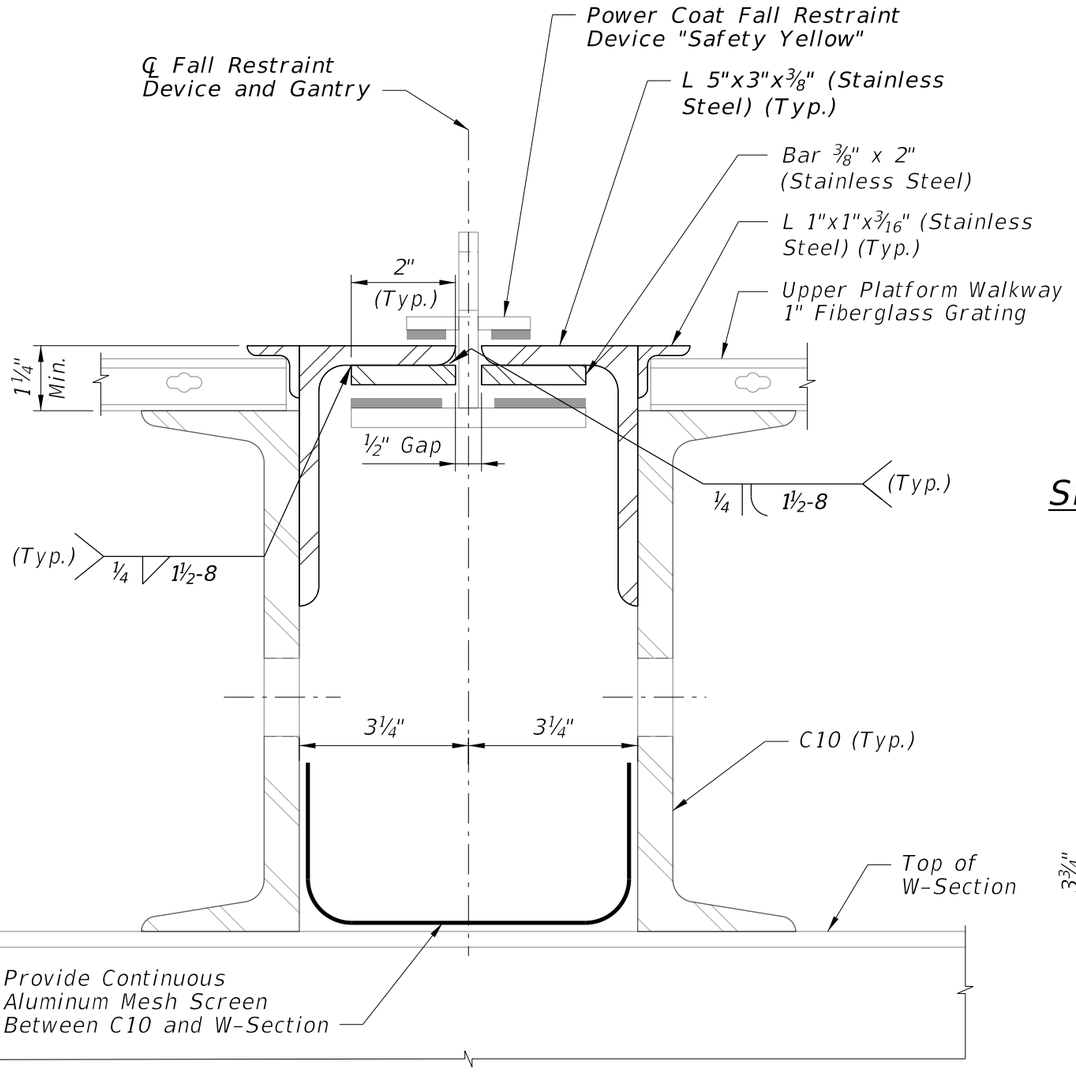
NOTES TO PREPARER:

1. SEMS SCREW w/ INTERNAL WASHER, ¾" LONG, AT 6" MAX. SPACING.
2. PROVIDE 1/32" x ¾" Ø NEOPRENE WASHER BETWEEN ALUMINUM SCREENING AND STAINLESS STEEL BAR, AND ½" x ¾" Ø NEOPRENE WASHER BETWEEN ALUMINUM SCREENING AND HSS POST.

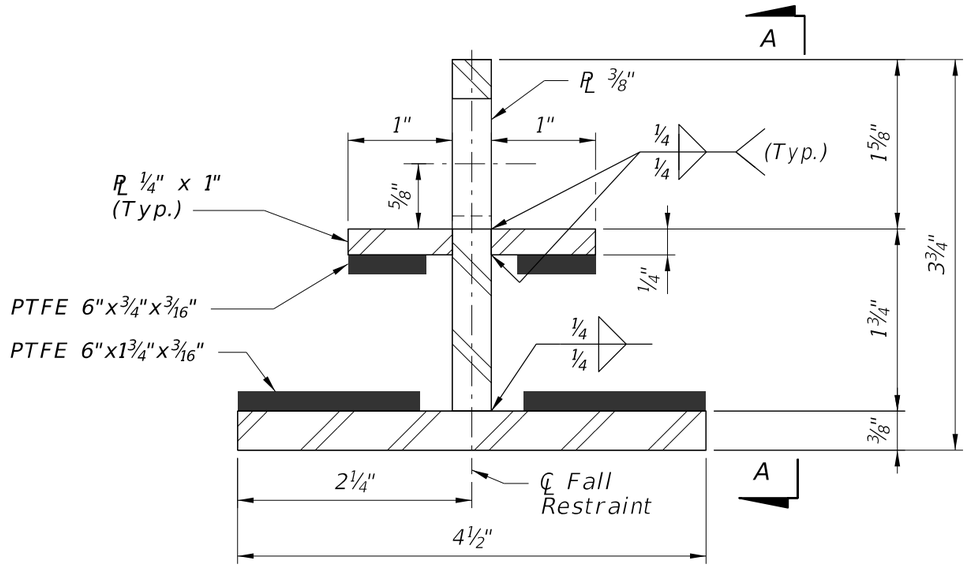


SECTION C-C

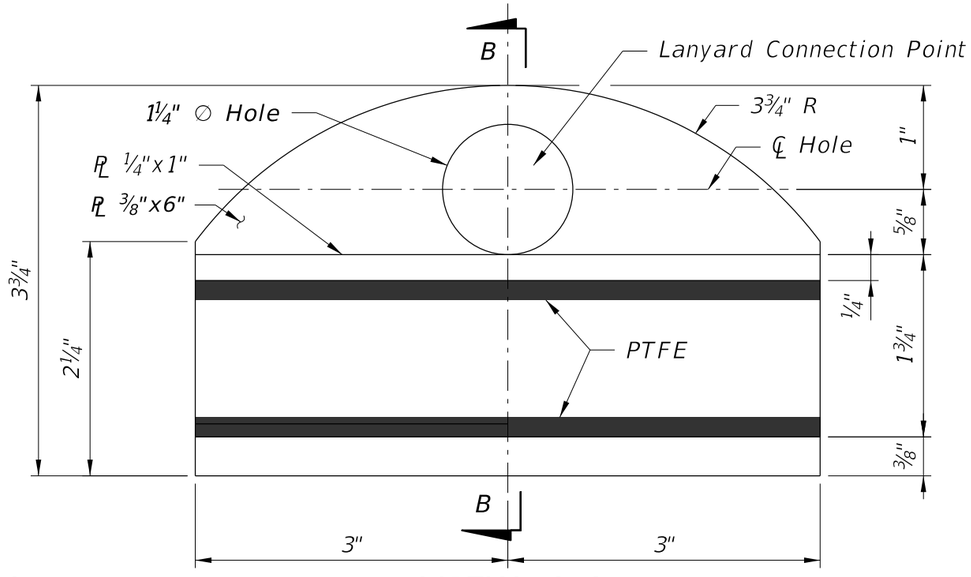
Exhibit 251.7-20 Fall Restraint System Details



SECTION THROUGH FALL RESTRAINT ASSEMBLY ON GANTRY

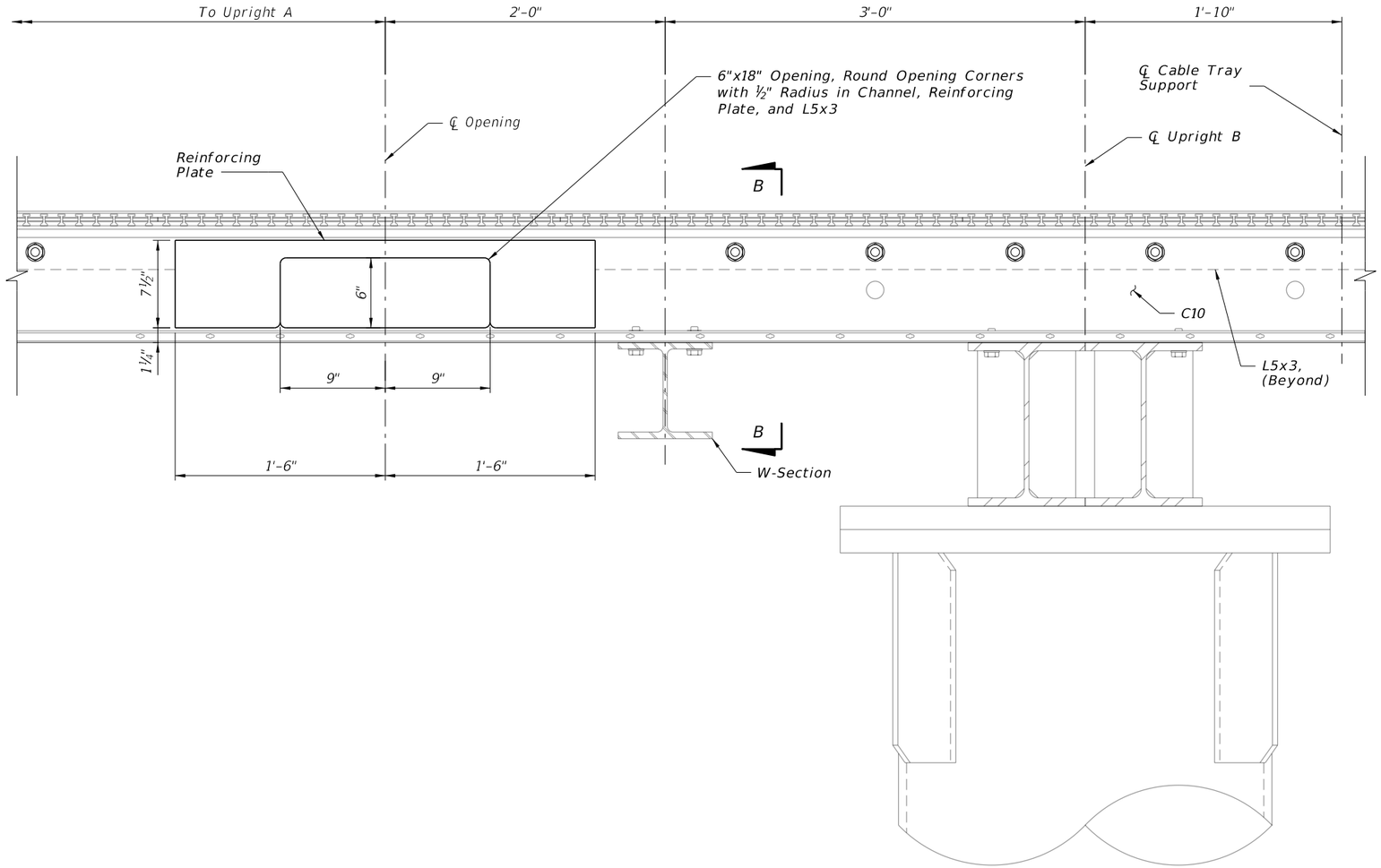


SECTION B-B - THROUGH FALL RESTRAINT DEVICE

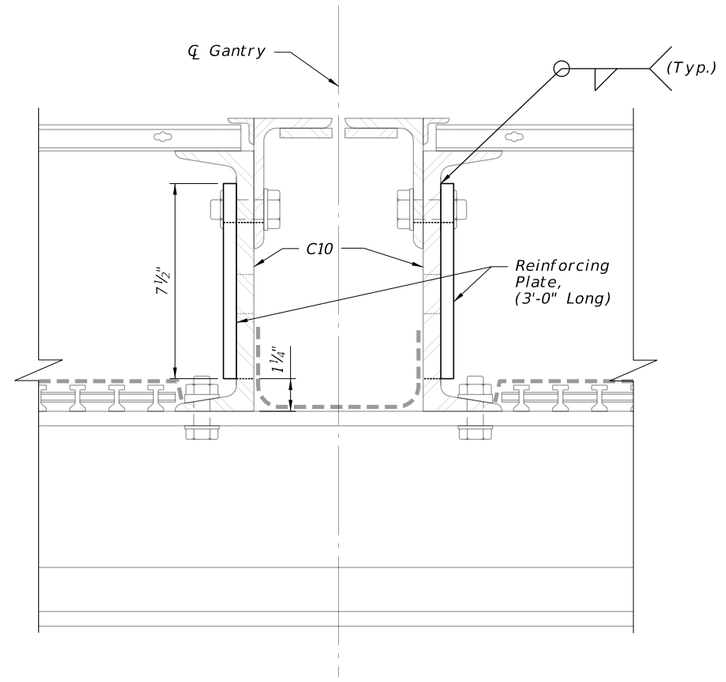


VIEW A-A

Exhibit 251.7-21 Reinforced Opening in Channels for Cable Tray Pass Thru

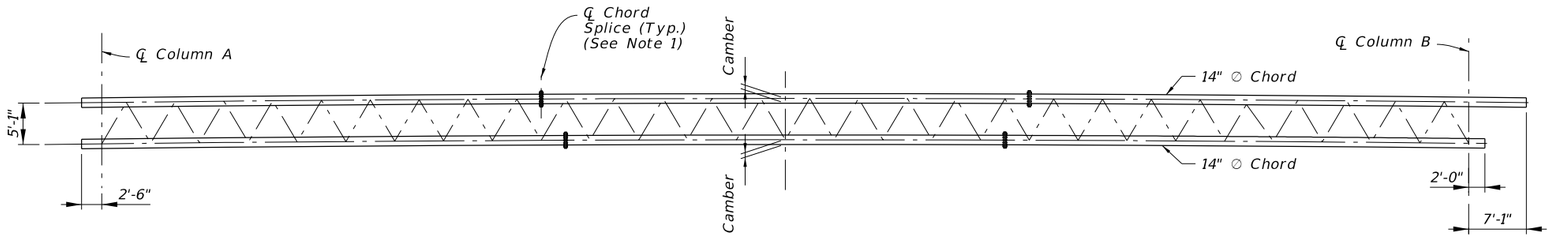


SECTION A-A



SECTION B-B

Exhibit 251.7-22 Camber and Splice Details

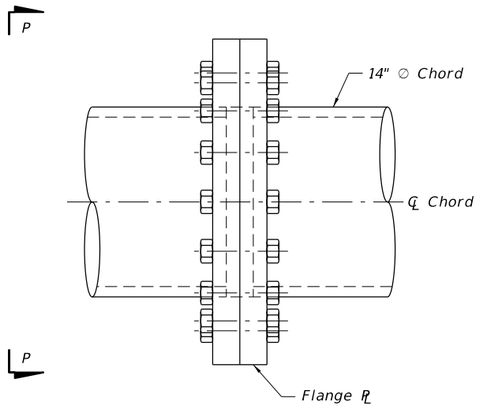


CAMBER DIAGRAM

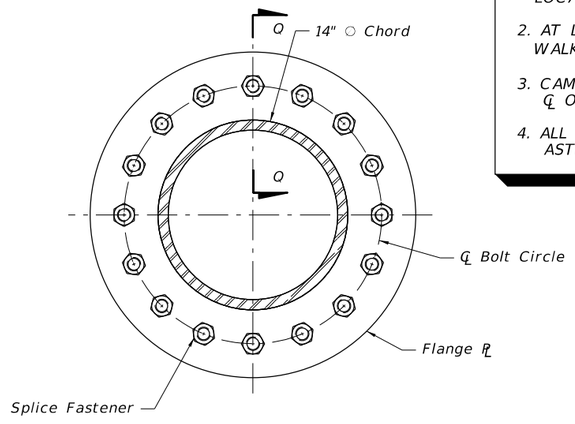
(See Camber Dimension Detail)

NOTES TO PREPARER:

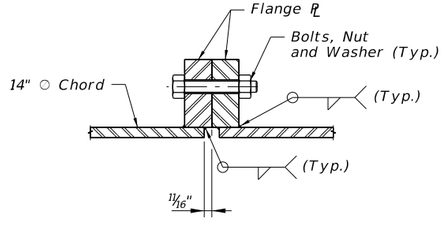
1. A MINIMUM OF TWO CHORD SPLICES IS REQUIRED. LOCATE SPLICES A MINIMUM OF 6 TRUSS PANEL LENGTHS APART. NO WELDED SHOP SPLICES ARE PERMITTED. CHORD SPLICE LOCATIONS MUST BE SHOWN IN THE SHOP DRAWINGS.
2. AT LOCATION OF SPLICE, DISCONTINUE CHANNELS AND WALKWAY SUPPORT MEMBERS BY LEAVING A GAP OF ½".
3. CAMBER DIMENSION IS MEASURED TO THE HORIZONTAL ℄ OF THE CHORDS.
4. ALL STEEL PLATES MUST BE IN ACCORDANCE WITH ASTM A709, GRADE 50.



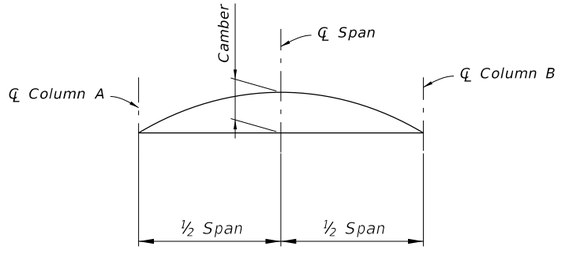
ELEVATION SPLICE CONNECTION



VIEW P-P



SECTION Q-Q



CAMBER DIMENSION DETAIL

251.8 Foundation Systems

(1) Gantries must be supported by a deep foundation system. Shallow foundation systems are not permitted.

(2) Geotechnical investigations for gantry foundations must be in accordance with ***GTR 280.3***.

(3) Design drilled shafts and driven piles per the requirements of ***Soils and Foundations Handbook***.

(4) Driven Piles

(a) At least one test pile per gantry must be dynamically monitored with a Pile Driving Analyzer (PDA) or Embedded Data Collector (EDC) and following ***Standard Specifications, Section 455***.

(b) All preformed pile holes installed in rock must be grouted following ***Standard Specifications Section 455,*** to restore lateral stability of the foundation, unless the rock is modeled as non-cohesive soil in design and sand backfill is used following the Specification requirements.

(5) Drilled Shafts

Thermal integrity (TITDS) tests are required at every drilled shaft. The TITDS tests will be performed by FDOT.

Modification for Non-Conventional Projects:
Replace the above paragraph with the following: Thermal integrity (TITDS) tests are required at every drilled shaft. The TITDS tests will be performed by the Design-Build Team. The signed and sealed report must be included in the Foundation Certification Package.

(6) Do not use of micropiles or auger cast piles.

251.8.2 Foundation Length

(1) After foundation length is determined based on design analyses add:

(a) 4 feet to the required foundation length when subsurface soil or rock is modeled as non-cohesive material.

(b) 6 feet to the required foundation length when any soil or rock is modeled as cohesive material in design.

(2) Design of the drilled shaft must include reduction of skin friction in limestone associated with the use of temporary casing.

252 Toll Equipment J-Arms

252.1 General Requirements

J-arms must be in accordance with ***Exhibit 252.1-1***.

252.1.1 J-Arm Attachment Hardware

The J-arms must be mounted to the horizontal support pipes (non-accessible gantries) or to the support arms (accessible gantries) as follows:

(1) Non-accessible gantry J-arm attachment hardware must be in accordance with ***Exhibit 252.1-2***, ***Exhibit 253.2-1***, ***Exhibit 253.2-2***, and ***Exhibit 253.2-3***.

(2) Accessible gantry J-arm attachment hardware must be in accordance with ***Exhibit 252.1-2***, ***Exhibit 254.2-5***, ***Exhibit 254.2-6***, ***Exhibit 254.2-7***, and ***Exhibit 254.2-8***.

(3) Telescoping brackets or supports are not allowed.

(4) All hardware connections must be designed to prohibit loosening over time.

(5) See ***GTR 251*** for rigidity and vibration requirements.

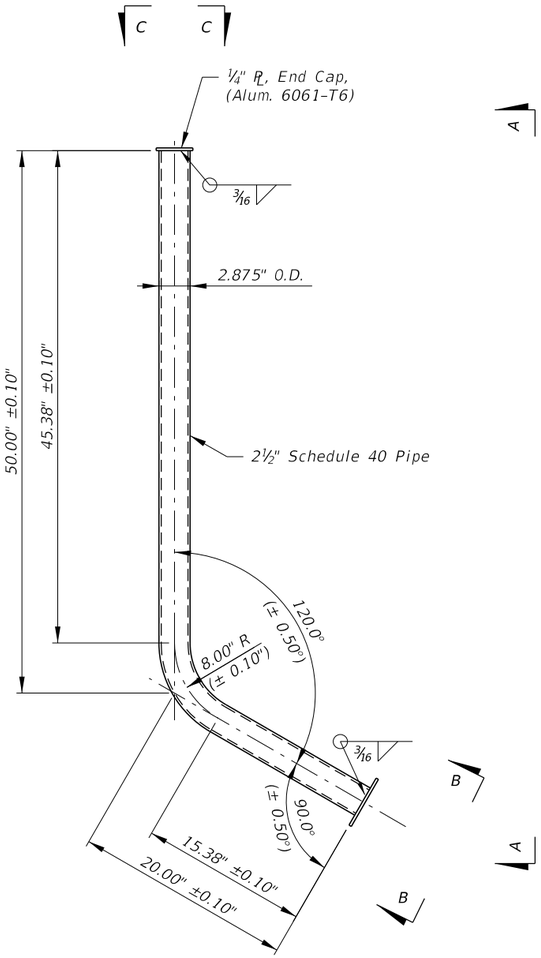
252.1.2 J-Arm Point of Attachment

(1) The point of attachment of the J-arm must be in the longest straight section of the J-arm. See ***Exhibit 251.4-1***, ***Exhibit 252.1-1***, and ***Exhibit 254.2-5***.

(2) All J-arms must accommodate 26 inches of vertical adjustability (13 inches up/down) from the reference point (neutral position of the J-arm). See ***Exhibit 252.1-1*** for the reference point on the J-arm.

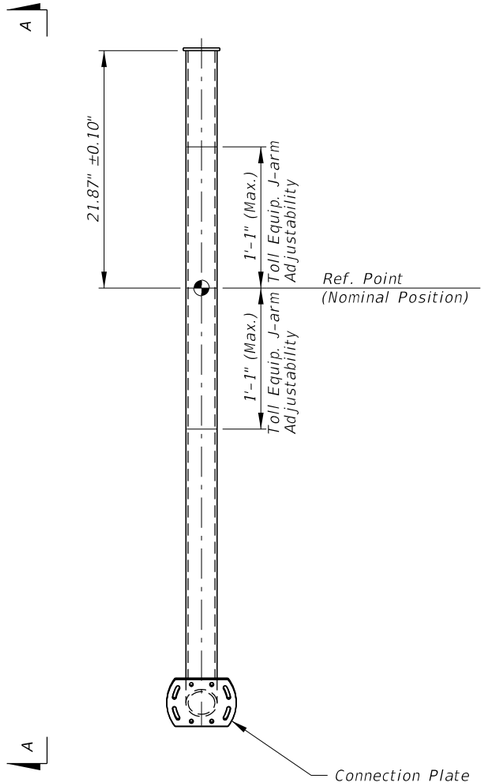
(3) Horizontal adjustability limits with respect to the J-arms must be within the limits identified in ***Exhibit 252.1-3*** and ***Exhibit 252.1-4***. For all other toll equipment, the centerline of J-arm coincides with the centerline of the toll equipment.

Exhibit 252.1-1 J-Arm Detail

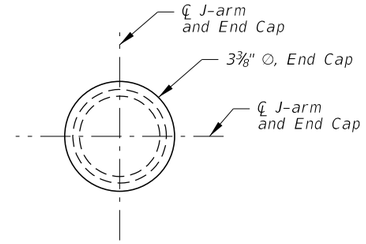


TOLL EQUIPMENT J-ARM

(Alum. 6061-T6)

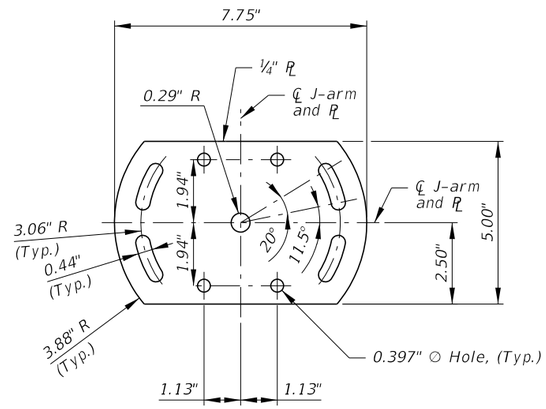


SECTION A-A



END CAP - SECTION C-C

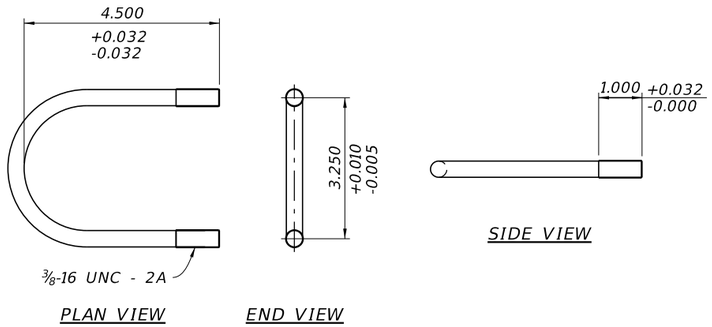
(Alum. 6061-T6)



CONNECTION PLATE - SECTION B-B

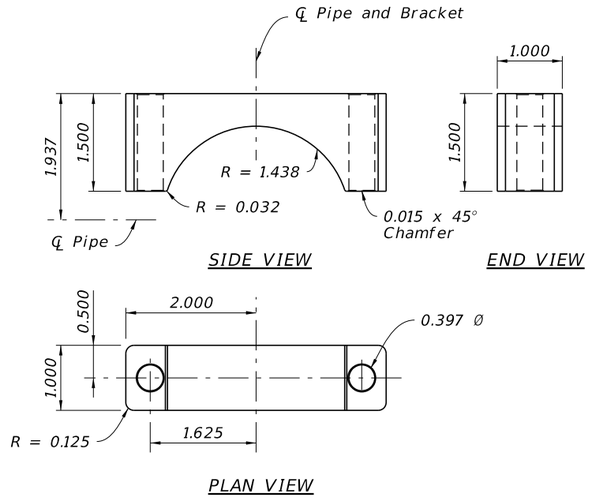
(Alum. 6061-T6)

Exhibit 252.1-2 J-Arm Attachment Hardware



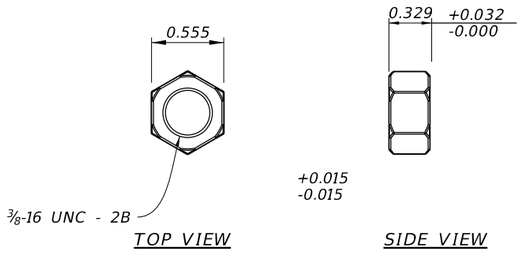
J-ARM PIPE TO J-ARM PLATE U-BOLT DETAIL

(2 Per J-Arm)



J-ARM PIPE SADDLE DETAIL

(2 Per J-Arm) (Alum. 6061-T6)

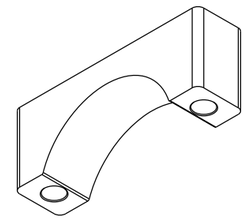


NUTS

NOTE: Nuts to be 316 Stainless Steel. (2 per leg, 4 Per U-Bolt)

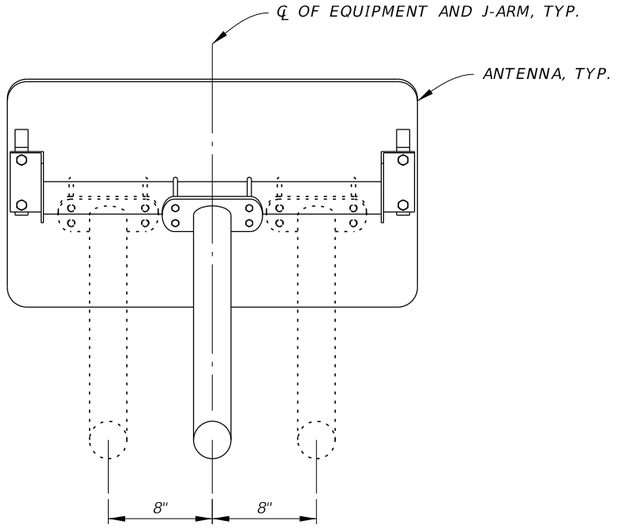
NOTES TO PREPARER:

1. BREAK ALL EDGES. CLEAN AND DEGREASE PART.
2. ALL DIMENSIONS ARE IN INCHES, UNLESS NOTED OTHERWISE.
3. U-BOLTS MUST BE 316 STAINLESS STEEL AND THREADS TO BE COATED WITH A SUITABLE ANTI-GALL COMPOUND.
4. FURNISH THREE (3) SPARE SETS OF J-ARM ATTACHMENT HARDWARE (U-BOLTS, PIPE SADDLES, MOUNTING PARTS, WASHERS, DOUBLE NUTS, ETC.)



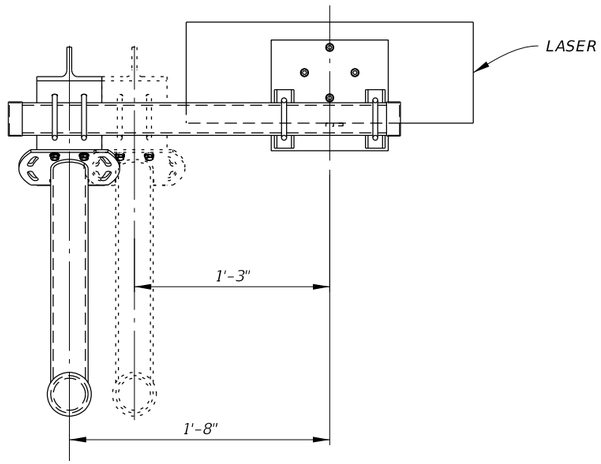
SADDLE ISOMETRIC VIEW

Exhibit 252.1-3 Toll Equipment Adjustability (1 of 2)



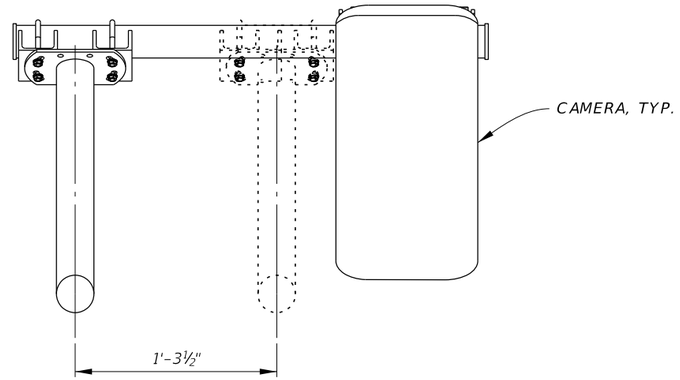
ANTENNA LIMITS OF ADJUSTABILITY FROM CENTERED J-ARM

PLAN

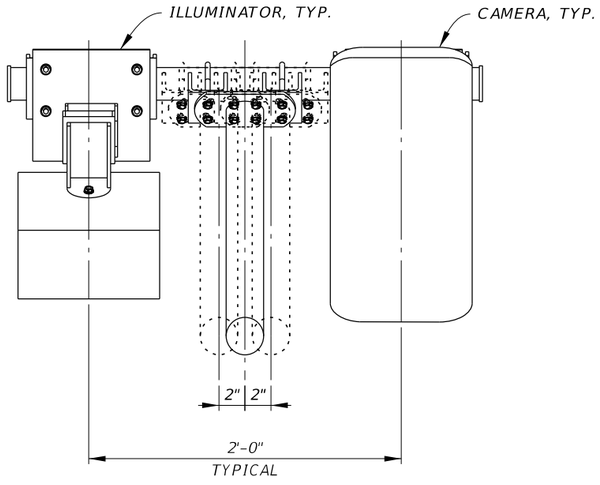


LASER LIMITS OF ADJUSTABILITY AND CAN BE MIRRORED ABOUT THE ℄ OF THE J-ARM

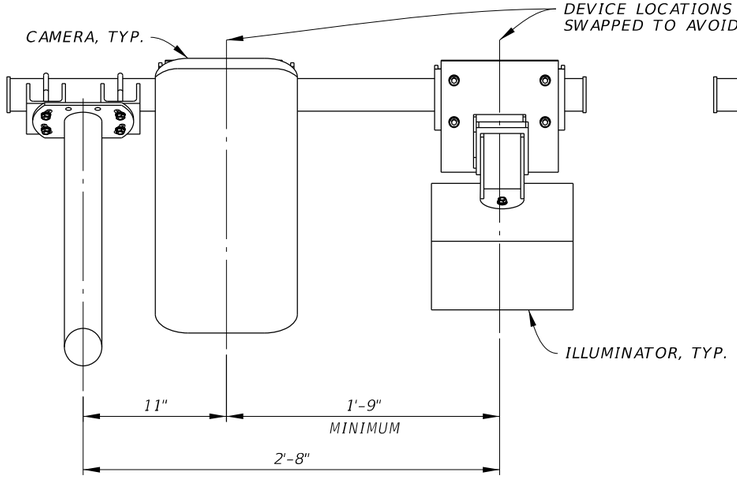
PLAN



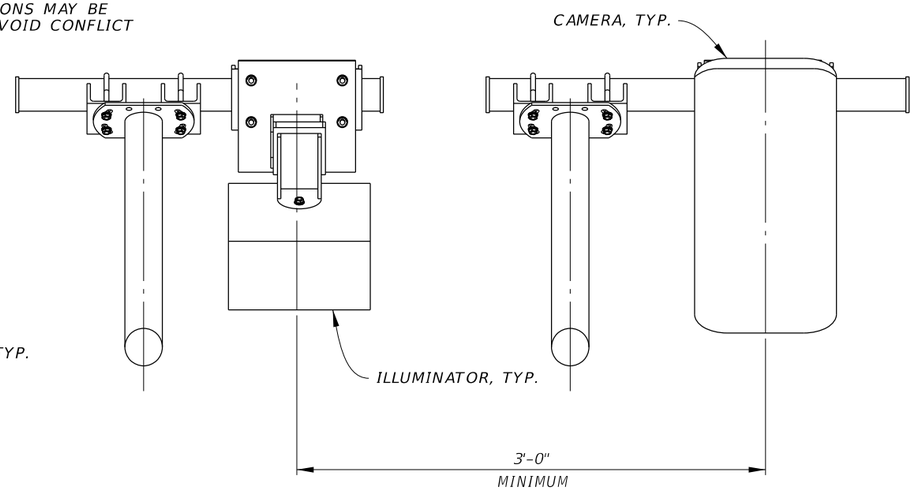
PLAN



FRONT AND SHOULDER CAMERAS - PLAN

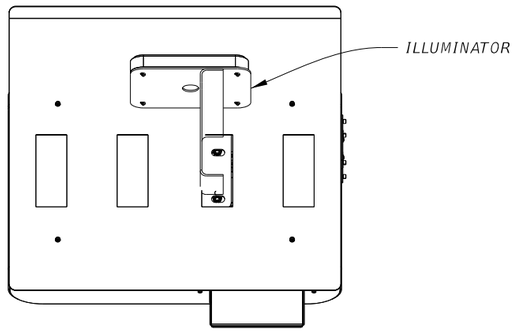


ALTERNATIVE FRONT AND SHOULDER CAMERAS – PLAN

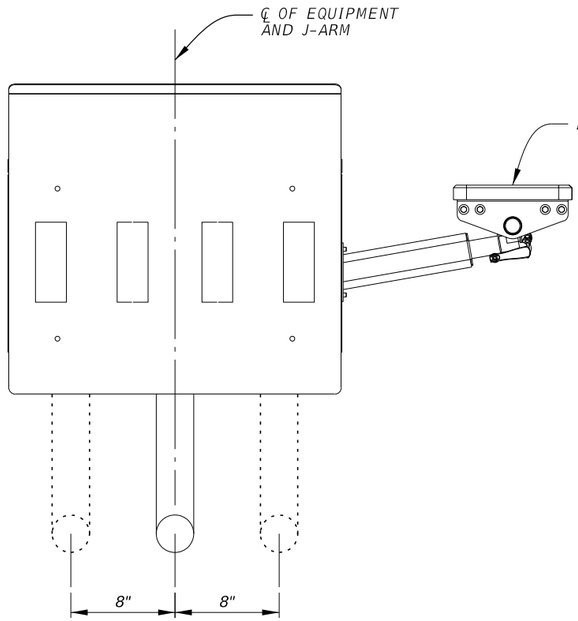


REAR TRAVEL LANE CAMERA – PLAN

Exhibit 252.1-4 Toll Equipment Adjustability (2 of 2)

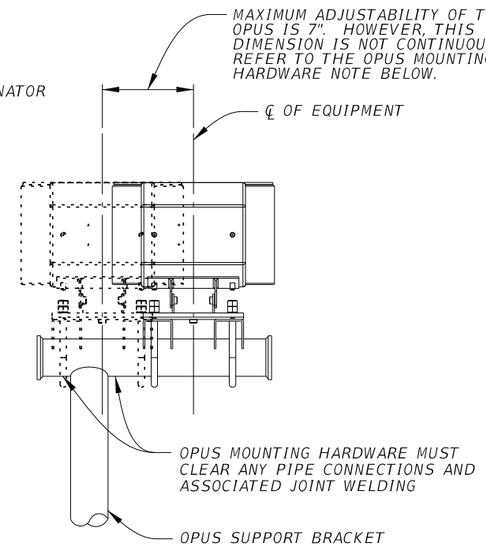


PLAN - ALTERNATIVE ILLUMINATOR CONFIGURATION



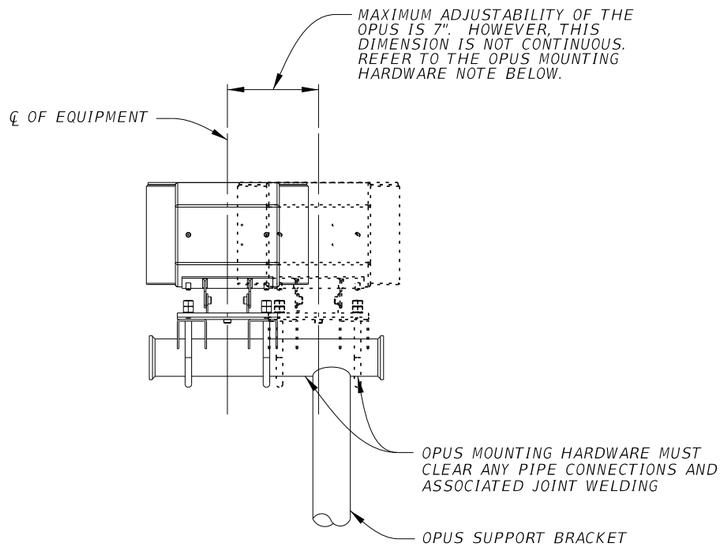
VCARS II LIMITS OF ADJUSTABILITY FROM CENTERED J-ARM

PLAN



FRONT OPUS LIMITS OF ADJUSTABILITY

PLAN



REAR OPUS LIMITS OF ADJUSTABILITY

PLAN

253 Horizontal Support Pipes for Non-Accessible Gantries

253.1 General Requirements

(1) Horizontal support pipes must be provided for attaching J-arms to the structural W-section of the gantry. See ***Exhibit 252.1-2***, ***Exhibit 253.2-1***, ***Exhibit 253.2-2***, and ***Exhibit 253.2-3*** for assembly details.

(2) The horizontal support pipes must be staggered to allow the J-arms to be on the same centerline offset, as required in ***GTR 250.2.1***.

(3) The W-section members' location must not conflict with the J-arms' position required for toll equipment installation. There must be a minimum of 7 1/2 inches between the centerline of the W-section and the centerline of the J-arm, resulting in a minimum of 1 inch of lateral clearance between any J-arm attachment hardware and the W-section supporting the horizontal support pipes as shown in ***Exhibit 253.2-3***.

253.2 Horizontal Support Pipes

(1) Horizontal support pipes must span between each set of adjacent W-section members over equipped lanes and shoulders.

(2) Horizontal support pipes must be provided to hold all J-arms. There must be horizontal pipes on both the approach and departure sides of the gantry above equipped lanes and shoulders.

(3) All horizontal support pipes will be 6'-6" long except when cantilevered as described in (8) below. Horizontal support pipes must be identical in diameter, wall thickness and material for each gantry.

(4) Each horizontal support pipe must hold a maximum of three (3) J-arms.

(5) Horizontal support pipes must have an outside diameter of 4.5 inches and must be attached to the structural members (W-section) by pipe saddles and U-bolts. See ***Exhibit 251.4-1***.

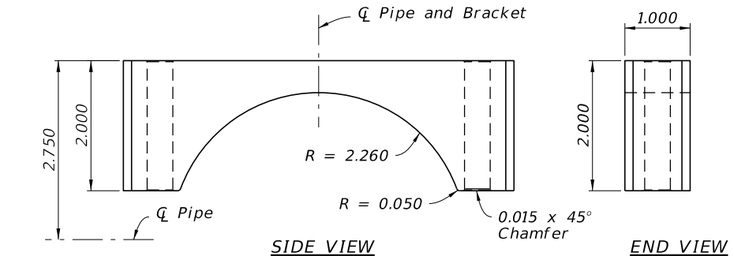
(6) Horizontal support pipes must extend a minimum of 3 inches beyond the pipe saddle U-bolt assembly that secures the horizontal pipes to the W-section members. The extension must not conflict with J-arm mounting installation.

(7) All horizontal support pipes must be level.

(8) Only on 42-foot and 48-foot cantilever gantry spans, horizontal support pipes can be cantilevered beyond the last W-section member for supporting equipment on the cantilevered portion. These cantilevered horizontal support pipes must not extend beyond the end of the longest chord.

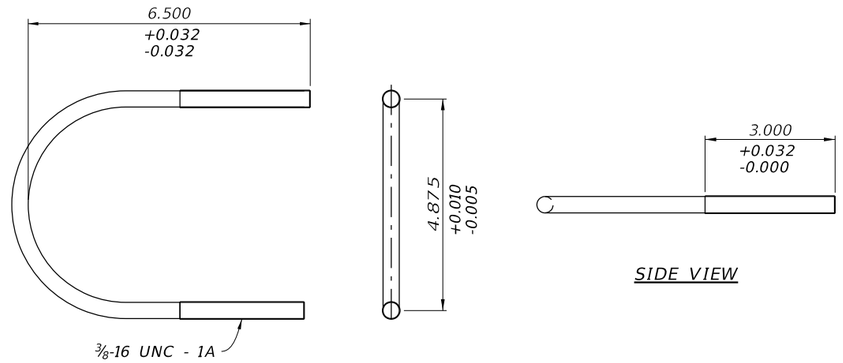
(9) For horizontal support pipes cantilevered from the gantry, J-arm mounting hardware must be a minimum of 3 inches inside the unsupported edge of the horizontal support pipe.

Exhibit 253.2-1 Horizontal Support Pipe Attachment Hardware (1 of 3)



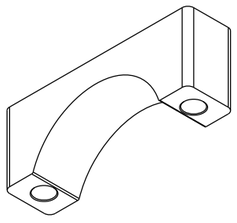
HSS4.500 PIPE TO J-ARM PLATE SADDLE DETAIL

(2 Per J-Arm) (ASTM A307 Grade A Steel Galvanized)



HSS4.500 PIPE TO J-ARM PLATE U-BOLT DETAIL

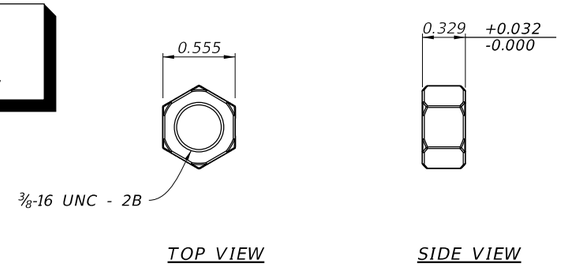
NOTE: (2 Per J-Arm) (U-Bolts to be 316 Stainless Steel)



SADDLE ISOMETRIC VIEW

NOTES TO PREPARER:

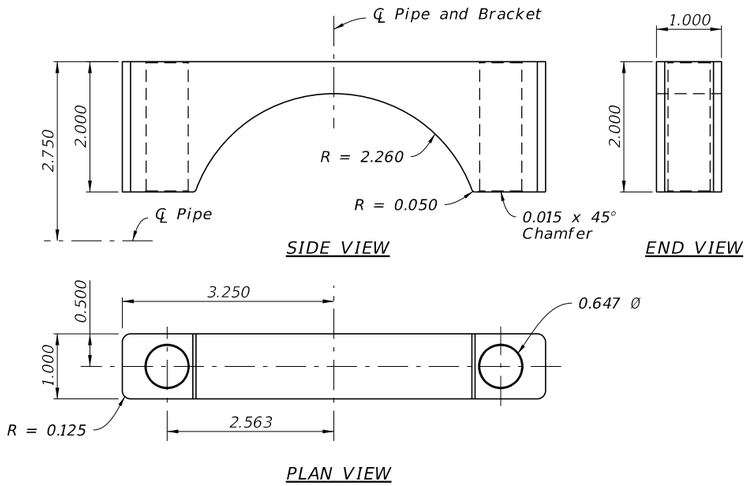
1. BREAK ALL EDGES. CLEAN AND DEGREASE PART.
2. ALL DIMENSIONS ARE IN INCHES, UNLESS NOTED OTHERWISE.



NUTS

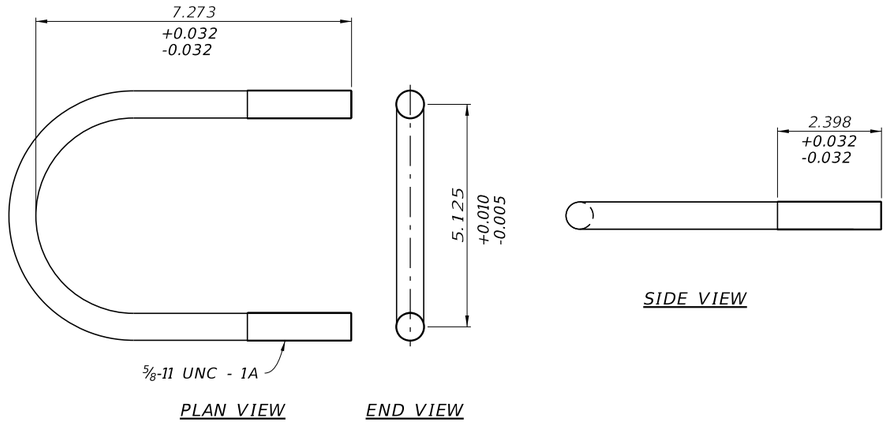
NOTE: Stainless Steel Nuts to be 316 Stainless Steel. (2 Per Leg, 4 per U-Bolt)

Exhibit 253.2-2 Horizontal Support Pipe Attachment Hardware (2 of 3)



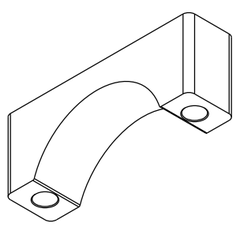
HSS4.500 PIPE TO W-SECTION SADDLE DETAIL

(2 Per Mounting Pipe) (ASTM A307 Grade A Steel Galvanized)



HSS4.500 PIPE TO W-SECTION U-BOLT DETAIL

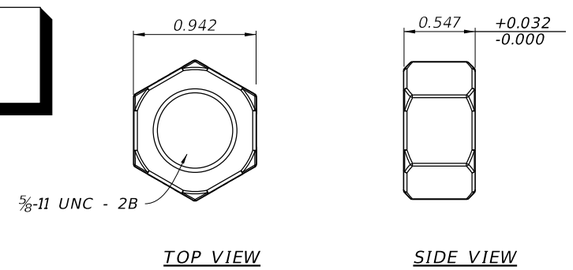
NOTE: (2 Per Mounting Pipe) (U-Bolts to be galvanized ASTM A449 Grade A Steel.)



SADDLE ISOMETRIC VIEW

NOTES TO PREPARER:

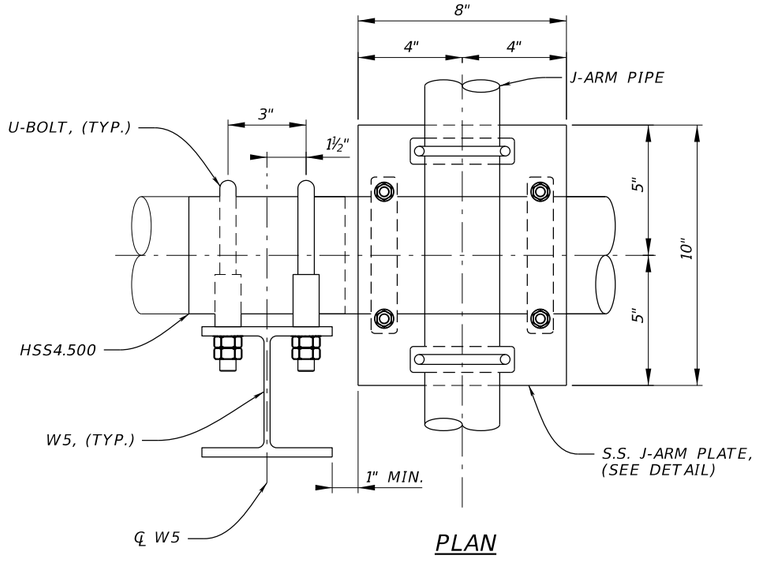
1. BREAK ALL EDGES. CLEAN AND DEGREASE PART.
2. ALL DIMENSIONS ARE IN INCHES, UNLESS NOTED OTHERWISE.



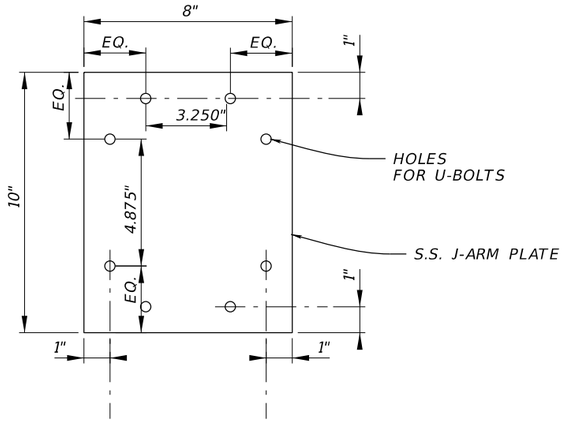
NUTS

NOTE: Nuts to be ASTM A563 (2 Per Leg, 4 per U-Bolt)

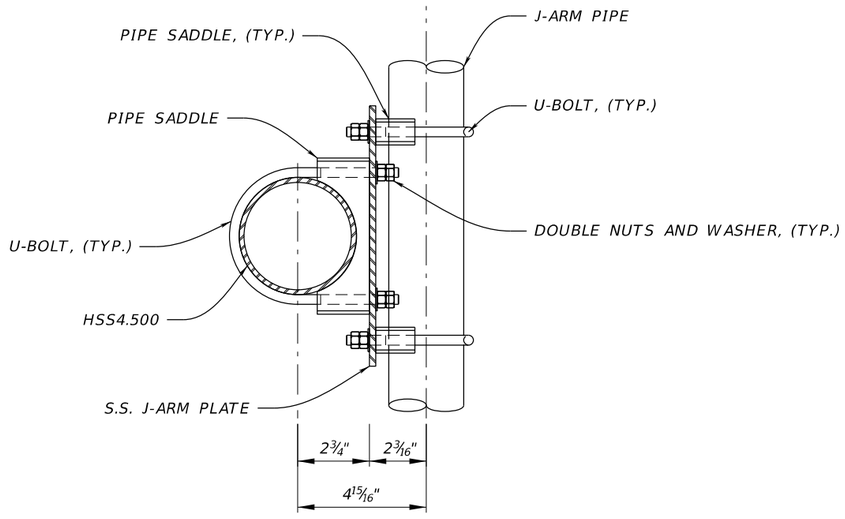
Exhibit 253.2-3 Horizontal Support Pipe Attachment Hardware (3 of 3)



PLAN



DETAIL



ELEVATION

254 Equipment Retraction Assembly for Accessible Gantries

The equipment retraction assembly includes the gear box, support arm, J-arm and associated hardware. The retraction assembly system allows the toll equipment to be retracted to the deck (walkway) where it can be serviced over live traffic by trained technicians.

254.1 General

(1) One equipment retraction assembly must be provided for each J-arm as shown in the exhibits included in this subsection.

(2) The number and positioning of gear boxes and support arms must be determined from the equipment layout.

(3) The equipment retraction assembly must fully retract each equipped J-arm individually without requiring other equipped J-arms to be retracted.

254.2 Support Arm Assembly

(1) The support arm assemblies must retract the J-arm mounted tolling equipment devices to the gantry walkway, as shown in ***Exhibit 254.2-1***, ***Exhibit 254.2-2***, ***Exhibit 254.2-3***, and ***Exhibit 254.2-4***.

(2) The support arms (“support arm”) must be as shown in ***Exhibit 254.2-5***, ***Exhibit 254.2-6***, ***Exhibit 254.2-7***, and ***Exhibit 254.2-8***. Each support arm must be attached to a single gear box.

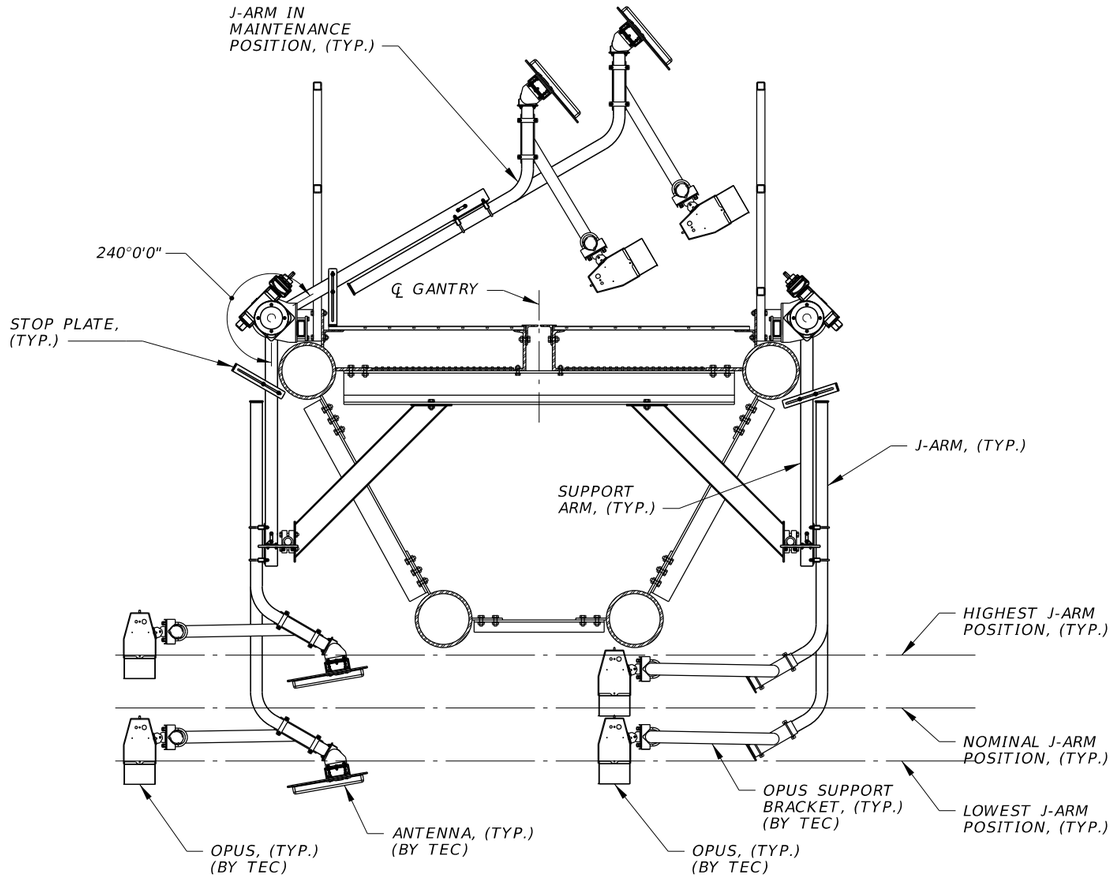
(3) Where toll equipment layout results in the latch plate conflicting with the latch bar brace:

  (a) Offset the support arm assembly per the adjustability as shown in ***Exhibit 252.1-3***, and ***Exhibit 252.1-4***.

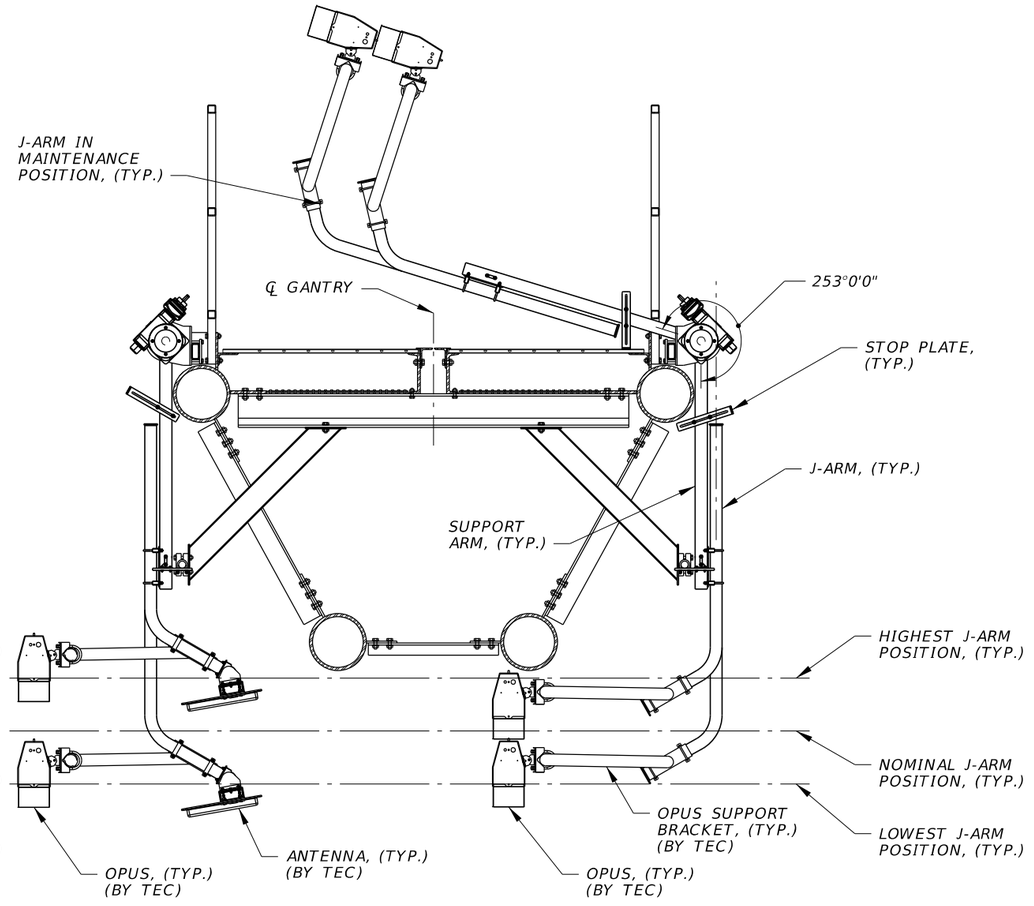
  (b) Where toll equipment is not adjustable, an alternate latch plate must be designed to avoid the conflict with the latch bar brace.

(4) Stop plates must be used to restrict the movement of the support arms as they swing into the maintenance position over the walkway. Type and mounting position of stop plates will vary for each piece of toll equipment. See ***Exhibit 254.2-1***, ***Exhibit 254.2-2***, ***Exhibit 254.2-3***, ***Exhibit 254.2-4***, and ***Exhibit 254.2-10*** for stop plate types and mounting.

Exhibit 254.2-1 Equipment Retraction Assembly Rotation (1 of 4)

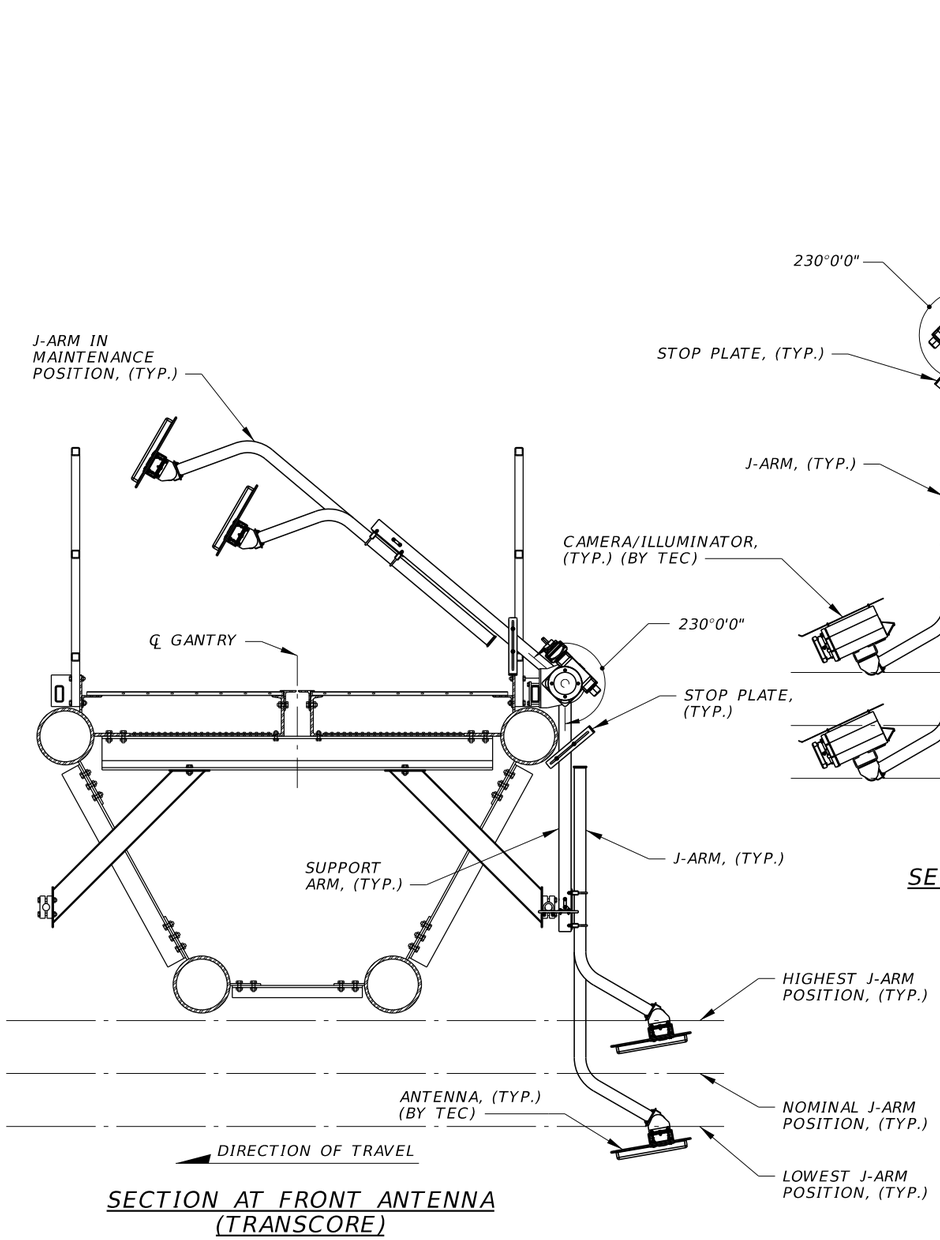


SECTION AT ℄ LANE/SHOULDER (TRANSCORE)

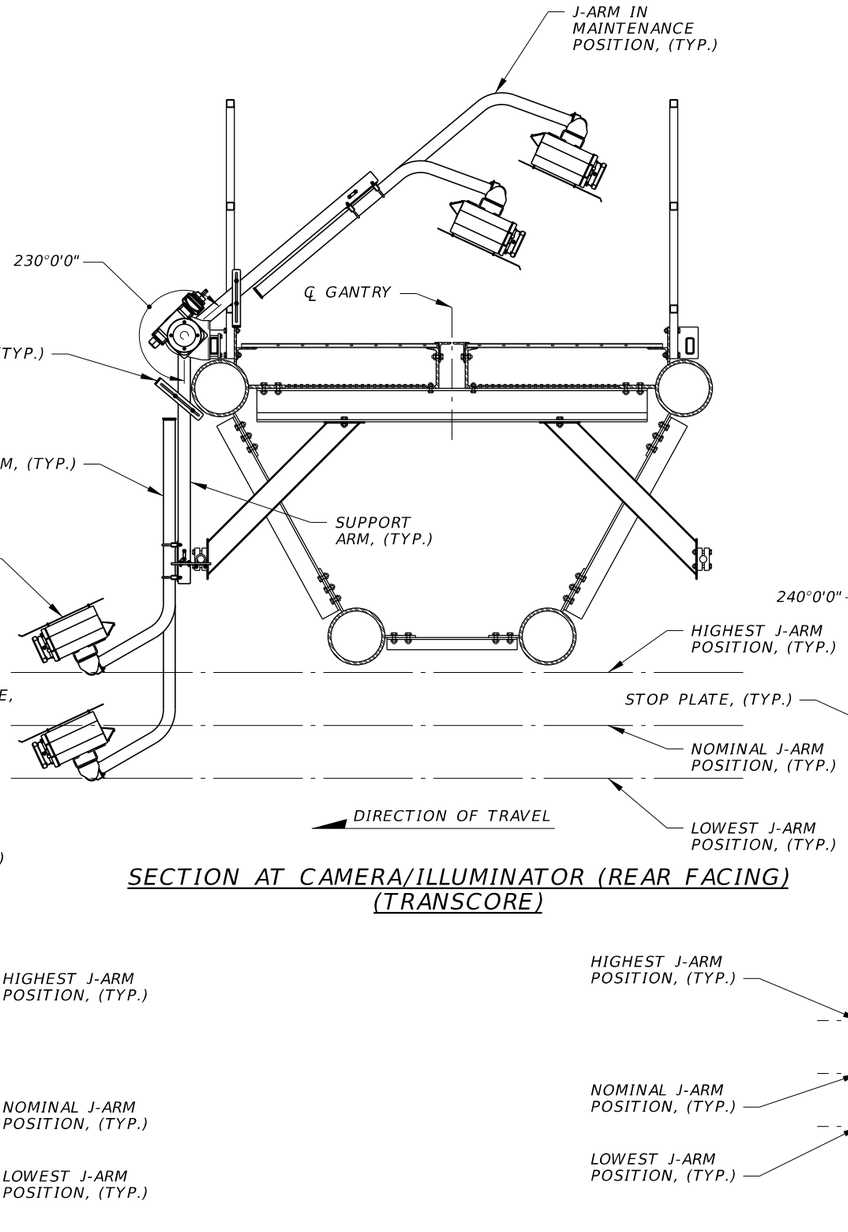


SECTION AT ℄ LANE/SHOULDER (TRANSCORE)

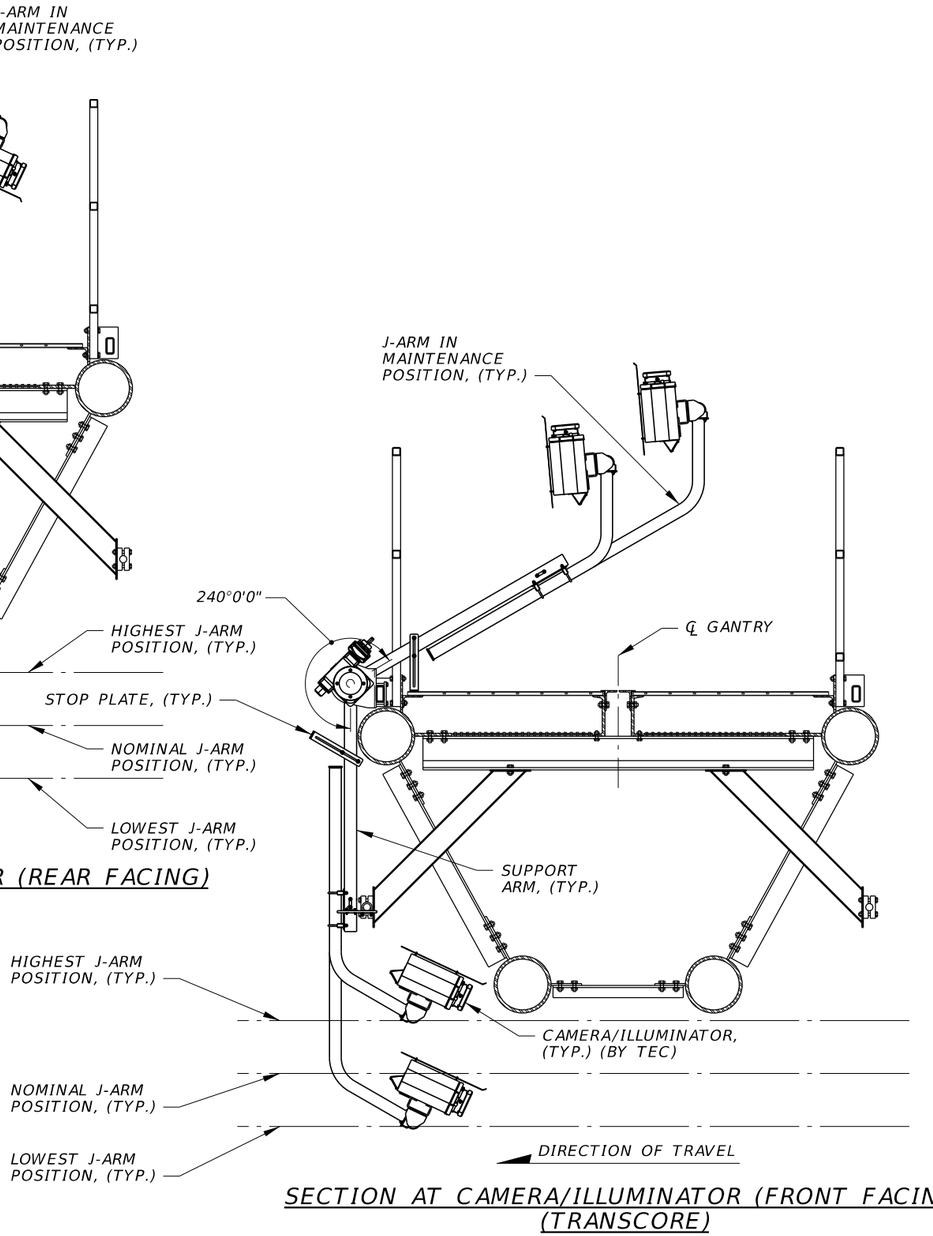
Exhibit 254.2-2 Equipment Retraction Assembly Rotation (2 of 4)



SECTION AT FRONT ANTENNA (TRANSCORE)

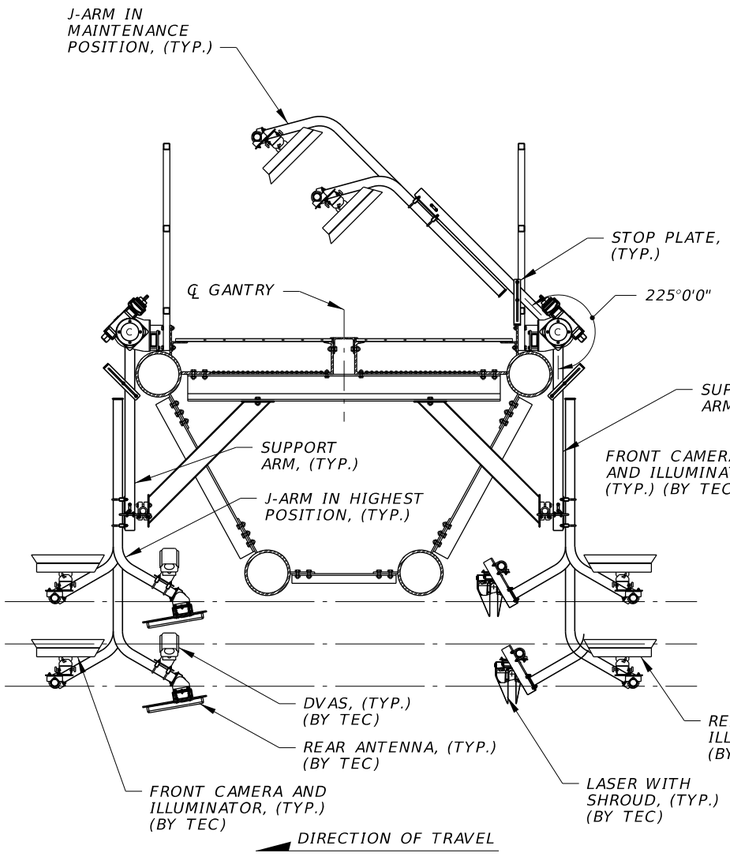


SECTION AT CAMERA/ILLUMINATOR (REAR FACING) (TRANSCORE)



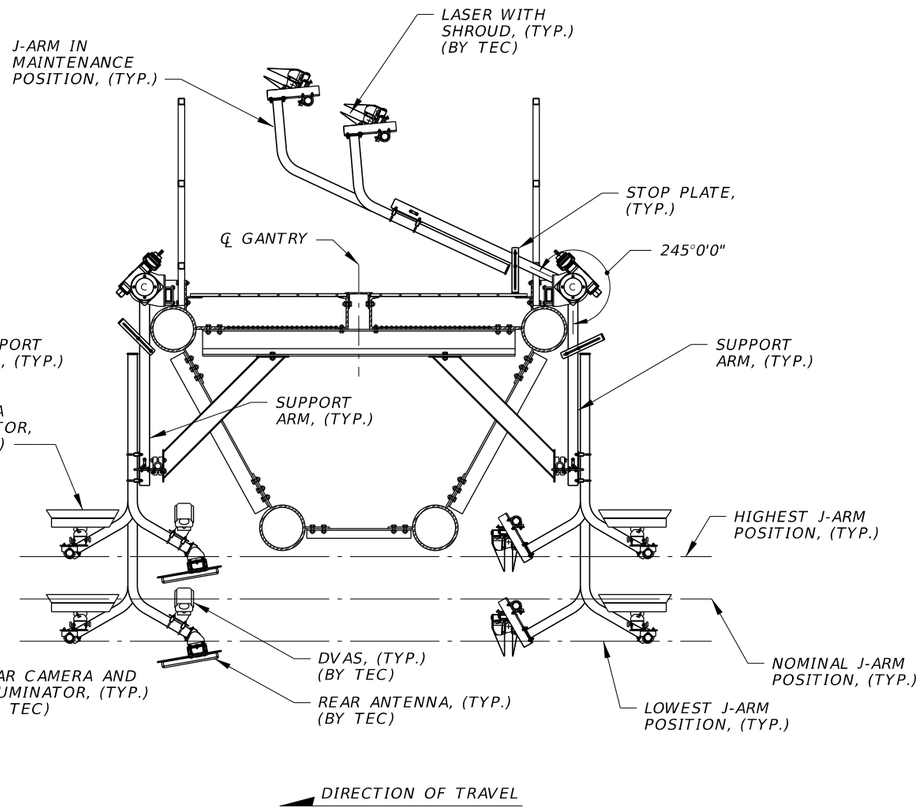
SECTION AT CAMERA/ILLUMINATOR (FRONT FACING (TRANSCORE)

Exhibit 254.2-3 Equipment Retraction Assembly Rotation (3 of 4)



SECTION AT ℄ LANE/SHOULDER (CONDUENT)

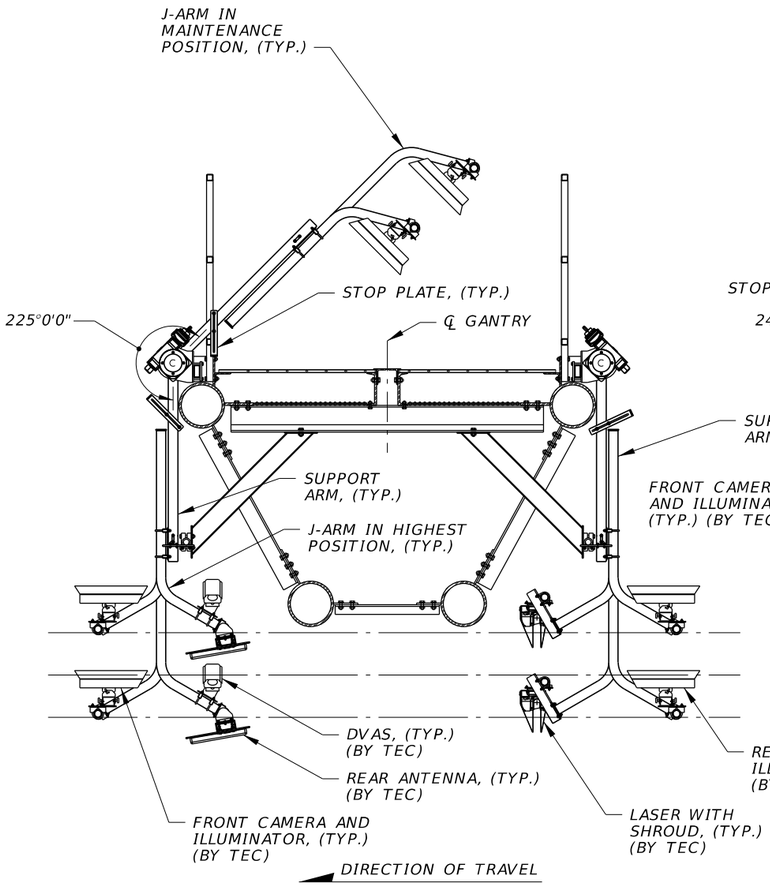
(TOLL EQUIPMENT SHOWN IN THE OPERATIONAL AND MAINTENANCE POSITIONS)



SECTION AT ℄ LANE/SHOULDER (CONDUENT)

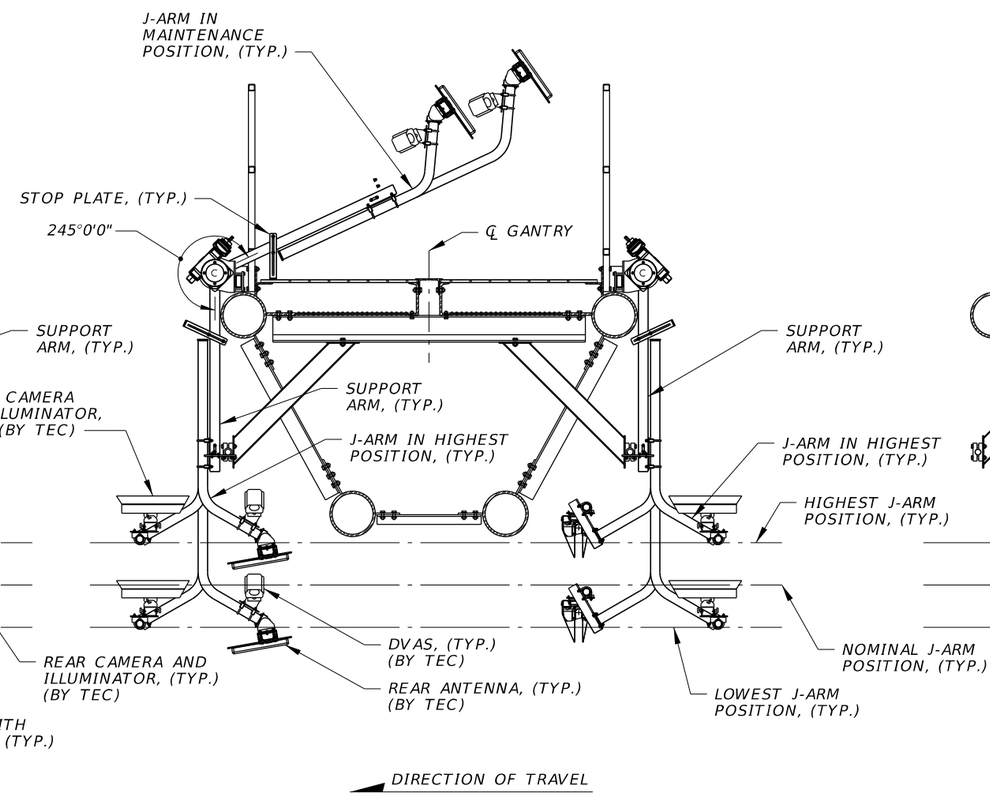
(TOLL EQUIPMENT SHOWN IN THE OPERATIONAL AND MAINTENANCE POSITIONS)

Exhibit 254.2-4 Equipment Retraction Assembly Rotation (4 of 4)



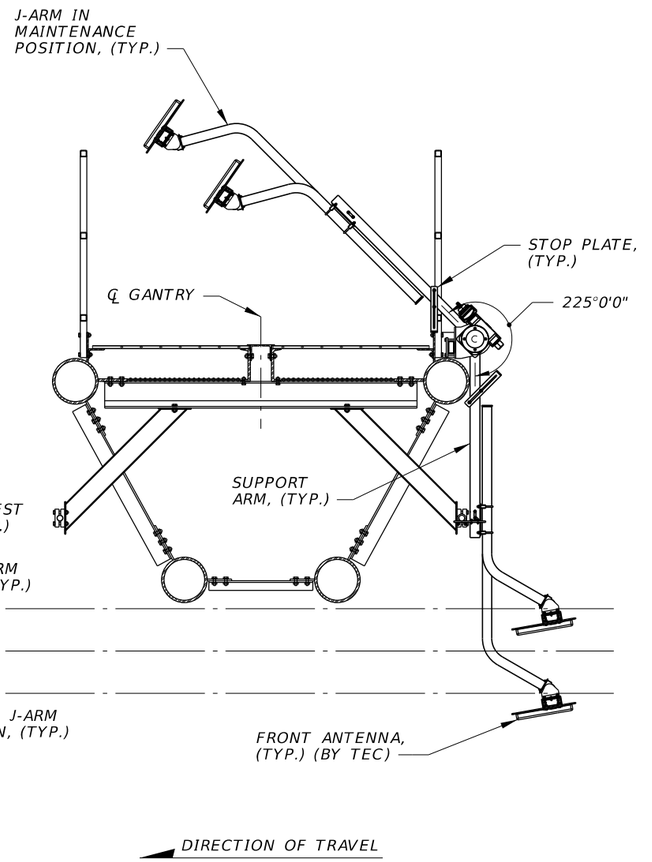
SECTION AT ℄ LANE/SHOULDER (CONDUENT)

(TOLL EQUIPMENT SHOWN IN THE OPERATIONAL AND MAINTENANCE POSITIONS)



SECTION AT ℄ LANE/SHOULDER (CONDUENT)

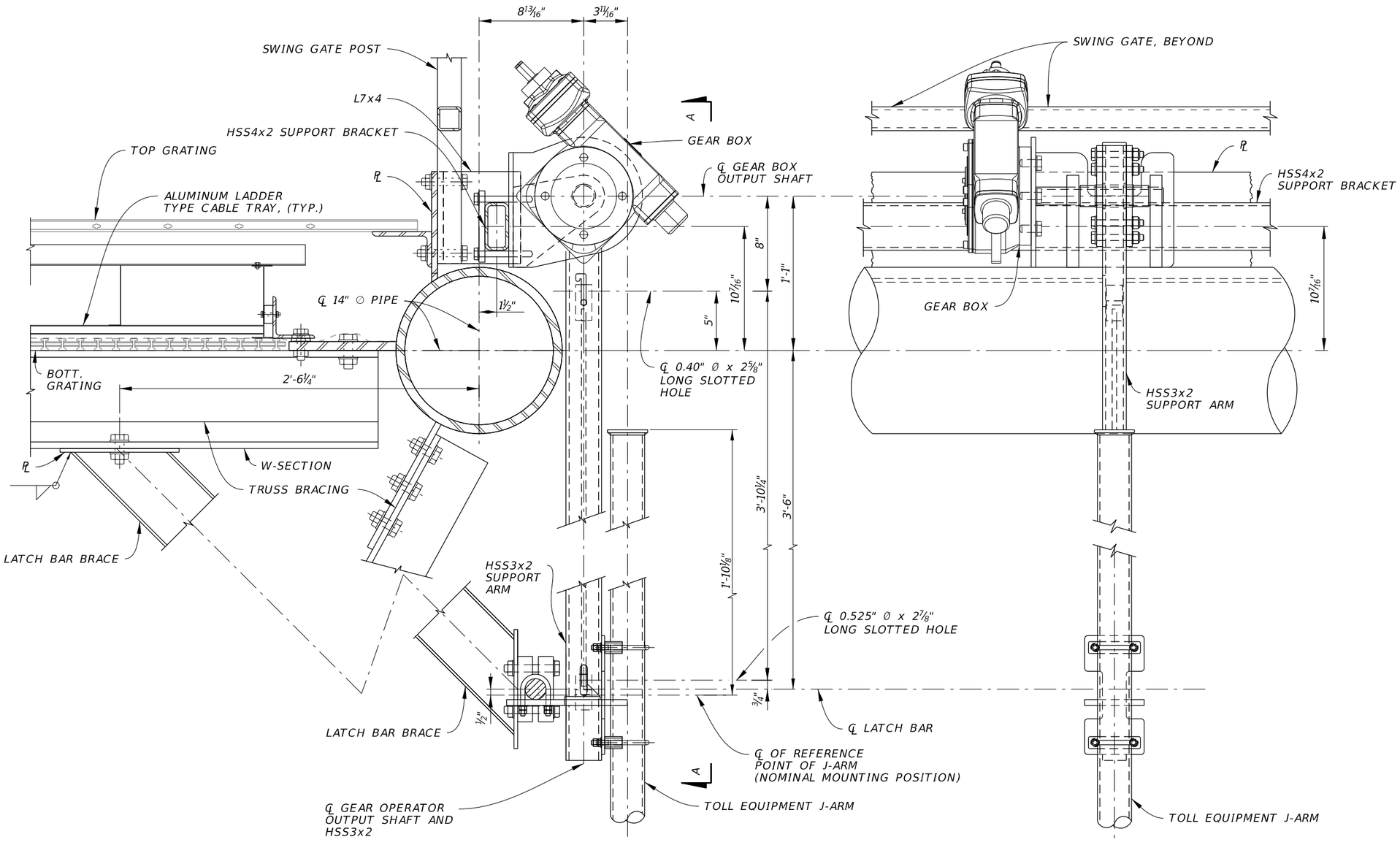
(TOLL EQUIPMENT SHOWN IN THE OPERATIONAL AND MAINTENANCE POSITIONS)



SECTION AT FRONT ANTENNA (CONDUENT)

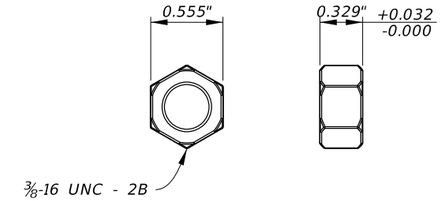
(TOLL EQUIPMENT SHOWN IN THE OPERATIONAL AND MAINTENANCE POSITIONS)

Exhibit 254.2-5 Equipment Retraction Assembly Support Arm (1 of 2)



SECTION AT SUPPORT ARM

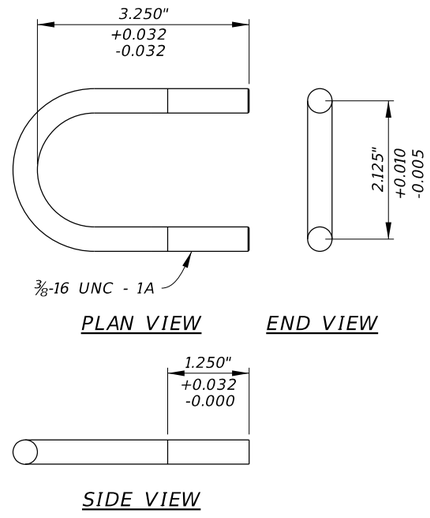
SECTION A-A



TOP VIEW SIDE VIEW

NUTS

NOTE: NUTS TO BE 316 STAINLESS STEEI (2 PER LEG, 4 PER U-BOLT)



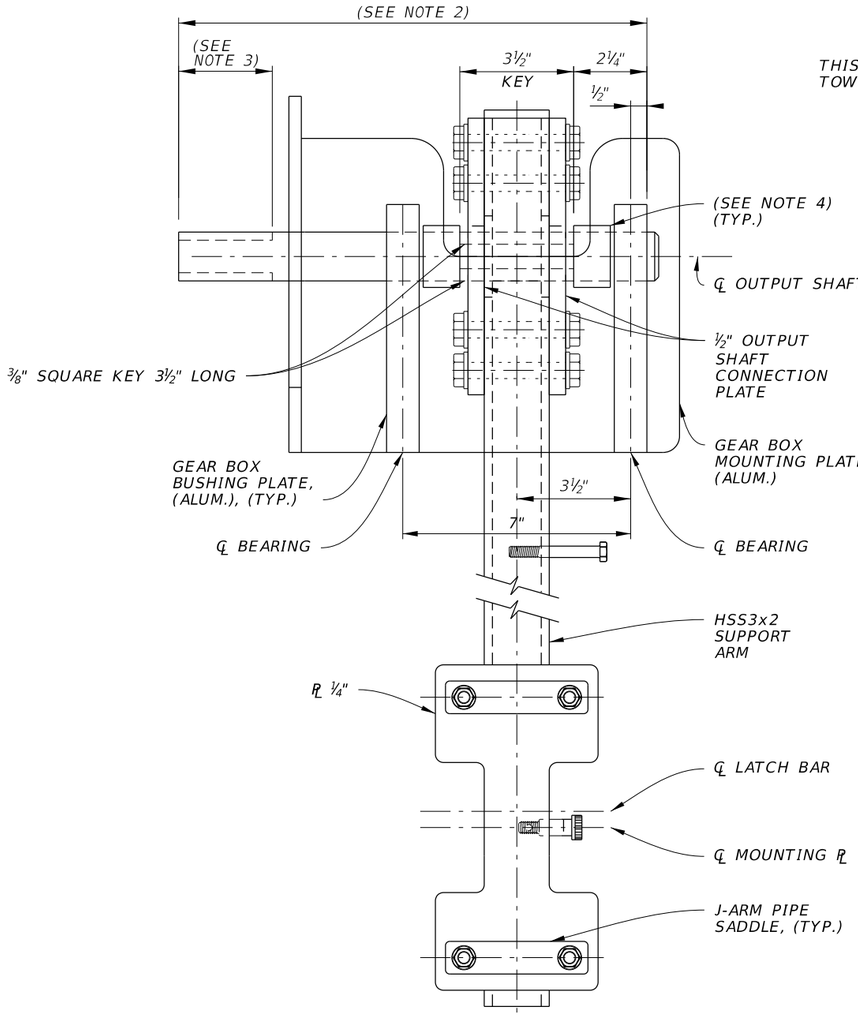
PLAN VIEW END VIEW

SIDE VIEW

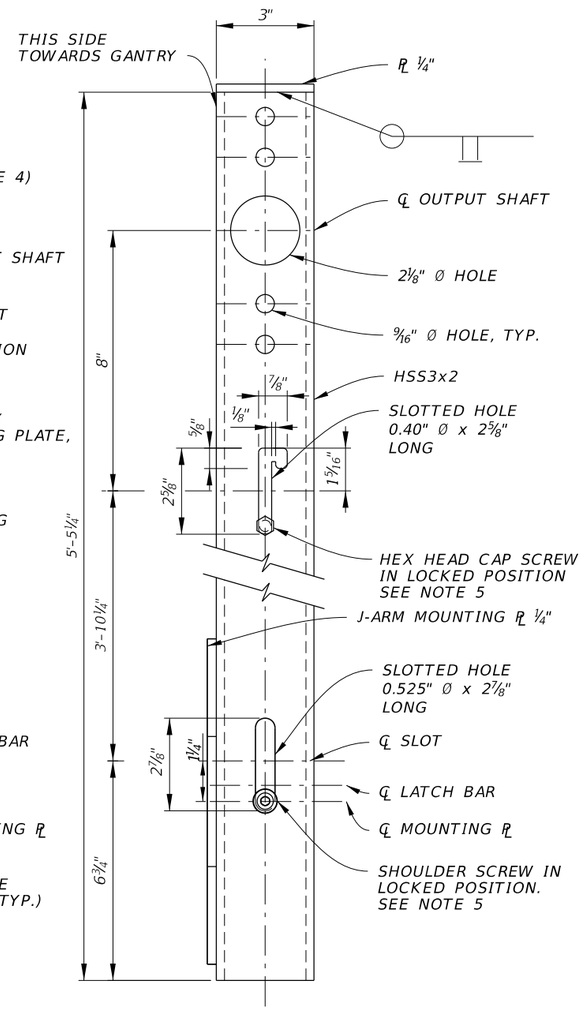
LATCH PLATE TO LATCH BAR U-BOLT DETAIL

NOTE: U-BOLTS TO BE 316 STAINLESS STEEL

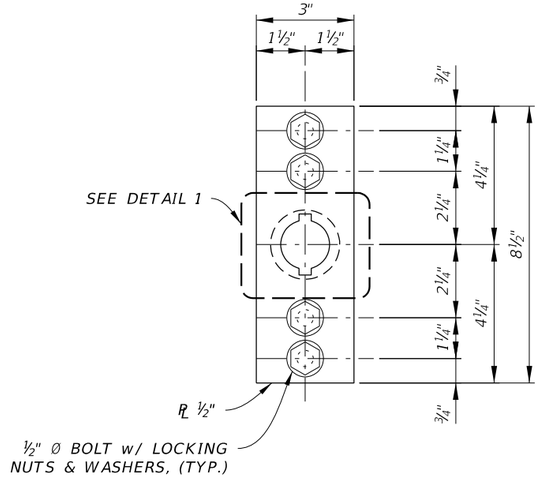
Exhibit 254.2-6 Equipment Retraction Assembly Support Arm (2 of 2)



SUPPORT ARM ELEVATION



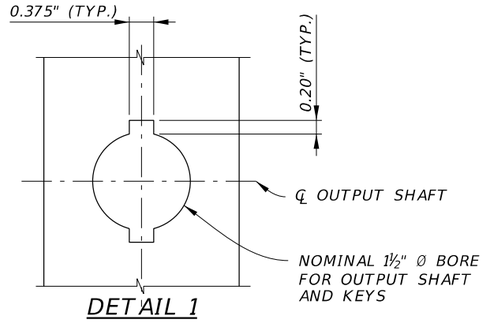
SUPPORT ARM - SIDE VIEW



OUTPUT SHAFT CONNECTION PLATE

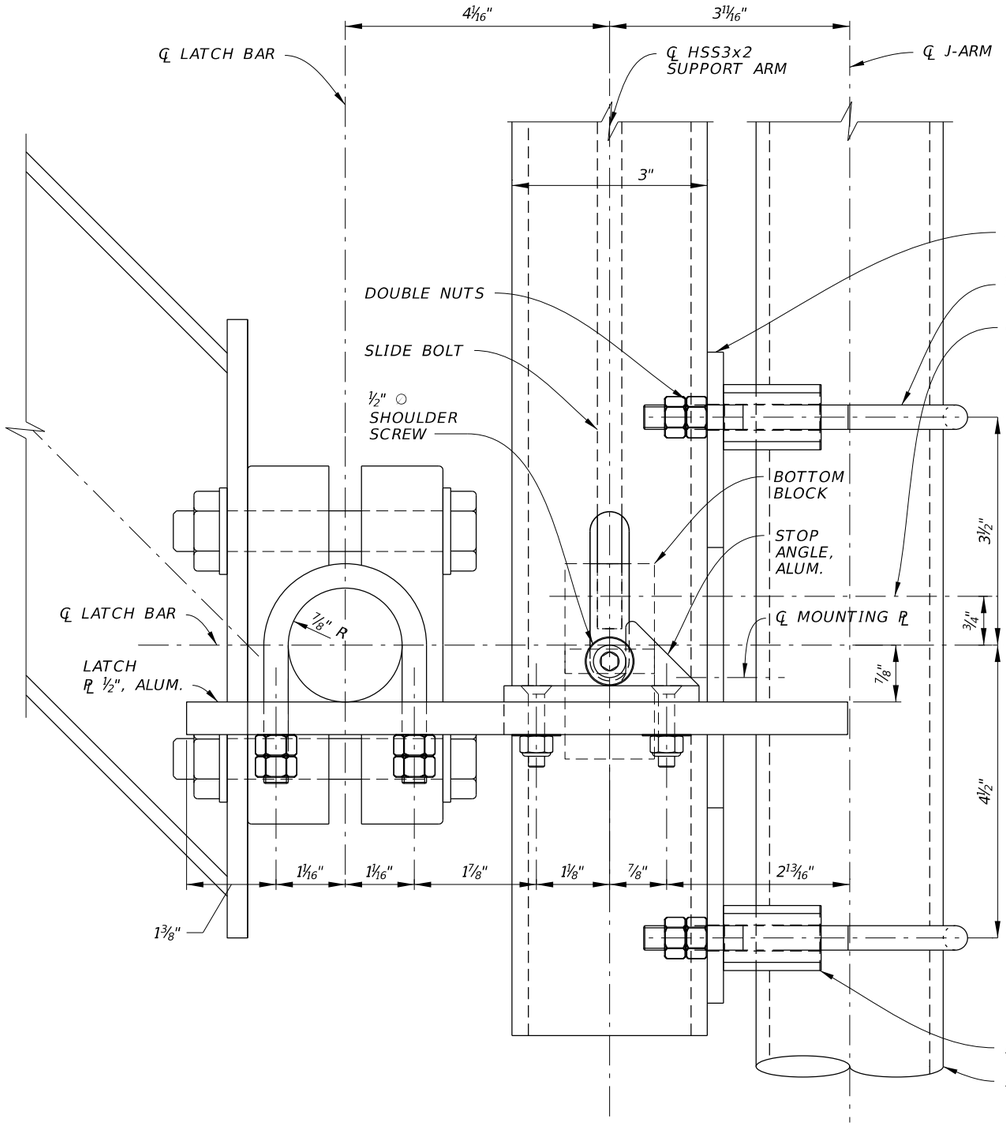
NOTES TO PREPARER:

1. PLATES ARE GALVANIZED STEEL, UNLESS NOTED OTHERWISE.
2. PROVIDE BRASS KEY FOR EACH KEYWAY.
3. LENGTH OF INSIDE GEAR OPERATOR KEY MUST ALLOW INSERTION OF GEAR OPERATOR OUTPUT SHAFT BUSHING.
4. PROVIDE 1½" SCH. 40 S.S. CENTERING COLLARS OF EQUAL LENGTH ON BOTH SIDES. SIZE COLLAR LENGTH SUCH THAT A ⅛" MAX. GAP IS ALLOWED BETWEEN BEARING FACES. SECURE OUTPUT SHAFT BETWEEN BUSHING PLATES WITH S.S. RETAINING CLIPS.
5. LOCATE SLIDE BOLT HEX HEAD SCREW AND SHOULDER SCREW ON SIDE OPPOSITE GEAR BOX.



DETAIL 1

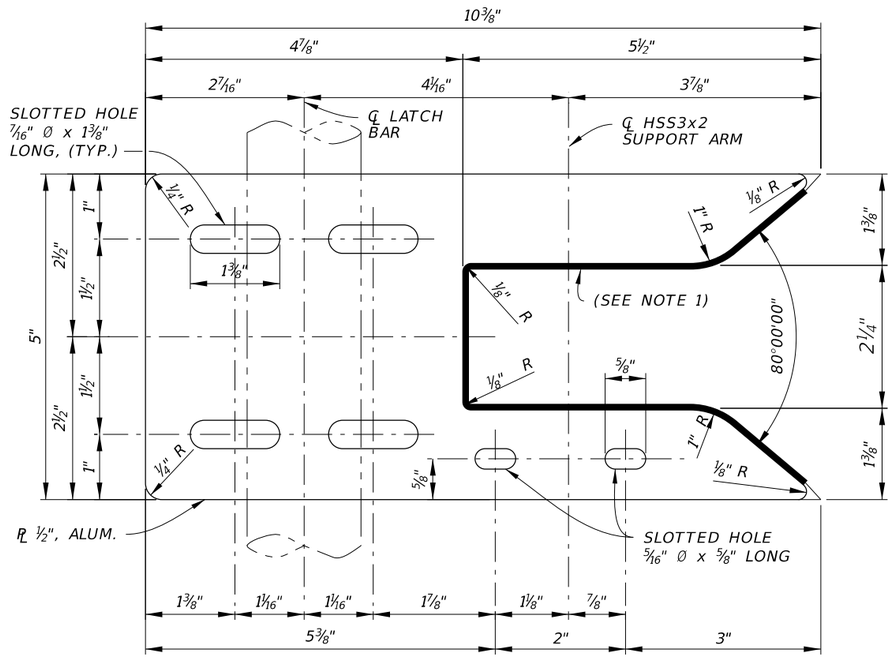
Exhibit 254.2-7 Equipment Retraction Assembly Details (1 of 2)



SUPPORT ARM LATCH DETAIL

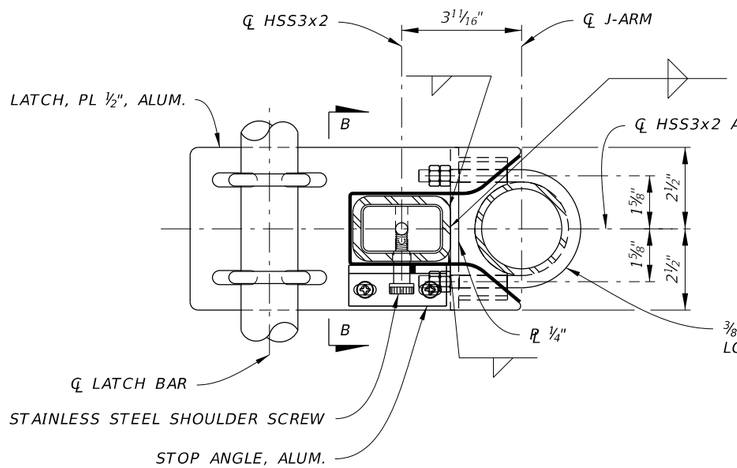
NOTES TO PREPARER:

1. *SILICONE RUBBER ADHESIVE, 3/32" THICK x ½" WIDE ALONG EDGE OF THE LATCH PLATE.*
2. *PROVIDE FIELD ADJUSTMENT NOTES TO SECURE LATCH WITH PLUMB SUPPORT ARMS.*

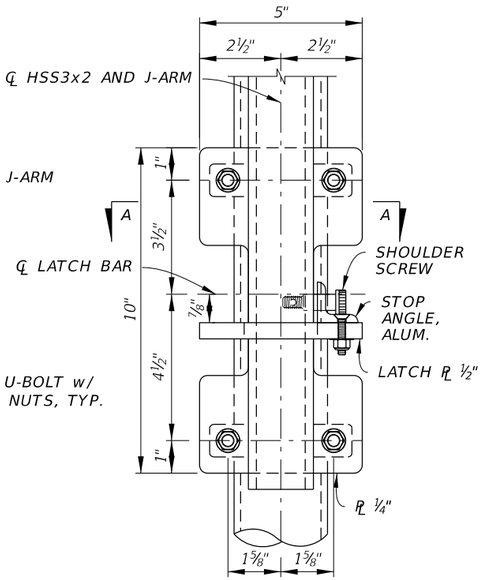


LATCH PLATE DETAIL - PLAN

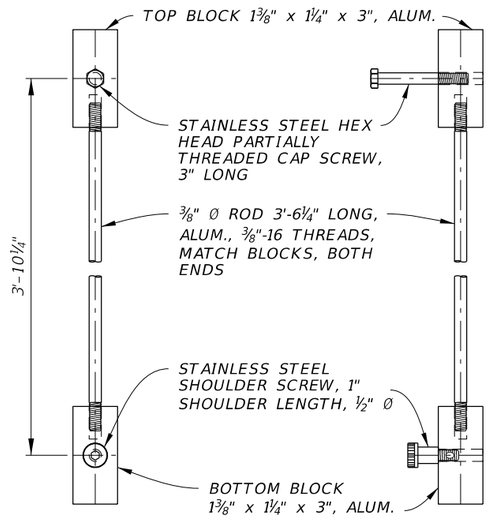
Exhibit 254.2-8 Equipment Retraction Assembly Details (2 of 2)



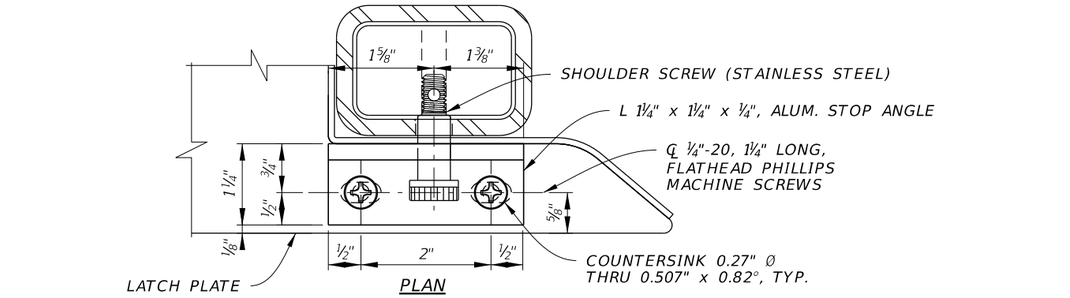
SUPPORT ARM LATCH DETAIL
SECTION A-A



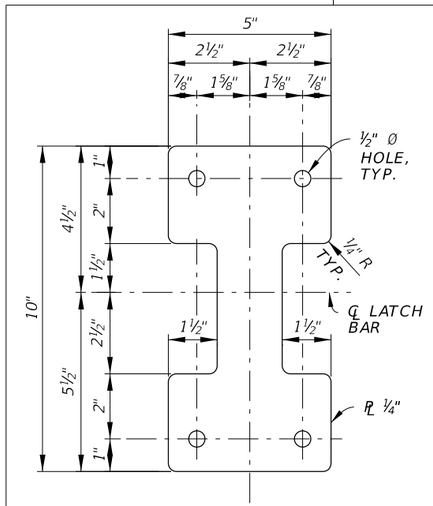
SUPPORT ARM LATCH DETAIL
SECTION B-B



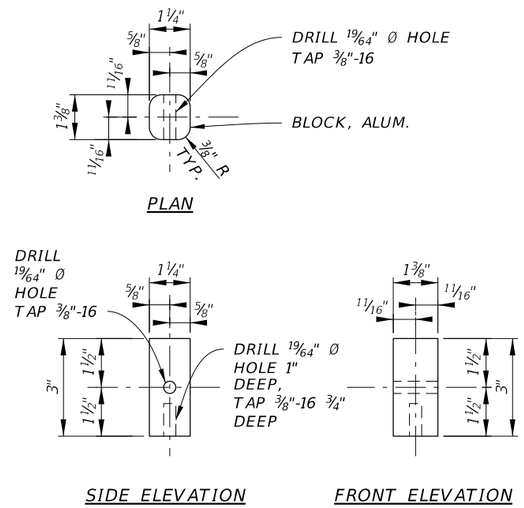
SLIDE BOLT ASSEMBLY



STOP ANGLE DETAILS

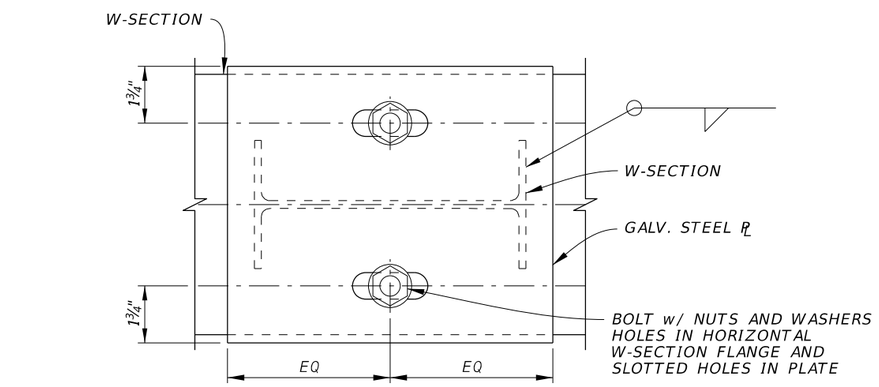


J-ARM MOUNTING PLATE

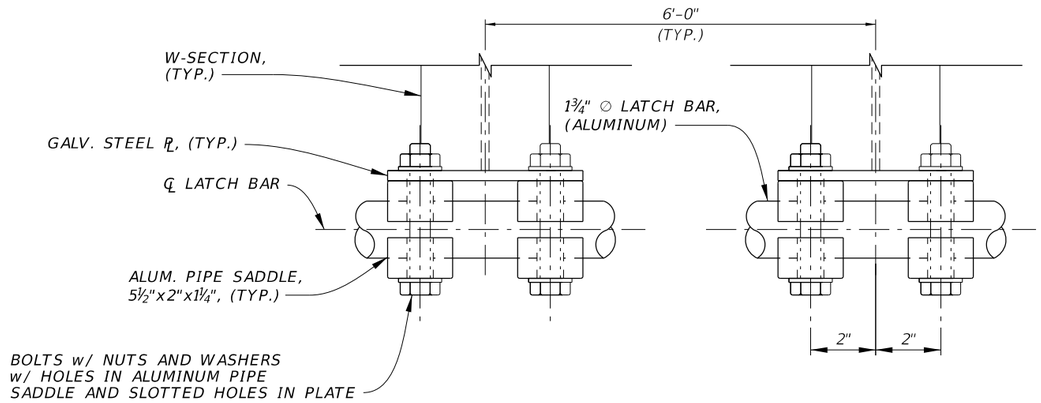


SLIDE BOLT ASSEMBLY DETAILS

Exhibit 254.2-9 Latch Bar Assembly



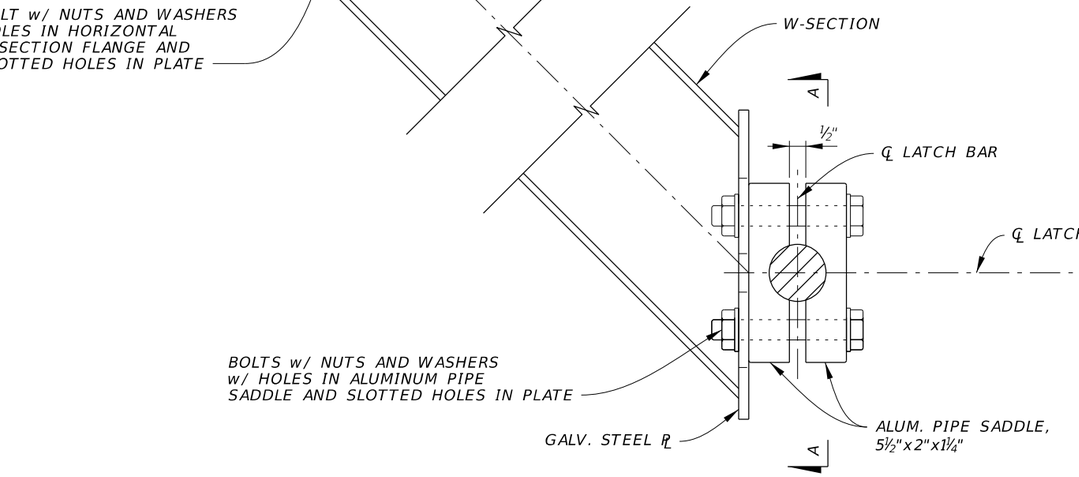
SECTION B-B



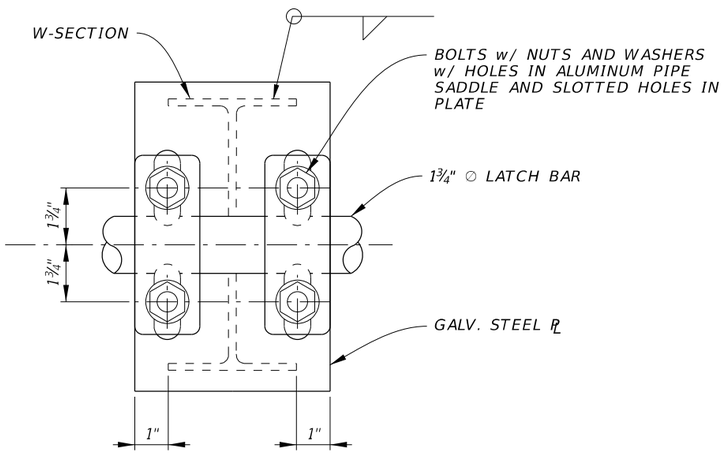
LATCH BAR PLAN - TYPICAL

NOTES TO PREPARER:

1. PROVIDE FIELD ADJUSTMENT NOTES TO SECURE LATCH WITH PLUMB SUPPORT ARMS.
2. SHOP ALIGN LATCH BAR TO ALLOW ALL J-ARMS TO BE MOUNTED PLUMB.
3. KEEP THE LATCH BAR HORIZONTALLY MOUNTED BY USING THE SLOTTED HOLES TO VERTICALLY ADJUST THE LATCH BAR PIPE SADDLE BOLTS FOR THE FINAL INSTALLED GANTRY CAMBER ONCE THE GANTRY IS SELF-SUPPORTING THE FULL WEIGHT OF THE STRUCTURE.



LATCH BAR SECTION- TYPICAL



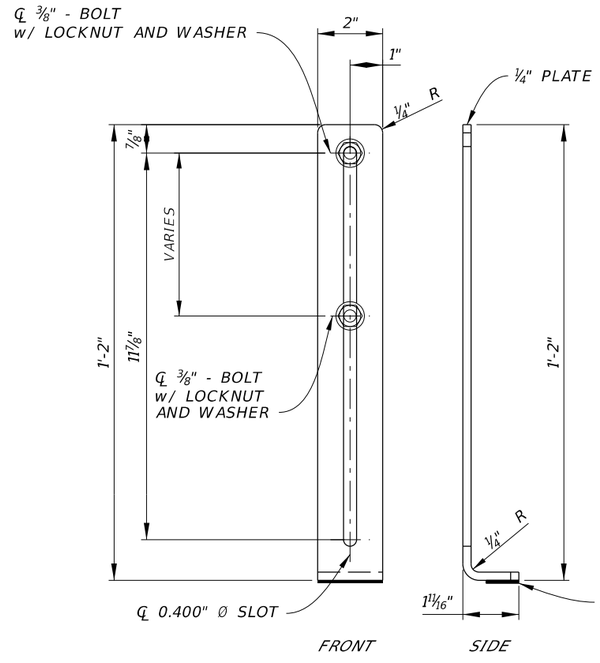
SECTION A-A

Exhibit 254.2-10 Stop Plate Types and Details

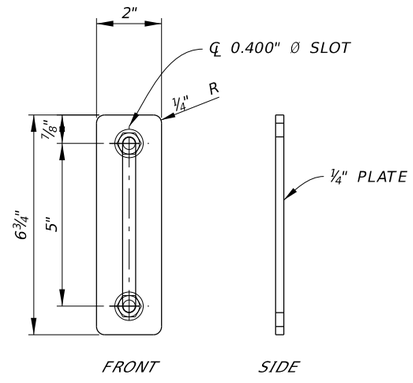
TABLE OF SUPPORT ARM QUANTITIES		
VENDOR	PHASE	TYP. SUPPORT ARM
TRANSCORE/ INFINITY	INTERIM	XX + 1 SPARE
	INTERIM 2	XX + 1 SPARE
	ULTIMATE	XX + 1 SPARE
CONDUENT	INTERIM	XX + 1 SPARE
	INTERIM 2	XX + 1 SPARE
	ULTIMATE	XX + 1 SPARE

NOTE TO PREPARER:

1. DURING INSTALLATION, ORIENT THE EXPOSED BOLT THREADS AWAY FROM THE GEAR OPERATOR.
2. PROVIDE (1) ONE CAPTURE PLATE, (2) TWO ⅜" BOLTS WITH LOCKNUTS AND WASHERS FOR EACH STOP PLATE.



STOP PLATE



CAPTURE PLATE

UPPER SUPPORT ARM - STOP PLATE ASSEMBLY

254.3 Gear Boxes

The gear boxes must be provided in accordance with the ***Exhibit 254.3-1***, and ***Exhibit 254.3-2***.

(1) Swing gate posts must be removable so that they can be repositioned along the kick plate to adjust the position of swing gates for interim to ultimate configurations to accommodate gear box attachment system flexibility. See ***Exhibit 254.3-3***.

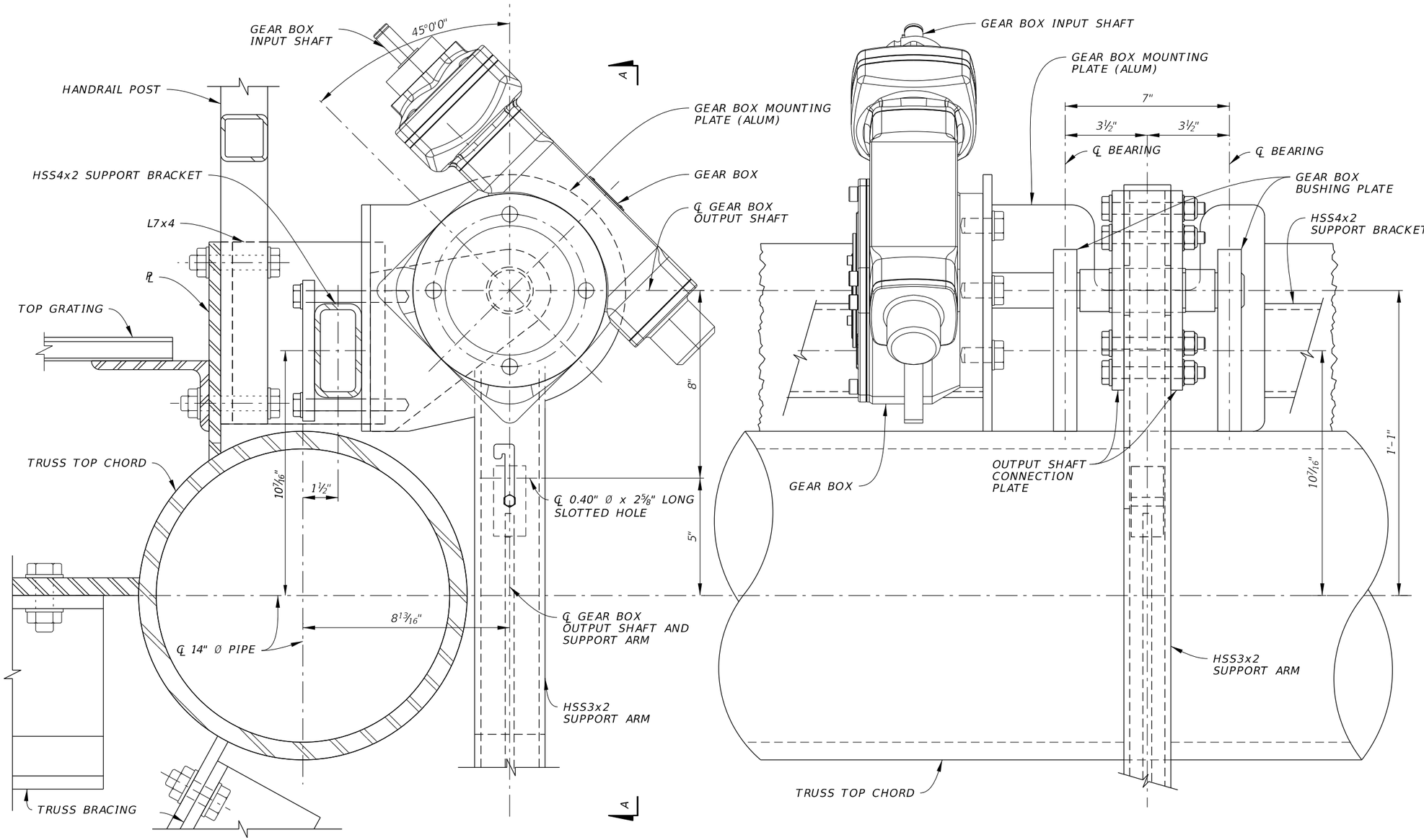
(2) Gear boxes must be oriented such that fixed gantry elements (gantry top chord field splices, swing gate support posts, other gear boxes, latch bar brace supports, etc.) do not prevent or impair retraction of the toll equipment.

(3) For each interim and ultimate layout:

  (a) Each TEC equipment layout must have the same quantity of left gearboxes.

  (b) Each TEC equipment layout must have the same quantity of right gearboxes.

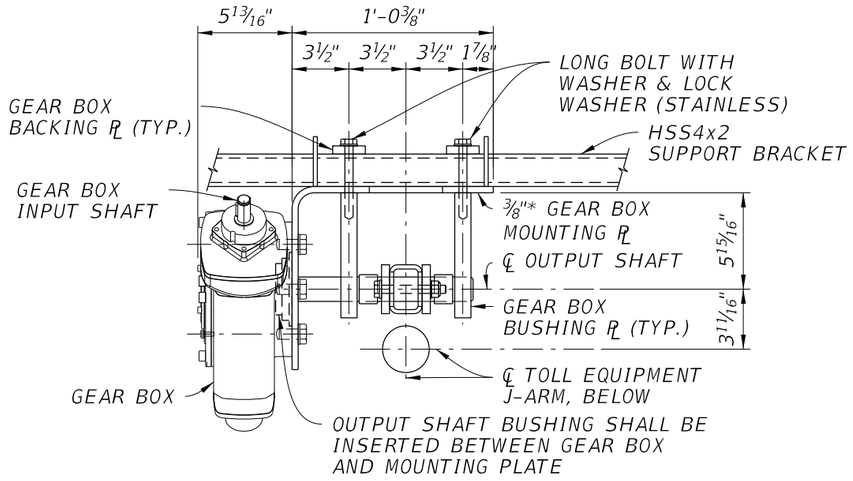
Exhibit 254.3-1 Gear Box Details (1 of 3)



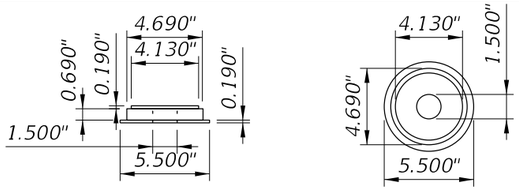
GEAR BOX SECTION - TYPICAL

SECTION A-A

Exhibit 254.3-2 Gear Box Details (2 of 3)

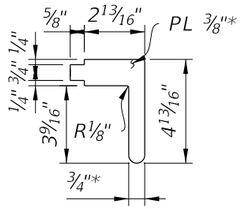


PLAN



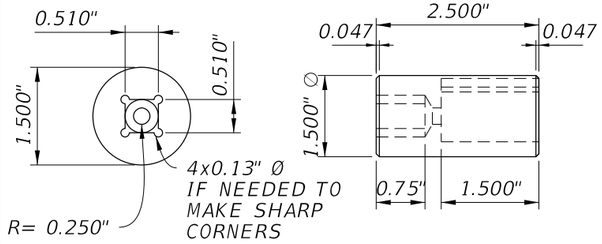
GEAR BOX OUTPUT SHAFT BUSHING

(GEAR BOX OUTPUT SHAFT BUSHING SHALL BE HDPE)



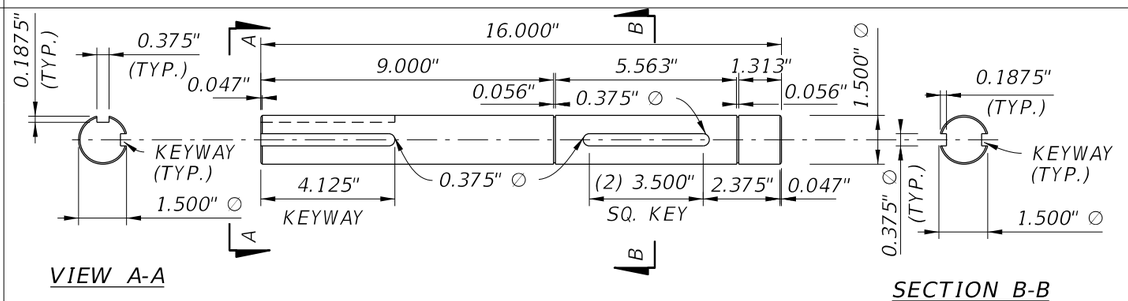
INSTALLATION ASSIST HOOKS

((2) PER UNIT)



GEAR BOX INPUT ADAPTER

(GEAR BOX INPUT ADAPTER SHALL BE BRASS)

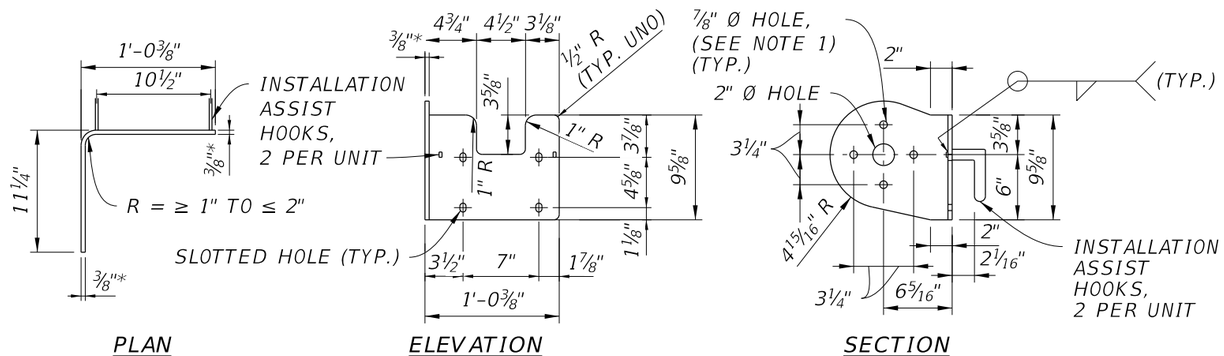


VIEW A-A

SECTION B-B

GEAR BOX OUTPUT SHAFT

(GEAR BOX OUTPUT SHAFT SHALL BE 304 STAINLESS STEEL)



PLAN

(MIRROR ABOUT VERTICAL FOR MOUNTING TO OPPOSITE HAND)

ELEVATION

(MIRROR ABOUT VERTICAL FOR MOUNTING TO OPPOSITE HAND)

SECTION

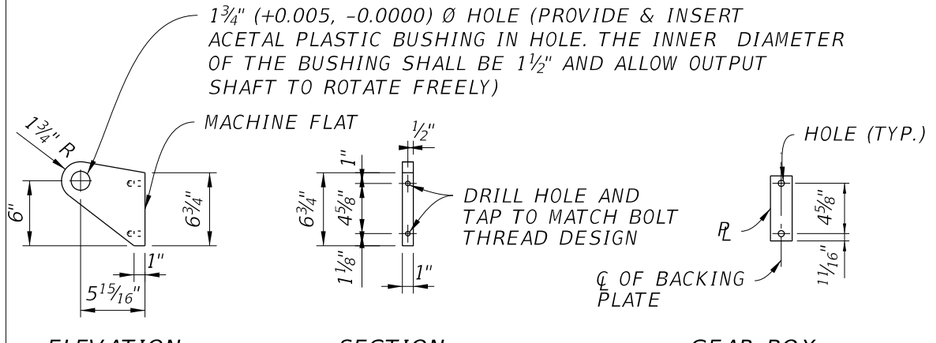
GEAR BOX MOUNTING PLATE

(RL ORIENTATION SHOWN, LR ORIENTATION SIMILAR BUT OPPOSITE HAND)
(GEAR BOX MOUNTING PLATES SHALL BE 6061-T6 ALUMINUM)

NOTE TO PREPARER:

* INDICATES MIN. DIMENSION.

1. PROVIDE (1) SPARE LR GEARBOX AND (1) SPARE RL GEARBOX PER GANTRY.



ELEVATION

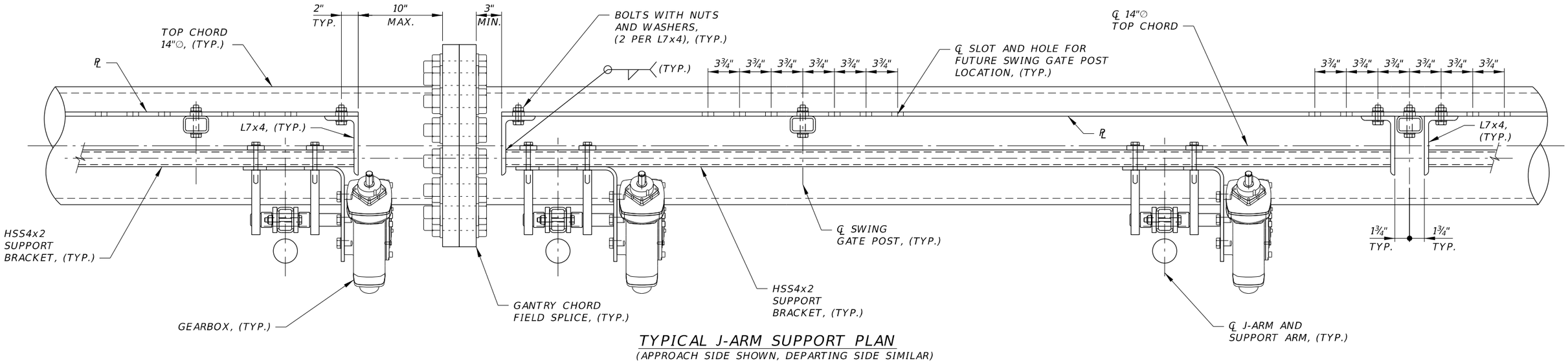
SECTION

GEAR BOX BACKING PLATE

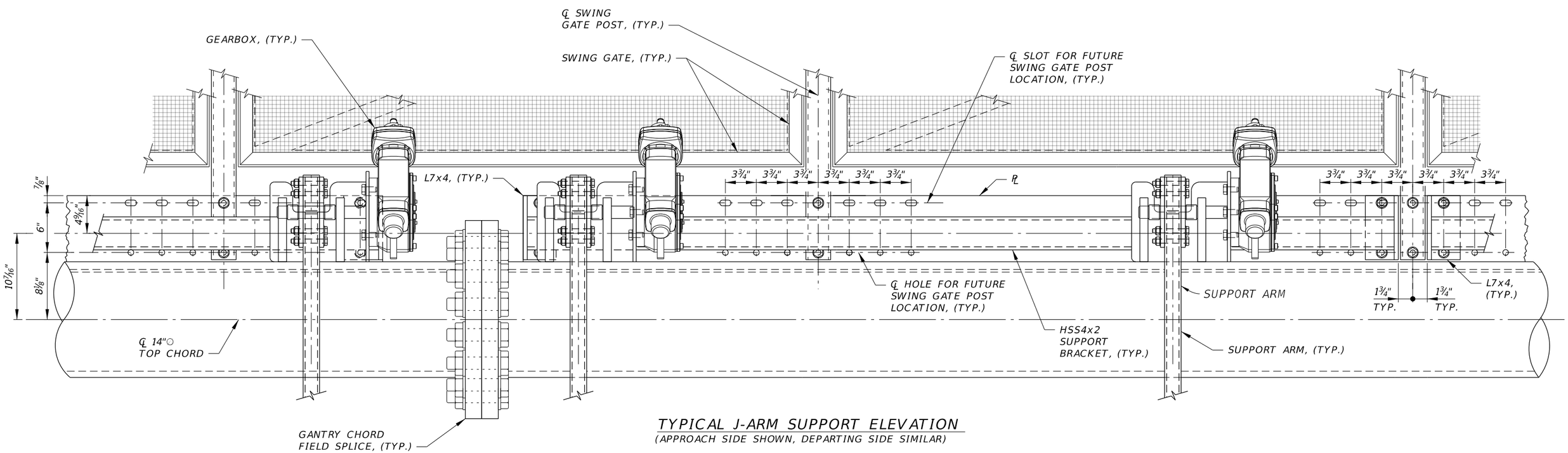
GEAR BOX BUSHING PLATE

(GEAR BOX BUSHING PLATES SHALL BE 6061-T6 ALUMINUM)

Exhibit 254.3-3 Gear Box Details (3 of 3)



TYPICAL J-ARM SUPPORT PLAN
(APPROACH SIDE SHOWN, DEPARTING SIDE SHOWN)



TYPICAL J-ARM SUPPORT ELEVATION
(APPROACH SIDE SHOWN, DEPARTING SIDE SIMILAR)

254.4 Gear Box Attachment System

(1) The gear box attachment system to the gantry must allow a minimum 6-inch lateral clearance between the centerline of the gear box input shaft and the centerline of the nearest swing gate post.

(2) The horizontal support member for the support of gear boxes that spans between swing gate posts must be as long as possible, up to 12 feet in length. The angles that connect these horizontal supports must only attach at swing gate posts and on each side of upper chord field splices. See ***Exhibit 254.3-3*** for additional details.

255 Gantry Electrical

255.1 General Requirements

Equipment and raceway placement must avoid conflicts with access to all site elements.

255.2 Cable Tray

(1) The AVI section of the cable tray must be used for the antenna RF cables.

(2) The data section of the cable tray must be used for data and composite cables rated less than 50V.

(3) The power section of the cable tray must be used for 120V power cabling.

(4) Bond cable trays and metal conduits with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor.

(5) The AVI data cable may be routed through either the AVI section or the data section of the cable tray.

(6) See ***GTR 255.5*** for non accessible gantry cable tray requirements.

(7) See ***GTR 255.6*** for accessible gantry cable tray requirements.

255.3 Wire Troughs

(1) Wire troughs must not be located between the gantry column and the roadside barrier.

(2) All wire troughs must be mounted on galvanized strut channel supports such that the bottom of the enclosure is 4 feet above the concrete slab or sidewalk below, as shown in ***Exhibit 255.3-1***, except for the AVI wire trough on the AVI reader ground-mounted frame.

(3) Drain fittings must be provided at the bottom of the wire trough as shown in ***Exhibit 255.3-1***. The drain fittings must maintain the NEMA 3R rating of the wire troughs.

(4) The data and power conduits/wireways must terminate in their respective wire troughs.

(5) The AVI conduits/wireways from the gantry must either terminate into the AVI wire trough or at the AVI reader ground-mounted frame.

(6) Raceways terminating into wire troughs from non-accessible gantries must be in accordance with ***GTR 255.5.1***.

(7) Raceways terminating into wire troughs from accessible gantries must be in accordance with ***GTR 255.6.4***.

(8) **For TEB Sites:** See ***GTR 242.14 (6)*** for conduit termination requirements from the wire troughs to the TEB.

(9) **For RTC Sites:** See ***GTR 232.11 (5)*** for conduit termination requirements from the wire troughs to the RTC and OCC.

255.3.1 Toll Equipment Building Sites

(1) Non-accessible gantry wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

(2) Accessible gantry power wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

(3) Accessible gantry data/AVI wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 96-inch L.

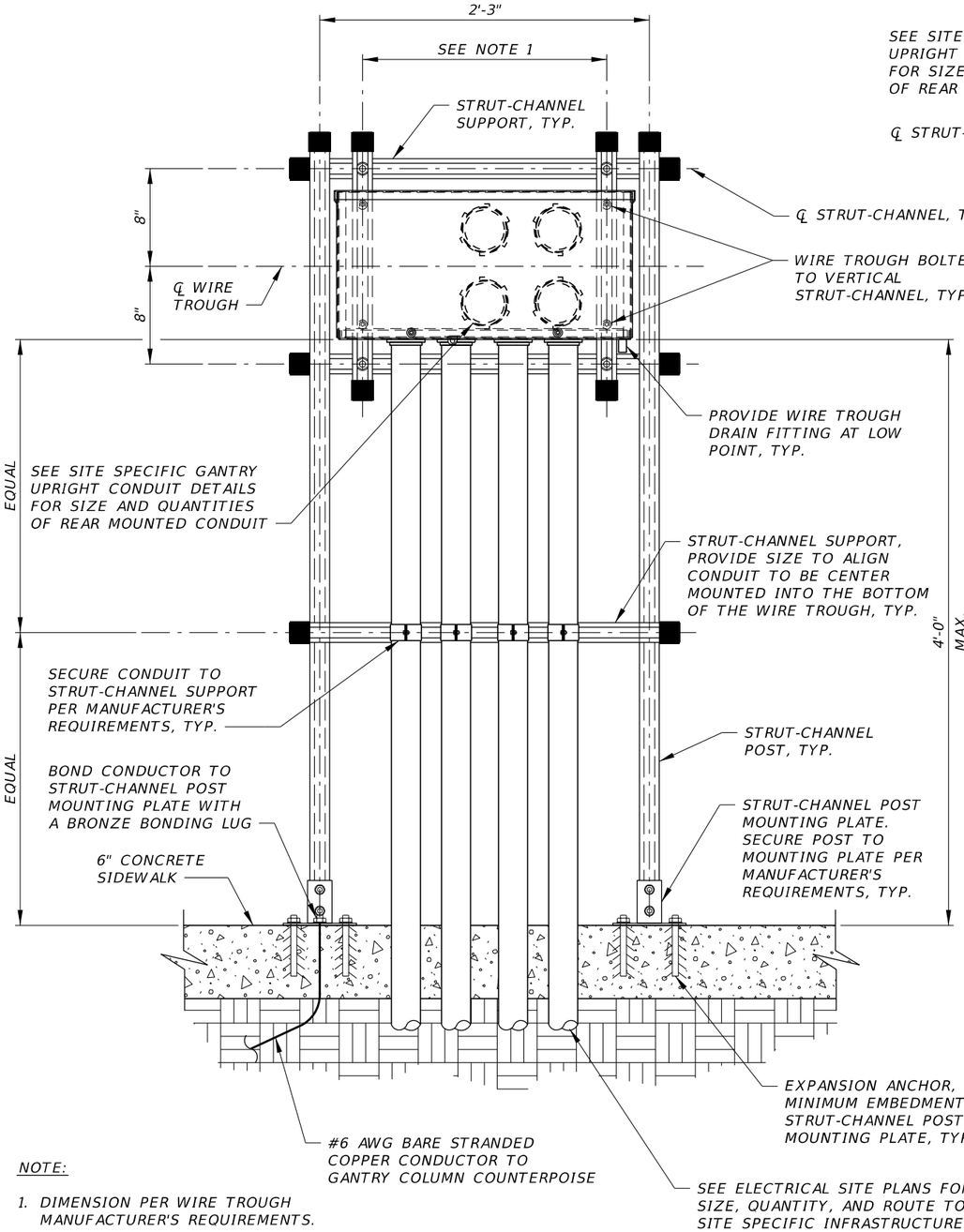
255.3.2 Roadside Tolling Cabinet Sites

(1) Non-accessible gantry power and AVI wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L.

(2) Single movement sites: Non-accessible gantry data wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 24-inch L

(3) Dual movement sites: Non-accessible gantry data wire troughs must be rated NEMA 3R and sized 12-inch H x 12-inch W x 36-inch L.

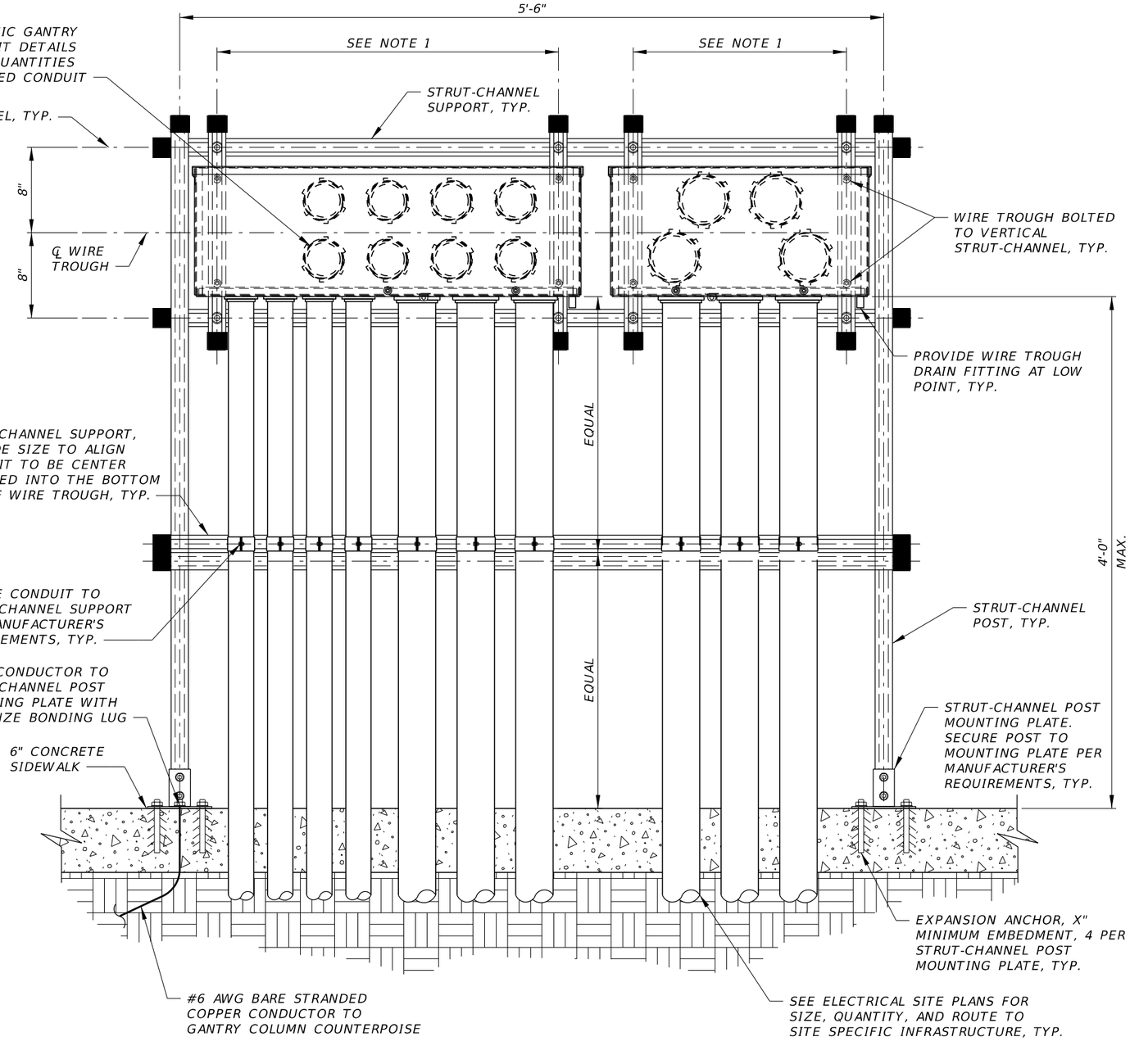
Exhibit 255.3-1 Wire Trough



NOTE:

1. DIMENSION PER WIRE TROUGH MANUFACTURER'S REQUIREMENTS.

WIRE TROUGH ELEVATION
N.T.S.



WIRE TROUGH ELEVATION - DUAL MOVEMENT RTC DETACHED TOLL SITE
N.T.S.

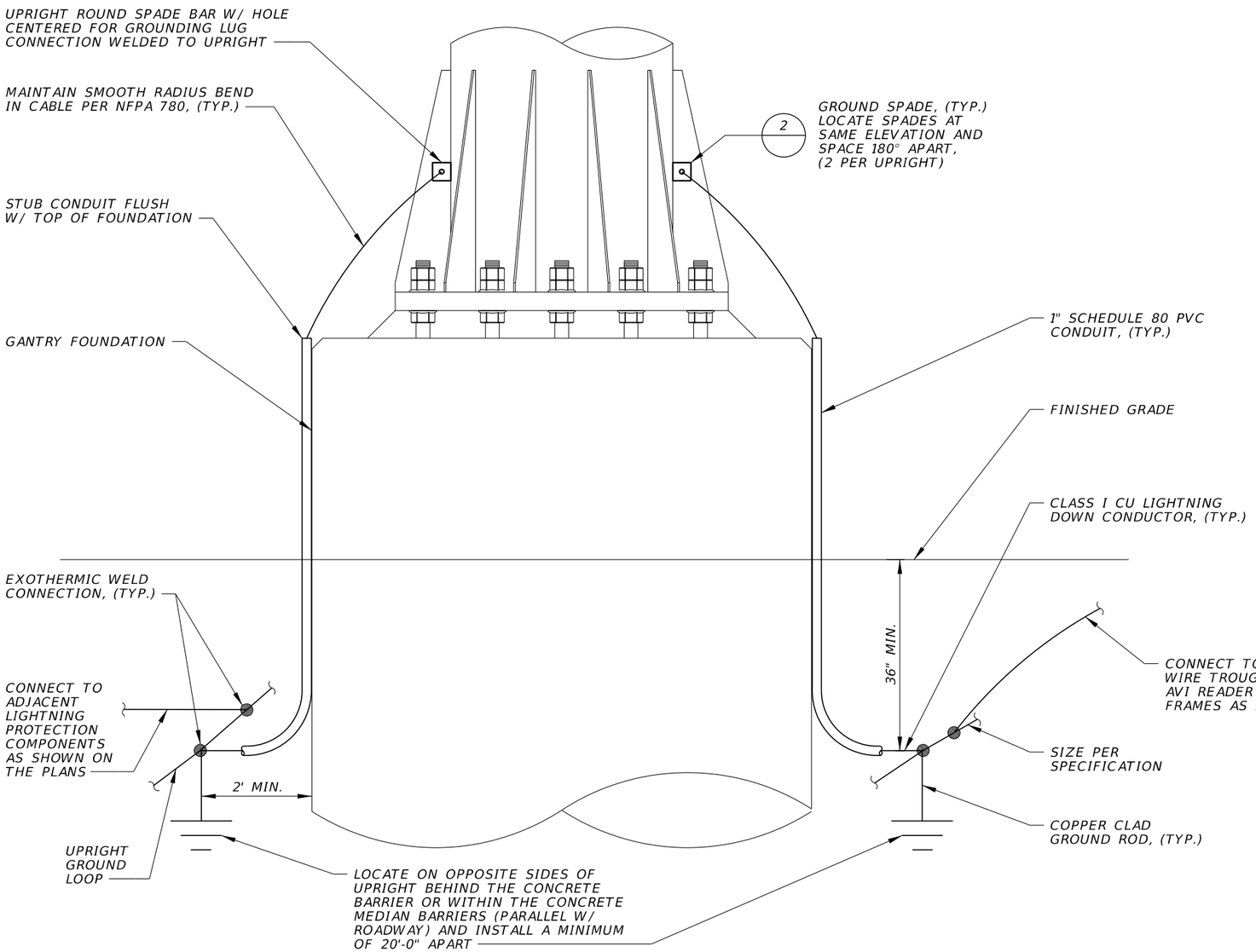
255.4 Lightning Protection

(1) Two grounding studs (lugs) must be installed at the base of each gantry upright for connecting to the lightning protection system.

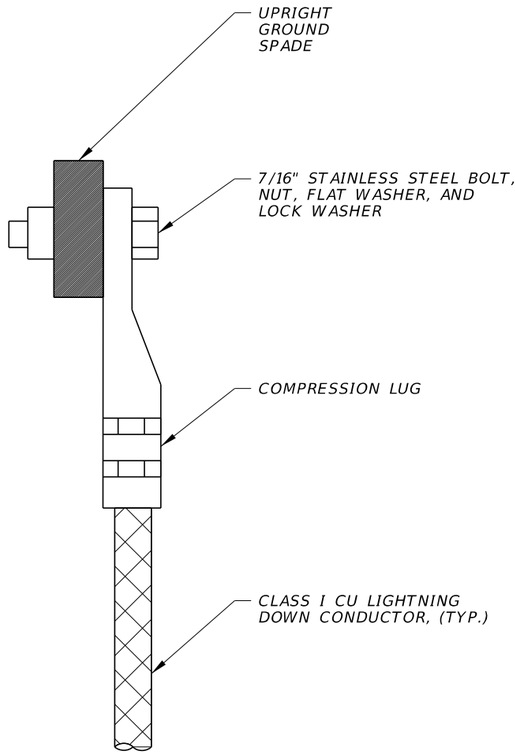
(2) All ground mounted metallic enclosures, supports, and equipment must be connected to an underground lightning protection system conductor at the base of the gantry foundations by lightning protection bonding conductors.

(3) See ***Exhibit 255.4-1*** for bonding and grounding of uprights, stair columns and wire troughs.

Exhibit 255.4-1 Gantry Upright Lightning Protection Detail



1 TYPICAL GANTRY UPRIGHT LIGHTNING PROTECTION DETAIL
NTS



2 GANTRY UPRIGHT GROUND SPADE CONNECTION DETAIL
NTS

255.5 Non-Accessible Gantry

Conduit, cable tray, AVI reader ground-mounted frames, AVI reader placement in TEBs, AVI reader mounting system on the gantry, lightning protection, duct banks, directional bores, loop pull boxes, and TEB penetrations must be provided as described herein for the connection of the gantry and roadside tolling equipment to the TEB or RTC.

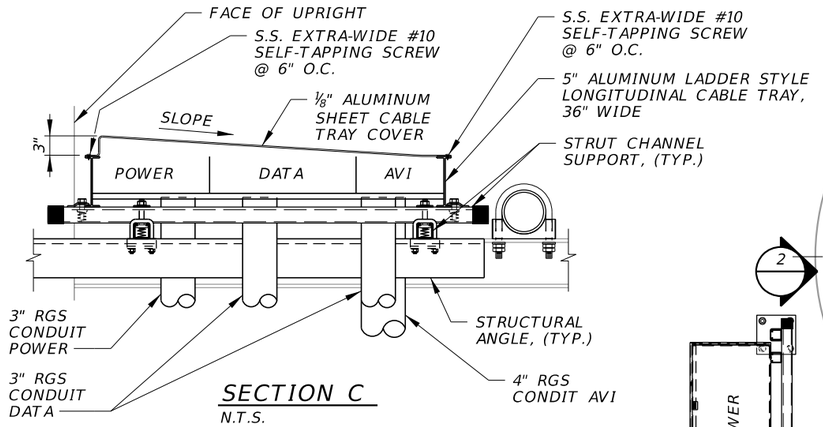
255.5.1 Conduit

(1) Vertical conduit from the horizontally mounted cable tray must be located on the gantry upright and terminated into wire troughs at the base of the gantry, except for median cantilever gantries as described in ***GTR 255.5.8***.

(2) Conduits must not terminate into the top of the wire trough.

(3) See ***Exhibit 251.4-2***, ***Exhibit 251.4-3***, ***Exhibit 255.5-1***, and ***Exhibit 255.5-2*** for conduit layout and support requirements.

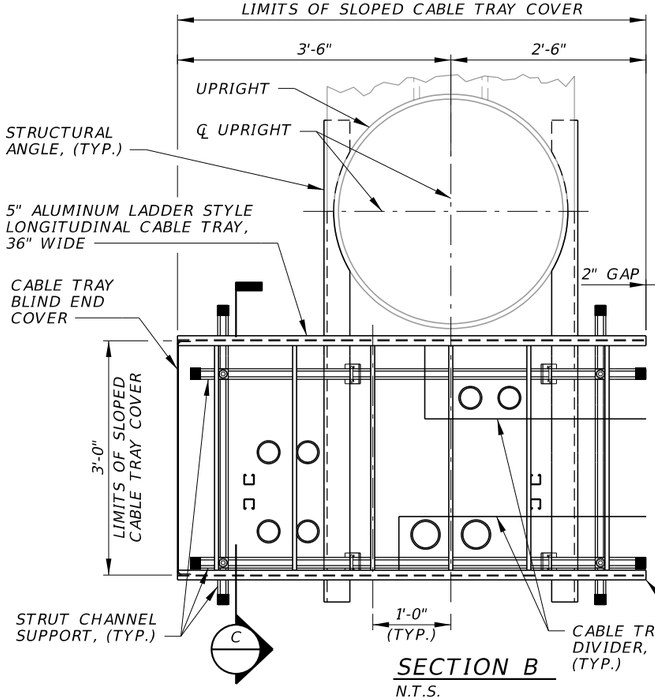
Exhibit 255.5-1 Span Upright Conduit Layout



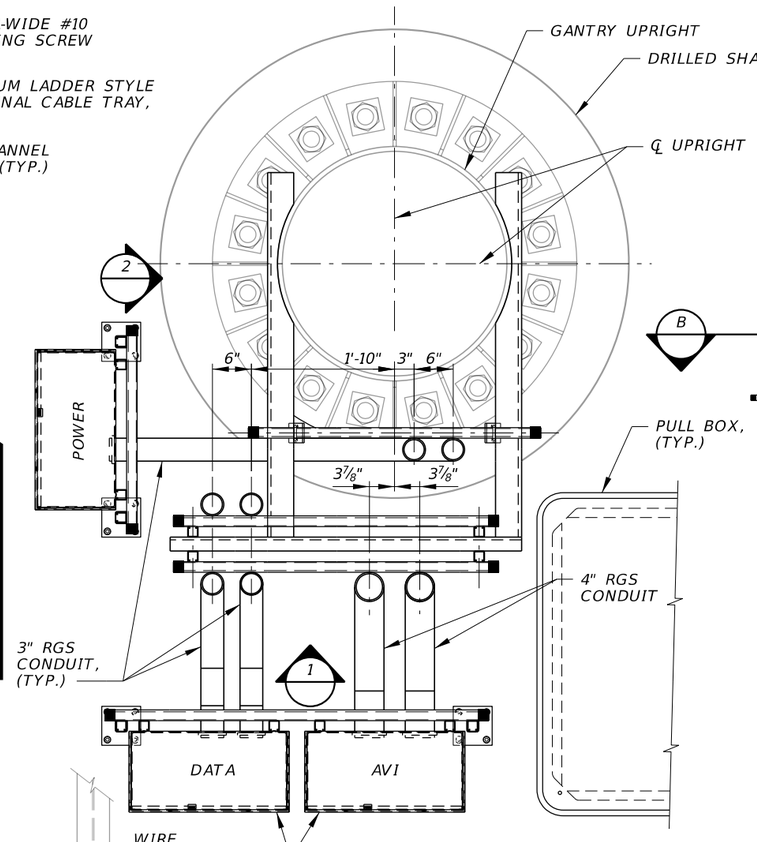
SECTION C
N.T.S.

NOTES TO PREPARER:

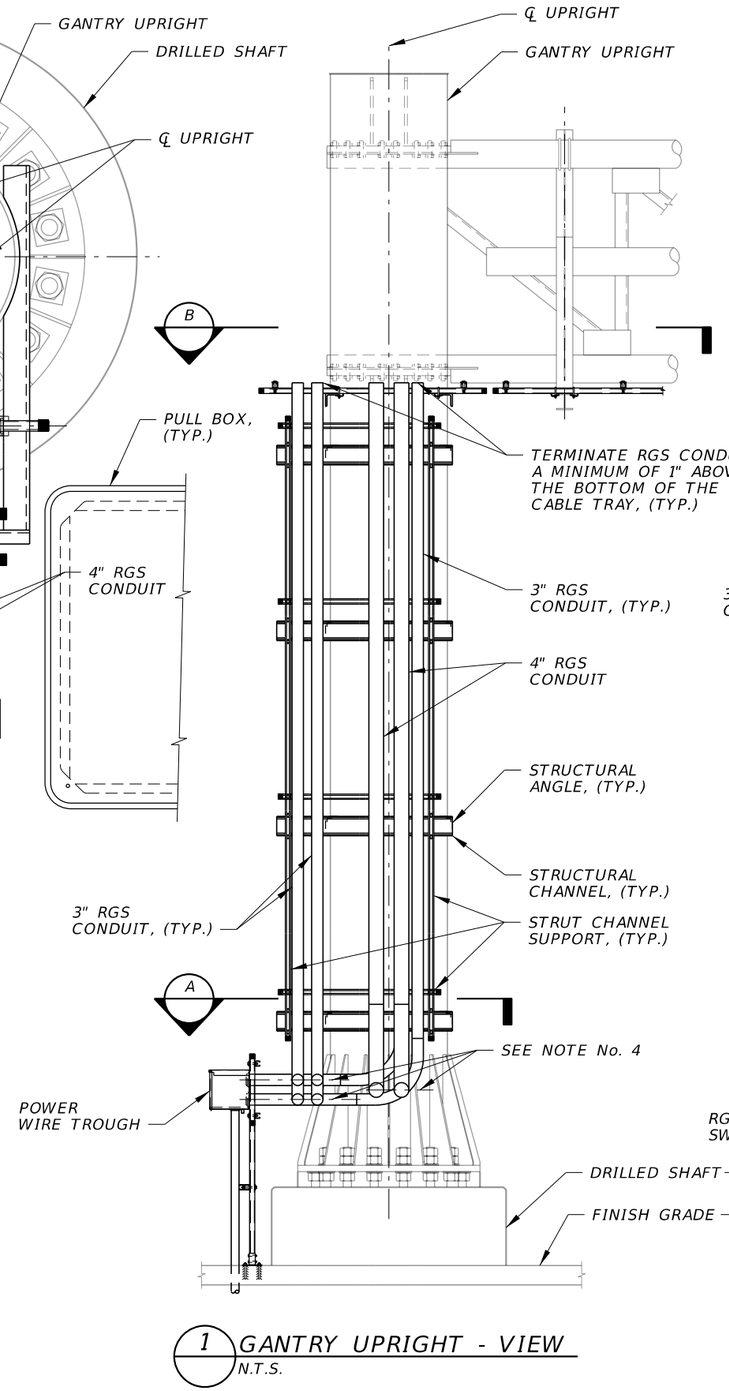
1. VERTICAL CONDUITS MUST NOT TERMINATE INTO THE TOP OF THE WIRE TROUGHS.
2. EXCHANGE POWER AND AVI WIRE TROUGHS, CONDUITS, AND CABLE TRAY LOCATIONS FOR TEB SITES WITH AVI READER GROUND-MOUNTED FRAMES.
3. SEE SITE SPECIFIC LAYOUTS FOR LOCATION OF WIRE TROUGHS AND GROUND-MOUNTED AVI AND POWER DISTRIBUTION FRAMES.
4. ALIGN RGS CONDUIT SWEEPS WITH GROUND-MOUNTED WIRE TROUGHS.



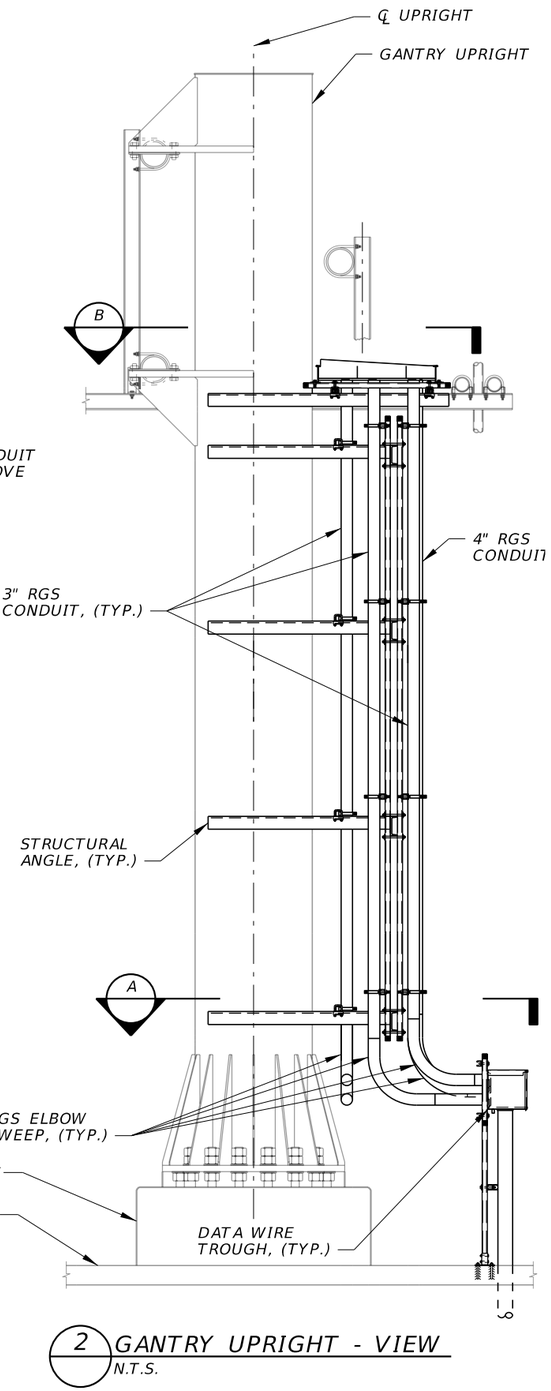
SECTION B
N.T.S.



SECTION A
N.T.S.

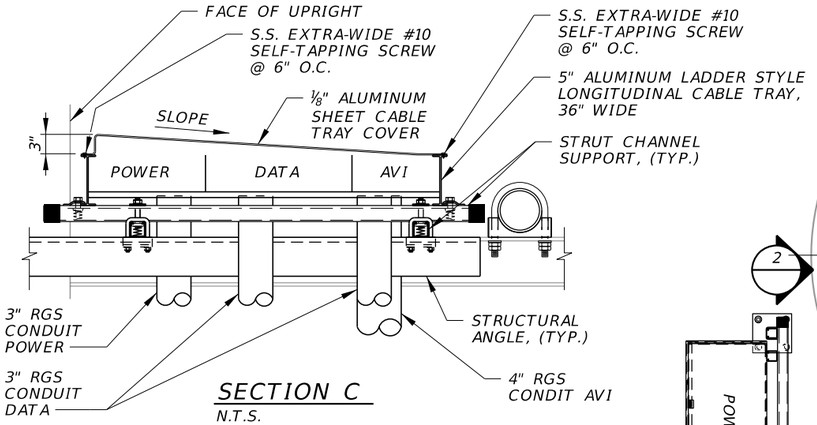


1 GANTRY UPRIGHT - VIEW
N.T.S.



2 GANTRY UPRIGHT - VIEW
N.T.S.

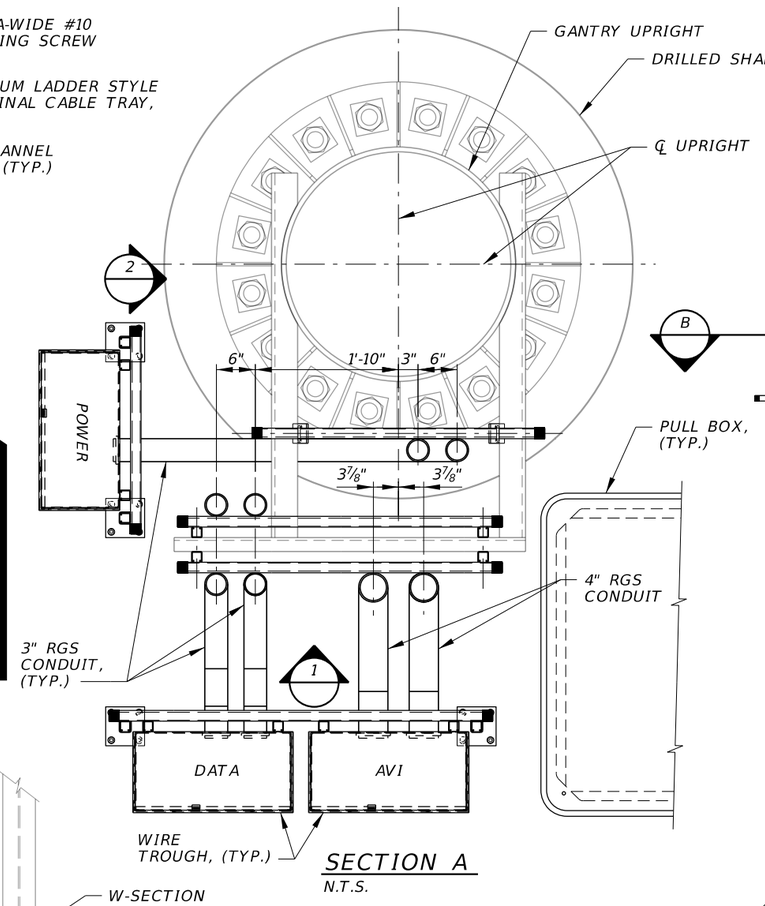
Exhibit 255.5-2 Cantilever Upright Conduit Layout



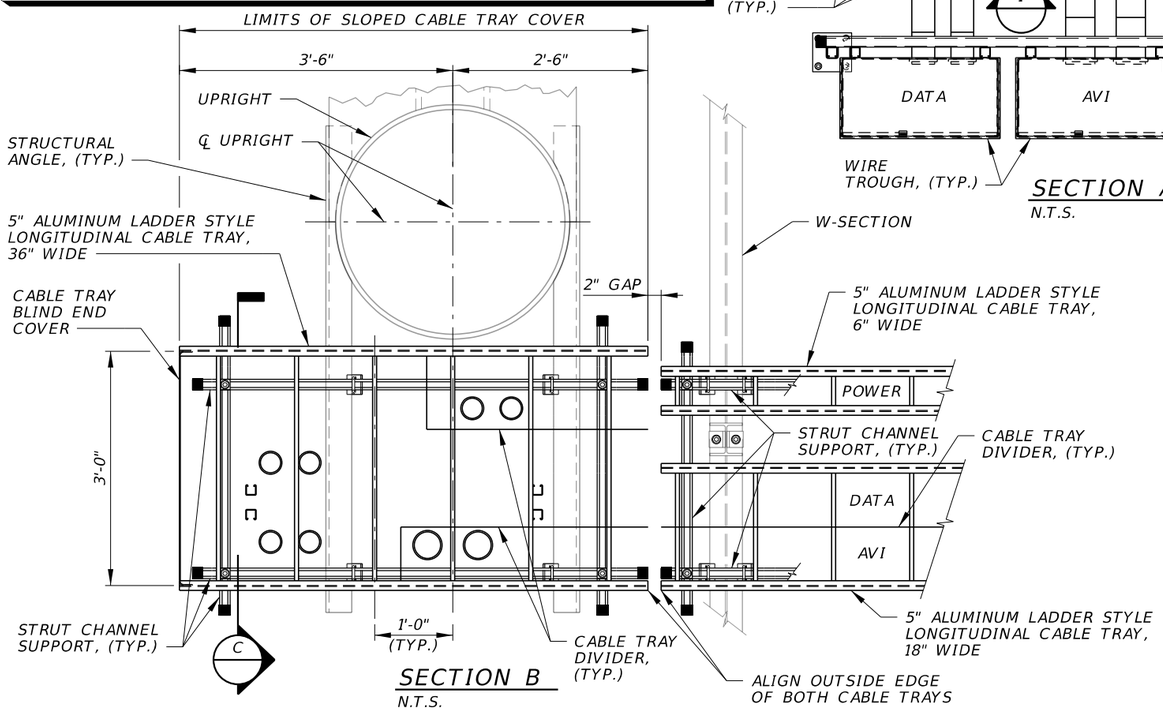
SECTION C
N.T.S.

NOTES TO PREPARER:

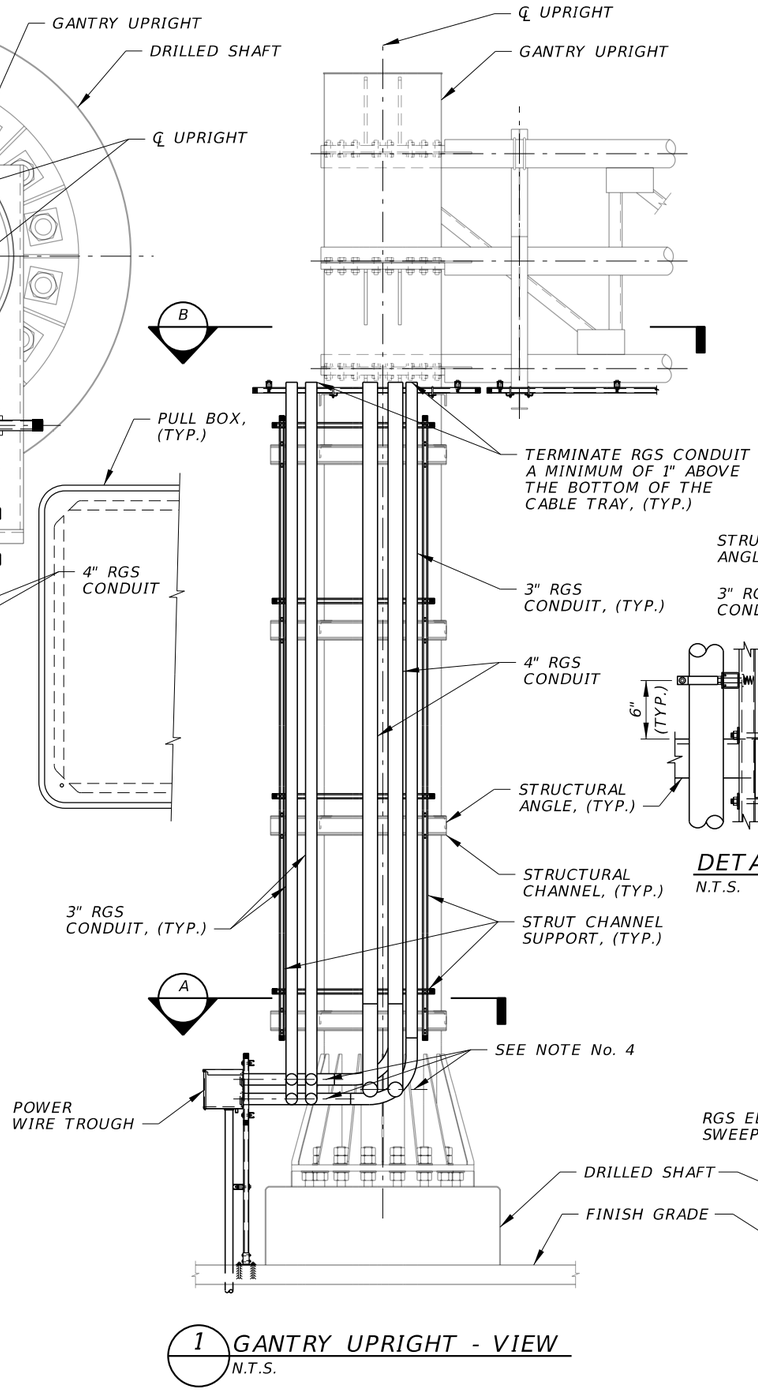
1. VERTICAL CONDUITS MUST NOT TERMINATE INTO THE TOP OF THE WIRE TROUGHS.
2. EXCHANGE POWER AND AVI WIRE TROUGHS, CONDUITS, AND CABLE TRAY LOCATIONS FOR TEB SITES WITH AVI READER GROUND-MOUNTED FRAMES.
3. SEE SITE SPECIFIC LAYOUTS FOR LOCATION OF WIRE TROUGHS AND GROUND-MOUNTED AVI AND POWER DISTRIBUTION FRAMES.
4. ALIGN RGS CONDUIT SWEEPS WITH GROUND-MOUNTED WIRE TROUGHS.



SECTION A
N.T.S.

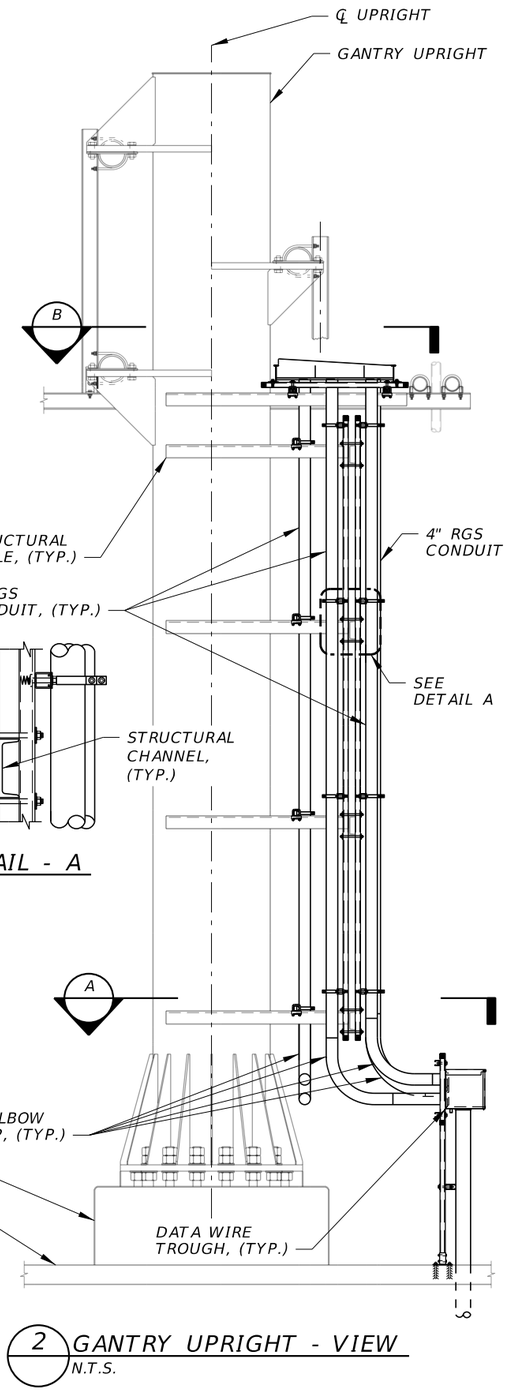


SECTION B
N.T.S.



1 GANTRY UPRIGHT - VIEW
N.T.S.

DETAIL - A
N.T.S.



2 GANTRY UPRIGHT - VIEW
N.T.S.

255.5.2 Longitudinal Cable Trays

(1) Provide 5-inch high aluminum ladder type cable tray with dividers to separate AVI, data, and power cabling.

(2) Cable tray must be no less than 9” wide and no greater than 24” wide.

(3) AVI, data, and power sections of the cable tray must be at least 8” wide.

(4) Provide waterfall fittings as needed for all cables that transition out of the longitudinal cable trays as shown in ***Exhibit 255.5-1***, ***Exhibit 255.5-2***, and ***Exhibit 255.5-3***.

(5) Extend the longitudinal cable tray to within 12” of the end of the upright cable tray below. Longitudinal cable tray must not extend beyond the nearest end of the upright cable tray below.

(6) Cable tray must be supported by strut channel frame as shown in ***Exhibit 255.5-1*** and ***Exhibit 255.5-2***. Strut channel must be secured to the gantry structure with beam clamps as shown in ***Exhibit 255.5-3***.

255.5.3 Equipment Cable Tray

(1) Equipment cable tray must be provided to support all cabling between the longitudinal cable tray and the equipment on the J-arms. A galvanized threaded rod assembly for field installation of galvanized strut channel to W-section members must be provided at NEC required spacing. These mechanically fastened assemblies must have galvanized self-locking nuts with washers installed above and below the W-members as shown in ***Exhibit 255.5-3***.

(2) Equipment cable trays must span along the entire W-section within 12 inches from the centerline of the approach and departure J-arms, except as stated below.

(3) In accordance with ***GTR 250.2.3***, VCARs must open for maintenance without conflict. When installation of the equipment cable tray as described in item (2) above results in impacts to VCAR maintainability, equipment cable tray must terminate 42 inches from the centerline of the applicable J-arm.

255.5.4 Upright Cable Tray

(1) An upright cable tray must be provided as a termination point for the vertical conduit installed on the uprights and support cables transitioning to the longitudinal cable trays located on the gantry truss as shown in ***Exhibit 255.5-1*** and ***Exhibit 255.5-2***.

(2) Weatherproof blind end covers must be provided on ends of the cable tray.

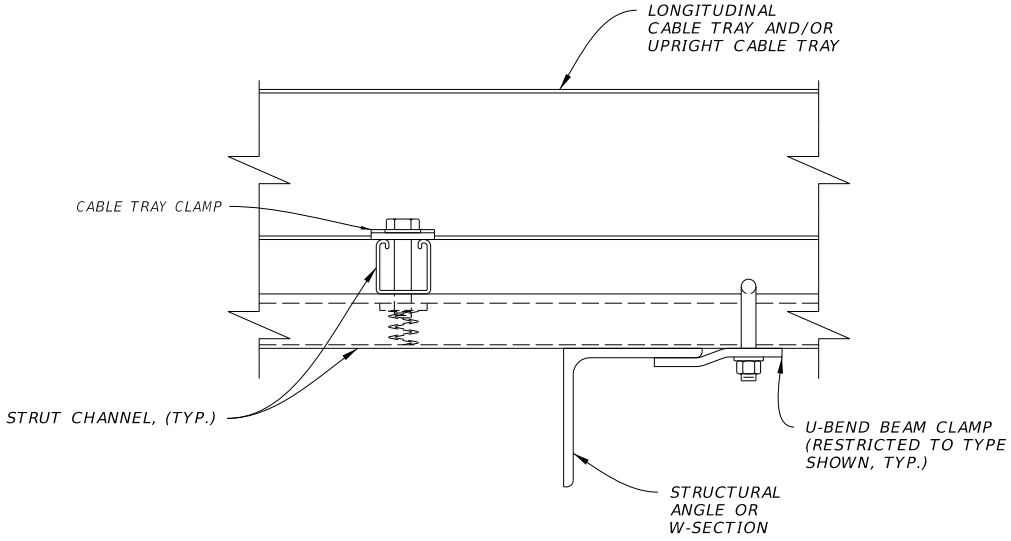
(3) A factory cable tray with a pitched cover must be provided over the vertical conduit terminations to prevent water intrusion. Extend the cover from the end of the cable tray to at least 18 inches beyond the conduit terminations.

(4) Vertical conduit terminations into the cable trays must be provided with manufacturer supplied fittings.

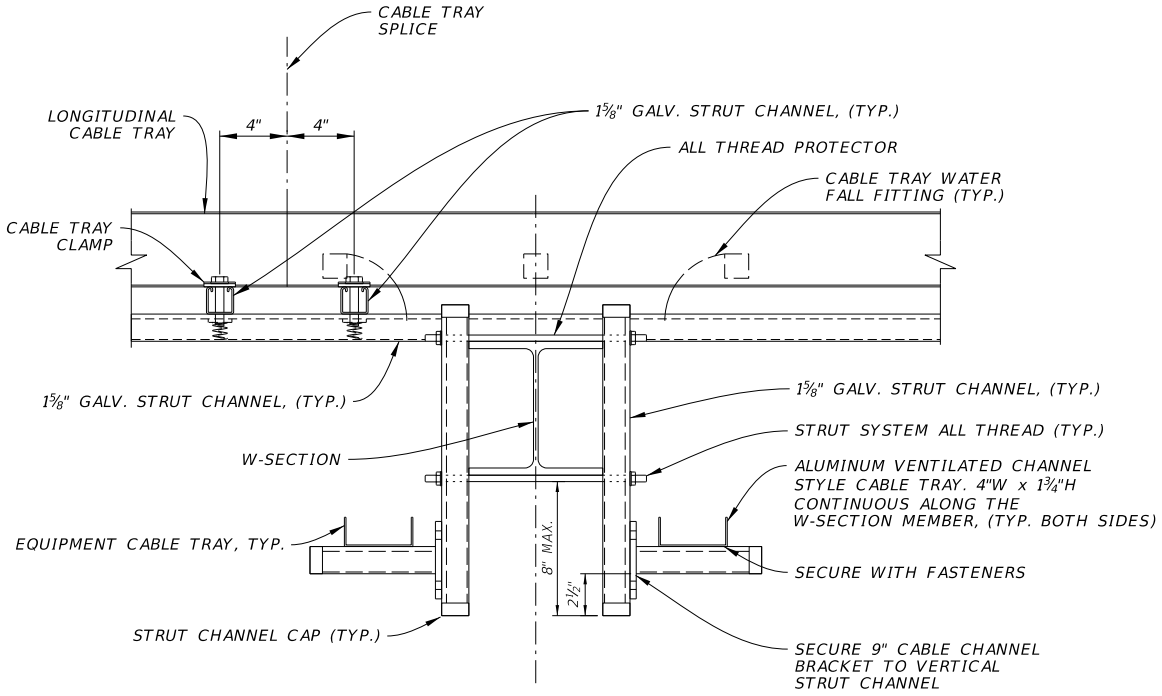
(5) Vertical conduit installed on the uprights must extend 1 inch above the bottom of the cable tray.

(6) Cable tray must be supported by strut channel frame as shown in ***Exhibit 255.5-1*** and ***Exhibit 255.5-2***. Strut channel must be secured to the gantry structure with beam clamps as shown in ***Exhibit 255.5-3***.

Exhibit 255.5-3 Toll Equipment Cable Tray



DETAIL AT UPRIGHT



DETAIL AT W-SECTION

255.5.5 AVI Reader Placement in Toll Equipment Building

For toll sites with only one critical power panel and where the cable distances allow, the AVI readers must be wall-mounted inside the associated TEB as shown in ***Exhibit 242.1-6***.

See ***GTR 242.14*** for additional requirements on AVI cable routing for AVI reader placement in the building.

255.5.6 AVI Reader Ground-Mounted Frames

(1) AVI reader ground-mounted frames must be used:

(a) At TEB sites when AVI Reader placement in TEBs cannot meet the requirements of ***GTR 255.5.5***.

(b) At RTC and TEB sites when antenna to AVI reader cable distance requirements identified in ***GTR 234.3 (1)*** can be met.

(2) See ***Exhibit 232.5-2*** for AVI reader ground-mounted frames.

(3) See ***GTR 242.14*** and ***GTR 232.11*** for additional requirements on AVI cable routing.

255.5.7 AVI Reader Gantry-Mounted Frame

(1) If the AVI readers cannot be placed inside the TEB or on AVI reader ground-mounted frames, mount the AVI readers over a shoulder on the gantry:

(a) Use the inside shoulder for EL-only toll sites.

(b) Use the outside shoulder for all other toll sites.

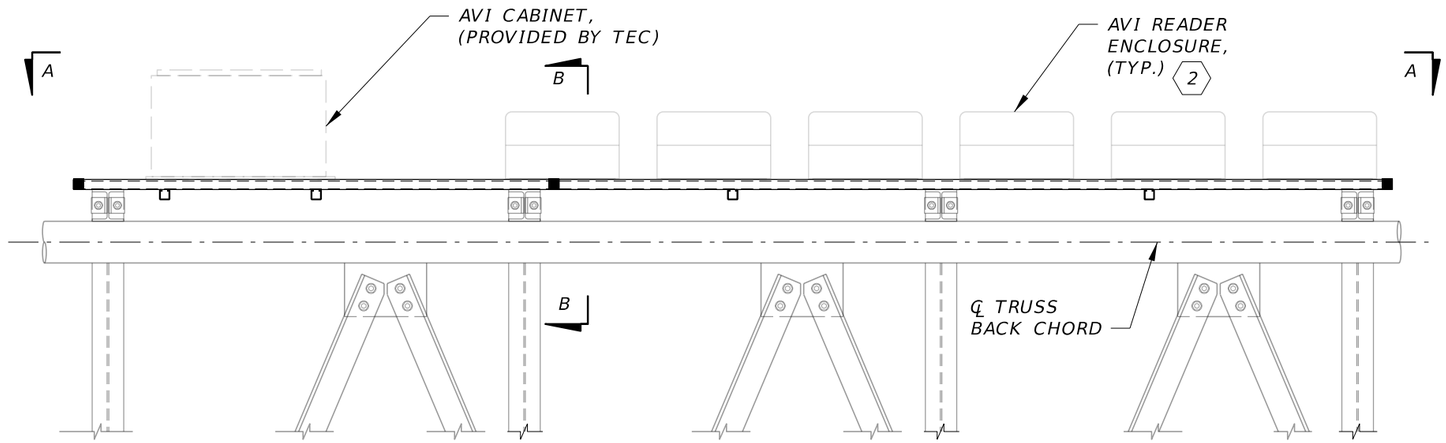
(c) Mount AVI readers on the departure side where possible.

(2) Provide galvanized strut channels on the non-accessible gantry truss for the TEC to vertically mount each TEC-provided AVI reader fiberglass NEMA 4 enclosure as shown in ***Exhibit 255.5-4***.

(3) TEC equipment enclosure, AVI reader fiberglass enclosures, and associated elements must not be in conflict with any gantry elements supporting interim and ultimate lanes.

(4) See ***GTR 242.14*** and ***GTR 232.11*** for additional requirements on AVI cable routing.

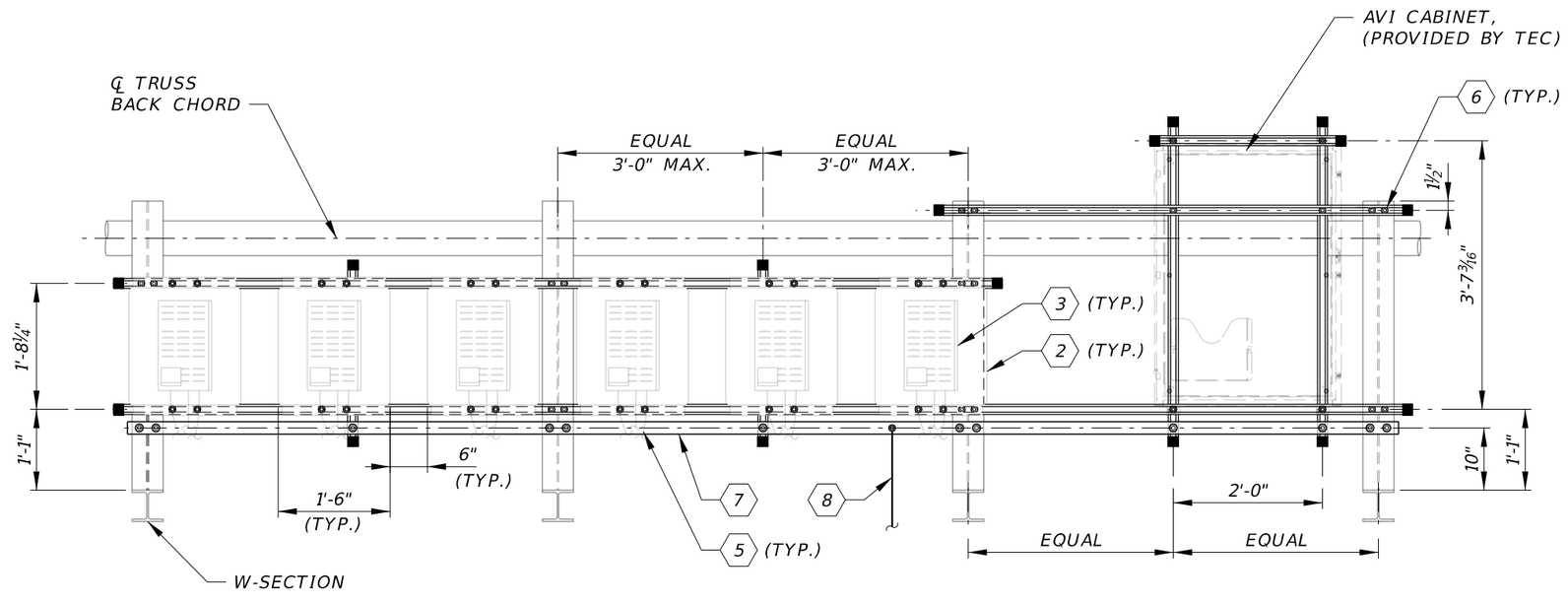
Exhibit 255.5-4 AVI Reader Non-Accessible Gantry Mounting Detail



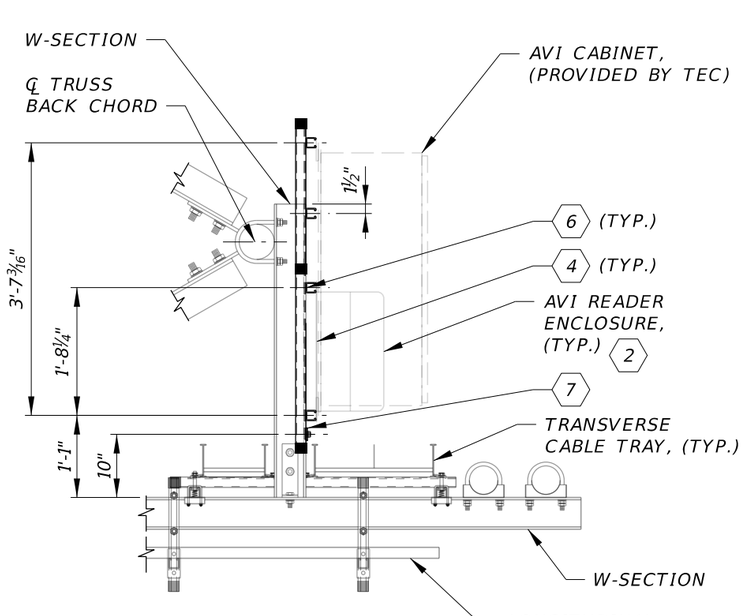
AVI READER MOUNTING PLAN
N.T.S.

NOTES TO PREPARER:

1. ONE AVI READER IS REQUIRED FOR EACH TOLL EQUIPMENT ANTENNA. EACH GANTRY MOUNTED AVI READER MUST HAVE AN AVI READER ENCLOSURE WITH ASSOCIATED MOUNTING HARDWARE.
2. AVI READER ENCLOSURE, (PROVIDED AND INSTALLED BY TEC)
3. AVI READER, (PROVIDED BY TURNPIKE TOLL SYSTEMS)
4. AVI READER ENCLOSURE MOUNTING PLATE, (PROVIDED AND INSTALLED BY TEC)
5. AVI READER CABLES, (PROVIDED AND INSTALLED BY TEC)
6. FASTEN STRUT CHANNEL TO SUPPORTS WITH MANUFACTURER'S APPROVED HARDWARE.
7. FASTEN 1/4" THICK, 2" HIGH COPPER GROUND BUS BAR BELOW AVI READERS AND DIRECTLY TO W-SECTION. PROVIDE LENGTH AS REQUIRED AND SUPPORTED A MAXIMUM OF EVERY 36 INCHES.
8. PROVIDE (1) #X GROUNDING CONDUCTOR AND CONNECT TO THE EQUIPMENT GROUNDING CONDUCTOR WITHIN THE POWER WIREWAY.



ELEVATION A-A
N.T.S.



SECTION B-B
N.T.S.

255.5.8 Cantilever Gantry Mounted on Median Barrier

(1) Each vertical conduit from the horizontally mounted cable tray must terminate in a vertically-mounted handhole (pencil pull box). The conduit and pencil pull box supports must be designed such that they do not conflict with the gantry upright stiffener plates. See ***Exhibit 255.5-5*** for additional requirements.

(2) Cantilever gantries must be designed according to the requirements for typical non-accessible span gantries with the following exceptions:

(a) The 3-inch power and data conduits routing below the median must be located a minimum of 5 feet away from the 1-inch roadway pavement loop conduits.

(b) Conduits on the upright consists of three 3-inch RGS conduits for data and one 3-inch RGS conduit for power extending from the upright cable tray above.

(c) When the toll loop pavement area is located on the same side as the TEB, [redacted] data and power conduits must route to separate pull boxes for cantilever data, and cantilever power, located in the median barrier as shown in ***Exhibit 232.1-13***.

(d) When the toll loop pavement area is located on the opposite side from the TEB, [redacted] data and power conduits must route directly to separate pull boxes for cantilever data, and cantilever power, located adjacent to the TEB. See ***Exhibit 232.1-4*** for dual movement example.

(e) When the RTC site serves a single movement median cantilever gantry, [redacted] data and power conduits must route to the OCC as shown in ***Exhibit 231.1-7*** and ***Exhibit 231.1-13***.

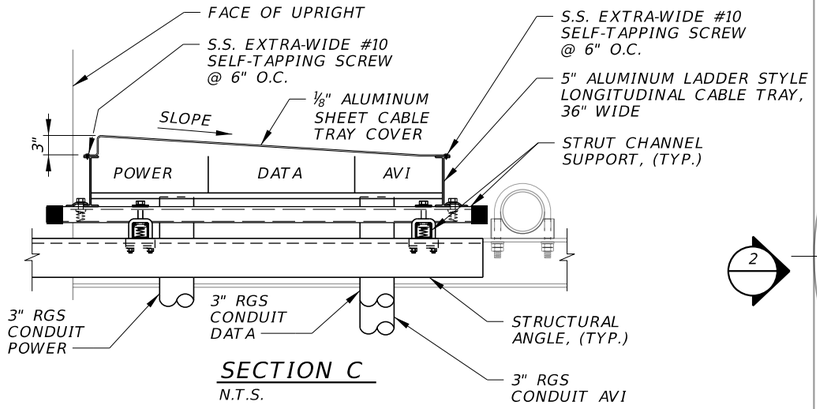
(f) When the RTC site serves dual movement median cantilever gantries, the [redacted] data and power conduits must route to the OCC associated with each gantry as shown in ***Exhibit 232.1-6*** and ***Exhibit 232.1-10***.

(3) A non-accessible span gantry may be considered to satisfy cable distance requirements from ***GTR 234***.

255.5.9 Cantilever Gantry Mounted Behind Concrete Barrier

Cantilever gantries electrical must be designed according to the requirements for typical non-accessible span gantries when the cantilever gantry is mounted behind the concrete barrier.

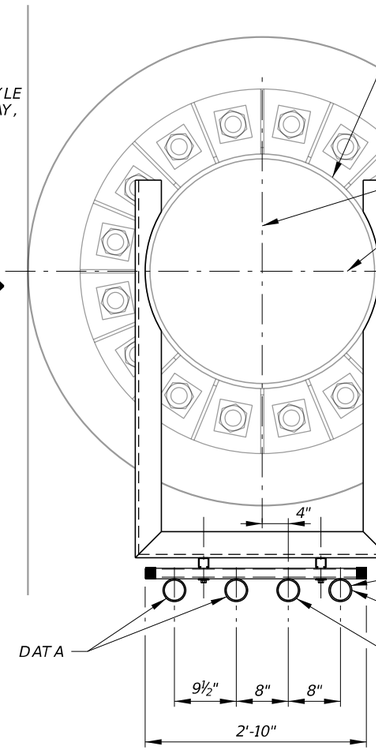
Exhibit 255.5-5 Cantilever Gantry Upright Conduit Layout



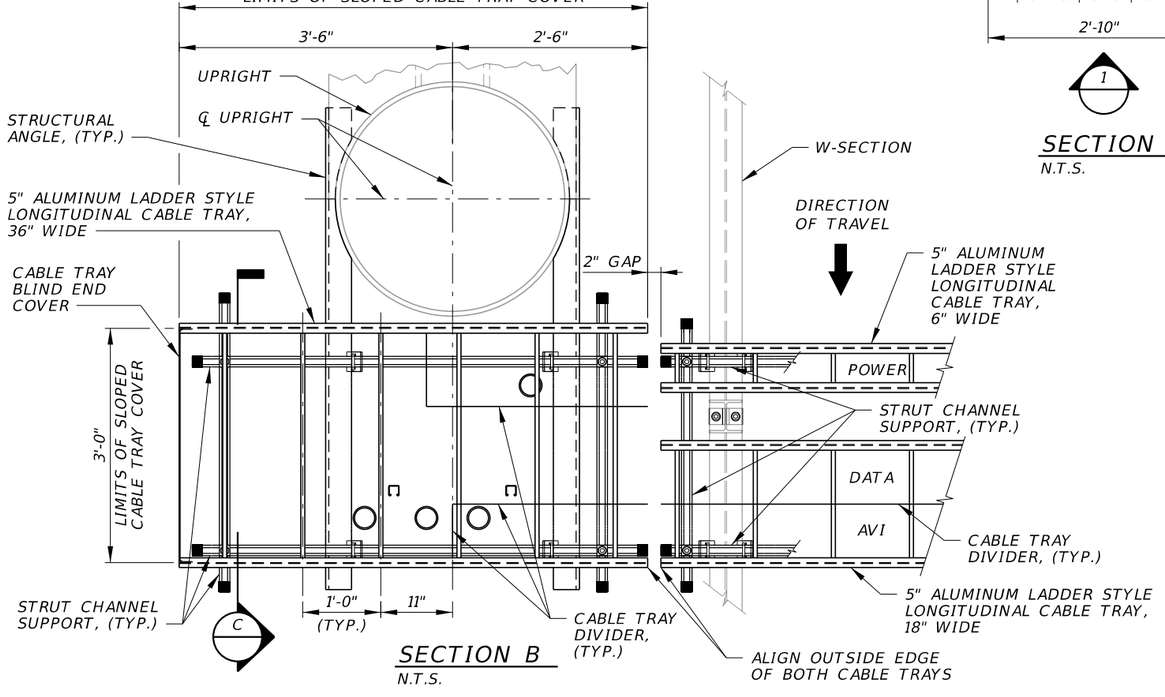
SECTION C
N.T.S.

NOTES TO PREPARER:

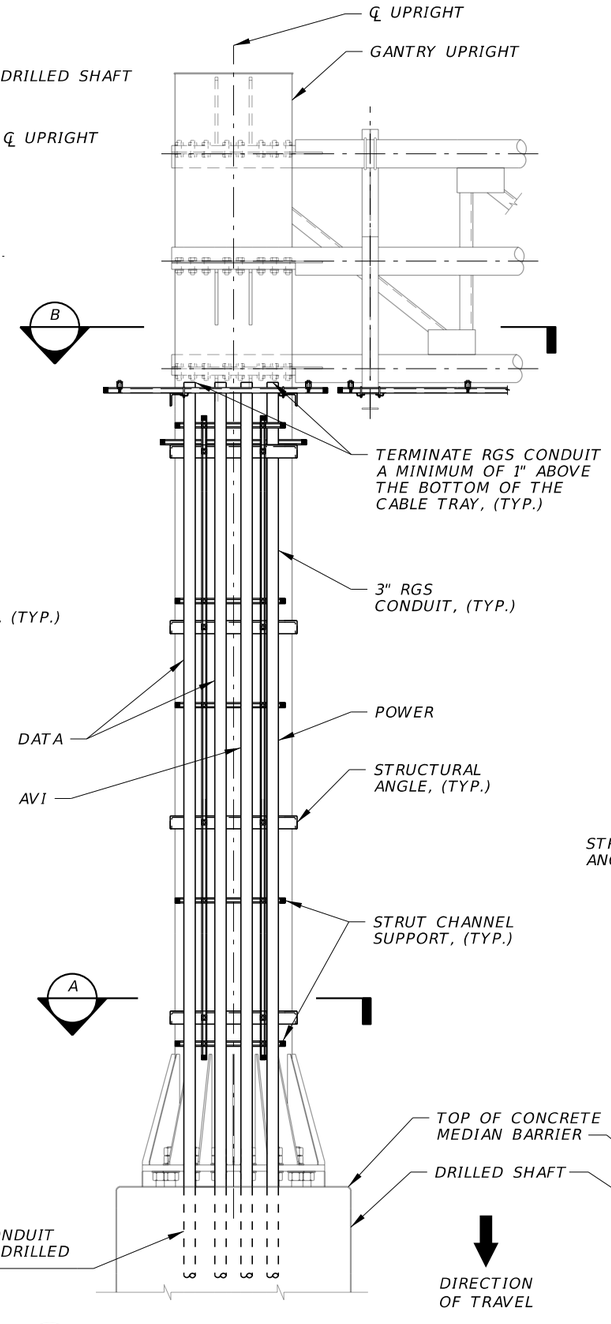
1. STRUT CHANNEL AND MOUNTING HARDWARE SHALL BE DEBURRED AND FILED SMOOTH TO REMOVE ROUGH EDGES PRIOR TO INSTALLATION.
2. PROVIDE PLASTIC END CAPS FOR STRUT CHANNEL SUPPORTS. STRUT CHANNEL AND END CAPS SHALL BE PROVIDED BY THE SAME MANUFACTURER.
3. PROVIDE REQUIRED FITTINGS, BUSHINGS, MOUNTING HARDWARE, AND ACCESSORIES TO PROVIDE A COMPLETE RACEWAY SYSTEM.
4. STRUT CHANNEL LENGTHS EQUAL TO OR LESS THAN 20 FEET SHALL BE CONTINUOUS AND WITHOUT SPLICES.



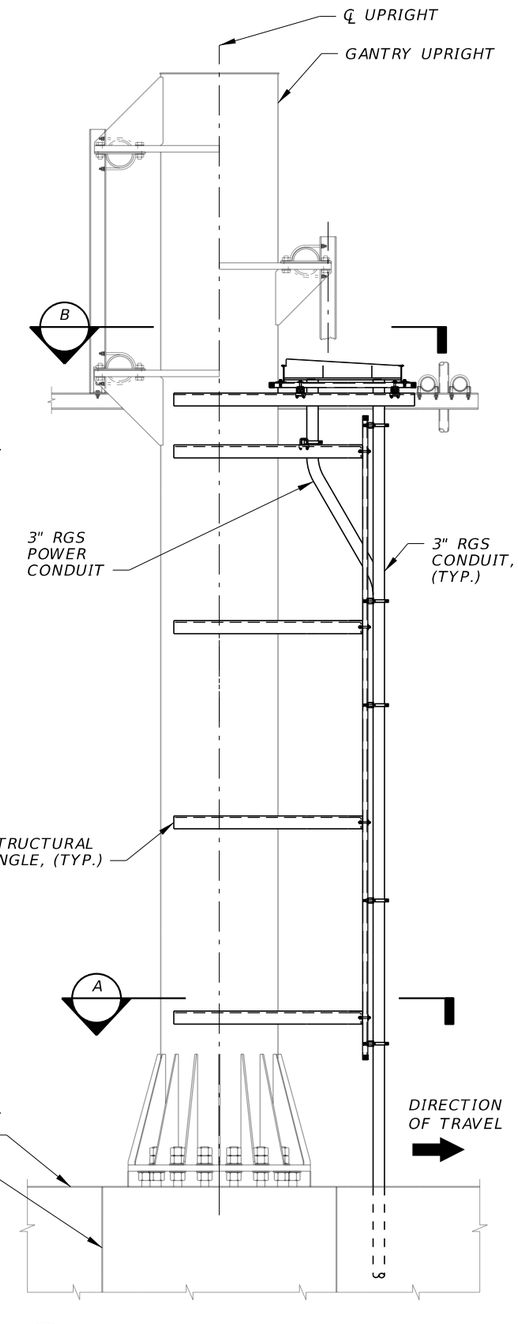
SECTION A
N.T.S.



SECTION B
N.T.S.



1 GANTRY UPRIGHT - VIEW
N.T.S.



2 GANTRY UPRIGHT - VIEW
N.T.S.

255.6 Accessible Gantry

255.6.1 General Requirements

(1) The following elements must be provided as part of the accessible gantry electrical layout:

(a) [redacted]

(b) Maintenance receptacles

(c) Cable trays

(d) TEC equipment enclosure and AVI reader mounting assemblies

(e) Wireways and associated strut channel supports

(f) Lighting control

(g) Lighting for platform and stairway

(2) See ***Exhibit 255.6-1*** for details of the electrical infrastructure of the accessible gantry.

(3) The 120 VAC branch circuits serving power outlets, lighting, or equipment on the gantry must be installed in the power section of the cable tray from panel EDP.

(4) Transverse cable trays must be provided connecting the power outlets, lighting and toll equipment conductors to the power cable tray on the gantry as shown in ***Exhibit 255.6-3***.

(5) A minimum of one (1) maintenance receptacle must be provided per direction of travel. Additional receptacles are required along the gantry at maximum longitudinal spacing of 100 feet.

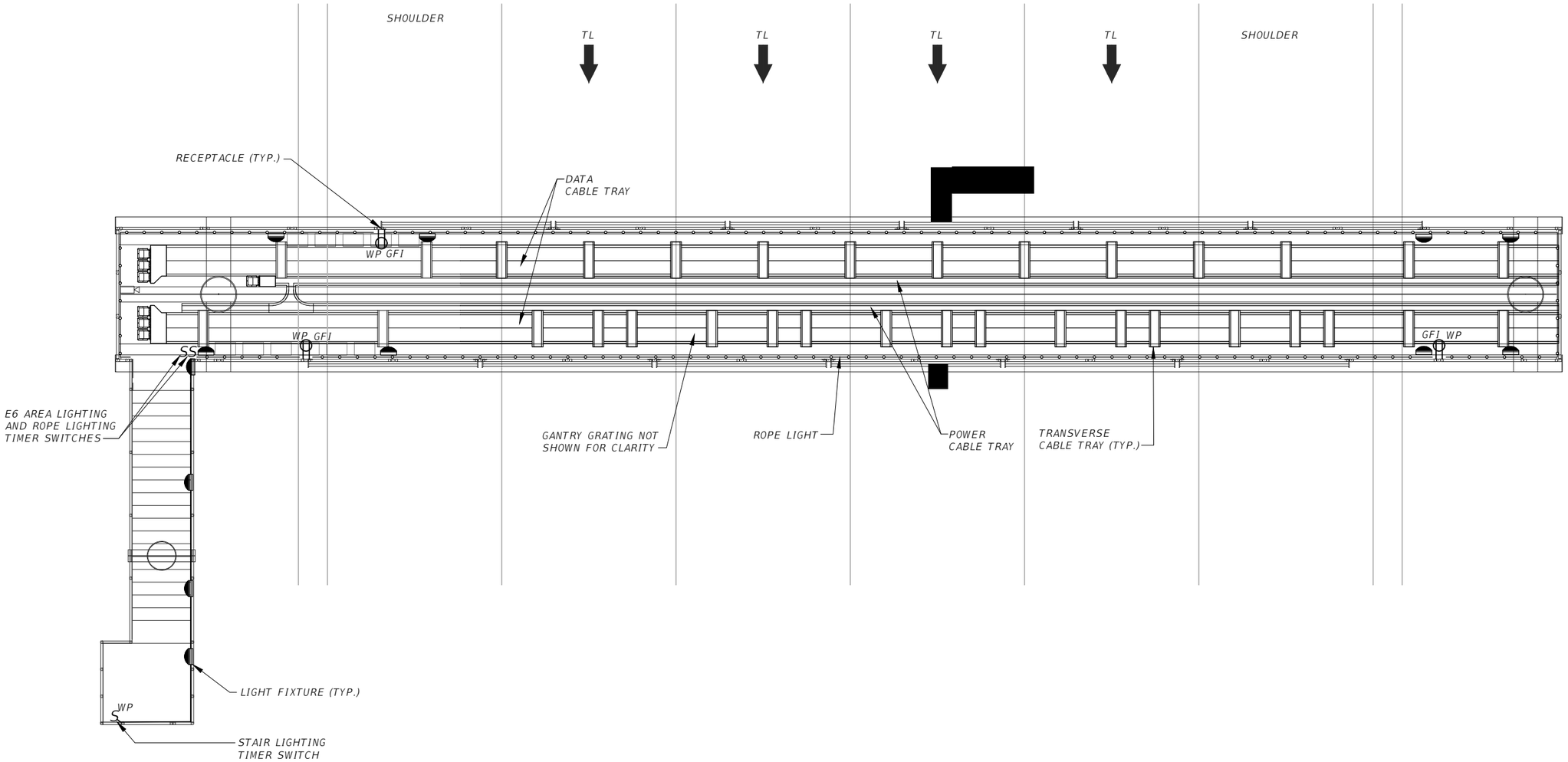
(a) See ***Exhibit 255.6-3*** for the two types of receptacle mounting details.

(b) Cables above the upper grating must be installed in conduits with CGB fittings for cable strain relief.

(6) Lighting fixtures must not be mounted on moveable swing gates or associated swing gate posts.

(7) Lighting and associated infrastructure must not impede the swing gates' operational requirements that allow toll equipment to be rotated to the maintenance position.

Exhibit 255.6-1 Accessible Gantry Electrical Plan



255.6.2 Cable Trays

(1) The following cable trays must be provided along the entire horizontal section(s) of the gantry as shown in ***Exhibit 255.6-2***:

(d) A minimum of two (2) 24-inch wide aluminum ladder type cable trays for data/AVI.

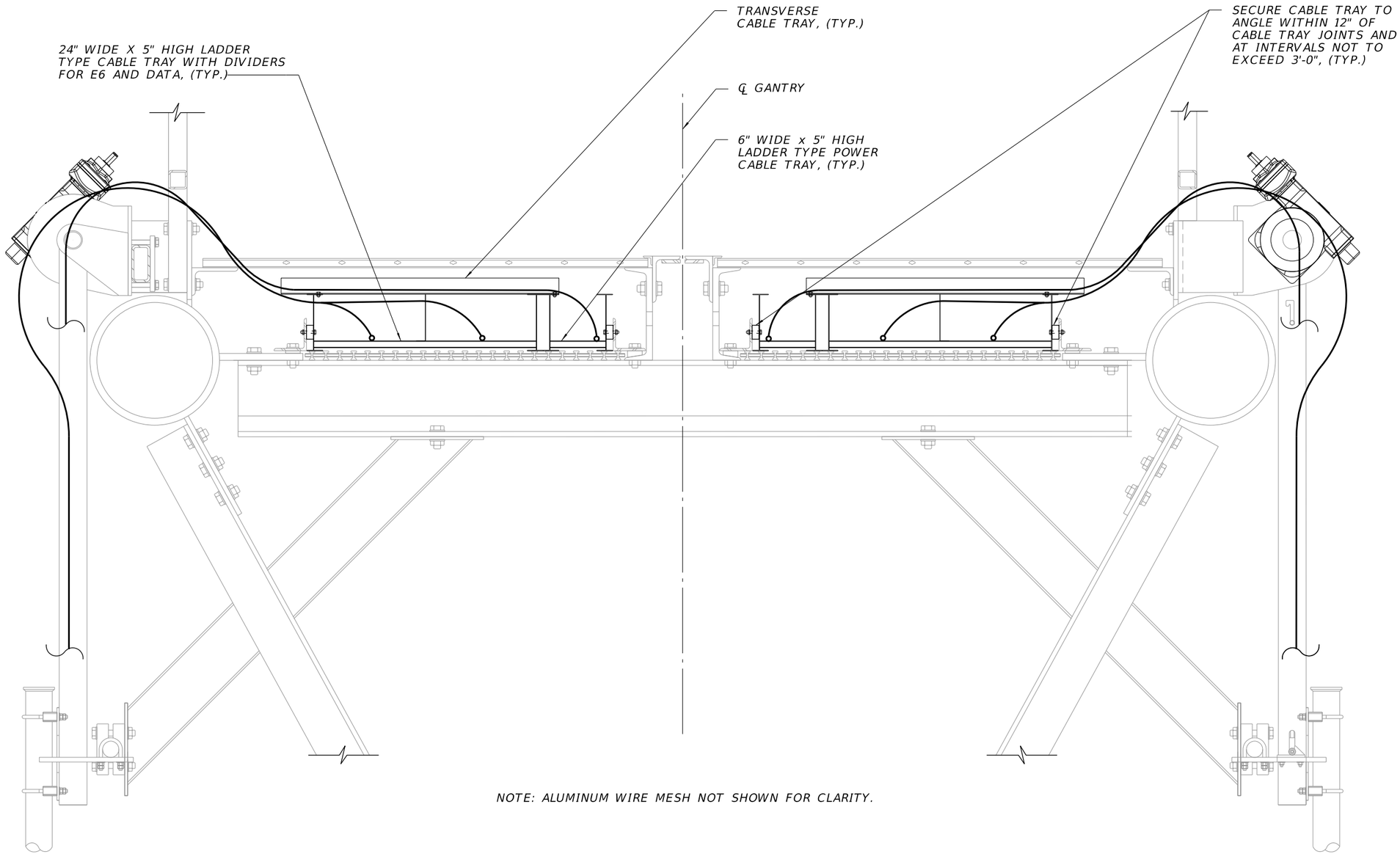
(e) A minimum of two (2) 6-inch wide aluminum ladder type cable trays for power.

(2) Cables installed in cable trays must be UL or other NRTL listed and rated as “Tray Cable (TC) Rated”.

(3) The data/AVI cable trays must be used to route data cabling for [redacted] tolling cameras, illuminators, TEC equipment, AVI cables, and antenna RF cables.

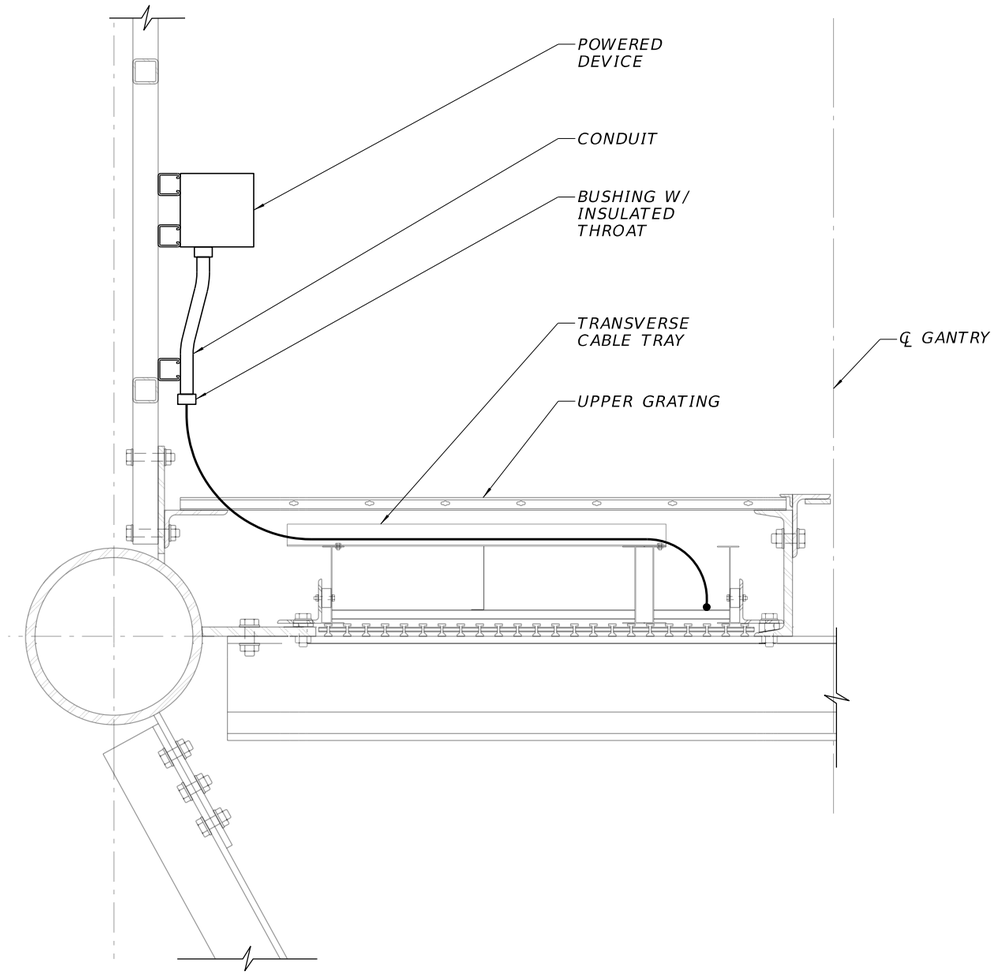
(4) 6-inch wide channel type transverse power cable trays must be used to route 120 VAC power cabling for TEC equipment, maintenance receptacles, gantry lighting, and gantry walkway lighting. See ***Exhibit 255.6-3*** for additional requirements.

Exhibit 255.6-2 Accessible Gantry Cable Tray Layout

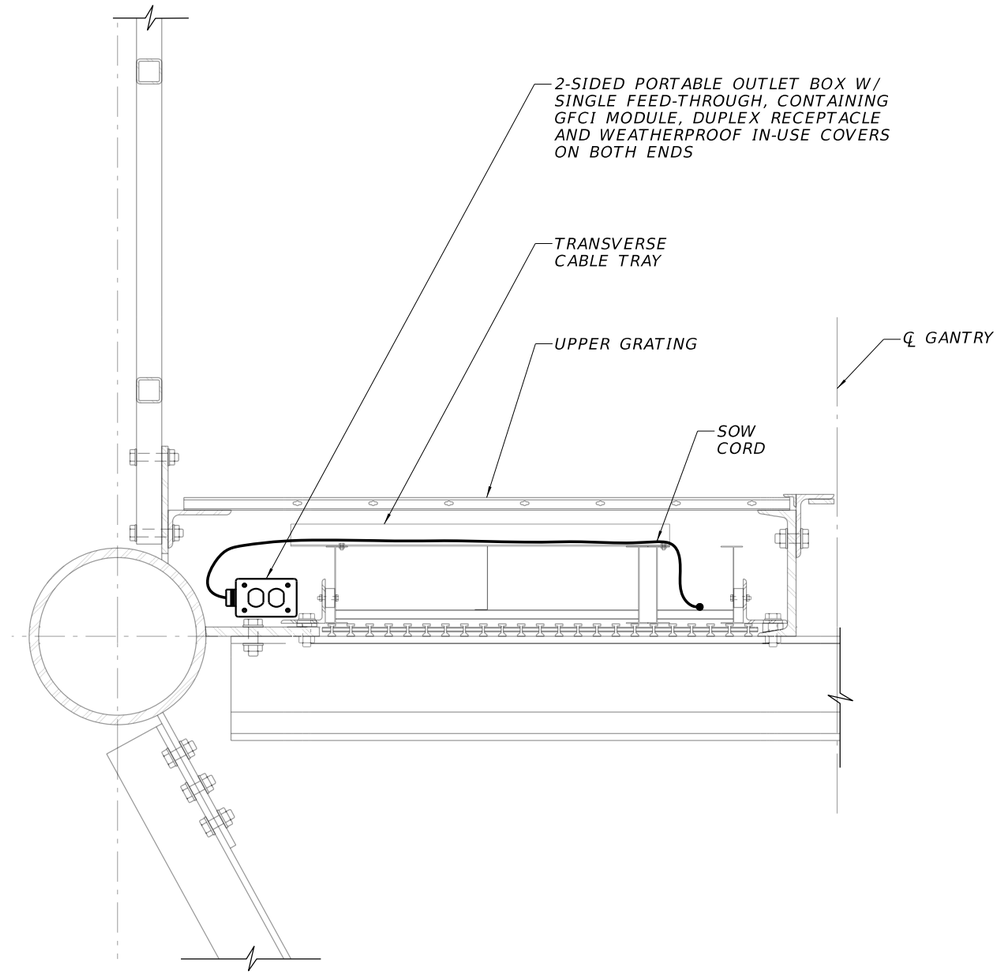


NOTE: ALUMINUM WIRE MESH NOT SHOWN FOR CLARITY.

Exhibit 255.6-3 Accessible Gantry Transverse Cable Tray



1 AREAS WITH FIXED SWING GATES
SCALE: NTS



2 AREAS WITH NON-FIXED SWING GATES
SCALE: NTS

NOTE: ALUMINUM WIRE MESH NOT SHOWN FOR CLARITY.

255.6.3 AVI Reader Accessible Gantry-Mounted Frame

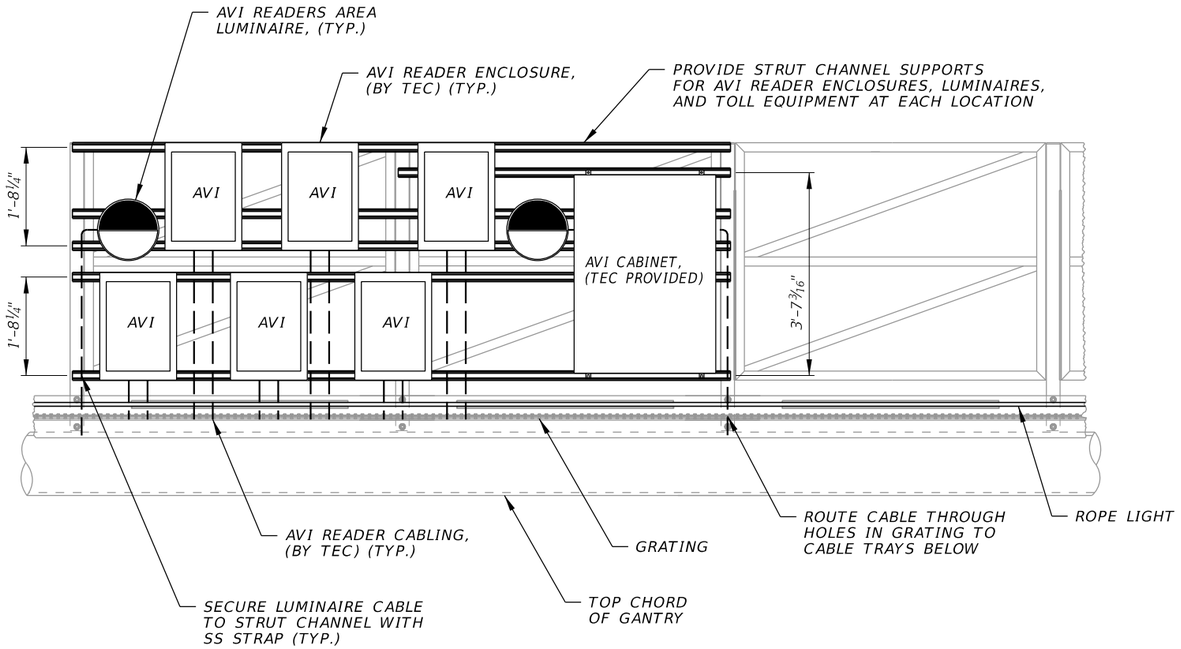
(1) The positioning of each AVI reader fiberglass enclosure and TEC equipment enclosure on the accessible gantry and the adjacent light fixtures, receptacles, switches, etc. must be as shown in ***Exhibit 255.6-4***, and ***Exhibit 255.6-6***.

(2) AVI reader fiberglass enclosures, TEC equipment enclosure, associated elements, strut channel, and mounting plates must not be located on the moveable swing gates or where swing gate elements would conflict with AVI reader enclosure access and associated light fixtures.

(3) AVI reader and TEC equipment enclosure mounting locations must not interfere with future toll equipment arm assemblies for existing or future lanes.

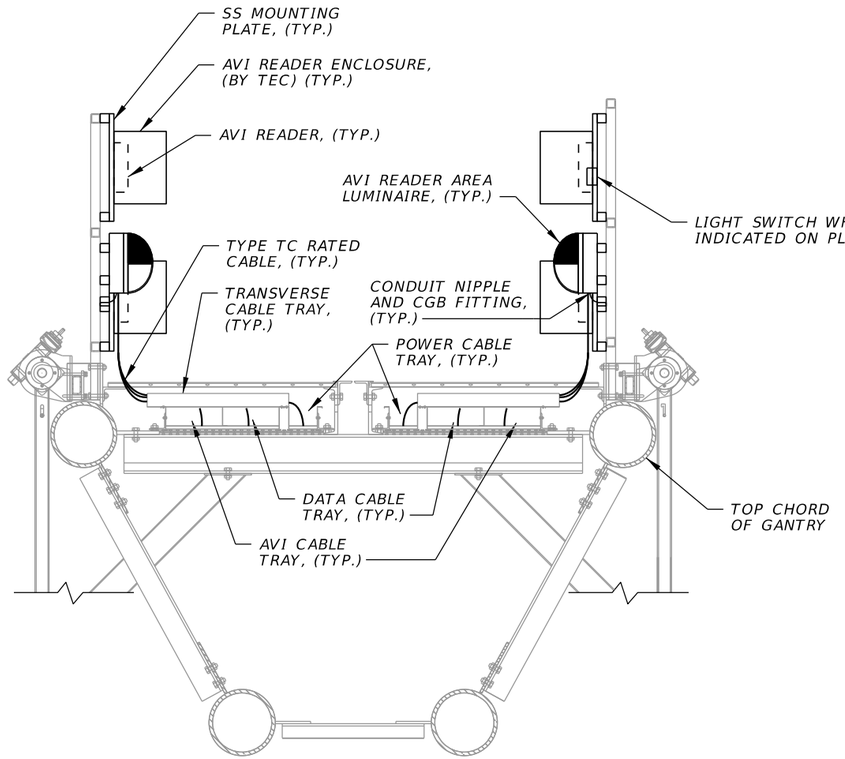
(4) A galvanized strut channel must be provided on the accessible gantry maintenance walkway at AVI reader and TEC equipment enclosure mounting locations as shown in ***Exhibit 255.6-4***. The element is used by the TEC to vertically mount each TEC-provided AVI reader fiberglass NEMA 4 enclosure and TEC equipment enclosure to the accessible gantry structure.

Exhibit 255.6-4 Accessible Gantry AVI Reader Enclosure Layout



1 TYPICAL AVI READER MOUNTING ELEVATION

SCALE: NTS



2 TYPICAL AVI READER MOUNTING SECTION

SCALE: NTS

255.6.4 Wireway Transition to Wire Troughs

(1) The horizontal cable tray sections along the gantry truss must terminate in a minimum of seven (7) 6-inch x 6-inch fiberglass wireways dual rated NEMA 12/3R.

(2) The fiberglass wireways must run horizontally on the truss prior to descending the gantry upright as shown in ***Exhibit 255.6-6***, and ***Exhibit 255.6-8***.

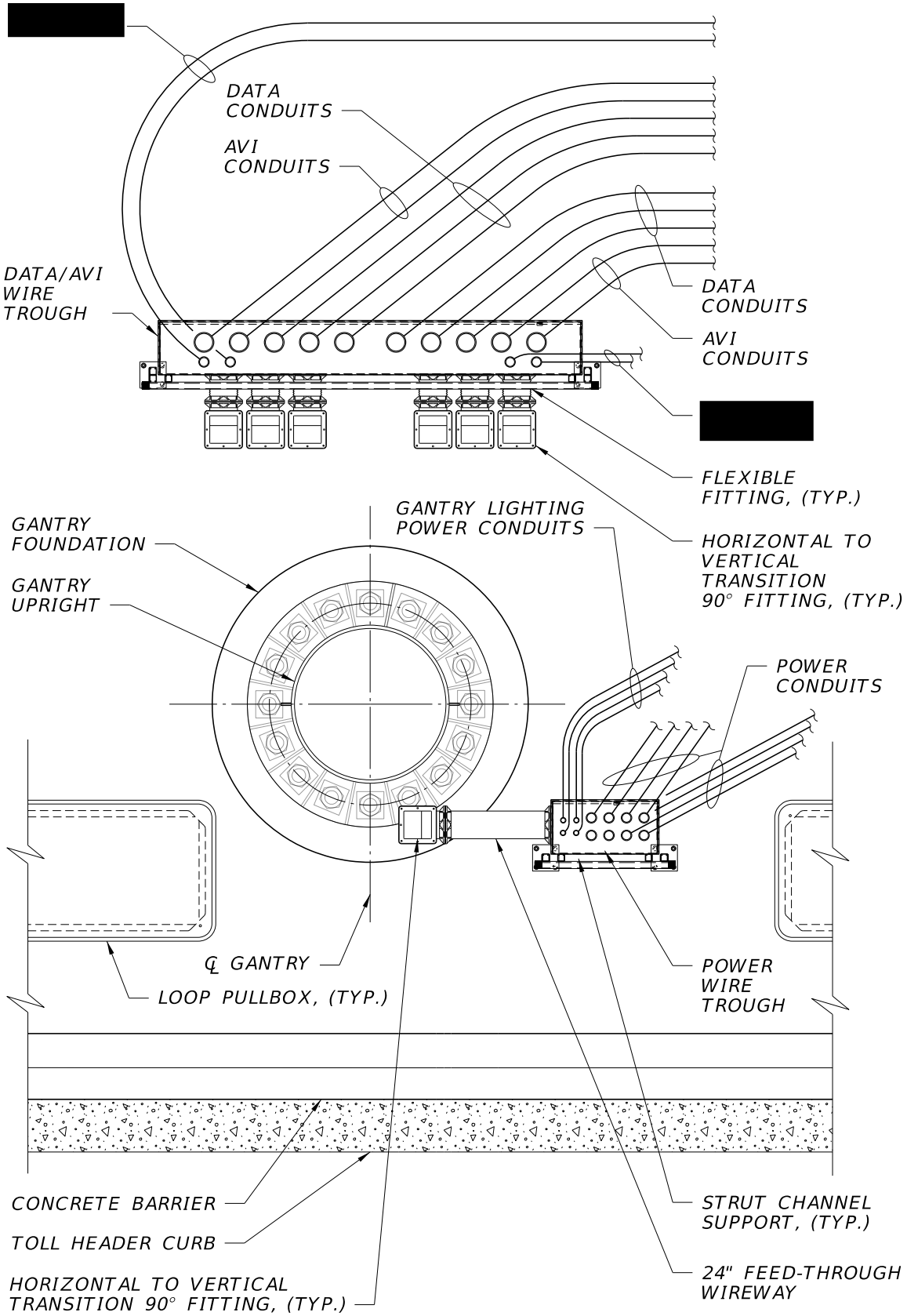
(3) The horizontal ends of the wireways must be protected from stormwater intrusion as shown in ***Exhibit 255.6-6***, and ***Exhibit 255.6-7***.

(4) The wireways must descend on the column located on the TEB side of the roadway and terminate in their respective NEMA 3R wire troughs as shown in ***Exhibit 255.6-5***, and ***Exhibit 255.6-8***. Wireways must not terminate into the top of the wire trough.

(5) Drain fittings must be provided at the bottom vertical to horizontal transition prior to wire trough termination as shown in ***Exhibit 255.6-8***. The drain fitting must maintain the NEMA 12/3R rating of the wireways.

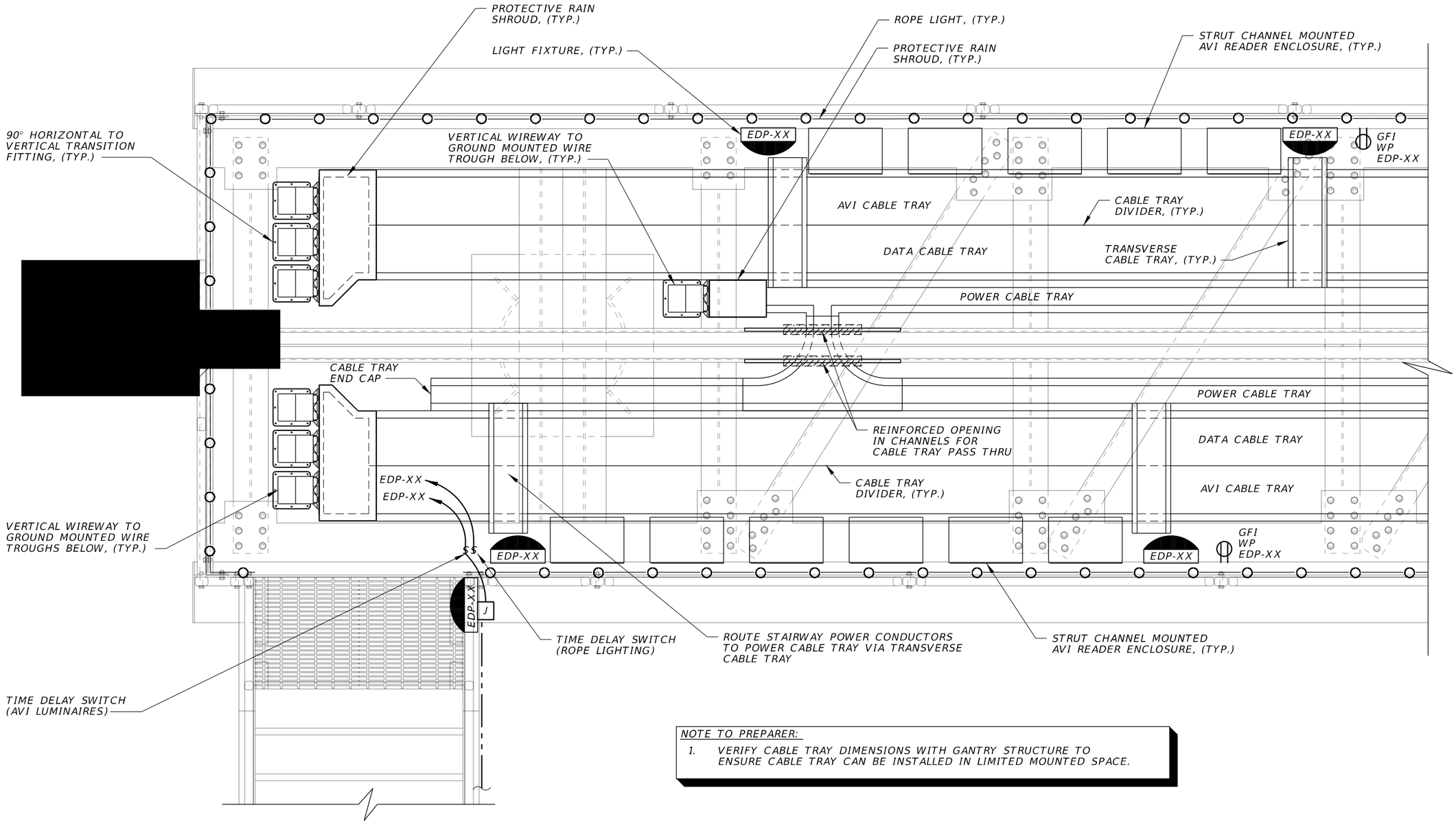
(6) All wireways must be routed and supported with galvanized strut channels as they descend the gantry upright as shown in ***Exhibit 255.6-8***.

Exhibit 255.6-5 Accessible Gantry Typical Wire Trough Layout



AT GROUND LEVEL
SCALE: NTS

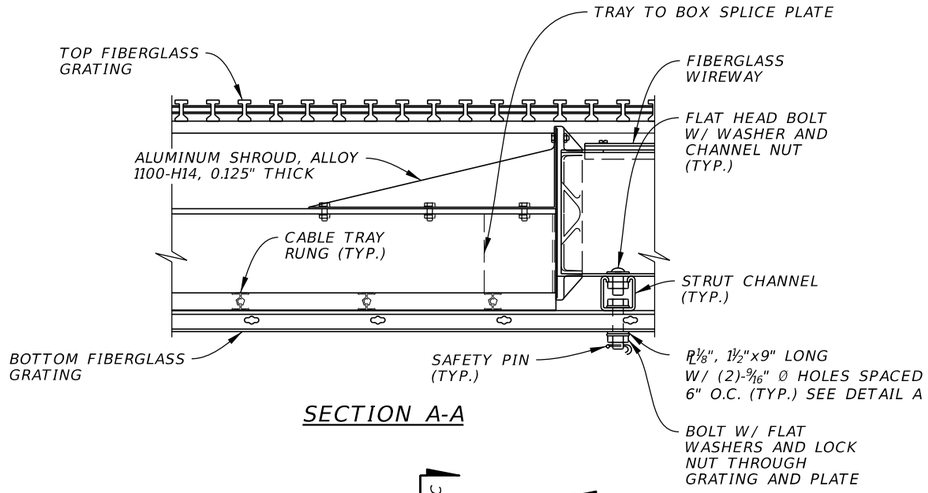
Exhibit 255.6-6 Accessible Gantry Typical Electrical Layout



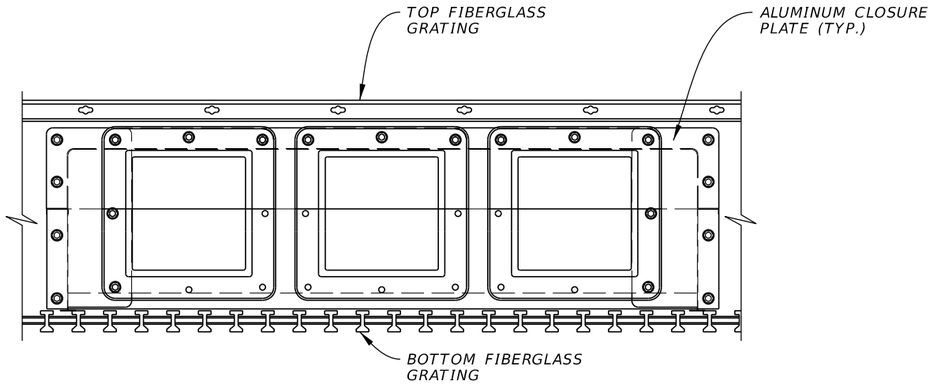
NOTE TO PREPARER:

1. VERIFY CABLE TRAY DIMENSIONS WITH GANTRY STRUCTURE TO ENSURE CABLE TRAY CAN BE INSTALLED IN LIMITED MOUNTED SPACE.

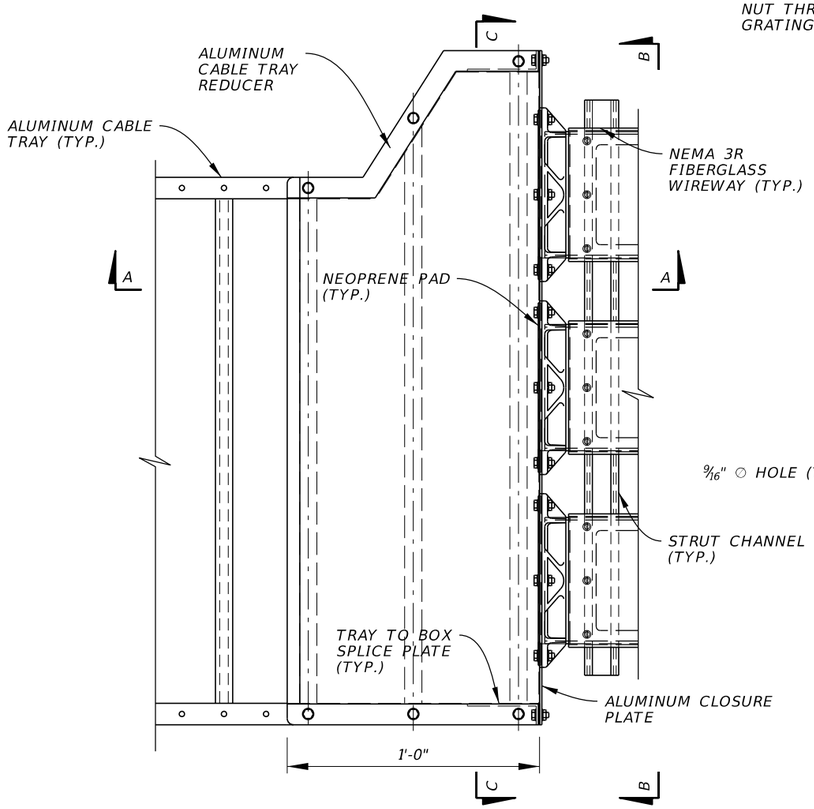
Exhibit 255.6-7 Accessible Gantry Typical Wireway to Cable Tray Detail



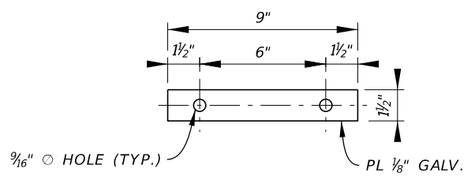
SECTION A-A



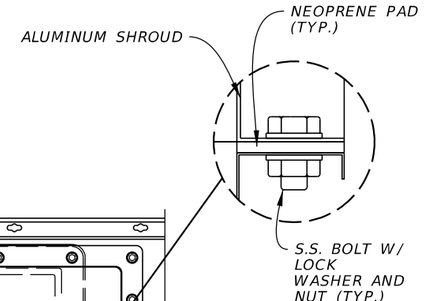
SECTION B-B

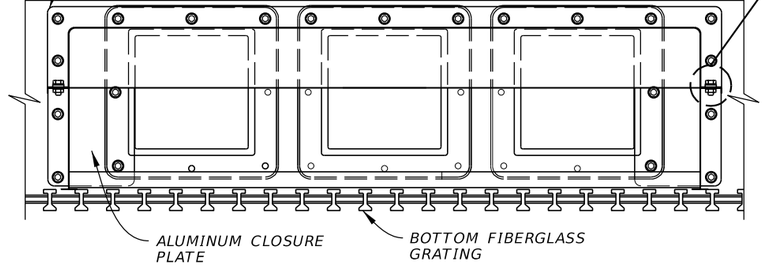


PLAN



DETAIL A



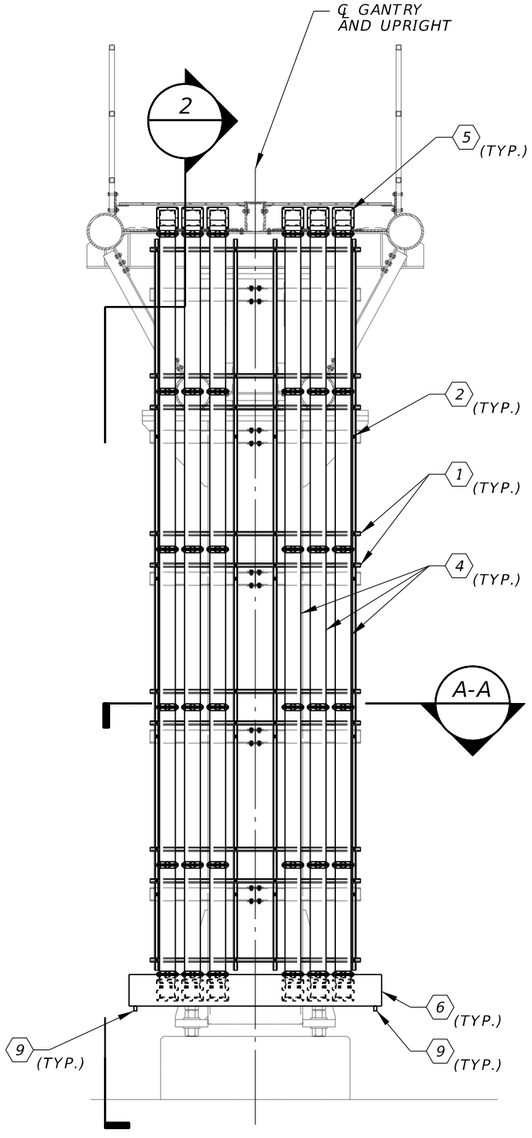


SECTION C-C

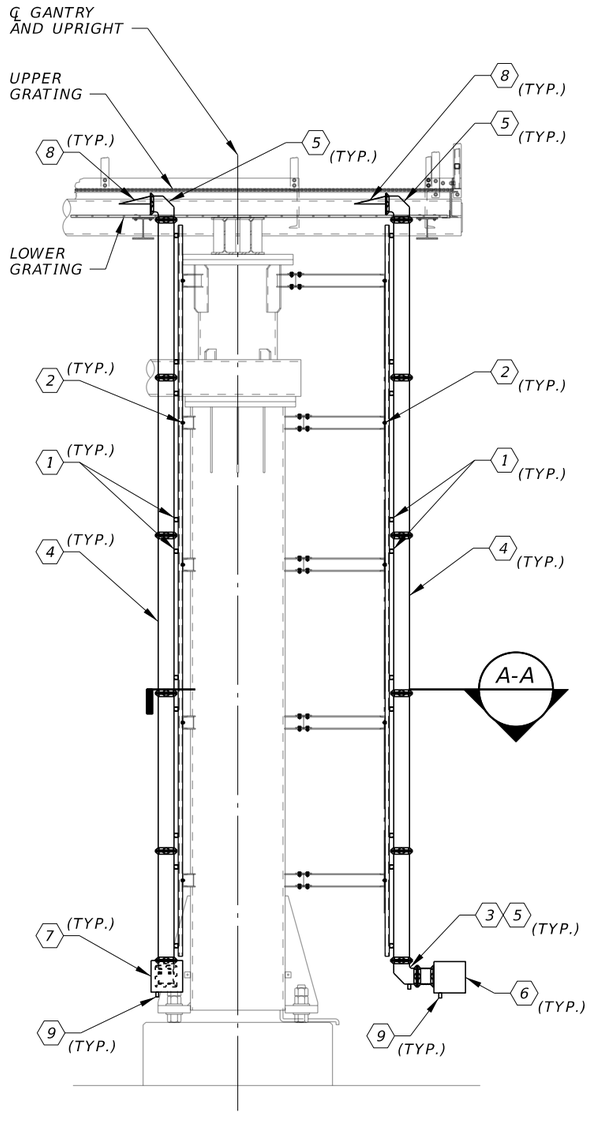
NOTE TO PREPARER:

1. ROUND ALL CORNERS OF ALUMINUM SHROUD WITH MINIMUM ¼" RADII.

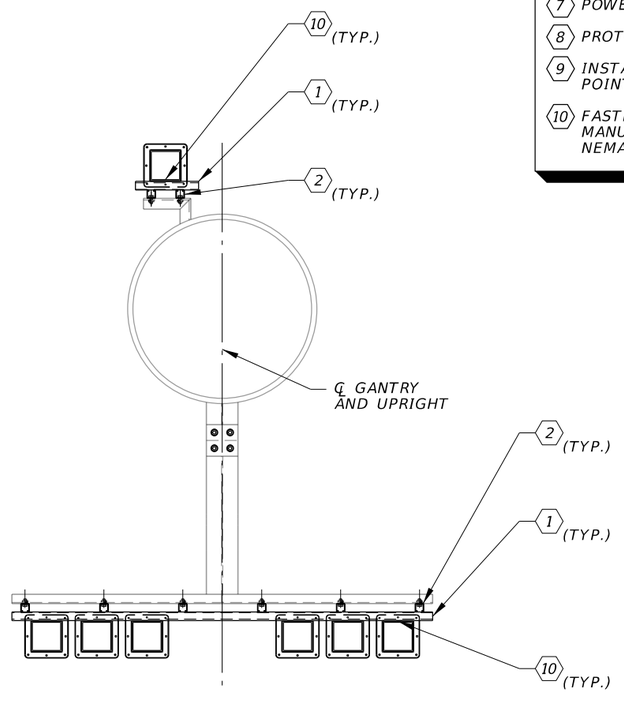
Exhibit 255.6-8 Accessible Gantry Upright Electrical Wireway Details



1 VERTICAL WIREWAY END ELEVATION
SCALE: NTS



2 VERTICAL WIREWAY SECTION
SCALE: NTS



SECTION A-A
SCALE: NTS

NOTES TO PREPARER:

1. HORIZONTAL STRUT CHANNEL SUPPORT FOR VERTICAL WIREWAY SUPPORT.
2. VERTICAL STRUT CHANNEL SUPPORT CONNECTION TO STRUCTURAL CHANNEL.
3. WIREWAYS MUST NOT TERMINATE INTO THE TOP OF THE WIRE TROUGH. INSTALL A DRAIN FITTING AT THE BOTTOM OF EACH ELBOW.
4. FIBERGLASS WIREWAY.
5. ELBOWS MUST MAINTAIN NEMA 3R RATING.
6. DATA/E6 WIRE TROUGH.
7. POWER WIRE TROUGH.
8. PROTECTIVE RAIN SHROUD.
9. INSTALL DRAIN FITTING AT WIRE TROUGH LOW POINT.
10. FASTEN WIREWAYS TO STRUT CHANNEL PER THE MANUFACTURER'S SPECIFICATIONS FOR THE NEMA 3R RATING.

255.6.5 Lighting for Platform and Stairway

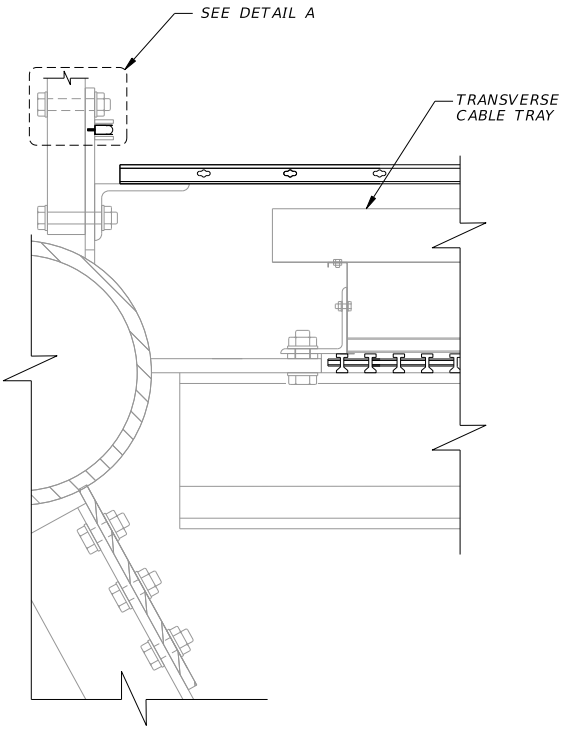
(1) LED rope light must be used along the entire length of the accessible gantry platform around the full perimeter as shown in ***Exhibit 255.6-1*** and ***Exhibit 255.6-6***. See ***Exhibit 255.6-9*** for rope lighting mounting details.

(2) AVI reader area lighting must be provided on either side of the AVI reader mounting assembly as shown in ***Exhibit 255.6-4***.

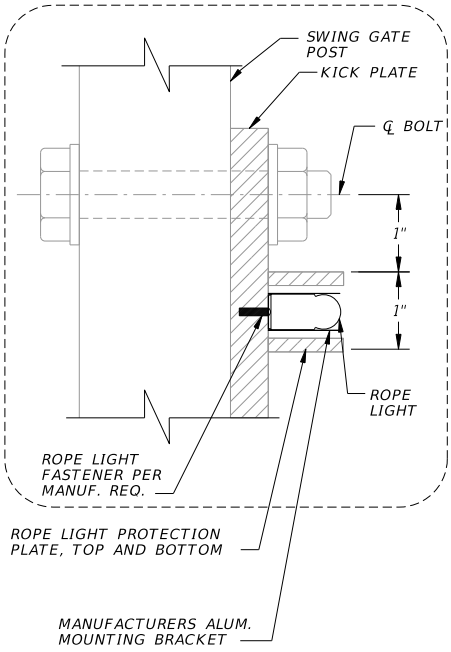
(3) Stair and platform luminaire must be the same as specified for the TEB exterior walls without the photocell accessory. This fixture must be affixed to the stair rail and the non-moveable portion of the swing gate structural system as shown in ***Exhibit 255.6-10***.

(4) Timer switches must be provided at the lower platform and upper platform to independently control the lighting for the stairs, AVI reader area lighting, and rope lighting. See ***Exhibit 255.6-1***, ***Exhibit 255.6-6***, and ***Exhibit 255.6-10*** for timer switch locations.

Exhibit 255.6-9 Accessible Gantry Rope Light Mounting Details

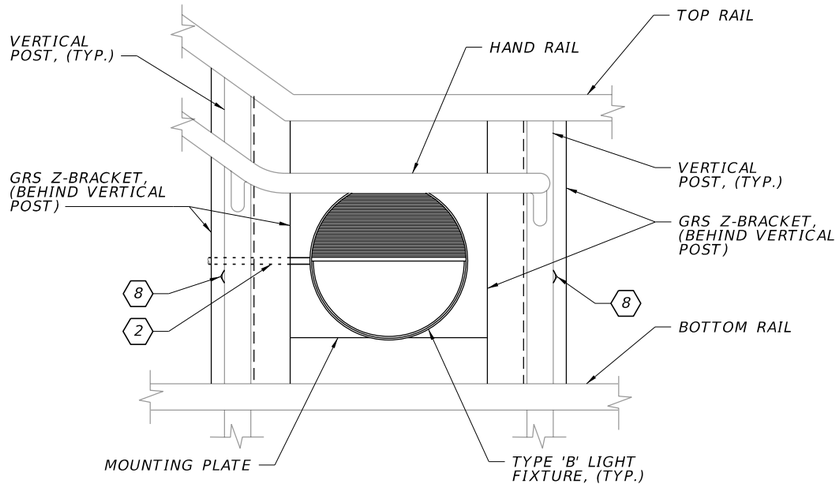


SECTION
SCALE: NTS



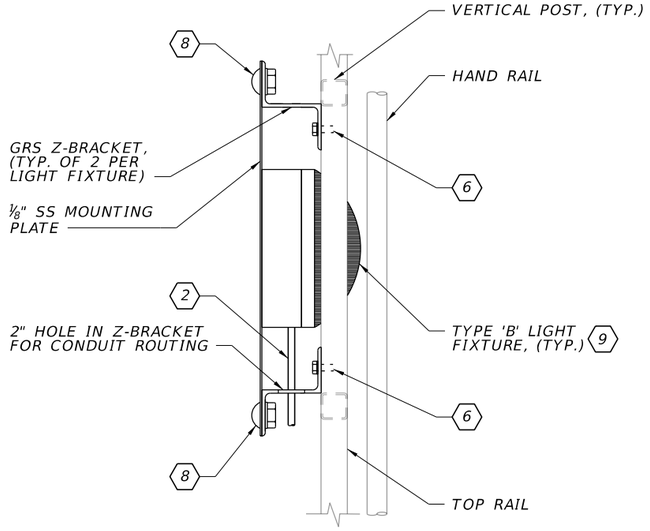
DETAIL A
SCALE: NTS

Exhibit 255.6-10 Accessible Gantry Stair and Platform Lighting



1 STAIRWAY PLATFORM LIGHT FIXTURE MOUNTING DETAIL

NTS

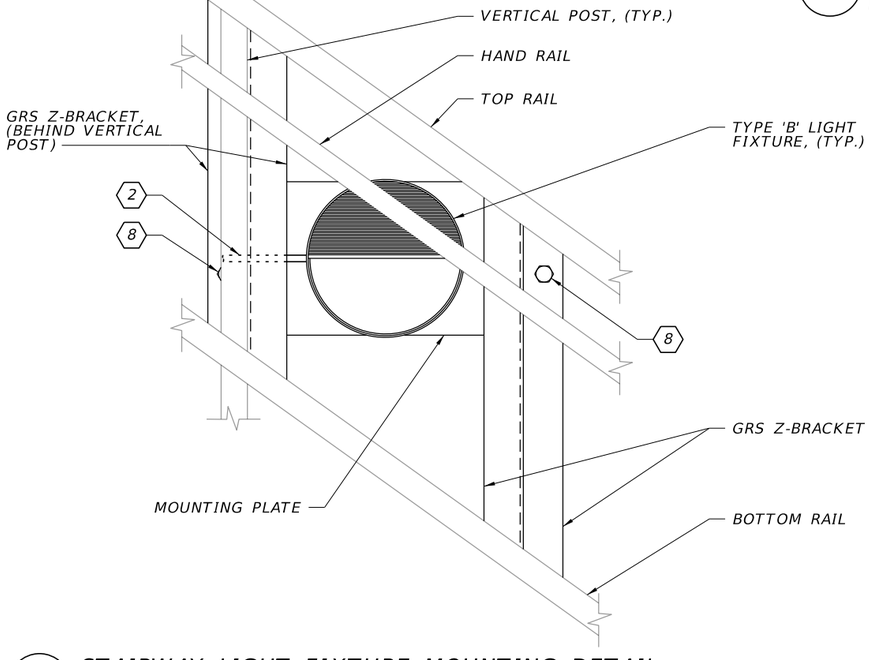


2 STAIRWAY LIGHTING DETAIL (TOP VIEW)

NTS

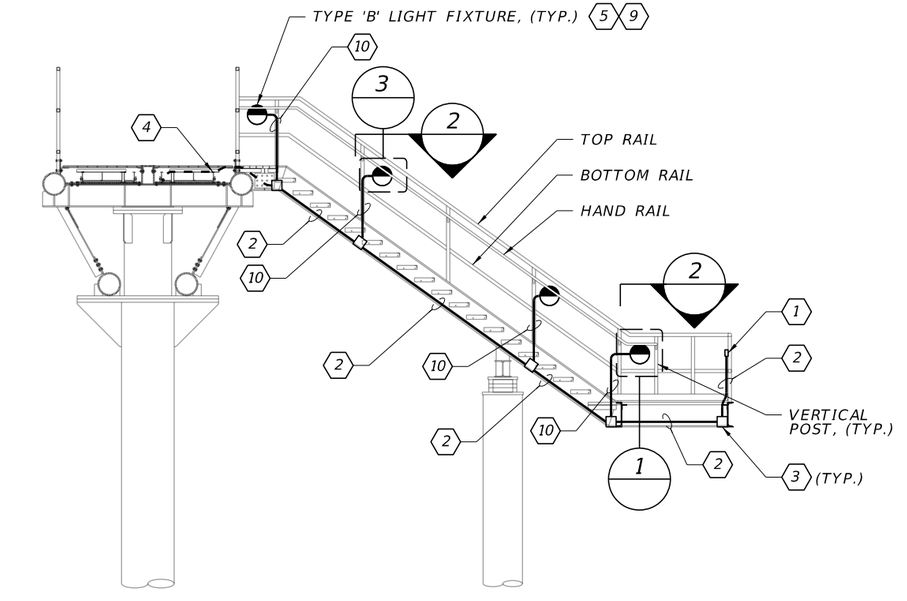
NOTES TO PREPARER:

1. LIGHT (ON TIMER) SWITCH FOR STAIRWAY LTG.
2. CONDUIT AND CONDUCTOR DESIGN BY EOR.
3. 4" SQUARE WEATHER PROOF JB.
4. ROUTE CONDUCTORS TO POWER CABLE TRAY.
5. STAIRWAY LIGHTING MUST BE LOCATED ON THE ROADWAY SIDE OF THE GANTRY AND FACE AWAY FROM THE ROADWAY.
6. HEX HEAD BOLT. PROVIDE A MINIMUM OF (4) PER FIXTURE.
7. GRS Z-BRACKET.
8. HEX HEAD BOLT, FLAT WASHERS & SELF LOCKING NUTS.
9. TYPE 'B' LIGHT FIXTURE WITH SURFACE ADAPTER (JB).
10. CONDUIT AND CONDUCTOR DESIGN BY EOR.



3 STAIRWAY LIGHT FIXTURE MOUNTING DETAIL

NTS



4 STAIRWAY LIGHT FIXTURE MOUNTING DETAIL

NTS

255.7 CCTV System

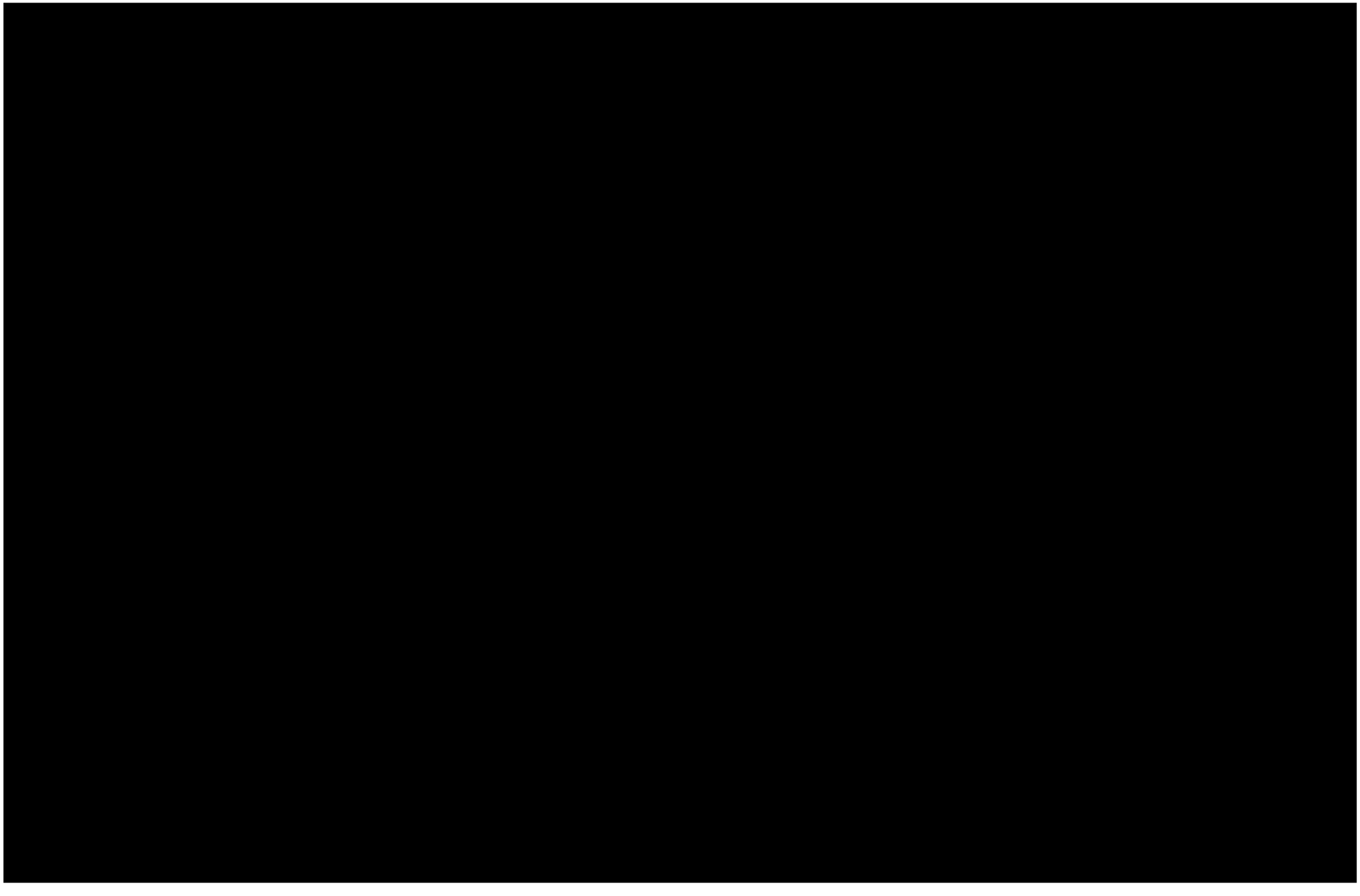
(1) See ***GTR 232.9*** for site-wide CCTV requirements.

(2) See ***Exhibit 232.9-1*** and ***Exhibit 232.9-2*** for location of gantry mounted CCTV cameras.

(3) [redacted]

(4) Location of accessible gantry mounted CCTV cameras 7, 8, 9, and 10 must be coordinated to avoid conflicts with gate operations and J-arm retraction systems. See ***Exhibit 232.9-1*** for quantity and layout of boxes to support the CCTV cameras.

Exhibit 255.7-1 CCTV Camera Gantry Backbox Mounting Details



260 Communications

260.1 General Requirements

(1) At least two physically redundant fiber optic infrastructure paths must be provided to establish communications between a toll site and the Turnpike's tolls data centers.

(2) A toll-fiber optic lateral must be provided for each TEB and OCC.

(3) Coordinate with Turnpike Tolls Design for the tolls communications requirements of existing buildings that are re-used.

(4) All TEBs and OCCs must be directly connected to the backbone.

260.2 Communications Cabinets

260.2.1 Toll Equipment Building Toll Communications Cabinet

(1) One toll communications cabinet must be provided in each TEB.

(2) Wall-mounted toll communication cabinet, rack, fiber distribution panel(s) and all associated accessories and hardware must be provided as shown in ***Exhibit 242.3-1*** and ***Exhibit 260.2-1***.

(3) See ***GTR Part 2, Appendix 2***, TSP Section for ***Toll Communications Cabinet for TEB Sites*** for additional requirements.

260.2.2 Roadside Tolling Cabinet Site Outdoor Communications Cabinet

(1) One OCC must be provided at each RTC site with the components and accessories shown in ***Exhibit 260.2-2***. See ***GTR Part 2, Appendix 3***, TSP Section for ***Outdoor Communication Cabinet at RTC Toll Sites*** for additional requirements.

(2) Provide underground infrastructure supporting the outdoor communications cabinet power and interconnectivity as shown in RTC site enlarged electrical site plans described in ***GTR 232.1 Item (2)***.

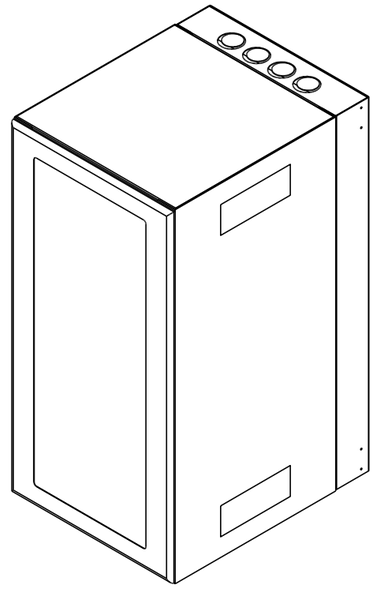
(3) Provide two (2) factory-installed side-mounted 240V, 1-phase AC units each. Each unit shall be shop-mounted on different sides of the enclosure (never on the same side or on the front or back). Design the cooling system such that one cooling unit will keep the interior enclosure temperature from exceeding 85 degrees Fahrenheit on a sunny day with outside ambient temperature of 95 degrees Fahrenheit with the electronic equipment inside the enclosure. See below for the heat rejection for each component in the OCC:

(a) [redacted]
(b) Network Video Recorder (NVR) ..... 341 BTU/h
(c) WAN Switch..... 2,047 BTU/h

(d) RTC UPS ..... 500 BTU/h
(e) OCC UPS ..... 600 BTU/h

Exhibit 260.2-1 Toll Communications Cabinet, Conduit, and Cable Routing

[redacted]



ISOMETRIC VIEW
N.T.S.

[redacted]

Exhibit 260.2-2 Outdoor Communications Cabinet



260.3 Tolls Fiber Allocation

(1) Fibers allocated to the Turnpike must be for exclusive use by the Turnpike. The Turnpike allocated fibers must be "patched or spliced through" and must not traverse District/tolling agency switches.

(2) Splice vault (SV) installations must take into consideration that both ITS and Tolls may need to co-locate splice enclosures in the same SV, for the purpose of extending the backbone or for providing lateral connections. ITS and Tolls fiber laterals must be labeled accordingly.

(3) For Districts or other tolling agencies, The Turnpike must be provided with Department (District other than The Turnpike) and/or tolling agency fiber optic strands to communicate with The Turnpike Tolls Data Center(s).

(4) When the Department (District other than the Turnpike) and/or tolling agency engages in construction such that new backbone fiber optic cable is installed, Turnpike Toll Systems requires two buffer tubes (specifically Red and Black) comprising twenty four (24) strands for their exclusive and irrevocable right to use, as part of the single cable trunk, in a contiguous strand count (96, 144, 288, etc.). All fiber must be SMFOC. All fiber splicing must be by fusion splicing.

(5) When the Department (District other than the Turnpike) and/or tolling agency engages in construction such that existing backbone fiber optic cable is used, tolls must be granted a minimum of four (4) fiber strands for their exclusive and irrevocable right to use. All fiber shall be SMFOC. All fiber splicing must be by fusion splicing.

260.4 Toll Fiber Optic Lateral and Infrastructure

All TEBs and OCCs must fully connect to the backbone using underground conduits with a toll fiber optic lateral as described herein:

(1) Each toll fiber optic lateral connection consists of a minimum of two (2) 2-inch conduits (one spare). The connection must be made from new or existing splice vaults and must terminate in a rack mounted, pre-terminated fiber optic distribution panel (patch panel) located inside the toll communications cabinet in the TEB or in the OCC.

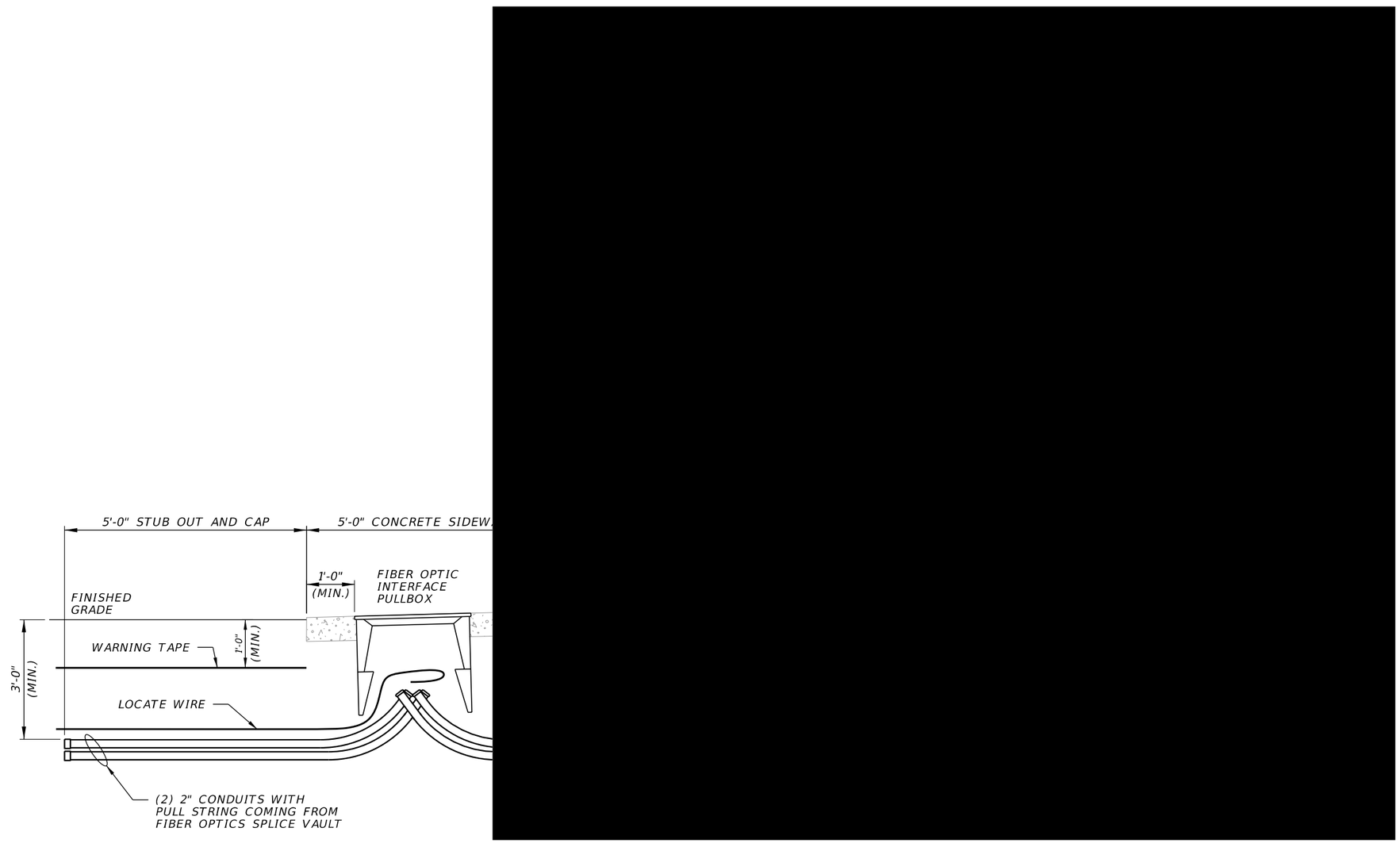
(2) Toll fiber optic lateral and conduits must be routed to the TEB or OCC via directional bore or open trench installation with pull boxes as required. The conduit must enter the TEB or OCC via the ITS interface pull box located in the toll site. Conduits must be stubbed out five (5) feet beyond the edge of the concrete sidewalk prior to sidewalk construction. The conduits must terminate as shown in ***Exhibit 260.4-1***.

(3) Each tolls fiber optic lateral connection must be made via a single 48-strand SMFOC (two (2) 24-strand cables must not be provided) composed of blue, orange, green, and brown buffer tubes.

(4) For existing buildings without a fiber optic lateral connection or other available raceways, provide conduits that must enter the building via the same wall penetrations as used for the gantry and loop conduits.

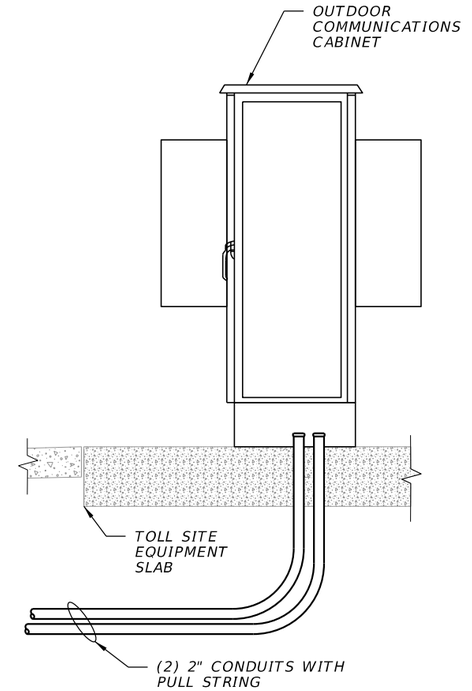
(5) Standard route marker(s) (SRM) must be provided for all toll fiber optic laterals in accordance with ***Standard Specifications, Section 630***. Label each SRM with the following, “TURNPIKE TOLLS SunWatch Operations (877) 786-3375”, for Turnpike projects.

Exhibit 260.4-1 Fiber-optic Interface



TEB EXTERIOR/INTERIOR - SIDE ELEVATION
SCALE: NTS

TEB INTERIOR - FRONT ELEVATION
SCALE: NTS



OCC - FRONT ELEVATION
SCALE: NTS

260.5 Splicing and Termination of Tolls Fiber Optic Lateral

Each fiber optic lateral connection must be configured as follows:

(1) All lateral fiber strands must be fusion-spliced in the splice vault enclosure as shown in ***Exhibit 260.5-1***. Use splice trays with a minimum capacity of 24, one tray for red backbone buffer and one tray for black backbone buffer.

(2) Black buffer backbone must be spliced to lateral Blue buffer going North or East. Black buffer backbone must be spliced to lateral Orange buffer going South or West.

(3) When Red buffer backbone is spliced, it must be spliced to lateral Green buffer going North or East and to the lateral Brown buffer going South or West.

(4) Patch panel cassettes must be places such that Position A is Blue buffer, Position B is Orange buffer, Position C is Green buffer, and Position D is Brown buffer.

(5) All 48 FDP fiber strands must be fusion spliced to factory polished, pre-terminated pig tails in cassette assemblies, connectorized as SC duplex pairs. The patch panel will be mounted in the toll communications cabinet located inside the TEB or in the OCC.

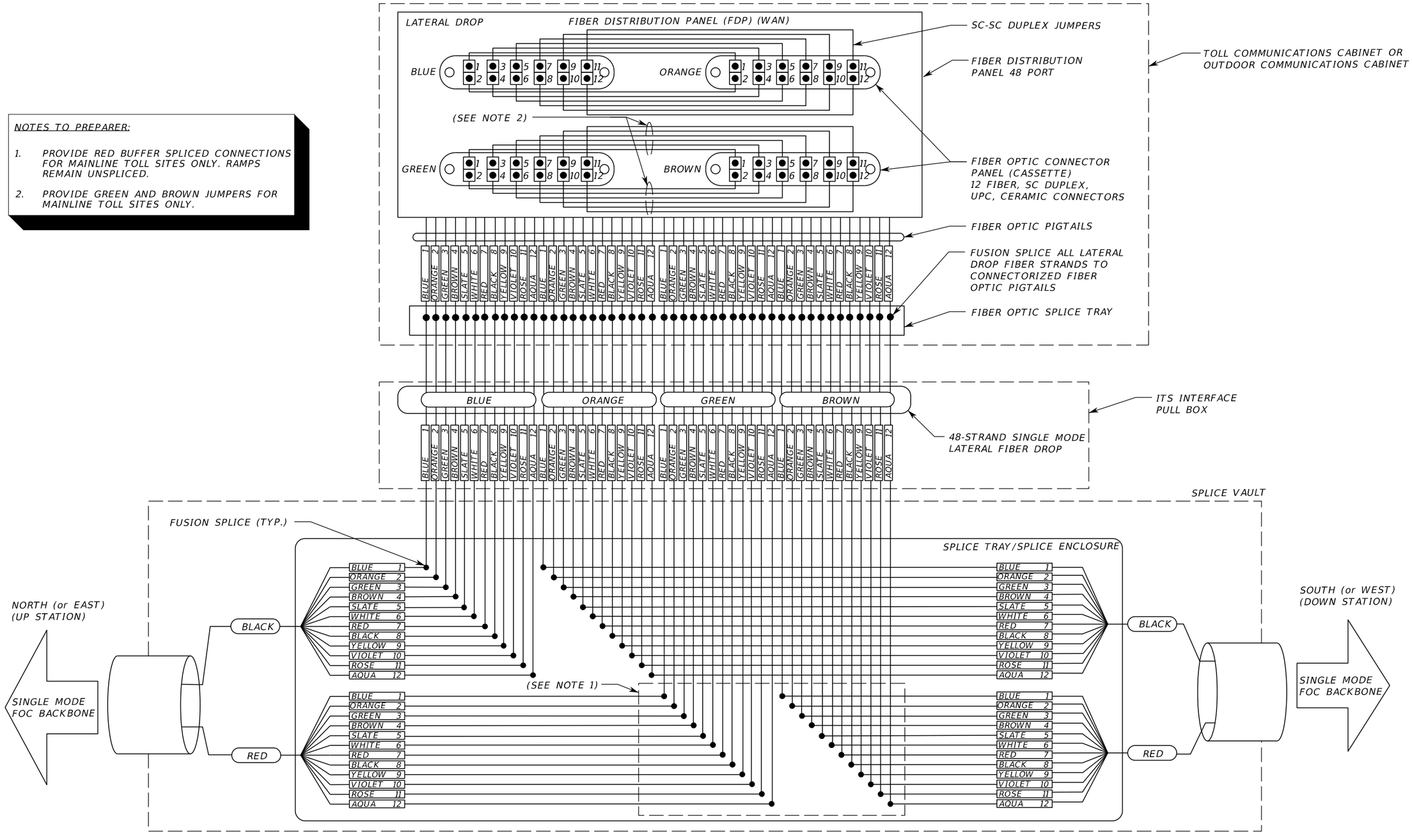
(6) There must be one patch panel (including all associated accessories) for each toll fiber optic lateral.

(7) For each patch panel, jumper all ports with SC to SC single mode duplex fiber optic jumpers so as not to interrupt data communications. Jumpers must be the minimum length necessary and neatly routed in cable management with no sharp bends.

Exhibit 260.5-1 Fiber-Optic Lateral Splice Diagram

NOTES TO PREPARER:

1. *PROVIDE RED BUFFER SPLICED CONNECTIONS FOR MAINLINE TOLL SITES ONLY. RAMPS REMAIN UNSPLICED.*
2. *PROVIDE GREEN AND BROWN JUMPERS FOR MAINLINE TOLL SITES ONLY.*



260.6 Leased Circuit Digital Communication Lines

The following infrastructure must be provided for all toll facilities regardless of whether a leased circuit is actually procured:

(1) Two (2) 2-inch conduits (inclusive of pull ropes, splice vaults, pull boxes, etc.) must be provided between the Telco's nearest splice vault or point of presence and each toll site. The conduit must be installed as depicted in ***Standard Plans, Index 630-001 and Standard Specifications, Section 630.***

(2) A dedicated 24-inch x 36-inch pull box must be provided at each toll site for the Telco leased line connectivity as shown in ***Exhibit 260.6-1***.

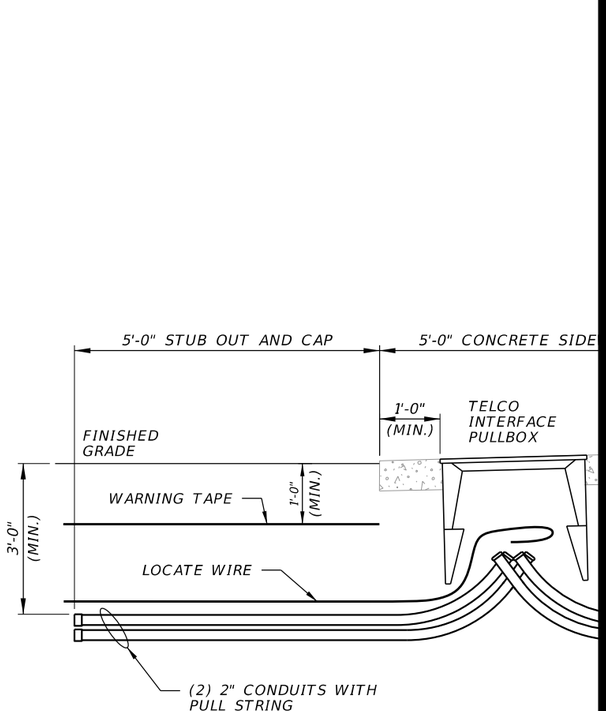
(3) If there is no physically redundant (at least two paths) layer 1 fiber optic infrastructure to establish communications between a toll site and the Department's tolls data centers, provide a notice to the Department to procure a leased line at least 200 days prior to primary walk-through.

(4) For TEB sites provide the following:

(a) 24-inch x 48-inch wall space within the building for Telco use. The plywood finished wall space must be painted gray or white and all equipment must be placed such that space is conserved for future equipment.

(b) An orange colored 120 Volt, 20 Amp duplex receptacle adjacent to the proposed Telco equipment space for Telco use. The 120 VAC receptacles must be served from the critical power system.

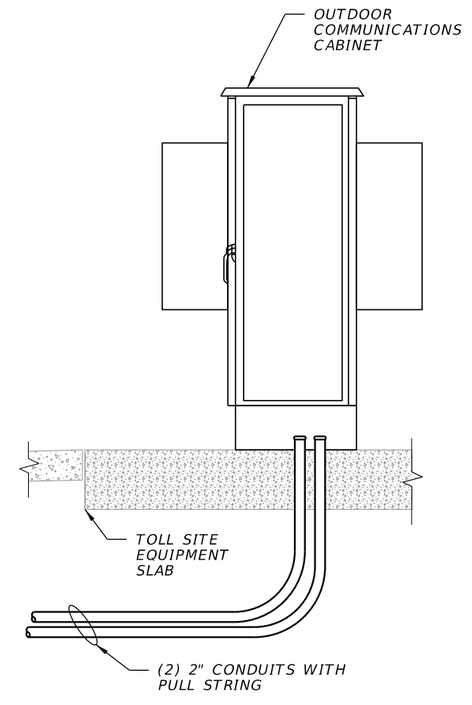
Exhibit 260.6-1 Leased Line Digital Communication Interface



TEB EXTERIOR/INTERIOR - SIDE ELEVATION
SCALE: NTS

[redacted]

TEB INTERIOR - FRONT ELEVATION
SCALE: NTS



OCC - FRONT ELEVATION
SCALE: NTS

260.7 Impacting Existing Tolls Communications

(1) Communications must be maintained at existing toll facilities as follows:

(a) Until a replacement toll system is installed, commissioned, tested, and actively collecting tolls.

(b) Preserve master/slave relationships until the slave communication dependencies are not required.

(2) All new toll fiber optic lateral spliced to an active fiber optic backbone will cause an outage to the Department's data communications system. The Maintenance of Communication (MOC) documents for each project must include information relating to toll site related outage as described herein:

(a) An outage request must be submitted to the Department's CEI for approval for all planned outage work. The Department must have five working days to review the outage request and respond to the Contractor. The outage request must contain the following requirements at a minimum:

- Outage Request Contact Name:
- Caller Call Back Name/Cell #:
- Project FPID:
- Planned Date:
- Planned Date #2:
- Planned Start Time:
- Planned Stop Time:
- Reason:
- Prime Contractor/Cell #:
- ITS Subcontractor/Cell #:
- Splice Subcontractor/Cell #:
- Location (MP and Facility):
- Location #1:
- Location #2:

(b) In order to minimize impacts to the Department's existing data communications system, proposed work requiring communication outages (i.e., fusion splice, etc.) must be performed between 10:00 pm and 5:00 am.

(c) Once the new tolling systems are collecting tolls as described, the existing toll fiber optic lateral must be fully removed from end to end between the splice vault and the patch panel. The existing fibers between Toll Facilities must also be removed in their entirety.

(d) Once a toll fiber optic lateral is removed, the backbone must be fusion spliced color to color in the existing splice enclosure and splice tray where that toll fiber optic lateral was removed. Identify how this can be accomplished without causing an outage to the Department's data communications system. If an outage is unavoidable ensure that the plans and specifications call for outage notification in accordance with the requirements stated above.

270 Building Permits

270.1 Introduction

(1) Florida's Turnpike Enterprise is authorized by the Florida Statutes to enforce the FBC for Toll Collection Facilities. The Turnpike may issue its own building permits for toll collection facilities.

(2) The Turnpike applies for permits through local building departments having jurisdiction for any buildings that are not toll collection facilities.

(3) State Fire Marshal will issue permits separately for toll collection facilities.

270.2 Building Code Administrator

The Turnpike has acquired the services of a Building Code Administrator (BCA) to perform permitting services for toll collection facilities.

270.3 Building Permit Coordinator

(1) The Turnpike has a Building Permit Coordinator who is the liaison to the Building Code Administrator.

(2) The Building Permit Coordinator's information is posted on the submission information is posted on the Florida's Turnpike Public Website in a document labeled ***Toll Facility Code Compliance and Permit Procedures***.

(3) Plans review for permitting and permit issuance must be processed by the BCA and the State Fire Marshal via the Building Permit Coordinator.

270.4 Permit Requirements

(1) Each new TEB in the project must have a separate building permit and a separate State Fire Marshal approval for new TEBs. Separate permits are also required for demolition, modifications or renovations to existing toll facilities, and site improvements.

(2) All compliance documentation for toll facilities such as, construction documents for permitting must be submitted through the Building Permit Coordinator for review by the BCA and State Fire Marshal for plans review and permitting purposes.

(3) Prepare and submit signed and sealed contract documents for permit(s) review.

(4) Contract document revisions require BCA and State Fire Marshal review of revised plans and specifications.

(5) All submitted contract documents, must be signed and sealed by the professional Architect/Engineer of record registered in the State of Florida.

(6) The documentation that must be submitted to the Building Permit Coordinator must include the following. Additional requirements may be required depending on the specific site conditions.

(a) Signed and sealed plans of all building and site disciplines (civil, structural, architectural, mechanical, electrical, and plumbing). This includes all plans for the building plus plans of all associated site work including maintenance pull-off areas, generator, fuel tanks, transformer, AVI reader ground mounted frames, etc.

(b) Signed and sealed TSP for all building and site disciplines (civil, structural, architectural, mechanical, electrical, and plumbing).

(c) Project cost estimate for all vertical construction and adjacent applicable site construction for each toll site.

(d) Separate sets of permitting documentation are required for:

i. Each building site location, including civil, electrical, and associated utilities.

ii. Each building type including civil, architecture, structural, mechanical, electrical, and associated utilities

iii. Construction cost estimates for each building and each building site. Develop a cost estimate using the template for Toll Site EOR-AOR Estimate of Values which is located at: ***https://floridasturnpike.com/business-opportunities/design/tolls-design/***

iv. Separate permits are required for demolition of existing toll sites.

(7) The plans are subject to the latest adopted edition of procedures titled "***Toll Facility Code Compliance and Permit Procedures***" (including amendments).

(8) Coordinate with the Building Permit Coordinator for the electronic delivery of permitting documentation that is required. E-Submittals files must be under 24mb.

The electronic delivery should conform to the following file naming conventions:

(a) Toll Facility Plans.....FPID_TS#_Plan.pdf

(b) Technical Special Provisions .....FPID_TSP.pdf

(c) Toll Facility Cost Estimates.....FPID_TS#_Cost Estimate.pdf

(9) For each building site, the Building Permit Coordinator has thirty working days from receipt to review and accept the provided building permitting documents. Upon acceptance, the Building Permit Coordinator will forward the documents to BCA and State Fire Marshal for approval. Working day periods do not include

weekends, holidays, special events, and work period shut downs prescribed by all applicable contract documents.

(10) The Building Permit Coordinator's review of the plans prior to letting is for conformance to the documentation requirements. It is the sole responsibility of the AOR/EOR to ensure the permitting documents for BCA and State Fire Marshal approval are complete and correct.

(11) See ***GTR Part 2, Appendix 2***,TSP Section for ***Building Permits for TEB Sites*** for additional requirements.

280 Geotechnical

280.1 Roadside Tolling Cabinet Site(s)

(1) Geotechnical investigation shall consist of one SPT boring per RTC site. Test boring shall be located within 20 feet of proposed slab(s) and advanced to a minimum depth of 20 feet below the bottom of proposed slab(s).

(2) If the gantry SPT boring is within 20 feet of the toll site equipment slab a separate boring is not required.

280.2 Toll Equipment Building Foundation

(1) Geotechnical investigation shall consist of one SPT boring per TEB. Test boring shall be located within 20 feet of proposed TEB and advanced to a minimum depth of 20 feet below the bottom of proposed foundation.

(2) If the gantry SPT boring is within 20 feet of the TEB a separate boring is not required.

280.3 Gantry Foundation

Geotechnical investigation and foundation design must be in accordance with the Overhead Sign Structure requirements of the ***Soils and Foundations Handbook*** with the following modifications:

(1) At least one test boring for each gantry foundation. However, one boring may suffice for more than one foundation only if it meets the requirements of ***Soils and Foundations Handbook*** Section 3.2.2.7 (1).

(2) The test boring must have a minimum depth of 10 feet below the design tip elevation.

Modification for Non-Conventional Projects:
Append GTR 280.3 with the following: (3) Foundation installation plans and foundation certification packages must be submitted for all the gantry foundations following the requirements in the ***FDOT's Design-Build Specifications, Section 455***.

Appendix 1

TECHNICAL SPECIAL PROVISION SECTIONS FOR TEB AND RTC TOLL SITES

See ***GTR 210*** for additional requirements.

TECHNICAL SPECIAL PROVISION

FOR

FIBER REINFORCED CONCRETE FOR TOLL LOOP PAVEMENT

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____

Fla. License No.: _____

Firm Name: _____

Firm Address: _____

City, State, Zip Code: _____

SECTION T350
FIBER REINFORCED CONCRETE FOR TOLL LOOP PAVEMENT

T350-1 Description.

Construct non-metallic Fiber Reinforced Portland cement concrete pavement for roadway and shoulder, in one course, on a prepared subgrade or base. Use either the fixed-form or the slip-form method of construction.

If any uncontrolled cracks appear during the life of the Contract, remove and replace the cracked concrete at no expense to the Department. Investigate and implement immediate effective solutions to eliminate further cracks, in consultation with, and subject to the approval of the Engineer.

T350-2 Materials.

T350-2.1 General: Meet the following Standard Specifications requirements except as modified herein:

Coarse Aggregate	Section 901
Fine Aggregate*	Section 902
Portland Cement and Blended Cement	Section 921
Water	Section 923
Admixtures**	Section 924
Curing Materials**	Section 925
Embedded Items	Section 931
Fiber-reinforced Polymer Macro-Fibers***	ASTM C 1116, Type III

*Use only silica sand except as provided in Section 902 of the Specifications.

**Use products listed on the Department's Approved Product List (APL).

*** Use basalt or carbon FRP macro-fibers meeting the component material composition requirements of Section 932-4 of the Specifications.

Do not use materials containing hard lumps, crusts, or frozen matter, or that is contaminated with materials exceeding the specified limits in the above listed Sections.

T350-2.2 Fibers: Fibers are to be used for concrete pavement. To ensure uniformity throughout the mix, fibers must be added at the concrete plant, unless otherwise specified by the Engineer:

1. The concrete must be enhanced with temperature/shrinkage and flexural reinforcement by means of polymeric fibers. Reinforcing fibers must be a synergistic blend of high performance macro-monofilaments with sinusoidal deformations and collated-fibrillated polypropylene fibers. The blend of fibers must be packaged in degradable bags of five (5) pounds net contents and mixed into the concrete at a proportion of 5 pounds (1 bag) per cubic yard or 0.33 percent by volume.

2. Fibrous concrete must produce an Average Residual Strength (ARS) of no less than 215 psi from a test set of five beams in accordance with ASTM C1399 Test Method for Determining Average Residual Strength of Fiber Reinforced Concrete. The ARS test must be performed at the time the mix design is developed.

3. Fibers must be added to the concrete as recommended by the supplier. Fiber supplier must provide installation and finishing guidelines.

T350-2.3 Concrete: Use concrete meeting the requirements of Section 346 of the Specifications, Class I, unless requirements herein or on plans are more stringent.

1. Composition of concrete. Master Proportion Table must be as follows:
    a. Grade of Coarse Aggregate:.....Grade 57
    b. Maximum Water/Cement Ratio:.....0.40 lbs/lb
    c. Minimum Cement Content: ..... 16 lbs/ft^3 conc. mix
    d. Slump Range:..... 1.5 – 4.5 inches
    e. Amount of Entrained Air: .....1% – 6 %
    f. Fibers: .....5 lbs/yd^3 (polypropylene)
2. Provide concrete with a minimum compressive strength of 2,500 psi prior to placing traffic on the slab and a minimum 28-day compressive strength of 3,000 psi and maximum water to cementitious materials ratio of 0.50 unless plans call for more stringent requirements.
3. In fiber reinforced concrete mixes, use Type D water-reducing and retarding admixture, and shrinkage reducing admixture (SRA) meeting the requirements of Section 924 of the Specifications.
4. For concrete pavement placed using the slip-form method of construction, utilize concrete with a target slump of 1.5 inches plus or minus 1 inch. For concrete pavement placed by hand in constructed forms, utilize concrete with a target slump of 3 inches plus or minus 1.5 inches. Air content testing for concrete pavement mixes is not required.
5. Utilize concrete with a target slump of 3 inches plus or minus 1.5 inches.
6. Notify the Engineer if any of the component quantities are adjusted. If any material sources change, resubmit the mix design to the Engineer for approval prior to use.
7. The Department will exercise control over the concrete by rigid inspection of the consistency, yield, strength of concrete, and of the air content where applicable.

T350-2.4 Glass Fiber Reinforced Polymer (GFRP) Dowel Bars: Provide round and straight glass fiber reinforced polymer dowel bar:

1. Fibers must be in the form of unidirectional rovings of appropriate size or weight. Fiber sizings and coupling agents shall be appropriate for the resin system used. The fiber type will determine the physical properties of the FRP bar; therefore, the FRP bars shall be designated according to fiber composition with the first letter of the acronym designating fiber types as follows: Glass Fiber Reinforced Polymer rebar (GFRP), Carbon Fiber Reinforced Polymer rebar (CFRP), Aramid Fiber Reinforced Polymer rebar (AFRP), etc. Each bar type must meet the pertinent properties for that type of FRP bar as contained within this specification.
2. Matrix Resins: Commercial grades of vinylester thermosetting are permitted, provided the finished product meets the physical and durability requirements of this specification. A vinylester resin is defined as a thermosetting reaction product of an epoxy resin with an unsaturated acid, usually methacrylic acid, which is then diluted with a reactive monomer, usually styrene (ASTM C904). The base polymer in the resin system must not contain any polyester. Blending of vinylester resins is permitted. Styrene may be added to the polymer resin during processing. The amount of styrene, as a weight percentage of the polymer resin, added during processing shall be reported. Added styrene shall be less than 10% by weight of resin (pph resin).
3. Fillers: Commercial grade inorganic fillers such as kaolin clay, calcium carbonate, and aluminum trihydrate are permitted and shall not exceed 30% by weight of the polymer resin constituent. Commercial grade additives and process-aids, such as release agents,

low-profile shrink additives, initiators, promoters, hardeners, catalysts, pigments, fire-retardants, and ultra-violet inhibitors are permitted as appropriate for the processing method.

4. Shrink additives shall be less than 10% by weight of the polymer resin. Commercial grade inorganic or organic non-woven surfacing mats or veils are permitted.

5. Manufacturing Process: GFRP Dowels are to be produced with any variation of the pultrusion process. FRP rebar manufacturer shall report the date of production and the lot size.

6. Fiber Content: The FRP rebar manufacturer shall report the fiber content by volume of the end product. The minimum acceptable fiber content shall not be less 70% by weight as measured by ASTM D2584.

7. Glass Transition Temperature: The glass transition temperature (Tg) of the resin used shall be reported. The minimum acceptable Tg shall not be less than 230°F (110°C) using Dynamic Mechanical Analysis (DMA) per Test Method D7028. This number does not equate to maximum use temperature. ACI 440.1R-03 does not currently designate maximum use temperatures of FRP bars. Individual manufacturers shall be consulted to verify appropriate use temperatures.

8. Material Properties:

a. Size: The size of GFRP bars shall be designated as the diameter of the cross section of the dowel. When the GFRP bar is not of the conventional solid round shape (that is, elliptical or oval), the outside diameter of the bar or the maximum outside dimension of the bar will be provided in addition to the equivalent nominal diameter. The nominal diameter of these unconventional GFRP bars would be equivalent to that of a solid plain round bar having the same area. See Table 3, ASTM D8444-24 for Nominal Dimensions for a given bar size.

b. Transverse Shear Strength (perpendicular to the bar): The mean transverse shear strength of GFRP bars from the tested lot shall meet or exceed the following values, as determined by Test Method D7617 and in accordance with ASTM D8444-24.

Table 1- Mean Transverse Shear Strength of GFRP Dowels

Mean Transverse Shear Strength of GFRP Dowels	
Psi	MPa
≥23,200	≥160

c. Apparent Horizontal Shear Strength: The mean apparent horizontal shear strength, or shear-beam shear strength parallel to the longitudinal axis of GFRP bars from the tested lot shall meet or exceed the following values, as determined by Test Method D4475 and in accordance with ASTM D8444-24.

Table 2- Mean Apparent Horizontal Shear Strength of GFRP Dowels

Mean Horizontal Shear Strength of GFRP Dowels	
Psi	MPa
≥7,250	≥50

d. Bond Strength: The bond strength shall be determined on the as-manufactured dowel bar (no bond breaking agents, or other coatings may be used) by test

method in Annex A1, ASTM D8444-24. The mean bond strength shall not exceed the maximum limit given in Table 3, ASTM D8444-24.

e. Moisture Absorption: As a short-term indicator of long-term durability, samples of the GFRP dowels shall be subject to a mass uptake by moisture per ASTM D570.

Table 3- Moisture Absorption

Moisture Absorption Maximum – 1%

9. Presence of voids, hollow fibers or thermal cracks: The procedures outlined in ASTM D5117 shall be followed to check for voids, continuous hollow fibers or thermal cracks in the longitudinal direction of the dowel. Any continuous defect will reduce long-term durability of the dowel and shall not be present.

10. Testing: FRP bars produced for a project shall have representative samples (as agreed upon between the FRP rebar manufacturer and engineer) tested for the properties listed above. Testing shall be performed in accordance with procedures outlined above. The FRP dowel manufacturer shall furnish documentation showing the composition, and typical test values for the type of FRP dowels being furnished.

11. Documentation: For all FRP bars to be used on a project, the FRP Dowel Bar Manufacturer shall furnish the Engineer two (2) copies of written certification that the FRP bars meet the requirements of this Technical Special Provision. In addition, the certification shall list the test values of the FRP bars, test date, and location where testing was performed. Certifications shall bear the signature of a responsible authorized representative of the FRP rebar Manufacturer. Each bundle of FRP bars shall be identified with a corresponding lot number. Lot numbers shall be affixed to each bundle by means of a durable tag.

12. Identification: Dowels shall be identified in accordance with ACI 440.IR-03. Each FRP Dowel Manufacturer shall label the FRP dowel container or packaging with the following information:

a. A symbol to identify the manufacturer/producer.

b. Information to indicate the type of fiber:

i. **g** for glass

ii. **c** for carbon

iii. **a** for aramid

iv. **h** for hybrid

c. The dowel bar diameter.

d. Markings shall be used at the construction site to verify that the specified type, grades, and bar sizes are being used.

13. Chairs: Chair for supporting GFRP dowels shall be non-metallic as recommended by dowel manufacturer for required placement and spacing. Refer to the Plans for dowel locations and additional information concerning dowel size, length, and spacing.

14. Delivery and Storage: Handle and store GFRP dowels in accordance with manufacturer's instructions. Place the dowel on wood pallets so they are maintained free from dirt and mud. Dowels must be stored under an opaque cover to avoid direct sunlight and chemical substances.

T350-2.5 Glass Fiber Reinforced Polymer (GFRP) Tie Bars: Provide round deformed (undulations) and sand coated glass fiber reinforced polymer tie bar surface to affect a mechanical and chemical bond to concrete. Ensure that the resin used to manufacture the bars

consists of an acrylic modified epoxy resin with a minimum of 5 percent and a maximum of 7 percent tensile elongation at break. Ensure that the minimum glass fiber content is 70 percent by weight. Refer to the Plans for bar locations and additional information concerning bar size, length, and spacing:

1. Binding Material: The binding material is composed of Vinylester resin, which is homogeneous throughout the cross section of the bar.

2. Fiber Reinforcement: Fiber is continuous E-CR glass fibers with a volume fraction of 70 percent minimum per ASTM D2584.

3. Manufacturing: Bars shall be manufactured using a pultrusion process and the glass rovings are drawn through a resin bath, surface undulations and sand are applied prior to thermo set of the polymeric resin.

4. Chairs: Chair for supporting GFRP bars shall be non-metallic as recommended by bar manufacturer for required placement and spacing. Refer to the plans for bar locations and additional information concerning bar size, length, and spacing.

5. Ties Wire: All ties will be made with nylon or plastic wire (zip) ties. No metal ties will be allowed.

6. Allowable Damage to Bars: When the visible damage in a linear foot of a bar exceeds 2% of the surface areas in that linear foot or the depth of damage exceeds 0.04 inches, the bar cannot be used. Repair of the bar shall not be allowed, and it shall be immediately removed from the project.

7. Field Modification of Bars: follow Section 415 of the Specifications.

8. Delivery and Storage: Handle and store GFRP bars in accordance with manufacturer's instructions. Place the bars on wood pallets so they are maintained free from dirt and mud. Bars must be stored under an opaque cover to avoid direct sunlight and chemical substances. When handling the bars use equipment that avoids damaging or abrading them and lift bundles at multiple pickup points. Do not drop or drag the bars.

T350-2.6 Forms: Provide forms in accordance with Section 350 of the Specifications.

1. **Form Release Agent:** Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2. **Form Ties:** Use factory-fabricated, adjustable-length, and removable only metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

   a. Snap-off metal ties must not be used in fiber-reinforced concrete.
   b. Ties must not remain within concrete.

T350-3 Delivery Certification.

Comply with the requirements of Section 346-6 of the Specifications.

For fiber reinforced concrete, start the finishing and curing process prior to the drying of the concrete surface. Include the details of the mixing, batching, delivery, placement, finishing and curing methods of the fiber reinforced concrete in the quality control plan.

T350-4 Submittals and Shop Drawings.

Submit Concrete Pavement Mix Design for fiber reinforced concrete per Section 346 of the Specifications and the following:

1. Laboratory Test Reports: Submit copies of laboratory test reports for concrete materials and mix design test as specified or explicitly state the pre-approved mix design already furnished to the Engineer will be used.

2. Material Certificates: It is preferable to provide copies of materials certificates in lieu of materials laboratory test reports when permitted by the Department. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

3. Product Data: Submit product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and others as requested by the Department.

4. Submit manufacturer's printed product data to indicate proposed polymeric, steel, or FRP macro-fiber-reinforced concrete materials including application rate per cubic yard of concrete.

5. Submit manufacturer's printed batching and mixing instructions.

6. Submit manufacturer's Certification of performance meeting the requirements of ASTM C1116.

T350-4.1 Fiber: A submittal package for fibers must accompany the concrete mix design for approval by the Engineer before any concrete can be placed. ARS test results must be submitted with the mix design. The fiber submittal package must contain the following:

1. Product literature describing a blend of macro-filaments and collated-fibrillated fibers.

2. Assertion that fibers comply with ASTM C1116, Type III fibers.

T350-4.2 GFRP Dowel Bars: A submittal package for GFRP dowel bars must accompany the concrete mix design for approval by the Engineer. The dowel package must be approved before any concrete can be placed. The dowel bar submittal package must contain the following:

1. Manufacturer's product data, including material, mechanical properties, test results and all other items to show compliance with the items indicated above.

2. Independent test reports for material and mechanical properties performed by an independent testing agency for:

a. Each dowel size

b. Each type of fiber reinforcement specified

c. Certification from the manufacturer that all products meet the requirements of this Technical Special Provision Section in accordance with Section 6 of the Specifications.

T350-4.3 GFRP Tie Bar: A submittal package for GFRP tie bars must accompany the concrete mix design submittal. The tie bar package must be approved before any concrete can be placed. The GFRP tie bar submittal package must contain the following:

1. Manufacturer's product data, including material, mechanical properties, test results and all other items to show compliance with the items indicated above.

2. Independent test reports for material and mechanical properties performed by an independent testing agency for the items listed below. The Contractor must account for lead times for testing:

a. Each bar size.

b. Each type of fiber reinforcement specified.

3. Certification from the manufacturer that all products meet the requirements of this Technical Special Provision in accordance with Section 6 of the Specifications.

T350-4.4 Joint Layout: A submittal package for joint layout within the toll loop pavement area must accompany the concrete mix design for approval by the Engineer and Turnpike Tolls Design before any concrete can be placed. Joint types must be identified with applicable details. Coordinate joint layout with Turnpike Tolls Design for site specific TEC loop layout to ensure that toll loops do not cross joints. Show loop conduit protection methodology.

T350-5 Mixing and Delivering Concrete.

Comply with the requirements of Section 346 of the Specifications that are applicable to fiber reinforced concrete.

When ready mix concrete is used, the concrete ingredients including the fibers must be added to the truck mixer at the plant. Obtain approval of the Engineer if fibers or admixtures are to be added at the jobsite. The fibers must be added per manufacturer's written instructions.

T350-5.1 Fiber Reinforced Concrete Mixing: Follow the requirements of the manufacturer's recommendation for mixing sequence, number of revolutions at mixing speed, and mixing procedure. Do not exceed the limits defined in Chapter 9.2 of the Materials Manual. Batch fiber reinforced concrete in whole cubic yard quantities. Add fibers at the concrete plant.

Limit the batch volume to three-quarters of the rated capacity of the transit mixer. Ensure that no fiber clumps enter the mix. Demonstrate a satisfactory method of introducing the fibers into the mixture during the field demonstration batch.

T350-5.2 Laboratory Trial Batch of Fiber Reinforced Concrete Mix: Perform a laboratory trial batch meeting the requirements of Section 346-6.2 of the Specifications. Ensure the fiber reinforced concrete meets the plastic and hardened properties of this Technical Special Provision and the applicable provisions of ASTM C1116.

During the development of the laboratory trial batch, and where macro fibers are required, prepare a set of at least 5 beams from each sample of fresh or hardened concrete meeting the requirements of ASTM C1399. Deliver the samples of concrete beams to the State Materials Office for an ARS test at the time the mix design is being developed.

T350-5.3 Field Demonstration of Fiber Reinforced Concrete Mix: Subsequent to the satisfactory laboratory trial batch, perform a field demonstration of the proposed mix design by production and placement of at least one demonstration batch (3 cubic yards minimum) for approval by the Engineer. During the development of the field trial batch, and where macro fibers are required, prepare a set of at least five beams from each sample of fresh or hardened concrete meeting the requirements of ASTM C1399. Deliver the samples of concrete beams to the State Materials Office for an ARS test within 7 days of casting the samples.

The Engineer's approval will be based on the acceptable results of the plastic and hardened concrete samples and an acceptable surface finish of the field demonstration concrete and the ability to introduce fibers without clumping.

T350-5.4 Fiber Reinforced Concrete Placement and Curing: Ensure fiber reinforced concrete delivered to the project conforms to the applicable provisions of ASTM C1116.

Place and cure the fiber reinforced concrete in accordance with Section 400 of the Specifications.

T350-5.5 Test Requirements: Comply with the requirements of Section 346 of the Specifications and the following:

1. Test cylinders, made in accordance with ASTM C31. One set of fifteen test cylinders (diam.: 4 inches, height: 8 inches) must be made per each lot for fiber reinforced

concrete. A set of three cylinders must be tested in accordance with ASTM C39, prior to the time of opening to traffic, but no earlier than 24 hours, (cure these test cylinders in a manner identical to the corresponding section of pavement). The remaining set of cylinders must be tested at the age of 28-days.

2. Provide a strength-maturity relationship curve as outlined by FM 3-C1074 for opening to traffic determined during design mix verification. Use the maturity method specified in this Technical Special Provision to determine if the concrete has achieved 2,500 psi and can be opened to traffic.

If the average of the first set of cylinders compressive strength is less than 2,500 psi, then the pavement must remain closed. The Engineer and the Contractor must schedule times for testing the next three (3) sets. When the average of a set of cylinders achieve 2,500 psi or higher, the Engineer may open pavement to traffic, but only if this will facilitate the Contractor's operations.

a. Verify the strength of the last slab of each day's placement.

b. The specified 28-day strength for fiber reinforced concrete, based on the average of three cylinders, is 3,000 psi.

3. Fabricate three test cylinders for strength and maturity curve correlation testing. The compressive strength cylinders and maturity curve correlation testing will be performed at the first day of production or at the discretion of the Engineer.

4. Thickness determinations: Use non-destructive testing as identified in Section 350 of the Specifications.

T350-6 Construction Requirements.

T350-6.1 Restrictions: Do not use metal in the toll loop pavement.

T350-6.2 Equipment: Equipment must meet the requirements of Section 350-3 of the Specifications as applicable to non-metallic fiber reinforced concrete.

T350-6.3 Excavation and Subgrade Preparation: Excavate to the required depth and compact the foundation material upon which these items are to be placed. Shape and compact the foundation materials to a firm, even surface, true to grade and cross-slope. Compact areas that have been excavated more than 6 inches below the bottom of the concrete, to a minimum of 95% of AASHTO T99 density. The area to be compacted includes the area directly under and 1 foot beyond each side of the toll loop pavement, when right-of-way allows.

Maintain the finished subgrade in a smooth, compact condition. Restore any areas which are disturbed prior to placing the concrete. Do not place concrete on a frozen subgrade.

Uniformly moisten the subgrade surface ahead of the paving operations with no standing water.

Geotextile Fabric: When called for in the plans, place geotextile fabric in accordance with Section 514 of the Specifications.

Coordinate stub-up locations through concrete slab for electrical toll loop placement and ensure associated conduit with pull strings are installed prior to placing concrete.

T350-6.4 Protection of Toll Loop Conduits: Take special care to prevent conduit loop damage from heat during the installation of any asphalt base used in the rigid pavement design.

Loop conduits and loop conduit stub-ups must be positionally secured and protected from physical damage and / or movement during the concrete pouring operation.

T350-6.5 Setting Forms: Conform to the requirements of Section 350-5 of the Specifications. Metal forms and ties must be removed from the non-metallic fiber reinforced pavement.

T350-6.6 Protection From Weather: Conform to the requirements of Section 350-6 of the Specifications.

T350-6.7 Placement Widths: Conform to the requirements of Section 350-7 of the Specifications.

T350-6.8 Delivery Certifications: Conform to the requirements of Section 350-8 of the Specifications.

T350-6.9 Sampling and Testing Methods: Conform to the requirements of Section 350-9 of the Specifications.

T350-6.10 Striking Off, Consolidating and Finishing Concrete: Place concrete with striking-off, consolidation and finishing per applicable requirements of Sections 350-10 and 350-11 of the Specifications.

T350-6.11 Curing: The concrete overlay must be cured immediately after placement using white, water- based curing compound at a rate as recommended by the manufacturer. Follow by wet curing to maintain a wet condition at all times as specified in Section 350-12 of the Specifications.

Burlap Mats: Particular care must be taken to apply the burlap as early as possible and to maintain it in a saturated condition at all times. Wet burlap curing must be maintained a minimum of 72 hours or until the pavement is opened to traffic, whichever event happens first. The Contractor may propose for approval an alternate curing method.

T350-6.12 Joints: Comply with applicable joint requirements of Section 350 of the Specifications and as the following:

1. Location: Joints must be constructed in accordance with the location shown in the approved joint layout package and with the details shown on the plans.

a. The joints must be sawed using the early saw cut method such as but not exclusively the “Soff-Cut” method. The joints must be cut as soon as the saw equipment can be used without damaging surface concrete and when there is no chance the pavement will be scarred by cutting or raveling of the joint.

b. No wet cutting will be allowed without the approval of the Engineer.

c. No overrun in joint will remain untreated. In cases of overrun, the overrun area must be repaired using an approved epoxy compound.

d. Sufficient saw machines must be available at the jobsite to prevent delay in joint sawing.

e. Equipment will be approved by the Engineer.

2. Construction Joints: The joint sawing must be accomplished in two steps. The initial cut must be 1/8-inch-wide to full depth indicated on the Plans. The second saw cut must form the joint groove according to the dimensions indicated in the Plans.

a. After final sawing and formation of the joint groove, the joint must be cleaned and sealed as specified in Section 350 of the Specifications.

b. The backer rods must be used where required in the Plans. The backer rods must have an adequate diameter to effectively seal the joint groove and must be placed in joint groove so as to satisfy the sealant depth required in the Plans.

c. All work will be approved by the Engineer.

3. Cracked or Broken Panels: At the Contractor’s expense, remove and replace concrete panels that develop cracks prior to opening to traffic. The joints must be sealed in accordance with the Plans.

T350-7 Final Surface Finish.

Concrete pavement surface and finish must comply with applicable requirements of Section 350 of the Specifications.

T350-8 Opening Pavement to Traffic.

Comply with the applicable requirements of Section 350 of the Specifications.

T350-9 Acceptance.

Testing of thickness and compressive strength of concrete and acceptance of fiber reinforced concrete pavement will be in accordance with requirements listed herein and the applicable sections of Section 350 of the Specifications.

T350-10 Method of Measurement.

The quantities to be paid for will be the plan quantity, in square yards, of Reinforced Cement Concrete Pavement,12" Thick, Type III Synthetic Fiber Reinforced, omitting any areas not allowed for payment under the provisions of Section 350-16.3 of the Specifications and adjusted for average thickness as provided herein.

For purposes of payment, the average thickness of pavement will determine the final pay quantities for this pavement as follows:

The area of pavement represented by the difference between the calculated average thickness and the specified thickness will be converted into equivalent square yards of specified thickness pavement, and the quantity thereby obtained will be added to, or deducted from, the quantity of pavement to be paid for, subject to the limitation that the maximum average of over-thickness permitted in the adjustment of the quantity of pavement to be paid for will be 1/2 inch.

T350-11 Basis of Payment.

The Contract unit price for Reinforced Cement Concrete Pavement, 12" Thick, Type III Synthetic Fiber Reinforced, includes all labor, testing, materials, and equipment necessary for a complete and accepted installation. Excavation for new installations will be paid for under the items for the grading work on the project.

Payment will be made under:

Item No 350-	Reinforced Cement Concrete Pavement, 12" Thick, Type III Synthetic Fiber Reinforced - per square yard

TECHNICAL SPECIAL PROVISION

FOR

TOLL SITE EQUIPMENT SLABS AND FOUNDATIONS

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T400
TOLL SITE EQUIPMENT SLABS AND FOUNDATIONS

T400-1 Description.

Construct Portland cement reinforced concrete slab to support toll equipment, toll equipment buildings, generator, and fuel tank foundations, on a prepared subgrade or base. Use concrete reinforced with steel bars or welded wire reinforcement, in accordance with details and notes shown in the Plans.

T400-2 Materials.

T400-2.1 General: Ensure that the materials used for the construction of slabs have certification statements from each source, showing that they meet the applicable requirements of the following:

T400-2.2 Concrete: Use concrete meeting the requirements of Section 346 of the Specifications, Class I, unless requirements herein or on plans are more stringent.

Utilize concrete with a target slump of 3 inches plus or minus 1.5 inches.

Provide concrete with a minimum 28-day compressive strength of 3,000 psi and maximum water to cementitious materials ratio of 0.50, unless plans call for more stringent requirements.

The requirements of Sections 346-3 and 346-4 of the Specifications do not apply unless called for on plans.

Notify the Engineer if any of the component quantities are adjusted. If any material sources change, resubmit the mix design to the Engineer for approval prior to use.

T400-2.3 Reinforcement: For all steel reinforcement required by the Plans, meet the requirements of Section 415 of the Specifications.

T400-2.4 Joint Materials: Meet the requirements of Section 932 of the Specifications.

T400-2.5 Geotextile: If specified, meet the requirements of Section 514 of the Specifications.

T400-2.6 Forms: Provide forms in accordance with Section 520-3 of the Specifications.

T400-2.7 Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

T400-2.8 Form Ties: Use factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

Unless otherwise indicated and except as noted, provide ties so portion remaining within concrete after removal is 1-1/2 inches inside concrete and will not leave holes larger than 1-inch diameter in concrete surface.

T400-3 Submittals and Shop Drawings.

1. Product Data: Submit product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and others as requested by the Department.

2. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Conform to ACI Detailing Manual MNL-66, showing bar schedules,

stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required and formed openings through concrete structures.

3. Laboratory Test Reports: Submit copies of laboratory test reports for concrete materials and mix design test as specified or explicitly state the pre-approved mix design already furnished to the Engineer will be used.

4. Material Certificates: It is preferable to provide copies of materials certificates in lieu of materials laboratory test reports when permitted by the Department. Material certificates shall be signed by Manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

T400-4 Construction Requirements.

T400-4.1 General: Perform concrete structures work in accordance with Section 400 of the Specifications.

T400-4.2 Excavation and Subgrade Preparation: Excavate to the required depth and compact the foundation material upon which these items are to be placed. Shape and compact the foundation materials to a firm, even surface, true to grade and cross-slope. Compact areas that have been excavated more than 6 inches below the bottom of the concrete, to a minimum of 95% of AASHTO T99 density. The area to be compacted includes the area directly under and 1 foot beyond each side of the toll site equipment slab, when right-of-way allows.

Maintain the finished subgrade in a smooth, compact condition. Restore any areas which are disturbed prior to placing the concrete. Do not place concrete on a frozen subgrade.

When called for in the plans, place geotextile fabric in accordance with Section 514 of the Specifications.

Coordinate conduit stub-up locations through the concrete slab for electrical toll equipment placement and ensure associated conduit are installed prior to placing concrete.

T400-4.3 Placing Concrete: Place the concrete in the forms, and tamp and spade it to prevent honeycombing, and until the top of the structure can be floated smooth and the edges rounded to the radius shown in the Plans.

Protect unhardened concrete from effects of inclement weather. Cease operations in rain. The following will apply when placing in cold and hot weather:

1. During the cold weather, do not mix or place concrete when the air temperature is below 40ºF. Protect the fresh concrete from freezing in accordance with Standard Specifications Section 400 until the concrete reaches a minimum compressive strength of 1,500 psi.

2. During placing in hot weather, cool the aggregates and mixing water as necessary to maintain the concrete temperature at not more than 100ºF at time of placement with the protective covering.

Install expansion and contraction joints in accordance with the Plans and Section 520-6 of the Specifications. In addition to the requirements of Section 520-6.2 of the Specifications, construct expansion joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as upright pedestals, foundation walls, grade beams, foundations, pull boxes, and elsewhere as indicated.

T400-4.4 Finishing:

1. Screeding: Strike-off the concrete by means of a wood or metal screed, used perpendicular to the forms, to obtain the required grade and remove surplus water and laitance.

2. Surface Requirements: Finish all exposed surfaces while the concrete is still green. Provide a broom finish unless noted otherwise on plans. Ensure that the surface variations

are not more than 1/4 inch under a 10-foot straightedge or more than 1/8 inch on a 5 foot transverse section. Finish the outer edges of the concrete with an edging tool having a radius of 1/2 inch unless noted otherwise on plans.

3. Curing: Cure the concrete as specified in Section 520-8 of the Specifications.

4. Backfilling and Compaction: After the concrete has set sufficiently, but not later than three days after pouring, install backfill around the toll equipment slab in accordance with the plans, to the required elevation with suitable material. Place and thoroughly compact the material in layers not thicker than 6 inches.

T400-5 Method of Measurement.

Toll equipment building foundations will not be measured separately and will be considered as incidental work.

The quantity to be paid for toll site equipment slabs will be plan quantity, in square yards, completed and accepted.

T400-6 Basis of Payment.

The toll equipment building foundation as specified in this Section will not be paid for directly but will be considered as incidental work.

Price and payment will be full compensation for work specified in this Section for toll site equipment slabs. Excavation for new installations will be paid for under the items for the grading work on the project.

Payment will be made under:

Item No. 400-45-5	Reinforced Concrete, Toll Site Equipment Slab, 12" Thick - per square yard

TECHNICAL SPECIAL PROVISION

FOR

PIPE BOLLARDS

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T519
PIPE BOLLARDS

T519-1 Description.

Construct pipe bollards in accordance with this Section and the Plans.

T519-2 Materials.

T519-2.1 General: Meet the following requirements:

1. Concrete .....Section 347
2. HDPE Sleeve ..... ASTM D4976-PE235(1)
3. Galvanized Steel .....Section 962
    a. Steel Pipe: Conform to ASTM A 53, Type S, Grade B, Schedule 40, galvanized.
4. Hardware
    a. Nuts and bolts shall be regular hexagon type conforming to ASTM A307, Grade A.
5. Gravel.....No. 57 Stone
6. Weed block ..... Polypropylene or Polyester Fabrics

(1) - HDPE must be designed for impact strength and UV resistance. UV Stabilizer must be combined with the HDPE.

T519-3 Construction Requirements.

T519-3.1 Removable Pipe Bollard:

1. Construct concrete foundation with embedded galvanized steel pipe sleeve and bolt in accordance with the Plans.
2. Construct pipe bollard in accordance with the Plans.
3. Attach pre-manufactured yellow high-density polyethylene sleeve (per manufacturer's instructions).
4. Provide gravel surrounded with weed block at locations depicted in the Plans.

T519-3.2 Permanent Pipe Bollard:

1. Construct concrete foundation with embedded galvanized steel pipe in accordance with the Plans.
2. Fill bollard with concrete in accordance with the plans. Round off top.
3. Attach pre-manufactured yellow high-density polyethylene sleeve (per manufacturer's instructions).

T519-4 Method of Measurement.

The quantity paid for will be the number of each type as designated, constructed, in place, and accepted. Includes foundations, sleeves, gravel, and weed block.

T519-5 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section, including all materials, hardware, labor, and incidentals required to complete the installation.

Payment will be made under:

Item No. 519- 78 Bollard - each

LEVEL 3

TECHNICAL SPECIAL PROVISION

FOR

ACCESSIBLE GANTRY GEAR BOXES

FINANCIAL PROJECT NO.: _____-_-__-__

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LEVEL 3

SECTION T734
ACCESSIBLE GANTRY GEAR BOXES

T734-1 Description.

Furnish and install the accessible gantry gear boxes in accordance with the Plans and Specifications.

T734-2 Materials.

Provide AUMA GS gear boxes for accessible gantries with:

1. Model no. 100.3/VZ 4.3
2. F-16 Bolt Pattern
3. No end stops
4. Specify left -KN-LR or right -KN-RL, as shown on the Plans
5. Total reduction ratio shall be 208:1 maximum.
6. Minimum working output torque: 2,065 ft-lb.
7. Provide unit with a locking device such that the output rotation can be stopped at no more than 10-degree intervals.
8. Unit shall be permanently lubricated, weatherproof, and suitable for unsheltered outdoor service.
9. Supply unit without output mounting flange.
10. Provide NEMA 4/6 standard housing with KN corrosion protection.
11. Output gear head shall be machined to match the “Gear Box Output Shaft”.
12. Provide unit with a 1.5” bore and (2) two 0.375” keyways.

T734-3 Submittals and Shop Drawings.

Provide catalog cut sheets and / or data sheets for the accessible gantry gear boxes. Shop drawings for accessible gantries must depict the actual hardware used.

T734-4 Method of Measurement.

The work specified in this Section will not be measured but will be included in the pay items for each accessible gantry, and each J-arm assembly for accessible gantry.

T734-5 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

TOLL GANTRIES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T735
TOLL GANTRIES

T735-1 Description.

Furnish and erect toll gantries at the locations identified in accordance with the Plans. Furnish and install J-arm assemblies and associated hardware on existing gantries. Furnish and install J-arm assemblies, gear boxes, and associated hardware on existing accessible gantries.

The Department designates a toll gantry with a walkway as an accessible toll gantry.

The Department designates a toll gantry without a walkway as a non-accessible toll gantry and may further classify it as a cantilever or span structure.

Meet the requirements shown in the following Standard Plan Indices:

Non-Accessible Cantilever Toll Gantry……. Standard Plans Index 700-040
Non-Accessible Span Toll Gantry.…….…. Standard Plans Index 700-041
Accessible Span Toll Gantry…….……. Standard Plans Index 700-041

T735-1.1 Supporting Hardware: Provide the following as shown on the Plans:

1. Non-accessible toll gantry supporting hardware:
    a. W-Sections
    b. Horizontal support pipes
    c. Attachment hardware for connection to structure chords, J-Arms, W-Sections and horizontal support pipes
2. Accessible toll gantry supporting hardware, structure chords, including associated mounting hardware:
    a. Swing gate assemblies
    b. Walkway system
    c. Fall arrest system
    d. Access stair assembly
    e. Equipment retraction assemblies including toll equipment support systems
    f. Electrical infrastructure

T735-2 Materials.

T735-2.1 General Requirements: Meet the general material requirements of Section 700-2.1 of the Specifications and the Overhead Signs material requirements of Section 700-2.4.3 of the Specifications unless otherwise noted in Section 735-2.2 of the Specifications. Hot-dip galvanized steel, in accordance with Section 962-11 of the Specifications.

T735-2.2 Supporting Hardware: Meet the requirements of Standard Specifications Section 962-11 when galvanizing for fittings and appurtenances for all structural steel, fasteners, and hardware.

All aluminum materials must meet the requirements of Section 965 of the Specifications. Weld aluminum structures in accordance with Section 965 of the Specifications.

Metallic mounting assemblies must meet ASTM B117 for corrosion resistance.

Provide supporting hardware meeting the requirements of this Technical Special Provision and Table T735-1.

TABLE T735-1 MATERIALS FOR SUPPORT HARDWARE AND FITTINGS

ITEM	MATERIALS
Steel U-Bolts	ASTM A449 or ASTM 193 B7 with minimum yield strength of 55,000 psi and a minimum ultimate strength of 90,000 psi
Aluminum bars, plates, stiffeners backing ring, shims and shapes Bar, Rod, and Shapes	Alloy 6061-T6 per ASTM B308
Stainless Steel Plates	Type 304L per ASTM A240
Stainless Steel Structural Shapes, Bars, and U-Bolt	Type 316L per ASTM A276
Stainless Steel screws, bolts, washers, and nuts	18-8 Stainless Steel unless otherwise noted
SEMS Machine Screws with washers and nuts for Upper Platform End Panel and Swing Gates	18-8 Stainless Steel with Phillips Pan Head with internal tooth-lock washer #10-32 threading
1" Fiberglass Grating for Upper Grating and Lower Grating	Fiberglass grating, pultruded, I-bar, SPF polyester resin, gray, 1.000" height x 0.600" top flange width I-bar bearing bars, spaced 1.500" on center with 0.900" clear space between bearing bar top flanges, anti-skid surface and fully sealed, bearing bars run parallel to length of panel, gray cross-rods spaced 6" on center, 60% open area, flame retardant to UL94V0 and ASTM E84 Class 1 or Class A compliant
Stainless Steel Wire Mesh (above lower grating and inside fall restraint assembly)	Wire mesh, square weave, stainless steel Type 316 woven construction, mill finish, 6x6 square mesh, 0.1317" x 0.1317" opening, 0.0350"wire
Stair Treads	Welded bar grating, hot-dipped galvanized, stair tread, 19-W-4 spacing, minimum 1-1/4" height x 3/16" thick rectangular bearing bars, serrated, run parallel to length of stair tread; with checkered plate 90-degree nosing; load capacity 400 lbs.
Upper Stair Landing and Access Platform Lower Landing Grating	Welded bar grating, hot-dipped galvanized, GW-150 smooth, welded fabrication, 19-W-4 spacing, 1-1/2” x 3/16” bearing bars, 77% open area, spaced 1-3/16” on centers, cross bars, 4" on centers; grating must support a uniform load of 500 lbs. over a clear span of 48" with a deflection of less than 0.2"
Access Platform Grating	Welded bar grating, hot-dipped galvanized, GW-150 smooth, welded fabrication, 19-W-4 spacing, 1-1/2” x 3/16” bearing bars, 77% open area, spaced 1-3/16” on center, regular cross bars, 4" on center, width 36"; grating must support a minimum uniform load of 237 lbs. over a clear span of 72" with a deflection of less than 0.45"

TABLE T735-1 MATERIALS FOR SUPPORT HARDWARE AND FITTINGS ITEM	MATERIALS
Self-Closing Hinge for Access Platform Gate	Stainless Steel Type 304, self-closing full mortise-mount spring hinge, with adjustable tension, rounded corners, 1-3/4" thickness, 4-1/2" x 4" overall dimensions with 2 leaves
Aluminum Screening	Wire mesh, square, aluminum alloy, mill finish, woven-intercrimp weave, 2” x 2” mesh (square), 0.4370" x 0.4370" opening (square), 0.063" thick (16 gauge) wire diameter, 76% open area
Full Mortise Pin & Barrel, Continuous hinge for Swing Gate	Stainless Steel Type 304, full mortise pin and barrel continuous hinge, supporting a minimum door weight of 300 lbs.
Rivet Nut for Swing Gate Latch assembly	Aluminum twist resistant locking rivet nut
Hex Head Screw for Gate Latch Post Connection Plate	Galvanized Flanged Hex Head Screws Medium-Strength
Retaining Rings for Gear Box Output Shaft	Stainless Steel
Fasteners for Swing Gate Hinge	Stainless steel – size and type per hinge manufacturer
PTFE Tape (polytetrafluoroethylene) For fall arrest system	Slippery PTFE Bar, with a slippery surface on one side and an etched texture on one side. The etched texture is scuffed to readily accept adhesive. Chemical Resistant, Impact Resistant, Low Water Absorption, Slippery, Wear Resistant, Weather Resistant. Use outdoor rated silicone adhesive made for attaching PTFE to stainless steel
Bushing for Gear Box Output Shaft	HDPE
Bushing for Gear Box Bushing Plate	Slip fit acetal plastic flanged sleeve bearing
Silicone Rubber adhesive Latch plate and Stop Plate	High-Temperature Silicone Rubber Strip with Adhesive-Back, Outdoor rated, Tensile Strength Min. 700 psi
Brass Keys for Output Shaft and Gear Box Input Adapter	Marine Grade Brass 485 meeting ASTM B21 or approved alloy: Corrosion resistant brass alloy appropriate for industrial applications and rated for deployment in an outdoor marine environment
Input Adapter for AUMA Gearbox	Input adapter shall be brass and machined to match input of AUMA gearbox. Input shall be configured to accept a standard ½” square socket wrench with appropriate tolerances

Conform to American Gear Manufacturers Association AGMA-9002 Bores and Keyways for Flexible Couplings (Inch Series) for sizes and tolerances of keys, keyways, key seats, key shafts, and key hubs/bores.

All flanged hex head screws must be serrated.

T735-2.3 Toll Gantry Foundations, Fabrication, Installation, and Erection: Meet the requirements of Section 700.3.2 and Section 700-3.3.3 of the Specifications**.**

T735-3 Toll Equipment Attachment Infrastructure.

T735-3.1 Toll Equipment J-Arms: Furnish and install J-Arms and all associated hardware in accordance with the Plans.

J-Arms must be fabricated within the following tolerance limits:

1. Outside diameter of 2.875 inches with an ovality tolerance of +/- 0.015 inch along the straight sections of the arm. (ANSI H35.2)

2. The minimum and maximum outside diameter within the curved section of the J-Arm must be 2.790" and 2.904" respectively.

3. J-Arm pipe bending must be in accordance with the requirements specified in Pipe Fabrication Institute Standard ES-24, Pipe Bending Methods, Tolerances, Process and Material Requirements.

4. Equipment retraction assembly for accessible toll gantries.

Furnish and install equipment retraction assemblies and all associated hardware in accordance with the Plans and Specifications.

T735-3.2 J-Arm Fasteners and Attachment Hardware: All U-bolts must be furnished with double nuts and a saddle. Weld aluminum structures in accordance with Section 965 of the Specifications. Install u-bolts, nuts, and washer assemblies in accordance with Section 460-5 of the Specifications.

J-Arm attachment for gantries includes non-accessible gantry hardware and accessible gantry hardware as shown in the Plans and Specifications.

T735-3.3 Sampling and Testing: Test J-Arm roundness, yield, and tensile strength at the fabrication facility before shipping to the jobsite in accordance with the Producer's Quality Control Plan.

Provide a sample J-Arm from each J-Arm fabricator for testing and acceptance by the Engineer, prior to fabricating any J-Arms for the project. Sample J-Arm(s) that meet criteria may be used as production J-Arms.

T735-3.4 Installation of Supporting Hardware: Furnish and install supporting hardware in accordance with the Plans and Specifications.

T735-3.5 Delivery of Spare Equipment: Toll facilities gantry subcomponent plans will provide the quantity of spare equipment required. Deliver spare equipment to the Department's Central Repair Depot at Florida's Turnpike Milepost 99. Provide two weeks advance notice prior to delivering the spare items. Deliver the equipment in the original manufacturer's storage packaging. If the manufacturer does not use packaging for storage, wrap in heavy duty industrial grade clear plastic and label. Place hardware in boxes and label.

T735-4 Toll Gantry Electrical Infrastructure.

Toll gantry electrical infrastructure includes the following as shown on the Plans and Specifications:

1. Raceways (including conduits, wireways, and cable trays) for power, AVI, data, and CCTV, associated fittings, and accessories located on the toll gantry, which includes but is not limited to, the pull ropes, grounding wire, strut channel frames and all associated attachment hardware.

2. Fixtures, raceway, and conductors for lighting, lighting control, wiring devices, strut channel frames, and all associated attachment hardware.

3. AVI Reader frames as well as all wire troughs and associated strut channel frames, at the base of the toll gantry.

4. Lightning protection at the toll site, except for the toll equipment building lightning protection and the generator equipotential bonding.

5. Grounding and bonding for electrical systems at the gantry.

All toll gantry electrical infrastructure must be rated NEMA 3R or NEMA 4.

T735-5 Shop Drawings and Certifications.

Submit shop drawings in accordance with Section 5 of the Specifications. Include fabrication and connection details including field splice locations and material certifications. Prior to the submittal of the shop drawings, determine the actual in-place dimensions for all toll gantry structures on the basis of existing field conditions and include in the shop drawings.

Include gantry toll equipment locations with respect to the lane lines on the pavement below and the uprights.

Each J-Arm fabricator must be an approved fabricator of aluminum products per Sections 105-3 of the Specifications. Provide a letter from each J-Arm fabricator to the Department stating that the fabricator is currently equipped/capable of fabricating the J-Arms. This letter must be provided at least one month in advance of providing the sample J-Arm.

T735-6 Method of Measurement.

Contract unit price for each toll gantry, furnished and installed, will include furnishing the truss, uprights, columns, foundation(s), support hardware, toll gantry electrical infrastructure, accessible gantry gear boxes (where called for on the Plans), and all equipment, labor, and materials necessary for a complete and accepted installation.

Unit price for each J-arm assembly with associated hardware will be measured as each.

Unit price for each J-arm assembly, and gear box, with associated hardware on an accessible gantry will be measured as each.

T735-7 Basis of Payment.

Price and payment will be full compensation for furnishing all materials and completing all work described in the Plans and Specifications.

Payment will be made under:

Item No. 735-1-	Toll Gantry - each
Item No. 735-1-95	J-arm assembly, Non-accessible Gantry - each
Item No. 735-1-96	J-arm retraction assembly, Accessible Gantry - each

TECHNICAL SPECIAL PROVISION

FOR

CABLE TRAYS FOR TOLL GANTRIES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T735A
CABLE TRAYS FOR TOLL GANTRIES

T735A-1 Description.

Furnish all labor, materials, services, testing, and equipment necessary to provide and install cable trays including cable trays and accessories for use on toll gantries.

T735A-2 Materials.

T735A-2.1 General: Furnish materials from a company specializing in manufacturing the products specified in this section with minimum three years of experience, and with service facilities within 100 miles of Project.

T735A-2.2 Cable Tray Requirements for Gantries: Provide manufacturer's standard clamps, hangers, brackets, splice plates, expansion joints, reducer plates, blind ends, barrier strips, connectors, conduit to tray adaptors, ladder drop-out fittings, and grounding straps for all gantry cable trays.

T735A-2.2.1 Longitudinal Ladder Style Cable Trays:

1. Loading depth: 4” NEMA VE 1 with 5” total rail height.
2. The aluminum cable tray side rails will be manufactured from aluminum alloy extrusions that meet the material specifications of the Aluminum Association Alloy #6063-T6.
3. Ensure the cable tray system is designed to safely support a uniformly distributed load of 100 pounds per foot with 6-foot support spans. When loaded at 100 pounds per foot, the maximum deflection of the cable tray shall not exceed ½ inch at any point.
4. The UL cross sectional area of each side rail shall be 1 square inches minimum.
5. Finish: Aluminum, non-painted.
6. Inside width:
    a. Accessible Gantries: (2) 24" for data, (2) 6" for power centered symmetrically about the gantry centerline..
    b. Non-Accessible Gantries: See Plans.
7. Cable tray dividers:
    a. Accessible Gantries: The DATA cable tray must be equipped with a center divider to separate the future tolling data cables from the AVI coaxial cables.
    b. Non-Accessible Gantries: The cable tray must be equipped with two dividers to separate the future tolling data cables, AVI coaxial cables, and power cables.
8. Straight Section Rung Spacing: 6 inches on center.

T735A-2.2.2 Transverse & Ventilated Channel Style Cable Tray:

1. Loading depth: 1-3/4” height.
2. The aluminum cable tray will be manufactured from aluminum alloy that meets the material specifications of the Aluminum Association Alloy #6063-T6.
3. Ensure the cable tray system is designed to safely support a uniformly distributed load of 30 pounds per foot with 6-foot support spans.
4. The UL cross sectional area of each side rail shall be 0.4 square inches minimum.
5. Finish: Aluminum, non-painted.

6. Inside width: 4”.

T735A-2.3 Warning Signs for Cable Trays: Provide engraved nameplates for cable trays in accordance with the following:

1. 1/2-inch black letters on yellow laminated plastic nameplate
2. Engrave cable tray nameplates with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

T735A-3 Shop Drawings and Submittals.

1. Product Data: Provide data for fittings and accessories.
2. Shop Drawings: Indicate tray type, metal type, rung spacing, loading depth in accordance with NEMA VE 1, dimensions, support types, support points, accessories, and finishes.
3. Provide documentation of Manufacturer's Instructions as follows:
   a. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.
   b. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

T735A-4 Construction Requirements.

Verify that field measurements are as indicated on shop drawings, and as instructed by the manufacturer.

Install metallic cable tray in accordance with NEMA VE 1. Provide supports at each connection point, at the end of each run, at other points to maintain spacing between supports of 6 ft maximum, and as required by the manufacturer. Use expansion connectors where required where joints are crossed.

Ground and bond cable tray. Provide electrical continuity between all tray components. For ladder type cable tray: Install a 10 AWG copper equipment grounding conductor from the service entrance ground bus to the cable tray. Use Cu/Al rated mechanical lugs at the end of the grounding conductor to bond it to the cable tray. For ladder type cable tray at outdoor gantries: Bond the cable tray and each metal conduit with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor. Bond all metallic conduits terminating at the tray by using bonding type bushings. Install to create a continuous, low-resistance, electrical ground return path in accordance with the requirements of the NEC.

Use anti-oxidant compound to prepare aluminum contact surfaces before assembly. Electrical connections to the cable tray shall be made with Cu/Al rated lugs. Carefully coordinate the cable tray installation with other trades to avoid interferences and maintain proper NEC clearances.

Install the cable tray at plan locations and heights and as required by field connections. Cable tray wire shall not be spliced at the tray or inside the tray.

T735A-5 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

SURFACE RACEWAYS AND WIRE TROUGHS AT TOLL GANTRIES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T735B
SURFACE RACEWAYS AND WIRE TROUGHS AT TOLL GANTRIES

T735B-1 Description.

Furnish of all labor, materials, services, testing, and equipment necessary to provide and install surface raceways and wire troughs at each toll site.

T735B-2 Qualifications.

Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years of experience.

T735B-3 Materials.

T735B-3.1 Wireways Installed Outdoors:

1. Wireways installed outdoors shall be manufactured from temperature and chemically resistant fiberglass material and shall be rated NEMA 3R, NEMA 12, and IP55.

2. Vertically mounted wireways shall be listed for vertical installation and the removable covers shall be equipped with captivated monel cover screws and oil resistant gaskets.

3. Wireways shall be fastened in place using the manufacturers brackets or hangers and in accordance with the manufacturer's installation instructions.

T735B-3.2 Wire Troughs:

1. Wire troughs installed indoors in dry locations shall have a minimum cross section of 12 inches by 12 inches and be manufactured from 14-gauge steel and then phosphatized before painting inside and outside with ANSI 61 gray colored polyester paint.

a. Indoor wire troughs shall be equipped with slip-on removable covers and embossed mounting holes on the back of the enclosure.

b. Do not field drill mounting holes in the enclosure. Use the embossed mounting holes provided by the manufacturer.

2. Wire troughs installed outdoors or in wet locations shall have a minimum cross section of 12 inches by 12 inches and shall be manufactured from 14-gauge galvanized steel and then phosphatized before painting inside and outside with ANSI 61 gray colored polyester paint.

a. Outdoor wire troughs shall include an integral drip-shield along the top, and seam free sides, front, and back.

b. The removable front cover shall be a "slip on" type metal cover with corrosion resistant fasteners along the bottom of the cover. The fasteners shall be captive and held to the cover. The removable cover shall include provisions for padlocking.

c. Factory provided mounting holes on the back of the wire troughs shall be embossed. Field drilled mounting holes are not acceptable.

d. The wire troughs shall be UL 870 listed, and rated NEMA 3R or NEMA 4X.

T735B-4 Submittals and Shop Drawings.

1. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

2. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of

Product.

T735B-5 Quality Assurance.

1. Perform Work in accordance with National Electrical Contractors Association NECA Standard of Installation.
2. Maintain one copy of document on site.

T735B-6 Construction Requirements.

T735B-6.1 Installation:

1. Install products in accordance with manufacturer's instructions.
2. Wireways and wire troughs shall be mounted plumb and level.
3. Wireways shall be secured to the structure using the original equipment manufacturer’s brackets and/or hangers.
4. The ends of all wireways shall be closed using the original equipment manufacturers fittings.
5. Field drilling for mounting galvanized metal enclosures, or wire troughs is not acceptable. Use factory provided mounting holes only.
6. Do not terminate conduits and wireways into the top of a wire trough where installed outdoors.

T735B-7 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

DRILLED SHAFT ANCHOR BOLTS AT TOLL GANTRIES

FINANCIAL PROJECT NO.: _____-_-__-__

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Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T735C
DRILLED SHAFT ANCHOR BOLTS AT TOLL GANTRIES

T735C-1 Description.

Furnish all labor, materials, services, testing, and equipment necessary to provide and install drilled shaft anchor bolts for each toll gantry foundation.

T735C-2 Materials.

Anchor bolt nut and washer assemblies must meet the requirements of ASTM F3125, Grade A325.

T735C-3 Submittals and Shop Drawings.

Submit shop drawings in accordance with Section 5 of the Specifications.

Product Data: Provide dimensions, sizes and locations, materials, fabrication details, finishes, and accessories.

T735C-4 Construction Requirements.

Meet the requirements of Technical Specifications Section T735-2.3.

Install anchor bolt, nut and washer assemblies in accordance with 460-5, except that 460-5.4.2 Preparation of Faying Surfaces is not required.

T735C-5 Method of Measurement.

No separate payment will be made for the drilled shaft anchor bolts at toll gantries; payment is included with the pay item of each toll gantry.

T735C-6 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

AS-BUILT SURVEY OF INSTALLED ANCHOR BOLTS AT TOLL GANTRIES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T735D
AS-BUILT SURVEY OF INSTALLED ANCHOR BOLTS AT TOLL GANTRIES

T735D-1 Description.

Provide an as-built survey of the installed anchor bolts and foundation for each toll gantry foundation.

T735D-2 Submittals and Shop Drawings.

Submit shop drawings in accordance with Section 5 of the Specifications.

Provide the following as-built information:

1. Station and offsets of the center of the anchor bolt circle(s)
2. Orientation of the anchor bolt circle(s)
3. Elevation(s) of the top of foundation(s)
4. Any other as-built requirements identified in Standard Plans 700-041.

T735D-3 Method of Measurement.

No separate payment will be made for the as-built survey of installed anchor bolts at toll gantries; payment is included with the pay item of each toll gantry.

T735D-4 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

Appendix 2

TECHNICAL SPECIAL PROVISION SECTIONS FOR TOLL SITES WITH A TEB

See ***GTR 210*** for additional requirements.

TECHNICAL SPECIAL PROVISION
FOR
TEB SITES' TOLL FACILITIES
Financial Project ID _____

Project Name1
Project Name2
Project Name3

I hereby certify that these Technical Special Provisions have been properly prepared by me, or under my responsible charge, in accordance with procedures adopted by the Florida Department of Transportation.

Approved By:

CIVIL/UTILITIES
Professional Engineer Name:
Date:
Fla. License No.:

STRUCTURAL
Professional Engineer Name:
Date:
Fla. License No.:

ARCHITECTURAL
Registered Architect Name:
Date:
Fla. License No.:

MECHANICAL
Professional Engineer Name:
Date:
Fla. License No.:

ELECTRICAL
Professional Engineer Name:
Date:
Fla. License No.:

Date:
Firm Name:
Firm Address:
City **State** **Zip Code**
Certificate of Authorization
Page:

TABLE OF CONTENTS FOR TEB SITES

THE FOLLOWING SPECIFICATION SECTIONS ARE ADDED AS A TECHNICAL SPECIAL PROVISION AND SHALL GOVERN "LUMP SUM" TOLL FACILITIES CONSTRUCTION WORK AT _____

THE LISTED SPECIFICATIONS WERE PREPARED UNDER THE DIRECT SUPERVISION OF THE PERSON SIGNING AND SEALING THE COVER SHEET OF THESE TECHNICAL SPECIAL PROVISIONS FOR THEIR RESPECTIVE DISCIPLINES INDICATED.

SECTION	TITLE	DISCIPLINE	SECT. PAGE NO	TSP PAGE NO.
00 00 01	SIGNATURE SHEET/ TABLE OF CONTENTS	Not Applicable	1-X	X
DIVISION 01 - GENERAL REQUIREMENTS FOR TOLL FACILITIES				
THE FOLLOWING DIVISION 01 SECTIONS ARE NOT PART OF, NOR INTENDED TO REPLACE, "DIVISION I - GENERAL REQUIREMENTS AND COVENANTS" LISTED IN THE FDOT STANDARD SPECIFICATIONS.				
01 11 00	SUMMARY OF WORK	Architectural	1-X	X
01 29 73	SCHEDULE OF VALUES	Architectural	1-X	X
01 41 26	BUILDING PERMITS	Architectural	1-X	X
01 51 00	TEMPORARY UTILITIES	Architectural	1-X	X
01 74 23	FINAL CLEANING	Architectural	1-X	X
01 77 00	PROJECT CLOSEOUT	Architectural	1-X	X
01 78 36	GUARANTEES /WARRANTIES / REPAIRS	Architectural	1-X	X
01 78 39	RECORD DOCUMENTS, MAINTENANCE MANUALS, AND EQUIPMENT OPERATIONAL INSTRUCTIONS/ DEMONSTRATIONS	Architectural	1-X	X
DIVISION 02 – EXISTING CONDITIONS				
02 41 16	SELECTIVE DEMOLITION	Architectural	1-X	X
02 41 20	CUTTING AND PATCHING	Architectural	1-X	X

SECTION	TITLE	DISCIPLINE	SECT. PAGE NO	TSP PAGE NO.
DIVISION 03 – CONCRETE				
03 35 00	APPLIED FINISH	Architectural	1-X	X
03 41 00	PRECAST STRUCTURAL CONCRETE	Structural	1-X	X
DIVISION 05 – METALS				
05 50 00	METAL FABRICATIONS	Architectural	1-X	X
DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES				
06 10 00	ROUGH CARPENTRY	Architectural	1-X	X
DIVISION 07 - THERMAL AND MOISTURE PROTECTION				
07 21 00	THERMAL INSULATION	Architectural	1-X	X
07 26 16	BELOW-GRADE VAPOR BARRIER	Architectural	1-X	X
07 53 50	SBS MODIFIED BITUMEN ROOFING SYSTEM	Architectural	1-X	X
07 60 00	FLASHING AND SHEET METAL	Architectural	1-X	X
07 92 00	JOINT SEALANTS	Architectural	1-X	X
DIVISION 08 – OPENINGS				
08 11 00	METAL DOORS AND FRAMES	Architectural	1-X	X
08 71 00	DOOR HARDWARE	Architectural	1-X	X
DIVISION 09 – FINISHES				
09 65 00	RESILIENT BASE	Architectural	1-X	X
09 91 00	PAINTING	Architectural	1-X	X
DIVISION 10 – SPECIALTIES				
10 14 00	SIGNAGE	Architectural	1-X	X
10 44 16	FIRE EXTINGUISHERS AND ACCESSORIES	Architectural	1-X	X
DIVISION 13 - SPECIAL CONSTRUCTION				
13 34 23	FABRICATED STRUCTURES	Structural	1-X	X

SECTION	TITLE	DISCIPLINE	SECT. PAGE NO	TSP PAGE NO.
DIVISION 23 - MECHANICAL				
23 05 00	GENERAL MECHANICAL REQUIREMENTS	Mechanical	1-X	X
23 05 93	TEST AND BALANCE	Mechanical	1-X	X
23 09 00	DUAL AIR CONDITIONER CONTROL SYSTEM AND SEQUENCE OF OPERATIONS	Mechanical	1-X	X
23 11 13	FUEL OIL PIPING	Mechanical	1-X	X
23 13 23	CONCRETE PROTECTED ABOVE GROUND FUEL STORAGE TANK	Mechanical	1-X	X
23 20 00	PIPING AND SPECIALTIES	Mechanical	1-X	X
23 81 19	DUCTLESS SPLIT SYSTEM AIR CONDITIONERS	Mechanical	1-X	X
DIVISION 26 – ELECTRICAL				
26 05 00	COMMON WORK RESULTS FOR ELECTRICAL	Electrical	1-X	X
26 05 01	SHOP DRAWINGS AND SUBMITTALS	Electrical	1-X	X
26 05 02	SUBSTITUTIONS	Electrical	1-X	X
26 05 03	REFERENCE STANDARDS AND REGULATORY REQUIREMENTS	Electrical	1-X	X
26 05 04	ELECTRICAL SYMBOLS AND ABBREVIATIONS	Electrical	1-X	X
26 05 05	OPERATIONAL TESTS AND PERFORMANCE VERIFICATION	Electrical	1-X	X
26 05 19	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	Electrical	1-X	X
26 05 20	EQUIPMENT WIRING SYSTEMS	Electrical	1-X	X
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	Electrical	1-X	X

SECTION	TITLE	DISCIPLINE	SECT. PAGE NO	TSP PAGE NO.
DIVISION 26 – ELECTRICAL (*Continued)*				
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	Electrical	1-X	X
26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS	Electrical	1-X	X
26 05 34	SURFACE RACEWAYS	Electrical	1-X	X
26 05 36	CABLE TRAYS	Electrical	1-X	X
26 05 43	UNDERGROUND DUCTBANKS FOR ELECTRICAL SYSTEMS	Electrical	1-X	X
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS	Electrical	1-X	X
26 09 13	SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)	Electrical	1-X	X
26 24 16	PANELBOARDS	Electrical	1-X	X
26 24 17	TOLL EQUIPMENT CRITICAL POWER PANELBOARD	Electrical	1-X	X
26 27 13	ELECTRICITY METERING AND UTILITY SERVICE ENTRANCE	Electrical	1-X	X
26 27 16	ELECTRICAL CABINETS AND ENCLOSURES	Electrical	1-X	X
26 27 26	WIRING DEVICES	Electrical	1-X	X
26 28 13	FUSES	Electrical	1-X	X
26 28 17	ENCLOSED SAFETY SWITCHES	Electrical	1-X	X
26 32 13	EMERGENCY GENERATOR - PERMANENT	Electrical	1-X	X
26 33 53	STATIC UNITERRUPTIBLE POWER SUPPLY SYSTEM	Electrical	1-X	X
26 36 00	AUTOMATIC TRANSFER SWITCH	Electrical	1-X	X
26 41 13	LIGHTNING PROTECTION SYSTEM	Electrical	1-X	X
26 43 13	SURGE-PROTECTIVE DEVICES, 1KV or Less	Electrical	1-X	X
26 51 13	LIGHTING FIXTURES AND LAMPS	Electrical	1-X	X

SECTION	TITLE	DISCIPLINE	SECT. PAGE NO	TSP PAGE NO.
DIVISION 27 – COMMUNICATIONS				
27 11 16	TOLLING COMMUNICATIONS CABINET	Electrical	1-X	X
27 41 34	PATHWAYS FOR CLOSED CIRCUIT TELEVISION	Electrical	1-X	X
DIVISION 28 - ELECTRONIC SAFETY AND SECURITY				
28 05 14	ACCESS CONTROL SYSTEM	Electrical	1-X	X
DIVISION 31 – EARTHWORK				
31 31 16	SOIL TREATMENT	Architectural	1-X	X

END OF TABLE OF CONTENTS

SECTION 01 11 00
SUMMARY OF WORK FOR TEB SITES

LEVEL 1

PART 1 - GENERAL

1.1 TOLL FACILITY WORK COVERED UNDER CONTRACT DOCUMENTS

Insert project specific information in Section A below.

A. Work as related to the Toll Facilities, (Toll Facility Work), in general, consists of Toll Facility Construction at (insert Project Name) (MP insert number) (County Name) County (insert County number) State Road No. (insert number) for the Florida Department of Transportation.

1. Work as related to the Toll Facilities at each toll site location includes the following when depicted on the Plans:
   a. Toll Equipment Building and associated equipment.
   b. Generator, fuel tank, reinforced concrete slab and all associated accessories.
   c. Toll site elements include wire troughs, cabinets, and concrete bumper guards.

2. Toll Facility Work also includes the following items when depicted on the Plans, but is covered under separate specifications:
   a. Gantry Structure, gantry foundation, and all electrical infrastructure down to and including the wire troughs to support the toll equipment installation.
   b. Concrete sidewalks, concrete barriers, curbs, and metal bollards, gravel, toll site equipment slab(s), pipe handrail, pedestrian railing, bullet rail, fencing, and fence gate(s) with access control.
   c. Guardrail and guardrail transitions
   d. Conduit, conductors, and pull boxes
   e. Toll site equipment slabs supporting the generator and fuel tank
   f. Toll site foundations (TEB cast-in-place foundation)

B. For additional information concerning acceptance of the Work by the Department, refer to Technical Special Provision Section 01 77 00 - PROJECT CLOSEOUT.

C. The method of measurement and basis of payment for each Section is specified in Article 3.1- MEASUREMENT AND PAYMENT at the end of this Section.

1.2 SECURITY PROVISIONS UNTIL FINAL ACCEPTANCE

A. Provide security provisions and protective measures until each toll site is fully operational and opened to traffic. Each toll site shall be maintained in a condition acceptable to the Department for Final Acceptance and occupancy.

1. All security and protective measures shall comply with Section 7 – LEGAL REQUIREMENTS AND RESPONSIBILITY TO THE PUBLIC of the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition, as amended.

B. Provide security provisions required to prevent vandalism and theft during the previously stated period of time.

1. All materials required for security provisions may be new or used, but shall be adequate in capacity for required usage, shall not create unsafe conditions, and shall not violate requirements of applicable laws, codes, and standards.

C. Submit a complete, detailed security plan to the Engineer for written approval.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. Furnish and install infrastructure necessary to support the tolling system provided by the Department's Toll Equipment Contractor (TEC). This shall include, but is not limited to the following items when depicted on the Toll Facility plans: toll equipment structures (gantries) and associated elements, special pavement (asphalt or concrete) in the toll loop pavement area under the gantry to accommodate the inductive traffic classification and detection tolling loops, maintenance pull-off areas, toll equipment building(s), electrical utility services, electrical panels, stand-by generators, above-ground diesel fuel storage tanks, automatic transfer switches, uninterruptible power supplies, maintenance by-pass switches, tolling communications cabinet, fiber optic communication's cables, lateral drop(s), infrastructure needed to provide connectivity to each building, AC, plumbing, AVI Reader NEMA enclosures, directional bores, underground ductbank(s), wireways, pull boxes, conduits, wall and floor penetrations, lightning protection systems, grounding systems, and concrete pads.

B. Provide one (1) communication path from each end of the tolled corridor (for a total of two (2) communication paths) as a redundant path of communication to ensure an alternative communications path.

C. Fully review, design, permit, and certify the requirements of the Construction Documents.

D. Construct in compliance with all applicable laws, codes, standards, and the requirements of the Contract Documents.

E. Obtain all required permits and pay all fees required for obtaining fuel tank permits, and utility connections (power, communications, etc.), as defined herein and the Contract Documents.

F. Include tracking for each toll site's construction activities separately in the construction schedule.

G. Provide at least two portable toilets at each toll site during toll equipment installation, testing, and commissioning for the exclusive use of Florida's Turnpike Enterprise (FTE) and TEC personnel.

PART 2 - PRODUCTS

"Not Used"

PART 3 - EXECUTION

3.1 MEASUREMENT AND PAYMENT

A. General: The Toll Facility Work consists of the furnishing of all labor, materials, equipment, and incidentals necessary to construct each toll site as shown on the Plans, summarized in this Technical Special Provision. This work includes a "Lump Sum" Toll Equipment Building as well as toll gantries, and toll site work, unless otherwise specified or indicated on the Plans and/or specified herein.

B. Method of Measurement:

1. The quantities for each Toll Equipment Building lump sum include the following:
   a. The building(s), the building foundation(s), the building structure(s), and all materials and equipment within the building(s), as shown on the Plans.
   b. All structural, architectural, mechanical, plumbing, and electrical in conjunction with the Toll Equipment Building Work and conduits in the toll site that originate from the Toll Equipment Building excluding loop home run conduits which are paid for separately.
   c. Procuring the building permit, and permits required, for each toll site location. The Department will pay the cost of the building permit. Responsibility for re-inspection fees are in accordance with Technical Special Provision Section 01 41 26 – Building Permits.
   d. All work specified in Acceptance Procedures for Toll Facilities for each TEB toll site location.

2. The Contract unit price for each Bumper Guard for Parking Lot, furnished and installed is in accordance with Standard Plans 520-001.

3. The Contract unit price for each Emergency Generator - Permanent, furnished and installed, will include furnishing, placement, and testing of all equipment, materials and hardware as specified in the Contract Documents, and all labor, equipment, operational software packages, firmware, and miscellaneous materials necessary for a complete and accepted installation. Include the fuel tank with related piping and accessories.

4. The Contract unit price for each Toll Facility Electrical Power Service, furnished and installed, will include furnishing, placement, and testing of all conduit, conductors, meters, materials and hardware as specified in the Contract Documents between the secondary side of the utility transformer and the main circuit breaker inside the service entrance overcurrent protection device.

If there is demolition in this project add item 5 to include method of measurement language to identify project specific demolition items that are part of 735-88:

Coordinate pay item numbers below with FTE Specs and Estimates and the latest Basis of Estimates.

3.2 Basis of Payment:

A. Price and payment will be full compensation for all work and materials for Toll Equipment Buildings under the following:

Item No. 735- 74- Toll Plaza ..... Lump Sum

Add 735-88 if there is demolition in this project:

Item No. 735-88 Toll Plaza Modify Existing Lump Sum

B. Price and payment will be full compensation for all work and materials for non-lump sum items will be made under the following:

Item No. 542- 70- Concrete Bumper Guard for Parking Lot..... Each

Item No. 639- 13- Emergency Generator - Permanent ..... Each

Item No. 639-7-122 Electrical Power Service, Toll Site Electric Metering and Utility Service Entrance..... Each

END OF SECTION 01 11 00

SECTION 01 29 73
SCHEDULE OF VALUES FOR TEB SITES

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Schedule of Values must be prepared using the Florida's Turnpike Enterprise (FTE) template Form SOV-1 which is included in this subsection.

B. The Schedule of Values will be used by the Engineer for reviewing Lump Sum contract (as defined in the Standard Specifications 2-3.1) items and as a basis for interim or partial payments.

C. The Schedule of Values shall indicate that one (1) percent of the money due under the Lump Sum Contract is reserved for Project Closeout. It is understood that payment will not be made of this reserve amount until all Project Closeout items have been submitted to the Engineer by the Contractor and are in a manner and form satisfactory to the Engineer and as provided by this specific Contract.

D. Project Closeout items are defined as any item that this Contract requires the Contractor to furnish to the Engineer as provided by the Standard Specifications, Supplemental Specifications, Special Provisions, Technical Special Provision, or the Plans. Examples include but are not limited to: Operations and Maintenance Manuals, Systems and Equipment Testing, Department Personnel Training, Supplies required for initial operation of equipment, Project Record Drawings, Warranties, Guarantees.

1.2 RELATED WORK

A. TSP Section 017700 – PROJECT CLOSEOUT

1.3 FORM AND CONTENT OF SCHEDULE OF VALUES

A. The Schedule of Values shall follow template SOV-1 which is attached to this technical special provision section. The Schedule of Values shall identify the following:

1. Title of Project and Location.

2. Engineer and Project number.

3. Name and address of Contractor.

4. Contract designation.

5. Date of submission.

B. The Schedule of Values shall list the installed value of the component parts of each toll facility site's lump sum pay item of the Work in sufficient detail to serve as a basis for computing unit prices for progress payments during construction.

C. Identify each major line item and sub-component of each toll facility site as listed in template SOV-1 herein this Technical Special Provision.

D. For the various portions of the Work, prepare the Schedule of Values such that:

1. Each item shall include the proportional amount of the Contractor's overhead and profit. The contractor's bid amount shall match the Schedule of Values total for each toll site.

2. A separate line item for Project Closeout shall be provided.

3. A separate completed SOV for each toll site shall be provided within 60 days of the Contract Award.

1.4 REVIEW AND RE-SUBMITTAL

A. After a review by the Engineer, revise and re-submit the Schedule of Values and Sub-schedule of Material Values as required.

B. Resubmit the revised Schedules in the same manner.

SCHEDULE OF VALUES TEMPLATE –SOV-1

TEMPLATE (Revise to include tolling pay items associated with this specific toll site)						
Project Name:		**Date:**				
State Road No.		**Contract No:**				
County:		**CEI:**				
FPID: XXXXXX-X-XX-XX		**Contractor:**				
		Contractor Address:				
Toll Facility Summary of Pay Items		**Toll Facility ID:**				
Item Number	**Item Description**	**Unit of Measure**	**Unit Cost**	**Quantity**	**Cost Amount**	**Notes**
0515- 1- AB	**Pipe Handrail, Guiderail**	LF	$0.00	0	$0.00	
0515- 2- ABB	**Pedestrian/Bicycle Railing**	LF	$0.00	0	$0.00	
0515- 4- AB	**Bullet Rail, Single Rail**	LF	$0.00	0	$0.00	
0519- 78- 1	**Bollards, Removable**	EA	$0.00	0	$0.00	
0519- 78- 2	**Bollards, Permanent**	EA	$0.00	0	$0.00	
0520- 2- 10	**Concrete Curb, Toll header Curb**	LF	$0.00	0	$0.00	
0521-1-AA	**Median Concrete Barrier (Scheme #)**	LF	$0.00	0	$0.00	1
0521-72-40	**Shoulder Concrete Barrier**	LF	$0.00	0	$0.00	
0522- 2	**Concrete Sidewalk, 6" Thick**	SY	$0.00	0	$0.00	
0536- 1-AA	**Guardrail**	LF	$0.00	0	$0.00	2
0536- 8-1AB	**Guardrail Transition Connection to Rigid Barrier**	EA	$0.00	0	$0.00	
0542- 70	**Concrete Bumper Guard for Parking Lot**	EA	$0.00	0	$0.00	
0550- 10- ABC	**Fencing, Toll Site Perimeter**	LF	$0.00	0	$0.00	
0550- 60- 2BC	**Fence Gate**	EA	$0.00	0	$0.00	
0630- 2- 11	**Conduit, Furnish & Install, Open Trench**	LF	$0.00	0	$0.00	3
0630- 2- 12	**Conduit, Furnish & Install, Directional Bore**	LF	$0.00	0	$0.00	3
0635- 5- 11	**Pull & Splice Box, Furnish and Install, Tier 15, 24" x 36"**	EA	$0.00	0	$0.00	
0635- 5- 12	**Pull & Splice Box, Furnish and Install, Tier 15, 30" x 48"**	EA	$0.00	0	$0.00	
0635- 5- 13	**Pull & Splice Box, Furnish and Install, Tier 15, 12" x 12"**	EA	$0.00	0	$0.00	
0639- 5- 1	**Emergency Generator - Permanent, Up to 25 KW**	EA	$0.00	0	$0.00	*4*
0639- 5- 2	**Emergency Generator - Permanent, 26-50 KW**	EA	$0.00	0	$0.00	
0639- 5- 31	**Emergency Generator - Permanent, 51-75 KW**	EA	$0.00	0	$0.00	
	Fuel Tank	EA	$0.00	0	$0.00	
0639- 5- 32	**Emergency Generator - Permanent, 76-100 KW**	EA	$0.00	0	$0.00	
	Fuel Tank	EA	$0.00	0	$0.00	
0639- 7- 122	**Electrical Power Service, Toll Site Electrical Metering and Utility Service Entrance**	EA	$0.00	0	$0.00	
0735- 1- ABC	**Toll Gantry, Non-Accessible, Furnish and Install, Cantilever, Span Length XX'**	EA	$0.00	0	$0.00	
0735- 1- ABC	**Toll Gantry, Non-Accessible, Furnish and Install, Span, Span Length XX'**	EA	$0.00	0	$0.00	

0735- 1- ABC	**Toll Gantry, Accessible, Furnish and Install, Span, Span Length XX'**	EA	$0.00	0	$0.00	
0735- 1- 95	**J-arm Assembly, Non-accessible Gantry**	EA	$0.00	0	$0.00	
0735- 1- 96	**J-arm Assembly, Accessible Gantry**	EA	$0.00	0	$0.00	
0735- 74- A	**Toll Plaza *(Toll Site #)***	LS	$0.00	0	$0.00	
	Precast Concrete Structure (TEB)					
	Precast Concrete Structure Foundation					
	Building Finishes					
	Metal Doors and Frames					
	Door Hardware					
	Lightning Protection (UL Master Label)					
	Surface Raceways and Wire Troughs					
	Cable Trays					
	Toll Communications Cabinet (Indoor)					
	Raised Aluminum Support Frame					
	AC System and Associated Condensate System					
	Fuse Cabinet					
	Panelboards					
	Critical Power Panelboards					
	Automatic Transfer Switch					
	UPS with By-Pass Switch					
	Grounding and Bonding for Electrical Systems					
	Security System Infrastructure					
	Supervisory Control and Data Acquisition					
	Lighting Fixtures					
	Surge Protection					
	Toll Equipment Building Conduit					
	Power Conductors and Cables					
	Project Close-Out, Cleaning, Acceptance Procedures					
	As-Builts					
	Manuals, Warranties, and Spare Equipment					
Total Cost					**$0.00**	

Notes:

1. Only include if there is an elevated median concrete barrier with pull boxes.
2. Only include guardrail when it is present for tolls use only.
3. Does not include conduits associated with the toll gantry and toll equipment building lump sum.
4. Select generator matching project scope.

PART 2 - PRODUCTS

"Not Used"

PART 3 - EXECUTION

"Not Used"

END OF SECTION 01 29 73

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies building and site permit acquisition requirements and conditions.

1.2 RELATED WORK

A. The work of the following Standard SpecificationsSections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. SUMMARY OF WORK.....Section 01 11 00
2. TEMPORARY UTILITIES.....Section 01 51 00
3. PROJECT CLOSEOUT.....Section 01 77 00
4. SIGNAGE.....Section 10 14 00
5. FIRE EXTINGUISHERS AND ACCESSORIES.....Section 10 44 16
6. FABRICATED STRUCTURES.....Section 13 34 23
7. GENERAL HVAC REQUIREMENTS.....Section 23 05 00
8. COMMON WORK RESULTS FOR ELECTRICAL .....Section 26 05 00
9. SELECTIVE DEMOLITION .....Section 02 41 16

1.3 BUILDING PERMITS

A. The Florida's Turnpike Enterprise (FTE) is authorized by the Florida Statutes to enforce the Florida Building Code for Toll Collection Facilities. FTE may issue its own building permits for Toll Collection Facilities.

B. FTE has acquired the services of Building Code Administrators (BCA) to perform permitting services for Toll Collection Facilities.

C. The Contractor is responsible for applying for the building and demolition permits and applying for the associated inspections. The Contractor is also responsible for applying for the State Fire Marshal inspections.

D. The Contractor must use the forms listed below which are in the Department's Project Solve software:

1. Building Permit Application

2. Inspection Request Form

3. Inspection Report Form

E. The Contractor must submit the site and building permit documentation in support of the permit applications, to the BCA and State Fire Marshal through the Building Permit Coordinator, to obtain the above permits/certifications.

F. The State Fire Marshal approval and any Building permits must be acquired prior to the start of any building related work. The Contractor is responsible for any at-risk work.

G. Section 109.4 of the Florida Building Code states that work commenced prior to permit issuance is subject to penalties for commencing work prior to a permit being issued.

H. Penalty fees per industry standard are equal to two times the building permit fee and are the responsibility of the Contractor.

I. The Plans and supporting documents and permit procedures are subject to the requirements of the BCA. Shall be subject to the latest adopted edition of "*FTE Toll Facility Code Compliance and Permit Procedures"* which can be obtained from the BCA.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Separate sets of permitting documentation are required for each building site location, including civil, architecture, structural, mechanical, electrical, and plumbing. Construction cost estimates for each building are also required for new building permits.

B. Separate permits are required for demolition of each existing toll facility.

C. All compliance documentation for Toll Collection Facilities such as, construction documents for permitting must be submitted through the Building Permit Coordinator for review by BCA and State Fire Marshall for Plans review and permitting purposes.

D. Submit electronic documents for State Fire Marshal approval. There is a 24MB file size limit for documents to be submitted for State Fire Marshal approval, that will be strictly enforced.

E. The Building Permit Coordinator submits the Plans to BCA and the State Fire Marshal. The Building Permit Coordinator submission information is included in Section 10 of a document labeled FLORIDA'S TURNPIKE ENTERPRISE CONSTRUCTION PRE-SERVICES MANUAL. The document can be accessed by using the link inside the *"FTE Toll Facility Code Compliance and Permit Procedures"* which is located at: https://floridasturnpike.com/business-opportunities/design/tolls-design/.

1.5 PERMITS AND EASEMENTS TO BE OBTAINED BY CONTRACTOR

A. Secure building permits, fire marshal plan approval, fuel tank permits, etc.

1.6 QUALITY ASSURANCE

A. All submitted permit documents, technical special provisions, Plans, calculations, and specifications must be signed and sealed by the professional Architect/Engineer of record registered in the State of Florida.

B. Permit related work shall not commence until after permit issuance.

1.7 RESPONSIBILITY

A. The Contractor shall be responsible for re-inspection fees except for the inspection fees for passed, the first failed and the first work-not-ready inspections.

B. Contractor bears all responsibility for fees pertaining to permit reactivation, permit reissuance, re-inspections, and Red-Flag conditions as defined in the current codes.

C. The Contractor is solely responsible to ensure the permitting and Fire Marshal approval documentation is complete and correct. Although the Building Permit Coordinator and the BCA review the Contractor's documentation, neither shall be responsible for incomplete or incorrect submittals.

D. Permits shall be available for inspection as detailed in the latest adopted edition of the "*FTE Toll Facility Code Compliance and Permit Procedures"* located on the Florida's Turnpike Enterprise public facing website which is located at: https://floridasturnpike.com/business-opportunities/design/tolls-design/ .

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PERMIT ACQUISITION

A. This Section specifies building and site permit acquisition requirements and conditions.

B. Separate submissions shall be made for each toll site.

C. Submit the following documentation for each site to the Building Permit Coordinator.

1. Final Plans of all building and site disciplines (civil, structural, architectural, mechanical, electrical, and plumbing.). This shall include all Plans for the building plus Plans of all associated site work including maintenance pull-off areas, generator, fuel tanks, transformer, and AVI enclosures (if any).

2. Final Technical Special Provision Sections for all building and site disciplines (civil, structural, architectural, mechanical, electrical, and plumbing).

3. Project cost estimate for all vertical construction and adjacent applicable construction for each toll equipment building.

D. Submit electronic PDF delivery of the permitting documentation, for each site.

E. The Building Permit Coordinator shall have ten working days from receipt to review and accept the provided building permitting and Fire Marshal approval documentation per building site. Working day periods shall not include weekends, Holidays, Special Events, and work period shut downs prescribed by all applicable contract documents.

F. Re-submit Plans after addressing Building Permit Coordinator comments. Any re-submissions shall also be subject to the ten-working day review period.

G. Once complete and correct documentation is received the timeframe for issuing permits is as follows:

1. Building permits review shall take up to 30 working days to be issued.

2. Permit issuance after receipt of a complete and accurate permit application shall take up to 10 working days.

3. Fire Marshal approval may require up to 60 working days to be issued.

H. If the documentation submitted is deemed incomplete and/or incorrect, by the BCA, the permitting and approval timeframes specified herein shall re-start once the correct and/or complete documentation is received by the permitting or approving entity.

3.2 PERMIT COMPLIANCE INSPECTIONS

A. Use the Turnpike's ProjectSolve to schedule all inspections.

B. Coordinate all required permitting related inspections though the CEI and the Building Code Administrator.

END OF SECTION 01 41 26

SECTION 01 51 00
TEMPORARY UTILITIES

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish, install, maintain, and protect temporary utilities required for construction of the Gantry and Toll Facility at locations and in a manner that will be safe, non-hazardous, sanitary, and protective of persons and property, and free of deleterious effects.

B. Remove physical evidence of temporary utilities at completion of Work.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with rules and recommendations of franchised utility companies and governing regulations.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials may be new or used, but shall be adequate in capacity for required usage, shall not create unsafe conditions, and shall not violate requirements of applicable codes and standards.

2.2 TEMPORARY UTILITIES

A. Types of services required include, but not by way of limitation, surface drainage, electrical power, lighting, heating, ventilation, and communication.

B. Include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best service the Project's needs.

1. Provide drinking water units supplied with bottled water.

2. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

C. Comply with utility company's recommendations on materials and methods or engage utility companies to install services.

D. Water Used for Construction:

1. Provide potable water adequate for construction.

2. Where non-potable water is used, mark each outlet with adequate health-hazard warning signs.

E. Arrange with electric company and provide service required for power. Provide connections and pay costs of installation, maintenance, operation, removal of service, and power used.

F. Electrical Power:

1. Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, lighting, and start-up testing of permanent electric-powered equipment system.

2. Provide overload protection, disconnect switches, and other required electrical devices.

G. Lighting:

1. Provide sufficient temporary lighting for proper workmanship by combined use of daylight, general lighting, and portable plug-in task lighting.

2. Provide general lighting with local switching which will enable energy conservation during periods of varying activity.

H. Heating and Ventilating:

1. Prior to enclosure, provide heating as necessary to protect work, materials, and equipment against damage from dampness and cold.

2. Provide temporary heat and ventilation as areas are closed-in as necessary to maintain minimum temperature of 55 degrees F (except where higher temperatures are specified in various Technical Special Provision Sections), to facilitate progress of work, to meet specified minimum conditions for installation of materials, and to protect materials and finishes from damage due to temperature or humidity.

3. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.

4. Solid fuel salamanders will not be permitted.

5. Provide connections to existing facilities, where occurring, extent and supplement with temporary units as required to comply with requirements.

2.3 FIRE PROTECTION

A. During construction, provide temporary fire protection in accordance with local Fire Protection Code, governing authorities, and NFPA 10 - Portable Fire Extinguishers.

B. Provide fire extinguishers of types, sizes, numbers, and locations as would be reasonably effective in extinguishing fires during early stages.

C. Take necessary precautions in welding or cutting operations to keep work area free of combustible material.

D. Do not use welding equipment around flammable liquids or vapors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Review site conditions and factors which affect construction procedures and construction facilities, including adjacent properties and public facilities, which may be affected by execution of Work.

3.2 INSTALLATION

A. Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the Work.

B. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities. Maintain and operate systems continuously during entire construction period. Modify and extend systems as work progress requires.

C. Install facilities of neat and reasonable uniform appearance, structurally adequate for required purposes.

D. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced need. Discontinue and

remove temporary facilities and make incidental similar use of permanent work of project, only when and in manner authorized by Engineer and, if not otherwise indicated, immediately before Final Acceptance.

3.3 ENERGY CONSERVATION

A. Install and operate temporary facilities and perform construction activities in manner which reasonably will be conservative and avoid waste of energy and materials including water.

3.4 RESTORATION AND REPLACEMENT

A. Restore existing facilities used for temporary services to specified or to original condition.

B. Use filter in air conditioning units that are operated during construction, maintain filters as necessary, and replace filters upon completion of job.

C. Replace burned out lamps used in permanent fixtures during construction with new lamps.

3.5 CLEANING AND REPAIR

A. Clean and repair damage caused by installation or by use of temporary facilities.

B. Grade area of site affected by temporary installations to required elevations and slopes.

END OF SECTION 01 51 00

SECTION 01 74 23
FINAL CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Final Cleaning of the Toll Site, Toll Gantry and Toll Facility as follows:

1. Provide Final Cleaning of the Work, immediately prior to Final Acceptance, consisting of cleaning each surface or unit of Work to normal "clean" condition expected for a first-class building cleaning and maintenance program. Comply with manufacturer's written instructions for cleaning operations.

2. The following are examples, but not by way of limitation, of cleaning levels required:

a. Remove labels which are not required as permanent labels, including all gum residue.

b. Clean exposed exterior and interior hard-surface finishes, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition. Buff out scratches and marks on exposed metal surfaces.

c. Wipe surfaces of mechanical and electrical equipment clean; remove excess lubrication and other substances.

d. Remove debris and surface dust from limited-access spaces including roofs and similar spaces. Clean tops of ductwork and horizontal surfaces of structural members in exposed areas.

e. Clean concrete floors in non-occupied spaces broom clean. Remove noticeable paint marks and construction stains.

f. Clean light fixtures and lamps so as to function at full efficiency. Replace any damaged lens.

B. Provide final cleaning of the Site as follows:

LEVEL 1

1. Provide Final Cleaning of the Work, immediately prior to Final Acceptance expected for a first-class building cleaning and maintenance program.

2. The following are examples, but not by way of limitation, of cleaning levels required:

   a. Clean areas in accordance with Paragraph A. above for building areas affected by the Contractor for work performed after the Final Acceptance.

   b. Clean Project Site, of litter and foreign substances. Sweep paved areas to a broom clean condition; remove stains, petrochemical spills and other foreign deposits. Rake grounds that are neither planted nor paved, to a smooth, even-textured surface, breaking up or removing clumps of material.

1.2 RELATED WORK

A. PROJECT CLOSEOUT: Section 01 77 00.

PART 2 - PRODUCTS

"Not Used"

PART 3 - EXECUTION

“Not Used”

END OF SECTION 01 74 23

SECTION 01 77 00
PROJECT CLOSEOUT

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. This Technical Special Provision Section specifies general administrative and procedural requirements for Toll Site, Toll Gantry and Toll Facility project closeout. The requirements include, but are not limited to, the following:

1. Toll Site Interim Acceptance and Toll Site Final Acceptance inspection procedures.
2. Project Record Document submittals.
3. Operating instructions and maintenance manual submittals.
4. Submittal of warranties, guarantees, and maintenance agreements.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 1 through 48 of the TSP for Toll Sites with a TEB, and shall be coordinated with this Section

1.2 RELATED WORK

A. SCHEDULE OF VALUES: .....Section 01 29 73.

B. BUILDING PERMITS: .....Section 01 41 26

C. FINAL CLEANING: .....Section 01 74 23

D. GUARANTEES/WARRANTIES/REPAIRS: .....Section 01 78 36

E. RECORD DOCUMENTS, MAINTENANCE MANUALS, AND EQUIPMENT OPERATIONAL INSTRUCTIONS/DEMONSTRATIONS: .....Section 01 78 39

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Pre-Substantial (Verification of) Completion Checklists as listed below are attached at the end of this Section:

1. 01 77 00 Type-1, Toll Site Acceptance Checklist – TEB Non-Accessible Gantry Sites

2. 01 77 00 Type-2, Toll Site Acceptance Checklist – TEB Accessible Gantry Sites

C. Operational Tests and Performance Verification Section 26 05 05.

1.4 TOLL SITE INTERIM ACCEPTANCE

A. Prior to a request for Primary Toll Site Walk-through, complete the following:

1. Verify that all items on the appropriate checklists identified in 1.3 B are completed and all outstanding items are corrected and recorded as complete on the checklist.

2. The roadway pavement surface course and permanent striping in its final alignment for the toll loop pavement area (100 feet of pavement centered on the gantry) are installed and accepted by the Engineer and, the approach and departure roadway is available for the Toll Equipment Contractor:
   a. 3500 feet of roadway at each mainline tolling gantry (2000 feet of approach and 1500 feet of departure).
   b. 2500 feet of roadway at each ramp tolling gantry (1500 feet of approach and 1000 feet of departure) or as length of ramp permits for the TEC testing activities' posted speed.

3. Sodding has been provided per the roadway component plans around each toll site.

B. Complete the Primary Toll Site Walk-Through. Allow five (5) working days for the Engineer to provide a list of any deficiencies. Correct deficiencies identified by the Engineer before proceeding to Operational Testing Walk-Through.

C. Complete the Operational Testing Walk-Through as described in Section 26 05 05 – Operational Tests and Performance Verification. Allow five (5) working days for the Engineer to provide a list of any deficiencies. Correct deficiencies identified by the Engineer before proceeding to Toll Site Interim Acceptance.

D. Prior to Toll Site Interim Acceptance, the following must be completed:

1. Complete clean up requirements. Touch-up and otherwise repair and restore marred exposed finishes on the interior of the building. Complete all touch-up painting in the interior.

2. Upon successful completion of the Operational Testing Walk-Through provide the following to Florida's Turnpike Enterprise (FTE) Toll Systems:
   a. Make final change-over of permanent locks and transmit keys to the Engineer. Advise the Engineer of change-over in security provisions.
   b. Install portable toilets for FTE and TEC use as identified in 01 11 00 – Summary of Work.

E. Allow five (5) calendar days from Toll Site Interim Acceptance for the Engineer to provide a list of any deficiencies. Correct deficiencies identified by the Engineer.

F. Contractor access is prohibited into the tolling site after the TEC has started installation of the tolling equipment.

1.5 FINAL ACCEPTANCE

A. Prior to a request for an inspection for Final Acceptance, maintain the following procedures:

1. Conduct Walk-through inspections in the presence of the Engineer in the month prior to the request for Final Acceptance. Each inspection shall determine outstanding work necessary to meet the Final Acceptance requirements stipulation under this Technical Special Provision. A list of outstanding work required will be updated by the Engineer with the Contractor. The outstanding work list will be reduced progressively from the initial inspection until, in the opinion of the Engineer, the Contractor's work qualifies as to the state of readiness for the formal inspection punch-list prior to Final Acceptance by the Department.

B. Final Acceptance for the Project shall require that the following be accomplished:

1. All record documents, maintenance manuals and equipment operational instructions have been turned over to the Department’s representatives and equipment operational demonstrations have been performed pursuant to Technical Special Provision 01 78 39 - RECORD DOCUMENTS, MAINTENANCE MANUALS, EQUIPMENT OPERATIONAL INSTRUCTIONS/ DEMONSTRATIONS.

2. All punch list items completed and accepted.

3. Remove temporary facilities from the site, along with construction tools and equipment, mock-ups, and similar elements.

4. Turn over extra stock as specified in other Technical Special Provisions to the person designated by Contract.

5. Provide instruction to Department in maintenance of equipment and finishes.

6. Turn over special tools for items such as louver vanes, adjustable dampers, thermostats, allen-head locking devices, to the person designated by the Contract.

PART 2 - PRODUCTS
“Not Used”

PART 3 - EXECUTION

3.1 Toll Site Acceptance Checklist are:

TOLL SITE ACCEPTANCE CHECKLIST
TYPE 1 (TEB NON-ACCESSIBLE GANTRY SITES)

(**ALL** Items must be completed, without deficiencies, and field verified prior to Department acceptance)

Document and report any deficiencies immediately.

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Observations & Issues Noted (start with: Not Started, Work In Progress, or Completed)
A	**GANTRY & ASSOCIATED ELEMENTS**			
1	Tolling Gantry Column & Truss (wireway supports located per Contract Documents).			
2	W-Sections (aka I-Beams or Outriggers).			
3	Horizontal Support Pipes (quantity/size) & Hardware (saddle plates, u-bolts, nuts, & bolts). Spare 4.5" pipes/hardware.			
4	Toll Equipment J-Arms - quantity. J-arms -sizing and tolerances. Spare j-arms/hardware provided.			
5	Toll Equipment J-Arms Hardware (saddle plates, u-bolts, nuts, & bolts).			
6	Measure minimum height above roadway to ensure toll equipment clearances achieved.			
7	Measure maximum height above roadway to ensure toll equipment clearances achieved.			
8	Inspect the Lightning Protection System. The gantry column requires two copper down conductors connected to the gantry base and extended to the ground ring below grade through PVC installed at the gantry foundation. Also each metal wire trough, AVI enclosure, engine generator, fuel tank, and toll building should be connected to the underground lightning protection conductor.			
9	Corrosion Inspection for all equipment and gantry.			
10	Note condition of all hardware assembly, including any signs of galling or any other hardware damage.			
11	Note condition of all hardware for signs of wear/ tear, rust, damage to galvanization etc.			

B	GANTRY ELECTRICAL, WIRE TROUGHS, and AVI READER MOUNTING FRAME			
1	Fittings, couplings, bushings, and reducers at conduit ends have been installed per CDs.			
2	Strut channels have been installed per CDs. Strut channel ends are installed with PVC caps rated for outdoor use by the strut channel manufacturer.	-	-	-
3	Rigid conduit and sweeps have been properly installed and secured to the gantry upright.			
4	Ground mounted power, data, and AVI wire troughs have been installed per CDs.			
5	AVI Reader ground-mounted frame with supporting AVI conduit strut channel supports have been installed per CDs.			
6	Rigid conduit has been installed and properly spaced on the strut channel frames per the CDs. All conduit has been installed with pull ropes and correct associated labels.			
7	Rigid conduit terminations in each cable tray have been properly connected, grounded, and sealed.			
8	Equipment cable trays have been securely mounted to the w-members and terminated per the CDs.			
9	Gantry upright cable trays have been securely mounted to the gantry upright per the CDs.			
10	Longitudinal cable trays with dividers for data, AVI readers, and power are supported per the CDs. Cable trays have been properly connected and grounded with manufacturer approved mounting hardware.			
11	Cable tray waterfall fittings have been properly installed per CDs.			
12	When vertical junction boxes (pencil pull boxes) are shown in the CDs, verify the metallic conduit entering and leaving each vertical junction box (pencil pull box) have been installed and secured to: - Gantry upright and supports - Pencil pull boxes			
13	Conduit runs from upright to roadside and/or median pull box per CDs have been properly installed, secured, and sealed.			

14	AVI Reader frame has been installed per CDs and includes: - Galvanized strut channel - Strut channel mounting hardware - Ground bar with mounting hardware - Grounding conductor bonded to counterpoise			
15	Each AVI Reader's infrastructure (fiberglass enclosure and mounting plate) has been properly installed and grounded.			
C	**LOOP ELECTRICAL INFRASTRUCTURE**			
1	Loop Pavement Constructed and of Correct Length (100ft total length, half before and after the gantry).			
2	Pavement Loop Stub-Ups Installed & with Correct Quantity: Min. - Five 1” stub-ups per loop pullbox.			
3	9” Min. Separation Between Each Stub-up. 6" separation at each stub-up pullbox termination.			
4	9” Distance From Stub-up To the Face of Barrier Wall (asphalt locations). Proper stub-up locations for concrete pavement locations.			
5	Loop Pullboxes Installed & in the Correct Position (see Plans): - Pullbox location provide stub-up placement to enable saw cutting of lead-in wires around loops.			
6	Verify the 3” Interconnect Conduits Between Loop Pullboxes are Installed per Plans.			
7	Four 3” Conduit Home Runs to the Building from Correct Pullboxes.			
D	**GANTRY TO BUILDING ELECTRICAL CONNECTIONS**			
1	For AVI Readers Mounted inside the Building, Wireway shall have: - Proper Support with Brackets & galvanized strut channel support; - Flexible Fittings, Watertight Seal & Aluminum Enclosures Installed. - Dedicated 6" x 6" Wireway for AVI Cables			
2	Verify Correct Size and Quantity of Conduits Installed Below Grade (Data/AVI/Loops & Power): - 4" AVI Conduits - 4" Data Conduits - 2" Power Conduits - 3" Loop Conduits - 1" Power Conduits for AVI Enclosure Electrical			

3	Duct Banks (Data/AVI/Loops & Power) Installed with Separate Pullboxes for Data and Power Conduits.			
4	Duct Banks Encased in Concrete if applicable.			
5	Duct Bank Pullboxes Properly Installed, Labeled, & of Correct Size (see Plans).			
6	If Duct Bank Pullboxes Have Locks (Screwed-In Locks, or other type), Were Locks Provided & of Correct Quantity to Lock All Pullboxes.			
7	Duct Banks (From Fuel Tank & Generator to Building)) Installed with Correct Number of Conduits: - Two 2" from Gen. CKT Board to ATS - Two 1" from EDP to Fuel Monitor and Jacket water Heater - 1" from Battery Charger to Outside Battery - 1" from ATS to Gen Control Panel [redacted]			
8	Photographs of conduit layout before backfill and foundation installation. Does conduit stub-up in building match pre-fab contractor openings?			
9	All salvage materials delivered per contract			
E	**Existing Buildings Only (wall penetration):**			
1	Conduit Duct Bank "Chase" Mounted on Exterior Building Wall Properly Installed, Secured to Wall, & with Correct Number of Conduits: - 4" AVI Conduits - 4" Data Conduits - 2" Power Conduits - 3" Loop Conduits - "1" Power Conduits for AVI Enclosure			
2	Conduit Chase Wire Trough Properly Terminated, Sealed, with Bushing, etc.			
3	Separate Wire Troughs for Data & Power Properly Installed, Secured to Building Wall, & Accommodate Incoming Conduits Properly.			
4	Conduit Penetrations to Building Wall Properly Terminated: - One Penetration Per Duct Bank Conduit. - Penetration Size Same as Duct Bank Conduits. - Penetration is sloped toward exterior of building. - Penetration is Properly Enclosed & Sealed.			

5	Conduit Penetration at Correct Height for Transition into Interior Ceiling Mounted Cable Trays (existing buildings only).			
F	**New Buildings Only (floor penetrations):**			
1	Duct Bank Conduit Stub-Ups in Building Floor Installed, Properly Terminated, with Bushing, etc.			
	TOLL EQUIPMENT BUILDING - ARCHITECTURAL, STRUCTURAL, ELECTRICAL, MECHANICAL AND PLUMBING			
G	**Existing Buildings Only:**			
1	Building Modifications Fully Complete: - Wall Demolitions/Reconstruction/Painting - Window Hardening (enclosing or impact film installation) - Door Replacements or Hardening of Door Glass with Impact Film - Ceiling Modifications - Flooring Modifications (see Architectural plans for further info)			
2	Conduit Chase Encased with Concrete or Shaft of Other Material (applies only to buildings where conduit penetrates front side of building).			
3	Hazardous materials close-out reports - Asbestos abatement close-out report, Abatement contractor's license, color photographs of the abated components (before & after, air monitoring exposure reports, lead-pint abatement reports. Disposal certificates			
4	Visual inspection of building for Mold Complete			
H	**New Buildings Only:**			
1	Pre-Fabricated Building Fully Constructed: - Foundation In Place - Floor Slab Poured (if applicable) - Building Delivered and Installed - Building Connected/Secured to Foundation - Building/Foundation Connection Properly Sealed - Painting of Walls/Flooring			
2	Mold inspection of building for Mold Complete and certifications received			
3	Building Door Installed & with Hardware: - Interior Push Bar/Electrified Lever Trim - RX Tested - Door Contact - Painting of Door			
	EXTERIOR ELECTRICAL			

I	**New Buildings Only:**			
1	Back-Up Power Generator Installed, Tested, and Certified.			
2	Generator Fuel Tank Fully Operational (Installed, Tested, and Fire Marshall Certified).			
3	Ensure the fuel tank is 90% full. The Contractor shall provide a transmittal to the CEI that shows the sulfur content of the diesel fuel, the Cetane number, and the type and amount of biocide added to the fuel.			
4	Utility Power is Installed, Tested and Certified.			
5	Building/Site Lightning Protection Installed, Tested and Certified with Master Label. Existing building(s) may require recertification as well.			
	INTERIOR ELECTRICAL			
J	**New Buildings Only:**			
1	Duct Bank Conduit Stub-Ups in Building Floor Installed, Properly Terminated, with Bushing, etc.			
2	Duct Bank Conduit Stub-Ups Correctly Positioned Per Rack and Conduit Layout (see conduit layout).			
3	Raised metal frame to support tolling cabinets installed and secured to the floor. Also the frame shall be grounded to the concrete encased electrode at each end.			
4	Inspect the grounding electrode conductors at the MDP to ensure compliance with NEC 250. Verify the main bonding jumper is properly installed. Verify the concrete encased electrode is properly installed.			
5	Floor Opening Around Conduits Properly Enclosed & Sealed.			
6	[redacted]			
7	[redacted]			
K	**Both Building Types (New or Existing)**			
1	Main Distribution Panel (MDP), Emergency Distribution Panel (EDP), Stand-by Generator and Automatic Transfer Switch (ATS) Installed, Tested, & Certified. Verify the circuit breakers with adjustable trip unit settings have been set to agree with the time-current curves in the Power Design Analysis Report (PDAR).			

2	Critical Power Panel Installed, Tested, Wired for tolls and comm racks and Certified. - One Panel for Single Tolling Movements. - Two Panels for Multiple Directions of Travel. Verify the circuit breakers with adjustable trip unit settings have been set to agree with the time-current curves in the PDAR.			
3	Critical Power Panels are Powerlink G3 Type.			
4	Critical Power Panel Contains the proper number of 20 Amp single pole breakers and two 20 Amp, 2 pole Breakers.			
5	All Surge Protective devices Installed. Leads shall not exceed 18 inches. Leads shall be gently braided.			
6	UPS units Installed, Tested, and Certified. A Network Interface Card shall be installed and shall be communicating with SCADA. Verify the UPS alarms are being received at the SunWatch located next to Turkey Lake HQ.			
7	UPS Quantity and Model Correct: - One UPS for Single Tolling Movements. - Two UPSs for Multiple Directions of Travel. - One Maintenance Bypass Switch (per UPS) - Size 15KVA.			
8	UPS Phase Matches Incoming Power Phase: - Single Phase or Three Phase.			
9	[redacted]			
10	Cable Trays Installed, Properly Secured to Ceiling, Placed Correctly (see Plans).			
11	Cable Tray Type is 24" Wide & Divided for Data and Power Cables.			
12	Flexible Conduit Drops from Cable Tray to Toll Equipment Racks Installed, Properly Terminated in Cable Tray, & Properly Secured to Cable Tray and Racks.			
13	[redacted]			
14	[redacted]			
15	Building Lighting Installed, Tested, and Certified.			

16	Inspect the building Lightning Protection System. Ensure the system was installed per Plans and Specifications. Verify the installed system is UL 96A Listed. Contractor shall provide the UL 96A certificate. Inspect the building Lightning Protection System. Ensure the system was installed per Plans and Specifications. Verify the installed system is UL 96A Listed.			
	HVAC (Interior/Exterior)			
L	**Both Building Types (New or Existing)**			
1	New interior and exterior HVAC Units Fully Operational (Installed, Tested, & Certified).			
2	Condensate Drain Wells Installed, Tested, & Certified (see Plans).			
3	Exterior Disconnects Installed, Tested, & Certified.			
4	Remote Controller for Dual Unit Control Installed, Tested, and Certified.			
	INTERIOR PLUMBING			
M	**Existing Buildings Only:**			
1	Restroom Fixtures Fully Removed: - Toilets, Sinks, etc. - Toilet/Sink Hook-Ups Sealed & Capped.			
N	**FIBER OPTIC COMMUNICATIONS INFRASTUCTURE & DEVICES**			
1	Communications Rack Properly Installed/Secured in proper location.			
2	Patch Panel Properly Installed in Communications Rack.			
3	Connection from Backbone-to-Building Installed: - Splice Vaults. - Pullboxes. - Conduit, including empty spare. - Tone Wire, (Not installed in Tolls spare conduit). - Warning Tape.			
4	Connection from Backbone-to-Building Installed: - Installed Standard Route Markers as per Standard Specification 630 - Minimum 1 at midpoint, one at each turn (3 minimum)			
5	Fiber Cable Connection from Backbone-to-Building Installed, Tested, & Certified: - 48SM - Termination in Patch Panel Complete.			
O	**RFIs and Shop Drawings**			
1	All RFIs have been answered and accepted			

2	All shop drawings have been submitted and closed out			
3	All CEI submittals as per TSP Section requirements have been received			
P	**CERTIFICATE OF OCCUPANCY**			
1	Obtain Certificate of Occupancy from the Building Code Administrator for the building and site			

TOLL SITE ACCEPTANCE CHECKLIST
TYPE 2 (TEB ACCESSIBLE GANTRY SITES)

(**ALL** Items must be completed, without deficiencies, and field verified prior to Department acceptance)

Document and report any deficiencies immediately.

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Observations & Issues Noted (start with: Not Started, Work In Progress, or Completed)
A	**GANTRY & ASSOCIATED ELEMENTS**			
1	Suspended access stair (gate, latches, operation, handrailing, screening).			
2	All Grating (secured, tighten loose nuts/bolts, cut-out openings to correct size and position, supports in place, deflection).			
3	Facade and Handrailing (post positioning, secured latches, tethers, pins, operation, screening).			
4	Fall arrest system (secured and operational along entire length of gantry).			
5	Gear boxes (secured, positioned per Plans and operational at all maintenance positions).			
6	Quadchord Truss (all bolts fastened per field tolerances).			
7	Toll Equipment J-arms quantity and all physical aspects. J-arms meet tolerances. Spare j-arms/hardware.			
8	Toll Equipment J-arms (Sizing per Plans) & Hardware (saddle plates, u-bolts, nuts, & bolts).			
9	Measure minimum height above roadway to ensure toll equipment clearances achieved.			
10	Inspect the Lightning Protection System. Each gantry column requires two copper down conductors connected to the gantry base and extended to the ground ring below grade through PVC installed at the gantry foundation.			
11	Corrosion Inspection for all equipment and gantry.			

12	Note condition of all hardware assembly, including any signs of galling or any other hardware damage.			
13	Note condition of all hardware for signs of wear/ tear, rust, damage to galvanization etc.			
B	**GANTRY ELECTRICAL, CABLE TRAYS, AND WIRE TROUGHS**			
1	Cable tray and fitting quantities (Data, Power, crossing sections), supported/attached per Plans, secured, loose nuts/bolts, properly connected segments/fittings, any bent elements (side walls/rungs).			
2	[redacted]			
3	[redacted]			
4	AVI Reader Supporting System: Installed per Plans, galvanized strut channel support properly secured/loose nuts, bolts, spacing matches AVI fiberglass enclosure size, cable routing can be secured. Support system is properly grounded.			
5	AVI Readers area lighting and Access Stair lighting and lighting controls, properly installed and operational.			
6	Wireway is properly installed and secured to: - Gantry Truss & Supports - Gantry Column & Supports - Drip fittings installed at vertical to horizontal transition prior to wire troughs. - Missing parts (nuts/bolts/supports per manual/code).			
7	Wireway Transitions properly installed and secured to: - Gantry Truss & Supports - Gantry Column & Supports - Drip fittings installed at vertical to horizontal transition prior to wire troughs.			
8	Wireway Terminations into wire troughs properly installed/secured/sealed for: - Data wire trough - Power wire trough - AVI wire trough			
9	Wire Trough Quantity (Data/Power/AVI/Loops if required), Size, concrete pad around wire troughs per CDs.			

10	Wire Trough Conduit Terminations Properly Sealed & Bushings Installed. Provide the Following Quantities for each Direction of Travel: - (3) 4" Data Conduits - (4) 2" Power Conduits - (2) 4" AVI Conduits			
11	Maintenance and Rope Lighting receptacles, properly installed and operational.			
C	**LOOP ELECTRICAL INFRASTRUCTURE**			
1	Loop Pavement Constructed and of Correct Length (100ft total length, half before and after the gantry).			
2	Pavement Loop Stub-Ups Installed & with Correct Quantity: Min. - Five 1” stub-ups per loop pullbox.			
3	9” Min. Separation Between Each Stub-up. 6" separation at each stub-up pullbox termination.			
4	9” Distance From Stub-up To the Face of Barrier Wall (asphalt locations). Proper stub-up locations for concrete pavement locations.			
5	Loop Pullboxes Installed & in the Correct Position (see Plans): - Pullbox location provide stub-up placement to enable saw cutting of lead-in wires around loops.			
6	3” Interconnect Conduits Connecting Specific Loop Pullboxes Installed and Connects Correct Pullboxes: - Between First-Second & Second-Third Pullboxes. - Between the Last Two Pullboxes.			
7	(4) Four 3” Conduit Home Runs to the Building from Correct Pullboxes.			
8	(4) Four Intermediate Pullboxes to Intercept the Median Loop Pullboxes' Directional Bores, where applicable, (see Plans).			
D	**GANTRY TO BUILDING ELECTRICAL CONNECTIONS**			
1	AVI Conduits ((2) two 4") Termination in Concrete Pad Properly Installed and Sealed. Quantity is per Direction of Travel.			
2	Data Conduits ((3) three 4") Termination in Concrete Pad Properly Installed and Sealed. Quantity is per Direction of Travel.			
3	Power Conduits ((4) four 2") Termination in Concrete Pad Properly Installed and Sealed. Quantity is per Direction of Travel.			

4	Duct Banks (Data/AVI/Loops and Power) Installed with Correct Number of Conduits: - 4" AVI Conduits - 4" Data Conduits - 2" Power Conduits - 3" Loop Conduits			
5	Duct Banks (Data/AVI/Loops and Power) Installed with Separate Pullboxes for Data and Power Conduits.			
6	Duct Banks Encased in Concrete if located beyond the 6" thick sidewalk limits.			
7	Duct Bank Pullboxes Properly Installed, Labeled, and of Correct Size (see Plans).			
8	If Duct Bank Pullboxes Have Locks (Screwed-In Locks, or other type), verify Locks and Correct Quantity are Provided to Lock All Pullboxes.			
9	Photographs of conduit layout before backfill and foundation installation. Does conduit stub-up in building match pre-fab contractor openings?			
10	All salvage materials delivered per contract			
E	**Existing Buildings Only (wall penetration):**			
1	Conduit Duct Bank "Chase" Mounted on Exterior Building Wall Properly Installed, Secured to Wall, & with Correct Number of Conduits: - 4" AVI Conduits - 4" Data Conduits - 2" Power Conduits - 3" Loop Conduits			
2	Conduit Chase Wire Trough Termination Properly Installed, Sealed, with Bushing, etc.			
3	Separate Wire Troughs for Data and Power Properly Installed, Secured to Building Wall, and Accommodates Incoming Conduits per NEC.			
4	Conduit Penetrations to Building Wall Properly Terminated: - One Penetration Per Duct Bank Conduit. - Penetration Size Same as Duct Bank Conduits. - Penetration is sloped toward exterior of building. - Penetration is Properly Enclosed & Sealed.			
5	Conduit Penetration at Correct Height for Transition into Interior Ceiling Mounted Cable Trays (existing buildings only).			
F	**New Buildings Only (floor penetrations):**			
1	Duct Bank Conduit Stub-Ups in Building Floor Installed at Correct Height, Properly Terminated, with Bushing, etc.			

	TOLL EQUIPMENT BUILDING - ARCHITECTURAL, STRUCTURAL, ELECTRICAL, MECHANICAL AND PLUMBING			
G	**Existing Buildings Only:**			
1	Building Modifications Fully Complete: - Wall Demolitions/Reconstruction/Painting - Window Hardening (enclosing or impact film installation) - Door Replacements or Hardening of Door Glass with Impact Film - Ceiling Modifications - Flooring Modifications (see Architectural plans for further info)			
2	Conduit Chase Encased with Concrete or Shaft of Other Material (applies only to buildings where conduit penetrates front side of building).			
3	Hazardous materials close-out reports - Asbestos abatement close-out report, Abatement contractor's licese, color photographs of the abated components (before & after, air monitoring exposure reports, lead-pint abatement reports. Disposal certificates			
4	Visual inspection of building for Mold Complete			
H	**New Buildings Only:**			
1	Pre-Fabricated Building Fully Constructed: - Foundation In Place - Building Delivered and Installed - Building Connected/Secured to Foundation - Building/Foundation Connection Properly Sealed - Painting of Walls/Flooring			
2	Mold inspection of building for Mold Complete and certifications received			
3	Building Door Installed & with Hardware: - Interior Push Bar/Electrified Lever Trim - RX Tested - Door Contact - Painting of Door			
	EXTERIOR ELECTRICAL			
I	**New Buildings Only:**			
1	Back-Up Power Generator Installed, Tested, and Certified.			
2	Generator Fuel Tank Fully Operational (Installed, Tested, and Fire Marshall Certified).			

3	Ensure the fuel tank is 90% full. The Contractor shall provide a transmittal to the CEI that shows the sulfur content of the diesel fuel, the Cetane number, and the type and amount of biocide added to the fuel.			
4	Utility Power is Installed, Tested and Certified.			
5	Building/Site Lightning Protection Installed, Tested and Certified with Master Label. Existing building(s) may require recertification as well.			
	INTERIOR ELECTRICAL			
J	**New Buildings Only:**			
1	Conduit Stub-Ups in Building Floor Installed at Correct Height, Properly Terminated, with Bushing, etc.			
2	Conduit Stub-Ups Correctly Positioned Per Rack and Conduit Layout (see conduit layout).			
3	Raised metal frame to support tolling cabinets installed and secured to the floor. The frame shall be grounded to the concrete encased electrode at each end.			
4	Inspect the grounding electrode conductors at the MDP to ensure compliance with NEC 250. Verify the main bonding jumper is properly installed. Verify the concrete encased electrode is properly installed.			
5	Floor Opening Around Conduits Properly Enclosed and Sealed.			
6	[redacted]			
7	[redacted]			
K	**Both Building Types (New or Existing)**			
1	Main Distribution Panel (MDP), Emergency Distribution Panel (EDP), Stand-by Generator and Automatic Transfer Switch (ATS) Installed, Tested, and Certified. Verify the circuit breakers with adjustable trip unit settings have been set to agree with the time-current curves in the Power Design Analysis Report (PDAR).			
2	Critical Power Panel Installed, Tested, Wired for tolls and comm racks and Certified. - One Panel for Single Tolling Movements. - Two Panels for Multiple Tolling Movements. Verify the circuit breakers with adjustable trip unit settings have been set to agree with the time-current curves in the PDAR.			
3	Critical Power Panels are Powerlink Type.			

4	Critical Power Panel Contains the proper number of 20 Amp single pole breakers and two 20 Amp, 2 pole Breakers.			
5	All Surge Protective devices Installed. Leads shall not exceed 18 inches. Leads shall be gently braided.			
6	UPS units Installed, Tested, and Certified. A Network Interface Card shall be installed and shall be communicating with SCADA. Verify the UPS alarms are being received at the SunWatch located next to Turkey Lake HQ.			
7	UPS Quantity and Model Correct: - One UPS for Single Tolling Movements. - Two UPSs for Multiple Tolling Movements. - One Maintenance Bypass Switch (per UPS) - Size (per CDs).			
8	UPS Phase Matches Incoming Power Phase: - Single Phase or Three Phase.			
9	SCADA Control Panel and all remote sensors are installed and powered from the Critical Power Panel.			
10	Cable Trays Installed, Properly Secured to Ceiling, Placed Correctly (see Plans).			
11	Cable Tray Type is 24" Wide and Divided for Data and Power Cables.			
12	Flexible Conduit Drops from Cable Tray to Toll Equipment Racks Installed, Properly Terminated in Cable Tray, and Properly Secured to Cable Tray and Racks.			
13	[redacted]			
14	[redacted]			
15	Building Lighting Installed, Tested, and Certified.			
16	Inspect the building Lightning Protection System. Ensure the system was installed per Plans and Specifications. Verify the installed system is UL 96A Listed. Contractor shall provide the UL 96A certificate. Inspect the building Lightning Protection System. Ensure the system was installed per Plans and Specifications.			
	HVAC (Interior/Exterior)			
L	**Both Building Types (New or Existing)**			
1	New interior and/or exterior HVAC Units Fully Operational (Installed, Tested, and Certified).			
2	Condensate Drain Wells Installed, Tested, and Certified (see Plans).			

3	Exterior Disconnects Installed, Tested, & Certified.			
4	Remote Controller for Dual Unit Control Installed, Tested, and Certified.			
	INTERIOR PLUMBING			
M	**Existing Buildings Only:**			
1	Restroom Fixtures Fully Removed: - Toilets, Sinks, etc. - Toilet/Sink Hook-Ups Sealed and Capped.			
N	**FIBER OPTIC COMMUNICATIONS INFRASTRUCTURE & DEVICES**			
1	Communications Rack Properly Installed/Secured in proper location.			
2	Patch Panel Properly Installed in Communications Rack.			
3	Connection from Backbone-to-Building Installed: - Splice Vaults. - Pullboxes. - Conduit, including empty spare. - Tone Wire, (Not installed in Tolls spare conduit). - Warning Tape.			
4	Connection from Backbone-to-Building Installed: - Instaled Standard Route Markers as per Standard Specification 630 - Minimum 1 at midpoint, one at each turn (3 minimum)			
5	Fiber Cable Connection from Backbone-to-Building Installed, Tested, and Certified: - 48SM - Termination in Patch Panel Complete.			
O	**RFIs and Shop Drawings**			
1	All RFIs have been answered and accepted			
2	All shop drawings have been submitted and closed out			
3	All CEI submittals as per TSP Section requirements have been received			
P	**CERTIFICATE OF OCCUPANCY**			
1	Obtain Certificate of Occupancy from the Building Code Administrator for the building and site			

END OF SECTION 01 77 00

PART 1 - GENERAL

1.1 SUMMARY

A. This Technical Special Provision Section specifies general administrative and procedural requirements for guarantees, warranties, and related repairs (or replacement) required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of responsibilities in performance of the Work stipulated in the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition, as amended, Article 5-13 - Recovery Rights, Subsequent to Final Payment.

1.2 RELATED WORK

A. PROJECT CLOSEOUT: .....Section 01 77 00

B. RECORD DOCUMENTS, MAINTENANCE MANUALS, AND EQUIPMENT OPERATIONAL INSTRUCTIONS/DEMONSTRATIONS: .....Section 01 78 39

C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in other sections of the Technical Special Provision.

D. Certifications and other commitments and agreements for continuing services to the Department are specified elsewhere in the Technical Special Provision.

1.3 MANUFACTURER AND SUPPLIER WARRANTIES

A. All manufacturer and equipment supplier warranties shall commence on the Date of Final Acceptance of the total Contract as acknowledged in writing by the Department and taken over for use by the Department.

1. Security, AC, Communication, and Standby Power Systems will not be accepted, nor the initiation of warranty start recognized until these systems are functioning properly and acknowledged as accepted in writing by the Department.

B. Written warranties made to the Department are in addition to implied warranties, and shall not limit duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Department can enforce such other duties, obligations, rights, or remedies.

1. Ensure that all warranties comply with these stipulations prior to submission.

C. Repairs: All repairs or replacements resulting from a breach of warranty shall be promptly performed.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit written warranties to the Department prior to the Date of Final Acceptance. If the Department designates a commencement date for warranties other than the Date of Final Acceptance, or a designated portion of the Work, submit written warranties on the Department's request.

B. Warranties shall be submitted properly executed by the supplier or manufacturer, or a combination thereof, as stipulated in other Technical Special Provisions. Warranties shall also be fully identified and contain all appropriate terms and conditions.

C. Provide a bound manual for all manufacturer and equipment supplier warranties required by the Contract Documents. Identify each warranty with proper Technical Special Provision Section.

PART 2 - PRODUCTS
"Not Used"

PART 3 - EXECUTION
“Not Used”

END OF SECTION 01 78 36

SECTION 01 78 39
RECORD DOCUMENTS, MAINTENANCE MANUALS AND EQUIPMENT OPERATIONAL INSTRUCTIONS/DEMONSTRATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Record Documents, Maintenance Manuals, and Equipment Operational Instructions/Demonstrations as follows:

1. The provisions of this Technical Special Provision apply to the maintaining, marking, recording and submitting of Project Record Documents; organizing operating and maintenance data into suitable sets of manuals; and conducting operational instructions and demonstrations for each and every piece of equipment or system furnished under this Contract.

2. Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistive location. Provide access to record documents for the Engineer's reference during normal working hours.

1.2 RELATED WORK

A. The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. PROJECT CLOSEOUT.....Section 01 77 00

2. GUARANTEES/WARRANTIES/REPAIRS.....Section 01 78 36

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Record Documents: At completion of all Work under this Contract, deliver record documents to the Engineer, in duplicate with transmittal, containing as a minimum, the following:

1. Date

2. Project title and numbers

3. Contractor's name and address. Include final list of all subcontractors

4. `Title and number of each record document

5. Certification that each document as submitted is complete and accurate

6. Contractor's signature, or that of his authorized representative

B. Operating Instructions and Maintenance Manuals:

1. Submit three (3) copies of each completed manual on equipment and systems, in final form, to the Engineer for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.

2. Refer to Technical Special Provision Sections for individual requirements on operating and maintenance of the various pieces of equipment and operating systems.

1.4 RECORD DOCUMENTS

A. Record Drawings:

1. Maintain a set of documents that indicates the actual installation and/or location where the installation and/or location varies substantially from the Work as originally shown due to Addenda, Alternates, Change Orders, Field Orders, etc.

2. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

3. Note related Change Order numbers where applicable.

4. Review the completed Project Record Drawings and ascertain that all data furnished on the prints is accurate and truly represents the work as actually installed.

5. The record drawing prints, including those changed and unchanged, shall be submitted to the Engineer for compliance review.

B. Miscellaneous Record Submittals:

1. Miscellaneous record submittals shall include, but not be limited to, the following:

   a. Warranties
   b. Inspection and test reports
   c. Field records
   d. Surveys
   e. Mix records
   f. Inspections by governing authorities

2. Refer to individual Technical Special Provision sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.

3. Immediately prior to date(s) of Final Acceptance, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Department's records.

1.5 AS-BUILT DOCUMENTS

A. The Department shall review, certify, and accept the As-Built Plans prior to issuing Final Acceptance of the project in accordance with the Chapter 5.12 Final As-Built Plans Process of the Construction Project Administration Manual (TOPIC No. 700-000-000).

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

A. Submit complete operating instructions and maintenance manuals for each and every piece of equipment or system furnished under the Contract. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy- duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.

B. Equipment and Systems: Provide the following information for each piece of equipment, for each building operating systems, and each electric or electronic system.

1. Description: Provide a complete description of each unit and related component parts, including the following:

    a. Equipment or system function
    b. Operating characteristics
    c. Limiting conditions
    d. Performance curves
    e. Engineering data and tests
    f. Complete nomenclature and number of replacement parts
    g. Copies of warranties
    h. Copies of inspection and test reports
    i. Wiring diagrams
    j. Recommended "turn around" cycles
    k. Inspection procedures
    l. Shop Drawings and Product Data
    m. Fixture lamping schedule

2. Manufacturer's Information: For each manufacturer of a component part of piece of equipment provide the following:

    a. Printed operating and maintenance instructions
    b. Assembly drawings and diagrams required for maintenance
    c. List of items recommended to be stocked as spare parts

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:

    a. Routine operations
    b. Trouble-shooting guide

c. Disassembly, repair and reassembly
d. Alignment, adjusting and checking

4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:

   a. Start-up procedures
   b. Equipment or system break-in
   c. Routine and normal operating instructions
   d. Regulation and control procedures
   e. Instructions on stopping
   f. Shut-down and emergency instructions
   g. Summer and winter operating instructions
   h. Required sequences for electric or electronic systems
   i. Special operating instructions

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

7. Coordination Drawings: Provide each Contractor's Coordination Drawings.

   a. Provide as-installed color-coded piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

9. Circuit Directories: For electric and electronic systems, provide complete circuit directors of panelboards, including the following:

   a. Electric service.
   b. Controls.
   c. Communication.

PART 2 - PRODUCTS

"Not Used"

PART 3 - EXECUTION

3.1 EQUIPMENT OPERATIONAL DEMONSTRATIONS

A. Prior to Final Acceptance of the whole Work or designated portions thereof, provide a competent and experienced person (or persons) thoroughly familiar with the Work to demonstrate to, and instruct the Department's personnel in operation, adjustment and maintenance of products, equipment and systems.

B. This instruction shall include, but not limited to, normal start-up, run, stop, and emergency operations, location and operation of all controls, alarms and alarm systems. The instruction shall include tracing the system in the field and on the diagrams in the instruction booklets so that the Department's operating personnel will be thoroughly familiar with both the system and the data supplied. Provide instruction at mutually agreed upon times.

1. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.
2. For equipment that requires seasonal operation, provide similar instruction during other seasons.

C. If installers and/or Contractor's personnel are not experienced in operational procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following: (Items listed are examples only and not all inclusive)

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. Similar procedures and facilities

D. As part of instruction for operating equipment, demonstrate the following procedures: (Items listed are examples only and not all inclusive)

1. Start-up
2. Shut down
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

7. Effective energy utilization.
8. Similar operations.

E. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.

F. Engineer shall be notified in writing of scheduling and completion of all equipment operational instructions and demonstrations with Department's personnel.

END OF SECTION 01 78 39

SECTION 02 41 16
SELECTIVE DEMOLITION

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes all labor, materials, equipment, and supervision necessary to complete all selective demolition work including salvage, removal and disposal services required for remodeling, renovation, building demolition, and addition work as indicated on Plans.

1.2 RELATED WORK

A. The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. CUTTING AND PATCHING .....Section 02 41 20

2. HEATING VENTILATING AND AIR CONDITIONING (HVAC): Division 23 Sections for demolishing, cutting, patching or relocating HVAC items

3. ELECTRICAL: Division 26 Sections for demolishing, cutting, patching or relocating electrical items

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 QUALITY ASSURANCE

A. Qualifications of Demolition Contractor:

1. Demolition shall be performed only by a qualified Contractor with at least five (5) years documented experience in operations of a similar nature.

B. Requirements of Regulatory Agencies:

1. Comply with governing local and state safety codes pertaining to demolition work, and the following:
   a. ANSI A10.6 Safety and Health Program Requirements for Demolition Operations.
   b. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations.

2. Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Schedule:

1. Submit schedule for any temporary disconnection of electrical, communication, security, mechanical and/or plumbing service for Department's approval. Such disconnections shall be restricted to outside of normal operating and/or business hours.

1.6 JOB CONDITIONS

A. Condition of Areas:

1. The Department assumes no responsibility for actual condition of areas to be demolished.

B. Protection of Existing Construction:

1. Existing construction adjacent to demolition operations, and those portions designated to remain shall be given maximum protection while demolition work is in process. Damage to these portions shall be repaired or replaced at no additional cost to the Department.

C. Salvage:

1. If indicated or otherwise required by the Department, salvageable items shall include both existing items which shall be removed and relocated to new areas or re-used in existing locations as indicated on Plans; and salvageable items which shall be turned over to the Department for future maintenance. In both cases, salvageable items shall remain the property of the Department and be carefully removed from the structure as work progresses. Items to be salvaged or re-used shall be determined by Engineer and/or Department.

2. Items to be re-used shall be stored in a safe, secure area, and be protected from damage until they are re-installed per Plans. Items which are to be turned over to the Department for future maintenance shall be transported to an area designated by the Department.

3. All salvageable items indicated on Plans to be removed, which are not specifically scheduled for re-use, relocation, or future maintenance, shall become the property of the Contractor and shall be removed from the job site and premises.

D. Hazardous Materials

1. All total demolition, selective demolition, and renovation activities must be coordinated with the FDOT-provided asbestos and lead paint reports. All hazardous materials must be disposed of per all applicable State and hazardous materials handling guidelines.

2. Asbestos containing material (ACM) and lead based paint (LBP) reports may be provided by the FDOT. However, the Contractor is responsible for identifying any areas of the buildings and structures that may need additional assessment. The Contractor is responsible for abatement of ACM and LBP and all costs associated with monitoring and inspection (including FDEP inspection fees, if applicable). The Contractor must provide an asbestos abatement close-out report for each building as required to include:
   a. A copy of the abatement contractor's license and insurance policy
   b. A copy of the scope of work and schedule
   c. A copy of the NESHAP notification to FDEP
   d. A copy of the asbestos abatement contractor's approved work plan
   e. Color photographs of the abated components before and after asbestos abatement
   f. Daily work notes explaining site-specific asbestos abatement activities
   g. Current asbestos worker and supervisor training certifications, physicians' written opinion medical surveillance documents, and current respirator fit test documents for all workers and supervisors performing any asbestos abatement related activities
   h. A copy of the personal breathing zone air monitoring characterizing worker exposure during the asbestos abatement related activities. The data will include a description of the abatement task and the laboratory results
   i. A copy of the clearance testing plan and results
   j. The name and location of the landfill where the asbestos materials are disposed
   k. A copy of the signed and completed waste manifest

E. Protection:

1. Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to adjacent structures, other facilities, and persons.

2. Erect temporary barriers and passageways as required.

F. Utility Services:

1. Existing utilities indicated to remain and to be kept in service, shall be maintained and protected against damage during demolition operations.

2. DO NOT interrupt existing utilities serving occupied or "in-use" facilities, except when authorized in writing by the Department. Provide temporary services during interruptions to existing facilities, as acceptable to the Department.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Posting of Danger Signs:

1. Danger signs shall be conspicuously posted around demolition areas.

B. Access to Demolition Area:

1. With the exception of passageways and ladders for the use of workmen, access to demolition areas shall be entirely closed off at all times.

C. Temporary Shoring:

1. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

2. Strengthen or add new supports when required during progress of demolition.

3.2 PROTECTION

A. Protect existing work that is to remain in place, that is to be re-used, or that is to remain the property of the Department, by temporary covers, shoring, bracing, and supports. Repair items damaged during performance of the work or replace with new. DO NOT overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition or removal work.

3.3 DEMOLITION

A. Remove debris from elevated portions by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Remove structural framing members (if applicable) and lower to ground by method suitable to minimize ground impact or dust generation.

C. Concrete: Cut concrete full depth at junctures with construction indicated to remain, using power- driven saw, then remove concrete between saw cuts.

D. Masonry: Cut masonry at junctures with construction indicated to remain, using power-driven saw, then remove masonry between saw cuts.

E. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished at junctures with construction indicated to remain, then break up and remove.

F. Below-Grade Construction: Abandon foundation walls and other below-grade construction. Cut below-grade construction as indicated on Plans.

G. NO materials shall be dropped (by gravity) to any point.

3.4 FILLING VOIDS

A. If required, foundations and all other items removed shall have resulting void completely filled as follows:

1. Use satisfactory soil materials as defined in ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), consisting of stone, gravel, and sand, free from debris and trash.

2. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, trash and debris.

3. Place fill materials in horizontal layers not exceeding 6-inches in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, but not less than 90 percent density when tested in accordance with ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, unless subsequent excavation for new work is required.

4. After fill placement and compaction, grade surface to meet adjacent contours.

3.5 DUST CONTROL

A. Use temporary enclosures, and other suitable methods to limit dust and dirt rising and scattered in air to lowest practical level.

B. Take appropriate action to check the spread of dust and to avoid the creation of a nuisance in the surrounding area. DO NOT use water.

C. Comply with governing regulations pertaining to environmental protection.

3.6 DISPOSAL

A. Except for all items to be salvaged, all parts of the structures and appurtenances and all materials recovered during their demolition shall become the property of the Contractor; shall be removed from the Project by the Contractor; and disposed of off-site in a legal manner.

3.7 CLEAN-UP

A. Clean adjacent construction and improvements of dust, dirt, and debris caused by demolition operations, to a degree acceptable to the Engineer and/or Department.

B. Return adjacent areas to condition existing prior to start of demolition work.

C. Keep building areas, including exterior, clean and free of debris at all times.

END OF SECTION 02 41 16

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor shall be responsible for all cutting, fitting and patching existing construction affected by and required to complete this Work to include, but not be limited to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of Contract Documents.

5. Provide penetrations of non-structural surfaces for installation of connections and electrical conduit.

1.2 RELATED WORK

A. The work of the following Sections is related to the work of this Section. Other Sections not referenced below may also be related to the proper performance of this work.

1. SELECTIVE DEMOLITION.....Section 02 41 16

PART 2 - PRODUCTS (NOT USED)

2.1 MATERIALS

A. Comply with specifications and standards for each specific product(s) involved.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of Work.

C. Report unsatisfactory or questionable conditions to the Engineer. Do not proceed with work until the Engineer has provided further instructions.

3.2 INSPECTION

A. The Contractor must perform a hose-down test of the wall penetration system once all elements have been patched or sealed.

B. The test must be witnessed and approved by the BCA and the CEI.

C. The Contractor must provide seven calendar days advance notice prior to the hose-down test.

D. Water must be directly hosed on all areas susceptible to water intrusion that were part of the cutting and patching scope. If there is water intrusion in any water amount or any indication thereof, the work will not be accepted.

3.3 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of the Work.

B. Provide devices and methods to protect other portions of Project from damage.

C. Provide protection from elements for that portion of the Project, which may be exposed by cutting and patching work.

3.4 PERFORMANCE

A. Execute cutting and demolition by methods, which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

C. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

D. Replace surfaces airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

E. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes

END OF SECTION 02 41 20

LEVEL 3

SECTION 03 35 00
APPLIED FINISH

PART 1 - GENERAL

1.1 SUMMARY

A. Place an applied finish on all exterior concrete surfaces for pre-engineered precast concrete structure after structure has been erected and is complete in-place.

B. Place an applied finish on all cement plaster surfaces for screen wall enclosure.

1.2 RELATED WORK

A. FABRICATED STRUCTURES ----------Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. All work shall conform to Sections/Indexes of the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition, as amended.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit samples for each type of applied finish on 12-inch x 12-inch plywood panels showing a representative texture and color.

PART 2 - PRODUCTS

2.1 APPLIED FINISH COATING

A. Comply with requirements of Standard Specifications Section 400 – CONCRETE STRUCTURES, Item 400-15.2.6 – Class 5 Applied Finish Coating.

B. Provide the following products for applied finish coatings:

1. Primer: TEX-COTE® SUPER-COTE™ TEXTURED PRIMER as manufactured by Textured Coatings of America, Inc.

2. Top Coat: TEX-COTE® SUPER-COTE™ COOLWALL® as manufactured by Textured Coatings of America, Inc.

C. Texture shall be “medium” and color shall be as indicated on Plans and/or as determined by Department.

PART 3 - EXECUTION

3.1 PREPARATION

A. Precast structure surfaces shall be prepared in accordance with Paragraph 400-15.2.6.3 – Surface Preparation of Standard Specifications Section 400 – CONCRETE STRUCTURES.

3.2 APPLICATION

A. Application shall be prepared in accordance with Paragraph 400-15.2.6.3 – Surface Preparation of Standard Specifications Section 400 - CONCRETE STRUCTURES.

END OF SECTION 03 35 00

SECTION 03 41 00
PRECAST STRUCTURAL CONCRETE

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. The work includes precast structural concrete construction as it relates to the fabrication of the Equipment Building.

B. The work includes concrete bumper guards for parking lots in accordance with FDOT Standard Plan Index 520-001.

1.2 RELATED WORK

A. Standard Specifications Section 346 Structural Portland Cement Concrete

B. FABRICATED STRUCTURES: .....Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers: A company specializing in providing precast prestressed concrete products and services, as shown on the Plans, for at least five years. When requested by the Engineer, written evidence shall be submitted to show experience qualifications and adequacy of plant capability and facilities for performance of contract requirements. Written evidence of plant's established quality control program shall be also submitted for review.

B. Codes and Standards: Comply with the provisions of the governing edition of the following publications. Where provisions are in conflict, the more stringent shall apply.

1. Latest adopted edition of the Florida Building Code including amendments

2. ACI Manual of Concrete Practice

3. PCI Manual for Quality Control, MNL-116

4. AWS D1.1, Structural Welding Code, Steel

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Shop Drawings:

1. Submit shop drawings for approval and do not proceed with fabrication prior to receiving written approval of the Engineer.

2. Shop Drawings shall be complete and shall include a layout plan, fabrication details, reinforcement, strand patterns, connection and anchorage details, member identification marks. The identification marks shall appear on the manufactured units to facilitate correct field placement. Drawings shall be signed and sealed by the responsible Structural Engineer in the State of Florida.

B. Mix Design/Product Data: Submit concrete mix design. Include product data for proprietary materials and items such as reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds and others as requested by the Department and the Engineer of Record.

C. Test Reports: Provide reports on concrete and other materials upon request.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: The provisions of Standard Specifications Section 346 of shall govern unless modified herein.

B. Reinforcing Bars: ASTM A615, Grade 60 and ASTM A706 deformed bars of a USA manufacturer.

C. Anchors and Inserts: Structural steel ASTM A153/A153M hot dipped galvanized.

D. Finish shall be standard finish such as is produced in plastic lined or metal forms. Units with honeycomb, structural defects, "ghosting" of mesh or other reinforcing or other imperfections will, at the discretion of the Engineer, be rejected.

E. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

F. Welded Wire Fabric: ASTM A185, welded steel wire fabric.

G. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, commercial quality, G90 (Z275) coating designation; mill phosphatized.

2.2 CONCRETE MIXES

A. Concrete: Minimum 28-day cylinder strength of 5,000 pounds per square inch of regular weight concrete having a dry density of no more than 150 pounds per cubic foot.

B. Release Strength: Minimum of six tenths of the concrete strength specified in A. above.

C. Use of calcium chloride, chloride ions or other salts is not permitted.

2.3 FORMS

A. Provide forms, subject to Engineer's approval, adequate to provide uniform profiles as required, resulting in uniform surface finishes. Use steel forms for members that are of standard manufacturing. Wood forms may be used for non-standard members.

PART 3 - EXECUTION

3.1 MANUFACTURE

A. Manufacturing procedures and tolerances shall be in general compliance with PCI MNL-116.

B. Framing Members: Provide the members indicated on the Plans.

C. Cutting Strands: Burn strands alternately to minimize torsional effect.

D. Welding Plates for Anchoring Adjacent Members: Install at points to ensure diaphragm action. Install at bearing points to provide anchorage to the supporting members.

E. Openings: Small circular openings (6" or less in dimension) may be core drilled at the site provided their locations do not weaken the structural integrity of the precast member. Make provisions in the shop for all other openings.

F. Finish:

1. Surfaces Not Covered by Forms: Finish top surface with vibrating screed.

2. Formed Surfaces: Surfaces exposed to view must be uniform in color and texture. Finish ends by cutting strands flush and covering with a high strength mortar bonded with an epoxy resin bonding agent. Exterior finish walls of Toll Equipment Buildings shall be per Section 13 34 23.

G. Inspection: Manufacturer of units shall make allowance for actual field dimensions of the structure.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling:

1. Precast concrete members shall be lifted and supported during manufacturing, stockpiling, transporting and erection operations only at the lifting or supporting points, or both, as shown on the shop drawings by specialty engineer, and with approved lifting devices. All lifting devices shall have a minimum safety factor of four.

2. Transportation, site handling, and erection shall be performed with acceptable equipment and methods, and by qualified personnel. Handle at all times in a manner to prevent structural and surface damages. Protect all members from surface contaminates that will prevent bonding or application of finishes.

B. Storage:

1. Store all units off ground.

2. Place stored units so that identification marks are discernible.

3. Separate stacked members by battens across full width of each bearing point.

4. Stack so that lifting devices are accessible and undamaged.

5. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

6. If panel units are to be stored as an assembled building unit, the building must be powered and the air dehumidified.

END OF SECTION 03 41 00

SECTION 05 50 00
METAL FABRICATIONS

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all metal fabrications as indicated on the Plans and/or herein specified. The work includes, but is not limited to, the following:

1. Fuel Tank Anchor Metal Bracket and Straps (SS)

2. Pipe bollards (Galv. Steel) with Sleeves (HDPE)

3. Condenser Support Racks (SS)

4. Miscellaneous Steel Framing and Supports (Galv. Steel)

5. Wall and Corner Guards (SS)

6. Hinge Jamb Guard (Galv. Steel)

7. Condensate Strut Channel & Line Cover (Galv. Steel)

1.2 RELATED WORK

A. PAINTING ..... Section 09 91 00.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction and Standard Plans, latest editions, as amended.

B. Reference Standards: Comply with provisions of the following, unless otherwise indicated or specified:

1. American Institute of Steel Construction (AISC):
   a. AISC Code of Standard Practice for Steel Buildings and Bridges
   b. AISC Specification for Structural Buildings Allowable Stress Design and Plastic Design with Commentary
2. American National Standards Institute (ANSI)
   a. Referenced Standards
3. American Society for Testing and Materials (ASTM)

a. Referenced Standards

4. American Welding Society (AWS)
   a. AWS D1.1 Structural Welding Code - Steel
5. Steel Structures Painting Council (SSPC)
   a. Referenced Standards

C. Qualifications for Welding Work:

1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."
2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within previous twelve (12) months.
   a. If re-certification of welders is required, re-testing will be Contractor's responsibility.
      1) Special care shall be taken to keep welding electrodes free of moisture.

D. Field measurements shall be taken prior to preparation of shop drawings and fabrication, where possible. Trimming and fitting shall be allowed wherever taking field measurements before fabrication might delay the work.

E. Items shall be preassembled in the shop to the greatest extent possible to minimize field splicing and assembly. Units shall be disassembled only as necessary for handling and shipping limitations. Disassembled units shall be clearly marked for reassembly.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit manufacturer's product data for paint products.

B. Shop Drawings: Submit shop drawings for fabrication and erection of metal fabrications. Include Plans, elevations, details of sections and connections, anchorages and accessory items. Provide templates for anchor and bolt installations.

C. Welding Certifications:

1. Submit certificates for welding procedures and personnel.
2. Submit certificates to the Department's Commercial Inspection Agency for review prior to submittal to the Engineer for review.

1.5 PRODUCT DELIVERY AND STORAGE

A. Materials shall be delivered to the site undamaged and shall be stored and protected from the elements by covering them in plastic. All material damaged prior to Final

Acceptance shall be removed from the Site and replaced at no additional cost to the Department.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: For metal fabrications work which will be exposed to view, only materials which are smooth and free of surface blemishes such as pitting, seam marks, roller marks, rolled trade names and roughness shall be used.

B. Steel Plates, Shapes and Bars: Conform to ASTM A36

C. Steel Pipe: Conform to ASTM A53, Type S, Grade B, Schedule 40, black finish unless galvanizing is required

D. Galvanized Metal Sheet: Conform to ASTM A366/366M. Finish to conform to ASTM A123/A123M

E. Stainless Steel Sheets: ASTM A480

F. Stainless Steel Miscellaneous: Provide 18-8, 304, or 316 unless noted otherwise

2.2 FASTENERS

A. General:

1. Zinc-coated fasteners shall be used for exterior locations or built into exterior walls wherever possible.
2. Fasteners and connections shall be welded wherever possible.

B. Nuts and bolts shall be a regular hexagon type conforming to ASTM A307, Grade A

C. Lag bolts shall be square head type conforming to ASME B18.2.1

D. Machine screws shall be cadmium plated steel conforming to ASME B18.6.3

E. Wood screws shall be flat head carbon steel conforming to ASME B18.6.1

F. Washers shall be round, carbon steel conforming to ASME B18.22.1

G. Masonry anchorage devices shall be expansion shields conforming to ASTM E 488

H. Toggle bolts shall be tumble-wing type conforming to Federal Specification (FS) FF-B-588, type, class, and style as required

I. Lock washers shall be helical spring-type carbon steel conforming to ASME B18.21.1

J. See 2.1-F for stainless steel fastener requirements

2.3 PAINT

A. Shop Primer for Ferrous Metals: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universally modified alkyd primer complying with performance requirements selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry firm containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035A (SH) or SSPC-Paint 20.

C. Dissimilar Metals Coating, from the APL or:

1. “Eck Corrosion Protective Coating"; Eck Company.
2. “Ship-2-Shore Industrial Thick Film” by Ship-2-Shore Corrosion Protective Coatings.

2.4 FINISHES

A. General:

1. Comply with NAAMM “Metal Finishes Manual” for recommendations relative to application and designation of finishes.
2. Finish metal fabrications after assembly.

B. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process in compliance with the following requirements:

1. ASTM A153 for galvanizing iron and steel hardware.
2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products.

C. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with the minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exterior: SSPC-SP 6 “Commercial Blast Cleaning.”
2. Interior: SSPC-SP 3 “Power Tool Cleaning.”

D. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete or masonry, unless otherwise indicated.

Comply with requirements of SSPC-PA 1 “Paint Application Specification No. 1" for shop painting.

2.5 FABRICATION

A. Miscellaneous Steel Framing and Supports:

1. Miscellaneous steel framing and supports which are not a part of structural steel framework shall be galvanized and provided as required to complete the work indicated on Plans. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise indicated, fabricate structural steel shapes, plates, and steel bars of galvanized, welded construction, using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
    a. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish cast-in-place inserts if units are required to be installed after concrete is placed.
    b. Submit any frame changes required to accommodate equipment approved in shop drawing phase if there are deviations from the basis of design.

B. Corner Guards - Surface Mounted as depicted in the toll facility plans: Extruded one-piece unit without splices, installed with screws:

1. Material: Type 304 stainless steel, No. 4 finish
2. Thickness: 18 gage, 0.05 inch
3. Width of Wings: 1-1/2 inches
4. Styles: Provide 90 degree corners and wall end protectors
5. Length: 48 inches, one piece
6. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate. Screws to be stainless steel for use in pre-drilled, counter-sunk holes.
7. Fabricate components with tight joints, corners and seams
8. Pre-drill holes for flush attachment

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which the metal fabrications are to be installed. Do not proceed until the unsatisfactory conditions have been corrected in an acceptable manner.

3.2 INSTALLATION

A. Materials of type, size and thickness shown shall be used, or if not shown, of required size and thickness to produce adequate strength and durability in the finished product. Metal shall be well formed to shape and size with sharp lines and angles.

B. Exposed work shall be formed true to line and level with accurate angles and surfaces and straight sharp edges. Exposed edges shall be eased to a radius of 1/32 inch unless otherwise shown. Bent metal corners shall be formed to the smallest radius possible without causing grain separation, or otherwise impairing work.

C. All corners and seams shall be welded continuously, complying with AWS recommendations. At exposed connections, exposed welds shall be ground smooth and flush to match and blend with adjoining surfaces.

D. Shearing and punching shall leave clean, true lines and surfaces. Curved work shall be evenly sprung.

E. Exposed connections shall be formed with hairline joints, flush and smooth, using concealed fasteners wherever possible. Exposed fasteners shall be of the type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts shall be used.

F. Anchoring devices shall be fabricated and spaced to provide adequate support for the intended use.

G. Metal fabrications shall be cut, reinforced, drilled and tapped, as required, to receive finish hardware and similar items.

H. All steel fabrications to be installed in exterior locations (outside the building) shall be galvanized as specified.

I. All metal fabrications shall be installed as shown on the Plans and adjusted to satisfactorily function for the purpose intended.

3.3 ADJUST AND CLEAN

A. All exposed surfaces shall be left clean and free from all blemishes or discolorations after erection.

END OF SECTION 05 50 00

SECTION 06 10 00
ROUGH CARPENTRY

LEVEL 2

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Types of work in this Section include, but are not limited to, rough carpentry for:

1. Wood grounds, nailers, and blocking.

2. Plywood backing.

3. Decay and termite resistant wood treatment.

1.2 RELATED WORK

A. FABRICATED STRUCTURES ..... Section 13 34 23.

B. SBS MODIFIED BITUMEN ROOFING SYSTEM.....Section 07 53 50.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with provisions of the following, unless otherwise indicated or specified:

1. American Forest & Paper Association (AFPA):
   a. Manual for Wood Frame Construction.

2. American Lumber Standards Committee (ALSC):
   a. Board of Review.

3. APA - The Engineered Wood Association (APA):
   a. APA Standard Grading Rules.
   b. Form No. E30K - APA Design/Construction Guide: Residential & Commercial.

4. American Society for Testing and Materials (ASTM):
   a. Reference Standards.

5. American Wood Preservers' Association (AWPA):
   a. Reference Standards.

6. Federal Specifications (FS):
    a. Reference Standards. U.S. Department of Commerce (DOC), National Institute of Standards and Technology:
    b. Referenced Product Standards (PS).

7. Southern Pine Inspection Bureau (SPIB):
    a. SPIB Standard Grading Rules.

8. Coast Lumber Inspection Bureau (WCLIB):
    a. WCLIB Standard Grading Rules.

9. Western Wood Products Association (WWPA):
    a. WWPA Standard Grading Rules.
    b. Recommended Nailing Schedule.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data for Treated Lumber: Submit treatment plant's data showing the lumber type, certification by the treating plant stating chemicals and process used, net amount of treatment retained, and conformance with applicable standards. Include a statement that moisture content of treated materials was reduced to a maximum of 19 percent prior to shipment to the Site.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Maintain materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

B. For lumber and plywood pressure treated with waterborne chemicals, provide space between each course to provide air circulation.

1.6 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, plates, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber Standards, General:

1. Manufacture lumber to comply with DOC PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by ALSC Board of Review.

2. Factory mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade species, moisture content at time of surfacing, and mill.

3. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by DOC PS 20, for moisture content specified for each use.

4. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

B. Grounds, Blocking, Nailers, Blocking, and Similar Members:

1. Grounds, nailers, blocking, and similar members shall be standard grade light framing size lumber of any species or board size lumber as required. No. 2 Common or Standard grade boards per WCLIB or WWPA rules, or No. 2 boards per SPIB rules.

C. Plywood Panels:

1. Comply with DOC PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels and, for products not manufactured under PS 1 provisions, with APA Form No. E30K.

2. Factory mark each construction panel with APA trademark evidencing compliance with grade requirements.

3. Finish plywood panels at interior of Toll Equipment Buildings shall be AB Marine Grade non-fire rated and have a paintable surface. The type A surface is to be exposed.

D. Fasteners and Anchorages:

1. Provide size, type, material, and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

2. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating pursuant to ASTM A153.

E. Decay and Termite Resistant Wood Treatment:

1. All lumber and plywood specified for decay and termite resistant treatment shall be pressure treated according to AWPA Standard P-5 and FS TT-W-550. Preservatives containing arsenic are NOT acceptable.

2. Products: Provide one of the following treatments or approved equal:
   a. “Wolman® E” Copper Azole; Arch Treatment Technologies, Inc. Lonza.
   b. “Preserve” ACQ; Viance, Inc.
   c. “NatureWood"; Koppers Performance Chemicals

2.2 WOOD TREATMENT

A. Decay and Termite Resistant Wood Treatment: Chemicals shall be applied in a closed cylinder by vacuum-pressure process in strict accordance with manufacturer’s instructions and with the approved standards and recommended treating practices as listed in AWPA Standards C2 and C9 or the appropriate AWPA standard covering the commodity treated and as listed in FS TT-W-571.

1. After treatment and before shipment, lumber 2" nominal or less shall be dried to a 15-19 percent moisture content.

2. Plywood shall be dried after treatment and before shipment to moisture content of 18 percent or less.

B. Provide decay (termite) of the following lumber:

Location – Toll Equipment Building	Treatment (General)
Wood members in contact with concrete, used in connection with roofing, furring for interior plywood panels on ceiling and walls, or exposed to moisture	Decay (Termite)

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which rough carpentry work is to be installed. Do not proceed with rough carpentry work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Material with defects, which might impair the quality of the work, and units which are too small to fabricate with a minimum of joints or the optimum joint arrangement, shall be discarded.

2. All rough carpentry work shall be set accurately to required levels and lines, with members plumb and true, and accurately cut and fitted.

3. All rough carpentry work shall be securely attached to substrates by anchoring and fastening as shown, and as required for structural adequacy.

4. Fasteners shall be of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Tight connections shall be made. Fasteners shall be installed without splitting of wood; predrill as required.

5. Use washers where required for fasteners to avoid movement of material through loading and/or vibration.

6. Seal cut ends where exposed to moisture or where moisture could migrate via gravity, capillary action, expansion or pressure gradients.

B. Wood Grounds, Nailers, and Blocking:

1. Wood grounds, nailers, and blocking shall be installed where indicated on the Plans, and wherever required for screeding or attachment of other work. Shapes shall be formed as shown and cut as required for true line and level of work to be attached.

2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work.

C. Plywood Panels:

1. Comply with applicable recommendations contained in APA Form No. E 30K for types of plywood panels and applications indicated.

2. Fastening Methods: Fasten panels as follows, in strict accordance with the Florida Building Code:
   a. Backing Panels: Screw to supports.
   b. Fasteners must be countersunk, flush with the plywood surface, concealed with appropriate wood filler and lightly sanded to produce a smooth uniform finish.

3. Install with A-side exposed and joints butted flush. Smooth out all fasteners.

END OF SECTION 06 10 00

SECTION 07 21 00
THERMAL INSULATION

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Provide rigid insulation on interior face of exterior walls as indicated on Plans and specified herein.

1.2 RELATED WORK

A. FABRICATED STRUCTURES .....Section 13 34 23.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Submit samples and product data for each type of insulation.

1.4 PRODUCT HANDLING, DELIVERY, AND STORAGE

A. Deliver products in unopened containers. Provide adequate storage.

B. Deliver materials to the job site in original unopened packages, clearly marked with product brand name and manufacture's labels. Store under cover and protect from weather and construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Polyisocyanurate Board Insulation: ASTM C1289, Type I, Class 1 or 2, foil faced, with maximum flame-spread and smoke-developed indices of 75 and 450, respectively. Provide thickness to achieve “R” value indicated on Plans.

1. Manufacturers – Provide products by one of the following or approved equal:
   a. Dow Chemical Company.
   b. Atlas Roofing Corporation.
   c. Rmax, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install insulation in strict accordance with manufacturer's published instructions.

END OF SECTION 07 21 00

SECTION 07 26 16
BELOW-GRADE VAPOR BARRIER

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install an under-slab vapor barrier located under all concrete floor slabs within building line.

1.2 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit manufacturer's published descriptive literature, including typical details and installation instructions, for vapor barrier membrane, mastic, and tape.

1.3 DELIVERY AND STORAGE

A. Packaged Materials: Deliver materials in bundles, rolls, and sealed containers bearing the manufacturer's original labels. Store materials in an enclosed area free from contact with soil and weather and maintain at not less than 50 degrees F for at least 24 hours before use. If material is dated for use or "shelf life" is indicated on the labels, all outdated material shall be removed from the Site.

PART 2 - PRODUCTS

2.1 VAPOR BARRIER MATERIALS

A. Vapor Barrier Membrane: Comply with the following:

1. Membrane Material: Flexible plastic or plastic laminate membrane, minimum 10.0 mils in thickness.

2. Products: Provide one of the following vapor barrier membranes or approved equal:
   a. “Moistop Underslab”; Henry, A Carlisle Company
   b. “Griffolyn Type 65G”; Reef Industries.,

B. Mastic: Comply with the following:

1. Provide mastic compound as recommended by the membrane manufacturer.

C. Tape: Double-sided pressure sensitive tape with release paper. Suitable as a durable field seam around penetrations in the vapor barrier membrane and to join membrane sheets together

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which the under-slab vapor barrier is to be installed. Do not proceed with vapor barrier work until unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Apply directly to compacted earth base, under concrete slabs, one layer of the vapor barrier membrane. Maintain 6-inch side laps and 9-inch end laps; turn down membrane 12-inches at slab/wall intersections.

B. Laps shall be fully sealed with mastic in strict accordance with manufacturer's published instructions for application procedures and limitations for temperature and setting time.

C. Additional strips shall be used at penetrations of membrane to close openings in membrane. Set in mastic.

D. Extreme care and precaution shall be exercised after membrane has been applied to prevent punctures, tears, and other abuses. Should such vapor barrier damage occur, repair the membrane by application of a membrane patch, sized to lap 9-inches on all sides of the damaged area, and set in a full bed of mastic.

END OF SECTION 07 26 16

SECTION 07 53 50
SBS MODIFIED BITUMEN ROOFING SYSTEM

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install a multi-ply SBS modified bitumen roofing system, including cover board, rigid insulation, composition flashing and stripping and roofing accessories, as indicated on the Plans and specified herein.

B. Sheet metal materials included as work of this Technical Special Provision are specified under Technical Special Provision 07 60 00 - FLASHING AND SHEET METAL.

1.2 RELATED WORK

A. GUARANTEES/WARRANTIES/REPAIRS.....Section 01 78 36.

B. ROUGH CARPENTRY .....Section 06 10 00.

C. THERMAL INSULATION.....Section 07 21 00.

D. FLASHING AND SHEET METAL .....Section 07 60 00.

E. FABRICATED STRUCTURES .....Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Product Compliance: The roofing system shall have a State of Florida Product Miami Dade Control Notice of Acceptance (NOA) and meet all requirements of the Florida Product Approval System as required by Florida Statute 553.842 and Florida Administrative Code 9B-72.

B. Installer's Qualifications: A single Installer, with a minimum of five years successful documented experience, with at least five (5) roofs installed using roofing systems similar to that required for this Project.

1. Installer shall be approved by the roofing system membrane manufacturer prior to bidding and throughout the life of the installation. Submit evidence of this approval.

C. Manufacturer’s Qualifications:

1. Minimum of ten (10) years documented experience manufacturing SBS modified bitumen roofing membranes.

D. Codes and Standards: Comply with provisions of referenced codes and standards for the following, unless otherwise indicated or specified:

1. Florida Building Code, Latest Adopted Edition, as amended.

2. American Society for Testing and Materials (ASTM).

3. Factory Mutual Global (FMG).

4. Federal Specifications (FS).

5. National Roofing Contractors Association (NRCA).

6. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).

7. Underwriters' Laboratories, Inc. (UL) or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7 to provide procurement flexibility.

1.4 PERFORMANCE CRITERIA

A. UL Class A Roof System requirements and FMG Class I Roof System for designated wind load per FMG Loss Prevention Data Sheet 1-28, “Wind Loads to Roof Systems and Roof Deck Securement.”

B. Provide roof covering materials bearing UL Classification Marking on bundle, package and/or container indicating that materials have been produced under UL's Classification and Follow-up Service.

C. Comply with the following testing procedures:

1. Florida Building Code Test Protocol TAS 105-Test Procedure for Field Withdrawal Resistance Testing.

2. Florida Building Code Test Protocol TAS 114-Test Procedures for Roof System as the High Velocity Hurricane Zone Jurisdiction.
    a. Appendix A-Test Procedure for Above Deck Combustibility ASTM E108.
    b. Appendix C-Test Procedure for Simulated Uplift Pressure Resistance of Roof System Assemblies.
    c. Appendix E-Test Procedure for Corrosion Resistance of Fasteners, Batten Bars and Stress Distribution Plates.
    d. Appendix F-Test Procedure for Susceptibility to Hail Damage for Roof Systems Assemblies.

3. Florida Building Code Test Protocol TAS 117 (A) -Test Procedure for Withdrawal Resistance Testing of Mechanical Fasteners Used in Roof System Assemblies.

4. Florida Building Code Test Protocol TAS 117 (B) - Test Procedure for Dynamic Pull-Through Performance of Roofing Membranes Over Fastener Heads or Fasteners with Metal Bearing Plates.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, installation instructions and current recommendations for each type of roofing product required. Include data substantiating that materials comply with specified requirements.

1. Provide Material Safety Data Sheets for roofing system components.

B. Shop Drawings: Submit shop drawings indicating as a minimum, the following:

1. Typical parapet details and flashing details for all structures.

C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the standard roofing manufacturer's warranty.

D. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of meeting performance requirements.

2. State of Florida Approved Product Certificates.

E. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.

1. Indicate compliance of bulk roofing asphalt materials delivered to Project with requirements. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.

2. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported before final heating and application on roof.

F. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

G. Qualification Data: For Installer.

H. Research/Evaluation Reports: State of Florida Product Control Notice of Acceptance for roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranty: Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

L. Manufacturer's Qualifications:

1. Submit manufacturer's qualification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weathertight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F.

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

D. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer’s written instructions for handling, storing, and protecting during installation.

1.7 PROJECT CONDITIONS

A. Environmental Requirements: Proceed with roofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

1.8 WARRANTY

A. Manufacturer's Roofing Warranty: Provide roofing membrane manufacturer's premium No Dollar Limit (NDL) Warranty agreement including flashing endorsement, signed by an authorized representative of roofing system manufacturer, on form which was published as of date of Contract Documents.

1. Flashing endorsement to, but not by way of limitation, the manufactured coping specified in Technical Special Provision 07 60 00 - FLASHING AND SHEET METAL.

2. Warranty Duration: Fifteen (15) years from the date of Final Acceptance.

B. Refer to Technical Special Provision 01 78 36 - GUARANTEES/WARRANTIES/ REPAIRS for additional requirements.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM DESCRIPTION - GENERAL

A. The roofing system in general, consists of the following:
1. Cover board and rigid insulation boards adhered to structural concrete roof deck substrate.
2. Roof membrane base and top ply heat weld applied to cover board.
3. Flashing membrane base and top ply heat weld applied to roofing membrane and heat weld applied and mechanically fastened to low parapet.

B. Roofing system components that contain asbestos material shall NOT be permitted on this Project.

2.2 MEMBRANE COMPONENTS

A. Roof Membrane:

1. Base Ply: Composed of selected SBS modified bitumen onto a non-woven polyester reinforcement with a thermofusible film on both the underside and topside surfaces. Comply with ASTM D6164, Type 1, Grade S.
   a. Nominal Thickness: 120 mils.
   b. Application Technique: Heat Weld.

2. Top Ply: Composed of selected SBS modified bitumen onto a non-woven polyester reinforcement with a thermofusible film on the underside surface and a colored topside surface. Comply with ASTM D6164, Type 1, Grade G.
   a. Nominal Thickness: 160 mils.
   b. Granule Color: "White".
   c. Application Technique: Heat Weld.

B. Flashing Membrane:

1. Base Flashing Ply: Composed of selected SBS modified bitumen onto a non-woven polyester reinforcement with a thermofusible film on both the underside and topside surfaces. Comply with ASTM D6164, Type 1, Grade S.
   a. Nominal Thickness: 120 mils.
   b. Application Technique: Heat Weld.

2. Top Flashing Ply: Composed of selected SBS modified bitumen onto a non-woven polyester reinforcement with a thermofusible film on the underside surface and a colored topside surface. Comply with ASTM D6164, Type 1, Grade G.
   a. Nominal Thickness: 160 mils.
   b. Granule Color: "White".
   c. Application Technique: Heat Weld.

2.3 COVER BOARD

A. Fiberglass mat-faced, gypsum core cover board conforming to ASTM E136.

2.4 RIGID ROOF INSULATION BOARD

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer’s standard sizes and thicknesses indicated or as required by State of Florida Energy Code.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, felt or glass fiber mat facer on both major surfaces.

2.5 INSULATION AND COVER BOARD ADHESIVE

A. High Velocity® Insulation Adhesive PG highly elastomeric one-step (two part), VOC compliant foamable adhesive.

2.6 ACCESSORIES

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing system.

B. Primer: Roofing manufacturer’s recommended primer for use on concrete, metal or wood substrates where heat welded application is used.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FMG 4470; designed for fastening membrane components to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

D. Sealant Materials: Provide polyurethane joint sealants as specified herein for sealing joints in metal flashings, counterflashings, copings, and thru-wall scuppers; comply with ASTM C920. Color as selected by Department from manufacturer's standard line.

1. Joint Backing: Closed cell polyethylene in round or square shape. Non-staining, non-absorbent and capable of at least 30 percent recovery.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match thicknesses of insulation required.

C. Do not proceed with installation until after the minimum concrete curing period recommended by roofing system manufacturer. Test concrete substrate for excessive moisture using methods recommended by roofing system manufacturer.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing."

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Shingling Plies: Install roofing system with ply sheets shingled uniformly to achieve required number of membrane plies throughout. Shingle in direction to shed water.

D. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSULATION AND COVER BOARD INSTALLATION

A. Coordinate installing roofing system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation and cover board.

C. Install one or more layers of insulation and cover board under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

E. Attached Insulation and Cover Board - Concrete Decks: Install a layer(s) of insulation and cover board and secure to substrate using insulation adhesive applied in ribbons as required by adhesive manufacturer for purpose intended and as indicated on Plans.

3.5 ROOF MEMBRANE INSTALLATION

A. General: Install roof membrane over area to receive roofing, according to manufacturer's written instructions. Extend roof membrane over and terminate beyond cants.

1. Unroll sheets and allow to relax for the minimum time period required by manufacturer.

B. Modified Bituminous Membrane: Install two plies of modified bituminous membrane, starting at low point of roofing system.

1. Adhere base and top ply to insulation substrate using heat weld method applied as required by roofing system manufacturer.

C. Laps: Accurately align sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

1. Repair tears and voids in laps and lapped seams not completely sealed.

2. Apply granules, while asphalt is hot, to cover asphalt bead exuded at laps.

D. Install modified bituminous membranes with side laps shingled with slope of roof deck where possible.

3.6 FLASHING AND STRIPPING INSTALLATION

A. Install modified bituminous membrane base flashing over sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:

1. Prime substrates with primer as required by roofing system manufacturer.

2. Base Ply Flashing Application: Install base ply flashing membrane and adhere to substrate using heat weld application.

3. Top Ply Flashing Application: Heat weld apply modified bituminous membrane base flashing to substrate.

B. Extend base flashing up the wall a minimum of 8 inches above roof membrane and 6 inches onto field of the top ply roofing membrane.

C. Mechanically fasten top of modified bituminous membrane base flashing securely at terminations and perimeter of roofing.

1. Seal top termination of base flashing.

D. Install modified bituminous stripping where metal flanges and edgings are set on membrane roofing, according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Engineer.

1. Notify Department and Engineer 48 hours in advance of the date and time of inspection.

3.8 PROTECTING AND CLEANING

A. Protect membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Department and Engineer.

B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Final Acceptance and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures required by manufacturer of affected construction.

END OF SECTION 07 53 50

SECTION 07 60 00
FLASHING AND SHEET METAL

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of flashing and sheet metal work includes the furnishing and installation of all rain gutters and downspouts for the Work, complete as indicated on the Plans and herein specified.

1.2 RELATED WORK

A. GUARANTEES/WARRANTIES/REPAIRS: .....Section 01 78 36.

B. SBS MODIFIED BITUMEN ROOFING SYSTEM: .....Section 07 53 50.

C. FABRICATED STRUCTURES: .....Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications: Flashing and sheet metal work shall be fabricated by a qualified sheet metal fabricator with at least five (5) years documented experience in installations of a similar nature.

B. Reference Standards: Comply with provisions of the following, unless otherwise indicated or specified:

1. American Architectural Manufacturers Association (AAMA):
   a. Referenced Standards.

2. American Society for Testing and Materials (ASTM):
   a. Referenced Standards.

3. Factory Mutual Global (FMG):
   a. Referenced Standards.

4. Federal Specifications (FS):
   a. Referenced Standards.

5. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   a. Referenced Standards.

C. Performance Requirements:

1. Wind Uplift Resistance: Installation of all sheet metal work shall comply with FMG 1-90 wind uplift requirements in FMG Loss Prevention Data Sheet 1-28, “Wind Loads to Roof Systems and Roof Deck Securement.”

2. The assembly must conform to the Florida Building Code requirements for Certification of Exterior Products and Materials (Notice of Approval).

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit complete product data, including manufacturer’s material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

B. Shop Drawings: Complete shop drawings shall be prepared for all flashing and sheet metal work fabrication, assembly, and attachment details, size of all members, fastening devices, supports and anchors, patterns, clearances, and all necessary connections to work of other trades.

C. Installer’s Qualifications: Submit documented evidence of installer’s qualifications.

D. Warranty: Submit specimen copy of specified warranty.

1.5 HANDLING AND STORAGE

A. Sheet metal materials shall be carefully handled to prevent damage to surfaces, edges, and ends; and shall be stored at the site above the ground in a covered, dry location. Damaged items that cannot be restored to original condition will be rejected and shall be replaced at no additional cost to the Department.

1.6 PROJECT CONDITIONS

A. Coordinate work of this Technical Special Provision with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.7 WARRANTY

A. Finish Warranty: Provide manufacturer's standard fifteen (15) year written performance warranty. Refer to Technical Special Provision 01 78 36 – GUARANTEES/ WARRANTIES/REPAIRS for additional requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized (Hot-Dipped) Sheet Metal Material:

1. Galvanized (hot-dipped) sheet rain gutters and downspouts, and all miscellaneous sheet metal items indicated on Plans shall be fabricated to shapes detailed on Plans.

2. Galvanized steel sheet shall comply with ASTM A 653, G90, commercial quality, for hot-dip galvanized steel sheet, mill phosphatized where indicated for painting. Provide minimum 24 gauge material thickness, unless otherwise indicated on Plans.

3. Finish:

a. Provide manufacturer's standard fluoropolymer 2-coat thermocured coating system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.

1) Color to be selected by Department.

b. Products, Resin Based Coating Systems: Provide one of the following fluoropolymer (cool metal) coating systems or approved equal:

1) "Hylar 5000"; Solvay Group.

2) "Kynar 500"; Arkema Group, Inc.

2.2 FABRICATION

A. Shop fabricate work to greatest extent possible, with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work.

B. Form work to fit substrates. Comply with material manufacturer’s published instructions and current recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces that are to receive sheet metal work shall be even, smooth, sound, thoroughly clean and dry, and free from defects that might affect their application.

3.2 INSTALLATION

A. Install sheet metal fabrications as required for the work.

B. Perform cutting, fitting, drilling, and other operations as required to complete the work. Accessories and other components necessary to complete the work, whether or not specifically indicated or specified, shall be provided. Where sheet metal abuts or extends into adjacent materials, the juncture shall be executed in a manner to ensure weathertight construction.

C. Manufactured items shall be installed in strict accordance with manufacturer's published instructions.

D. All surfaces exposed to view shall be installed using continuous cleats to provide no visible fasteners.

3.3 CLEAN UP

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

END OF SECTION 07 60 00

SECTION 07 92 00
JOINT SEALANTS

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. This Technical Special Provision includes the furnishing and installation of joint sealants as indicated on the Plans and herein specified.

1.2 RELATED WORK

A. METAL DOORS AND FRAMES: Section 08 11 00.

B. PAINTING: Section 09 91 00.

C. FABRICATED STRUCTURES: Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: The Installer shall have a minimum of five (5) years continuous documented experience in the application of the types of materials required and approved or licensed by the manufacturer to install elastomeric sealants required for this Project.

B. Product Testing: Obtain test results for test reports required as submittals from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

3. Test other joint sealants for compliance with requirements indicated by referencing standard specification and test methods.

C. Performance Requirements: Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit complete manufacturer's technical data for each manufactured item. Include the following:

1. Certification that each product to be furnished is recommended for the application shown.

2. Complete instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.

B. Qualification Data: For Installer and testing agency.

C. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.5 PRODUCT DELIVERY AND STORAGE

A. Deliver all products to the Project site undamaged, and in the manufacturer's original packing. Store products within the manufacturers' published temperature tolerances.

1.6 ENVIRONMENTAL CONDITIONS

A. Do not install joint sealant materials when the ambient and substrate temperatures are below 40 degrees F, unless the manufacturer specifically recommends application of materials at lower temperatures. If Project progress or any other condition requires installations when ambient and substrate temperatures are below 40 degrees F (or below the minimum installation temperature recommended by the manufacturer), consult the manufacturer's representative and establish the minimum provisions required to ensure satisfactory work. Record in writing to the manufacturer, with a copy to the Engineer, the conditions under which such installation must proceed, and the provisions made to ensure satisfactory work.

B. Do not proceed with installation of bulk compounds during inclement weather unless the full compliance with all requirements and manufacturer's published instructions. Do not proceed with the installation of elastomeric sealants under extreme temperature conditions which would cause joint openings to be at either maximum or minimum width, or when such extreme temperatures or heavy wind loads are forecast during the period required for initial or nominal cure of elastomeric sealants. Whenever possible, schedule the

installation and cure of elastomeric sealants during periods of mean temperatures (nominal joint width shown) so that subsequent stresses upon the cured sealants will be minimized.

PART 2 - PRODUCTS

2.1 GENERAL

A. Hardnesses indicated and specified are intended to indicate the general range necessary for overall performance. The manufacturer's technical representative shall determine the actual hardness recommended for the conditions of installation and use. Except as otherwise indicated or recommended, compounds shall be provided within the range of hardness (Shore A, Fully cured, at 75 degrees F) of 25 to 40.

B. Prior to installation of each specified sealant, confirm its compatibility with the joint surfaces, joint fillers, and other materials in the joint system. Only materials that are known to be fully compatible with the actual installation conditions, as shown by manufacturer's published data or certification, shall be provided.

2.2 SEALANTS

A. Exterior Sealants: Sealants for exterior locations and all interior and exterior expansion joints shall be cold-applied elastomeric joint sealant, which is a two-part polyurethane sealant complying with ASTM C 920.

1. Products, Horizontal Joints:Provide one of the following Type M (multicomponent), Class 25, Use T (traffic) sealants or approved equal:
    a. “Urexpan NR-200"; Pecora Corporation.
    b. "Vulkem 245"; Tremco.
    c. "Sonolastic SL 2"; Sonneborn, Div. of ChemRex Inc.

2. Products, Vertical Joints: Provide one of the following Type M (multicomponent), Class 25, Use NT (nontraffic) sealants or approved equal:
    a. "Dynatrol II"; Pecora Corporation.
    b. "Vulkem 227"; Tremco.
    c. "Sonolastic NP 2"; Sonneborn, Div. of ChemRex Inc.

B. Interior Sealants: Sealants for interior locations shall be acrylic latex sealant compound, non-staining, non-bleeding, paintable, complying with ASTM C 834.

1. Products: Provide one of the following sealants or approved equal:
    a. "AC-20+"; Pecora Corporation.
    b. "Sonolac"; Sonneborn, Div. of ChemRex Inc.
    c. "Tremflex 834"; Tremco.

2.3 MISCELLANEOUS MATERIALS

A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by the sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

C. Backer Rods: Provide closed-cell, expanded polyethylene backer rods. The size and shape of the rod shall be that which will control the joint, form optimum shape of sealant bead on the back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when the joint is compressed.

1. Basis of Design: "Ethafoam"; Sealed Air Corp or approved equal.
    a. HBR, by Nomaco Foam Products
    b. Kool-Rod, by W. R. Meadows, Inc

2.4 COLORS

A. For concealed joints, provide manufacturer's standard color from the product that has the best overall performance qualities for the application shown. For exposed joints, the Engineer will select colors from the manufacturer's standard or premium line of colors from the product that provides the match to the materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer’s written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.

4. Clean metal and similar nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint sealant manufacturer, based on prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 JOINT SEALANT INSTALLATION

A. General: Comply with joint sealant manufacturers' published instructions, unless more stringent requirements are shown or specified, or the manufacturer's technical representative recommends otherwise.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Prime or seal joint surfaces as indicated or recommended by the sealant manufacturer. Do not spill or allow primers or sealers to migrate onto adjoining surfaces.

D. Install sealant backer rods for all elastomeric sealants, unless indicated to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

E. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly, or as indicated on the Plans.

F. Employ only proven installation techniques that will ensure sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Unless otherwise indicated, fill sealant joints to a slightly concave surface and slightly below adjoining surfaces. Where horizontal joints occur between a horizontal surface and a vertical surface, fill joints to form a slight cove, so that the joint will not trap moisture and dirt.

1. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

G. Install sealants to depths indicated, or if not indicated, as recommended by the sealant manufacturer, but within the following general limitations measured at the center (thin) section of the bead.

1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposure, fill joints to a depth equal to 75 percent of the joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.

2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, Fill joints to a depth equal to 50 percent of joint width, but not more than 3/8 inch nor less than 1/4 inch.

3. For joints sealed with non-elastomeric sealant compounds, fill joints to a depth in the range of 75 percent to 115 percent of the joint width.

H. Do not permit joint sealant materials (primers, sealers, or sealants) to spill onto adjoining surfaces, or be allowed to migrate into the voids of adjoining surfaces including rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces.

I. Promptly remove excess sealant from surfaces adjacent to joints as the work progresses. Clean adjoining surfaces as necessary to eliminate evidence of spillage, without damage to the adjoining surfaces or finishes.

3.4 CURE AND PROTECTION

A. Cure sealants in compliance with the manufacturer's published instructions and current recommendations to obtain high early bond strength, internal cohesive strength, and surface durability.

B. The installer shall advise the Contractor of procedures required for the curing and protection of sealants compounds during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering), at the time of Final Acceptance.

END OF SECTION 07 92 00

SECTION 08 11 00
METAL DOORS AND FRAMES

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all flush steel door(s) and steel door frame(s) as indicated on the Plans and herein specified.

1.2 RELATED WORK

A. JOINT SEALANTS: Section 07 92 00.

B. DOOR HARDWARE: Section 08 71 00.

C. PAINTING: Section 09 91 00.

D. FABRICATED STRUCTURES: Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Product Compliance: Steel doors and frame assemblies shall have a Miami-Dade County Product Control Notice of Acceptance (NOA) or comply with requirements of the Florida Product Approval System as required by Florida Statute 553.842 and Florida Administrative Code 9B-72.

B. Manufacturer: Provide steel doors and frames manufactured by a single firm specializing in the production of this type of work.

C. Design Criteria: Comply with the following: Thermal Design Criteria: Fabricate all exterior door assemblies as thermal insulated door and frame assemblies, tested in accordance with ASTM C 236. Provide thermal-rated assemblies with a minimum U-Factor of 0.24.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit manufacturer's technical information and installation instructions for each type of door and frame. Include core description, construction details, and finishes.

B. Shop Drawings: Submit shop drawings for the fabrication and installation of the steel doors and frames. Drawings shall include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware, and reinforcements and details of joints and connections showing anchorage and accessory items.

1. Include a schedule of doors and frames using the same opening numbers referenced on the Plans and the same schedule format.
2. Submit shop drawings as a package with the submittals for other doors and finish hardware to facilitate a coordinated review.
3. Shop drawings shall indicate accurate dimensions of work shown. Frame returns shall allow for conditions (i.e., whether 5/8-inch gypsum board; or exposed masonry as scheduled). Except where otherwise shown, provide a 1/4-inch sealant space for each jamb and head abutting wall materials.
4. List and locate all items of finish hardware furnished under Technical Special Provision 08 71 00 – DOOR HARDWARE but prepared for by the manufacturer of steel doors and frames, from templates provided by the hardware supplier.
5. Include a copy of Miami-Dade County Product Control Notice of Acceptance (NOA) with shop drawing submittal.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect doors and frames during transit, storage, and handling to prevent damage, soiling, and deterioration.

B. Package each door at the factory in a separate heavy paper carton. Mark each carton for location to correspond with the shop drawings.

C. Ship welded frames in bundles securely strapped or in packages.

D. Store doors and frames at the building site under cover. Store frames in an upright position. Place the units on minimum 4-inch-high wood sills or on floors in a manner to prevent rust or damage. Avoid the use of non-vented plastic or canvas shelters that may create a humidity chamber. If the wrapper on the door becomes wet, remove the carton immediately. Provide a 1/4-inch air space between the doors to promote air circulation.

1.6 PROJECT CONDITIONS

A. Measurements: Obtain and verify all measurements at the buildings as required to properly fabricate and install all special door and frame requirements if and when they occur. Verify all conditions which may affect door installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Regent Series, Hurricane Resistant Doors and Frames as manufactured by Ceco Door ASSA ABLOY.

B. Products of the following manufacturers or an approved equal, are acceptable provided they are in compliance with Technical Special Provision requirements and contract plans:

1. [redacted]
2.
3.

2.2 STEEL FRAMES

A. [redacted]
B.
C.
D.

2.3 STEEL DOORS

A. [redacted]

1. [redacted]

B. [redacted]

1. [redacted]

2. [redacted]

3. [redacted]

4. [redacted]

2.4 FINISH

A. Shop Applied Finish:

1. Apply a primed finish to all galvanized and non-galvanized metal surfaces furnished under this Technical Special Provision. Clean and chemically treat metal surfaces to assure maximum paint adherence; follow with a dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer on all exposed surfaces.

2. Finished surfaces shall be smooth and free from irregularities and rough spots. Paint shall be baked or oven dried. The time and temperature for drying shall be in accordance with manufacturer's recommendations for developing maximum hardness and resistance to abrasion.

B. Paint Finish: Finish painting of steel doors and frames is specified under Technical Special Provision 09 91 00 - PAINTING.

2.5 HARDWARE PROVISIONS AND REINFORCING

A. Hardware Provisions for Pressed Steel Frames:

1. [redacted]
2.
3.
4.
5.

B. Hardware Provisions for Steel Doors:

1. [redacted]
2.
3.
4.
5.

C. Location of Hardware: The location of hardware in connection with hinged and other swing type hollow metal doors and frames shall be as follows, unless indicated or specified otherwise:

1. Top Hinge: To manufacturer's standard, but not greater than 5 inches from head rabbet to top of hinge.

2. Bottom Hinge: To manufacturer's standard but not greater than 10 inches from finish floor to bottom of hinge.

3. Intermediate Hinge: Equally spaced between top and bottom hinge. Confirm this requirement with the specified exit device so as not to interfere with exit device installation and operation.

4. Locks: 38 inches from finish floor to center of strike.

5. Refer to Technical Special Provision 08 71 00 - DOOR HARDWARE for additional locations.

D. Anchors:

1. [redacted]

2.

2.6 WORKMANSHIP

A. All work shall be shop fabricated to required profiles by forming and welding with corners, angles and edges straight and sharp.

B. Fit and fabricate accurately with corners, joints, seams and surfaces free from warp, buckles or other defects.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which steel doors and frames are to be installed. Do not proceed with steel door and frame installation until all unsatisfactory conditions have been corrected.

3.2 DOOR AND FRAME INSTALLATION

A. General: Install standard steel doors, frames and accessories in accordance with approved shop drawings, manufacturer's data and as herein specified.

B. Steel Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames," unless otherwise indicated.

1. Set frame in precast wall during fabrication. Set frames accurately in position, plumbed, aligned, and braced securely until concrete is set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

2. Anchors shall be located at the hinge and strike levels.

C. Steel Doors: Fit steel doors accurately in frames, within clearances specified in SDI-100 "Recommended Specifications for Standard Steel Doors and Frames."

3.3 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after installation, sand smooth all rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

C. Cleaning: Immediately prior to final inspection and before Final Acceptance, remove all protective materials and clean all exposed members. Thoroughly clean all glass, including` removal of manufacturer's labels or any other material or substance on the glass, in the event this has not been performed at a prior time. Cleaning shall be performed by the use of cleaning materials and methods which will not damage the glass or surroundings in any way.

1. Do not use abrasives or harmful cleaning agents.

END OF SECTION 08 11 00

SECTION 08 71 00
DOOR HARDWARE

LEVEL 3

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work covered by this Section consists of furnishing and installing all finish hardware as shown on the Plans, indicated on schedules, and as specified herein.

1. All hardware on accessible doors shall meet or exceed the requirements of the Americans with Disabilities Act (ADA) whether or not full compliance is indicated in the Hardware Schedule located at the end of this Section.

1.2 RELATED WORK

A. GUARANTEES/WARRANTIES/REPAIRS: .....Section 01 78 36.

B. METAL DOORS AND FRAMES: .....Section 08 11 00.

C. ACCESS CONTROL SYSTEM: .....Section 28 05 14

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the latest adopted editions of the following:

1. Florida Administrative Code, Chapter 13D-1.

2. Florida Building Code, latest adopted edition as amended.

3. Door and Hardware Institute (DHI):
   a. Referenced Standards.

4. National Fire Protection Association (NFPA):
   a. NFPA 80.....Standard for Fire Doors and Other Opening Protectives.
   b. NFPA 101.....Life Safety Code, latest adopted edition as amended.

B. Installer Qualifications: An experienced installer who has completed finish hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.4 SUPPLIER QUALIFICATIONS

A. Finish Hardware shall be furnished by one supplier, with appropriate technical knowledge and experience to correctly interpret Plans and Specifications. Supplier shall be prepared at all times during progress of installation to promptly provide a qualified Architectural Hardware Consultant (AHC) to approve its complete installation, in order that all items shall be installed in the best manner and function properly. This will necessitate a project site visit prior to final inspection. Supplier shall be bona-fide direct distributor of all materials furnished.

B. It shall be the supplier's responsibility to furnish hardware in accordance with the intent of this specification. Where, by virtue of architectural design or by function, a change is necessary, hardware of equal design and quality shall be furnished upon written approval by the Engineer.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit complete product data for each item of finish hardware listed in the Finish Hardware Schedule. Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Hardware Schedule: Submit complete typewritten sets of the Hardware Schedule. Organize the Hardware Schedule into door hardware sets indicating complete designations of every item required for each door. Organize door hardware sets in the same order as in Paragraph 3.3 – DOOR HARDWARE SCHEDULE. No factory order shall be placed for finish hardware items until approval has been given by the Engineer.

1. Each item in the Hardware Schedule shall be identified on the first page of the Schedule by the manufacturer’s name and part number.

C. [redacted]

D. Supplier Qualifications: Submit documented evidence of supplier’s qualifications.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Finish Hardware shall be delivered to the Project site, or as otherwise specified.

B. All items of Finish Hardware shall be packaged, numbered, and labeled to identify each opening for which it is intended, and to correspond with item numbers on the approved Finish Hardware Schedule.

1.7 COORDINATION

A. Templates: All finish hardware to be installed on, or in metal doors and/or frames, shall be manufactured to template. Template machine screws shall be furnished for all such materials. Supplier shall furnish an approved Finish Hardware Schedule and all necessary template transmittals to metal frame fabricators, or other suppliers requiring same, for their coordination and use.

B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to building systems, including power supplies.

PART 2 - PRODUCTS

2.1 GENERAL

A. An asterisk (*) after a manufacturer's name denotes whose product designation is used in the DOOR HARDWARE SCHEDULE for purposes of establishing minimum requirements.

B. Other than those doors that are restricted to less than 180 degrees opening by building or by overhead holders or stops, all butts and closer arms shall be of sufficient size to allow full 180-degree opening of doors.

C. All door hardware shall be consistent and coordinated with the selected manufacturers to ensure the hardware is compatible and all warranties are valid.

2.2 FINISHES

A. Butts - Exterior:.....US32D

B. Push, Pull, and Kick Plates: US32D

C. Lock Guard US32D

D. Butts - Interior:.....US26D

E. Exit Devices:.....US26D

F. Door Stops and Miscellaneous: US26D

G. Locks:..... [redacted]

H. Closers: .....SBL

2.3 LOCATIONS

A. Hardware locations dimension shall be as follows:

1. [redacted]

2.

2.4 BUTT HINGES

A. [redacted]

B.

C.

D.

E. Provide butt hinges by one of the following manufacturers, meeting the requirements of the Contract Documents, or an approved equal:

1. [redacted]

2.

3.

4.

5.

2.5 LOCKSETS

A. Locksets shall be furnished in the functions as specified in the hardware sets.

B. Levers, escutcheons, locksets and cylinders shall be the products of one manufacturer.

C. [redacted]

D.

E. Basis of Design:

1. [redacted]

F. [redacted]

G.

2.6 KEYING/KEY CONTROL SYSTEM

A. Cylinders shall be furnished by Schlage Manufacturing Company. Temporary cores and keys shall be furnished for use during construction. Cylinder to be Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. [redacted]

2.

B. Permanent Cores: To be provided by the Department.

1. [redacted]

C. Permanent Keying System: To be provided by the Department:

D. Temporary Keys: Provide nickel-silver keys complying with the following:

1. [redacted]

2.

E. Permanent cores and keys shall be provided by the Department.

F. In addition, the Contractor must keep a log of all small miscellaneous keys, including but not limited to generator covers, power panels, and AC lock out boxes. These keys and log must be turned over to the Florida's Turnpike Enterprise Loss Prevention Manager prior to Project closeout.

2.7 PANIC HARDWARE (EXIT DEVICE)

A.

B.

1.

2.

3.

4.

5.

6.

2.8 DOOR CONTACT AND POWER TRANSFER DEVICE

A.

1.

B.

1.

2.9 CLOSERS

A.

B. All closers shall be provided with limited opening resistance to meet handicap requirements.

C. Furnish drop plate brackets where required.

D. Closer at exterior doors shall be installed on the inside of the building.

E. Products: Provide one of the following door closers or an approved equal meeting the requirements of the basis of design:

1. [redacted]
2.
3.
4.

2.10 DOOR TRIM

A. Products: Provide the following door trim items by one of the manufacturers specified herein:

B. Kick Plates:

1. [redacted]
2.
3.

C. Jamb Guards:

1. [redacted]

2. The guards shall be shop fabricated from ¼" thick galvanized steel plates.

3. The plates shall be galvanized after fabrication.

4. Paint the jamb guards to match the interior wall color.

D. Lock Guard:

1. [redacted]

2. [redacted]

3. [redacted]

2.11 WEATHER-STRIPPING

A. General: Continuous weather-stripping shall be installed at each edge of every exterior door leaf. Provide non-corrosive fasteners as recommended by manufacturer for application indicated. Include door top protection (drip caps) for exterior doors where scheduled or as required.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Weather-stripping at Jambs and Heads: Bumper-type resilient inserts and metal retainer strips, surface-applied. Extruded aluminum retainer, natural anodized finish; closed cell EPDM sponge neoprene insert, except vinyl insert for door shoes.

D. Products: Provide one the following products:

1. [redacted]

2. [redacted]

2.12 THRESHOLDS AND DOOR BOTTOMS

A. General: Extruded aluminum units, vinyl insert, of type, size and profile as shown or scheduled. Provide thresholds at labeled doors where required by Code, whether specified or not. Product shall be one of the following manufacturers or approved equal.

B. Products, Thresholds: Provide one of the following:

1. [redacted]
2. [redacted]

C. Products, Threshold Elevators: Provide one of the following:

1. [redacted]
2. [redacted]

D. Products, Door Bottoms: Provide one of the following:

1. [redacted]
2. [redacted]

2.13 DRIP CAPS

A. Install on all exterior doors not under cover as scheduled.

B. Products: Provide one of the following:

1. [redacted]
2. [redacted]

2.14 PROXIMITY CARD READERS

A. See Section 28 05 14 - ACCESS CONTROL SYSTEM for additional door hardware requirements.

2.15 FASTENERS

A. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Preparation: Comply with the following:

1. Steel Doors and Frames: Builders Hardware Manufacturers Association (BHMA) standards designated ANSI/BHMA A156 series of standards for builders hardware products.

B. Mount hardware units at heights indicated in the following publication, except as specifically listed herein under Paragraph 2.3 LOCATIONS.

1. Steel Doors and Frames: Comply with ANSI/BHMA A156 series of standards for builders hardware products.

C. Install each hardware item in compliance with the manufacturer's published instructions and current recommendations. Coordinate removal, storage, and re-installation or application of surface protection with finishing work specified in Division 09. Also coordinate with Sections 09 91 00 – PAINTING and 08 11 00 – METAL DOORS AND FRAMES where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way.

Do not install surface-mounted items until finishes have been completed on the substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

D. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

E. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

F. Clean adjacent surfaces soiled by hardware installation. Clean operating items as necessary to restore proper function and finish.

3.3 DOOR HARDWARE SCHEDULE

A. The following Hardware Sets apply to the Toll Equipment Buildings and are based on door location types as indicated. Refer to Plans for specific door numbers, sizes, types, and swings.

[redacted]

Exit Device to Include:

1. [redacted]
2. [redacted]

END OF SECTION 08 71 00

SECTION 09 65 00
RESILIENT BASE

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install resilient base complete as indicated on the Plans and herein specified.

1.2 RELATED WORK

A. PAINTING: Section 09 91 00.

1.3 QUALITY ASSURANCE

A. Installer's Qualifications:

1. Installation shall be performed only by a qualified installer with at least five (5) years documented experience in installations of a similar nature.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data:

1. Submit manufacturer's technical data for resilient base.

2. Maintenance Instructions:
   a. Submit manufacturer's recommended maintenance practices for resilient base.

3. Installer Qualifications:
   a. Submit documented evidence of installer’s qualifications.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original unopened containers with manufacturer's brand name and color clearly marked thereon, and store in conformity with manufacturer's recommendations.

1.6 PROJECT CONDITIONS

A. Maintain minimum temperature of 65 degrees F in spaces to receive resilient base for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Stored resilient base materials in spaces where they will be installed for at least 48 hours before beginning installation.

B. Install resilient base after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Resilient Base:

1. 4 inch-high vinyl base, 1/8 inch gage, cove base, ASTM F 1861, Type TV, with matching end stops and preformed or molded corner units.

2. Products: Provide one of the following resilient bases or an approved equal; color as selected by Engineer:
   a. Johnsonite, Tarkett Inc.
   b. Roppe Corp.
   c. VPI Floor Products.

3. Use cove base profile.

B. Adhesives (Cements):

1. Waterproof stabilized type as recommended by base manufacturer to suit material and substrate conditions.

C. Patching Compound:

1. Latex type as recommended by base manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect wall surfaces to determine that they are satisfactory for resilient base installation. Wall surface shall be smooth and free from cracks, holes, ridges or coatings preventing adhesive bond, and other defects impairing performance or appearance.

B. Do not allow resilient base work to proceed until wall surfaces are satisfactory.

C. Do not start work until painting has been completed.

3.2 PREPARATION

A. Use patching compounds as recommended by resilient base manufacturer for filling small cracks, holes and depressions in wall surfaces to receive base.

B. Remove coatings from wall surfaces that will prevent adhesive bond, including compounds incompatible with resilient base adhesives, paint, oils, waxes and sealers.

3.3 INSTALLATION

A. Installation General:

1. Install resilient base using method indicated in strict compliance with manufacturer's printed instructions. Extend resilient base into spaces, reveals, and similar openings.

B. Installation of Base:

1. Apply wall base to walls where base is indicated and/or required. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to substrate throughout length of each piece with continuous contact, using weights as necessary, at horizontal and vertical surfaces.

2. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

3.4 CLEANING AND PROTECTION

A. Do not wash base until time period recommended by resilient base manufacturer has elapsed to allow resilient base to become well-seated in adhesive.

B. Damp-mop base being careful to remove black marks and excessive soil.

C. Remove excess adhesive or other surface blemishes, using appropriate cleaner recommended by resilient base manufacturer.

D. Protect base against damage during construction period to comply with resilient base manufacturer's directions.

E. Replace all damaged base at no cost to Department.

3.5 EXTRA STOCK

A. Deliver stock of maintenance materials to Department. Furnish maintenance materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.

1. Resilient Base: 4-foot length of type installed.

END OF SECTION 09 65 00

SECTION 09 91 00
PAINTING

LEVEL 2

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This Section includes the surface preparation and application of painting and related work in locations indicated on the Plans and specified herein.

1.2 RELATED WORK

A. APPLIED FINISH: Section 03 35 00

B. METAL FABRICATIONS: Section 05 50 00.

C. JOINT SEALANTS: Section 07 92 00.

D. METAL DOORS AND FRAMES: Section 08 11 00.

E. FABRICATED STRUCTURES: Section 13 34 23.

F. COMMON WORK RESULTS FOR HVAC: Section 23 05 00.

1.3 QUALITY ASSURANCE

A. All surfaces of fabricated items that are left unfinished by the requirements of other Sections shall be painted under this Section. All work specified in this Section shall be in addition to shop and mill coats, priming and field coats which are specified in other Sections.

B. Perform all touching up of shop coats and field coats of paint on structural steel and miscellaneous steel or iron as required and/or specified.

C. Aluminum, steel, stainless steel, copper, bronze, chromium plating, nickel, monel metal (nickel alloys), lead, lead coated copper and other surfaces with factory finishes shall not be painted or finished, except as otherwise specified.

D. Remove and re-finish or otherwise correct in a manner approved by Engineer all work under this Section which peels, crazes, blisters, fails to adhere or otherwise fails to properly serve its intended purpose at no additional cost to the Department.

1.4 PRODUCT DELIVERY AND STORAGE

A. All materials shall be delivered to the Project site in manufacturers' sealed packages, with labels intact.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit manufacturer’s product data for each type of product used.

B. Samples: Submit three (3) sets of full color chip line for each type of paint specified, for color selection(s) by the Engineer.

C. Draw Downs: Provide three (3) stepped draw downs, defining each separate coat, including block fillers and primers, for each color and material to be applied.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All ready-mixed paints shall be first-line (best quality grade) retail products. The use of lead-containing paint is NOT permitted.

B. Thinners and additives shall be of types recommended by the paint manufacturer.

C. Products: Paint materials and systems specified in subsection 3.10 are produced by Sherwin-Williams (S-W). Subject to compliance with requirements, equivalent paint materials and systems by one of the following manufacturers or an approved equal are also acceptable:

1. Benjamin Moore.
2. ICI Dulux.
3. Porter Paints.
4. PPG Architectural Finishes, Inc.
5. Pratt & Lambert.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions under which painting is to be applied. Do not proceed with painting work until unsatisfactory conditions have been corrected.

3.2 COLORS

A. Colors shall be per approved color schedule on Plans or to be compatible with FTE / District established scheme and / or design guidelines.

B. Each coat of paint shall be applied in varying shades, with the final coat matching the approved color selected.

3.3 PREPARATION FOR PAINTING

A. Surfaces to be painted shall be clean, smooth, free from scratches and dust and thoroughly dry. Wood surfaces shall be well sanded before painting work is started.

B. Concrete surfaces shall be cleaned, grouted, rubbed and pointed, water flushed clean and free of all dust, oily grease and laitance, and allowed to dry prior to painting.

C. Steel and Iron shall be free from grease, rust, scale and dust. Touch up any chipped or abraded places on items that have been shop coated. Where steel and iron have heavy coating of scale, it shall be removed by wire brush or sand blasting necessary to produce a satisfactory surface for painting.

3.4 PROTECTION

A. Adjacent fixtures and hardware shall be removed during the painting application.

B. Particular care shall be taken by the use of clean drop cloths, masking and other suitable means, to protect adjoining surfaces, fixtures, and materials of all kinds. Painting applicator shall be held responsible for, and shall repair, all damages resulting from the painting operation.

C. All ceiling and soffit overhead painting shall be applied only while the floor is completely and continuously covered with drop cloths.

3.5 APPLICATION

A. Paints shall be applied in the colors and minimum number of coats scheduled herein and at the square foot coverage as stated in the paint manufacturer's printed specifications. It is intended that paint so applied shall cover to the satisfaction of the Engineer or additional coats shall be applied until approval is obtained.

B. Paints shall not be applied to surfaces which show a moisture content greater than 15 percent as determined by an electronic moisture meter.

C. Paints shall not be applied when the temperature falls below 45 degrees F., in damp, rainy weather, or when the relative humidity exceeds 85 percent.

D. Paint shall be evenly spread and well distributed. The finish coats shall be free from any noticeable laps, brush marks, streaks, runs, sags, wrinkles, and shiners.

3.6 BACK PRIMING

A. All wood backs to be placed against concrete or masonry (except pressure treated wood) shall be painted with a sealer coat of paint or clear varnish before installation

3.7 DESTROYING WASTE

A. At the end of each day, all cloths and waste materials that have been used in preparation and application of inflammable paint materials shall be destroyed or placed in closed metal containers. Under no circumstances shall any waste be emptied into plumbing fixtures, drains, or clean-outs of the plumbing systems of the building. Waste shall not be allowed to accumulate on the Site.

3.8 TOUCH UP AND CLEANING

A. Upon completion, all touching-up as required shall be applied and any paint shall be removed from all surfaces that are not specified to receive paint.

3.9 PAINTING OF PIPING FOR IDENTIFICATION

A. Exposed piping, piping concealed in accessible pipe spaces and piping behind access panels shall be identified to designate service.

B. Legend shall be stencil applied (painted on) at 40 feet spacing on straight runs where pipes pass through walls or floors and regulators, strainers, and clean-outs (except valves and fittings on plumbing fixtures and equipment).

C. Legend shall give name in full or abbreviations. Size of stenciled identity lettering shall vary with the diameter of pipe covering as follows:

1. Up to 1" .....1/2" high letters.

2. Above 1" .....3/4" high letters.

3.10 PAINTING SCHEDULE

A. Trade Names used are only to set a standard of quality desired.

B. Omit primer on items with shop coat primer. All shop coats shall be touched up with the same kind of paint as the shop coat and allowed to dry before application of finish coats.

C. The following surfaces shall be finished with the designated number of coats (in addition to shop or manufacturer's coats) with the respective designated products of Sherwin Williams (SW), with a Dry Film Thickness (DFT) of not less than indicated:

EXTERIOR

1. Metal, Galvanized: Gloss Finish.
   a. 1-coat SW Water Based Catalyzed Epoxy Primer: .....3.0 - 5.0 DFT
   b. 2-coats SW Corothane II. For each coat: .....2.0 - 4.0 DFT
   c. Total .....7.0 - 13.0 DFT

2. Metal, Ferrous: Gloss Finish.
   a. 1-coat SW Tile-Clad High Solids: .....2.5 - 4.0 DFT
   b. 2-coats SW Corothane II. For each coat: .....2.0 - 4.0 DFT
   c. Total .....6.5 - 12.0 DFT

INTERIOR

1. Metal, Galvanized: Gloss Finish.
   a. 1-coat SW Hi-Solids Alkyd Metal Primer: .....3.0 - 5.0 DFT.
   b. 2-coats SW ProMar 200 Alkyd Gloss Enamel.
      For each coat: .....1.8 DFT each coat.
   c. Total .....6.6 - 8.6 DFT.

2. Metal, Ferrous: Eggshell Finish.
   a. 1-coat SW Hi-Solids Alkyd Metal Primer: .....3.0 - 5.0 DFT.
   b. 2-coats SW ProMar 200 Alkyd Eg-Shel Enamel
      For each coat: .....: 1.8 DFT.
   c. Total .....6.6 - 8.6 DFT.

3. Plywood for Opaque Eggshell Finish: Each coat of enamel applied and re-rolled to achieve uniform stipple.
   a. 1-coat SW ProBlock Interior/Exterior Latex Primer Sealer: 1.4 mils DFT.
   b. 2-coats SW MPI-52 Gloss Level 3 Interior Latex Eg-Shel
      For each coat: .....1.5 mils DFT
   c. Total .....4.4 mils DFT

END OF SECTION 09 91 00

SECTION 10 14 00
SIGNAGE

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Provide exterior panel signage for emergency power shutoff switch and fuel tank signage as shown on the Plans.

1.2 QUALITY ASSURANCE

A. Uniformity of Manufacturer:
   1. For each sign form and graphic image process indicated, furnish products by a single manufacturer.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Product Data:
   1. Submit manufacturer's technical data and installation instructions for each type of sign required.

1.4 Samples:

A. Submit digital scanned samples of the proposed sign form and material showing finishes, colors, and copy and include with the product data information.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Subject to compliance with Technical Special Provision requirements, provide products of one of the following or an approved equal:
   1. ACE Sign Systems, Inc.
   2. APCO Graphics, Inc.
   3. Best Sign Systems Inc.
   4. Mohawk Sign Systems.
   5. Nelson-Harkins Industries.

2.2 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength, corrosion resistance, and durability properties of Alloy 5005-H32.

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete work.

2.4 FINISH

A. Baked Enamel Finish: Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

2.5 FABRICATION

A. Exterior Panel Signs: Produce smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
   1. Mounting Height: as indicated on Plans.

B. Graphic Content and Style: Provide sign copy to comply with the requirements indicated for sizes, styles, spacing, content, positions, materials, finishes and colors of letters, numbers, symbols and other graphic devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Locate sign units and accessories where shown or scheduled using mounting methods in compliance with the sign manufacturer's instructions.
   2. Install signs level, plumb and at height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Wall Mounted Panel Signs:
   1. Attach panel signs to exterior surfaces using non-removable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

3.2 CLEANING AND PROTECTION

A. At completion of sign installation, clean soiled sign surfaces in accordance with the sign manufacturer's instructions. Protect units from damage until acceptance by the Engineer and/or Department.

END OF SECTION 10 14-00

SECTION 10 44 16
FIRE EXTINGUISHERS AND ACCESSORIES

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this Technical Special Provision shall include the following:
   1. Fire Extinguishers.
   2. Brackets.
   3. Exterior Cabinet Enclosure.
   4. Accessories.

B. Coordinate with Department for re-use of existing fire extinguishers that are currently in storage in lieu of providing new units.

1.2 RELATED WORK

A. FABRICATED STRUCTURES: Section 13 34 23.

1.3 QUALITY ASSURANCE

A. Reference Standards:
   1. National Fire Protection Association (NFPA):
      a. NFPA 10 - Portable Fire Extinguishers.
   2. Single Source Responsibility:
      a. Provide fire extinguishers, brackets, and accessories by single manufacturer.
   3. Requirements of Regulatory Agencies:
      a. All fire extinguishers shall be Underwriters' Laboratories (UL) approved and labeled or by other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7 to provide procurement flexibility.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data:
   1. Submit manufacturer's technical data and installation instructions for fire extinguishers, cabinets, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Products: Provide fire extinguishers and accessories by one of the following manufacturers or an approved equal:
   1. J.L. Industries, Inc.
   2. Larsen's Manufacturing Co.
   3. Potter-Roemer.

2.2 FIRE EXTINGUISHERS AND CABINETS

A. [redacted]

B. Cabinet for exterior mounted fire extinguisher shall be surface mounted, sized to accommodate fire extinguisher used, must be weatherproof and fabricated of anodized aluminum for door and trim.

C. Brackets shall be used for all fire extinguishers. For exterior installations, provide Larsen's "#846" or equivalent. For interior installations, provide Larsen's "#5525" or equivalent. Refer to Plans for location(s).

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify servicing, charging, and tagging of all fire extinguishers.

3.2 INSTALLATION

A. Install the items of this Technical Special Provision in strict accordance with the original design, approved Shop Drawings, NFPA 10, and requirements of agencies having jurisdiction, as approved by the Engineer, anchoring all components firmly into position.
   1. Fire Extinguisher Locations: As indicated on Plans.

END OF SECTION 10 44 16

SECTION 13 34 23
FABRICATED STRUCTURES

LEVEL 1

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide all materials, labor, equipment, and services to engineer, fabricate and erect a pre-engineered, precast concrete building system as indicated on the Plans and specified herein.

B. Provide concrete and concrete work in conformance with Section 03 41 00 – PRECAST STRUCTURAL CONCRETE.

1.2 RELATED WORK

A. APPLIED FINISH: .....Section 03 35 00.

B. PRECAST STRUCTURAL CONCRETE: .....Section 03 41 00.

C. ROUGH CARPENTRY: .....Section 06 10 00.

D. THERMAL INSULATION: .....Section 07 21 00.

E. SBS MODIFIED BITUMEN ROOFING SYSTEM:..... Section 07 53 50.

F. FLASHING AND SHEET METAL: .....Section 07 60 00.

G. JOINT SEALANTS: .....Section 07 92 00.

H. METAL DOORS AND FRAMES: .....Section 08 11 00.

I. DOOR HARDWARE: .....Section 08 71 00.

J. PAINTING: .....Section 09 91 00.

K. AIR CONDITIONING: .....Division 23.

L. ELECTRICAL: .....Division 26.

M. COMMUNICATIONS: .....Division 27.

N. ELECTRONIC SAFETY AND SECURITY: .....Division 28.

O. FDOT SPECIFICATIONS FOR ROAD AND BRIDGE, SECTIONS AS LISTED BELOW:

1. CLEARING AND GRUBBING: .....SECTION 110
2. EXCAVATION AND EMBANKMENT: .....SECTION 120
3. EXCAVATION FOR STRUCTURES AND PIPE: .....SECTION 125
4. DEWATERING: .....SECTION 455
5. SPREAD FOOTINGS: .....SECTION 455 PART D

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Provide pre-engineered building manufactured by a firm experienced in manufacturing precast concrete building systems that are similar to those indicated for this project and have a record of successful in-service performance.
2. Manufacturers must be Florida DBPR certified manufacturers with current Florida DBPR certifications.

B. Installer's Qualifications:

1. Engage an experienced installer to erect the pre-engineered precast concrete building who has specialized in the erection and installation of types of precast building systems similar to that required for this project and who is certified in writing by the precast building system manufacturer as qualified for erection of the manufacturer's project specific products.

C. Single-Source Responsibility:

1. Obtain the building system components, including wall and roof panels, and accessory components, from one source, from a single manufacturer and/or producer.

D. System Performance Requirements:

1. Engineer, design, fabricate, and erect the pre-engineered precast concrete building system to withstand loads from wind, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience, including exposure to weather, without failure.
2. The structural design criteria shall be based on the current Florida Building Code's structural requirements within the Miami-Dade County area regardless of the actual project location.
    a. Risk Category: IV
    b. Wind Exposure Category: "C"

E. Design Loads:

1. Basic design loads include live load, wind load, and dead load.

a. Live Loads:

1) Roof: 65 PSF, unless otherwise noted in Plans or specifications.

2) Floor: 125 PSF, unless otherwise noted in Plans or specifications.

b. Wind Loads:

1) Per the current Florida Building Code's structural requirements within the Miami-Dade County area regardless of the actual project location.

F. Reference Standards:

1. Florida Building Code: .....Latest Adopted Edition, as amended.
2. American Concrete Institute (ACI): .....Latest Edition of ACI Reference Standards.
3. Concrete Reinforcing Steel Institute (CRSI): .....Latest Edition of Manual of Standard Practice.
4. American Society for Testing and Materials (ASTM): .Latest Edition of Reference Standards.

G. Inspections: The CEI, Building Code Administrator (BCA), Department, and Florida's Turnpike Enterprise Toll Systems will inspect the fabrication of the precast concrete building as listed below. Coordinate with the CEI and request these inspections in Project Solve as per the "FTE Toll Facility Code Compliance and Permit Procedures" document to make these inspections.

1. Frame Inspection: To be conducted prior to installation of wall surfaces and ceiling membranes, only after the roof, all framing, fire blocking, and bracing is in place; and installation of all concealed wiring, pipes, ducts, and vents are complete . The frame-in inspection will also include the following:

a. Electrical Rough-In Inspection.

b. Plumbing Rough-in Inspection.

c. Mechanical Rough-in Inspection.

2. Final Inspection: To be made after the building is completed and ready for occupancy. NOTE: See Florida Building Code (FBC), Building for required tests. This will also include a final inspection of all specialties involved in the Frame-in inspection. See FBC, Plumbing Code, FBC, Mechanical, and National Electric Code and for required tests.

3. If the BCA's Inspector determines, while inspecting, that certain work requiring an inspection has been concealed, the BCA may order removal of the obstruction concealing the work so that the inspector may inspect it, even if this entails removing something previously constructed.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated for each maintenance building.

2. An exact size, routing and location of all wall-mounted equipment, including conduit shall be provided to scale for review and approval prior to fabrication.

3. A template for the building floor showing the opening for electrical and communication conduit stub-ups shall be provided prior to fabrication, to the electrical contractor for installing the gantry to building conduits in the field.

B. Structural Calculations:

1. Submit structural calculations for pre-engineered precast concrete building system. Structural calculations shall be prepared by or under the supervision of a Professional Engineer registered in the State of Florida and, shall verify that the wall and roof panels meet the indicated loading requirements and codes of authorities having jurisdiction. Submit two (2) original sets of these design calculations sealed by the licensed Professional Engineer.

C. Shop Drawings:

1. Submit shop drawings for precast concrete building wall and roof panels, and other building system components and accessories.

a. Building Accessory Components: Provide details of precast concrete building anchors, ties, and accessory components to clearly indicate methods of installation including the following:

1) Installer Certificate: Provide Installer certificates signed by a precast concrete building manufacturer certifying the Installer complies with the requirements included under 1.3 QUALITY ASSURANCE, Paragraph C., of this Section.

2) Shop Drawings, Reinforcement: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Conform to ACI 315, Guide to Presenting Reinforcing Steel Design Details, showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for formed openings through concrete structures.

3) Material Certificates: It is preferable to provide copies of materials certificates in lieu of materials laboratory test reports when permitted by the Department. Material certificates shall be signed by the manufacturer and Design/Builder, certifying that each material item complies with, or exceeds, specified requirements.

4) Warranty: Sample of special warranty to cover all components of this structure.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates, (current and valid).

B. Manufacturer's production record of initial and final tension in prestressing strands and induced tension due to strand elongation during deflection (harping) shall be submitted to the Engineer upon request.

C. Upon completion of the building frame, manufacturer shall issue written certification that all precast prestressed members have been manufactured and installed in accordance with approved shop drawings and design calculations, and in accordance with the intent of the Plans. This certification shall bear the seal of the responsible Structural Engineer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include the manufacturer's maintenance manuals for all components including, door hardware, air conditioning units, and electrical systems for the precast concrete building. See Divisions 23, 26, and 28 for additional closeout requirements.

1.7 COORDINATION

A. Coordinate installation of anchorages for precast concrete building. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Buildings must not be transported until all inspections are satisfactorily completed and the building has been formally accepted by the Department. Buildings must not be transported until all elements are in compliance with approved shop drawings, Contract Document requirements, all governing codes having jurisdiction, and the building has been formally accepted by the Department and any other agencies having jurisdiction

B. Deliver the prefabricated, precast concrete building and other manufactured items to the project site location in a manner in which they will not be damaged.

C. Exercise care when unloading to prevent damage of any kind. Report any damage to the CEI immediately prior to and after installation.

D. Store the precast concrete building in a stable, level area where the building is not in contact with other materials that would stain the exterior components of the precast

concrete building or prohibit connection to the cast-in-place building foundation, if on-site temporary storage is required.

E. Install building on cast-in-place building foundation within 48 hours of delivery.

1.9 WARRANTY

A. Special Warranty: Manufacturer's form in which the manufacturer agrees to repair or replace all components including, but not limited to, the structure, entry door, frame and hardware, electrical systems and components, mechanical systems and components, and all interior finishes that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two (2) years from date of Substantial Completion (Toll site interim acceptance).

PART 2 - PRODUCTS

2.1 PREFABRICATED EQUIPMENT BUILDING, GENERAL

A. General: Provide a complete, integrated set of mutually dependent components that form a completely assembled, prefabricated building, ready for installation on Project site.

1. Building Style: Standard (chamfered) square corners.
2. Doors: Swing door on one side, as indicated on Plans.

B. Lighting Fixtures: As indicated on Electrical Plans.

C. Cooling Units: Two redundant ductless split AC systems including a condensate drywell, as indicated division 23.

2.2 PREFABRICATED EQUIPMENT BUILDING

A. Manufacturers: Subject to compliance with requirements, provide products by one manufacturer offering products that may be incorporated into the Work include:

1. [redacted]
2.

3. [redacted]

a.

b.

4. Swinging Door: See Section 08 11 00 – METAL DOORS AND FRAME and Section 08 71 00 – DOOR HARDWARE.

5. Finish: Finish exterior concrete wall surfaces (TEB) per Section 03 35 00 – APPLIED FINISH. .

6. Mechanical Equipment: See Specification Division 23 – Mechanical and Plans for air conditioning components; includes hurricane straps for exterior mounted HVAC units.

7. Electrical Equipment: See Division 26 – Electrical and Plans for electrical equipment and components.

8. Access Control: See Division 28 – Access Control and Plans for equipment and components.

9. Prefabricated Joints: Provide grout, sealants or fillers as appropriate to ensure a water tight joint assembly.

2.3 FABRICATION

A. Fabricate equipment building completely in factory.

B. Pre-hang doors at factory.

C. Pre-wire equipment building at factory, ready for connection to service at Project site.

D. Fabricate equipment building with removable lifting eyes as required for installation.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with National Association of Architectural Metal Manufacturers (NAAMM) AMP-500 "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

B. Refer to Section 03 35 00 – APPLIED FINISH

C. Refer to Section 09 91 00 - PAINTING.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation of precast concrete shall be performed by the manufacturer or the Contractor under the direct supervision of the manufacturer. Members shall be lifted by suitable lifting devices at points provided in the manufacturer's installation plans. Temporary shoring and bracing, if necessary, shall comply with manufacturer's recommendations.

B. Each member shall be installed on the indicated supports and made secure by welding unless otherwise detailed. Leave one end free as long as possible to curtail the involvement of shrinkage and creep in the adjacent construction elements. For members installed with flanges placed against each other, weld at the joints by use of the specified welding plates. Minimum bearing shall be as shown on the Plans.

C. Accessible building: Install the interior floor surface per Plans. The elevation of adjacent concrete walks should be lower and allow positive drainage away from the building.

D. Set building plumb and aligned. Level floor slab true to plane with full bearing on concrete bases. Set building in full grout or mortar bed such that there will be uniform bearing between the precast concrete slab and the foundation slab.

E. Fasten building securely to concrete bases with plates as detailed in the Plans.

F. Connect electrical power service to power distribution system according to requirements specified in Division 26 Sections.

G. Provide a ¼" +/- tolerance to allow for an even bearing surface for the precast concrete building. Galvanized or stainless-steel shims shall be used to ensure all load bearing surfaces are at the same elevation within 1/16" +/- tolerance. The shims shall be completely encased in non-shrink, high-strength grout.

3.3 ADJUSTING

A. Adjust doors, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

C. After completing installation, inspect exposed finishes and repair damaged finishes.

3.4 TESTING

A. The Contractor must perform a hose-down test of the wall penetration system once all elements have been furnished and installed.

B. The test must be witnessed and approved by the Department and the CEI.

C. The Contractor must provide seven calendar days advance notice prior to the hose-down test.

D. Water must be directly hosed on all areas susceptible to water intrusion, around the door, wall and roof penetrations (conduit/wireway/etc), wall joints, and any other areas that were sealed. If there is water intrusion in any water amount or any indication thereof, the fabricated structure will not be accepted.

3.5 CLEANING AND TOUCH-UP

A. Clean component surfaces of matter that could preclude paint bond. Touch-up and patch abrasions, marks, or other defects.

END OF SECTION 13 34 23

SECTION 23 05 00
GENERAL MECHANICAL REQUIREMENTS

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies general mechanical requirements for all Division 23 – MECHANICAL Specification Sections.

B. Drawings and Specifications: The Drawings and Specifications shall be considered as complementary, one to the other, so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Drawings are to be considered diagrammatic, not necessarily showing in detail or to scale all of the equipment or minor items. In the event of discrepancies between the Drawings and the Specifications, or between either of these and any regulations or ordinances governing mechanical work, notify the Engineer in ample time to permit revisions.

1.2 RELATED WORK

A. GUARANTEES/WARRANTIES/REPAIRS: .....Section 01 78 36.

B. RECORD DOCUMENTS, MAINTENANCE MANUALS, AND EQUIPMENT OPERATIONAL INSTRUCTIONS/DEMONSTRATIONS: .....Section 01 78 39.

C. TEST AND BALANCE: .....Section 23 05 93.

D. DUAL AIR CONDITIONER CONTROL SYSTEM AND SEQUENCE OF OPERATIONS: .....Section 23 09 00.

E. FUEL OIL PIPING: .....Section 23 11 13.

F. CONCRETE PROTECTED ABOVE GROUND FUEL STORAGE TANK: .....Section 23 13 23.

G. PIPING AND SPECIALTIES: .....Section 23 20 00.

H. DUCTLESS SPLIT SYSTEM AIR CONDITIONERS: .....Section 23 81 19.

I. ELECTRICAL: .....DIVISION 26

1.3 CODES AND STANDARDS

A. The codes and standards covering mechanical work include, but are not limited to:

1. American National Standards Institute (ANSI).

2. American Society for Testing and Materials (ASTM).

3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).

4. American Society of Mechanical Engineers (ASME).

5. American Welding Society (AWS).

6. Florida Building Code, Latest Adopted Edition, as amended.

7. Florida Department of Environmental Protection (DEP) Regulations.

8. National Electrical Manufacturers Associations (NEMA).

9. National Fire Protection Association (NFPA).
   a. NFPA 30 Flammable and Combustible Liquids Code.
   b. NFPA 58 Storage and Handling of Liquified Petroleum.
   c. NFPA 90A Installation of Air Conditioning and Ventilating Systems
   d. NFPA 90B Installation of Warm Air heating and Air Conditioning Systems
   e. NFPA 101 Life Safety Code.

10. National Sanitation Foundation (NSF).

11. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

12. Codes, Regulations, Ordinances, and similar regulatory requirements, of all governing authorities having jurisdiction over this Work.

B. These codes, society and association recommendations constitute minimum requirements and no reductions from design requirements will be permitted, even if allowed by the applicable codes, without expressed written permission of the Engineer.

1.4 SHOP AND ERECTION DRAWINGS

A. Submit required and requested shop and erection drawings for review by Engineer before ordering or installing any equipment or material. Equipment or material ordered or installed before Engineer's review may not be accepted and will have to be removed from the Project.

B. Shop drawings shall consist of manufacturer's scale drawings, cuts or catalogs, including descriptive literature which shall clearly indicate the construction, material, physical dimensions, wiring diagrams and complete operating data clearly marked for each item. Data of general nature will not be accepted.

C. Erection drawings shall consist of 1/4" scale drawings of the work including foundations in plan and elevation. These drawings shall show clearances between units and relation of equipment to space assigned and to the work of other trades. Normally,

with the exception of drawings for ductwork, erection drawings are required for mechanical equipment rooms. Provide drawings for other area requested by the Engineer.

D. Prior to making any changes in the work that is shown on the Contract Drawings, prepare and submit to the Engineer a drawing with a minimum of 1/4" scale showing proposed change. Do not proceed with the change without a written approval by the Engineer. All such approved drawings shall be included into final set of record drawings.

E. The Engineer's approval of shop drawings does not relieve the Contractor of their responsibility to comply with all requirements of this Specification.

1.5 RECORD DRAWINGS

A. Record Drawings shall be submitted to the Engineer before Final Acceptance and shall include the following as a minimum requirement:

1. Factory programmed with capability to field reprogram set points per Department preferences.

2. AC controller to be programmed to operate both AC units to insure equal wear on both units while allowing the Lag unit to assist upon demand.

B. Refer to Section 01 78 39 - RECORD DOCUMENTS, MAINTENANCE MANUALS, AND EQUIPMENT OPERATIONAL INSTRUCTIONS /DEMONSTRATIONS for additional requirements.

1.6 FEES, PERMITS AND INSPECTIONS

A. Obtain all permits for work under this Contract and pay all expenses in conjunction therewith. Also, procure and deliver to the Engineer all certificates issued by the authorities having jurisdiction.

B. The work will be observed by the Engineer during the course of construction. Provide for inspection by others having jurisdiction during the proper phases.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor bolts, anchorage devices, and sleeves which are to be embedded in cast-in-place concrete or masonry, in ample time not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Do not store materials on structure in a manner that might cause distortion or damage to members or support structures. Repair or replace damaged materials or structures as directed at no additional cost to the Department.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials or products specified herein and/or indicated on Drawings by trade name, manufacturer's name and/or catalog number shall be provided as specified.

B. Since manufacturers reserve the right to change their products at anytime, verify all dimensions, performance data, and similar criteria for each piece of equipment submitted to ensure compliance with the intent of the Drawings and Specifications.

C. All materials shall be new of the quality specified.

D. Deviations mean the use of any listed approved manufacturer other than those on which the Drawings are based.

2.2 SPACE AND ACCESS TO EQUIPMENT

A. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor at no additional cost to the Department.

B. Provide access panels to service and maintenance devices such as cleanouts, air vents, service valves, air volume balancing dampers, fire dampers, and similar items that are installed in concealed spaces.

2.3 CUTTING AND PATCHING

A. Unless otherwise indicated on the Mechanical Drawings, perform all cutting and patching necessary for the Work. Where interferences occur, and departures from indicated arrangements are required, coordinate the mechanical work with the other trades involved and make a determination as to changed locations and elevations of the ductwork and/or piping and shall obtain approval from the Engineer for the proposed changes.

2.4 SAFETY REQUIREMENTS

A. In addition to the components specified and shown on the Drawings and necessary for the specified performance, incorporate in the design and show on the shop drawings all the safety features required by the current codes and regulations, including but not limited to those of the Occupational Safety and Health Act of 1970, and Amendments thereto.

2.5 ELECTRICAL WORK

A. Furnish all control wiring and conduit for the AC equipment and include control devices such as thermostats, control switches, contactors, relays and starters. All Work shall conform in all respects to the requirements of the applicable requirements of Division 26 Specifications.

2.6 CLEANING AND PROTECTING

A. During construction protect all piping and equipment from damage and dirt. Cap the open ends of all piping and equipment.

B. After completion of Project, clean the exterior surface of equipment included in this Section, remove all residues and as directed touch up paint or completely repaint all damaged surfaces.

2.7 PAINTING

A. All field painting unless otherwise noted shall be as specified in Section 09 91 00 - PAINTING.

B. All equipment shall have factory standard finish, except as specifically indicated herein. Where zinc chromate paint is specified it shall be formulated using a synthetic resin vehicle.

C. Ironwork installed under this Division of the Specifications exposed to view within the building, and not otherwise specified to be painted, galvanized, copper or chrome plated, such as piping, pipe hangers, structural supports, supports for apparatus, black iron partitions or casings, tanks, and similar items shall be painted with one coat of zinc chromate primer.

2.8 EQUIPMENT IDENTIFICATION

A. Identify each unit by its system number and other appropriate designation by engraved plastic nameplates in letters of approved size and wording. Equipment requiring identification shall include packaged and split system air conditioning units.

2.9 WATERPROOFING

A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Engineer before work is performed.

B. Provide all necessary sleeves, caulking and flashing required to make openings absolutely watertight. Waterproof flashing materials shall be compatible with base materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Where the contact of dissimilar metals may cause electrolysis and where copper will contact concrete, mortar or plaster, separate metal contact surfaces with not less than one coat of zinc chromate primer and one heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than open course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used. Completed work shall be cleaned and excess cement removed.

3.2 TESTS AND INSPECTIONS

A. Provide equipment start-up procedures in accordance with manufacturer's recommended guidelines and installation checklist. Provide factory certifications where required for warranty purposes.

B. Include all tests and inspections specified and/or required under laws, rules and regulations of all departments having jurisdiction. Tests shall be performed as indicated herein and other Sections of Specifications.

C. Refer to TSP Section 23 05 93 – TEST AND BALANCE, for additional AC test and inspection procedures.

D. Notify the Engineer at least 72 hours in advance of all tests. Furnish all necessary instruments, gauges and other equipment required for tests. Make preliminary tests prior to giving notice of final tests.

E. All parts of the work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition.

F. Correct defects disclosed by these tests without any additional cost to the Department. Repeat tests on repaired or replaced work.

G. Maintain separate log of all tests being conducted and have it available for review by Engineer. Log to indicate date, type of tests, duration and defects noted and when corrected.

H. The Building Inspection/Permitting Agency shall perform acceptance and inspection of mechanical and plumbing systems. In addition, obtain Final Acceptance of mechanical and plumbing systems from the Department's Representative.

3.3 ACCEPTANCE INSPECTION

A. Representatives of installers responsible for work under this Division shall be present at time of acceptance inspections and shall furnish required mechanics, tools, and ladders to assist in the inspection.

B. As a precedent to requesting a final inspection, the following steps shall be met:

1. Complete all work under this Section of the Specifications.

2. Have each system balanced to assure design performance. (See Section 23 05 93 - TEST AND BALANCE for detailed requirements.)

3. Furnish the Engineer with letter from an authorized representative of the equipment manufacturer certifying that all work has been checked for operation and calibration and that the system is operating as intended.

4. Clean all dirty cooling coils and other equipment that may have accumulated dirt during construction.

C. A list of items to be corrected as a result of acceptance inspection will be furnished to the installer. Notify Engineer in writing of any items appearing on list of correction that are disputed by installer. When ready, request in writing a re-inspection of Work.

D. Provide certification that all work is in conformance with all codes and standards by the governing agencies having jurisdiction of the work.

E. Provide hard copy of AC equipment parts manual to Construction and Engineering Inspection (CEI) prior to Final Acceptance of the building by FTE. Provide one (1) complete hard copy to remain in each building for future use.

3.4 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Bound Instructions: Before final payment is made, furnish one USB Flash Drive copy and 6 sets of bound operation and maintenance manuals to the Department. The manuals shall consist of catalog cuts, bulletins, shop drawings, wiring diagrams, schedules, parts lists, procedures and other data showing the equipment installed and shall include the following:

1. Approved wiring and control diagrams, with data to explain the detailed operation and control of each component.

2. A control sequence describing startup, operation and shutdown.

3. Operating and maintenance instructions for each piece of equipment, including lubrication instructions.

4. Parts lists and recommended spare parts.

5. Other data and instructions as specified under the various Sections.

B. All data furnished shall conform to the installation as constructed. Cuts showing other equipment and data not applicable to the installation shall be crossed out and where practical shall be omitted from the manual. The assembly of the manual shall be in a logical manner and each section shall be indexed in the Table of Contents.

C. After each manufacturer has outlined a maintenance procedure for that manufacturer's equipment installed, compile these procedures in a logical manner to provide a procedure for the operating personnel of the Department to follow in their day to day operation of the facility.

D. The materials shall be permanently bound into each booklet between rigid plastic or cloth binding covers. The instruction booklets shall be approximately 9-inches by 12-inches and the diagram booklet large enough to contain the drawing without excessive folding so that they may be easily opened.

E. The booklets shall be neatly entitled with a descriptive title, the name of the job, the location, year of installation, Department, Manufacturer, Contractor and Engineer. Copies of drawings shall be in black and white background and shall be easily legible. The arrangements of the booklets, the method of binding, materials to be included and the composite text shall all be reviewed and approved by the Engineer.

3.5 OPERATIONS INSTRUCTION TO DEPARTMENT

A. Provide a minimum of 1 hour of instruction to representatives of Department in operation and maintenance of all installed mechanical systems and equipment.

B. Provide maintenance manual and acquaint Department's representative with its contents during instruction.

C. Furnish letter naming Department's personnel receiving instruction and dates when instruction was given.

D. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment so that service or spare parts can be readily obtained.

END OF SECTION 23 05 00

SECTION 23 05 93
TEST AND BALANCE

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Procure the services of an independent Test and Balance Agency, approved by the Engineer, which specializes in the balancing and testing of heating, ventilating, and air conditioning systems.

B. Agency to balance, adjust, and test following systems and/or equipment:
1. Air distribution systems including air handling units and air devices.

C. As soon as possible after receipt of this Contract, allow the Test and Balance Agency to schedule it's work in cooperation with other trades involved and comply with the completion date(s) or calendar days required for completion, as specified.

1.2 RELATED WORK

A. GENERAL MECHANICAL REQUIREMENTS: .....Section 23 05 00.

B. DUAL UNIT AC CONTROL SYSTEM AND SEQUENCE OF OPERATION: .....Section 23 09 00.

C. DUCTLESS SPLIT SYSTEM AIR CONDITIONERS: .....Section 23 81 19.

1.3 QUALITY ASSURANCE

A. The Test and Balance Agency shall submit proof of having successfully completed at least five (5) projects of similar size and scope and shall be certified as conforming to the standards and guidelines of the Associated Air Balance Council (AABC), unless otherwise approved.

B. All instruments used shall be accurately calibrated within six months of balancing and maintained in good working order. If requested, the test shall be conducted in the presence of the Engineer and/or his representative.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Complete report of the test and balance data.

B. Test and Balance Agency qualifications.

1.5 AIR BALANCE SCOPE

A. The codes and standards covering mechanical work include, but are not limited to:
   1. Test and adjust RPM to original requirements.
   2. Test and record motor full load amperes.
   3. Test and adjust system for original design supply / return CFM air.
   4. Test and record entering air temperatures. (D.B. cooling)
   5. Test and record entering air temperatures. (W.B. cooling)
   6. Test and record leaving air temperatures. (D.B. cooling)
   7. Test and record leaving air temperatures. (W.B. cooling)
   8. Test and Balance Agency shall check all controls for proper calibrations and list all controls requiring adjustments including sequence of operations. The Test and Balance Agency shall provide list by Contractor for adjustments and/or clarification by the EOR.
   9. Test and Balance Agency shall check and verify the dual unit controller is switching over from Lead unit to Lag upon loss of power and returning to Lead unit once the power is restored. Confirmation/documentation of test will be required in writing as part of the report.
   10. After the completion of the equipment Test and Balance, provide temperature and humidity level readings every 15 minutes for a duration of not less than 1 ½ hours. These readings shall be recorded with the door closed and no work being performed in the building.

1.6 TEST BALANCE REQUIREMENTS

A. All testing shall be performed with the building empty of workers and with the door closed at all times. The Test and Balance Agency shall provide a temporary heat load of adequate size to create a full load condition inside the equipment building. A full load shall be defined as sufficient heat to fully load the lead unit and to provide the required temperature rise for the lag unit to start as described in the sequence of operations. The temporary heat source shall be neither radiant type nor located directly next to the controller and only heat the interior space of the toll equipment building.

B. The testing shall begin after the building temperature/conditions have stabilized to obtain maximum accuracy of the report findings.

C. All information required as shown but not listed to shall be compiled in a neat, orderly itemized format on AABC Test Forms. All test data shall be submitted to the Engineer.

1.7 EVAPORATOR COIL

A. Provide the following for the Evaporator Coil:
   1. Mark Number.
   2. Total Supply Air CFM original Specified and Actual.
   3. Return Air CFM original Specified and Actual.
   4. Cooling - Return and Supply Air DBF and WBF originally Specified and Actual temperatures at full load. Refer to paragraph 1.6.A for the definition of full load.
   5. Motor HP originally Specified and Actual.
   6. Motor and Fan RPM originally Specified and Actual.
   7. Voltage, Phase and Cycles originally Specified and Actual.

PART 2 - PRODUCTS
"Not Used"

PART 3 - EXECUTION

3.1 GENERAL

A. Air balance and testing shall not begin until modifications to the system have been completed and the system is in full working order. Mechanical systems installer shall make all preliminary tests and adjustments, shall place all systems and equipment into full operation and continue the operation during each working day of testing and balancing.

B. Replacement of fittings, AC unit components and similar items required to effect proper air balance or operate the system shall be furnished and installed by the mechanical installer at no additional cost to the Department.

C. Test and Balance Agency shall furnish the Contractor and Engineer at the end of each day a list of items that must be repaired or adjusted.
   1. This work shall be performed as soon as possible so as not to delay the completion of the test and balance work.

D. Submit complete report of the test and balance data of air conditioning systems for review by the Engineer and Engineer of Record.
   1. If there are any test results outside of the required acceptable range, adjustments must be made, or repairs completed within 10 working days of the completion of the EOR's review.
   2. All items that reported outside of acceptable range must be re-evaluated by the Test and Balance Agency within 5 working days of the completion of any repairs or adjustments.

E. All air filters shall be cleaned by the mechanical Installer before the test and balance work can proceed and thereafter as required by the Test and Balance Agency.

F. Lock in place all accessories after final adjustments are made and permanently mark the set point of adjustment.

END OF SECTION 23 05 93

SECTION 23 09 00
DUAL AIR CONDITIONER CONTROL
SYSTEM AND SEQUENCE OF OPERATIONS

LEVEL 1

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. DUCTLESS SPLIT SYSTEM AC: ..... Section 238119 -

1.2 SUMMARY

A. This Section includes Lead/Lag dual unit control equipment for redundant ductless split system air conditioning (AC) units in toll equipment buildings. Ensure the Lead/Lag dual unit control equipment is wired to both AC units and is capable of controlling the AC systems to maintain the programmed temperature range inside the toll building.

B. The combination Lead/Lag dual unit controller and thermostat unit shall be manufactured by the same company as the air conditioners and the controller/thermostat shall be capable of controlling 2 air handlers in a single group.

C. Wiring for the combination Lead/Lag dual unit controller and thermostat shall consist of a two-conductor cable that connects in a serial fashion to each air handler. The two-conductor cable will provide 12 VDC for the controller and also communicate with each air handler.

1.3 SEQUENCE OF OPERATION

A. The combination Lead/Lag Controller (LLC) and thermostat shall automatically operate the fully redundant AC systems in the toll building. Normally the Lead AC unit will run in the Automatic Cooling/Fan mode to cool the building to the specified design temperature and the Lag AC unit will remain in standby mode.

1. On a call for cooling, the Lead AC unit will operate in Automatic Cooling/Fan mode adjusting capacity to maintain the building temperature at the programmed thermostat set point. When the building temperature drops below the set point, the Lead unit compressor and supply fan will shut off. Upon a subsequent call for cooling the process will repeat.

2. If the temperature rises 7.2 degrees Fahrenheit above set point when the Lead unit is operating, then the controller/thermostat will start the Lag unit. The Lead and the Lag unit will continue to operate to maintain the building temperature at the programmed thermostat set point. When the building temperature drops below the set point, the Lag unit compressor and supply fan will shut off. Upon a subsequent call for cooling the process will repeat.

B. If the Lead unit fails to operate the Lag unit will switch to lead and run in the automatic cooling/fan mode adjusting capacity to maintain the building temperature at the programmed thermostat set point.

C. System Set Points: The AC control system shall maintain the toll building at 75 degrees Fahrenheit dry bulb, plus or minus 2 degrees. The Lead/Lag changeover should be programmed to automatically alternate the Lead/Lag units every 7 days.

D. The adjustable factory time delay for compressor short cycle protection shall be set differently for each unit to prevent simultaneous start-up of the units following the loss of primary power.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams.
3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
7. Controlled Systems:
   a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
   b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.

c. Written description of sequence of operation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer

B. Field quality-control test reports

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data shall be provided as follows:

1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.9 COORDINATION

A. Coordinate location of thermostats, and other exposed control sensors with plans and room details before installation.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

A. The Lead/Lag dual unit control system & thermostat shall consist of sensors, indicators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems such that the programmed temperature is maintained within the building.

B. The control system shall include a solid state microprocessor based Lead/Lag dual unit controller designed to operate redundant air conditioning systems with the following requirements:

1. Factory programmed with capability to field reprogram set points per Department preferences.
2. Lead/Lag dual unit controller to be programmed to operate both AC units to insure equal wear on both units while allowing the Lag unit to assist upon demand.
3. Program settings should be retained during indefinite power loss to the controller.
4. Lag unit automatically becomes Lead unit if lead unit loses power.

2.2 CONTROLLER INTERFACE

A. The Lead/Lag dual unit controller & thermostat shall utilize a back lit LCD display screen to show the status of the system, display setting descriptions, and provide a convenient user interface. When a fault is detected, the LCD screen displays the description of the fault.

B. Menu Button. Pushing the menu button will put the controller into the configuration mode.

C. The Lead/Lag Dual Unit Controller shall be set to Rotation and Back-up Mode to enable automatic switchover.

D. On/off Button – Turns each Lead/Lag dual unit controller On or Off.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units.

3.2 INSTALLATION

A. Connect and configure equipment to achieve sequence of operation specified.

B. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation.

C. Install labels and nameplates to identify control components.

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

B. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service and Equipment Start-Up: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation.

B. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.

B. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Department’s maintenance personnel to adjust, operate, and maintain AC instrumentation and controls.

END OF SECTION 23 09 00

SECTION 23 11 13
FUEL OIL PIPING

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installing of the fuel oil supply and return piping system between the aboveground fuel storage tank and the emergency generator including valves, fittings, and pipe supports.

B. The head loss (pressure drop) associated with the supply and return piping, including fittings, check valves, elbows, and anti-siphon valves shall not exceed the capability of the engine generator fuel pump.

C. The exposed fuel oil piping shall be protected by a removable 10 gauge aluminum diamond plate cover.

1.2 RELATED SECTIONS

A. EMERGENCY GENERATOR - PERMANENT: .....Section 26 32 13

B. CONCRETE PROTECTED ABOVE GROUND FUEL STORAGE TANK: ..... Section 23 13 23

1.3 REFERENCES

A. America National Institutes (ANSI)

B. American Society of Mechanical Engineers (ASME)

C. American Standards Testing and Materials (ASTM)

D. NFPA 30 - Flammable and Combustible Liquids Code

E. State of Florida Department of Environmental Protection (DEP):

E. DEP 62-762 Aboveground Storage Tank Systems
F. API 607- Fire Test of Quarter Turn Valves and Valves Equipped with Non-metallic seats.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Shop drawings for all piping, fittings, valves and pipe supports shall be submitted for review and approval by the Department.

B. Submit head loss (pressure drop) calculations showing that the pressure drop through the fuel oil piping, valves, elbows, anti-siphon valve, etc., does not exceed the pumping capability of the emergency generator fuel pump.

1.5 QUALITY ASSURANCE

A. Qualifications of Welders: All welders employed for this Work shall be qualified under the requirements of ANSI B31.1.0 Section 127.5. Certification of welder's qualifications shall be submitted to the Engineer before any welds are made.

B. Pipe Welding Qualifications: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The supplier will be responsible for shipping, delivery, and rigging costs.

B. Provide pipe end caps and other protective materials to keep all piping, valves and fittings clean and free from damage.

PART 2 - PRODUCTS

2.1 FUEL OIL PIPING SYSTEM

A. General: Fuel oil piping and equipment shall be located as shown on the Drawings. Coordinate piping with outside utilities and with equipment suppliers utilizing shop drawings or installation instructions. All piping shall be supported according to standard engineering practice. Pipe supports shall be suitable for outdoor use.

B. Aboveground Piping: Fuel oil piping shall be manufactured in accordance with ASTM A53 Standard Specifications for Pipe, and will be black steel, schedule 40, type E, or type S, Grade B. The piping exterior shall be painted with two coats of yellow exterior grade paint described in ANSI/ASME A13.1.

C. Fittings:

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.

2. Wrought-Steel Welding Fittings: ASTM A234, for butt and socket welding.

3. Unions: ASME B16.39, Class 150, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets.

2.2 FUEL OIL VALVES

A. Ball Valves for use with diesel fuel oil piping and diesel fuel tanks serving an emergency generator shall be rated for use with light oil and shall include the following features:

1. NPT threaded end connections that comply with ASME B1.20.1.

2. Rated for use at 125 psi SWP, and 400 psi cold working pressure.

3. Valve body will be 2 piece cast bronze or 2 piece brass.

4. The bore of ball valves shall be the “full port” type, such that the bore size equals the size of the valve in inches.

5. The valve stems shall be brass and designed to be blow-out proof.

6. The valve stem packing material will be polytetrafluoroethylene and a metal packing nut will allow adjustments to compact the packing material.

7. Valve balls will be hard chromium plated brass.

8. Valve handles will be zinc plated steel, and the grip area coated with vinyl insulation, and the handles shall be removable.

9. Valve operating handles shall fully open or close the ball by turning the handle not more than 90 degrees.

2.3 ANTI-SIPHON VALVES

A. Anti-siphon valve bodies shall be UL listed and fabricated from ductile iron, electroplated with a zinc coating, and painted with epoxy paint by the manufacturer. The internal spring shall be zinc plated steel and the head pressure will be adjustable from 0 ft to 12 ft of head. The anti-siphon valve will include a built-in pressure relief valve to relieve pressure from the downstream piping system.

2.4 PIPE SUPPORTS AND FASTENERS

A. Pipe supports, pipe clamps, and metal support channels used with fuel oil piping systems shall be stainless steel.

2.5 PROTECTIVE ALUMINUM COVER

A. The exposed fuel oil piping shall be protected by a removable 10 gauge aluminum diamond plate cover that is bolted to the concrete pad using removable fasteners. The

aluminum diamond plate cover will protect the pipes from physical damage and also prevent excessive heating by the sun.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: The location and quantity of piping and fittings on the Drawings are for illustration only and careful coordination of the work is necessary to avoid conflicts.

B. Piping: Run all piping parallel or perpendicular to the building lines unless otherwise indicated.

C. Fuel oil piping shall be secured and supported at 5-foot intervals and within 1 foot of the end of each pipe run. Fuel oil piping shall not be fastened directly against walls, floors, tanks, or concrete slabs. Mechanical supports or pipe clamps shall be utilized to secure fuel oil pipes and allow for expansion and contraction of the pipe.

3.2 JOINING PIPE

A. Join pipes with ASTM A53, black steel, schedule 40 threaded couplings and fittings.

B. Welder Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Equipment Connection: Braded stainless steel flexible fuel oil supply and return piping connections at the emergency generator shall be provided by the generator manufacturer.

3.3 TESTS

A. Piping: Piping shall be disconnected from tanks and equipment prior to testing. Piping shall be tested at 50 psig air pressure for a period of four (4) hours.

B. Prior to connecting the emergency generator to the fuel piping, adjust the head pressure setting on the anti-siphon valve to the lowest setting that will not allow fuel to siphon from the fuel tank. Ensure the weather cap is re-installed over the adjustment screw.

END OF SECTION 23 11 13

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete Protected Above Ground Fuel Storage Tank and related accessories.

1.2 RELATED SECTIONS

A. EMERGENCY GENERATOR - PERMANENT: .....Section 26 32 13

B. SCADA System: .....Section 26 09 13

1.3 REFERENCES

A. America National Institutes (ANSI)

B. American Society of Mechanical Engineers (ASME)

C. NFPA 30 - Flammable and Combustible Liquids Code

D. NFPA 70 - National Electrical Code

E. NFPA 780 – Installation of Lightning Protection Systems.

F. State of Florida Department of Environmental Protection (DEP): DEP 62-762 - Aboveground Storage Tank Systems

G. UL 142 – Steel Aboveground Tanks for Flammable and Combustible Liquids

H. UL 2085 – Protected Aboveground Tanks for Flammable and Combustible Liquids.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Shop drawings and erection drawings shall be submitted on the tank including all dimensions, weights, loads, components, and location and size of each field connection. Installation and testing manuals shall be provided.

B. Shop drawings shall be submitted of all tank accessories including but not limited to gauge assemblies, level switches, fuel tank monitoring system, solenoid valves, leak detection system, analog fuel sensor, emergency vents, strainers and foot valves. The

shop drawings shall indicate, at a minimum, the dimensions, materials of construction, and installation instructions.

C. Warranty Statements

D. Submit head loss / pressure drop calculations that show the total pressure drop of the fuel supply and return piping, including check valves, foot valves, 90 degree bends, etc. Ensure the emergency generator fuel pump is capable of overcoming the pressure drop caused by the piping system.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Warranty: The fuel tank shall be provided with a 20-year manufacturer's warranty.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The supplier will be responsible for shipping, delivery, and rigging costs.

B. Protect equipment from dirt and moisture by securely wrapping in heavy plastic until it is installed.

PART 2 - PRODUCTS

2.1 CONCRETE PROTECTED ABOVE GROUND FUEL STORAGE TANK

A. Description: The above ground diesel fuel storage tank(s) shall be steel, double walled, and contained in a 2-hour fire rated concrete vault. The tank shall be rectangular in shape and have continuous welds on all exterior seams. The primary tank shall be wrapped with a minimum ¼ inch thick insulating spacer material.

B. The secondary containment shall consist of a minimum 30-mil polyethylene membrane, enclosing spacer material. The steel tank and secondary containment shall be encased in 6 inches of monolithic reinforced concrete with minimum design strength of 4000 psi after 28 days.

C. The bottom of the concrete vaulted tank shall be provided with 4-inch concrete skids and the entire vault shall have an exterior protective epoxy coating as per manufacturer's standards. The unit shall be UL 142 Listed and UL 2085 Listed by a National Recognized Testing Laboratory (NRTL) approved by the United States

Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

D. Openings: The tank shall be equipped with the following openings on the top of the tank for use with fuel piping, gauges, and accessories. The following openings will be NPT male threaded. One 4-inch for the fill port, one 4-inch for the emergency vent, one 4-inch nipple spare, three 2-inch nipples, and one additional 2-inch monitor port for monitoring the interstitial space between the primary and secondary tanks. Other openings are indicated on the drawings.

E. Fuel: See Emergency Generator specifications for diesel fuel requirements. The contractor that provides the emergency generator must also provide the fuel for the fuel tank.

F. Tank Capacity: The fuel tank capacity shall allow the emergency generator to run for 72 hours at design demand load, not to exceed 500 gallons, while providing power to the building during a utility power outage.

G. A tank anchoring system shall be provided for the tank based on details provided in the plans.

H. The fuel tank shall be on the State of Florida Department of Environmental Protection (FDEP) approved list of tanks with current FDEP EQ number.

2.2 ANALOG LIQUID LEVEL SENSOR

A. Description: Provide a calibrated, analog electrical, ultrasonic type liquid-level sensor as described below.

B. The liquid-level sensor shall be a continuous output liquid level sensor that provides a direct current signal that is proportional to the fluid height in the tank. The sensor shall provide a continuous and linear current signal output from 4 mA when the tank is empty to 20 mA when the tank is full. The accuracy of the sensor shall be plus or minus 0.125”. The sensor shall operate on 24 VDC supplied by the SCADA system control panel. The sensor shall be threaded into a 2 inch NPT port.

2.3 LIQUID LEVEL SWITCHES

A. Description: Fluid level magnetic switch floats shall be provided for detecting the high level and low level tank level alarm points in the fuel tank. Ensure each switch can operate in normally open or normally closed contact states. The tank high level alarm switch will be set at 90% of the tank full level. The low level alarm switch will be set at 30% of the tank full level. The floats shall be constructed of Buna N material, and the stems shall be constructed from brass. The visible and audible tank alarms will be annunciated at the fuel tank monitor panel.

B. Leak Detection: A leak detection magnetic float switch shall be provided in the secondary fuel tank to detect leakage into the secondary tank. The switch contacts shall be a hermetically sealed reed switch. The stem material shall be brass, and the float material shall be Buna N. The visible and audible leak alarm will be annunciated at the fuel tank monitor panel.

2.4 DIRECT READING LIQUID LEVEL GAUGE

A. Install a direct reading liquid level gauge on top of the fuel tank and facing the fuel fill port. This gauge will be used during fuel filling operations to prevent overfilling the tank. The gauge shall be low profile with a cast aluminum body and a red indicator. The gauge markings will be E, ½, F. The operating arm that connects to the float shall be stainless steel and the float shall be HDPE material.

2.5 FUEL TANK MONITOR (FTM) AND ALARM PANEL

A. FTM Description: Provide a calibrated, leak-detection and fuel level monitoring system with probes, float switches, sensor cables, conduits, and other components to make up a complete and functional system. Ensure the enclosure is rated NEMA 4 and is installed in close proximity to the tank fuel fill port such that the alarms will be noticed by the person filling the tank.

B. The fuel tank monitoring panel shall include an audible and visual leak detection alarm, high level alarm, and low level alarm. Separate alarm contacts are required in the panel for the high level, low level, and leak detection alarms. The SCADA system will monitor these contacts and provide for remote monitoring of the fuel tank alarms. The alarm contacts shall be rated for 120 Volts, 3 Amps.

2.6 EMERGENCY TANK VENT

A. Provide an emergency vent of adequate capacity and size for each fuel tank and any interstitial spaces within the tank. The emergency vent will be a weighted, mushroom-style emergency vent. When pressure builds up within the tank, the weighted cast iron lid is forced up off its seat to relieve the pressure. When pressure is relieved, the lid lowers and is automatically reset.

2.7 NORMAL TANK ATMOSPHERIC VENT

A. Description: Provide a normal atmospheric vent cap and galvanized vent pipe of adequate capacity and size for each tank. The vent cap shall be constructed of cast aluminum and will be equipped with a 40-mesh brass insect screen. The vent shall extend a minimum of 12-feet above grade or 1-foot above the nearest enclosure, whichever is greater.

2.8 EXTRACTOR FITTING

A. Description: A 2” x 2” x ¾” tee fitting with female pipe threads shall be utilized as an extractor fitting for the foot valve.

2.9 FILL PORT

A. Provide a 4” carbon steel fuel filling port that includes an inlet spout adapter and a threaded fuel cap.

B. Ensure the fill port is enclosed by a 7-gallon, liquid tight, UL listed metal spill containment enclosure with a hinged metal cover. The hinged metal cover shall be equipped with a hasp for pad locking the cover closed. The overfill containment enclosure shall include a ball valve and a return line to return spilled fuel back to the primary tank.

2.10 LIGHTNING PROTECTION

A. Description: Above ground tanks shall be bonded to the toll building lightning protection system in accordance with NFPA 780. An underground lightning protection system conductor shall bond together the tolling gantry columns, the engine generator frame, the fuel tank ground lugs, the toll building power distribution system ground bar, and all outdoor metal items and equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tank in accordance with manufacturer’s written instructions and in accordance with NFPA 30.

B. Install tank accessories in accordance with manufacturer’s written instructions.

C. Provide unions, couplings, bushings as required to provide a complete installation.

D. Tank and connections shall be tested for tightness after installation and before being placed into service in accordance with NFPA 30.

E. Install the fuel tank and generator on a continuous concrete pad. In cases where the slab is poured against adjacent asphalt or concrete, the slab shall be poured flush such that there are no tripping hazards. In all cases, the slabs are to provide positive drainage away from the site and toll equipment building. Provide ½” perimeter joint around the concrete pad to isolate the surrounding areas from vibration.

END OF SECTION 23 13 23

SECTION 23 20 00
PIPING AND SPECIALTIES

LEVEL 1

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install the condensate drainage and refrigerant piping systems complete with all supports, hangers, specialties, and accessories as shown on Plans and herein specified.

B. Provide new materials free from defects and of American manufacture, and clearly marked with manufacturer's name and weight, classification, or working pressure of pipe and fitting.

1.2 RELATED WORK

A. GENERAL HVAC REQUIREMENTS: Section 23 05 00.

B. DUCTLESS SPLIT SYSTEM AIR CONDITIONERS: Section 23 81 19.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Submit manufacturer's technical data sheets and shop drawings for approval on all pipe, fittings, valves, hangers and supports, sleeves and specialties as listed in this Technical Special Provision before any work is commenced. Submit plumbing and piping erection drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 PIPE

A. The following schedule covers the materials which shall be furnished and installed unless otherwise specified under the particular system section:

	MATERIALS	SERVICE
1.	PVC pipe, DWV, Sch. 40.	Condensate piping.
2.	Class IV Concrete	Precast Concrete Pipe (for Dry Well)

2.2 PIPE FITTINGS

A. PVC Pipe: Schedule 40, DWV pipe and fittings for condensate drainage shall conform to ASTM D 2751. All PVC socket type connections shall be made with PVC solvent cement complying with ASTM D 2564.

B. Air Gap Fitting: Coated cast iron air gap fitting with integral cast air ports, female threaded inlet and outlet.

2.3 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports for the different applications as follows:

1. Plumbers strap shall not be used.

2. Pipe Saddles: 18 gauge galvanized iron, 12 inches long (min.) installed at all points where insulated lines bear on hangers.

3. Supports shall be generally capable of maintaining the installed load plus 500 lb. Support copper tubing at 6-foot (max.) intervals horizontally. Support PVC piping every 4 feet.

2.4 PIPE SLEEVES

A. Interior: Galvanized sheet metal, 22 gauge. Provide for pipe passing through walls or floors before pouring concrete. Plastic sleeves are permitted.

B. All sleeves shall be large enough to allow full thickness of insulation through sleeves for insulated piping, and for two layers of 30 lb. felt wrapping around un-insulated piping.

2.5 CONDENSATE DRY WELL

A. Provide precast concrete pipe for dry well, with the bell end supporting a H-20 traffic rated manhole cover and frame as shown on the Plans.

PART 3 - EXECUTION

3.1 GENERAL

A. The Plans are generally diagrammatic. They do not show every bend, off-set, elbow or other fittings which may be required in the piping for installation in the space allotted. Careful coordination of the work of this Technical Special Provision with that of other Divisions is necessary to avoid conflicts.

B. Line and Grade: Install gravity lines at uniform grade to low point after field verification of low point invert.

3.2 PIPE SLEEVES

A. Place all sleeves for piping prior to the pouring of concrete or in time to set in place as masonry walls are erected.

B. After piping is installed through the sleeves, complete with insulation or wrapping, the sleeves shall be sealed water-tight with an approved mastic or caulking compound.

3.3 JOINTING PIPE

A. Provide nipples of same material and weight as pipe used. Part of standard weight nipples is less than 1-1/2 inches.

B. Provide reducing fittings where changes in pipe sizes occur.

C. Provide unions or flanges in all service lines at each piece of equipment, specialty, valves or at other locations required for ready disconnect.

D. Provide all necessary drain piping from the low point of each of the systems, and other miscellaneous piping required by the various systems to make a complete installation. Drains shall not be smaller than connection at equipment and no drain shall be smaller than 3/4 inch.

E. PVC Pipe:

1. Remove all burrs from cut ends of PVC piping with knife, deburring tool or file.

2. Visually inspect the inside of pipe and fitting sockets and remove all dirt, grease or moisture with chemical cleaner and wipe clean with cloth prior to application of solvent.

3. All thermoplastic pipe installed underground shall be installed in accordance with ASTM D 2321.

3.4 PIPE HANGERS AND SUPPORTS

A. Provide brackets, rolls, clamps and supplementary steel as required for proper support of pipe lines. Design hangers to allow for expansion and contraction of pipe lines and of adequate size to permit covering to run continuously through hangers. Support piping at equipment independently so that no weight will be supported by equipment. Coordinate location of hangers with light fixtures. Wire brush all steel or iron supports and prepare surfaces under this Technical Special Provision for painting.

B. Special Supports: All clamps, hangers and supports required by equipment manufacturers, shall be furnished and installed as per their recommendations.

C. Plumbers tape, straps, chain, wire hangers, or perforated bar shall not be allowed as a means for hanging pipe.

3.5 EQUIPMENT CONNECTIONS

A. Make connections between equipment and the piping systems as shown and specified.

B. Make connections between any piece of equipment and any piping system by means of unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance.

3.6 CONDENSATE DRY WELL

A. Field coordinate with civil site and grading plans, utility plans, and all other trades for the exact location of the condensate dry well.

B. Do not locate dry well in the direct path of the site conduits.

END OF SECTION 23 20 00

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install two (2) ductless split system air conditioning systems with a wired duplex controller/thermostat. Mount the air handler's high on an interior wall of the building, and mount the condensing units outside of the building. Provide controls, refrigerant piping, condensate drains, attachments, and accessories as specified herein, and shown on the plans.

1.2 RELATED SECTIONS

A. Dual AC Control System and Sequence of Operation: .....Section 23 09 00

1.3 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Provide units by a single manufacturer, unless otherwise approved by the Engineer.

B. Performance Requirements:

1. Comply with performance requirements of the following:
   a. Air-Conditioning & Refrigeration Institute (ARI) Standards:
      ARI210 - Unitary Air-Conditioning Equipment.
      ARI270 -Sound Rating of Outdoor Unitary Equipment.
   b. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE):
      ASHRAE 52 - Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
      a. Underwriters' Laboratories (UL) Reference Standards.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each air handling unit (AHU), and conditioning unit (CU). Include the rated capacity, sensible capacity, operating characteristics, rough-in dimensions (as applicable), rigging procedures, service connection requirements, drain connections, performance ratings, materials, manufacturer's model numbers, power/electrical requirements, wiring diagrams showing connection points for the thermostat/dual unit controller.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for split AC systems.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Provide operation, maintenance and parts manuals in accordance with items 1 through 5 below.

1. Provide one USB Flash Drive copy and one paper book copy of the ductless split AC system manufacturer's parts manuals for each building under this contract. The parts manuals must show the original equipment manufacturers part numbers for all parts and accessories included with the packaged terminal air conditioner units.

2. Provide one USB Flash Drive copy and one paper book copy of the ductless split AC system manufacturer's service and repair manuals for each building under this contract.
   a. The service and repair manuals shall include the manufacturer's suggested preventive maintenance service activities, suggested intervals between each service, and the required parts and tools to perform the service.
   b. The service and repair manual will include separate chapters on each subsystem or major component of the ductless split AC systems. Each chapter will provide exploded view diagrams, required tools, and step by step procedures to repair or replace each component in the subsystem.

3. Turn over the USB Flash Drive and paper parts manual book and the USB Flash Drive and paper service manual book to the Construction Engineering & Inspection (CEI) firm when the site is turned over to the Department for installing the tolling equipment.

4. The Construction Engineering & Inspection representative will accept the paper and USB Flash Drive copy of the manuals and provide a written receipt to the contractor to show that the manuals were received and are awaiting review. The contractor will submit an electronic copy of the manuals to the Department for review as a Shop Drawing.

5. If the manuals are incomplete, or are lacking in meaningful parts information or step by step repair instructions, or do not cover the model or type of equipment being provided, then the Department may REJECT the manuals and indicate on the shop drawing review forms the nature of the deficiencies. The contractor will then collect the deficient materials from the CEI, correct the deficiencies, and then re-submit the materials within 15 calendar days for another review.

6. Submit a written copy of the warranty for each Air Conditioner system. Ensure the owner is listed as Florida's Turnpike Enterprise, with the physical address of the toll equipment building that the unit is being installed in. Ensure the physical address shown on the warranty is the same address as shown on the toll building utility bill.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ductless split AC system (s) in factory-fabricated containers designed to protect units and finish until final installation.

1. Store ductless split AC system (s) in original containers and in location to provide adequate protection to unit(s) while not interfering with other construction operations.

2. Handle ductless split AC system (s) carefully to avoid damage to components, enclosures, and finish. Do not install damaged equipment; replace and return damaged components to equipment manufacturer.

1.8 WARRANTY

A. Ductless split AC system(s) shall have a warranty that guarantees the AC systems are free from defects in materials and workmanship for a period of five (5) years and seven (7) years for the compressor. This guarantee shall be provided by the equipment manufacturer and include all parts and labor for the full extended guarantee period. The warranty period shall commence on the date that the Department accepts the completed building. Ensure the warranty lists the owner as: Florida's Turnpike Enterprise.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Description: Ductless split system, single zone, cooling only, utilizing a scroll type compressor controlled by a variable speed inverter drive.

B. Performance Rating: Cooling capacity of units shall meet the sensible heat and total heat requirements determined per design calculations and stated on the design drawings. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy the sensible cooling capacity.

2.2 COMPONENTS

A. Air Handling Unit (AHU)

1. High performance indoor wall mounted ductless AHU, with straight cool and no electric heat. The air handling units shall be factory assembled, wired, and tested. Ensure the AHU's are equipped with a self-diagnostic feature, a 3-minute time delay mechanism, an automatic restart function after a power failure, and a test run switch.

2. Fan: Direct drive sirocco fan with double inlet, forward curve, operated by a single motor. The fan shall be statically and dynamically balanced and the fan motor will be equipped with permanently lubricated bearings. The indoor fan shall have three different fixed speed settings: Low, Mid, Hi, and an Auto speed setting. The Auto fan setting will adjust the fan speed based on the difference between controller set-point and room temperature.

3. Vanes: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

4. Each AHU will be factory configured for left hand or right hand piping connections that is field selected by the installer.

5. The long life return air filter shall be washable.

6. A factory provided wall installation bracket shall be shipped with each unit.

7. The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All

tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory.

8. A condensate pan with a drain shall be factory provided under the evaporator coil. A condensate pan liquid level switch (DPLS1) will connect to the unit control board, and if actuated will stop the AHU from running to prevent condensate from overflowing.

9. The indoor air handler unit shall receive operating power from the outdoor condensing unit.

10. The refrigeration system shall include a liquid line filter drier, a linear expansion valve and a high-pressure safety switch. Refrigeration system's will use R-410A. Refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements. Ensure the refrigerant lines are individually insulated in twin-tube, flexible, closed-cell, CFC-free, elastomeric material.

B. Condensing Unit (CU)

1. The scroll compressor speed will be controlled by a variable speed inverter drive. The compressor speed will automatically vary to match the room heat load.

2. Provide each CU with the factory Seacoast Protection package that consists of:
   a. Phosphate coating and acrylic-enamel coating on the weather protective housing.
   b. The fan motor support shall be coated with epoxy resin.
   c. The separator assembly shall be epoxy resin coated.
   d. The condenser coil shall factory treated with "Blue Fin" protective coating.

C. The air cooled condenser shall be constructed of mechanically expanded copper tubes in enhanced surface aluminum fins. Components shall be rated for up to 100-degrees F ambient.

D. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse amplitude modulated signal, 24 volts DC. Control wiring shall be stranded wiring sized per manufacturer's recommendation.

E. Sequence of Operation: Refer to section 23 09 00 Dual AC Control System and Sequence of Operation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine rough-in electrical services and installation of floors and walls and other conditions under which ductless split units are to be installed. Verify dimensions of services and substrates before installing units.

3.2 INSTALLATION

A. Set each ductless split component securely in place, in strict accordance with manufacturer's instructions; adjust to correct height and level.

B. Provide adequate drainage for condensate system.

3.3 CLEANING

A. After completion of installation and completion of other work in surrounding areas, remove protective coverings, if any, and clean ductless split systems, internally and externally.

3.4 EXTRA PARTS

A. Provide one additional/spare filter for each unit.

END OF SECTION 23 81 19

SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL

LEVEL 1

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Plans, Specifications and general provisions of the Contract, including contractual conditions apply to this section.

1.2 WORK INCLUDED

A. This section includes Basic Electrical Requirements specifically applicable to Division 26, 27, and 28 Sections.

B. Furnish, perform, or provide all materials, equipment, and labor including the planning, purchasing, transporting, storing, installing, testing, cutting, patching, trenching, excavating, backfilling, coordination, field verification, and miscellaneous materials necessary for the installation of complete electrical systems as described or implied by these specifications and the applicable Plans.

C. All electrical equipment and materials used on this project shall be new and not used or reconditioned. Electrical equipment and machinery shall be of the most current designs and models.

D. Systems, equipment, materials and accessories that are assembled or installed in a toll equipment building shall comply with the following:

1. Florida Building Code, Current Edition in effect.

2. Florida Fire Prevention Code and the publications as referenced in

3. NFPA 1 – Uniform Fire Code (the Florida Latest Edition) and NFPA 101 – Life Safety Code (the Florida Latest Edition).

4. Provide an Arc Flash Hazard Analysis, in accordance with the latest version of the Standard for Electrical Safety in the Workplace, NFPA 70E. An arc flash hazard analysis shall determine the Arc Flash Protection Boundary and the personal protective equipment that people within the Arc Flash Boundary shall use. The arc flash hazard analysis shall be updated when a major modification or renovation takes place. Field install Arc Flash and Shock Warning labels on each piece of new electrical distribution equipment such as panelboards, safety switches, motor control centers, and automatic transfer switches. The labels will indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions.

E. Electrical distribution systems for Toll Facilities must be fully rated and selectively coordinated systems. The protective features of the electrical distribution system will automatically and selectively isolate a faulted or overloaded circuit from the remainder of the electrical system. Only the closest protective device to the fault will operate to isolate the fault without affecting other parts of the system.

F. Coordinate and verify power and communication company service requirements prior to material procurement and installation of service equipment.

G. Provide the labor and materials required to electrically connect all the items and equipment served by the power distribution systems in the toll facilities and tolling gantries that are identified in the Contract Documents. Some of this equipment may be shown on the civil or plumbing plans but not on the electrical plans.

H. Obtain all new physical addresses that may be required for the initiation of new electric and/or communication services and pay any required costs and fees.

1.3 DEFINITIONS

A. Provide: Furnish, install, and electrically connect to the power distribution system as applicable.

B. Review of shop drawings: A service by the Engineer to reduce the possibility of materials being ordered which do not comply with Contract Documents. The Engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the Contract Documents. When an error is not detected, this does not grant the Contractor permission to proceed in error.

C. Wiring: Wire and cable, installed in raceway with boxes, fittings, connectors, supports, accessories, overcurrent protection, and disconnects per applicable codes.

D. Work: Labor and materials required to complete a project.

E. Connect: Provide the labor and wiring to electrically connect equipment to the power distribution system, the digital communication system, access control, SCADA and all other subsystems associated with the toll facility as depicted on the toll facility plans.

F. Engineer: Florida's Turnpike Enterprise Director, Office of Construction, acting directly or through a duly authorized representative.

1.4 WORK SEQUENCE

A. Coordinate with the General Contractor for phasing. Renovation projects require the existing building and electrical systems to remain operational while the renovation work takes place.

1.5 DESCRIPTION

A. Install the equipment in locations shown or described in the Contract Documents.

B. Install all equipment such that all Code and Manufacturer recommended working clearances are maintained. Properly arrange and install all equipment within designated spaces. If a departure from the Contract Documents is necessary, submit to the Engineer for approval, detailed Plans of the proposed changes with written reasons for the changes. No change shall be implemented without approval as permitted by the Contract Documents.

C. Verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

D. Branch circuits shall be designed and installed such that the worst-case voltage drop at the end of a fully loaded circuit, operating at 0.8 pf lagging, does not exceed 3% voltage drop, measured line to neutral. Feeder circuits shall be designed and installed such that the worst-case voltage drop at the end of a fully loaded circuit, operating at 0.8 pf lagging, does not exceed 2% voltage drop, measured line to line.

E. All electrical enclosures, wireways, wire troughs, and pull boxes containing energized electrical conductors shall be equipped with access covers that are secured by screws, bolts, and or locks. Hinged door electrical enclosures shall be closed and pad locked when the equipment is energized. The padlocks shall be keyed with keys that match existing locks in the same toll maintenance region.

1.6 INVESTIGATION OF SITE

A. Examine the Contract Documents and the site of the proposed work carefully before submitting a proposal for the work. Investigate the conditions, the quality, and the quantities of the work and materials that will need be performed to meet the requirements of the Contract Documents.

B. Conduct a site visit to become familiar with all aspects of the proposed work and existing field conditions of the work. No compensation or reimbursement for additional expenses for failure investigate the existing facilities will be authorized. This shall include rerouting around existing obstructions. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.

C. Existing sizes, conditions and utilities indicated are taken from record documents, existing construction documents, and field surveys. Unforeseen conditions probably exist and the existing conditions shown on Plans may differ from the actual existing installation.

D. Provide removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that will be demolished.

E. Occupied buildings must remain in operation while the new work is being performed. Schedule work for a minimum outage to the Department. Reroute existing conduit and wiring in areas under construction such that the building systems remain active and useable for the building occupants. Notify the Project Manager 48 hours before any shut-down of existing systems.

1.7 CONTRACT DOCUMENTS

A. The Plans are diagrammatic and are not intended to include every detail of construction, materials, methods, or equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with the Civil, Architectural, Structural, Mechanical, and Plumbing trades as applicable. Layout the equipment before installation so that all trades may install equipment in the spaces available.

B. Should conflicts exist between the Plans and Specifications, take responsibility to ask for clarification prior to performing the work.

C. Refer to the Toll Facility plans for dimensions and fit the work to conform to the details of the building construction. The right is reserved to shift any switch, receptacle, ceiling outlet or any special outlet a maximum of 12 inches from its location as shown before it is permanently installed, without incurring additional costs, delay claims, or other impacts to the Contract or project schedule.

D. Wiring arrangements for equipment shown on the Plans are intended to be diagrammatic and do not show all required conductors and functional connections. Provide all items to form a complete and operating system.

E. Locations indicated for outlets, switches, and equipment are approximate and shall be coordinated with the Contract Documents and other trades. Where instructions or notes are insufficient to locate the item, ask for clarification from the Engineer.

1.8 MATERIALS AND EQUIPMENT

A. Unless otherwise noted, all material shall be new and U.L. listed or labeled. In lieu of UL listing or labeling, a statement or data demonstrating compliance with Contract Documents from a National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7 shall be submitted for approval.

B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to the Engineer's review and written approval.

C. When a product is specified to be in accordance with a trade association or government standard and at the request of the Engineer, furnish a certificate from the manufacturer that shows the product complies with the referenced standard. Supporting test data may also be requested by the Engineer to substantiate compliance.

D. Where multiple items of the same equipment or materials are required, they shall be the product of the same Manufacturer.

E. Prior to placing equipment orders, verify that the physical dimensions of the equipment will allow for proper installation in the space allotted on the Plans and with NEC working clearances.

F. Electrical equipment shall be protected from the weather during shipment, storage, and construction per the manufacturer's recommendations. Should any equipment be subjected to damage by water, it shall be replaced without additional cost to the Department.

G. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair the damaged equipment (in compliance with industry standards) at no additional cost to the Department. Any equipment and/or testing required for the repairs shall be provided by the Contractor.

H. Material and equipment shall be provided complete and shall function up to the specified capacity or function. Should any material or equipment, as a part or as a whole, fail to meet the performance requirements, the material or equipment shall be replaced or repaired to bring the performance up to the specified requirements. Damages to the finish or the paint by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Department.

I. Where tamper proof screws are specified or required, Phillips head or Allen head screws are not acceptable as tamperproof. For each size or type used, provide the Department with three tools. If existing tamper proof equipment exists on the job site, the screw heads shall match the existing.

1.9 SUPERVISION OF THE WORK

A. Reference the Contract Documents for additional requirements.

B. A qualified and experienced electrical superintendent shall be in charge of the work in progress at all times. If, in the judgment of the Department’s representative, the electrical superintendent is not performing duties satisfactorily, the General Contractor shall immediately replace the individual upon receipt of a letter of request from the Department. Once a satisfactory electrical superintendent has been assigned to the work, that individual shall not be withdrawn by the Electrical Contractor without the written consent of the Department.

Provide field superintendent(s) who have a minimum of four years previous successful experience on projects of comparable sizes and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected.

1.10 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by the work of others. Work required under other divisions will be performed at no additional cost to the Department including but not limited to electrical work required for the following items when depicted on the Toll Facility plans:

1. Door hardware

2. Mechanical Division of the toll building plans and specifications

B. Installation studies shall be performed by the Contractor to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the General Contractor prior to installation of the equipment.

1.11 SUBMITTALS AND SHOP DRAWINGS

A. Submit specific shop drawings which indicate the fabrication, assembly, installation, and erection of particular systems' components. Plans that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, code requirements, or applicable standards.

B. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Department. Coordinate the exact location of floor stub-ups with the General Contractor (and receive their approval) prior to rough-in.

C. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (lights, motors for fans, compressors, etc.). Coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. Adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the Department.

D. Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing in the power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in the Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.

E. Provide the following when TEBs are depicted on the toll facility plans:

1. Detailed interior toll building elevation drawings at a scale of 1/2" = 1' shall be prepared by the Electrical Contractor and submitted with the engineering shop drawings for review and approval by the Engineer of Record prior to the start of work. Prepare a separate set of drawings for each toll building and show the site specific name in the title block. Provide a drawing for each wall in each of the Toll Equipment Buildings in the project. The elevation drawings shall show the actual physical dimensions required for the installation to assure proper integration of the equipment with other building systems while maintaining NEC required clearances. Locations of conduits, racking, junction boxes, panelboards, safety switches, receptacles, light switches, control panels, UPS units, Bypass switches, surge protection devices, wall cabinets, leased line circuit boards, thermostats, and all wall mounted equipment shall be shown. Coordination drawings shall be provided for all areas and rooms where electrical switchboards, panelboards, and transformers are installed.

2. Detailed coordination drawings at a scale of 1/2" = 1' shall be prepared by the Electrical Contractor and submitted with the engineering shop drawings for review and approval by the Engineer of Record prior to the start of work. Prepare a separate set of drawings for each toll building and show the site-specific name in the title block. Provide a reflected ceiling drawing for each ceiling and a plan view drawing for each floor in the Toll Equipment Building(s). The drawings shall show the actual physical dimensions required for the installation to assure proper integration of the equipment with other building systems while maintaining NEC required clearances. Locations of conduits, racking, ladder type cable trays, light fixtures, etc., shall be shown on the drawings. Coordination drawings shall be provided for all areas and rooms where electrical switchboards, panelboards, and transformers are installed.

3. Detailed site conduit drawings at a scale of 1" = 20' shall be prepared by the Electrical Contractor and submitted with the engineering shop drawings for review and approval by the Engineer of Record prior to the start of work. Prepare a separate set of drawings for each toll site and show the site-specific name in the title block. Provide a detailed drawing showing how all site conduits will be routed from origin to termination point.

4. Detailed conduit routing drawings for the enlarged site plan at the building at a scale of 1/4"=1' shall be prepared by the Electrical Contractor and submitted with the engineering shop drawings for review and approval by the Engineer of Record prior to the start of work. Prepare a separate set of drawings for each toll site and show the site-specific name in the title block. The shop drawings shall also show in detail how the conduits will stub-up in the building floor slab and how the conduits will penetrate the exterior building wall and interior building walls.

1.12 PROVISION FOR OPENINGS

A. Perform the following for all toll equipment buildings depicted on the Toll Facility Plans:

1. Locate openings required for work. Provide sleeves, guards or other approved methods to allow passage of items installed.

2. Coordinate with roofing Contractor on installation of electrical items which penetrate the roof or are mounted on the roof. Roof penetrations shall be installed so as to not void the roof warranty.

3. Where work pierces any waterproofing, it shall maintain the integrity of the waterproofing. Coordinate the work which pierces the waterproof barrier with the General Contractor.

4. Coordinate with Fabricated Structures Manufacturer to accommodate the field installed locations of electrical items which penetrate the Toll Equipment Building floor, walls and ceiling.

5. Field verify all conduits installation penetrating the foundation to ensure that conduit layout is completed prior to the foundation pour.

1.13 CONCRETE PADS

A. Furnish and install reinforced concrete pads for transformers. Unless otherwise noted, pads shall be four (4) inches high and shall exceed the dimensions of the equipment being set on them, including future sections, by six (6) inches on each side. The concrete pads will be reinforced with 6x6-W1.4xW1.4 welded wire mesh. Trowel all surfaces smooth.

B. Refer to Civil & Structural plans for the requirements of outdoor concrete slabs supporting generators and other free-standing equipment. Coordinate slab installation, dimensions, and conduit stub-ups with approved equipment shop drawings.

1.14 SURFACE MOUNTED EQUIPMENT

A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. inside toll equipment buildings depicted on the toll facility plans shall have a factory finish or shall be painted as directed by designer. Paint shall be in accordance with applicable sections and/or divisions of these specifications.

1.15 CUTTING AND PATCHING

A. Reference Division 1 - General Requirements.

1. Provide cutting and patching necessary for the installation of Division 26 work.

2. Cutting of work in place shall be cut, drilled, patched and refinished to match specified finish.

3. Backfill new grades to match adjacent undisturbed surface.

4. Schedule work to place Division 26 work to avoid as much cutting and patching as practical.

1.16 TRENCHING AND BACKFILLING

A. All trenching, backfilling and compaction requirements shall be in accordance with other sections of these specifications.

B. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 C.F.R.s. 1926. 650 Subpart P.

1.17 DELIVERY, HANDLING, PROTECTION OF MATERIALS, AND STORAGE

A. Ship, deliver, and store products in the manufacturer’s protective packing to prevent damaging.

B. Handle equipment carefully to prevent damage to components, breakage and denting or scoring of surfaces and finishes.

C. Store all equipment and products in clean, dry spaces. Protect all equipment from dirt, fumes, water, chemicals, construction debris and physical damage. Any equipment exposed directly to moisture will not be acceptable and shall be replaced at no additional cost to the Department.

D. Replace damaged products and equipment. Repair and repaint marred and damaged finishes to original factory finish as directed by manufacturer and as herein specified.

E. Keep all conduits and other openings protected against entry of foreign matter.

1.18 INSTALLATION

A. Listed or Labeled Equipment shall be installed and used in accordance with any instructions included in the listing or labeling.

B. Erect equipment to minimize interference and delays with the execution of the Work.

C. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the Department at no additional cost to the Department.

D. Equipment requiring electrical service shall not be energized or placed in service until the General Contractor is notified and is present or have waived their right to be present. Where equipment to be placed in service involves service or connection from another Contractor, notify the General Contractor in writing as appropriate when the equipment will be ready.

E. Equipment supports shall be secured and supported from structural members unless written approval is granted by the Engineer.

F. Plywood material shall not be used as a backboard for mounting panelboards, disconnects, motor starters, and dry type transformers. Install additional structural supports to support wall mounted electrical equipment.

G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided by the electrical contractor.

1.19 AS-BUILT DOCUMENTS

A. Verify aspects of as-builts for accuracy. As-Built Documents shall show all components including but not limited to:

1. Raceways 1-1/4" and above, cable tray systems, and grouped raceway racking as installed, including dimensions from fixed lines such as slab edges.

2. All site underground raceways and duct banks.

3. Pull boxes and manholes including elevations.

4. Lighting.

5. All junction boxes 6”X6” and larger shall be shown in exact location.

6. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box shall be indicated.

7. Any circuit number changes.

8. All conductors and cables, cable sizes, raceway sizes, etc.

9. Any panelboard changes, including load changes.

10. All access panels.

11. All existing conditions.

12. Location of lighting control devices such as photocell controls, space occupancy sensors, etc.

13. All wireway and cable tray systems.

14. Exact location of all driven grounding electrodes

15. Show the location of all grounding and lightning protection ground loops.

16. SCADA system control panels and associated electrical devices, connections, and power supplies as depicted on the Toll Facility plans.

17. Riser diagrams exactly as installed.

18. Panelboards, equipment racks, disconnects and switches and Surge-Protective devices.

19. Update the plan notes to agree with items actually furnished, actual installation methods, etc.

1.20 WARRANTY

A. Reference the Contract Documents.

B. The Warranty will cover the materials and workmanship provided by the Contractor to complete the project. The Warranty shall be provided by the Contractor to the Department and shall include Labor and Materials for a period of one year from the date of the Substantial Completion. The Warranty shall not include light bulbs in service after one month from date of substantial completion of the project.

1. Explain the provisions of warranty to the Department at the Operational Testing Walk-through.

C. Where extended Warranties or Guarantees are called for in the Contract Documents, furnish three copies to be inserted in the Operation and Maintenance Manuals.

D. All preventative maintenance and normal service will be performed by the Department’s maintenance personnel after final acceptance. This shall not alter the Contractor's 1 year warranty or the manufacturer’s warranty of the installed equipment.

1.21 WASTE MATERIALS DISPOSAL

A. Include in base bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, laws, regulations and guidelines applicable. Comply fully with Florida Statute 403.7186 regarding mercury

containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal.

END OF SECTION 260500

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements for shop drawing submittals applicable to Division 26, 27, and 28.

B. See Section 260502 - Substitutions for additional requirements when submittals consist of substitution equipment.

C. Requirements for shop drawings that must operate together as a system.

1.2 SUBMITTAL OF "SUBSTITUTE" EQUIPMENT OR PRODUCT

A. Manufactured items or equipment shown in the released for construction plans and/or specifications that show part numbers or catalog numbers may not be substituted unless the words "or approved equal" are shown immediately after the part number or catalog number.

B. Representation: In submitting a substitute item, equipment, product, etc. that has not been listed on Plans, in Contract Documents or in an addenda, verify / perform the following:

1. Substituted item is equal or superior to specified product in all aspects.

2. Coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.

3. Waive all Claims for additional costs related to substitution which may subsequently become apparent.

4. Provide the same warranties for the substitution as for the original product specified.

5. Absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, mechanical, structural, architectural, civil, etc.

6. Absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in the substituting procedure thus submitting inferior, misapplied or mis-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review of the substituted product by all involved parties.

1.3 SHOP DRAWING SUBMITTALS SHALL INCLUDE:

A. The first sheet of each shop drawing shall list the project title and Contractor information. The list shall include the site-specific name of the building or site, the subcontractors, engineers, contact names, and telephone numbers, (see form included at end of this section).

B. Submit a shop drawing that includes specification sheets, catalog sheets, schematics, manuals, etc. for each separately numbered specification section in the Index of the Technical Special Provision (TSP). If the project will not use any products from a TSP section, then submit the shop drawing with a note indicating "No products or materials from this TSP section will be installed on this project."

C. The following shop drawing sections must be compatible and operate together as a system when depicted on the Toll Facility plans:

1. Dual AC Control System and Sequence of Operation: .....Section 23 09 00

2. Ductless Split System Air Conditioners: .....Section 23 81 19

3. Fuel Oil Piping: .....Section 23 11 13

4. Concrete Protected Above Ground Fuel Storage Tank: .....Section 23 13 23

5. Supervisory Control and Data Acquisition: .....Section 26 09 13

6. Panelboards: .....Section 26 24 16

7. Emergency Generator-Permanent: .....Section 26 32 13

8. Static Uninterruptible Power Supply: .....Section 26 33 53

9. Automatic Transfer Switch: .....Section 26 36 00

D. The following shop drawing sections must be compatible and must be coordinated for installation of the electrical conduits entering toll equipment buildings when depicted on the Toll Facility plans:

1. Fabricated Structures: .....Section 13 34 23

2. Common Work Results for Electrical: .....Section 26 05 00

E. Each set of shop drawings will show the name or title of the toll site(s).

F. Submittal product data shall be presented in a clear and thorough manner. Clearly mark each sheet to identify pertinent products or models applicable to this project.

Indicate all optional equipment and delete or cross out non-pertinent data. Markings shall be made with arrows, circles or underlining. Highlighting is not acceptable.

G. Partial shop drawings for a TSP specification section are not acceptable and will not be reviewed. Ensure each shop drawing submittal is complete and includes all the products, materials, manuals, etc. specified in the particular TSP section.

H. Drawings, riser diagrams, wiring diagrams, and schematic diagrams shall include identification of the project name, and the specific site name when multiple sites are included in the same project.

I. Product Data: Technical product data is required for all items as called for in the specifications regardless if item furnished is as specified.

1. Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the specifications. Furnish drawings, or diagrams, dimensioned and in the correct scale, covering equipment, showing arrangement of components and overall coordination.

2. In order to facilitate review of product data, they shall be clearly annotated, indicating by cross-reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the Contract Documents. Identify product data as to the item and/or location (i.e. "surge suppression switchboard MDP").

3. See specific sections of the specifications for further requirements.

4. Re-Submit any technical data or shop drawing rejected by the Engineer of Record or the Department.

"EXAMPLE PAGE 1"

ELECTRICAL SYSTEM SHOP DRAWING AND BROCHURES

SECTION 260526 - GROUNDING

FLORIDA DEPARTMENT OF TRANSPORTATION
FPID #515462-2-62-01

XYZ TOLL PLAZA
JACKSONVILLE, FLORIDA

ARCHITECT:

ENGINEER:

GENERAL CONTRACTOR:

SUBCONTRACTOR:
(Provide list of all subcontractors)

END OF SECTION 260501

SECTION 260502
SUBSTITUTIONS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section specifies general, administrative and procedural requirements for substitutions for Division 26, 27 and 28.

B. If a new request for substitution is submitted for an item that impacts previously approved requests for submission for any reason, the Department reserves the right to request that the new and/or the previously approved request for submission be re-submitted for review.

1.2 DEFINITIONS

A. Definitions used in this TSP are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:

1. Does not meet all the requirements of these specifications under Part 1 - General or Part 2 - Products for any section included in Division 26 - Electrical Specifications, Division 27 CCTV Specifications, and Division 28 Security Specifications.

2. Is not the specified manufacturer and/or model which accomplishes the same result as that design specified in Division 26 - Electrical Specifications, Division 27 CCTV Specifications, and Division 28 Security Specifications.

3. Is of similar or different design that:
   a. Requires more space.
   b. Requires more power.
   c. Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.
   d. Affects the project schedule or cost.

1.3 REQUEST FOR SUBSTITUTION SUBMITTALS

A. Separate requests for substitutions shall be submitted for each individual product, material, equipment, etc. that is defined as a substitution.

B. The submittal must consist of a dated written request for substitution as required below. The request must be very specific as to what specified item the request for substitution is submitted for.

C. Each request for substitution submittal shall include:

1. Name of product, material, equipment, etc. to be substituted.

2. Drawings, product data, performance data and/or other information necessary for the Engineer to determine whether the equipment meets all specifications and requirements.

3. Compliance statement. Each request for substitution shall include the following compliance statement typed on letterhead of submitting company:
   a. Submittal complies with all aspects/requirements of Contract Documents: (Yes/No) If No, state deviances:
   b. Submittal complies with all applicable codes: (Yes/No) If No, state deviances:
   c. Submittal does not require change to any other element of the work: (Yes/No) If No, state required change:
   d. Meets or exceeds the performance of specified product: (Yes/No) If No, state required change:
   e. Affects project schedule: (Yes/No) If Yes, quantify impact:
   f. Affects project cost: (Yes/No) If Yes, quantify impact:

1.4 CONSIDERATION AND ACCEPTANCE

A. Request for substitutions will not be considered if:

1. Submittal does not comply with all requirements as noted above or does not contain all information required above.

2. If submittal does not contain compliance statement, fully filled out.

3. If "No" was answered to items a, b, c, or d in the compliance statement section 1.3.C.3.

4. Submittals are received beyond time limitations noted above.

5. Samples:
   a. Sample(s) may be required to be submitted, if deemed necessary by the Engineer to determine if the substitution meets specifications.

b. The Engineer reserves the right to reject the sample and consequently the substitution if the sample not meet the requirement of the Contract Documents.

B. Substitutions will be considered on basis of design, concept of work, and overall conformance with information given in Contract Documents, including but not limited to:

1. Design criteria, which shall be equal or superior to the specified item.

2. Finishes, which shall be identical or superior to finishes of specified product.

3. Lenses or louvers, which shall be identical in size, thickness and type material specified.

4. Physical size and dimension which are identical or within design criteria limitations as determined by the Engineer.

5. Photometric data, which shall be identical or superior in quantity and quality.

6. Trim detail, electrical, and mechanical qualities, shall be identical or within design criteria limitations as determined by the Engineer.

C. The Engineer's decision on acceptance or rejection of substitutions is final.

D. Approval of a substituted item or listing a substituted item as an approved substitution does not modify or act as a waiver of the requirements of the Contract Documents. See Section 260501 for additional requirements on approved substitution submittals, equipment, etc.

E. The naming of any manufacturer as an approved substitution does not imply automatic approval as a substitution. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for systems that meet or exceed these specifications.

END OF SECTION 260502

SECTION 260503
REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Reference Standards and Regulatory Requirements specifically applicable to the project and these specifications.

B. The requirements stated herein are in addition to Division 01 - General Requirements and any supplemental requirements/conditions.

1.2 REFERENCES

A. The following references may or may not be referenced within these specifications:

ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects 1735 New York Avenue, NW Washington, DC 20006
ACI	American Concrete Institute
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103

BICSI	BICSI Executive Offices University of South Florida Tampa, Fl 33620-8700
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60195
DCA-ARM	Department of Community Affairs-Accessibility Requirements Manual
DOCA or DCA	State of Florida Department of Community Affairs 2740 Center View Drive Tallahassee, Florida 32399-2100
EIA/TIA	Electronics Industries Association/Telecommunications Industry Association 2001 Pennsylvania Avenue, NW Washington, DC 20006
EJCDC	Engineers' Joint Contract Documents Committee American Consulting Engineers Council 1015 15th Street, NW Washington, DC 20005
FBC	Florida Building Code
FBCFG	Florida Building Code – Fuel Gas
FBCM	Florida Building Code – Mechanical
FBCP	Florida Building Code – Plumbing
FEMA	Federal Emergency Management Agency.
FLA.	State of Florida
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 688 Norwood, MA 02062
FPC	Fire Protection Code
IEEE	Institute of Electrical and Electronics Engineers 345 East 47th Street New York, NY 10017
IES	Illumination Engineering Society

ICPEA	International Power Cable Engineer's Association
LPCR	Local Power Company Requirements
LTCR	Local Communication Company Requirements
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code (ANSI C2)
NEMA	National Electrical Manufacturers' Association 2101 'L' Street, NW Washington, DC 20037
NFPA	National Fire Protection Association Battery March Park Quincy, MA 02269
OSHA	The Occupational Safety and Health Act
SFM E	State Fire Marshal's Rule on Elevators
SFM FAS	State Fire Marshal's Rule on Fire Alarm Systems
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 8224 Old Court House Road Vienna, VA 22180
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
NFPA 13	Standard for the Installation of Sprinkler Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 31	Standard for the Installation of Oil Burning Equipment
NFPA 33	Standard for Spray Application Using Flammable and Combustible Materials
NFPA 69	Standard for Explosion Prevention Systems
NFPA 70	National Electrical Code

NFPA 72	Standard for the Installation, Maintenance and Use of Local Protective Signaling Systems
NFPA 75	Standard for the Protection of Electronic Computer/Data Processing Equipment
NFPA 82	Standard for Fire Doors and Windows
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air Conditioning Systems
NFPA 91	Standard for the Installation of Exhaust Systems for Air Conveying of Materials
NFPA 92A	Standard for Smoke Control Systems
NFPA 96	Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment
NFPA 101	Life Safety Code
NFPA 105	Standard for Smoke Control Door Assemblies
NFPA 110	Standard for Emergency and Standby Power Systems
NFPA 780	Standard for Lightning Protection
ASTM E136	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees Fahrenheit

1.3 REGULATORY REQUIREMENTS

A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws. All Work shall meet these requirements.

1. Standards and Miscellaneous Codes/Requirements: Comply with latest edition or notice available unless otherwise adopted by Authority having Jurisdiction of the following standards, codes and regulatory requirements:

ADA
ANSI
ASHRAE
ASME
ASTM
CRSI
DCA
EIA/TIA
FBC
FBCFG
FBCM
FBCP
FFPC
IEEE
IES
LPCR
LTCR
NEC
NECPA
NESC
NEMA
NFPA Codes and Standards as listed in section 1.2 above
OSHA
SMACNA
UL
Applicable Florida Statutes and Referenced Codes/Standards.
All Federal, State, Local Codes, Laws and Ordinances as applicable.

END OF SECTION 260503

SECTION 260504
ELECTRICAL SYMBOLS AND ABBREVIATIONS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Symbols and abbreviations specifically applicable to all Division 26, 27, and 28 sections in addition to those in Division 01 - General Requirements and any supplemental requirements or conditions.

1.2 SYMBOLS

A. In general, the symbols used on the Plans conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted.
   1. Corps of Engineers
   2. Special Symbols as shown in schedules or legends.
   3. FDOT Symbols for roadway lighting or site utilities

1.3 ABBREVIATIONS

A. The following abbreviations or initials are used.

AC Air Conditioning
A.C. Alternating Current
A/E Architect/Engineer (or Engineer when Architect not applicable)
AFF Above Finished Floor
AFG Above Finished Grade
AHU Air Handler Unit
AIC Ampere Interrupting Capacity
AL Aluminum
AMP Ampere
ANSI American National Standards Institute
AWG American Wire Gauge
BLDG Building
BRKR Breaker
BTU British Thermal Unit
BTUH BTU Per Hour
C. Conduit
C.B. Circuit Breaker
CBM Certified Ballast Manufacturers
CFM Cubic Feet per Minute
CKT. Circuit
C/L Center Line
Clg. Ceiling
Comp. Compressor

Conn. Connection
Cond. Condenser
Cont. Continuous
C.R.I. Color Rendering Index
C.T. Current Transformer
C.T.B. Computer Terminal Board
CU. Copper
C.U. Compressor Condenser Unit
D.B. Direct Burial
D.C. Direct Current
Disc. Disconnect
DN. Down
DPST Double Pole Single Throw
E.C. Electrical Contractor (or General Contractor)
EMT Electric Metallic Tubing
Equip. Equipment
EST Estimate
FACP Fire Alarm Control Panel
FHC Fire Hose Cabinet
FLA Full Load Amperes
FT. Feet
FTE Florida's Turnpike Enterprise
FLR Floor
F.C. Footcandles
FVNR Full Voltage Non-Reversing
GAL. Gallon
Galv. Galvanized
GPH Gallons per Hour
GPM Gallons per Minute
GFCI Ground Fault Circuit Interrupting
GRS Galvanized Rigid Steel Conduit
GND. GRD Ground
HTG Heating
HT Height
HZ Hertz (Cycles)
HPF High Power Factor
HPS High Pressure Sodium
HP. Horsepower
HR. Hour
IMC Intermediate Metallic Conduit
Incand. Incandescent
in. Inches
J.B. Junction Box
Kcmil Thousand Circular Mils
KVA KiloVolt Ampere
KW Kilowatts

KWH Kilowatt Hour
L.L.D. Lamp Lumen Depreciation
LED Light Emitting Diode
LT. Light
LTG. Lighting
LTS. Lights
L.P.F. Low Power Factor
M.C.B. Main Circuit Breaker
M.D.P Main Distribution Panelboard
M.L.O. Main Lugs Only
Maint. Maintenance
MH. Manhole; Metal Halide
MFG. Manufacturer
max. Maximum
MCM Thousand Circular Mils
MCP Motor Circuit Protector
MTD Mounted
N. Neutral
NEC National Electrical Code
NETA ATS International Electrical Testing Association, Acceptance Testing Specifications.
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
NF Non Fused
N.C. Normally Closed
N.O. Normally Open
NIC. Not in Contract
No. Number
OD Outside Diameter
O.L. Overload
OLS Overloads
% Percent
∅ Phase
P. Pole
P.T. Potential Transformer
PSF Pounds per Square Foot
PSI Pounds per Square Inch
PB Pullbox
PNL Panel
PR Pair
Pri. Primary
PVC Polyvinyl Chloride
Recept. Receptacle
RMC Rigid Metal Conduit
RPM Revolutions per Minute
SCA Short Circuit Amps

Sec. Secondary
S/N Solid Neutral
SPD Surge-Protective Device
SPST Single Pole Single Throw
SF Square Foot
SW. Switch
SWBD Switchboard
Sys. System
THHN; THWN Nylon Jacketed Wire
TYP Typical
Temp. Temperature
U.L. Underwriters' Laboratories
VFD Variable Frequency Drive
VSD Variable Speed Drive
VHF Very High Frequency
VHO Very High Output
V Volt
VA Volt Amperes
Vol Volume
W Wire
W.P. Weatherproof
XFMR Transformer
Y Wye
Yd. Yard
Yr. Year
3R Rainproof
4X Stainless Steel Dustight, Watertight

END OF SECTION 260504

SECTION 26 05 05
OPERATIONAL TESTS AND PERFORMANCE VERIFICATION

LEVEL 1

PART 1 - GENERAL

1.1 DESCRIPTION OF PROCESS

A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to operationally test the electrical and control systems installed.

B. After the electrical systems have been installed and individually commissioned, the systems and equipment will be functionally tested with all the systems and equipment running simultaneously to verify that the normal operation of any one system or piece of equipment does not interfere or aggravate any other system or equipment. The Contractor will perform the operational tests and a Department representative will observe the process.

C. An important component of this process is providing the Department with the operation manuals, service manuals, parts manuals, spare parts, keys, system settings, software on discs, and warranty documents for each piece of equipment provided in accordance with the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 APPLICABILITY

A. All items provided in this section are applicable only when the respective components are depicted in the Toll Facility plans.

3.2 OPERATIONAL TESTS

A. Before the Operational Tests begin, the facility must be clean and all unused materials and equipment must have been removed. After successful completion of the operational tests, the toll facility and equipment will be locked and secured by the Department.

B. A report, that shows all systems are functioning properly and the normal operation of any one system or piece of equipment does not interfere or aggravate any other system or equipment, will be provided to the Department. The forms below in Subsections 3.3 through 3.8 will be used as the template for the report. If the system or component being

tested does not function properly or interferes or aggravates any other system or equipment, then the system will receive a “Fail” grade. Any systems that Fails the operational test will be repaired or adjusted by the Contractor at no additional cost to the Department, and then retested. If the system fails the operational test three times, then the system or components must be removed by the contractor and replaced with a different system or components. The replacement system or components will be retested as specified above, to ensure it is satisfactory, at no additional cost to the Department.

C. Ensure the following systems are energized and operating normally with no alarms.

1. Electrical power distribution system
2. Emergency Power Off Station
3. Emergency generator - ready to operate
4. Above ground storage tank and fuel tank monitor panel as applicable.
5. Automatic transfer switch

D. When toll equipment buildings are depicted in the Toll Facility plans, also ensure the following systems are energized and operating normally with no alarms.

1. UPS and UPS Bypass switch
2. HVAC system
3. Lighting – Normal and Emergency
4. SCADA system
5. Tolling Communication Rack
6. Fiber Optic Communications System

3.3 Lighting System – Normal and Emergency.

	Lighting System – Normal and Emergency	**Pass or Fail**
1.	Operate the light switches/toggle switches in each room to verify that the lights are controlled in accordance with the Plans.	
2.	Operate the light switches/toggle switches that control the convenience/service lights on the accessible gantry if present. Verify that the lights are controlled in accordance with the Plans.	
3.	Test the emergency lights in each room. Open the circuit breaker serving the normal lighting and then observe each emergency light as it operates. After 2 minutes, close the circuit breaker for the normal lights and observe the emergency lights turn off automatically.	
4.	Operate the outdoor lights and site lighting. Cover the outdoor photocell and observe the outdoor lights as they illuminate. Uncover the outdoor photocell and observe the outdoor lights turn off.	

3.4 Above Ground Storage Tank and Fuel Tank Monitor Panel.

	Above Ground Storage Tank and Fuel Tank Monitor Panel	**Pass or Fail**
1.	Open the circuit breaker that serves the fuel tank monitor (FTM). Verify the panelboard directory card description is accurate. Close the circuit breaker that serves the FTM and observe the FTM "power on" light is energized.	
2.	Press the "TEST" button on the FTM and observe the High level, Low level, and Leak alarm lights energize. Also confirm the alarm horn sounds. Release the test button and clear the alarms.	
3.	Operate the fuel oil pipe valves. The valves should operate easily with no binding. Leave the valves in the open position.	
4.	Inspect the direct reading fuel level gauge on top of the fuel tank. The fuel level should be between 90% and 95% full.	
5.	Inspect the analog fuel level sensor and wiring for proper installation and operation.	
6.	Use the SCADA control panel operator interface to view the level in the fuel tank. The SCADA system should indicate that the fuel level is between 90% and 95% full.	
7.	Turn over the operator manuals and parts manuals to the FTE representative.	

3.5 Access Control System.

	Access Control System Commissioning Procedure	**Pass or Fail**
1.	Verify the door key(s) for the toll equipment building are available and are on site.	
2.	Open the circuit breaker(s) in the panelboard that will serve the future access control system. Verify the panelboard directory card description is accurate. Leave the breaker open.	
3.	Inspect the door locking hardware, and the request to exit device J-box. Verify each device is present and installed.	
4.	[redacted]	
5.	Use an Ohm Meter to measure the continuity of the request to exit switch contacts in the [redacted]. When the sensor detects the presence of a person on the secure side of the door, the request to exit contacts should be closed and the Ohm Meter should measure less that 0.1 Ohm. When the sensor does not detect a person near the door, the request to exit contacts should be open and the Ohm Meter should measure greater than 1 Mega Ohm.	
6.	With the access controlled door closed, open the door from the outside (unsecured side) by using the key to unlock it. Verify the key will lock and unlock the door.	
7.	Review the construction plans and verify that each access control raceway and junction box are present.	
8.	Turn over the door keys to the Department representative.	

3.6 HVAC System.

	A/C System Lead/Lag Operational Test	**Pass or Fail**
1.	Check the setting of the thermostat and verify it is set for 75 degrees Fahrenheit. Reprogram thermostat if necessary.	
2.	Measure the dry bulb temperature and relative humidity in the toll equipment building near the center of the room for 1 hour. Ensure the temperature is maintained between 73 degrees and 78 degrees and the relative humidity remains less than 50%.	
3.	Verify that only one A/C unit is running and that one A/C unit running with the 1st stage compressor running will cool the toll equipment building to 75 degrees and less than 50% relative humidity.	
4.	Open the circuit breaker that serves the A/C unit that is running. This is the "Lead" unit. Verify the panelboard directory card description is accurate and agrees with the Name Plate Label affixed to the unit.	
5.	Monitor the other A/C unit (the Lag unit) and verify it starts and begins to cool the room within 60 seconds.	
6.	Close the circuit breaker that serves the A/C unit in step 1 above. Verify the unit is re-energized.	
7.	Repeat steps 4, 5, and 6 for the other A/C unit.	
8.	Measure and record the full load Amperage of each A/C unit when operating with the compressor at 1st stage cooling level. Also measure and record the full load Amperage of each A/C unit when operating at 2nd stage cooling. Verify the full load Amperage when operating in 2nd stage cooling is at least 10% greater than when operating in 1st stage cooling.	Amps 1st ____ Amps 1st ____ Amps 2nd ____ Amps 2nd ____
9.	Turn over the operator manuals and parts manuals to the FTE representative.	

3.7 UPS Operational Test.

	UPS Operational Test	**Pass or Fail**
1.	Ensure the UPS unit is operating normally with no active alarms and the external UPS Bypass Switch in the NOT BYPASSED mode. Also ensure the clean power panel is energized by the output from the UPS.	
2.	Review the configuration settings that are programmed into the UPS. Verify the settings agree with those provided by FTE during equipment start-up.	
3.	The Department representative will change the default UPS password.	
4.	The FTE representative will contact Sunwatch and verify: a) The UPS network interface card is communicating and operating satisfactorily. b) The on-site Department provided Network switch is communicating and operating satisfactorily.	a) b)
5.	Locate the circuit breaker(s) that serve the UPS and the external UPS Bypass switch. Ensure the panelboard directory card description is accurate and it agrees with the Name Plate Label affixed to the UPS unit.	
6.	Place the UPS in the Internal Bypass mode. Verify the following: a) The LCD display on the UPS indicates the Bypass Mode. b) Ensure Sunwatch received the "UPS Internal Bypass" alarm? c) Ensure the Department's Network Switch did not re-boot due to loss of power.	a) b) c)
7.	Place the UPS On-Line (not in Internal Bypass). Verify the following: a) The LCD display on the UPS indicates the Normal Mode. b) Ensure Sunwatch received the "UPS No Longer In Internal Bypass" alarm? c) Ensure the Department Network Switch did not lose power or re-boot due to a power disruption.	a) b) c)
8.	Place the UPS external maintenance bypass switch in the "UPS Bypassed" position. Ensure the Department network Switch did not lose power or re-boot.	

	UPS Operational Test	**Pass or Fail**
9.	Place the UPS external maintenance bypass switch in the "UPS" position. Ensure the Department network Switch did not lose power or re-boot due to a power disruption.	
10.	Open the circuit breaker that serves the UPS. Verify the following: a) The LCD display on the UPS indicates the reserve battery mode and displays the number of reserve minutes remaining. b) Ensure Sunwatch received the "UPS On Battery" alarm. c) Ensure the Department Network Switch did not lose power or re-boot due to a power disturbance.	a) b) c)
11.	Close the circuit breaker that serves the UPS. Verify the following: a) The LCD display on the UPS indicates the normal mode. b) Verify Sunwatch received the "UPS Normal" alarm. c) Ensure the Department Network Switch did not lose power or re-boot due to a power disturbance.	a) b) c)
12.	Turn over the operator manuals, parts manuals, system passwords, and warranty documentation to the Department representative.	

3.8 Emergency Generator and Automatic Transfer Switch

	Emergency Generator and Automatic Transfer Switch	**Pass or Fail**
1.	Open the circuit breaker(s) that serves the emergency generator block heater and the battery charger. Verify these items are de-energized. Verify the panelboard directory card description is accurate. Close the circuit breaker(s) that serves the block heater and battery charger.	
2.	Review the configuration settings that are programmed into the generator control panel. Verify the settings agree with those provided by Department during equipment start-up.	
3.	The Department representative will change the default generator controller password.	

	Emergency Generator and Automatic Transfer Switch	**Pass or Fail**
4.	Review the configuration settings that are programmed into the Automatic Transfer Switch control panel. Verify the settings agree with those provided by Department during equipment start-up.	
5.	The Department representative will change the default Automatic Transfer Switch control panel password.	
6.	Verify the generator controller start/stop switch is in the AUTO REMOTE position. Open the toll equipment building main circuit breaker to simulate a utility power outage. Record the elapsed time between the power outage and power being restored by the generator set & ATS. The maximum acceptable elapsed time is 10 seconds to restore power.	_____ Seconds
7.	The Department representative will contact Sunwatch and verify the "Building on Emergency Power" alarm is active.	
8.	While the building is being powered from the generator set, verify the UPS is on line, providing power to Panel C, and the UPS has no active alarms showing on the operator interface.	
9.	Close the toll equipment building main circuit breaker to simulate a return of utility power. Record the elapsed time between the power restoration and the ATS operating to restore normal utility power to the building. The maximum acceptable elapsed time for the ATS to switch back to Utility power is 15 minutes.	_____ Minutes
10.	With the generator running, the UPS on-line, and the normal utility power restored, operate the generator Emergency Power Off (EPO) station. Ensure the generator shuts down immediately by emergency stop. All other equipment should remain operational.	
11.	Reset the generator emergency stop alarm and place the generator control panel Off/Run/Auto switch in the AUTO position.	
12.	Turn over the generator and ATS operator manuals, parts manuals, service manuals, and warranty documents to the Department representative.	

END OF SECTION 26 05 05

SECTION 260519
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wire and cable

B. Wiring connectors and connections

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceway and Boxes for Electrical Systems

B. Section 26 05 01 – Shop Drawings and Submittals

1.3 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association)

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)

C. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

A. Submit data sheets and catalog sheets describing each type of conductor, connector, splicing material, and terminal lug that will be installed on the project.

B. Include descriptive names for the conductors that indicate the system or equipment they serve. i.e. “generator feeders”, “service entrance conductors”.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years’ experience.

1.6 PROJECT CONDITIONS

A. Coordination and Meetings

B. Conductor sizes on the Plans are based on copper.

C. Electrical power conductors 10 AWG and smaller may be spliced in order to construct longer circuits. Electrical power conductors 8 AWG and larger may not be spliced.

D. The current carrying capacity of electrical power conductors shall be determined using the tables in NEC Article 310. Calculating the current carrying capacity of conductors by assuming a lower ambient temperature than the one shown in the header of the Ampacity table(s) in Article 310 is not permissible, unless the lower ambient temperature is written and described in the Contract Documents.

E. Aluminum wiring is not permitted.

F. Ensure all sizes are given in American Wire Gauge (AWG) or in thousand circular mils (kcmil).

G. Conductors shall be marked with color codes as described in Part 3 below.

1.7 COORDINATION

A. Coordinate Work with other trades.

B. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

C. Determine required separation between cable and other work.

D. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Install THHN/THWN insulated copper conductors rated for 600 Volts, with PVC insulation, and a nylon thermoplastic outer jacket. Ensure the solid or stranded conductors are made of annealed copper and rated for 90°C in dry locations, and 75°C for wet or below grade locations. Ensure the conductors are UL 83 Listed and are suitable for use in residential, commercial, and industrial environments. All systems and low voltage conductors shall be stranded conductors.

B. Install XHHW or XHHW-2 insulated copper conductors rated 600 Volts, with XLPE insulation to protect the conductor against high temperatures and wet locations. Ensure the solid or stranded conductors are made of annealed copper and rated for 90°C in dry locations, and 75°C for wet or below grade locations. Ensure the conductors are UL 44 Listed and are suitable for use in residential, commercial, and industrial environments.

C. Type TC Multiconductor Power and Control Tray Cable.

1. The individual conductors shall be stranded copper with XHHW-2 insulation.

2. The overall cable jacket will consist of a flame retardant, moisture resistant, and sunlight resistant PVC covering.

3. The cable shall be listed for installation indoors, outdoors, in cable trays, raceways, and for direct burial in the ground.

4. Type TC cable may be installed as open wiring in lengths not to exceed fifty feet between the cable tray and the device or equipment served. Open wiring shall be secured and supported at intervals less than six feet.

5. Type TC Cables with three individual conductors sized between 12 AWG and 10 AWG shall be constructed with a green colored grounding conductor, a white neutral conductor, and a black phase conductor.

6. Type TC Cables with four individual conductors sized between 12 AWG and 10 AWG shall be constructed with a green colored grounding conductor, a white neutral conductor, a black phase conductor, and a red phase conductor.

2.2 WIRING CONNECTORS

A. Install fully insulated mechanical connectors, UL 486B Listed, and rated for 600 Volts maximum for 8 AWG and larger conductors in dry locations.

B. Install PVC insulated spring pressure cable connectors (wire nuts), UL 486C Listed, and rated 600 Volts maximum for 10 AWG and smaller conductors in dry locations.

C. Electrical conductor splices and/or taps below grade level are not acceptable. For emergency conductor repairs below grade, install wrap-around UF splice kits with splice closure sleeves filled with sealing gel that entirely encapsulates the mechanical connector to seal out moisture. The underground splice kit shall be qualified to ANSI C119.1 for underground splicing and shall be rated for use on 600 Volt connections.

D. Communications cables, coaxial cables, and Ethernet cables shall be installed in continuous lengths and shall not be spliced in the field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordination and Meetings: Verify the existing conditions before starting work.

B. Verify that interior of any buildings are protected from weather.

C. Verify that mechanical work likely to damage wire and cable has been completed.

D. Verify that raceway installation is complete and supported.

E. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final approved submittal for equipment to assure proper number and size of the conductors. (As for multiple speed motors, different motor starter arrangements, etc.).

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 GENERAL

A. Install products in accordance with manufacturer's instructions.

B. Route wire and cable as required to meet the Project Conditions.

C. Install cable in accordance with the NECA "Standard of Installation".

D. Use solid conductor wire for feeders and branch circuits 10 AWG and smaller and use stranded conductors for #8 AWG and larger. Bonding grounding conductor can be solid copper. All systems and low voltage conductors shall be stranded conductors.

E. Use conductors 12 AWG or larger for power and lighting circuits.

F. Increase branch conductor sizes as required to maintain a branch circuit voltage drop of less than 3% to the load served when the branch circuit is operating at full rated load.

G. Ensure all 120V, 20A circuit homeruns over 50ft. are #10 cu. minimum unless noted otherwise.

H. Ensure all 120V, 20A circuit homeruns over 150ft. are #8 cu. minimum, unless noted otherwise.

I. Pull all conductors into the raceway at the same time. Do not exceed the manufacturer’s recommended pulling tensions.
   1. Do not pull wire until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.
   2. Ensure the minimum bending radius of insulated wires or cables is not less than the minimum recommended by the manufacturer or the N.E.C..
   3. Where coaxial or fiber optic conductors are installed, special requirements apply as outlined under that specific system detail specifications.

J. Use suitable wire pulling lubricant for building wire. Ensure compound or lubricant does not cause the conductor or insulation to deteriorate.

K. Neatly train and lace wiring inside boxes, equipment, and panel boards.

L. Ensure conductor sizes indicated on circuit homeruns or in schedules are installed over the entire length of the circuit unless noted otherwise on the Plans or in these specifications.

3.4 VERTICAL RISERS

A. Provide vertical cable riser supports that are spaced per N.E.C. 300.

3.5 CONTROL AND SIGNAL CIRCUITS

A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, THWN/THHN.

B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the Contract Documents.

C. Conductor insulation for Fire Alarm Systems shall be as approved by Code Inspection Authority only. Wire approvals by the A/E shall not supersede this final Approval for conditions of this specific project.

D. All control and signal circuit conductors shall be stranded copper conductors.

3.6 COLOR CODING

A. All feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for the system throughout the building. Feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

B. Unless otherwise approved, or to match the existing, the color-codes shall be as follows:

UTILITY or GENERATOR POWER

480/277 Volt, 3 phase, 4 wire

Phase A = brown
Phase B = orange
Phase C = yellow
Neutral = gray
Equip ground = green

208/120 Volt, 3 phase, 4 wire
Phase A = black
Phase B = red
Phase C = blue
Neutral = white
Equip ground = green

120/240 Volt, 1 phase, 3 wire
Line 1 = black
Line 2 = red
Neutral = white
Equip Ground = green

UPS POWER / CLEAN POWER

208/120 Volt, 3 phase, 4 wire
Phase A = black
Phase B = red
Phase C = blue
Neutral = white with yellow stripe down the entire length
Equip ground = green with yellow stripe

120/240 Volt, 1 phase, 3 wire
Line 1 = black
Line 2 = red
Neutral = white with yellow stripe
Equip ground = green with yellow stripe

3.7 TAPS/SPLICES/CONNECTORS/TERMINATIONS

A. Clean conductor surfaces before installing lugs and connectors.

B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

C. Conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wire ways, junction boxes, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written approval of Engineer).

D. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pull boxes at proper vertical spacing.

E. A calibrated torque wrench shall be used for all bolt tightening.

F. Clean conductor surfaces with a wire brush before installing lugs and connectors.

G. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.8 FIELD QUALITY CONTROL

A. Perform inspections and tests listed in 1999 NETA ATS, Section 7.3

B. Perform an Insulation Resistance test – using the form below - on all power system conductors larger than 10 AWG. Turn over written test results to the CEI within 48 hours of completing the test.

CONDUCTOR INSULATION RESISTANCE

PROJECT NAME:_____

CONDUCTOR FROM _____ TO_____

SIZE_____ LENGTH _____

SIZE_____ LENGTH _____

INSULATION TYPE:_____ INSULATION VOLTAGE RATING: _____

DATE:_____ TIME_____ WEATHER CONDITIONS:_____

TEST VOLTAGE (DC):_____ AMBIENT TEMPERATURE:_____

MEGGER INSTRUMENT/SERIAL NUMBER:_____

RESISTANCE MEASUREMENTS:

A to B _____ Meg Ω	A to N _____ Meg Ω	A to GND _____ Meg Ω
B to C _____ Meg Ω	B to N _____ Meg Ω	B to GND _____ Meg Ω
C to A _____ Meg Ω	C to N _____ Meg Ω	C to GND _____ Meg Ω
		N to GND _____ Meg Ω

● Note any insulation damage or improper installation _____

_____

● Verify proper color code for each phase, neutral and ground. See specifications 260519.

_____

TEST CONDUCTED BY _____

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and grounding electrode conductors

B. Inspection wells

C. Equipment grounding conductors

D. Supplemental Equipment Ground Bar installed below the MDP or service entrance main disconnect

1.2 RELATED SECTIONS

A. Section 264113 - Lightning Protection System

1.3 REFERENCES

A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association)

B. NEC 250

C. NFPA 780

1.4 GROUNDING SYSTEM DESCRIPTION

A. The following items will be bonded together to form the grounding system for the power distribution system.

1. Metal underground water pipe – if available

2. Metal frame of the building - if available

3. Concrete-encased electrode consisting of 20 feet of 2/0 AWG minimum size, bare copper conductor imbedded in the building footer and clamped to the rebar. Extend the conductor to the Neutral bar of the service entrance panelboard / enclosure. Ensure this grounding electrode conductor is not spliced and not connected to the supplemental equipment ground bar.

4. Rod electrodes – Copper clad steel rods, 5/8 inch diameter, and UL Listed. A minimum of two rods are required for each electrical service.

5. Couplings or connectors used to join multiple ground rods together shall be of the threaded type.

6. Supplemental equipment ground bar located below or adjacent to the MDP.

7. The lightning protection system ground ring surrounding the toll equipment building in accordance with NFPA 780.

B. Uninterruptible power supply (UPS) system grounding. If the UPS contains an isolation transformer and is considered a separately derived system, then the neutral point of the transformer will be grounded as follows:

1. One grounding electrode conductor will be extended to one of the ground rods installed at the service entrance.

2. One grounding electrode conductor will be extended to a concrete-encased electrode consisting of 20 feet of #4 AWG minimum size, bare copper conductor imbedded in the building footer and clamped to the rebar.

C. Install a separate equipment grounding conductor to serve each computer equipment rack that will be installed. Some of the racks may be installed in the future. For future equipment racks, coil 10 feet of #4 AWG stranded grounding conductor, colored green, above or below the rack location for future connection. Install a name tag that describes the purpose of the conductor. i.e. Toll Equipment Grounding Conductor.

D. Ground all raised aluminum frames that support toll equipment cabinets at two locations. Connect each end of the metal frame to the concrete encased electrode. The bonding jumper between the metal frame and the concrete encased electrode shall not be smaller than # 2/0 AWG bare Copper. Ensure the lugs connected to the metal frame are rated for aluminum and/or copper.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding Rod Resistance: Use the fall of potential three-point method and test each ground rod individually before connecting it to the system. Ensure the maximum resistance to ground (earth) does not exceed 25 Ohms. If a ground rod measures greater than 25 Ohms to ground then a second ground rod should be installed nearby, but not closer than the depth of the 1st rod, and then bond the two rods together with a direct buried conductor. Turn over the test reports to the Department within 1 week of performing the test

B. The resistance to ground should be consistent between the ground rods. Any rod that measures more than 20% different than the surrounding rods should be investigated.

C. After bonding all the power system grounding components together, use the "Clamp on Method" to measure the resistance to ground of the completed system. Ensure the maximum resistance to ground (earth) does not exceed 5 Ohms. Drive additional ground rods if necessary to meet the requirements. Promptly turn over the test reports to the Department.

1.6 SUBMITTALS FOR REVIEW

A. Section 260501 – Shop Drawings and Submittals: Procedures for submittals.

B. Product Data: Provide data sheets for all grounding electrodes, clamps, bonding straps, ground bars, exothermic welding products, and inspection wells.

C. Submit a site specific One-Line Grounding Plan that indicates all grounding electrode conductor connection points and grounding conductor sizes at the service disconnect, automatic transfer switch (ATS), back-up generator, and the uninterruptable power supply (UPS) when depicted on the Toll Facility plans.

D. Show the locations of the grounding system inspection wells on the Electrical Site Plan. Avoid placing inspection wells in paved areas. Inspection wells in paved areas will be "traffic rated" H-20.

1.7 SUBMITTALS FOR CLOSEOUT

A. Project Record Documents: Record the actual locations of components, grounding electrodes, and inspection wells.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Material: Copper-clad steel, sectional with threaded couplings

B. Diameter: 5/8 inch

C. Length: 20 feet total length.

2.2 EXOTHERMIC CONNECTIONS

A. Use exothermic welding to bond the grounding conductors to the ground rods.

2.3 GROUNDING CONDUCTORS

A. Material: Stranded or solid copper

B. Grounding Electrode Conductor: Sized to meet NFPA 70 requirements.

2.4 GROUNDING INSPECTION WELLS

A. Within non-paved areas, install non-traffic rated ground access wells that are manufactured from 20,000 PSI high density polymer concrete and that meets ASTM C-857 specifications. The minimum size shall be 12" x 12" x 12". Install a high-density polymer concrete cover for each access well.

B. Install traffic rated ground access wells in paved areas and on roads or shoulders. The access wells shall be traffic rated H-20 with 10 inch diameter cast iron top and cast iron cover, with 12 inch minimum cast iron riser.

2.5 SUPPLEMENTAL EQUIPMENT GROUND BAR

A. Provide supplemental ground bars when depicted inside the toll equipment buildings on the Toll Facility plans.

B. Install the supplemental equipment ground bar on the wall adjacent to, or under MDP. Use Red, 1 inch hex shaped standoff insulators, rated for 600 Volts to separate the bar from the wall. Install a grounding electrode conductor between the supplemental bar and the equipment ground bar, inside the service disconnect enclosure.

C. The equipment ground bar will Manufactured from electrolytic tough pitch 110 alloy copper bar with dimensions of approximately ¼ inch thick, 2 inches high, and 12 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning the work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install rod electrodes at locations indicated on the plans. The service entrance ground rod electrodes shall consist of two 20 ft driven rods spaced 20 feet apart or more.

B. Provide a grounding inspection well at each driven rod location in the power distribution system (not for lightning protection system). The top of the inspection well will be flush with the finished grade.

C. A main bonding jumper shall connect the neutral bus to the ground bus at the first service disconnect.

D. The main grounding electrode conductor shall be installed in one continuous length and shall not be spliced or broken at any point until it terminates at the neutral bus within the first service disconnecting means.

E. Provide bonding to meet NFPA 70 and Regulatory Requirements (i.e., metal duct work, metal piping, gas piping etc.).

F. Bond together metal siding not attached to a grounded structure and bond to ground.

G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Ground the metal wall studs when conductors are installed through holes in the studs.

3.3 FIELD QUALITY CONTROL

A. Measure the continuity of each grounding electrode conductor after it is installed and prior to connecting it to the system. The maximum acceptable continuity resistance is 0.02 Ohms.

END OF SECTION 260526

SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hardware for the support of conduit, tubing, and cable.

B. Wireway supports and wire trough supports

C. Anchors and fasteners

1.2 REFERENCES

A. NECA - National Electrical Contractors Association

B. ANSI/NFPA 70 - National Electrical Code

C. UL-5: Surface Metal Raceway and Fittings

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Provide manufacturer's catalog data for hangers, supports, and fastening systems.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, the National Electrical Code.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. and acceptable to the Department as suitable for purpose specified and shown.

C. ASTM A123 - Specifications for Zinc Coatings on Iron and Steel products.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide products with adequate corrosion resistance based on the environment where the products are installed. All steel products must be hot-dipped galvanized except for stainless steel products.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of the supported equipment and the conduit. Consider the weight of the wires in the conduit when selecting products.

C. The supports for wireways shall be installed in accordance with the manufacturer's written instructions.

D. Anchors and Fasteners:

1. Concrete surfaces and structural elements: Use expansion anchors, preset inserts, and self-drilling anchors.

2. Steel Structural Elements: Use beam clamps that will not damage the protective zinc coating of galvanized steel.

3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.

4. Solid Masonry Walls: Use expansion anchors, preset inserts, and self-drilling anchors.

5. Sheet Metal: Use galvanized sheet metal screws.

6. Wood Elements: Use galvanized wood screws.

2.2 STEEL CHANNEL

A. The cross-sectional width dimension of the channel shall be a minimum of 1-1/2". The depth will be as required to satisfy the load requirements. Channel with 1-1/2" depth or greater shall be rolled from 12 gauge steel.

B. Steel channel used for modular metal framing and conduit supports shall be in compliance with the Federal Specification W-C-582 and Federal Specification WW-H-171.

C. Attachment holes, when required, shall be factory punched on hole centers equal to the channel cross sectional width dimension and shall be a maximum of 9/16" diameter.

D. Channel attachment nuts shall be designed to pre-locate in the channel and provide a bearing surface on the turned down lips while making positive contact with the side walls of the channel.

E. Steel channel sections shall be rolled from AISI C1018 commercial grade steel and be in conformance with ASTM A569.

F. Stainless steel channel sections shall be available in either 304 or 316 stainless-steel.

G. Steel channel shall be installed in straight sections only and shall not be bent in the field.

H. Install hot dipped galvanized after fabrication channel or stainless-steel channel for exterior applications. Install painted steel or hot dipped galvanized channel for indoor applications. Steel channel that is hot dipped galvanized after fabrication shall have a minimum Zinc thickness of 1.5 ounces per square foot on each surface according to ASTM A123 - Specifications for Zinc Coatings on Iron and Steel products.

I. Galvanized steel channel that is field cut or field drilled shall have the damaged zinc finish repaired by using cold galvanizing methods. The cold galvanizing compound shall be pre-mixed and composed of a liquid organic zinc compound. After application, the dried zinc compound film shall be 95% metallic zinc.

J. Install protective end caps on steel channel that is field cut. The protective caps shall be made of soft PVC and manufactured by the same company that manufactured the steel channel.

2.3 CONDUIT SUPPORTS AND FASTENERS

A. Conduit shall be supported and securely fastened to the structure it is installed upon.

1. Hangers, clamps, straps, and hardware for supporting conduit shall be listed in accordance with UL 2239 – Hardware for the Support of Conduit Tubing, and Cable by UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

2. Hardware for supporting boxes shall be UL 514A listed by UL or other NRTL.

3. Cable ties or Ty-wraps shall not be used to support conduit or junction boxes.

B. Conduit supports and support fasteners and bolts used outdoors or in wet locations shall be manufactured from carbon steel and shall be hot dipped galvanized after fabrication and according to ASTM A123.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

B. Do not use powder-actuated anchors to secure electrical equipment.

C. Obtain permission from Engineer before drilling or cutting structural members or galvanized metal.

D. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

E. Install surface-mounted cabinets and panelboards with minimum of four anchors.

F. Interior items shall be supported directly from structural portion of the building. All above ceiling or ceiling mounted items shall be supported directly from the building superstructure, except standard lay-in type ceiling lighting fixtures, and small outlet boxes for devices such as exit lights. Lay-in type ceiling fixtures shall be provided with supplemental support wire or chain as specified elsewhere. Outlet boxes shall be attached to ceiling system by means of approved mounting brackets and shall also be provided with supplemental threaded rod hangers from super structure as specified elsewhere. No sagging of the ceiling will be permitted. Adjust supplemental supports accordingly.

G. Boxes and conduits shall not be supported or fastened to ceiling suspension wires or to ceiling channels. Support interior overhead conduits and boxes independent of the ceiling per NEC-article 300.11 (latest addition). Lighting fixtures and devices shall have supplemental supporting as specified herein.

H. The use of perforated iron straps for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables.

I. Parallel groups of conduit or conduit runs in a similar direction; they shall be grouped together and supported by means of 1½" x 1½", 12 gauge, pre-galvanized zinc coated conduit channel trapeze hanger system (racking) consisting of concrete inserts, threaded rods, washers, nuts, locknut washers, etc. Where galvanized "L" angle iron is used, conduits shall be individually fastened to the cross members with malleable iron hangars listed and approved for use on "L" angle iron, bolted with proper size cadmium machine bolts, washers and nuts. Conduits supported by strut channel shall be individually fastened with two piece strut straps with bolts and nuts listed and approved for such use. Beam clamps shall be malleable iron.

J. Hangers for PVC coated conduit shall be PVC coated and galvanized.

K. On concrete or brick construction, insert anchors shall be installed with round head galvanized machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or approved substitution.

L. Threaded rod hangars shall be galvanized continuous thread type, minimum 3/8" diameter. Increase size as required to support assembly. Bending of rod hangars is not permitted.

M. Conduit support racks shall be minimum of 24", increase, distance as required for quantity of conduits and spare capacity) provide space on each rack for 25 percent additional conduits. Group conduits on channel racking adjacent to each other at sides, allowing all remaining unused space at center as spare capacity. Spacing between conduits shall not exceed 1" unless written permission is granted by architect/engineer.

N. Each rack shall be provided with minimum of two (2) all-thread rod hangars located at the ends of the channel. Increase number of hangars as required to support assembly.

O. In general conduit supporting devices such as spring type conduit clips are not acceptable. Conduit clips with snap close strap are acceptable for use in dry interior concealed locations only. Back-to-back arrangement or attachment to other raceways, piping, etc. is not permitted.

P. All hangers, clips and accessories for supporting shall be listed by UL or other NRTL.

Q. Support systems shall meet requirements for seismic loads. Refer to general Conditions of the specifications.

R. Materials installed in environmental air plenum shall be UL Plenum listed by UL or other NRTL and bear the appropriate markings.

S. Conductors not in raceways, where specified and permitted elsewhere, shall be supported directly from the structure. with devices listed by UL or other NRTL as intended for such use. Ty-Rap cable ties in conjunction with Listed support devices within plenum air environments shall be plenum rated by UL or other NRTL.

T. Comply with requirements of Specification section 260533 – Raceways and Boxes for Electrical Systems.

END OF SECTION 260529

LEVEL 1

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Flexible metal conduit (FMC)

B. Liquid-tight flexible metal conduit

C. Electrical metallic tubing (EMT)

D. Fittings and conduit bodies

E. Wall and Ceiling Outlet Boxes

1.2 RELATED SECTIONS

A. Fire Stopping

B. Roof Penetrations

C. Common Work Results for Electrical: .....Section 26 05 00

D. Low Voltage Electrical Power Conductors and Cables: .....Section 26 05 19

E. Grounding and Bonding for Electrical Systems: .....Section 26 05 26

F. Hangers and Supports for Electrical Systems: .....Section 26 05 29

G. Identification for Electrical Systems: .....Section 26 05 53

H. Wiring Devices: .....Section 26 27 26

I. Electrical Cabinets and Enclosures: .....Section 26 27 16

1.3 REFERENCES

A. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated

B. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies

C. ANSI/NFPA 70 - National Electrical Code

D. NECA "Standard of Installation"

E. NEMA OS-1- Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports

F. NEMA 250 – Enclosures for Electrical Equipment (1000 volts maximum)

G. NEMA FB 2 – Selection and Installation Guidelines for Fittings for Use with Non-Flexible Metallic Conduit or Tubing, latest edition.

H. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.4 DESIGN REQUIREMENTS

A. Provide ANSI/NFPA 70 conduit sizes unless otherwise noted or specified (increased the conduit size above the minimum requirements of ANSI/NFPA 70 where indicated in this or other sections of these specifications or on the drawings).

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of Section 26 05 00.

B. Product Data: Provide shop drawing and catalog data sheets for each type of conduit, fitting, conduit body, raceway seal, and boxes used on the project.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 26 05 00.

B. Record actual locations and mounting heights of outlet, pull and Junction Boxes on project record documents.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 26 05 00.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.8 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit and boxes prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

Comply with FDOT Standard Specifications Section 630 (Conduit) with clarifications defined below

2.1 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

A. Provide ANSI/UL 360 compliant conduit, manufactured with an interlocked galvanized steel core and extruded PVC jacket.

B. Provide UL514B compliant fittings, compression type with threaded connectors, insulated throat and sealing washers. Hot dipped galvanized or zinc plated malleable iron or steel.

2.2 ELECTRICAL METALLIC TUBING (EMT)

A. Provide ANSI C80.3 compliant conduit with thin wall ferrous steel, hot dipped galvanized with smooth interior reamed ends.

B. Provide ANSI/NEMA FB 1 compliant fittings with hot dipped galvanized malleable iron or steel. Set screw type for dry locations and compression type for all other locations. Use UL or other NRTL Listed for Wet Locations fittings for installations in wet locations.

C. Provide ANSI/NEMA FB 1 compliant conduit bodies with hot dipped galvanized malleable iron or steel with threaded hubs and gasketed covers.

D. Die-cast fittings and conduit bodies are not permissible.

2.3 HIGH DENSITY POLYETHYLENE (HDPE) CONDUIT

A. For HDPE used for systems other than vehicle detection loops, ensure the conduit is ‘toneable’ and includes a copper conductor within the wall of the duct that allows locating the buried conduit.

B. For HDPE used for vehicle detection loops, ensure the conduit does not include the ‘toneable’ copper conductor.

2.4 EXPANSION AND DEFLECTION FITTINGS

A. Fittings: ANSI/NEMA FB 1

B. In metal conduit applications, use hot dipped galvanized malleable iron or steel with a 4” expansion chamber, internal tinned copper braided bonding jumper and factory installed packing.

C. In non-metallic conduit applications, use polyvinyl chloride with a 4” expansion chamber and factory installed packing. Fitting wall thickness must match conduit system application (i.e. schedule 40 or 80.)

2.5 OUTLET AND DEVICE BOXES

A. Provide outlet and device boxes installed indoors in dry locations that are listed in accordance with UL 514A and manufactured in accordance with ANSI/NEMA OS 1 – Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.

2. Provide concrete encased boxes that are rated for encasement in concrete.

B. At locations where outlet and device boxes are installed outdoors, use products that are manufactured from galvanized cast iron, rated NEMA FB 1, listed in accordance with UL 514A, Type FD, with threaded hubs, and suitable for use in wet locations. Provide covers with neoprene gaskets with stainless steel cover screws.

C. At locations where outlet and device boxes are installed on outdoor concrete surfaces use products that are manufactured by aluminum die casting methods, with aluminum alloy A380, to provide increased corrosion resistance, and will be UL Listed for use in wet locations in accordance with UL 514A – Metallic Outlet Boxes.

PART 3 - EXECUTION

3.1 CONDUITS

A. Flexible and liquid-tight conduit: 3/4” unless otherwise specified or noted.

B. Homerun Conduit: 3/4” unless otherwise specified or noted.

C. Branch Circuit Conduit: 3/4” unless otherwise specified or noted.

D. Increase conduit sizes as required for conductor fill, per NFPA 70, when conductor size is increased due to voltage drop as specified in other sections of these specifications.

3.2 GENERAL

A. Install all wires for power, lighting, systems, and controls in conduit. Size conduit as required to accommodate the number of conductors in accordance with the National Electrical Code, or as noted on the drawings. The sizes shown on the plans may be increased if desired to facilitate the pulling of conductors. The minimum conduit size is ¾ inch, unless noted otherwise.

B. Install conduits fittings and connectors in accordance with NECA "Standard of Installation" and NEMA FB 2 – Selection and Installation Guidelines for Fittings for Use with Non-Flexible Metallic Conduit or Tubing, latest edition. Perform installation studies prior to rough-in and arrange conduits in a neat manner. Avoiding excessive crossing of conduits.

C. Arrange conduit (including supports) to maintain any interior headroom, access to equipment and means of egress.

1. Provide the following minimum headroom clearance requirements for exposed conduits within an interior space:

a. Install conduit as high as possible.

b. Install conduit above the bottom of all light fixtures.

c. Install conduit at least 6" above the tallest door height (including large doors i.e. roll-up and sliding doors) serving the space.

d. Provide a minimum headroom of 7'-0" above the finished floor.

e. If a. through d. above cannot be met and conduit does not serve the space, then route conduit around the space.

f. If a. through e. above cannot be met coordinate exact conduit routing with the architect and engineer prior to rough-in and route conduit around required means of egress and per Department's required clearances for the use of the space.

D. Route exposed conduits parallel and/or perpendicular to walls.

E. Route conduits which contain communication, signal, data, control wiring and other wiring sensitive to EMF and RF interference at least 12 inches from power conduits and other EMF/RF generating equipment (i.e. light fixture ballast's, motors, capacitors etc.).

F. Use conduit hubs or sealing washers & locknuts to fasten conduit to sheet metal boxes in damp and wet locations.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at low points in conduit system.

H. Provide suitable pull rope in each empty conduit except sleeves and nipples.

I. Provide bonding bushings at the end of all conduit stubs which do not terminate into a bonded metal enclosure or junction box (i.e. at terminal boards, cable trays, etc.) bond per 260526.

J. Seal conduits that extend from the interior to the exterior with insulating electrical putty to prevent infiltration of outside air.

K. Use a thru-wall waterproof seal on each conduit that penetrates a wall at or below grade level.

L. Seal conduits entering a building from below grade and all conduits entering hot unconditioned spaces from cool air-conditioned spaces with insulating electrical putty to prevent moisture from entering. Slope these conduits away from the building.

M. Seal metal conduits entering air-conditioned spaces from unconditioned air spaces with insulating electrical putty to prevent moisture from condensing inside the conduit at the point where the conduit enters the cold air-conditioned room.

N. Where conduit crosses an expansion joint, install an approved expansion fitting for this type of installation.

O. Flexible conduit - wet locations: Where liquids are present, form drip loops in liquid-tight flexible conduits to prevent liquid from running into connections.

P. Install all raceways, and device boxes in masonry at the same time as the masonry.

Q. Extend homeruns from outlets shown to panel designated, do not combine homeruns, and do not collect homeruns in pull or junction boxes.

R. Use suitable unglued caps to protect installed conduit against entrance of dirt and moisture during construction. Retain caps on conduits which remain empty after construction is complete.

S. Where required, use a minimum 12” flexible galvanized steel conduit as connections to all motors or other vibrating equipment including dry type transformers or at other locations. Use angle connectors wherever necessary to relieve angle strain on flexible conduit.

T. Verify the “in the field” cable distance by measuring the cable distances after all raceways are installed, in accordance with the following:

1. Run a pull rope from the furthest originating and terminating devices through all raceways, bends, turns, elevation differences to its final destination.

2. Remove the pull rope from the raceways and measure from end-to-end.

3. Install conduit pathways such that the resulting cable distances do not exceed the lengths described in the signed and sealed Toll Siting Technical Memorandum and related GTR deviations.

   a. Measure the following to confirm maximum cable distances:
      1) The wave guide cable distance between the AVI Antenna and its corresponding AVI reader.
      2) The ethernet cable distance between the AVI reader and the new tolling equipment cabinets inside of the building or roadside tolling cabinet.
      3) The cable distance between toll equipment mounted to the J-arms and the tolling equipment cabinets inside the building or roadside tolling cabinet.
      4) The cable distance between tolling loops and the tolling equipment inside of the building or roadside tolling cabinet.

   b. If the cable distances are not in compliance with the cable distance limitation listed above, then perform all site modifications and corrections necessary to bring the cable distance to compliance with this document at no additional cost to the Department/FTE.

3.3 SUPPORTS

A. Arrange supports to prevent misalignment during wiring installation.

B. Support interior conduits using hot dipped galvanized straps, zinc coated steel straps, lay-in adjustable hangers, clevis hangers, or split hangers.

C. Group related conduits; support using conduit rack. Construct rack using steel channel and all thread provide space on each for 25 percent additional conduits.

D. Fasten conduit supports to building structure and surfaces under provisions of Section 260529.

E. Do not support conduit with wire, cable ties, or perforated pipe straps. Remove wire used for temporary supports.

3.4 APPLICATION

1. Metal Canopies: Do not install conduit on the top side of metal canopies or roof systems.

2. Roofs: Do not install conduit on roofs or secured to a roof. Serve equipment requiring electrical connections with rigid galvanized conduits that penetrate the roof from below. Install pipe boots for each conduit that penetrates the roof. Coordinate the location and penetration requirements with the Roofing

Contractor. Meet all requirements of the roofing specifications for roof penetrations.

A. Interior Dry Locations:

1. Concealed: Use rigid galvanized steel and/or electrical metallic tubing, unless drawings indicate otherwise.

2. Exposed: Use rigid galvanized steel and/or electrical metallic tubing, unless drawings indicate otherwise.

3. Install flexible metal conduit in exposed locations only. Flexible metal conduit must not exceed six (6) feet in length and not contain an equipment grounding conductor.

B. Wet and Damp Locations: Use rigid galvanized steel conduits or fiberglass wireways.

C. Underground Installations: Install PVC or HDPE conduits to serve the vehicle detection loop pullboxes. Do not install etal elbows on conduits serving vehicle detection loop pullboxes.

3.5 FIRESTOPPING

A. Fire-stop penetrations through fire resistance rated partitions and other assemblies, including empty openings and openings containing cables, conduits and other penetrating items, to preserve the fire resistance rating of the assembly. Comply with the following fire-stopping requirements:

1. Compatibility: Provide fire-stopping composed of Components that are compatible with each other, the substrates forming openings, and the items if any, penetrating the fire-stopping under conditions of service and application, as demonstrated by fire-stopping manufacturer based on testing and field experience.

2. Provide fire-stopping listed in the underwriter's laboratories fire resistance directory. Install identically to what is shown in the directory.

3. Submit fire-stopping details for approval by the Architect, Engineer and authority having jurisdiction prior to installation.

B. System Performance Requirements

1. General: Provide fire-stopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

2. [redacted]

3. [redacted]

   a. [redacted]

   b.

   c.

   d.

3.6 INSTALLATION

A. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet (3 m) if required to accommodate intended purpose.

B. Install device boxes to preserve the fire resistance rating of walls, partitions, floors, and other elements using UL or other NRTL Listed materials and methods.

C. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

D. Install flush mounted outlet and device boxes in “finished” and public areas. Install surface mounted device boxes in “unfinished” areas, mechanical rooms, and toll equipment buildings.

E. Install galvanized cast iron device boxes for outdoor outlets and junction boxes cast in concrete.

3.7 WALL PENETRATION HOSE-DOWN TESTING

A. Perform a hose-down test of the wall penetration system once all elements have been furnished and installed.

B. The test must be witnessed and approved by the BCA and the CEI.

C. Directly hose-down all areas susceptible to water intrusion, around the wall penetrations (conduit/wireway/etc), around areas that were sealed. If there is water intrusion in any water amount or any indication thereof, the work will not be accepted.

3.8 CLEANING

A. Clean the interiors of all boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore any damaged finishes.

END OF SECTION 26 05 33

LEVEL 1

SECTION 260534
SURFACE RACEWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wire Troughs

1.2 RELATED SECTIONS

A. Section 260526 – Grounding and bonding

1.3 REFERENCES

A. NECA (National Electrical Contractors Association) Standard of Installation.

B. NEMA WD 6 - Wiring Device Configurations.

C. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of Section 260500.

B. Product Data: Provide dimensions, knockout sizes and locations, materials, fabrication details, finishes, and accessories.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

PART 2 - PRODUCTS

2.1 WIRE TROUGHS

A. Wire troughs installed indoors in dry locations shall have a minimum cross section of 12 inches by 12 inches and be manufactured from 14-gauge steel and then phosphatized before painting inside and outside with ANSI 61 gray colored polyester paint.

1. Indoor wire troughs shall be equipped with slip-on removable covers and embossed mounting holes on the back of the enclosure.
2. Do not field drill mounting holes in the enclosure. Use the embossed mounting holes provided by the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Field drilling for mounting galvanized metal enclosures, or wire troughs is not acceptable. Use factory provided mounting holes only.

END OF SECTION 26 05 34

SECTION 26 05 36
CABLE TRAYS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aluminum cable trays and accessories.

B. Cable trays for use within toll buildings.

1.2 RELATED SECTIONS

A. Firestopping per NFPA

B. GROUNDING AND BONDING: .....Section 26 05 26

C. HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS: .....Section 26 05 29

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NEMA VE 1 – Metal Cable Tray Systems.

C. NEMA VE 2-2006 - Cable Tray Installation Guidelines.

D. CSA C22.2 No. 126 – Aluminum Cable Tray Systems

E. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.4 SUBMITTALS FOR REVIEW

A. Section 26 05 01 – Shop Drawings and Submittals: Procedures for submittals.

B. Product Data: Provide data for fittings and accessories.

C. Shop Drawings: Indicate tray type, metal type, rung spacing, loading depth in accordance with NEMA VE 1, dimensions, support types, support points, accessories, and finishes.

1.5 SUBMITTALS FOR INFORMATION

A. Submittals: In accordance with Section 26 05 00.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years of experience, and with service facilities within 100 miles of Project.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings, instructed by manufacturer.

PART 2 - PRODUCTS

2.1 LADDER-TYPE CABLE TRAY REQUIREMENTS FOR TOLL EQUIPMENT BUILDINGS

A. Loading depth: 4-inch NEMA VE 1 loading depth with 5 inch total side rail height.

B. The aluminum cable tray side rails will be manufactured from aluminum alloy extrusions that meet the material specifications of the Aluminum Association Alloy #6063-T6.

C. Ensure the cable tray system is designed to safely support a uniformly distributed load of 100 pounds per foot with 8-foot support spans. When loaded at 100 pounds per foot, the maximum deflection of the cable tray shall not exceed ½ inch at any point.

D. The UL cross sectional area of each side rail shall be 1 square inch or larger.

E. Finish: Aluminum – non painted

F. Inside Width: 24 inches minimum

G. Inside Depth: 4 inches minimum

H. The cable tray shall be equipped with a 4-inch center divider to separate the power cables from the data cables.

I. Straight Section Rung Spacing: 6 inches on center. Each rung must be capable of supporting a 200-pound concentrated load at the center of the cable tray over and above the cable load with a safety factor of 1.5.

J. Minimum Radius of any Fittings: 12 inches

K. Provide drop out fittings and drop out bushings above the tolling communications cabinet.

L. Provide manufacturer's standard clamps, hangers, brackets, splice plates, expansion joints, reducer plates, blind ends, barrier strips, connectors, conduit to tray adaptors, ladder drop-out fittings, and grounding straps.

M. The cable tray inside the toll equipment building shall be supported at 8 foot intervals from the ceiling using factory provided Trapeze Support Kits consisting of pre-galvanized steel channel with zinc plated hardware, hold down guide clamps, square washers, head cap screws and channel nuts.

2.2 WARNING SIGNS

Engraved Nameplates: 1/2-inch black letters on yellow laminated plastic nameplate, engraved with the following wording:
"WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!"

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metallic cable tray in accordance with NEMA VE 1.

B. Support trays in accordance with Section 26 05 29. Provide supports at each connection point, at the end of each run, at other points to maintain spacing between supports of 8 ft maximum, and as required by the manufacturer.

C. Use expansion connectors where required where joints are crossed.

D. Provide UL or other NRTL Listed fire stopping to sustain the wall fire ratings when passing cable tray through fire-rated elements and partitions.

E. Ground and bond cable tray under provisions of Section 26 05 26. Provide electrical continuity between all tray components.

F. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.

G. For ladder type cable tray: Install a 10 AWG copper equipment grounding conductor from the service entrance ground bus to the cable tray. Use Cu/Al rated mechanical lugs at the end of the grounding conductor to bond it to the cable tray.

H. For ladder type cable tray at outdoor gantries: Bond the cable tray and each metal conduit with grounding bushings and a #10 AWG, minimum bare copper equipment grounding conductor that originates from the critical power panel(s) in the TEB.

I. Electrical connections to the cable tray shall be made with Cu/Al rated lugs.

J. Bond all metallic conduits terminating at the tray by using bonding type bushings.

K. Carefully coordinate the cable tray installation with other trades to avoid interferences and maintain proper NEC clearances.

L. Install to create a continuous, low-resistance, electrical ground return path in accordance with the requirements of the NEC.

M. Install the cable tray at plan locations and heights and as required by field connections.

N. Provide short section of tray covers at all openings in walls for passage of cable tray unless otherwise indicated. Grout-in openings around cable tray after installations.

O. Cable tray wire shall not be spliced at the tray or inside the tray.

P. Cable tray installed outside will utilize screw on covers to protect the cables from the elements.

END OF SECTION 26 05 36

SECTION 260543
UNDERGROUND DUCTBANKS FOR ELECTRICAL SYSTEMS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete Encased Ductbanks

1.2 RELATED SECTIONS

A. Section 260533 – Raceways and Boxes for Electrical Systems

1.3 SUBMITTALS FOR REVIEW

A. Section 260501 - Submittals

B. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes. Also submit information on the conduit configuration, thermoplastic braces and spacers.

1.4 SUBMITTALS FOR CLOSEOUT

A. As-Built Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to form a complete duct system.

E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

PART 2 - PRODUCTS

2.1 PLASTIC CONDUIT

A. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, with fittings and conduit bodies to NEMA TC 3.

B. Thermoplastic duct spacers, and braces.

2.2 ACCESSORIES

A. Underground Warning Tape: 4-inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 DUCT BANK INSTALLATION

A. The conduits shall be encased in concrete with at least three inches of concrete at the top and bottom and two inches on each side. The minimum cover (below grade) to the top of a duct bank shall be 24 inches. A horizontal and vertical separation between the ducts of 1 inch or 1-1/2 inches (as required) shall be maintained by installing high impact spacers with horizontal and vertical locking intervals of 8 feet. Provide reducers for 1 inch and 3/4-inch conduits.

B. The concrete shall be minimum 2,500 psi strength at 28 days; 1/2-inch maximum aggregate size. The duct bank shall extend inside the building below the slab as shown on Drawings. Duct bank conduits shall have a continuous slope downward toward the associated pull boxes and away from buildings with a minimum pitch of 3 inches in 100 feet.

C. Prior to installation, submit a duct bank section layout identifying each conduit within duct bank, including reduction of conduits at each island and reduction of duct bank size as required by conduit count.

D. End bells will be used when terminating raceways at a manhole.

E. Stagger the conduit joints horizontally in concrete encasement 6 inches minimum.

F. Use suitable separators and chairs installed not greater than 4 feet on centers.

G. Install No. 4 steel reinforcing bars imbedded in and near the top of a conduit duct bank where it passes under paved roads.

H. Connect to existing concrete encasement using dowels.

I. Paint the top surface of the concrete with red colored spray paint and install an underground detectable warning tape above the duct bank before backfilling.

END OF SECTION 260543

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates and labels

B. Wire and cable markers

C. Conduit markers

1.2 REFERENCES

A. NFPA 70 - National Electrical Code

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of Section 26 05 00.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc., and acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Nameplates for Normal Power shall be laminated phenolic plastic, chamfer edges, red (and black version) front white core, with lettering etched through the outer covering. White engraved letters on red (and black version) background.

B. Nameplates for emergency power (where applicable) shall be laminated phenolic plastic. Red front, with white core, with lettering etched through outer covering, white engraved letters on red background.

C. Letter Size:

1. Use 1/4-inch high letters for identifying individual equipment and loads.
2. Use 1/2-inch high letters for identifying grouped equipment and loads.
3. Use 1-inch high letters for identifying Service Disconnecting means.

D. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for approval. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, “Panel A, 120/208V, 3-phase, 4-wire”. In addition, provide phenolic label in panel to describe where the panel is fed from. For example, “Fed from MDP-1:3:5”. The name of the machine on the nameplates for a particular machine shall be the same as the names used on all motor starters, and disconnect switches for that machine.

E. The following items shall be equipped with nameplates: Wire troughs, and conduits at the base of the gantry. All motors, motor starters, motor-control centers, push button stations, control panels, time switches, disconnect switches, transformers, panelboards, all circuit breakers in switchboards or panelboards greater than 400 Amps, contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical systems junction and pull boxes (larger than 4 11/16”), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number (if applicable).

F. Field install Arc Flash and Shock Warning labels on each piece of new electrical distribution equipment such as panelboards, safety switches, motor control centers, and automatic transfer switches. The labels will indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions.

G. Provide adhesion labels on inside door of each fused switch indicating NEMA fuse classification and the size fuse installed.

2.2 WIRE MARKERS

A. Description: Cloth, tape, split sleeve, or tubing type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:

1. Power and Lighting Circuits at both ends of each conductor. Branch circuit numbers or feeder numbers as indicated on the construction plans. Including the neutral conductor, i.e. the conductor connected to circuit breaker #2 will be labeled with a wire marker showing "2". The neutral associated with this circuit will also be labeled with a wire marker showing "2".
2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

2.3 CONDUIT/JUNCTION BOX COLOR CODE

A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

Color Code for Junction Boxes	**Krylon Paint #**
System Emergency 120/208 volt	Light Red 2110
Fire Alarm	Popsicle Orange 2410
Normal Power 120/240 volt	Glossy Black 1601
Fiber Optics	Plum Purple 1929
Sound System	Daisy Yellow 1813
Intercom	True Blue 1910
Computer/Data	Gold 1701
BAS	Light Beige 2502
FIDS / BIDS	Beige 2504
[redacted]	[redacted]
Leased Line Communication	Light Green 2011
Grounding	Fluorescent Green #3106

B. Conduits (not subject to public view) longer than 20 feet shall be painted with above color paint band 20 ft. on center. Paint band shall be 4" in length. Where conduit is parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

C. Junction boxes and conduit located in public areas (i.e. areas that can be seen by the public) shall be painted to match surface attached to. Provide written request to A/E for interpretation of those public areas which may be in question.

2.4 CONDUIT/JUNCTION BOX MARKER

A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe it's associated panel and circuit reference number(s) within, (i.e. ELRW-2, 4, 6) or systems within (i.e. fire alarm, intercom, etc.). Identification shall be by means of black permanent marker. (Paint 1/2 cover plate with appropriate color as noted in 2.3 above, and mark other 1/2 with associated panel/circuit or system description as described).

B. Identify conduit not installed in public areas with circuit numbers as described above. Spacing: 20 ft. on center, adjacent to color identification bands.

2.5 DEVICE COVER PLATE IDENTIFICATION

A. Self-adhesive clear printed labels with Black typed letters (pre-printed, dot matrix, or laser). Labels printed with Ink Jet printers are not acceptable.

B. Locations:

1. Each new switch and receptacle cover plate.
2. Each existing switch and receptacle cover plate in areas of remodel/renovation.
3. Each new communications cover plate (Systems Sections in Division 27).
4. Each existing communications cover plate (Systems Sections in Division 27). in areas of remodel/renovation.
5. Fire alarm system control modules, monitor modules and remote test stations.
6. Each connection to modular office furniture system.

C. Legend:

1. Receptacle plates adequately describe its associated panelboard and circuit reference (i.e., L1A-3).
2. System plates adequately describe its terminal board, or terminal cabinet, termination cable identifier, and assigned user code number, (i.e., TTB-LS2-***).

3. Fire alarm control devices adequately describe item severed and assigned address, if addressable, (i.e., AHU-1 Supply ID 12345-***).

2.6 UNDERGROUND WARNING TAPE

A. Description: 4-inch-wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

2.7 SIGNAGE

A. Description: Laminated phenolic plastic, chamfer edges, white core, face color as specified elsewhere, with lettering etched through the outer covering, 1" lettering.

B. Locations:

1. More than one service per NEC (if applicable).
2. Emergency Generator Systems per NEC (if applicable).

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates.

3.2 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using stainless steel pop rivets.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Paint colored band on each conduit longer than 6 feet (2 m).

E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

F. Identify junction boxes and outlet boxes.

G. Nameplates installed inside on dead front cover shall be self-adhesive tape. (Do not drill or install screws in dead front unless prior approval is granted by equipment manufacturer).

H. Exterior nameplates installed on wire troughs and all outdoor electrical equipment must be provided with an epoxy based adhesive.

I. Install wire markers at all connections and terminations.

END OF SECTION 26 05 53

SECTION 26 09 13
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM

LEVEL 3

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnish all labor and materials necessary to provide, install and test a Supervisory Control and Data Acquisition System in each Toll Building.

1.2 RELATED SECTIONS

A. Concrete Protected Above Ground Fuel Storage Tank: .....Section 23 13 23

B. Toll Equipment Critical Power Panelboard: .....Section 26 24 17

C. Emergency Generator - Permanent: .....Section 26 32 13

D. Automatic Transfer Switch: .....Section 26 36 00

E. Uninterruptible Power Supply Unit: .....Section 26 33 53

F. Test and Performance Verification: .....Section 26 05 05

1.3 RELATED DETAILS AND DRAWINGS:

A. Refer to the Plans and Specifications for the SCADA Block Diagram for additional information and wire types.

1.4 REFERENCES

A. Applicable Standards

1. FCC rules, part 15 – Limits for a Class A digital device.

2. IEEE C62.41 - Guide on Surge Voltages in AC Power Circuits Rated up to 600V.

3. NFPA 70 - National Electrical Code

4. MODBUS over serial line specifications and implementation guide V1.0

5. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.5 SYSTEM DESCRIPTION

A. General:

1. [redacted]

2.

3.

4.

B.

1.

2.

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. [redacted]

9. [redacted]

10. [redacted]

11. [redacted]

12. [redacted]

13. [redacted]

14. [redacted]

15. [redacted]

16. [redacted]

17. [redacted]

18. [redacted]

19. [redacted]

20. [redacted]

21. [redacted]

C. [redacted]

1. [redacted]

D. [redacted]

1. [redacted]

2. [redacted]

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. [redacted]

9. [redacted]

10. [redacted]

1.6 SUBMITTALS AND SHOP DRAWINGS

A. A separate set of shop drawings shall be submitted for each SCADA system at each site. Each set of shop drawings associated with each site will show the unique name of the toll building or site in the title blocks. Typical information associated with multiple sites shall be rejected for insufficient information.

B. The connection diagrams, Interconnection diagrams, and panel fabrication & layout drawings shall be submitted in paper and MicroStation and AutoCAD formats. The Engineer of Record shall update the diagrams and layout drawings for use as the Departments As-Built (Record) documents for each separate SCADA system. The final As-Built documents will be delivered in MicroStation and AutoCAD formats and in pdf format.

C. The following information shall be included in each set of SCADA system shop drawings.

1. Hardware Product Information Submittal:

   Hardware product information shall include, but not be limited to: catalog cut sheets, data sheets, performance surveys, test reports, equipment lists, material list, diagrams, pictures, and descriptive material. The product information shall cover all items including mechanical devices, mounting components, wiring, terminal strips, connectors, accessories, and spare parts. The submittal information shall show the standard and optional product features, as well as all performance data and specifications.

D. Prior to commencement of manufacture (or shipment for stock items), the SCADA System Provider shall submit for review product information for all equipment and material specified in this Section. Include specification sheets on each remote sensor, power meter, or interface card that will communicate or provide status to the SCADA system.

E. Connection Diagrams

1. Connection diagrams shall show the placement, labeling and wiring of components within panels, cabinets, and consoles. Wire lists and wireless diagrams shall not be accepted. Components shall be shown arranged in the physical layout (not necessarily to scale), as it would appear to a person servicing the equipment. Wiring designations, and routing designations, will follow the projects drawings standards. The connection diagrams will be submitted on 11”x17” paper.

2. The SCADA System Provider will submit connection diagrams for all new panels, cabinets, and consoles. Connection diagrams shall be Successfully Reviewed prior to the start of panel assembly. Loop diagrams may not be substituted for connection diagrams.

F. Interconnection Diagrams

1. Interconnection diagrams will be site specific and will show the external wiring between terminals of associated equipment, control panels, motor control centers, terminal boxes, field switches, field sensors, meters, critical power panels, and any other device, panel, or enclosure. Interconnection diagrams shall clearly depict all cable types, conductors, and cable tags. Cable tagging shall conform to project standards.

2. The SCADA System Provider shall prepare and submit interconnection diagrams for all major system components. Interconnection diagrams shall be Successfully Reviewed prior to the start of fabrication. The interconnection diagrams will be submitted on 11”x17” paper.

G. Panel Fabrication and Layout Drawings (PLFD)

1. As a minimum, PLFD will include front, back, and section views; the locations of all mounted components; drawing scale; nameplate engraving schedule; and structural materials and supports. A bill of material will also be provided on the drawing, or as a separate document. All drawings will be scaled. Overall dimensions and minimum clearances shall be shown. Sufficient detail shall be included to demonstrate material choices, outward appearance, construction methods, and seismic force resistance.

2. Complete shop drawings will be submitted for all panels, cabinets, and consoles which are fabricated, or modified, for this project. Reviewers will have the right to make modifications to the interior and exterior layouts of panels as part of the shop drawing review. No additional compensation will be provided to the SCADA System Provider for changes. The SCADA System Provider will budget for one redesign of the panel layout to incorporate the reviewers’ changes. Fabrication or modification shall not be started until PFLD submittals have been Successfully Reviewed. The PFLD drawings will be submitted on 11”x17” paper.

1.7 WARRANTY

A. The manufacturer will warrant all components against defects in materials and workmanship for two years. The warranty will cover all parts for two years and onsite labor for two years.

1.8 QUALITY ASSURANCE

A. Control Panel Integrator Qualifications

Minimum of ten years’ experience in the design, manufacture, and testing of solid-state PLC systems is required.

B. FACTORY TESTING

Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification.

PART 2 - PRODUCT

2.1 Products submitted other than listed part numbers are the responsibility of the contractor for system integration and revised PLC programming to make any substitute product integrate into the SCADA system.

2.2 FABRICATION

A. All materials and components making up the SCADA system will be new, of current design, and not in prior service except as required during factory testing. The SCADA system will be constructed of replaceable subassemblies.

2.3 WIRING

A. Wiring practices, materials, and coding will be in accordance with the requirements of the National Electrical Code (NFPA 70) and the National Electrical Manufacturer Association.

B. [redacted]

C.

D. Wiring inside the SCADA control cabinet will be routed through PVC wide finger wiring ducts. The white wiring ducts will have removable covers. The wiring duct will be equal to Panduit, Type G wide finger wiring duct.

2.4 SCADA SYSTEM CONTROL PANEL CABINET

A. [redacted]

[redacted]

B. [redacted]

1. [redacted]

2. [redacted]

3. [redacted]

2.5 [redacted]

A. [redacted]

[redacted]

B. [redacted]

1. [redacted]

2. [redacted]

C. [redacted]

1. [redacted]

2. [redacted]

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

a. [redacted]

b. [redacted]

c. [redacted]

d.

e.

f.

g.

7. [redacted]

8.

9.

10.

11.

12.

2.6 SCADA NETWORK SWITCH

A. [redacted]

2.7 WIREWAY UNDER THE SCADA CONTROL PANEL.

A. [redacted]

B. [redacted]

PART 3 - FIELD SERVICES

3.1 FIELD QUALITY CONTROL

A. The following inspections and test procedures will be performed by trained field service personnel during the SCADA system start-up and commissioning.

1. Visual Inspections
   a. Inspect equipment for signs of shipping or installation damage.
   b. Verify installation per drawings.
   c. Inspect cabinets for foreign objects.

2. Mechanical Inspections
   a. Check all I/O modules are correctly fitted.
   b. Check all power supply modules are correctly fitted.
   c. Check all terminal screws, nuts, and/or spade lugs for tightness.

3. Electrical Inspections
   a. Confirm input voltage is correct.
   b. Confirm each remote sensor, meter, and interface card is functioning correctly.

4. Operation test and performance verification
   a. The completed SCADA system will be operationally tested in accordance with Section 26 05 05 – Test and Performance Verification.

3.2 DEPARTMENT PROVIDED SERVICES AND EQUIPMENT

A. The Department will provide and install the following items:

1. The network switch in the tolling communications cabinet.

2. The program for the SCADA system PLC.

B. The contractor shall install and/or test the following items before notifying the Department that the SCADA system is ready to be programmed and the network switch is ready to be installed:

1. SCADA system control panel installed and energized

2. The conduits between the SCADA control panel and the tolling communications cabinet are installed.

3. The tolling communications cabinet is installed.

4. The power outlets serving the tolling communications cabinet are energized.

5. Testing of the tolling communications system fiber optic cables in accordance with specifications 633 – Intelligent Transportations Systems - Fiber Optic Cable Interconnect, has been completed satisfactorily.

C. Notify the Department 2 weeks prior to completing the work described in paragraph 3.2, B, above. Allow 14 days for the Department to install and test the network switch and the PLC program.

3.3 REPLACEMENT PARTS STOCKING

A. Replacement parts will available through a local distributor within 100 miles of the job site. The parts and materials within the SCADA control cabinet will be available 24 hours a day, 7 days a week, 365 days a year from a local distributor. Include the local distributors name on the shop drawings.

END OF SECTION 260913

SECTION 26 24 16
PANELBOARDS

LEVEL 2

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Main Distribution Panelboards (MDP)

B. Emergency Distribution Panels (EDP)

C. Branch circuit panelboards

1.2 RELATED SECTIONS

A. Grounding and Bonding: .....Section 26 05 26

B. Identification for Electrical Systems: .....Section 26 05 53

C. Fuses: .....Section 26 28 13

1.3 REFERENCES

A. NECA Standard of Installation (published by the National Electrical Contractors Association)

B. NEMA AB1 - Molded Case Circuit Breakers

C. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies

D. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. NEMA PB 1 - Panelboards

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association)

H. NFPA 70 - National Electrical Code

I. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor.

J. Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.4 SUBMITTALS FOR REVIEW

A. Provide submittals in accordance with Section 26 05 00 “Common Work Results for Electrical”.

B. Shop Drawings: Submit scaled drawings ½” = 1’ showing the physical location of each panelboard in each electrical room in relation to the other panelboards, switchboards, and mechanical equipment in the room. Indicate panelboard outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.5 SUBMITTALS FOR INFORMATION

A. Submittals for information must be in accordance with Section 26 05 01 “Shop Drawings and Submittals.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 SUBMITTALS FOR CLOSEOUT

A. Submittals for Contract Closeout must be in accordance with Section 01 78 39 “Record Documents Maintenance Manuals Equipment Operating Instructions-Demo”.

B. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

D. If installed circuit breakers differ from the basis of design in the plans, perform a final coordination study, using a recognized software program to confirm that the installed equipment meets the coordination study requirements.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.

1.8 MAINTENANCE MATERIALS

A. Maintenance materials for Contract Closeout must be in accordance with Section 01 78 39 “Record Documents Maintenance Manuals Equipment Operating Instructions-Demo”.

B. Furnish two of each panelboard key.

PART 2 - PRODUCTS

2.1 MAIN DISTRIBUTION PANELBOARD (MDP)

A. Manufacturers: MDPs must meet the requirements of the contract documents from one of the following or approved equal:

1. Schneider/Square D Co.

2. ABB/General Electric

3. Eaton/Cutler-Hammer

B. Description: NEMA PB 1, circuit breaker type panelboard with a vertically mounted main circuit breaker, a minimum of 18 one pole branch breaker spaces, and fully rated feed through lugs.

C. Panelboard Bus: Copper, ratings as indicated. Provide a ground bus in each panelboard.

D. Integrated Short Circuit Rating:

1. All panelboards, bussing and breakers shall be fully-rated, selectively coordinated to safely interrupt available short circuit currents. The AIC ratings shown on the drawings are the minimum ratings that can be provided.

E. The incoming utility power will be monitored on the line side of the main circuit breaker by a power meter located remotely on the SCADA control panel. The following accessories will be factory mounted inside a MDP enclosure:

1. Current transformers for each incoming phase and neutral conductors. The wound type current transformers will have a 5 Amp secondary, accuracy class 0.5%, with a minimum burden of 10 VA.

2. A CT shorting type terminal block for use with the current transformers.

3. A fused voltage disconnect with 2 amp fuses to sense the utility voltage on the line side of the main circuit breaker.

F. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL or other NRTL listed as Type HACR for air conditioning equipment branch circuits.

G. Main Circuit Breaker Accessories: The vertically mounted main circuit breaker will be equipped with the following accessories:

1. Auxiliary contacts, 1a/1b, rated 10 milliAmps at 24 VDC.

H. Enclosure:

1. Interior Dry Locations: NEMA 1

2. Exterior and Wet Locations: NEMA 3R or 4X stainless steel where shown on the plans.

I. Cabinet Front: Flush or Surface type as indicated, fastened with concealed trim clamps, hinged door with flush lock, welded metal directory frame, finished in manufacturer's standard gray enamel.

J. The number of utilized breaker spaces shall not exceed 80% of the full breaker space capacity. 20% of the breaker spaces shall remain empty.

K. MDP panelboards must be fed from the bottom with all applicable service entrance feeders and conduits.

L. Circuit breakers for use in panel MDP shall be the bolt-on type and shall be securely fastened to the bus bars using bolts. Plug-on type or clip-on type circuit breakers are not acceptable.

M. Provide a typed circuit directory card that accurately identifies each circuit and also provide a spare unused directory card for future use. Directory cards shall be from the same manufacturer as the panelboard. Place the spare directory card behind the typed directory card in the welded metal directory card holder.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers: Provide panelboards that meet the requirements of the contract documents from one of the following or approved equal:

1. Square D Co.

2. General Electric

3. Cutler-Hammer

B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, ratings as indicated. Provide a ground bus in each panelboard.

D. Integrated Short Circuit Rating:

1. All panelboards, bussing and breakers shall be fully-rated, selectively-coordinated to safely interrupt the available short circuit currents. The AIC ratings shown on the drawings are the minimum ratings that can be provided.

E. Molded Case Circuit Breakers: NEMA AB 1, thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

F. Enclosure:

1. Interior Dry Locations: NEMA 1

2. Exterior, Damp, and Wet Locations: NEMA 4X stainless steel

G. Cabinet Box: 5.75 inches (150 mm) deep, 20 inches (508 mm) wide.

H. Cabinet Front: Flush or Surface type, as indicated, cabinet front with concealed trim clamps, concealed hinge, welded metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

I. The number of utilized breaker spaces shall not exceed 80% of the full breaker space capacity. 20% of the breaker spaces shall remain empty.

J. Circuit breakers for use in panelboards shall be the bolt-on type and shall be securely fastened to the bus bars using bolts. Plug-on type or clip-on type circuit breakers are not acceptable.

K. Provide a typed circuit directory card that accurately identifies each circuit and also provide a spare unused directory card for future use. Directory cards shall be from the same manufacturer as the panelboard. Place the spare directory card behind the typed directory card in the welded metal directory card holder.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation".

B. Install panelboards plumb.

C. Provide filler plates for unused spaces in panelboards.

D. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise the directory to reflect any circuiting changes required to balance the phase loads. Provide (1) additional blank circuit directory for each branch circuit panelboard.

E. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

F. Field install Arc Flash and Shock Warning labels on each piece of new electrical distribution equipment such as panelboards, safety switches, motor control centers, and automatic transfer switches. The labels will indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling, below floor. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

H. Ground and bond panelboard enclosure according to Section 26 05 26.

I. Circuit breakers shall be molded case type unless noted otherwise on the plans.

J. The MDP shall be installed such that the bottom of the panelboard is not greater than 6 inches from the finished floor.

3.2 FIELD QUALITY CONTROL

A. Prior to energizing the installed panelboard perform the following:

1. Clean the interior of the enclosure and remove all dirt and debris.

2. Perform an insulation resistance test using a Volt Ohm Meter between each phase bus and ground. Investigate any reading of less than 1 MegaOhm.

3.3 ADJUSTING

A. Contract Closeout

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION 26 24 16

SECTION 262417
TOLL EQUIPMENT CRITICAL POWER PANELBOARD

LEVEL 3

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. The critical power panelboard(s) will serve as a networked SCADA system component for remotely controlling the circuit breakers that serve the tolling equipment. Ensure each Critical panelboard contains a minimum of fifteen, 120 Volt, 20 Amp, 1 pole, remotely operated molded case circuit breakers to allow control/switching of the branch circuits serving the tolling equipment. Additional circuit breakers may be necessary to serve other equipment. The critical power panelboard shall be capable of accepting 42 single pole circuit breakers.

B. Provide a common manufacturer on all major system components to assure seamless integration.

1.2 REFERENCES

A. Required UL Listings: UL 489 for Molded Case Circuit Breakers, UL 67 for Panelboards, UL 50 for Boxes and Enclosures, and UL 916 for Energy Management Equipment. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

B. NEMA Compliance: PB-1 for Panelboards

C. NEC 110-10 Compliance

D. FCC Approval: All assemblies are to be in compliance with FCC Emissions Standards specified in Part 15 Subpart J for Class A applications.

1.3 SYSTEM START-UP AND TRAINING

A. Start-Up: After the system has been installed, and the documentation delivered to the Department, secure the services of a factory trained manufacturer's representative for two days to verify correct operation of all system components.

B. Training: At system start-up, arrange for the factory representative to train the Department's personnel.

C. Factory Support: Ensure factory fax/telephone support is available free of charge during normal business hours to answer programming and application questions during the warranty period.

1.4 WARRANTY

A. Manufacturer must warrant per industry standard specified equipment to be free from defects in materials and workmanship for the lesser of one year from the date of installation or eighteen months from date of purchase.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. The panelboard shall be UL 67 listed, and shall be equipped with a main circuit breaker, and up to 42 branch circuit breakers. The main circuit breaker shall be mounted vertically and shall not be mounted horizontally.

B. The panelboard control system shall be POWERLINK-NF3500G4 with the integral Branch Circuit Monitor option (cat# BCM42C1) as manufactured by Square D Company. (Due to system compatibility issues this is the only acceptable product).

C. The panelboard shall be equipped with a metal directory card holder that is factory welded onto the inside of the hinged door. A clear plastic protector will slide into the directory card holder to protect the directory card.

D. Directory cards shall be produced using 40 pound or greater card stock. The directory card header shall show the panelboard name or designation.

E. The power distribution bussing shall be copper.

2.2 PANELBOARD CONTROL SYSTEM

A. Ensure the NF3500G4 control system consists of a microprocessor-based controller that provides system intelligence for 168 remotely operated branch circuits.

1. Ensure the control system meets or exceeds the following capabilities:
    a. Individual remote control for 42 branch circuits.
    b. Up to sixteen 2-wire maintained dry-contact inputs for connection to external low voltage (24 VDC or below) switch contacts.
    c. Zone creation of multiple branch circuits and control of individual branch circuits or zones.
    d. Individual branch circuit and zone override.

e. True closed loop control by monitoring branch circuit breaker status based on actual system voltage at load side terminal.
f. Downloadable firmware that will permit field installation of newest features in existing systems.
g. Ability to execute up to 4 daily schedules.
h. 365-day calendar with automatic leap year correction, and daylight savings time adjustment.
i. Astronomical clock with sunrise/sunset.
j. 7-day repeating scheduler.
k. 12-hour AM/PM or 24-hour military time format.
l. 32 special holiday/event periods.
m. Programmable sequence delay of circuit breakers.
n. Local display of day/date/time (with available LCD display).
o. Adjustable timer for inputs (time overrides).
p. Capacitor back-up power for time clock back up for 30 days.

B. Provide a display control module for each Critical Power Panelboard.

2.3 NETWORK

A. Ensure the Powerlink NF3500G4 controller network option allows other G4 controllers to be networked together to connect with other control systems.

B. The NF3500G4 controller shall communicate with the Departments managed Ethernet network switch in the tolls communications cabinet. The controller shall be equipped to send e-mails upon sensing an alarm and contain onboard web pages for configuration and control functions.

C. [redacted]

2.4 SYSTEM SOFTWARE

A. Ensure the software provides a user-friendly interface for set-up and maintenance of input-based and time-based schedules.

B. Ensure software provides remote monitoring and control of the system or individual remotely operated circuit breakers.

C. Operates on a Microsoft Windows 10 or most current Windows version. .

D. Ensure all control components are installed in a conventional panelboard enclosure. Provide suitable barriers between Class 1 and Class 2 wiring.

2.5 POWER INTERFACE MODULE

A. Provide power interface module 120 VAC to 24 VAC control power module for the operation of the remotely operated circuit breakers, and to provide power for low voltage inputs, and power for the electronics and communications. Power interface module shall be equal to cat# NF120PSG.

B. Ensure the module provides screw type terminals for up to sixteen 2-wire maintained or 2-wire momentary inputs, or eight 3-wire momentary inputs for connection to external low voltage (24 VDC or below) switch contacts

2.6 BRANCH CIRCUIT BREAKERS

A. To minimize installation labor and space requirements, ensure the remote operated circuit breakers, power interface module and control module are integral to the panelboard.

B. Remote Operated Circuit Breakers. Ensure all remote operated branch circuit breakers provide overload and short circuit protection suitable for that location in the electrical system, as defined in the panelboard schedules. Ensure remote operated power switching devices provide the following:

1. Load switching endurance rating of 200,000 open/close operations at full load and 0.8 lagging power factor.

2. Ensure 15A, 20A, and 30A current ratings are available for remote operated power switching devices. Ensure power switching devices provide integral branch circuit overcurrent protection as required by the National Electrical Code (NEC), and are fully-rated, selectively coordinated for providing adequate protection at that point in the system.

3. Ensure power switching devices are available in single-, two-, and three-pole configurations.

4. UL or other NRTL Listing SWD rating on 15A and 20A 1-, 2- and 3-pole branches, UL or other NRTL Listed HACR rating and UL or other NRTL Listed HID rating on all remotely operated power switching devices.

5. Handle that mechanically opens power switching device contacts when moved to the OFF position and disables remote control capabilities of the device.

6. Ensure operating mode selector button on each power switching device is provided to enable or disable remote operated function of the device independent of the handle.

7. Visible flag to clearly indicate the status of the circuit breaker contacts. Ensure status condition includes: ON, OFF, TRIPPED. Ensure the visible flag is

mechanical in nature, directly tied to the breaker mechanism, and is provided in addition to any status indicator supplied by the system electronics. Ensure switching devices not equipped with such an indicator is equipped with an alarm and auxiliary contacts.

8. Ensure all individual power switching devices rated for 120/240 or 208Y/120 VAC have a short circuit interrupting rating of 14,000 rms symmetrical amperes, minimum.

9. Ensure power switching devices meet all NEC requirements for circuit breakers; shall be UL or other NRTL Listed as circuit breakers.

10. Ensure panelboards accept standard circuit breakers for loads not controlled by the system.

C. Interconnections

1. Ensure all interconnections between circuit breakers, control buses and power interface modules meet NEC and UL or other NRTL requirements for Class 1 control circuits.

2. Use modular control buses to provide control power and communications to the remote operated branch breakers.

PART 3 - INSTALLATION

3.1 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation

1. Ensure the panelboard control system with remotely operated circuit breakers is installed and wired completely as shown on the plans by the contractor.

2. Ensure all remote-control wiring is installed in accordance with Article 725, Class 2 of the National Electrical Code and local codes.

3. Use wire size as recommended by manufacturer, but must not be smaller than #24 AWG.

4. Install system in accordance with manufacturer’s written instructions and the NEC.

5. Coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

END OF SECTION 26417

SECTION 262713
ELECTRICITY METERING AND UTILITY SERVICE ENTRANCE

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service racks

B. Metering transformer cabinets

C. Meter bases

1.2 RELATED SECTIONS

A. Section 262416 – Panelboards.

B. Section 263600 – Automatic Transfer Switch

1.3 REFERENCES

A. NECA Standard of Installation (National Electrical Contractors Association)

B. NFPA 70 - National Electrical Code

1.4 SYSTEM DESCRIPTION

A. System Characteristics: 240/120 Volts, 400 Amp, 1 phase, 3 wire, 60 Hertz or as shown on the plans.

1.5 SUBMITTALS FOR REVIEW

A. Section 260501 - Submittals: Procedures for submittals.

B. Product Data: Provide ratings and dimensions of transformer cabinets and meter bases. Include the Utility contact information, the electric meter base configuration and the utility transformer pad details in the engineering submittals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. and acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 PRE-INSTALLATION MEETING

A. Coordination and Meetings: Pre-installation meeting.

B. Review service entrance requirements and details with Utility Company representative.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company drawings.

PART 2 - PRODUCTS

2.1 METER BASES

A. Meter bases will be furnished by the Electrical Contractor.

B. Meter bases shall be fabricated from aluminum and then painted by the manufacturer.

C. The meter base shall contain in integral bypass that allows the meter to be removed and replaced without interrupting power to the building.

D. Neutral lugs must be sized to accommodate grounding conductors.

2.2 PAD FOR UTILITY TRANSFORMER

A. Description: Sized and configured as required by the Utility. Provide and install the transformer pad per the Utility requirements.

2.3 SECONDARY CONNECTION CABINET

A. If the quantity of underground service entrance conductors is greater than the utility pad mounted transformer lugs can accept, provide a secondary connection cabinet installed by the Electrical Contractor between the utility transformer and the service entrance point on the building. Ensure the customer's service entrance conductors and the utilities service entrance conductors are properly joined inside this enclosure. Contact the utility company for the specifications and requirements of this cabinet.

2.4 SERVICE DISCONNECT

A. The service disconnect shall be a vertically mounted main circuit breaker within a panelboard or as depicted in the plans.

B. The service disconnect shall not contain fuses as overcurrent protection for the power distribution system.

C. Ensure the service disconnect contain a set of auxiliary contacts. The contacts will be open when the service disconnect is open and closed when the service disconnect is closed.

D. The service entrance feeders shall enter from the bottom.

E. The service entrance feeder conduits shall utilize rigid metal conduit elbows coated with PVC or Bitumen.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Transformer pad, metering transformer cabinets, and meter base as required by the local Utility Company.

B. Service entrance conductors between the utility transformer and the toll facility shall be continuous and shall not be spliced or tapped.

C. Utility transformers serving toll facilities shall be dedicated to the toll facility and shall not serve any other loads.

END OF SECTION 262713

SECTION 262716
ELECTRICAL CABINETS AND ENCLOSURES

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hinged cover enclosures

B. Cabinets

C. Terminal blocks

D. Accessories

1.2 RELATED SECTIONS

A. Section 260529 – Hangers and Supports for Electrical Systems

1.3 REFERENCES

A. Quality Control

B. NECA Standard of Installation (National Electrical Contractors Association)

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

D. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems

E. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

A. Section 260500- Submittals: Procedures for submittals.

B. Product Data: Provide manufacturer's standard data for enclosures and cabinets.

1.5 MAINTENANCE MATERIALS

A. Contract Closeout

B. Furnish two of each key.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, Type 1 or 4X steel enclosure as required for the application or shown on the plans.

B. Covers: Continuous hinge, held closed by flush latch operable by key.

C. Provide interior metal panel with stand-off brackets for mounting terminal blocks and electrical components. The finish shall be white enamel paint.

D. Enclosure Finish: Manufacturer's standard enamel or brushed stainless steel.

E. Provide metal barriers to form separate wiring compartments for different wiring systems and voltages.

2.2 CABINETS

A. Electrical cabinets shall not be installed outdoors.

B. Cabinet enclosures shall be galvanized steel.

C. Cabinet Size: 24-inches (600-mm) wide x 24 inches (600 mm) high x 6-inches (150-mm) deep, minimum, increase dimensions as required for application.

D. Provide interior metal panel with stand-off brackets for mounting terminal blocks and electrical components; finish with white enamel.

E. Fronts: Steel, flush or surface as indicated with concealed trim clamps, door with concealed hinge, and flush lock keyed to match the branch circuit panelboards. Finish with gray baked enamel.

F. Knockouts: None

G. Provide metal barriers to form separate wiring compartments for different wiring systems and voltages.

H. Provide mounting rack for free-standing equipment.

2.3 TERMINAL BLOCKS

A. Terminal Blocks for power distribution systems operating at 50 Volts or greater shall be UL 1059 Listed, and shall be installed in accordance with NEMA ICS 4 - Application Guidelines for Terminal Blocks.

B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

D. Provide ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 260529.

C. Install cabinet fronts plumb.

D. Use the factory mounting holes to secure and support cabinets and enclosures. Do not field drill mounting holes.

3.2 CLEANING

A. Clean electrical parts to remove conductive and harmful materials.

B. Remove dirt and debris from enclosure.

C. Clean finishes and touch up damage.

END OF SECTION 262716

SECTION 262726
WIRING DEVICES

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall switches / Snap switches

B. Receptacles

C. Twist-Locking receptacles

D. Device plates and box covers

1.2 RELATED SECTIONS

A. Raceways and Boxes for Electrical Systems: .....Section 26 05 33

B. Grounding and Bonding for Electrical Systems: .....Section 26 05 26

1.3 REFERENCES

A. NECA - Standard of Installation

B. NEMA WD 1 - General Requirements for Wiring Devices

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements

D. NFPA 70 - National Electrical Code

1.4 SUBMITTALS FOR REVIEW

A. Submittals: In accordance with Section 26 05 00 - Common Work Results for Electrical :.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations and ratings.

1.5 SUBMITTALS FOR INFORMATION

A. Section 26 05 00 - Submittals: Provide specification sheets for each type of wiring device.

B. Identify the use or location for each device, such as “Receptacles above tolling cabinets”, “general use receptacles in toll building”.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES / SNAP SWITCHES

A. Description: Provide products that comply with NEMA WD 1, and are commercial specification grade, UL 20 Listed, and rated for AC only general-use.

B. Configuration:

1. Single pole single throw or 3-way.

2. Switches shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.

3. Provide same series switch for other configurations.

C. Ratings:

1. Voltage: 120-277 volts, AC

2. Dielectric voltage test: Withstands 1500 Volts for 1 minute.

3. Temperature rise: The maximum temperature rise shall not exceed 30 degrees C.

4. Flammability: Rated V-2 per UL 94.

5. Current: 20 Amps continuous current unless indicated otherwise on the plans.

2.2 LIGHTING TIMER SWITCHES

A. Description: Provide 125V, 20A 4-hour twist type time delay switch in metal weatherproof box.

2.3 STRAIGHT BLADE RECEPTACLES

A. Description: Provide products that comply with NEMA WD 1, and are UL 498 Listed, commercial specification grade, with the following features and benefits:

1. Shall be corrosion-resistant, with plated steel strap locked into the face and back body to resist pulling away from face/body assembly.

2. The brass power contacts shall be 0.032 inch thick, and utilize triple-wipe action.

3. Easily accessible break-off, line-contact connecting tab for fast, easy split-circuit wiring.

4. Impact-resistant nylon face and thermoplastic back body.

5. Accepts #14 - #10 AWG solid or stranded copper or copper-clad wire.

6. The terminal compartments shall be isolated from each other for positive conductor containment.

7. Shall be equipped with an auto-ground clip to assure positive grounding.

B. Configuration:

1. Simplex (single) or duplex outlets.

2. Receptacles installed outdoors shall be rated Weather Resistant and shall be of the ground fault circuit interrupter type.

3. Receptacles shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.

C. Ratings: Receptacles shall be rated as follows:

1. 20 Amp, 125 Volt, NEMA 5-20R

2. Receptacles shall meet UL 94 Flammability requirements.

3. Receptacles shall have a dielectric voltage withstand rating of 2000 Volts

4. Temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

2.4 TWIST-LOCK RECEPTACLES

A. Description. Provide products that comply with NEMA WD 1, and are UL 498 Listed, commercial specification grade, meets federal specification W-C-596, and have the following features and benefits:

B. Configuration:

1. Simplex (single)

2. Twist lock receptacles shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.

C. Ratings:

1. 20 Amp, 125 Volt, 2 horsepower, NEMA L5-20R with dielectric voltage withstand rating of 2000 Volts and temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

2. 30 Amp, 250 Volt, 2 horsepower, NEMA L6-30R with dielectric voltage withstand rating of 2000 Volts, and temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

3. Receptacles shall meet UL 94 Flammability requirements of HB or better

2.5 WALL PLATES / COVER PLATES

A. Cover Plates: Smooth thermoset plastic plates.

B. Provide labels on each wall plate and receptacle plate that show the branch circuit numbers and panelboard that serves them.

C. Weatherproof Cover Plate: Cast zinc cover plate with a “While-In-Use” cast zinc hinged weather proof and padlockable door.

2.6 WIRING DEVICE COLOR

A. Device colors shall be ivory when served by normal power, red when served by generator power, and orange when served by the critical power system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordination and Meetings

B. Verify that outlet boxes are installed at proper height. Coordinate outlet heights with interior elevations.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that floor boxes are adjusted properly.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that openings in access floor are in proper locations.

3.2 PREPARATION

A. Provide extension rings to bring recessed outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with the grounding pole on the bottom.

E. Connect wiring device grounding terminal to outlet box and branch circuit equipment grounding conductor.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Connect wiring devices by wrapping the solid conductor around the screw terminal and tightening the screw snugly. Back wiring/back stabbing is not acceptable. Stranded conductors shall be terminated with compression style lugs.

H. Install cast iron plates on outlet boxes and junction boxes in unfinished areas and on surface mounted outlets.

I. Install wiring devices as indicated on the Drawings, and as called for below.

J. Switches and receptacles shall be installed and located as follows, unless noted otherwise on Drawings.

1. Switches: Centerline 46" above finished floors.

2. Receptacles: Centerline 18" above finished floors generally; Verify and coordinate exact height and locations with plans and elevations.

K. Where light switches are located adjacent to doors, they shall be installed on "knob" side of door. Field-verify door swings.

3.4 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 26 27 26

SECTION 262813
FUSES

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses

B. Spare fuse cabinet

1.2 REFERENCES

A. NFPA 70 - National Electrical Code

B. NEMA FU 1 - Low Voltage Cartridge Fuses

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of Section 260501.

B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

1.4 PROJECT RECORD DOCUMENTS

A. Record actual fuse sizes and catalog numbers. Include this information in the O&M Manuals.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years' experience.

1.6 MAINTENANCE MATERIALS

A. Provide one set of spare fuses for each fuse size and type used on the project.

B. Provide two fuse pullers.

PART 2 - PRODUCTS

2.1 FUSE REQUIREMENTS

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Main Service Switches Larger than 600 amperes: Class L (time delay).

D. Main Service Switches: Class RK1 (time delay).

E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).

F. Power Load Feeder Switches: Class RK1 (time delay).

G. Motor Load Feeder Switches: Class RK1 (time delay).

H. Lighting Load Feeder Switches: Class RK1 (non-time delay).

I. Power Branch Circuits: Class RK1 (time delay).

J. Motor Branch Circuits: Class RK1 (time delay).

2.2 SPARE FUSE CABINET

A. Description: Install a wall-mounted 18-gauge steel cabinet, with all welded construction in each toll building to store spare fuses, fuse pullers, and various O&M manuals. Provide two sets of each fuse type or style used at each building.

1. Cabinet Size: 30 inches wide, 27 inches high, 14 inches deep
2. Doors: Flush mounted double doors with a two-point locking handle
3. Shelf: One adjustable shelf
4. Finish: Painted, putty color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

C. Record the proper fuse type, Amp rating, voltage, and catalog number inside each fused safety switch.

END OF SECTION 262813

SECTION 262817
ENCLOSED SAFETY SWITCHES

LEVEL 2

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Heavy duty fusible safety switches

B. Non-fusible heavy duty safety switches

1.2 RELATED SECTIONS

A. Section 262813 - Fuses

1.3 REFERENCES

A. NECA - Standard of Installation (published by the National Electrical Contractors Association)

B. NEMA FU1 - Low Voltage Cartridge Fuses

C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association)

1. NFPA 70 - National Electrical Code

2. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.4 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals.

1. Product Data: Provide switch ratings and enclosure dimensions. Provide a name/ label for each safety switch in the shop drawing submittals.

1.5 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout

1. Record actual locations of enclosed switches in project record documents.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Provide switches that meet the requirements of the contract documents from one of the following or approved equal:

1. Square D Co.

2. General Electric

3. Cutler-Hammer

2.2 FUSIBLE SWITCH ASSEMBLIES

A. Description: UL 98 and NEMA KS 1, heavy duty type, with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position. Install the factory provided equipment grounding bar in each switch. Fastening the grounding conductors to the inside of the painted enclosure with a screw is not acceptable.

B. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

2.3 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: UL 98 and NEMA KS 1, heavy duty type, with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position. Install the factory provided equipment grounding bar in each switch. Fastening the grounding conductors to the inside of the painted enclosure with a screw is not acceptable.

2.4 ENCLOSURES

A. Fabrication: NEMA KS 1.

1. Interior Dry Locations: Type 1

2. Exterior Damp and Wet Locations: NEMA 3R. or 4X (stainless steel) when shown on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install fuses in fusible disconnect switches.

1. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

1. Perform inspections and tests listed in NETA ATS, Section 7.5.

END OF SECTION 262817

SECTION 26 32 13
EMERGENCY GENERATOR - PERMANENT

LEVEL 3

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged emergency generator set.

B. Exhaust silencer, elbows, rain cap and fittings

C. Batteries and battery charger

D. Fuel for load bank testing and fuel to fill the tank at final completion.

E. Vibration isolators under emergency generator skids.

F. Weather protective enclosure

G. Base Fuel Tank at sites shown in the plans.

1.2 RELATED SECTIONS

A. Test And Performance Verification: .....Section 26 05 05

B. SCADA System: .....Section 26 09 13

C. Automatic Transfer Switch: .....Section 26 36 00

1.3 REFERENCES

A. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

B. NEMA MG1 - Motors and Generators

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

D. NFPA 30 - Flammable and Combustible Liquids Code

E. NFPA 70 - National Electrical Code

F. NFPA 110 - Emergency and Standby Power Systems

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit shop drawings under provisions of Section 26 05 01.

B. Sizing Program Results. Provide printouts in the shop drawings from the emergency generator manufacturer's sizing and simulation program. The sizing program printouts must show the following items or information:

1. Simulation #1. The program will show the selected emergency generator installed inside the weather protective enclosure while running at full (100% rated) load with the ambient temperature at 110 degrees Fahrenheit and the unit is installed at 100 feet above sea level. The printout will show the air flow in cubic feet per minute that is passing through the weather protective enclosure and the pressure drop across the selected radiator. Ensure the printout shows the selected engine model number, radiator model number or part number, alternator size, and weather protective enclosure part number. The printout will also show the instantaneous voltage and frequency dips upon a 100% rated load (block load) application at 0.8 power factor.

2. Simulation #2. Run a second simulation that lists the name and Watt rating of each electrical load that the emergency generator will serve. Use the construction plans to determine the site specific electrical loads and the sequence that the loads will be applied to the emergency generator. The printouts will show the voltage and frequency dips for each set of loads that are applied to the emergency generator. The power distribution system, including the emergency generator, must be designed to operate normally when the UPS units are operating at 100% full (rated) load.

C. Shop Drawings will include plan and elevation views with dimensions of the selected emergency generator with the exhaust system in place, and base fuel tank when applicable. Also show plan and elevation views with dimensions of the weather protective enclosure. Include specific dimensions for interconnection points such as:

1. Fuel piping connections

2. Exhaust outlet sizes and locations

3. Oil valve location

4. Radiator drain valve location

5. Spring isolator mounting points

6. Conduit stub up locations for the main generator feeder, jacket water heater circuit, and battery charger circuit.

D. Provide emergency generator fuel consumption rate curves at various loads.

E. Provide a manufacturers emergency generator data sheet that shows the EPA Tier Rating of the emergency generator package. The emergency generator must meet or exceed the current EPA tier rating requirements for stationary and off-road diesel engines. The emergency generator model number shown on the EPA documentation must match the emergency generator model number being submitted for review.

F. Provide calculations that show the ventilation rate of the cooling air flowing through the weather protective enclosure. Also show the pressure drops across the louvers and across the engine radiator.

G. Provide a site specific, point to point interconnection diagram on 11"x17"-inch paper. The site specific drawing will show the exact connection points for the Modbus RTU communications cables, remote EPO station, battery charger alarms, main fuel tank alarms, engine start contacts in the automatic transfer switch, ATS auxiliary contacts to indicate the position of the ATS, engine running auxiliary contacts, etc. Submittals will not be reviewed without this site-specific diagram showing the name of the tolling site.

H. Product Data: Provide data sheets that show the dimensions, weights, ratings, interconnection points, features, ratings, and internal wiring diagrams if applicable, for the following items:

1. Engine
2. Alternator
3. EPO
4. Radiator and radiator fan size
5. Radiator drain valve and extension hose
6. Antifreeze
7. Engine oil
8. Engine crankcase fumes disposal tube
9. Fuel filter
10. Diesel Fuel Additives for increasing Cetane # and fuel stabilizer.
11. Water separator
12. Fuel prime pump – hand operated
13. Analog fuel pressure gauge
14. Fuel pump suction pressure data and maximum external restriction data.

15. Head loss calculations for the proposed fuel piping and accessories

16. Flexible fuel lines

17. Jacket coolant heater and hose isolation valves

18. Oil drain valve and extension hose

19. Air cleaner and differential pressure indicator

20. Emergency Generator Control Panel

21. Modbus RTU communication card with wiring diagrams and a Modbus register map for the emergency generator controller.

22. Main Circuit Breaker and trip unit

23. Engine cranking battery

24. Battery cable size and lengths. Show the cable Voltage Drop during engine cranking.

25. Battery rack

26. Battery charger

27. Exhaust silencer, elbow, and rain cap.

28. Exhaust system stainless steel flexible connector

29. Thermal blankets for silencer

30. Vibration isolators

31. Weather protective enclosure

32. Warranty statement

33. The distributor will provide a written statement concerning the availability of repair parts and the physical address of the parts counter or parts warehouse that is open to the public, 5 days per week, Monday through Friday.

I. Operation Manual and Installation Manual

1. Provide one paper book copy and one electronic copy, of the Manufacturer's Operation Manual and the Installation Manual for the emergency generator and automatic transfer switch at each Toll Building. Provide a set of manuals for each emergency generator provided under this contract. Deliver the manuals to the Engineer at the same time the manuals are electronically submitted as a part of the Section 26 32 13- Emergency Generator - Permanent shop drawing. The

Engineer will not process the Section 26 32 13- Emergency Generator - Permanent shop drawing unless the paper copy and the digital copy of the Manufacturer's Operation Manual and the Installation Manual have been delivered.

2. The Construction Engineering & Inspection representative will accept the paper and digital copy of the O&M manuals and provide a written receipt to the contractor to show that the manuals were received and are awaiting review. The contractor will submit an electronic copy of the manuals to the Department for review as a Shop Drawing.

3. If the manuals are incomplete, or are lacking in meaningful operational or installation instructions, or do not cover the model or type of equipment being provided, then the Department may REJECT the manuals and indicate on the shop drawing review forms the nature of the deficiencies. The contractor will then collect the deficient materials from the Engineer, correct the deficiencies, and then re-submit the materials for another review.

1.5 SERVICE & REPAIR MANUAL, AND PARTS MANUAL

A. Provide one digital copy and one paper book copy of the emergency generator manufacturer’s parts manual for each emergency generator provided under this contract. The parts manual must show the original equipment manufacturers part numbers for all parts and accessories on the engine, radiator, main alternator, starter, charging alternator, and generator control panel.

B. Provide one digital copy and one paper book copy of the emergency generator manufacturer’s service and repair manual and include the following:

1. Include the manufacturer’s suggested preventive maintenance service activities, suggested intervals between each service, and the required parts and tools to perform the service.

2. 2. Include separate chapters on each subsystem or major component that make up the emergency generator package. Each chapter will provide exploded view diagrams, required tools, and step by step procedures to repair or replace each component in the subsystem.

C. If the manuals are incomplete, are lacking in meaningful parts information or step by step repair instructions, or do not cover the model or type of equipment being provided, then the manuals will be rejected and require re-submission.

1.6 WARRANTY

A. The packaged emergency generator system must be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of

system start-up. The warranty will include parts, shipping costs, rigging costs, engine fluids, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

B. Regular and scheduled maintenance will be performed by the Department's maintenance contractor. Requirements for consumables such as oil and filters to be original equipment manufacturer brands are not acceptable and must not void the manufacturer's warranty of the equipment.

1.7 QUALITY ASSURANCE

A. The emergency generator must be a standard product of the original equipment manufacturer. The vendor that provides the emergency generator package must be an authorized manufacturer's representative for the brand of emergency generator that is provided.

B. Perform an operational test on the emergency generator and automatic transfer switch before the site is turned over to the Department. After all the building systems and equipment have been installed, placed into service, and individually commissioned by the appropriate party, provide functional testing with all the systems and equipment running simultaneously to verify that the normal operation of any one system or piece of equipment does not interfere or aggravate the normal operation of any other system or equipment. Perform the operational testing with a Department representative present to observe the process.

1.8 QUALIFICATIONS

A. The company selling the products specified herein must be an authorized distributor for the original equipment manufacturer. The distributor must be factory authorized to supply parts, perform field services, and perform factory warranty work on the emergency generator and associated products specified herein. The distributor must maintain a parts inventory for the equipment provided and stock 50% of all parts for the engine, generator, and automatic transfer switch at their service facility within 100 miles of the project job site. The company selling the products specified herein must operate a public parts counter or parts warehouse that is open to the public, 5 days per week, Monday through Friday. The Department may inspect the service facility to verify the parts stock.

1.9 REGULATORY REQUIREMENTS

A. Furnish an emergency generator that is EPA Certified to the proper Tier Level for stationary and off-road diesel engines.

1.10 DELIVERY, STORAGE, AND HANDLING

A. The contractor will be responsible for shipping, delivery, and rigging costs.

B. Inspect the equipment for damages immediately upon delivery and contact the distributor or manufacturer before accepting a product that was damaged during shipping. Take photos of any damaged equipment before removing it from the truck. Make specific notes on the receiving ticket to describe the extent of any damage.

C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic until it is installed.

D. When lifting the emergency generator with a crane, use spreader bars to prevent bending the weather protective enclosure.

1.11 MAINTENANCE MATERIALS

A. The distributor will provide the following additional maintenance parts for each emergency generator provided under this contract: One air filter, one oil filter, one fuel filter, one water separator clear bowl, and one radiator fan belt. The parts will be new and must match the part numbers shown in the manufacturer's parts manual. Highlight these part numbers with a yellow highlighter in the paper parts manual.

B. Turn over the parts to the Engineer firm when the site is turned over to the Department for installing the tolling equipment. The Construction Engineering & Inspection representative will accept the parts and provide a written receipt to the contractor to show that list of parts that were received. The Engineer will verify that the parts are new and match the part numbers in the parts manual.

C. If the parts are incomplete, or are not new OEM parts, or do not match the parts shown in the manufacturers parts manual, then the Engineer will REJECT the parts that were submitted and indicate on the review form the nature of the deficiencies. The contractor will then collect the deficient parts from the Engineer, correct the deficiencies, and then re-submit the parts for another review.

PART 2 - PRODUCTS

2.1 PACKAGE EMERGENCY GENERATOR SYSTEM

A. ACCEPTABLE ORIGINAL EQUIPMENT MANUFACTURERS

1. Cummins Power

2. Caterpillar

3. Kohler

4. No substitutions

B. Description: Classify the Emergency Power Supply System (EPSS) in accordance with NFPA 110 as Level 2, Type 10. Show the classification on the engineering plans.

C. System Standby Rating: As shown on the Plans for each toll facility, while operating inside a weather protective enclosure, and at an ambient temperature of 110 degrees Fahrenheit, and at an elevation of 100 feet above sea level. The emergency generator will use an engine mounted radiator with a pusher type radiator fan. The full standby rated output will be available with varying loads for the duration of the interruption of the normal source power. The average power output must not exceed 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. The Standby power rating will be in accordance with ISO3046/1.

D. Generator (alternator) output voltage dip and frequency dip requirements: Upon application of 100% rated (full) load at 0.8 pf, in a single step, the instantaneous voltage dip at the output of the alternator shall not exceed 20% and the instantaneous frequency dip will not exceed 20%.

2.2 ENGINE

A. Type: Water-cooled inline or V-type, four stroke cycle, compression ignition diesel internal combustion engine.

B. Fuel: No. 2 fuel oil, ultra-low sulfur, not to exceed 15 ppm sulfur.

C. Engine speed: Rated for 1800 rpm.

D. Governor: Electronic isochronous governor. Random frequency variation shall not exceed ±0.25% .

E. Safety Devices: Pre-alarms and Engine shutdowns with alarms for high engine temperature, low oil pressure, overspeed, and emergency stop. Limits as selected by the manufacturer. Also provide overcrank / failure to start lock out and alarm.

F. Engine Starting: Positive engagement, cycle crank type, DC starting system with the number of starter motors in accordance with manufacturer's instructions. Include remote “two-wire” starting controls.

G. Engine Jacket Coolant Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C) under all site conditions, and suitable for operation on 208 or 240 volts AC. Also provide isolation valves on the coolant supply and return hoses to facilitate maintenance on the heater.

H. Radiator: High ambient radiator using propylene glycol based coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C) when the emergency generator is installed within the weather protective enclosure and running at 100% rated (full) load. Radiator air flow restriction 0.5 inches of water (1.25 Pa) maximum. Provide a metal radiator guard and provide an accessible coolant drain valve on the bottom of the radiator. If the weather protective enclosure makes the drain valve not accessible, then extend a permanent drain hose from the drain valve to the outside of the enclosure. The radiator shall also include low coolant alarm contacts.

I. Engine Accessories: Aftercooler, intake air filter(s) with differential pressure service indicators, spin on lube oil filters, lube oil cooler, gear-driven water pump, battery charging alternator, and crank case fumes disposal tube(s) routed outside. Also provide an oil drain valve on the bottom of the engine oil pan. If the weather protective enclosure makes the drain valve not accessible, then extend a permanent drain hose from the drain valve to the outside of the enclosure.

J. Engine Fuel System: Primary spin on fuel filter(s) with separate fuel/water separator with metal housing and see through containment bowl, fuel transfer pump with a suction head of 9 feet minimum, a hand operated fuel priming pump with an analog fuel pressure gauge mounted next to the hand prime pump. A factory installed fuel oil cooler shall be mounted on the radiator to keep the return fuel temperature below 85 degrees F.

1. For TEB sites, submit fuel piping head loss calculations to the Engineer for the piping that serves above ground storage tanks. The calculations will show that the emergency generator fuel pump is capable of operating properly with the proposed fuel pipes, and fuel pipe accessories such as foot valves, check valves, anti-siphon valves, pipe elbows, etc.

K. Mounting: Provide unit with suitable spring-type vibration isolators mounted under the structural steel base. If the engine and the alternator are isolated from the structural steel base by rubber snubbers/mounts, then vibration pads may be utilized under the structural steel base.

L. Paint. The engine and the engine accessories shall be painted by the original manufacturer. Additional painting of the engine and engine accessories are not acceptable to the Department. The engine may not be repainted to change the color. Belts and hoses shall not be painted. The OEM part numbers must remain visible on all belts, hoses, and filters.

2.3 GENERATOR

A. Generator: NEMA MG1, single-phase, four-pole rotors, brushless synchronous generator with a brushless permanent magnet exciter.

B. Insulation Class: H.

C. Temperature Rise: 130 degrees C

D. Enclosure: NEMA MG1, drip proof, IP 22 guarded.

E. Voltage Regulation: Include generator-mounted volts per hertz exciter-regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Include manual controls to adjust voltage drop, voltage level (plus or minus 25 percent) and voltage gain.

The manual voltage adjustment will be used to adjust the output voltage up to 120% of nominal to test over voltage protective device. The manual voltage adjustment will also be used to adjust the output voltage down to 80% of nominal to test under voltage protective device.

2.4 ACCESSORIES

A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless-steel exhaust fitting assembly, sized in accordance with engine manufacturer's instructions. Also provide an outlet elbow and a rain cap. If the exhaust piping penetrates the top of the outdoor enclosure, a rain collar shall be installed around the exhaust piping to minimize water entering the weather proof enclosure.

B. Removable Insulation Blankets: If the exhaust silencer is mounted inside the weather protective enclosure then the silencer and stainless-steel flex will be covered with removable insulation blankets. The insulation blankets will be minimum one inch thick with three layers. The outer layer will be silicone impregnated fiberglass. The middle layer will be fiberglass. The innermost layer will be stainless steel mesh.

C. Batteries: Heavy duty, high output, diesel engine starting type, vibration resistant, lead-acid storage batteries. The advertised Cold Cranking Amps shall be at 0 ºF. Ensure the batteries will withstand extreme vibration and sample batteries have been tested in accordance with IEC 61056-1. The prototype batteries shall pass a 50-hour vibration resistance test. Match the battery voltage to the engine starting system. Include copper battery cables and a key operated battery disconnect switch. Submit data sheet to the engineer on the battery switch. Calculate the voltage drop in the battery cables with full load cranking amps. Provide this calculation with the shop drawing submittals.

D. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

E. Battery Charger: Magnetic amplifier design, 10 Amps DC output with current limiting at 140%. Automatic float/equalize mode designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell and rated for use at ambient temperatures up to 120 ºF. Accessories shall include: Analog DC Voltmeter and Ammeter, alarms for low DC volts, high DC volts, and charger failure. Provide a wall mounted enclosure to meet NEMA 250, Type 1 requirements. The manufacturer shall provide a 10-year standard warranty on the charger. Battery charger must be wall-mounted inside the TEB.

F. Line Circuit Breaker: NEMA AB 1, molded case circuit breaker, generator mounted in a NEMA 1 enclosure. The circuit breaker enclosure shall provide adequate space for the Electrical Contractor to bend the generator feeder conductors in accordance with the NEC. The circuit breaker protective trip unit shall include integral thermal and instantaneous magnetic trips in each pole, sized in accordance with NFPA 70. Include a set of auxiliary contacts on the generator circuit breaker. The contacts will be open when the circuit breaker is open and closed when the circuit breaker is closed. These contacts will be monitored by the SCADA system.

G. Engine-Generator Control Panel: NEMA 1, IP22 generator mounted control panel made of heavy duty sheet steel and vibration isolated from the emergency generator set. The control panel shall house the engine and generator controls, gauges and indicators. Also provide a hinged vandal door over the face of the control panel with provisions for a padlock. The control panel shall include the following equipment and features:

1. Frequency Meter: 45-65 Hz. range

2. AC Output Voltmeter with true RMS sensing, 1/2 percent accuracy with phase selector switch.

3. AC Output Ammeter with true RMS sensing, 1/2 percent accuracy with phase selector switch.

4. Output voltage adjustment.

5. Push-to-test indicator lamps, for low oil pressure, high water temperature, overspeed, and overcrank shutdowns.

6. Engine Off/Auto/Start/Stop selector switch.

7. Engine running time meter.

8. Oil pressure gauge.

9. Fuel pressure gauge

10. Water temperature gauge.

11. Emergency stop button

12. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.

13. Additional visual indicators and alarms as required by the Safety Indication and Shutdown table below.

14. Remote Alarm Contacts: Pre-wire SPDT contacts to a terminal strip for remote alarm functions required by NFPA 110.

15. Provide over voltage protection (ANSI #59) and under voltage protection (ANSI #27) to protect the generator and/or building distribution system from a voltage regulator malfunction. Over voltage relay settings shall be adjustable from 100% to 125% of nominal voltage. Under voltage relay settings shall be adjustable from 75% to 100% of nominal voltage. The pickup and dropout times will be adjustable from 1 to 10 seconds. When the generator set is producing power, an over voltage or under voltage condition shall cause the emergency generator to automatically shut down on a fault. The engine shall not attempt to restart until the fault is acknowledged and the fault reset button is depressed. When the emergency generator shuts down normally and stops producing power, this shall not be considered a fault and the under-voltage relay shall not initiate an under voltage fault.

16. The generator control panel shall include a factory installed Modbus RTU communication port that will be connected to SCADA system control panel.

17. The alarms indicated below will be transmitted to the SCADA system by the generator control panel Modbus RTU interface for use as Remote Audible (R.A.) alarms at Sunwatch.

H. Emergency Generator EPO Station: The emergency power off (EPO) station will consist of a 30 mm diameter, heavy duty, corrosion resistant, chromium plated metal bezel, non-illuminated, trigger action, mechanical latching, turn to release, two position, push button mechanism, with a 40 mm diameter mushroom push button operator, colored red, with one set of normally open/normally closed (C/O) silver alloy contacts, rated for 24 Volts, 3 Amps, UL type 4 and NEMA 4 rated, and UL 508 listed. Conductors will be connected by screw clamp terminals. The mechanical durability rating must be 5,000,000 on/off cycles or greater. To protect against inadvertent operation of the EPO button, install the EPO push button operator within a UL type 4, NEMA 4 rated, guarded enclosure, colored gray. The enclosure material will be die cast zinc alloy. The emergency generator will not start if the EPO button is depressed to the off position. If the emergency generator is running and the EPO station is depressed to the off position, the engine will stop running immediately and the generator will stop producing power. Install the EPO Station on the outside wall of the toll equipment building, adjacent to the door, 6 ft above grade.

2.5 Safety Indication and Shutdowns

Indicator Function	**Level 1**				**Level 2**		
	C.V.	**S**	**R.A.**		**C.V.**	**S**	**R.A.**
Overcrank	x	x	x		x	x	x
Low water temp 70 degrees F	x		x		x		x
High engine temperature prealarm	x		x		o		x
High engine temperature	x	x	x		x	x	x
Low lube oil pressure prealarm	x		x		o		o
Low lube oil pressure shutdown	x	x	x		x	x	x
Overspeed	x	x	x		x	x	x
Low level radiator fluid	x		x		x		x
Low fuel level – main tank	x		x		x		x
Low fuel level – day tank	x		x		x		x
EPS supplying load	x		x		x		x
Generator control switch not in auto	x		x		x		x
High battery voltage	x		x		o		o
Low battery voltage	x		x		x		x
Battery charger AC failure	x		x		x		x
Remote emergency stop	x	x	x		x		x
Over Voltage		x				x	x
Under Voltage	x	x	x		x	x	x
Lamp / horn test switch	x		x		x		x
Audible alarm silencing switch	x		x		x		x
Generator breaker open	x		x		x		x
Emergency Power Off Initiated	x		x		x		x

CV; control panel visual indication. S: Shutdown of the EPSS. RA: Remote audible.
x = Required. o = Optional

A. Weather Protective Generator Set Enclosure: Manufactured with 14 gauge aluminum pre-painted panels with interlocking seams, stainless steel mechanical fasteners, stainless steel hinges, and door holder latches. The doors must be strategically located to allow access for maintenance and visibility of the instruments on the face of the control panel. The doors must have gaskets and will be key lockable. The engine radiator fan will draw air into the enclosure through a fixed aluminum intake louver and discharge the air through a gravity-open type aluminum discharge damper.

B. To prevent rodents and birds from entering the enclosure all openings in the enclosure will be covered from the inside with heavy aluminum wire mesh with 0.2 inch square holes. The wire diameter must be 0.047 inch or greater.

C. The emergency generator must operate properly inside the enclosure at rated (full) load with the outdoor ambient temperature up to 110 degrees Fahrenheit. The enclosure will be wind rated in "miles per hour" by the manufacturer in accordance with the Wind-Borne Debris Region map published in the current Florida Building Code.

D. Provide a factory installed sound attenuated aluminum enclosure. The enclosure shall be factory certified for the sound level not to exceed 72 db (A) when measured 7 meters from the emergency generator when the emergency generator is operating at 100% rated load.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. The original equipment manufacturers field service personnel will perform the initial start-up of the emergency generator and place the unit in service. The warranty document will show the Florida Turnpike Enterprise as the owner.

C. Diesel Fuel. Deliver and install #2 diesel fuel oil with less than 15 ppm of sulfur to fill the diesel fuel tank 90% full. Include fuel additives in proper quantities to increase the Cetane number to 50 minimum, increase the lubricity, and stabilize the fuel. Also add biocide to prevent bacteria and fungi from growing within the fuel tank. After testing the emergency generator, refill the tank to 90 % full.

3.2 FIELD QUALITY CONTROL

A. Provide field inspections and testing.

B. Over voltage and Under voltage operational test. The original equipment manufacturers field service personnel will perform the following operational test. Open the generator main circuit breaker before performing the over voltage and under voltage tests.

1. The manual voltage adjustment on the generator control panel will be used to adjust the generator output voltage up to 120% of nominal voltage to test the over voltage protective device. When the output voltage reaches 120% of nominal for 1 second, the emergency generator shall automatically shut down and the Over Voltage Alarm on the control panel shall initiate. Reset the fault and verify the alarm clears

2. The manual voltage adjustment on the generator control panel will be used to adjust the generator output voltage down to 80% of nominal voltage to test the under voltage protective device. When the output voltage reaches 80% of nominal for 1 second, the emergency generator shall automatically shut down and the Under Voltage Alarm on the control panel shall initiate. Reset the fault and verify the alarm clears

3. Return the manual voltage adjustment on the generator control panel to 100% of nominal output voltage after the testing is complete.

C. Load Bank Tests:

1. A 4-hour continuous load bank test will be performed after the unit is placed into service and all accessories are installed and the permanent fuel system is installed. The test shall be performed with resistive load banks, in the presence of the engineer and if required, the local fire marshal. The test shall be performed during regular business hours only - Monday - Friday, 8:00 AM to 5:00 PM. Run the emergency generator at the following % loads and time periods.
   a. 0.5 hour at 50% load
   b. 0.5 hour at 75% load
   c. 3 hours at 100%
   d. Block load at 100% load and verify voltage & frequency dip
   e. 0% load for 10 minutes to cool down

2. During test a written log shall be maintained at 15-minute intervals with the following:
   a. Ambient Air Temperature
   b. Amperes
   c. Hertz
   d. Oil Pressure and temperature
   e. Water Temperature
   f. Battery Charging DC voltage and Amps
   g. Exhaust Stack Temperature
   h. Noise Level in dba (each side)
   i. Differential pressure across the radiator

D. Test the alarm and shutdown circuits by simulating the faults, temperatures, and liquid levels. Verifying the alarm lights energize and the alarm horn sounds. Also verify the alarm silence feature works properly.

E. After testing the emergency generator, refill the tank to 90 % full

3.3 MANUFACTURER'S FIELD SERVICES

A. The manufacturers field service representative shall visit the job site a minimum of three times (sign in each time) after construction begins to coordinate the installation with the Contractor. Provide assistance with concrete pad sizes and shapes, routing and connection points for the control wiring, and proper silencer installation methods.

3.4 ADJUSTING

A. Adjust the generator output voltage and engine speed. Record for future use.

3.5 CLEANING

A. Touch up paint any scratches on the enclosures or housings in accordance with the manufacturer’s instructions.

B. Clean the engine and generator surfaces of grease and oil.

3.6 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 26 05 06.

B. Simulate a utility power outage by interrupting normal power and demonstrate that the system operates automatically to provide standby power to the building. Also simulate a generator over voltage fault condition and observe the engine shutting down, the generator breaker tripping open, and the OV fault lamp illuminated. Clear the faults, close the generator main circuit breaker and restore the emergency generator to the automatic operating mode.

END OF SECTION 26 32 13

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Furnishing of all labor, materials, services, testing, and equipment necessary to provide and install Static Uninterruptible Power Supply (UPS) systems with external maintenance bypass switches in each Toll Equipment Building.

B. Related Sections:

1. All electrical specifications sections

2. Panelboards: .....Section 26 24 17

3. Emergency Generators - Permanent: .....Section 26 32 13

4. SCADA System: .....Section 26 09 13

1.2 REFERENCES

A. Applicable Standards

1. UL 1778 - Underwriters Laboratory. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

2. FCC rules, part 15 – Limits for a Class A digital device.

3. IEEE C62.41 - Guide on Surge Voltages in AC Power Circuits Rated up to 600V.

4. IEEE 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

5. NFPA 70 - National Electrical Code

1.3 SYSTEM DESCRIPTION

A. General

1. The static uninterruptible power supply (UPS) system will provide continuous, high quality, conditioned, AC output power to the Toll Equipment Critical Power Panelboard. The UPS will protect the Toll Equipment Critical Power Panelboard from power disturbances on the normal power distribution system due to power blackouts, brownouts, surges, or noise interference. Beginning with fully charged batteries, the UPS will provide high quality, conditioned output power for 15 minutes at full (100% rated) load with no AC input power to charge the batteries.

2. The UPS system will contain an internal isolation transformer to electrically isolate the output power from the input power. The UPS system will meet the NEC definition of a separately derived electrical distribution system.

3. The UPS system will be of modular design and will consist of multiple power modules and multiple battery modules. All modules will operate simultaneously and share the load equally. Modules may be added or replaced while the UPS is on-line with no interruption or danger to the connected equipment.

B. Modes of Operation

1. The UPS is designed to operate as a true on-line system in the following modes:
   a. Normal - The critical AC load is continuously supplied by the UPS inverter. The input converter derives power from a utility AC source and supplies DC power to the inverter. The battery charger maintains a float-charge on the battery.
   b. Back-up - Upon failure of utility AC power the critical AC load is supplied by the inverter, which without any switching obtains power from the batteries.
   c. There is no interruption in power to the critical load upon failure or restoration of the utility AC power source.
   d. Recharge - Upon restoration of utility AC power, the input converter will automatically restart and resume supplying power to the inverter. The battery charger will resume recharge of the battery.
   e. Automatic Restart - After a utility AC power outage and complete battery discharge, the UPS will automatically restart and resume supplying power to the critical load. In addition, the battery charger will automatically recharge the battery. This feature is enabled (factory default) and will be capable of being disabled by the user. The user will also be able to program two auto restart delay settings.
      1. Battery capacity % level
      2. Countdown timer
   f. Bypass - The internal bypass will provide an alternate path for power to the critical load and is capable of operating in the following manner:

3. Automatic - In the event of an internal failure or should the inverter overload capacity be exceeded, the UPS will perform an automatic transfer of the critical AC load from the inverter to the bypass source.
4. Manual - Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the internal bypass will cause an immediate transfer of the critical AC load from the inverter to the internal bypass source. The input converter, inverter, and battery charging operations will continue to operate, provided the control enable switch is in the "On" position.

C. Performance Requirements

1. System
   a. Configuration: The UPS 12 bay frame system shall be configured as a
   b. UPS must be sized for the total connected critical power panel load. UPS must be 15KVA power output at a minimum, with N + 1 redundant power modules.
   c. Isolation: Input to output isolation is provided via the output transformer, regardless of the operating mode. (UPS or internal bypass)
   d. Remote Stop: The UPS provides provisions for remote stop (Emergency Power Off) capability.
   e. The power distribution system, including the emergency generator, shall be designed to operate normally when the UPS units are operating at 100% full (rated) load.

2. AC Input Supplied to the UPS
   a. Voltage Configuration: 208 or 240 VAC nominal. Ensure buildings with 3-phase power distribution systems are designed with 3-phase UPS systems. The UPS will be served by a dedicated feeder that is not spliced or tapped by other feeders. The UPS operating voltage range will be variable based upon output loading percentages as follows:

% UPS Load	Input Voltage Low Limit
90 – 100%	160 VAC
70 – 90%	140 VAC
50 – 70%	120 VAC
0 – 50%	120 VAC

b. Frequency: 40 to 70 Hz.

c. Input Current Distortion: 5% THD maximum at full load.

d. Input Power Factor: 0.99 lagging at 100% rated load.

e. Inrush Current: 150% of full load input current maximum for 3 cycles.

f. Surge Protection: Sustains input surges without damage per criteria listed in IEEE C62.41, Category A & B.

3. AC Output

a. Voltage Configuration: 240/120 VAC, single-phase, 3-wire, plus-ground or 208/120 VAC three-phase, 4-wire, plus ground. Refer to the power plans for AC output voltage. Ensure buildings with 3-phase power distribution systems are designed with 3-phase UPS systems.

b. Voltage Regulation: +/- 3% steady state.

c. Frequency Regulation: 60 Hz, +/- 0.2 Hz.

d. Frequency Slew Rate: fixed at 0.3 Hz per second maximum.

e. Bypass Frequency Synchronization Range: fixed at 3.5 Hz per second.

f. Voltage Distortion: 3% total harmonic distortion (THD) maximum into a 100% linear load, 5% THD maximum into a 100% non-linear load with crest factor ratio of 3:1.

g. Load Power Factor Range: 0.65 lagging to 0.9 leading

h. Output Power Rating: Rated kVA at: 0.9 lagging power factor.

i. Overload Capability: >100% - 104% indefinitely, 105% -130% for 1 minute, 131% - 150% for 10 seconds, 151% - 200% for 1 second. The load will be transferred to bypass when any of the above conditions are exceeded. A short circuit will cause an immediate shutdown.

j. Voltage Transient Response: +/- 7% maximum for any load step up to and including 100% of the UPS rating.

k. Transient Recovery Time: To within 1% of steady state output voltage within 60 milliseconds.

4. Batteries

a. Internal Battery: The batteries will consists of flame retardant, valve regulated, gas recombination, lead acid cells. Ensure the UPS is suitable for installation inside a computer room per requirements of UL Standard 1778 and NFPA 70.

b. Reserve Time: The UPS shall contain an internal battery system to provide a reserve time of 15 minutes when running at 100% rated output load. The UPS includes provisions to fit additional battery modules internally if space permits. The UPS shall be capable of interfacing with an external battery cabinet to extend the reserve time capabilities.

c. Battery Recharge: To prolong battery life, the UPS includes temperature-compensated battery charging. When equal number of power modules and battery modules are fitted the battery charger is able to recharge the internal batteries to

90% charge in five hours at nominal input voltage and nominal ambient temperature.

1.4 ENVIRONMENTAL CONDITIONS

A. Ambient Temperature

1. Operating: UPS 0° C to +40° C; battery 20° C to 25° C for optimum performance.

2. Storage: UPS –20° C to +60° C; battery –20° C to 25° C for maximum 6 months.

B. Relative Humidity

1. Operating: 5 to 95% non-condensing.

2. Storage: 5 to 95% non-condensing.

C. Altitude

1. Operating: To 10,000 feet. Derating/reduced operating temperature range required for higher altitudes.

2. Storage: To 30,000 feet.

D. Audible Noise

1. Noise generated by the UPS during normal operation shall not exceed 65 dBA measured at three feet (one meter) from the surface of the UPS.

E. Electrostatic Discharge

1. Ensure the UPS is able to withstand a minimum 4 kV contact without damage and will not affect the critical load.

1.5 SUBMITTALS AND SHOP DRAWINGS

A. Submit plan views and elevation views of each cabinet with overall dimensions and clearances required for maintenance procedures. Include battery sizing calculations or factory charts to indicate the number of batteries required to meet the reserve time when the UPS is operating at full (rated) load with no AC input power. Provide heat output and cooling air requirements. Also submit electrical diagrams including schematic and interconnection diagrams between the UPS and the maintenance bypass switch (BPS). Provide a site specific, point to point interconnection diagram on 11"x17" paper. The site specific diagram will show the connection points and cable types required for the Network Interface Card, and the BPS.

B. The specified UPS system will be supplied with one printed user's manual and one user's manual on CD or DVD. Manuals include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step by step operating procedures, and routine maintenance guidelines.

C. A warranty statement and repair parts availability statement will be submitted to the department.

1.6 WARRANTY

A. The UPS manufacturer will warrant the UPS against defects in materials and workmanship for two years. The warranty will cover all parts for two years and onsite labor for two years. Shipping charges for repair parts during the warranty period will not be charged to the Department. The UPS manufacturer shall provide a written warranty statement to the department that states: "During the warranty period a factory trained service technician will be dispatched and arrive at the site where the UPS is located within 4 hours of receiving a request for service by the Department." The warranty and the written warranty statement shall be included in the shop drawings.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. Minimum of ten year's experience in the design, manufacture, and testing of solid-state UPS systems is required.

B. Factory Testing

1. Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification. These tests include operational discharge and recharge tests on the internal battery to guarantee rated performance. The UPS ships completely assembled and all modules installed.

PART 2 - PRODUCTS

2.1 FABRICATION

A. All materials and components making up the UPS will be new, of current manufacture, and not in prior service except as required during factory testing. The UPS is constructed of replaceable subassemblies. All active electronic devices are solid-state.

B. Wiring

1. Wiring practices, materials, and coding will be in accordance with the requirements of the National Electrical Code (NFPA 70) and other applicable codes and standards.

C. Cabinet

1. Ensure the UPS unit(s) are comprised of: power modules, battery modules, control modules, and user interface module housed in a single free-standing enclosure and meets the requirements of IP20. The UPS system shall be designed such that the battery modules may be installed into any module bay in the cabinet and power modules into any module bay in the top half of the cabinet. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color. Casters and leveling feet will be provided. 12 bay cabinet dimensions may not exceed 20 inches wide, 32 inches deep, and 42 inches high.

D. Cooling

1. The UPS will be cooled by forced air from internally mounted fans. The air intake shall contain replaceable air filters with a PPI rating of 30.

2.2 COMPONENTS

A. Input Converter

1. General: Incoming AC power is converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter provides input power factor and input current distortion correction.

2. AC Input Current Limit
   a. The input converter is provided with AC input over current protection.

3. Input Protection
   a. The UPS has built-in protection against under voltage, over current, and overvoltage conditions including low-energy surges introduced on the primary AC source and the bypass source. The UPS can sustain input surges without damage per criteria listed in IEEE C62.41, Category A & B. The UPS cabinet contains an input breaker sized to supply 15 kVA rated load and to recharge the battery at the same time.

B. INVERTER

1. General
   a. The inverter converts DC power from the input converter output, or the battery, into precise regulated sine wave AC power for supporting the critical AC load.

2. Overload
   a. The inverter is capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm indicates overload operation. For greater currents or longer time duration, the inverter has electronic current-limiting protection to prevent damage to

components. The inverter is self-protecting against any magnitude of connected output overload. Inverter control logic senses and disconnects the inverter from the critical AC load without the requirement to clear protective fuses. The load will be transferred to bypass when any of the above conditions are exceeded.

3. Maximum Load Alarm
   a. The user can set the alarm point to a value less than 100% rating such that the UPS will alarm before an overload condition or loss of redundancy is reached.

4. Output Frequency
   a. The output frequency of the inverter shall be controlled by an oscillator. The oscillator will hold the inverter output frequency to +/- 0.5% for steady state and transient conditions. The inverter tracks the bypass continuously, providing the bypass source maintains a frequency within the user-selected synchronization range. If the bypass source fails to remain within the selected range, the inverter will revert to the internal oscillator.

5. Output Protection
   a. The UPS inverter shall employ electronic current limiting.

6. Battery Over Discharge Protection
   a. To prevent battery damage from over discharging, the UPS control logic controls the shutdown voltage set point. This point is dependent on the rate of discharge.

C. DISPLAY AND CONTROLS

1. General
   a. The front panel will consist of multiple status LEDs, switches, and a four line by twenty-character LCD display for additional alarm/configuration information. All mimic display LED's are green in color and indicate the following:
      1. AC Input
      2. On Battery
      3. Load On/Off
      4. On Inverter
      5. On Bypass
   b. The UPS fault indicator is used with additional indicators and audible alarms to notify the user that a UPS fault condition has occurred. The color of the fault indicator LED shall be red.
      1. Replace Battery Module
      2. Replace Power Module
      3. Replace Control Module
      4. On Bypass
      5. Low Battery
      6. Over Temp Warning

7. UPS Shutdown

c. If there is a fault condition, the UPS will attempt to maintain conditioned power to the load, or at minimum transfer to bypass. There will also be a visual indication on each module should the module fail and need to be replaced.

d. In addition to an audible/visual fault signal the UPS also records fault occurrences in a rolling event log. The event log on the standard unit can record up to 1024 occurrences, with the oldest events discarded first, etc. The user has access to the event log through the LCD display. Every alarm and/or event recorded in the event log will contain a time and date stamp.

2. Audible Alarms

a. The volume of all audible alarms is at least 65dBA at a distance of three feet (one meter). An audible alarm is used in conjunction with the LED/LCD indication to indicate a change in UPS status.

b. The audible alarms enunciate for utility line loss, low battery (while on battery), and all other alarm conditions. For all alarm conditions, the user must look at the display to determine the cause of error/alarm. All alarm tones are a continual tone until the condition rectifies itself or the alarm is silenced. Once silenced, the audible alarm will not sound until a new alarm condition is present.

3. Alarm Silence Button

a. In addition to the load On/Off switch, the user interface includes an audible "Alarm Silence" switch. If the alarm silence switch is pressed for one second, all current audible alarms will be disabled. If a new alarm occurs, or a canceled alarm condition disappears and then re-appears, the audible alarm is re-enabled.

4. LCD Display

a. The LCD display is used to provide information to the user. The display is used to program all information (voltage, frequency, etc.) into the UPS. Any display values that require time/date will be 'year 2000' compliant. The LCD shall be multilingual with 7 languages.

D. Automatic Battery Test

1. The UPS will initiate an automatic battery testing sequence periodically, at a programmed day and time of day, selectable by the end user. The user will be able to select the interval for the battery test and will be able to select 8, 12, 16, 20, or 26 week intervals, or can select to disable the automatic battery test.

2. Should a battery failure occur, the battery module will disconnect itself from the critical DC bus and the UPS will immediately return to normal mode and fault signals (visual, audible, and remote via serial) will be communicated. No audible or remote (via serial/contact closures) indication of the battery test is communicated during the duration of the automatic battery test.

3. Schedule the automatic battery test for a eight week interval to occur on Wednesdays at 10:00 AM.

E. Remote Emergency Power Off (Repo)

1. The remote emergency power off function (REPO) allows the user to disable all UPS outputs in an emergency situation. The REPO, in order to be flexible, will be able to interface with either normally open (N.O.) or normally closed (N.C.) systems. The REPO is activated when a pair of contacts, external to the UPS, is activated. The REPO connection is through a simple terminal block type connector.

2. The REPO function will not operate if no system control modules are present in the UPS or if the manual bypass switch is in the bypass position. The user must supply a means of interfacing with the REPO circuit to allow disconnecting the UPS input feeder breaker to remove all sources of power to the UPS and the connected equipment to comply with local wiring codes/regulations.

3. Regardless of the UPS mode of operation when the REPO is activated, the UPS output will not be re-enabled until the following occurs:
   a. REPO contacts are reset (closed if N.C. contacts are used and open if N.O. contacts are used)
   b. Input circuit breaker is closed
   c. Control enable switch is turned on
   d. User interface on/off switch is depressed

F. Internal Bypass

1. General
   a. An internal bypass circuit is provided as an integral part of the UPS. The bypass has an overload rating of 300% rated full load for 10 cycles and 1000% for sub-cycle fault clearing. The bypass control logic contains an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit provides a transfer of the load to the bypass source, without exceeding the transient limits specified herein, when an overload or malfunction occurs within the UPS.

2. Automatic Transfer
   a. The transfer control logic automatically activates the internal bypass, transferring the critical AC load to the internal bypass source, after the transfer logic senses one of the following conditions:
      1. Inverter overload capacity exceeded
      2. Inverter over temperature
      3. UPS fault condition

b. For inverter overload conditions, the transfer control logic inhibits an automatic transfer of the critical load to the bypass source if one of the following conditions exists:
   1. Inverter/Bypass voltage difference exceeding preset limits (+10% or -15 % of nominal)
   2. Bypass frequency out of preset limits (± 5 % of nominal frequency)
   3. Automatic Retransfer

c. Retransfer of the critical AC load from the internal bypass source to the inverter output is automatically initiated unless inhibited by the manual control. The transfer control logic inhibits an automatic retransfer of the critical load to the inverter if one of the following conditions exists:
   1. Bypass out-of-synchronization range with inverter output
   2. Overload condition exists in excess of the inverter full load rating
   3. UPS fault condition present

3. Manual Transfer
   a. In addition to the internal bypass function, the UPS will have a manual bypass function. The manual bypass function is provided via a switch mounted on the bottom-front of the UPS, removal of the lower front bezel is required. The actual AC break time between inverter and bypass is less than four milliseconds.
   b. The manual bypass provides a partial 'wrap-around' bypass, and is configured to wrap around the rectifier, battery charger, inverter, and battery in the same manner as the automatic bypass. The manual bypass does not wrap around the EMI filtering, over current protection or isolation transformer.
   c. The UPS will initiate an audible alarm upon transfer to manual bypass. The audible alarm is capable of being silenced by the user. The alarm will continue to sound (unless silenced) while in bypass mode. This shall provide a reminder to the user that the load continues to be powered from utility supply alone.

4. Internal Battery
   a. Flame retardant, valve regulated, gas recombination, lead acid batteries shall be used as a stored-energy source for the specified UPS system. The battery is housed in separate replaceable modules that slide into any open bay of the UPS cabinet, and are sized to support the inverter at rated load and power factor, in an ambient temperature between 20° and 25° C, for a 7 minutes reserve time. The expected life of the battery is 3 to 5 years or a minimum 250 complete discharge cycles. For extended battery reserve time, additional battery modules may be added if the frame size allows; external battery cabinets are available as an option.

G. Communications

1. The UPS allows for flexibility in communications via dry contacts and three Intellislot digital communications ports on the rear of the UPS. The UPS will communicate with the FTE SCADA system using an IntelliSlot interface card to provide HTTP supported SNMP communication over a local area network. The

IntelliSlot interface card will support 10/100Mbit Ethernet over unshielded twisted pair connection. Install a category 5e cable, 4 pair, copper UTP, CMP rated, network communication cable with RJ45 connectors. Label each end of the cable "NET SW - UPS". Ensure the communications cable is routed in ¾" conduit between the UPS and the Departments managed network switch (Brocade switch) in the Recorder Room (or Toll Equipment Building). A dry contact / discrete contact card, 24VAC/VDC at 0.3 Amp, shall be included to allow for local HMI UPS status capability. The dry contact card will allow the SCADA system to monitor the UPS On Battery, UPS Fault, Low Battery, and On Bypass, via an eight conductor cable to the SCADA system.

H. External Maintenance Bypass Switch (Bps)

1. The external BPS will provide complete "wrap around" protection and allow the UPS cabinet to be safely removed from service. The BPS will accept two incoming sources of power. Input "Source A" will be supplied from the UPS output. Input "Source B" will be from an alternate "bypass" feeder. The UPS feeders and/or the alternate "bypass" feeder may not be spliced or tapped by other conductors. When the BPS is in the "Source A" position, the Toll Equipment Critical Power Panel will receive power from the UPS. When the BPS is in the "Source B" position, the Toll Equipment Critical Power Panel will receive power from the alternate "bypass" feeder. When the BPS is in the Off position, the Toll Equipment Critical Power Panel will be de-energized.

2. The BPS shall by itself bypass power away from the UPS when maintenance is required without going thru an off switch position and cutting the power to the equipment being fed. The BPS shall not be located over other devices in the building and shall be located at an unobstructed location that can be easily accessed. The BPS shall not cause a power outage to the Toll Equipment Critical Power Panel when it is placed in either Source A or B modes.

3. The position of the external maintenance bypass switch will be monitored by the SCADA system. Provide a set of dry contacts, rated 24VAC/VDC at 1 Amp in the external maintenance bypass switch that will change state when the switch is operated.

4. Mount the top of the BPS at 4'-6" above finished floor oriented with controls on top of enclosure.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

The following inspections and test procedures will be performed by factory trained field service personnel during the UPS start-up and commissioning.

A. Visual Inspection

1. Inspect equipment for signs of shipping or installation damage.
2. Verify installation per drawings.
3. Inspect cabinets for foreign objects.
4. Verify neutral and ground conductors are properly sized and configured.

B. Mechanical Inspection

1. Check all power modules are correctly fitted.
2. Check all battery modules are correctly fitted.
3. Check all terminal screws, nuts, and/or spade lugs for tightness.

C. Electrical Inspection

1. Confirm input voltage and phase rotation is correct.
2. Verify bypass voltage jumper is correct for voltages being used.

3.2 UNIT START-UP AND SITE TESTING

A. The manufacturer's field service personnel will provide site testing for the UPS system. Site testing consists of a complete test of the UPS system and the associated accessories supplied for the UPS system including the external maintenance bypass switch.

B. Partial Battery Discharge Test

1. A partial battery discharge test will be conducted by the installing contractor as part of the UPS system standard start-up procedure. Perform the test as follows:
   a. Verify the external maintenance bypass switch (BPS) in the "Source A" position. (UPS providing the input power to the Critical Power Panel).
   b. Connect 5 KW of resistive portable load to the branch circuit breakers on the Toll Equipment Critical Power Panelboard.
   c. Start the emergency generator and verify that emergency generator power is available at the ATS. Open the circuit breaker feeding the normal (utility) power to the Automatic Transfer Switch. The ATS should switch to the Emergency Position.
   d. Ensure the UPS is operating normally with no alarms while receiving power from the emergency generator and while powering the 5 KW resistive portable load.

e. Open the circuit breaker for the feeder that serves the UPS and allow the UPS batteries to discharge 50%. Record the number of minutes it takes for the batteries to discharge to 50% of their capacity. Record all UPS alarms.

f. Close the circuit breaker serving the UPS and verify that the UPS is operating normally with no alarms while receiving power from the emergency generator and the UPS batteries are charging.

g. Close the circuit breaker feeding the normal (utility) power to the Automatic Transfer Switch and verify that the ATS switches to the Normal position within 5 minutes.

h. Allow the emergency generator to cool down for 5 minutes and turn off the emergency generator. Leave the emergency generator control switch in the "AUTO" position.

i. The test results will be documented, dated, and signed by the UPS technician and the Electrical Contractor. The electronic versions of the test results will be turned over to the Department for future reference.

C. External Maintenance Bypass Switch Test

1. An external maintenance bypass switch test will be conducted as part of the standard UPS start-up procedure. Test the external maintenance bypass switch (BPS) as follows:

a. Connect 5 KW of resistive portable load to the branch circuit breakers on the Toll Equipment Critical Power Panelboard. Open all other branch circuit breakers.

b. Place the BPS in the "Source A" position. (UPS providing the input power to the Critical Power Panel). For 3-phase distribution systems measure and record the phase rotation at the input of the Toll Equipment Critical Power Panelboard with the BPS in the "Source A" position.

c. Move the BPS to the Off position. Verify that no voltage exists on the Toll Equipment Critical Power Panelboard.

d. Move the BPS to the "Source B" position. Verify that proper voltage exists (Phase to Phase, Phase to Neutral, and Phase to Ground) at on the Toll Equipment Critical Power Panelboard and that power is being delivered to the 5 KW load. For 3-phase systems also verify that the phase rotation of "Source B" is compatible with "Source A".

e. Turn off the UPS and open the UPS feeder breaker. Verify the external maintenance bypass switch is operating satisfactorily and the UPS is completely bypassed and electrically isolated.

f. Close the UPS feeder breaker and turn on the UPS. Verify the UPS is operating properly.

g. Place the BPS in the "Source A" position. (UPS providing the input power to the Critical Power Panel).

h. Disconnect the 5 KW of resistive portable load on the Toll Equipment Critical Power Panelboard.

i. The test results will be documented, dated, and signed by the UPS technician and the Electrical Contractor. The electronic versions of the test results will be turned over to the Department for future reference.

3.3 REPLACEMENT PARTS STOCKING

A. Replacement parts will available through a local distributor within 100 miles of the job site. The replacement parts including power modules and battery modules for the UPS model installed at the job site will be available 24 hours a day, 7 days a week, 365 days a year.

END OF SECTION 26 33 53

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic transfer switch (ATS)

1.2 RELATED SECTIONS

A. Identification for Electrical Systems: Engraved nameplates: .....Section 26 05 53

B. Emergency-Generator - Permanent: Testing requirements: .....Section 26 32 13

1.3 REFERENCES

A. NFPA 70 - National Electrical Code

B. NEMA ICS 1 - General Standards for Industrial Control and Systems

C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies

D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

E. U.L. – 1008, 7th Edition. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

F. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

G. NFPA 101 – Life Safety Code

H. NFPA 110 – Emergency and Standby Power Systems

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of Section 26 05 01.

B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, withstand ratings, dimensions, and enclosure details.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 26 05 01.

B. Operation Data: Include instructions for operating the equipment. Include instructions for operating equipment under emergency conditions when the emergency generator is running.

C. Maintenance Data: Include routine preventative maintenance instructions and a lubrication schedule. Provide a list of special tools, maintenance materials, and replacement parts that should be stocked.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years' experience, and with service facilities within 100 miles of Project.

B. Supplier: Authorized distributor with a minimum of five years' experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70, and NFPA 110.

B. Furnish products listed and classified by UL or other NRTL and acceptable to authority having jurisdiction as suitable for purpose to supply power for emergency power systems.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 26 05 00.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

1.9 MAINTENANCE SERVICE

A. Furnish service and maintenance of each transfer switch for one year from the date of Substantial Completion.

1.10 MAINTENANCE MATERIALS

A. Provide maintenance materials and operators manuals.

B. Provide two of each special tool required for maintenance or manual operation.

1.11 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 110.

B. The Automatic Transfer Switch must be a standard product of the original equipment manufacturer. The vendor that provides the Automatic Transfer Switch must be an Automatic Switch Company authorized manufacturer’s representative. The Automatic Transfer Switch and the emergency generator shall be provided by the same vendor.

1.12 WARRANTY

A. The complete system provided under this specification section will be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of system start-up. The warranty will include parts, shipping costs, rigging costs, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

B. Regular and scheduled maintenance will be performed by the Department’s maintenance contractor. Maintenance work by the maintenance contractor shall not void the manufacturer’s warranty of the equipment. Requirements for consumables such as filters to be original equipment manufacturer brands are not acceptable and shall not void the manufacturer’s warranty of the equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide an ATS as manufactured by Automatic Switch Company.

2.2 AUTOMATIC TRANSFER SWITCH(ES)

A. Automatic Transfer Switch(es) not suitable for service entrance rated.

1. Description: NEMA ICS 2, automatic transfer switch(es), 2-pole or 4-pole as shown on the electrical drawings.

2. Provide with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.

3. Equip with a microprocessor based control system to provide all the operational functions. Include a real-time clock with NiCad battery back-up.

4. Include a 20 character, LCD display, with keypad, which allows access to the system. Provide password protection functionality.

5. Provide with an equipment grounding bar sized to accept the conductors as shown on the electrical drawings.

6. Factory test to ensure proper operation and compliance with the specification requirements.

7. Provide as double-throw, actuated by electrical operators momentarily energized. The transfer switch must be capable of transferring successfully in either direction.

8. Provide normal and emergency contacts that are positively interlocked mechanically and electrically to prevent simultaneous closing. Provide main contacts that are mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs and shall be silver-tungsten alloy. Separate arcing contacts, with magnetic blowouts, shall be provided on all transfer switches. Interlocked molded case circuit breakers are not acceptable. Molded case switches are not acceptable.

9. Provide such that control components and wiring are accessible from the front.

10. Provide 600-Volts SIS switchboard type for all control wires. Identify all control wire terminations with tubular, sleeve-type markers.

11. Mount the transfer switch indoors a NEMA 1 enclosure, unless otherwise indicated. Fabricate from 12-gauge steel with wire bending space exceeding UL-1008.

12. Equip with a door-mounted pocket, housing an operations and maintenance manual.

13. Equip with copper/aluminum solderless bolted pressure-type lugs rated for 90 degrees C.

14. Provide with three-point latches on all enclosure doors.

15. Provide bolted connections with Belleville compression-type washers.

16. Terminate control wires with locking spade-type connectors.

17. Provide solid-state components with an operating range of -20°C to +55°C and meet IEEE Standard 472-1974.

18. Provide as top or bottom accessible as shown on the Plans.

19. Equip with main contacts that can be replaced without removing main power cables.

20. Provide main contacts that are visible for inspection without any major disassembly of the transfer switch.

21. Withstand Ratings

a) Switch(es) shall be listed by Underwriters' Laboratories, Inc. or other NRTL, Standard UL-1008, 7th Edition with 3-cycle short circuit closing and withstand values for specific manufacturers breaker as follows:

RMS Symmetrical Amperes at 480 VAC

Switch Rating Amperes	Closing and Withstand Ratings
100 - 400	42,000
600 - 800	65,000
1000 - 1200	85,000

b) During the 3-cycle closing and withstand tests, there must be no contact welding or damage, and there shall be contact continuity across all phases after completion of testing. The 3-cycle tests must be performed without the use of current limiting fuses. Use test procedures in accordance with UL-1008, and be certified by Underwriters' Laboratories, Inc. or other NRTL.

c). When conducting temperature rise tests to UL-1008, the manufacturer must include post endurance temperature rise tests to verify the ability of the transfer switch to carry full-rated current after completing the overload and endurance tests.

2.3 PRODUCT OPTIONS AND FEATURES

A. Adjustable, 1-phase sensing of the normal source and emergency source. Factory set to pick up at 90% and drop out at 80% of rated voltage. The adjustable frequency picks up at 95% and dropout at 93% of rated frequency. The switch shall also include phase sequence monitoring on the normal and emergency source.

B. Time delay to override momentary normal source power outages. This will delay the engine start signal and transfer switch operation. Adjustable 0-999 seconds. Field adjusted to 1 second during start-up.

C. Time delay on transfer to emergency. Adjustable 1-300 seconds. Field adjusted to 1 second during start-up.

D. Time delay to control contact transition time on transfer to either source. Adjustable 1-300 seconds. (Delayed Transition Only) Field adjusted to 2 seconds.

E. Time delay on retransfer to normal, adjustable 0-9999 seconds, with engine overrun to provide adjustable 0–9999 second unloaded engine operation after retransfer to normal. Field adjust the retransfer to normal time delay to 900 seconds. Field adjust the unloaded engine cool down time delay to 300 seconds.

F. "Load Test Switch" to simulate a normal power failure. (Maintained type)

G. Contact to close on failure of normal source to initiate engine starting or other customer functions.

H. Contact to open on failure of normal source to initiate engine starting or other customer functions.

I. Green pilot light to indicate switch in normal position.

J. Red pilot light to indicate switch in emergency position.

K. Plant exerciser with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise the generating plant. Adjustable type with minimum of 1-minute increments and battery back-up. Also include selection of either "no load" (ATS will not transfer during exercise period) or "load" (ATS will transfer during exercise period). Field

adjust to 'LOAD" such that the ATS will transfer to emergency during the plant exercise period.

L. An LCD display, with 1% accuracy, shall show all three separate phase to phase voltages simultaneously, for both the normal and emergency source. A digital LCD frequency readout shall display frequency for both the normal and emergency source.

M. (2) Auxiliary contacts rated 10 Amp, 120 volts AC closed when the ATS is in the normal position. Wired to a terminal strip.

N. (2) Auxiliary contacts rated 10 Amp, 120 volts AC, closed when the ATS is in the emergency position. Wired to a terminal strip.

O. Adjustable relay to prevent transfer to emergency until voltage and frequency of generating plant have reached acceptable limits. Factory set at 90% of rated value.

P. Automatic synchronizing check relay to prevent retransfer from emergency to normal until the normal and emergency sources are within acceptable limits.

2.4 AUTOMATIC SEQUENCE OF OPERATION

A. Provide the following sequence of operation:

1. Should the voltage of the normal source drop below a preset value (adjustable 70-100%) set at 80% on any phase after a time delay (adjustable 0.5-6 seconds) set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.

2. The transfer switch shall transfer to emergency when the generating plant has reached a preset value (adjustable 90-100%) set at 90% of rated voltage and frequency.

3. After restoration of normal power on all phases to a preset value (adjustable 70-100%) set at 90% of rated voltage, an adjustable time delay period of 0-31 minutes (factory set at 5 minutes) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the emergency generator shall be allowed to operate at no load for a 5-minute period before shutting down.

B. Transfer switches shall transfer to emergency within the time limits as required by the National Electrical Code for each branch of emergency power system.

C. When more than one Automatic Transfer Switch is connected to an emergency generator, each ATS shall be programmed to switch from normal power to

emergency power sequentially. The Normal to Emergency time delay shall be adjustable 1-300 seconds and shall be adjusted as shown below:

1. The Normal to Emergency time delay shall be set to 1 second for an ATS serving a critical power system.

3. The Normal to Emergency time delay shall be set to 11 seconds for an ATS serving a non-critical power system.

2.5 ENCLOSURE

A. Finish: Manufacturer's standard gray enamel paint.

2.6 SURGE SUPPRESSION

A. Field install a UL-1449 Fourth edition listed surge suppression device for each transfer switch. Install the SPD on the outside of the ATS nearest the equipment ground bar inside the ATS. The SPD will protect the emergency generator feeder where it enters the ATS enclosure. Connect the SPD leads to the emergency conductors by tapping the emergency feeder conductors with insulation piercing connectors similar to TTD 0810F. The SPD leads shall be gently braided or twisted and shall not exceed 12 inches in length. The SPD enclosure shall include an integral disconnect switch to de-energize the SPD for maintenance. Refer to Section 26 43 13 for surge suppressor requirements.

2.7 SCADA SYSTEM COMPONENTS

A. When the automatic transfer switch is installed within a building, the Emergency power from the emergency generator will be monitored by a power meter located remotely on the SCADA control panel. The following accessories will be field installed by the contractor and mounted inside the “critical” ATS enclosure in the toll buildings:

1. Current transformers for each phase and neutral conductor on the emergency generator feeders. The wound type current transformers will have a 5 Amp secondary, accuracy class 0.5%, with a minimum burden of 10 VA.

2. A secondary leads of the current transformers shall pass through a CT shorting type terminal block installed adjacent to the CT’s.

3. A fused voltage disconnect with 2 amp fuses to allow the remote power meter to sense the voltage of the generator feeder.

B. The auxiliary contacts that indicate the position of the ATS will be monitored by the SCADA control panel.

C. When a service entrance rated automatic transfer switch is installed outdoors, the Utility power and Generator power will be monitored by separate power quality meters factory installed in the dead-front cover of the ATS. The power quality meters will communicate with the FTE SCADA System by Modbus communications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site conditions are suitable for the ATS.

B. Verify that surface is suitable for transfer switch installation.

3.2 INSTALLATION

A. Install transfer switches in accordance with manufacturer's instructions. Provide all associate control wiring to the generator as required.

B. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

C. Provide all interface control wiring and conduit as required to provide require emergency operation of equipment on project as applicable, i.e. elevators, building automation system, fire alarm control panel, smoke control system, etc.

3.3 MANUFACTURER'S FIELD SERVICES

A. The manufacturers field service representative shall visit the job site a minimum of three times (sign in each time) after construction begins to coordinate the installation with the E.C and G.C. Provide assistance with concrete pad sizes and shapes, proper mounting instructions for each ATS and the quantity and routing of ATS control wiring.

3.4 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 26 05 06.

B. Demonstrate the proper operation of each transfer switch in normal and emergency modes. Operate each ATS manually in the presence of the Department’s representative.

END OF SECTION 26 36 00

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of Systems: A Class I lightning protection system as described in NFPA 780 will be installed to protect the building(s), the toll equipment structure (gantry), the fuel tank, generator set, and any outdoor equipment that extends higher than 10 feet above grade level. The size of some components specified herein may exceed the minimum acceptable size for class I systems.

B. A bare copper grounding ring electrode will be installed a minimum of 24 inches below grade around the toll equipment building(s).

C. Each metal support column on toll equipment structures (i.e. gantries) will be grounded at two separate points near the base of the columns. Each grounding point will have a grounding pad and a separate down conductor and separate ground rod. The ground rods will be bonded together below grade.

D. The grounding pads at the base of the gantry columns will be installed by the gantry fabricator. Field welding to galvanized metal gantries is not acceptable and will be rejected.

E. Air terminals are not required on electrically continuous metallic toll equipment gantries.

F. Air terminals are not required on metallic outdoor generator set enclosures.

G. The following lightning protection systems at each site will be bonded together by a 98,600 circular mil, 24 strand, direct buried copper conductor.

1. Toll equipment buildings within 500 feet of each other.
2. Toll equipment metal gantry columns
3. Fuel tank and associated metal piping
4. Generator set
5. Metal enclosures and wireways within 25 feet of the gantry columns

H. The completed system will be inspected by an independent 3rd party and must receive a UL Master Label or The Lightning Protection Institute Inspection Program (LPI-IP) Certificate.

1.2 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of lightning protection of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Firms holding an EC License in the State of Florida with at least five (5) years of successful installation experience on projects with electrical installation work similar to that required for the project.

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Submit shop drawings for review before site work begins. Include drawings of the entire site that shows the location of each building and interconnections between each building and each piece of equipment bonded to the system. Include locations of air terminals, cabling, ground rings, ground rods, down conductors, through roof fittings. Provide an enlarged cross-sectional detail of the Through Roof fittings properly installed in the roof.

B. Submit product data sheets on air terminals, cabling, ground rings, ground rods, down conductors, through roof fittings, fasteners, cable connectors and exothermic welding products.

PART 2 - PRODUCTS

2.1 AIR TERMINALS

A. Air terminals will be aluminum or copper with a threaded 5/8 inch diameter base and pointed at the tip. Air terminals will be solid and not hollow.

B. Install all air terminals vertically. Install swivel type air terminal bases on angled surfaces and roofs.

C. Glue may be used to secure an air terminal to a horizontal roof surface, however glue may not be used to secure an air terminal to a vertical surface such as a parapet.

2.2 THROUGH ROOF FITTINGS

A. Through roof fittings will be compatible with the roofing system and will not affect the roof warranty. Turn over the through roof fittings to the roofing contractor for installation.

2.3 CONDUCTORS

A. Roof conductors will consist of copper or aluminum conductors complying with the weight and construction requirements of the Code. Roof conductors will be chemically compatible with the roofing components and metal flashing.

B. The angle of any turn shall not exceed 90°, and shall provide an approximately horizontal or downward course.

C. Down conductors will be copper.

D. Conceal the down conductors in buildings within the walls. Down conductors concealed within walls shall be installed in PVC conduit. The radius of any bend shall not be less than 8 inches.

E. Grounding ring electrode conductors and underground conductors will be copper and the minimum acceptable size is 98,600 circular mils, with 24 strands.

F. Install lightning protection conductors that require physical protection in schedule 80 PVC conduit.

2.4 FASTENERS

A. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor. Where fasteners are to be mounted in masonry's or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.

2.5 GROUND RODS

A. Lightning protection system ground rods will be sectional, 5/8" diameter, copper clad steel ground rods. The copper cladding will be a minimum of 0.010 inch thick. The ground rods will extend into the earth vertically not less than 20 feet.

2.6 CONDUCTOR CONNECTIONS AND SPLICES

A. Connections above grade level will be made with mechanically bolted fittings of aluminum, copper, or tin-plated bronze.

B. Connections below grade will be made by welding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The system will be installed by experienced installers in compliance with NFPA 780, the Lightning Protection Institute Standard of Practice 175, and Underwriters' Laboratories. All equipment to protect the existing and new building against damage by lightning shall be included whether or not specifically called for herein.

B. Installation shall be made in an inconspicuous manner with conductors coursed to be concealed as much as possible.

C. Down conductors shall be concealed within the structure, and shall be installed in 1" PVC electrical conduit.

D. All metallic equipment within 6 feet of any lightning conductor shall be bonded to conductor.

E. On buildings without parapets, the roof conductors will be installed concealed below the roof. "Through Roof" devices will be installed when penetrating the roof.

F. Ensure the "Through Roof" devices are compatible with the roofing materials. The Through Roof devices will be turned over to the roofing contractor for installation.

G. Install a 98,600 circular mil, 24 strand, bare copper lightning protection grounding electrode conductor around the buildings and extending out to each building, toll structure, or piece of equipment on the site. Install the conductor in direct contact with the earth and a minimum of 24 inches below grade.

3.2 TESTING

A. Use the fall of potential three-point method and test each ground rod individually before connecting it to the system. Ensure the maximum resistance to ground (earth) does not exceed 25 Ohms. If a ground rod measures greater than 25 Ohms to ground then a second ground rod should be installed nearby, but not closer than the depth of the 1st rod, and then bond the two rods together with a direct buried conductor. Turn over the test reports to the Department within 1 week of performing the test.

B. The resistance to ground should be fairly consistent between the ground rods. Any rod that measures more than 20% different than the surrounding rods should be investigated.

C. After bonding all the lightning protection system ground rods together and connecting the building ground ring, use the "Clamp on Method" to measure the resistance to ground of the completed lightning protection ground rod system. Ensure the maximum resistance to ground (earth) does not exceed 5 Ohms. Drive additional ground rods if necessary to obtain a resistance to ground reading of 5 Ohms or less. Turn over the test reports to the Department within 1 week of performing the test.

END OF SECTION 264113

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

A. Provide and install Surge Protection Devices (SPDs) to protect the normal electrical distribution system, the emergency electrical distribution system, the critical power electrical distribution system, and end use electrical equipment from the effects of transient voltage surges. Install the surge protection devices as shown on the plans or specified in this section.

B. Provide surge protective devices (SPDs) for the following systems and equipment:

1. Each main electrical service and MDP as shown on the drawings. Include branch circuit breakers in MDPs to disconnect and protect the surge protective device and its connecting conductors.

2. Each emergency electrical distribution panel (EDP)

3. Each critical power panel

4. Each distribution and branch panel as shown on the drawings. Include branch circuit breakers in the distribution and branch panels to disconnect and protect the Surge Protective Device and its connecting conductors.

5. Electronic equipment installed under Division 26, 27, or 28 including controls systems, access control system, , CCTV, SCADA Control Panel, etc. Communications and signaling circuits that travel outdoors will be protected with low voltage, fast acting, surge protection devices.

6. Site lighting pole light circuits (at the pole base)

7. Additional locations as required by NFPA 780

8. On each emergency power feeder entering the building and before the emergency feeder is connected to Automatic Transfer Switch

9. On all CU communication lines, DSL lines, T1 lines where they enter the building or at the high speed digital communication space.

10. Existing SPDs shown on the drawings shall remain active unless noted for replacement.

C. Install SPDs on the outside of control panels and electrical equipment.

D. Do not install SPD's inside of electrical panels or control panels.

1.2 REFERENCES

A. UL 1449 4th Edition, Standard for Surge Protective Devices

B. UL 1283, Standard for Electromagnetic Interference Filters

C. UL 96A Installation Requirements for Lightning Protection Systems

D. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002

E. IEEE Std. 1100-2005 Section 8.6.1

F. ANSI C84.1, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz).

G. NFPA 780 - Lightning Protection Code, latest edition.

H. NFPA 70 - National Electrical Code (NEC), current adopted year. Article 242

I. American National Standards Institute (ANSI) approved ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, 2009 edition (ANSI/NETA Acceptance Testing Specifications -2009).

J. UL 497, Standard for Protectors for Paired-Conductor Communications Circuits

K. UL 497A, Standard for Secondary Protectors for Communications Circuits

L. UL 497B, Standard for Protectors for Data Communications and Fire-Alarm Circuits

M. UL 497C, Standard for Protectors for Coaxial Communications Circuits

N. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

1.3 DEFINITIONS

A. In: Nominal discharge current rating as required by UL 1449 Fourth Edition

B. MCOV: Maximum Continuous Operating Voltage

C. MOV: Metal xide Varistor

D. VPR: Voltage Protection Rating (Clamping voltage)

E. SCCR: Short Circuit Current Rating

F. SPD: Surge Protective Device

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Submit under provisions of the General Requirements of the Contract Documents and Section 26 05 01.

B. Product Data: For each type of product indicated. Include rated capacities, bill of materials of number of MOVs installed per phase with MOV part number and surge current rating, operating weights, operating characteristics, furnished specialties, and accessories.

C. Product Certificates: SPD submittals shall include Listing documentation, signed by product manufacturer's certifying compliance with the following standards:

1. UL 1283 compliance verified information is posted at www.UL.com, under Certifications, searching using UL Category Code: FOKY.

2. UL 1449 4th Edition certification listing and classification page, VPR, MCOV, In, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer's UL docs.

3. UL 497, UL 497A, UL 497B, UL 497C as applicable.

D. Field quality-control test reports, including the following:

1. Test procedures used

2. Measure the continuity of each conductor between the equipment being protected and the SPD. The maximum resistance is 1 milliohm.

3. Failed test results and corrective action taken to achieve requirements

E. Operation and Maintenance Data: For Surge protective Devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance (O&M) data as called for in Section 26 05 07.

B. O&M data to include:

1. All approved shop drawings, product data, and/or cutsheets

2. Installation, connection, and maintenance information on each type of surge suppression

3. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness, as applicable

1.6 QUALITY ASSURANCE

A. All SPDs shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment for a minimum of five years.

B. Manufacturing facility shall operate a Quality System Certified as ISO 9001:2008 (or latest version) Compliant.

C. The SPD manufacturer shall provide requested technical assistance through support (including on-site as needed) by a factory-trained representative.

D. Source Limitations: Obtain SPDs and accessories for like applications through one source from a single manufacturer located in the United States.

E. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of SPDs and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Product Standards:

1. Comply with IEEE C62.41.1-2002, "IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits", IEEE C62.41.2-2002, "IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits", and test devices according to IEEE C62.45-2002, "IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits".

2. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449 4th Edition, "Surge Protective Devices".

3. NFPA 70, National Electrical Code article 242 latest edition

1.7 REGULATORY REQUIREMENTS

A. Equipment Certification: SPDs shall be listed by Underwriter Laboratories, shall bear the U.L. seal and be marked in accordance with referenced standard. SPDs shall be U.L. listed and labeled for intended use.

B. SPDs shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 780 and NFPA 70).

C. Comply with all standards and guides as listed under “References” above as applicable.

1.8 COORDINATION/PROJECT CONDITIONS

A. Verify proper grounding is in place.

B. Verify proper clearances, space, etc. is available for SPD.

C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge suppression device.

D. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Department not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Department's written permission.

E. Service Conditions: Rate Surge-protective Devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.

2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).

3. Humidity: 0 to 85 percent, no condensing.

4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.9 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

B. For Data line SPDs, Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge SPDs that fail in materials or workmanship within two years from date of Substantial Completion.

C. Any SPD, that shows evidence of failure or incorrect operation during the warranty period (to include failure of visual failure indicators) shall be replaced or repaired by the manufacturer during the warranty period. The manufacturer shall provide replacement units to the Department for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal.

1. ASCO
2. Emmerson/Liebert
3. L.E.A. International
4. Surge Suppression Incorporated

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE

A. Surge protective device minimum features and accessories:

1. Each SPD shall be UL 1449 Fourth Edition listed, and labeled as a Type 1 suppressor intended for use without the need for external or supplemental overcurrent protection.

2. Each SPD shall be labeled with 20kA I-nominal (In) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

3. Each SPD shall be of modular construction such that each of the SPD modules may be field replaced without the need to remove the entire SPD enclosure.

4. Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist the conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24”, the Contractor responsible for installation

must contact the specifying electrical engineer for additional installation instructions.

5. Each SPD shall be labeled with a 100kA short-circuit current rating (SCCR).

6. Each SPD shall be installed with a branch circuit breaker as a disconnecting means or provide an integral factory installed disconnect switch as a disconnecting means.

7. Each SPD will have the following modes of protection: Line to Line, Line to Neutral, Line to Ground, and Neutral to Ground.

8. The SPD shall include visual LED indicator lights for power and protection integrity.

9. Each SPD shall contain one set of form C contacts that change state when the SPD requires service.

B. Minimum Surge Current Capability**:** 200 kA per phase with less than 1 nanosecond response time.

C. Connection Means: Permanently wired, connected on the load side of the service entrance overcurrent protection, and meet the SPD manufacturer's instructions for overcurrent protection (breaker or fuse size).

D. Protection modes and UL 1449 Fourth Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

1. Line to Neutral: 700V for 120/240V, 1PH, 3W

2. Line to Ground: 700V for 120/240V, 1PH, 3W

3. Neutral to Ground: 700V for 120/240V, 1PH, 3W

4. Line to Line: 1200V for 120/240V, 1PH, 3W

2.3 SURGE-PROTECTIVE DEVICE (SPD) FOR DISTRIBUTION PANELBOARDS

A. Surge protective Device Description: Provide the following features and accessories:

1. SPD shall be UL 1449 Fourth Edition listed.

2. UL 1283 listed as an Electromagnetic Interference Filter

3. SPD shall be UL 1449 Fourth Edition , labeled as Type 1 intended for use without need for external or supplemental overcurrent controls or labeled as Type 2 with manufacturer approved over current protection.

4. SPD shall be UL 1449 Third Edition labeled with 20kA nominal discharge current (In) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

5. Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24", the Contractor responsible for installation ***must*** contact the specifying electrical engineer and the surge protective device manufacturer or distributor for installation assistance.

6. SPD marked with a 100kA short-circuit current rating (SCCR).

7. Modes of Protection: Line to Neutral, Line to Ground, Line to Line, and Neutral to Ground

8. The SPD shall include visual LED indicator lights for power and protection integrity.

9. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

10. Each SPD shall contain one set of form C contacts that change state when the SPD requires service.

B. Minimum Surge Current Capability**:** 150 kA per phase

C. Protection modes and UL 1449 Fourth Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

1. Line to Neutral: 600V for 120/240V, 1PH, 3W

2. Line to Ground: 600V for 120/240V, 1PH, 3W

3. Neutral to Ground: 600V for 120/240V, 1PH, 3W

4. Line to Line: 1200V for 120/240V, 1PH, 3W

2.4 DIRECT WIRED (120 VAC) SPDs

A. Surge-protective Device Description: Provide the following features and accessories:

1. SPD shall be UL 1449 Fourth Edition listed/recognized.

2. 15 and 30 Amp, 120 V rated. All continuous current bearing components must be either 15 or 30 Amp rated, minimum; depending on Location Load usage.

3. SPDs shall provide three suppression modes: Line-to-neutral, line-to-ground, and neutral-to-ground.

4. SPD shall provide a pulse life rating of 3,000 amperes (8/20µs waveform) every thirty (30) seconds for 2,000 occurrences.

B. Peak Single-Impulse Surge Current Rating**:** 20kA per mode, 60kA per protected circuit

C. SPD shall include visual LED diagnostic indicator for power and protection integrity.

D. SPD shall allow for chase nipple or DIN RAIL mounting.

2.5 Ethernet Surge Protective Devices (SPD).

A. Ethernet SPD's for data transmission speeds up to 10 GB per second without signal degradation. Ethernet cables will contain four sets of unshielded twisted pairs pf copper conductors. The SPD shall provide common mode, and differential mode protection.

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable.

2. Plug-in replaceable DIN rial mounted SPD modules that are the "in line" type that is connected in series with the Ethernet communication conductors.

3. Shall employ hybrid circuitry that combines silicon avalanche diodes with gas discharge modules. The SPD response time shall be one nano-second or less.

4. The nominal discharge current (In) shall be 4 kV / 2 kA, and the maximum surge current rating shall be 16 kA.

2.6 LEASED LINE SPDs.

A. Surge-protective Device Description: Modular design.

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable.

2. Plug-in replaceable modules design to fit on standard M1-50, 66 connecting block

3. Must be installed with matching ground rail or external ground post for extending metallic frame to building ground.

4. Nominal line voltage of 150 Volts, Maximum line voltage of 170 Volts, and the maximum clamping voltage shall be 190 Volts.

5. The nominal discharge current with 8x20 µs impulse will be 5 kA.

2.7 Modbus (RS-485) communications SPD's for protecting communications circuits with one twisted shielded pair of conductors with operating voltage of -7V to +12V.

1. The SPD will be DIN rail mounted, and connected "In Line" in series with the Modbus communications circuits.

2. The SPD will meet the requirements of IEC 61643-21 with certification to UL 497B.

3. The SPD will contain three stage high energy surge suppression. Stage 1 will consist of parallel connected gas discharge tubes. Stage 2 will have a series connected impedance. Stage 3 will consist of parallel connected transorb diodes.

4. The SPD maximum continuous operating voltage (MCOV) is 15 VDC.

5. The clamping voltage must be < 27 VDC.

6. The typical breakdown voltage will be 18 VDC.

7. The surge current rating will be 15 kA, and the response time will be one nano-second or less.

8. The IEC maximum discharge current, I nominal (8x20 μs) will be 10 kA.

2.8 SPD's for protecting 24 VDC signaling circuits with two conductors, and 4 to 20 milli-Amp current signal circuits with 2 conductors.

1. The SPD will be DIN rail mounted, and connected "In Line" in series with the signaling circuits.

2. The SPD will meet the requirements of IEC 61643-21 with certification to UL 497B.

3. The SPD will contain three stage high energy surge suppression. Stage 1 will consist of parallel connected gas discharge tubes. Stage 2 will have a series connected impedance. Stage 3 will consist of parallel connected transorb diodes.

4. The SPD maximum continuous operating voltage (MCOV) is 28 VDC.

5. The clamping voltage must be < 46 VDC.

6. The typical breakdown voltage will be 33 VDC.

7. The surge current rating will be 15 kA.

8. The IEC maximum discharge current, I nominal (8x20 μs) will be 10 kA.

2.9 ENCLOSURES

A. NEMA Type 1 enclosures shall be used for all enclosures inside of the building and NEMA Type 3R enclosures for exterior applications.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide, install, and connect an SPD's at the first electrical service disconnecting means. Branch breakers in the MDP shall serve as the disconnecting means for the SPD.

B. Provide, install and connect an SPD at each branch panelboard that serves outdoor equipment. Branch breakers in the panelboard shall serve as the disconnecting means for the SPD.

C. Provide, install and connect an SPD at each Critical Power Panelboard, i.e. Panel C. Branch breakers in the panelboard shall serve as the disconnecting means for the SPD.

D. Provide, install and connect an SPD to protect the emergency generator feeder at each Automatic Transfer Switch (ATS) in the project. The SPD will include an integral disconnecting means installed by the SPD manufacturer.

E. Provide, install, and connect SPD at location where Division 27 and 28 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect SPD equipment to equipment being protected and maintain U.L. listing.

F. Provide, install, and connect SPD at location where Division 26 equipment is connected to line voltage (120V) and low voltage conductors for ethernet and modbus. Provide terminations as required to connect SPD equipment to equipment being protected and maintain U.L. listing.

G. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.

H. Installation of SPD equipment and its grounding must be in accordance with the manufacturer's recommendations to assure short and proper ground paths.

I. Install external SPDs with a maximum of 24" length leads. Position the SPD as close to the circuit breaker used as possible. Utilize the breakers closest to the SPD mounting.

J. Install the leads slightly twisted together, but as short and straight as possible with no kinks or coils and an eight-inch minimum bending radius.

3.2 INSTALLATION OF SPDS

A. SPDs for other than Division 27 and 28 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

B. SPDs shall be close-nippled to the device being protected in a position nearest the neutral bus (if present) to minimize wire lead length between SPD and the buses or control breaker to which the SPD connects. SPD leads shall not extend beyond the SPD manufacturer's recommended maximum lead length without specific approval of the engineer.

C. SPDs shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

D. SPDs shall be installed in a manner that allows simple replacement within short periods of downtime.

E. SPDs other than point of use type shall be installed with a means of disconnecting the SPD at the panel. At the MDP locations, provide a dedicated 60 amp, breaker for the SPD device. At the distribution secondary and/or subpanels location, provide dedicated 30 Amp, breaker for the SPD device. Change rating of CB's noted above as required to properly provide system as recommended by manufacturer.

3.3 LEASED LINE CIRCUITS

A. Systems utilizing communication company pairs as a transmission medium shall be provided with SPD conforming to respective device in Part 2 of this specification.

B. SPDs shall be installed at each point where interface is made to communication company pairs.

C. In cases where a modem or other device is used to interface with the leased line circuit the following procedure shall apply:

1. Where the modem or coupling device is furnished by the communication company the SPDs shall be installed on the system side of the modem or coupling device.

2. Where the modem or coupling device is furnished by the system contractor, the SPD shall be installed on the leased line side of the modem or coupling device.

3.4 SIGNALING, COMMUNICATIONS AND DATA CONDUCTORS

A. Any signaling conductor, CCTV conductor, Ethernet conductor, Power over Ethernet (PoE) conductor, or SCADA system conductor that is routed in an exterior environment shall be protected by a surge protection device (SPD). The SPD's will be mounted indoors where possible.

3.5 PLACING SYSTEM INTO SERVICE

A. Before energizing any SPD, the installer shall measure the electrical system voltage and frequency and verify that each SPD is properly rated for use with measured voltage and frequency.

3.6 FIELD QUALITY CONTROL

A. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Testing: Perform the following field tests and inspections.

1. After installing surge protective devices, but before the electrical circuitry has been energized, measure the continuity of each lead. Measure between the equipment being protected and the point of connection to the SPD.

2. Complete startup checks according to manufacturer's written instructions.

3.7 DEMONSTRATION

A. Train Department's maintenance personnel to adjust, operate, and maintain SPDs.

END OF SECTION 26 43 13

SECTION 26 51 13
LIGHTING FIXTURES AND LAMPS

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Luminaires and accessories

B. Emergency lighting units

C. Exit signs

D. Lamps

E. Luminaire accessories

1.2 REFERENCES

A. NEMA WD 6 - Wiring Devices-Dimensional Requirements

B. NFPA 70 - National Electrical Code

C. NFPA 101 - Life Safety Code

1.3 SUBMITTALS FOR REVIEW

A. Submittals: Section 26 05 01 - Shop Drawings and Submittals.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBMITTALS FOR CLOSEOUT

A. Submittals for project closeout.

B. Submit manufacturer's operation and maintenance instructions for each product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish Products as scheduled.

2.2 EMERGENCY LIGHTING UNITS

A. Furnish products as scheduled.

B. Description: Self-contained emergency lighting unit.

C. Light source shall be LED (light emitting diodes)

D. Battery: 12 volt, with 1.5 hour capacity.

E. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.

F. Indicators: Lamps to indicate AC ON and RECHARGING.

G. TEST switch: Transfers unit from external power supply to integral battery supply.

H. Electrical Connection: Connection shall be hardwired via conduit (cord and plug connection shall not be allowed).

2.3 EXIT SIGNS

A. Furnish products as scheduled.

B. Description: Exit sign fixture suitable for use as emergency lighting unit.

C. The light source shall be LED (Light emitting diodes).

D. Battery: 12 volt, nickel-calcium, lead calcium type, with 1.5 hour capacity.

E. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twenty-four (24) hours.

F. Indicators: Indicator lamps to indicate AC ON and RECHARGING.

G. TEST switch: Transfers unit from external power supply to integral battery supply.

H. Electrical Connection: Connection shall be hardwired via conduit (cord and plug connection shall not be allowed).

2.4 LED LIGHT FIXTURES

A. Flat face, low profile, wall mount, exterior light fixtures.

1. The baseplate shall be manufactured from marine grade die-cast aluminum. The baseplate flange shall interlock and wrap around the lens base to prevent water intrusion.

2. Lens; The lens shall be made from ultraviolet stabilized, high impact resistant, virgin injection molded polycarbonate. Ensure the lens is held in place by a push/turn/lock in place device that does not require tools. The lens and lens base will be secured with a single, concealed, captive fastener with a center pin.

3. Gasketing: A self-adhesive neoprene gasket shall seal between the baseplate to the mounting surface.

4. The LED light source color temperature shall be 3500 degrees Kelvin with a minimum CRI of 82.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants. Provide pendant length required to suspend luminaire at the indicated height in the fixture schedule.

B. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on Drawings, as scheduled.

D. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within the luminaire.

E. Bond products and metal accessories to the branch circuit equipment grounding conductor.

F. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

G. Connect battery operated emergency light fixtures to local lighting circuit ahead of all switches. Provide and install all wiring as required for proper operation.

H. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match the type of ceiling system being furnished.

I. In addition to attaching ceiling mounted lighting fixtures to ceiling system, Surface mounted fixtures and/or ceiling boxes shall be supported to superstructure with all-thread rod.

J. Light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels.

K. Provide low voltage transformers and power supplies for all low voltage light fixtures.

L. Install tents of fire rated materials as required for fixtures in fire rated ceilings as per applicable codes.

M. Thermal protection for all fixtures with tents or fixtures surrounded by insulation.

N. Pendant suspended light fixtures shall be installed using the original equipment manufacturers pendant kit and materials. Threaded rods shall not be substituted for the manufacturer's pendant kit.

O. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and future access to the fixture for maintenance.

P. Locate all remote ballasts in well ventilated and accessible spaces.

Q. FIELD QUALITY CONTROL

1. Operate each luminaire after installation and connection. Inspect for proper connections and operation.

3.2 ADJUSTING

A. Contract Closeout

B. Aim and adjust luminaires as indicated.

C. Position exit sign directional arrows as indicated.

3.3 CLEANING

A. Contract Closeout: Cleaning installed work.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from inside the enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damaged paint.

3.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate luminaire operation for minimum of two hours.

3.5 PROTECTION OF FINISHED WORK

A. Relamp any luminaires that have failed lamps at Substantial Completion.

END OF SECTION 26 51 13

LEVEL 2

SECTION 27 11 16
TOLL COMMUNICATIONS CABINET

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Descriptions of the products and execution requirements relating to furnishing and installing Toll Communications Cabinet along with required accessories.

2. This section includes minimum requirements for the following:

   a. Toll Communications Cabinet

   b. Toll Communications Cabinet Accessories

   c. Fiber Distribution Panel (FDP)

3. Product specifications, general design considerations, and installation guidelines are provided in this document.

1.2 SUBMITTALS AND SHOP DRAWINGS

A. Submit product data sheet with detailed ordering information for approval.

B. The Toll Communications Cabinet submittal shall contain all components required to make a complete communications cabinet, to include data sheets for all communications cabinet accessories, din rail, cable management, Power Distribution Unit (PDU)(s), fiber distribution panel (FDP) and associated components.

1.3 REFERENCES

A. The following industry standards are the basis for the structured cabling described in this document.

TIA/EIA

TIA/EIA-568-B	Commercial Building Telecommunications Cabling Standard
TIA/EIA-569-A	Commercial Building Standard for Telecom Pathways and Spaces
TIA/EIA-606	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
TIA/EIA-607	Commercial Building Grounding/Bonding Requirements

NFPA

NFPA-70	National Electric Code (NEC)

ISO/IEC

ISO/IEC 11801	Generic Cabling for Customer Premises

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Provide communication cabinets and associated hardware for the proper mounting of fiber optic and WAN/LAN switches as described herein. One (1) Toll Communications Cabinet shall be provided for each new concrete toll equipment building.

B. The Toll Communications Cabinet shall be in accordance with the following:

1. Manufacturers Provide a wall mounted toll communication cabinet from one of the following, or approved equal, meeting the requirements in the contract documents:
   a. Chatsworth Products, Inc. CUBE-iT PLUS Cabinet Model # 12419-748.
   b. Middle Atlantic Products, CWR Series Cabinet Model # CWR-26-32-PD.
   c. NVent/ Hoffman Wall Mount Cabinet Model #EWMW482430
2. EIA compliant 19” cabling wall mount rack with 26 rack units (RU).
3. Minimum dimensions 48” H x 24” W x 24” Usable center compartment depth of 30”.
4. Maximum outside dimensions 50” H x26” W x36” D.

5. The cabinet body, top panel, side panels, mounting rails, rear panel and door shall be black polyester powder (or equivalent) painted steel.

6. Front door and rear panel access.

7. A nominal 4” to 6” deep rear panel, with 2.5” and 3” electrical knockouts on the top and bottom as shown on the plan.

8. The rear panel must be hinged, allowing the center compartment to swing open per the orientation shown on the plans (left hand reverse or right hand reverse opening), enabling access to the rear of installed equipment.

9. Static load rating: Minimum 200 pounds.

10. Provide a means of bonding the cabinet to the service entrance ground bar.

11. The cabinet must be UL listed.

12. Enclosures must be equipped with provisions and accessories for wall mounting, wire management, equipment mounting, structural support, fans, and air filter units.

13. Front equipment mounting rails must be installed with a front setback of 5”.

C. Tolling communication cabinet accessories shall include the following as supplied by the cabinet manufacturer specific to the make and model of the cabinet:

1. Two (2) exhaust fans, side mounted, minimum 95cfm each, 120 VAC, 60 Hz. The power to the fans will be provided by a dedicated power cord with a NEMA 5-15p plug.

2. One (1) pair of extra equipment mounting rails, for rear-mount, 26 RMU. All mounting rails to be configured as square hole cage nut type 12-24 Black.

3. Two (2) sets of Equipment Support Brackets.

4. Four (4) sets of 3 inch Horizontal Wire Management.

5. Two (2) vertical power distribution units (PDU) shall be furnished per each communication cabinet.

   a. PDUs shall be single-phase monitored, surge protected.

   b. PDU’s shall be NEMA 5-20r compliant and shall be vertically mounted to the communication cabinet, and have 6 outlets at a minimum.

   c. The PDU power input cords must come factory installed from the manufacturer as L5-20p (field retrofitted cords will not be accepted).

   d. The PDU receptacles must be standard simplex, rated for 20a and shall be capable of mounting directly to the cabinet using mounting hardware or tool-less feature.

6. One (1) rack mountable DIN rail kit, 4RU, minimum depth 6.75”.

D. Additional communications cabinet requirements include the following:

1. The communication cabinets shall be properly bonded and grounded to the existing or new grounding system.

2. The communications cabinet shall be mounted securely to the wall per manufacturer’s installation instructions.

E. Fiber Distribution Panel (FDP) shall be in accordance with the following:

1. Manufacturers - Provide a product from one of the following, or approved equal, meeting the requirements in the Contract Documents:

a. CORNING CCH-02U closet connector housing, two rack units, supplied with four pre-terminated CCH pigtail splice cassettes (CCH-CS12-59-P00RE)

b. LEVITON OPT-X 2000i SDX 2RU Rack Mount Enclosures with four (4) SDX adapter plates (5F100-2LC), OS2 fiber type, SC du.lex adapter type with pre-terminated pigtails (standard colors), four (4) splice trays (heat shrink, plastic holders 12 fibers), and cable clamp kit. Accessories include cable strain relief kit and fiber management ring kit.

c. Siemon RIC3-24-01, 2RU Rack Mount Enclosures with four (4) Quick-Pack adapter plates (RIC-F-SC12-01), OS2 fiber type, SC duplex adapter type with pre-terminated pigtails (standard colors), four (4) splice trays (heat shrink, plastic holders 12 fibers), and cable clamp kit. Accessories include cable strain relief kit and fiber management ring kit.

2. 19" EIA width rack mountable, FDP(s) suitable for loose tube, single or ribbon fiber optic cables housed inside of the communication cabinet.

3. One (1) FDP shall be provided per lateral fiber drop, or interconnect, and shall have the following features:

a. One (1) fiber distribution and splice enclosure shall occupy 2RU, and shall accommodate at least four (4) Pre-terminated splice cassette /pigtail splice modules / splice trays, as supplied by the FDP manufacturer for the make and model of the FDP.

b. Slide out tray

c. Removable tinted polycarbonate front door

d. Strain relief brackets, routing clips and guides

e. Mounting brackets for proper installation

4. Each pre-terminated cassette, pigtail splice module / splice tray shall be in accordance with the following:
    a. Six (6) SC/UPC duplex, single-mode, ceramic insert composite ports
    b. Twelve (12) single mode factory polished pre-terminated pigtails
    c. Twelve (12) single fiber heat-shrink splice protectors
    d. Protective braided tubing for incoming cable
    e. Grommets and cable ties for additional strain relief
    f. Mounting hardware for use with the fiber optic distribution panel (FDP)

5. Provide (12) single mode SC to SC jumpers for each set of two FOC buffers entering mainline toll equipment buildings with minimum length necessary to patch through all lateral fibers color-to-color.

6. Provide (12) single mode SC to SC jumpers for ramp toll equipment buildings with minimum length necessary to patch through all lateral fibers color-to-color.

7. In addition, the FDP shall be mounted at the position next below the top cable management position within the communication cabinet.

8. The number of fiber ports shall comply with the number of strands per cable sheath being dropped to the toll equipment building.

9. Provide adjustable front and rear equipment mounting rails to properly mount the FDP. The mounting rails shall be square hole cage nut with #12-24 hardware.

END OF SECTION 27 11 16

SECTION 27 41 34
PATHWAYS FOR CLOSED CIRCUIT TELEVISION

LEVEL 1

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Raceways for closed circuit television system.

1.2 RELATED SECTIONS

A. Raceways and Boxes for Electrical Systems: .....Section 26 05 33

B. Surface Raceways: .....Section 26 05 34

C. Identification for Electrical Systems: .....Section 26 05 53

1.3 REFERENCES

A. NFPA 70 - National Electrical Code

1.4 SYSTEM DESCRIPTION

A. Horizontal Pathways: Conform to EIA/TIA 569, and install raceways, cable trays, device boxes, surge protection devices, and cabinets as indicated on the plans.

B. Ethernet and/or video wiring serving the CCTV system will be installed in the future by others

C. The CCTV Cameras, and the video recorder will be installed in the future by others.

1.5 AS-BUILT DOCUMENTS

A. Record actual locations and sizes of pathways and outlets.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with the NEC and EIA/TIA 569.

PART 2 - PRODUCTS

2.1 RACEWAYS AND POWER OUTLETS FOR CLOSED CIRCUIT TELEVISION SYSTEMS

A. [redacted]

B.

C.

PART 3 - EXECUTION

3.1 INSTALLATION

A. [redacted]

B.

C. Provide identification in accordance with Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

END OF SECTION 27 41 34

SECTION 28 05 14
ACCESS CONTROL SYSTEM

LEVEL 3

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Access control system raceways and partial system wiring.

B. [redacted]

C.

D. Demonstration of components to the CEI.

1.2 RELATED SECTIONS

A. Section 26 05 33 – Raceways and Boxes for Electrical Systems

B. Section 26 05 19 – Low Voltage Electrical Power Conductors and Cables

C. Section 08 71 00 – Door Hardware

1.3 REFERENCES

A. EIA/TIA-568 - Commercial Building Wiring Standard

B. EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces

C. NFPA 70 – National Electrical Code

D. NFPA 101 – Life Safety

E. NFPA 731 – Installation of Electronic Premises Security Systems

1.4 ABBREVIATIONS AND DESCRIPTIONS

A. Critical Power Panel: The panelboard that receives power from the uninterruptible power supply unit.

B. The Department: Refers to the Florida Turnpike Enterprise.

C. FTE: Florida's Turnpike Enterprise

D. RCDD: Registered Communications Distribution Designer

E. VAC: Volts Alternating Current

F. VDC: Volts Direct Current

G. ACP: Access Control Panel

H. (Future): Items furnished and installed by the Department.

1.5 SYSTEM DESCRIPTION

A. [redacted]

B.

C.

1. [redacted]

2.

3.

4.

5.

6. [redacted]

D. [redacted]

1. [redacted]

2. [redacted]

1.6 SHOP DRAWING SUBMITTALS

A. Submit catalog or manufacturer specification sheets on each component of the system and each conductor being provided under this section.

1.7 QUALITY ASSURANCE

A. Perform this work in accordance with the manufacturer's installation instructions and with EIA/TIA-568: Commercial Building Telecommunications Standards and with EIA/TIA-659: Commercial Building Standards for Telecommunication Pathways.

1.8 QUALIFICATIONS

A. Installer: The company must have a minimum of three years experience installing Security and Access Control Systems.

1.9 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish Products listed and classified by Underwriters Laboratories, Inc. and acceptable to the Department engineer as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 ACCESS CONTROL SYSTEM COMPONENTS

A.

B.

C.

D.

E.

F.

G.

1.

2.

3.

H.

I. [redacted]

J.

K.

L.

2.2 ACCESS CONTROL PANEL (ACP)

A. [redacted]

1. [redacted]

PART 3 - EXECUTION

3.1 INSTALLATION

A. [redacted]

B.

C.

D.

E.

F.

3.2 DEMONSTRATION

A. The contractor shall demonstrate to the Construction Engineering Inspection (CEI) representative that the wiring for the electrically operated door lock, the wiring for the request to exit contacts, and the wiring for the door position switch has been installed correctly, terminated to the device it serves, and is labeled correctly. The end of the wiring that is not connected shall be terminated within the ACP. Demonstrate the following items for each door that will be monitored and/or controlled:

1.

2.

3.



END OF SECTION 28 05 14

SECTION 31 31 16
SOIL TREATMENT

LEVEL 2

PART 1 - GENERAL

1.1 SUMMARY

A. Provide soil treatment for termite control at all concrete slabs and foundations to be developed into occupied areas, as herein specified.

1.2 RELATED WORK

A. Standard Specifications Section: 400 Concrete Structures

1.3 QUALITY ASSURANCE

A. Applicator’s Qualifications: Engage a professional pest control operator, licensed in the State of Florida in accordance with regulations of governing authorities for application of soil treatment solution.

B. Requirements of Regulatory Agencies: All work shall comply with the Latest Adopted Edition of the Florida Building Code, as amended.

1.4 SUBMITTALS AND SHOP DRAWINGS

A. Product Data: Submit the following:

1. Manufacturer's technical data, complete with written substrate preparation and soil treatment application instructions. Include EPA-Registered Label.

2. Material Safety Data Sheets.

B. Applicator’s Qualifications: Submit the following:

1. Documented evidence of applicator’s qualifications.

2. A copy of the applicator’s current state license.

C. Certificate of Compliance: Submit a copy of the applicator’s Certificate of Compliance required by the Florida Building Code.

1.5 PROJECT CONDITIONS

A. Restrictions: Comply with the following:

1. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.

2. To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil manufacturer and EPA-Registered Label requirements.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

A. General: Provide an EPA-Registered emulsifiable, concentrated termiticide that dilutes with water, specially formulated to prevent termites' infestation. Termiticide shall be clearly labeled for use as a preventative treatment to new construction. Fuel oil will not be permitted as a diluent.

1. Dilute with water to concentration level compliant with manufacturer's written instructions.

2. Use only soil treatment solutions that are not injurious to plants.

B. Products: Provide one of the following products or approved equal:

1. "Dragnet SFR" permethrin; FMC Corp.

2. "Prevail FT"; cypermethrin; FMC Corp.

3. "Demon TC" cypermethrin; Syngenta.

4. "Prelude" permethrin; Syngenta.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except

B. previously compacted areas under slabs and foundations. Soil treatment solutions may be applied before placement of compacted fill under slabs, if recommended by soil treatment solution manufacturer.

C. Application Rates: Apply soil treatment solution in accordance with EPA-Registered Label directions. Distribute the treatment evenly.

D. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.

E. Post signs in areas of application warning workers that soil treatment solutions have been applied. Remove signs when areas are covered by other construction.

F. Re-apply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

G. Protect treated areas from rainfall if left exposed for extended period.

END OF SECTION 31 31 16

Appendix 3

TECHNICAL SPECIAL PROVISION SECTIONS FOR RTC TOLL SITES

See ***GTR 210*** for additional requirements

TECHNICAL SPECIAL PROVISION

FOR

EMERGENCY GENERATOR - PERMANENT AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T639A
EMERGENCY GENERATOR - PERMANENT AT RTC TOLL SITES

T639A-1 Description.

Furnish and install packaged emergency generator set(s) as shown on the Toll Facilities Plans.

T639A-2 Materials.

T639A-2.1 Standards: Emergency backup emergency generator set(s) must meet the following applicable industry standards:

1. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.
2. NEMA MG1 Motors and Generators
3. NFPA 30 - Flammable and Combustible Liquids Code
4. NFPA 70 National Electrical Code
5. NFPA 110 - Emergency and Standby Power Systems

T639A-2.2 Qualifications: The company selling the products specified herein must be an authorized distributor for the original equipment manufacturer. The distributor must be factory authorized to supply parts, perform field services, and perform factory warranty work on the emergency generator and associated products specified herein. The distributor must maintain a parts inventory for the equipment provided and stock 50% of all parts for the engine, generator, and automatic transfer switch at their service facility within 100 miles of the project job site. The company selling the products specified herein must operate a public parts counter or parts warehouse that is open to the public, 5 days per week, Monday through Friday. The Department may inspect the service facility to verify the parts stock.

T639A-2.3 Maintenance Parts: Provide the following additional maintenance parts for each emergency generator:

1. One air filter
2. One oil filter
3. One fuel filter
4. One radiator fan belt

The parts will be new and must match the part numbers shown in the manufacturer's parts manual. Highlight these part numbers with a yellow highlighter in the paper parts manual. Parts that are not new OEM parts, or do not match the parts shown in the manufacturer's parts manual will be rejected.

T639A-2.4 Packaged Emergency Generator Set: Acceptable original equipment manufacturers include:

1. Cummins Power
2. Caterpillar
3. Kohler
4. Approved equal

Classify the Emergency Power Supply System (EPSS) in accordance with NFPA 110 as Level 2, Type 10.

System Standby Rating: As shown on Plans for each toll facility, while operating inside a weather protective enclosure, and at an ambient temperature of 110 degrees Fahrenheit, and at an elevation of 100 feet above sea level. The emergency generator will use an engine mounted radiator with a pusher type radiator fan. The full standby rated output will be available with varying loads for the duration of the interruption of the normal source power. The average power output must not exceed 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. The Standby power rating will be in accordance with ISO3046/1.

Generator (alternator) output voltage dip and frequency dip requirements: Upon application of 100% rated (full) load at 1.0 pf, in a single step, the instantaneous voltage dip at the output of the alternator shall not exceed 20% and the instantaneous frequency dip will not exceed 20%.

T639A-2.4.1 Engine: Provide a water cooled inline or V type, four stroke cycle, compression ignition diesel internal combustion engine with the following requirements:

1. Fuel: No. 2 fuel oil, ultra-low sulfur, not to exceed 15 ppm sulfur.
2. Engine speed: Rated for 1800 rpm.
3. Governor: Electronic isochronous governor. Random frequency variation shall not exceed ±0.25%.
4. Safety Devices: Pre-alarms and Engine shutdowns with alarms for high engine temperature, low oil pressure, overspeed, and emergency stop. Limits as selected by the manufacturer. Also provide overcrank / failure to start lock out and alarm.
5. Engine Starting: Positive engagement, cycle crank type, DC starting system with the number of starter motors in accordance with manufacturer's instructions. Include remote “two wire” starting controls.
6. Engine Jacket Coolant Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C) under all site conditions, and suitable for operation on 120 Volts or 240 Volts AC. Also provide isolation valves on the coolant supply and return hoses to facilitate maintenance on the heater.
7. Radiator: High ambient radiator using propylene glycol based coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F (43 degrees C) when the emergency generator is installed within the weather protective enclosure and running at 100% rated (full) load. Radiator air flow restriction 0.5 inches of water (1.25 Pa) maximum. Provide a metal radiator guard and provide an accessible coolant drain valve on the bottom of the radiator. If the weather protective enclosure makes the drain valve not accessible, then extend a permanent drain hose from the drain valve to the outside of the enclosure. The radiator shall also include low coolant alarm contacts.

T639A-2.4.2 Engine Accessories: Aftercooler, intake air filter(s) with differential pressure service indicators, spin on lube oil filters, lube oil cooler, gear driven water pump, battery charging alternator, and crank case fumes disposal tube(s) routed outside. Also provide an oil drain valve on the bottom of the engine oil pan. If the weather protective enclosure makes the drain valve not accessible, then extend a permanent drain hose from the drain valve to the outside of the enclosure.

1. Engine Fuel System: Primary spin on fuel filter(s) with separate fuel/water separator with metal housing and see-through containment bowl, fuel transfer pump with a suction head of 9 feet minimum, a hand operated fuel priming pump with an analog fuel

pressure gauge mounted next to the hand prime pump. A factory installed fuel oil cooler shall be mounted on the radiator to keep the return fuel temperature below 85 degrees F.

2. Mounting: Provide unit with suitable spring type vibration isolators mounted under the structural steel base or steel tank. If the engine and the alternator are isolated from the structural steel base or tank by rubber snubbers/mounts, then vibration pads may be utilized under the structural steel base.

3. Paint. The engine and the engine accessories shall be painted by the original manufacturer. Additional painting of the engine and engine accessories are not acceptable to the Department. The engine may not be repainted to change the color. Belts and hoses shall not be painted. The OEM part numbers must remain visible on all belts, hoses, and filters.

T639A-2.4.3 Generator (Packaged Emergency Generator Set): Provide a NEMA MG1, single phase, four pole rotor, synchronous generator with a brushless permanent magnet exciter with the following requirements:

1. Insulation Class: H.
2. Temperature Rise: 130 degrees C.
3. Enclosure: NEMA MG1, drip proof, IP 22 guarded.
4. Voltage Regulation: Include generator mounted volts per hertz exciter regulator to match engine and generator characteristics, with voltage regulation plus or minus 1 percent from no load to full load. Include manual controls to adjust voltage drop, voltage level (plus or minus 25 percent) and voltage gain.

The manual voltage adjustment will be used to adjust the output voltage up to 120% of nominal to test the over voltage protective device. The manual voltage adjustment will also be used to adjust the output voltage down to 80% of nominal to test the under voltage protective device.

T639A-2.4.4 Accessories (Packaged Set): Provide the following accessories:

1. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless-steel exhaust fitting assembly, sized in accordance with engine manufacturer's instructions. Also provide an outlet elbow and a rain cap. If the exhaust piping penetrates the top of the outdoor enclosure, a rain collar shall be installed around the exhaust piping to minimize water entering the weatherproof enclosure.
2. Removable Insulation Blankets: If the exhaust silencer is mounted inside the weather protective enclosure then the silencer and stainless-steel flex will be covered with removable insulation blankets. The insulation blankets will be minimum one inch thick with three layers. The outer layer will be silicone impregnated fiberglass. The middle layer will be fiberglass. The innermost layer will be stainless steel mesh.
3. Batteries: Heavy duty, high output, diesel engine starting type, vibration resistant, lead acid storage batteries. The advertised Cold Cranking Amps shall be at 0 ºF. Ensure the batteries will withstand extreme vibration and sample batteries have been tested in accordance with IEC 61056-1. The prototype batteries shall pass a 50-hour vibration resistance test. Match the battery voltage to the engine starting system. Include copper battery cables and a key operated battery disconnect switch. Submit data sheet to the engineer on the battery switch. Calculate the voltage drop in the battery cables with full load cranking amps. Provide this calculation with the shop drawing submittals.
4. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

5. Battery Charger: The battery charger must be enclosed, automatic, dual-rate, solid-state, constant-voltage type having ac voltage compensation, dc voltage regulation, and must be current limiting. The battery charger must be located in the engine-generator set enclosure. The battery charger must employ transistor-controlled circuits to provide continuous taper charging. The battery charger must have two ranges, float and equalize, with a 0 to 24 hour equalizer timer, a dc cranking relay, silicon diode full-wave rectifiers, automatic surge suppressors, a DC ammeter, and a DC voltmeter. The battery charger must have a continuous rated output of not less than 10 amperes. The battery charger must conform to UL 1236.

6. Line Circuit Breaker: Manufactured in accordance with NEMA AB 1, and UL 489, molded case circuit breaker, generator mounted in a NEMA 1 enclosure. The circuit breaker enclosure shall provide adequate space for the Electrical Contractor to bend the generator feeder conductors in accordance with the NEC. The circuit breaker protective trip unit shall include integral thermal and instantaneous magnetic trips in each pole, sized in accordance with NFPA 70. Include a set of auxiliary contacts on the generator circuit breaker. The contacts will be open when the circuit breaker is open and closed when the circuit breaker is closed. These contacts will be monitored by the SCADA system.

7. Emergency Generator Control Panel: NEMA 1, IP22 generator mounted control panel made of heavy-duty sheet steel and vibration isolated from the emergency generator set. The control panel shall house the engine and generator controls, gauges and indicators. Also provide a hinged vandal door over the face of the control panel with provisions for a padlock. The control panel shall include the following equipment and features:

a. Frequency Meter: 45 - 65 Hz. Range.

b. AC Output Voltmeter with true RMS sensing, 1/2 percent accuracy with phase selector switch.

c. AC Output Ammeter with true RMS sensing, 1/2 percent accuracy with phase selector switch.

d. Output voltage adjustment.

e. Push to test indicator lamps, for low oil pressure, high water temperature, overspeed, and overcrank shutdowns.

f. Engine Off/Auto/Start/Stop selector switch.

g. Engine running time meter.

h. Oil pressure gauge.

i. Fuel pressure gauge.

j. Water temperature gauge.

k. Emergency stop button.

l. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.

m. Additional visual indicators and alarms as required by the Safety Indication and Shutdown table below.

n. Remote Alarm Contacts: Pre-wire SPDT contacts to a terminal strip for remote alarm functions required by NFPA 110.

o. Provide over voltage protection (ANSI #59) and under voltage protection (ANSI #27) to protect the generator and/or building distribution system from a voltage regulator malfunction. Over voltage relay settings shall be adjustable from 100% to 125% of nominal voltage. Under voltage relay settings shall be adjustable from 75% to 100% of nominal voltage. The pickup and dropout times will be adjustable from 1 to 10 seconds. When the

generator set is producing power, an over voltage or under voltage condition shall cause the emergency generator to automatically shut down on a fault. The engine shall not attempt to restart until the fault is acknowledged and the fault reset button is depressed. When the emergency generator shuts down normally and stops producing power, this shall not be considered a fault and the under-voltage relay shall not initiate an under-voltage fault.

p. The generator control panel shall include a factory installed Modbus RTU communication port that will be connected to the PLC within the SCADA system control panel.

q. The alarms indicated below will be transmitted to the SCADA system by the generator control panel Modbus RTU interface for use as Remote Audible (R.A.) alarms at Sunwatch.

Table 1- Safety Indication and Shutdowns

Indicator Function	Level 1				Level 2		
	C.V.	**S**	**R.A.**		**C.V.**	**S**	**R.A.**
Overcrank	x	x	x		x	x	x
Low water temp 70 degrees F	x		x		x		x
High engine temperature prealarm	x		x		o		x
High engine temperature	x	x	x		x	x	x
Low lube oil pressure prealarm	x		x		o		o
Low lube oil pressure shutdown	x	x	x		x	x	x
Overspeed	x	x	x		x	x	x
Low level radiator fluid	x		x		x		x
Low fuel level – main tank	x		x		x		x
Low fuel level – day tank	x		x		x		x
EPS supplying load	x		x		x		x
Generator control switch not in auto	x		x		x		x
High battery voltage	x		x		o		o
Low battery voltage	x		x		x		x
Battery charger AC failure	x		x		x		x
Remote emergency stop	x	x	x		x		x
Over Voltage		x				x	x
Under Voltage	x	x	x		x	x	x
Lamp / horn test switch	x		x		x		x
Audible alarm silencing switch	x		x		x		x
Generator breaker open	x		x		x		x
Emergency Power Off Initiated	x		x		x		x

CV; control panel visual indication. S: Shutdown of the EPSS. RA: Remote audible.
x = Required. o = Optional

T639A-2.4.5 Other Requirements (Packaged Emergency Generator Set):
Additional requirements are as follows:

Weather Protective Generator Set Enclosure: Manufactured with 14-gauge aluminum prepainted panels with interlocking seams, stainless steel mechanical fasteners, stainless steel hinges, and door holder latches. The doors will be strategically located to allow access for maintenance and visibility of the instruments on the face of the control panel. The doors must have gaskets and must be key lockable. The engine radiator fan will draw air into the

enclosure through a fixed aluminum intake louver and discharge the air through a gravity-open type aluminum discharge damper.

To prevent rodents and birds from entering the enclosure all openings in the enclosure will be covered from the inside with heavy aluminum wire mesh with 0.2 inch square holes. The wire diameter must be 0.047 inch or greater.

The emergency generator must operate properly inside the enclosure at rated (full) load with the outdoor ambient temperature up to 110 degrees Fahrenheit. The enclosure will be wind rated in "miles per hour" by the manufacturer in accordance with the Wind-Borne Debris Region map published in the current Florida Building Code.

Provide a factory installed sound attenuated aluminum enclosure. The enclosure shall be factory certified for the sound level not to exceed 72 db (A) when measured 7 meters from the emergency generator when the emergency generator is operating at 100% rated load.

T639A-2.4.6 Integrated Base Fuel Tank (Packaged Emergency Generator Set): Provide a sub-base tank as follows:

1. Provide a steel, dual wall, sub-base mounted fuel tank with a closed top primary tank, and a secondary containment basin.

2. Tank Capacity: The minimum fuel tank capacity must be designed for the emergency generator to run for 48 hours at design demand load, while providing power to the toll site(s) during a normal power outage.

3. The base fuel tank system shall be listed under UL 142, subsection entitled Special Purpose Tanks EFVT category, and will bear their mark of UL Approval according to their particular classification.

4. The fuel tank shall be a State of Florida Department of Environmental Protection (FDEP) approved tank with a current FDEP EQ number.

5. The above ground base fuel tank with secondary containment basin must be installed in accordance with the Flammable and Combustible Liquids Code—NFPA 30, the Standard for Installation and Use of Stationary Combustible Engine and Gas Turbines—NFPA 37, and Emergency and Standby Power Systems—NFPA 110.

6. The primary tank shall be rectangular in shape and constructed in clam shell fashion to ensure maximum structural integrity and allow the use of a full throat fillet weld.

7. The interior of the primary tank will be coated with a solvent-based film rust preventative coating.

8. Steel Channel Support System: Reinforced steel box channel for generator support, with a load rating not less than the weight of the packaged generator.

9. The fuel tank shall have a removable end channel for access to the electrical conduit stub up area.

10. Exterior Finish: The base tank exterior shall be painted black with two-part epoxy paint.

11. Normal venting shall be sized in accordance with the American Petroleum Institute Standard No 2000, Venting Atmospheric and Low Pressure Storage Tanks not less than 1-1/4" (3 cm.) nominal inside diameter.

12. The emergency vent opening shall be sized to accommodate the total capacity of both normal and emergency venting and shall be not less than that derived from NFPA 30, table 2-8, and based on the wetted surface area of the tank. The wetted area of the tank shall be calculated based on 100 percent of the primary tank. The vent is to be spring pressure

operated: opening pressure is 0.5 psig and full opening pressure is 2.5 psig. The emergency relief vent shall be sized to accommodate the total venting capacity of both normal and emergency vents.

13. Provide a 2" NPT opening within the primary tank for the fuel fill port.

14. Ensure that the fuel tank is equipped with a fuel spill container designed to contain small spills that occur at the fill port. The spill container shall have a hinged cover that is lockable with a padlock, and a drain valve to allow draining spilled fuel in the container to the main fuel tank.

15. The fuel fill port shall be equipped with an overfill prevention valve assembly to prevent over filling the fuel tank by providing positive shut-off during the fuel delivery process. Set the fuel supply shut off at 95% of the primary tank capacity.

16. Provide a direct reading, UL listed, spiral, fuel level gauge with a hermetically sealed, vacuum tested dial, to eliminate fogging. Locate the direct reading fuel level gauge adjacent to the fuel fill port so that it is accessible to the fuel delivery person.

17. The main fuel tank shall be equipped with fuel level alarm float switches for high level, low level, and critical low level. Set the high fuel level alarm at 90% of the tank capacity, set the low fuel level alarm at 30% of the tank capacity, and set the critical low fuel level alarm at 15% of the tank capacity. The emergency generator shall automatically shut down if the critical low fuel level is activated. The fuel level alarms will be electrically connected to the generator control panel to provide for audible and visible alarms. The generator control panel shall transmit the fuel level alarms to the SCADA system by Modbus communications from the generator control panel.

18. To prevent overfilling the fuel tank. provide an intrinsically safe audible high fuel level alarm panel in the vicinity of the fuel fill port for local annunciation of a high fuel level condition. The alarm panel will sound a 90 decibel alarm at 4 feet away. Set the high fuel level alarm at 90% of the tank capacity. Include a means to silence the alarm, and a means to test the audible buzzer. Ensure the alarm panel enclosure is petroleum and weather resistant.

19. Fuel in the secondary containment basin float switch: A float switch will be installed into the containment basin of the fuel tank. The float switch will be electrically connected to the generator control panel. This switch will close a set of contacts if fuel leaks from the main tank and into the containment basin and a visible and audible alarm will be initiated on the generator control panel.

20. Provide a drain valve for the secondary containment basin.

21. Ball valve: A ball valve will be installed in the fuel supply line to the generator. The operator will be manually able to shutoff fuel to the generator supply line.

22. Decal: The fuel tank must be equipped with the following permanent signs:

a. NFPA 704 “Fire Diamond”
b. “No Smoking: Flammable Diesel”
c. “XXX Gallons”

23. Install generator cabling and conduit connections to the Automatic Transfer Switch and the SCADA monitoring system as shown in the Plans and Specifications.

T639A-3 Delivery Storage and Handling.

Inspect the equipment for damages immediately upon delivery and contact the distributor or manufacturer before accepting a product that was damaged during shipping. Take photos of

any damaged equipment before removing it from the truck. Make specific notes on the receiving ticket to describe the extent of any damage.

Protect equipment from dirt and moisture by securely wrapping in heavy plastic until it is installed.

When lifting the emergency generator with a crane, use spreader bars to prevent bending the weather protective enclosure.

T639A-4 Shop Drawings and Submittals.

T639A-4.1 Shop Drawings:

Submit shop drawings in accordance with Section 5 of the Specifications Acceptance Procedures for Toll Facilities, and the following:

1. Sizing Program Results. Provide printouts in the shop drawings from the emergency generator manufacturer's sizing and simulation program. The sizing program printouts must show the following items or information:

2. Simulation #1. The program will show the selected emergency generator installed inside the weather protective enclosure while running at full (100% rated) load with the ambient temperature at 110 degrees Fahrenheit and the unit is installed at 100 feet above sea level. The printout will show the air flow in cubic feet per minute that is passing through the weather protective enclosure and the pressure drop across the selected radiator. Ensure the printout shows the selected engine model number, radiator model number or part number, alternator size, and weather protective enclosure part number. The printout will also show the instantaneous voltage and frequency dips upon a 100% rated load (block load) application at 0.8 power factor.

3. Simulation #2. Run a second simulation that lists the name and Watt rating of each electrical load that the emergency generator will serve. Use the construction plans to determine the site specific electrical loads and the sequence that the loads will be applied to the emergency generator. The printouts will show the voltage and frequency dips for each set of loads that are applied to the emergency generator. The power distribution system, including the backup generator, shall be designed to operate normally when the UPS units are operating at 100% full (rated) load.

4. Shop Drawings will include plan and elevation views with dimensions of the selected emergency generator with the exhaust system in place, and base fuel tank when applicable. Also show plan and elevation views with dimensions of the weather protective enclosure. Include specific dimensions for interconnection points such as:

   a. Fuel piping connections
   b. Exhaust outlet sizes and locations
   c. Oil valve location
   d. Radiator drain valve location
   e. Spring isolator mounting points

5. Conduit stub up locations for the main generator feeder, jacket water heater circuit, and battery charger circuit.

6. Provide emergency generator fuel consumption rate curves at various loads.

7. Provide a manufacturer's emergency generator data sheet that shows the EPA Tier Rating of the emergency generator package. The emergency generator must meet or exceed the current EPA tier rating requirements for stationary and off-road diesel engines. The emergency generator model number shown on the EPA documentation must match the emergency generator model number being submitted for review.

8. Provide calculations that show the ventilation rate of the cooling air flowing through the weather protective enclosure. Also show the pressure drops across the louvers and across the engine radiator.

9. Provide a site specific, point to point interconnection diagram on 11" x 17" paper. The site specific drawing will show the exact connection points for the Modbus RTU communications cables, remote EPO station, battery charger alarms, main fuel tank alarms, engine start contacts in the automatic transfer switch, ATS auxiliary contacts to indicate the position of the ATS, engine running auxiliary contacts, etc. Submittals will not be reviewed without this site-specific diagram showing the name of the tolling site.

10. Provide an electronic copy of the operation and maintenance manuals.

T639A-5 Product Data.

Provide data sheets that show the dimensions, weights, ratings, interconnection points, features, ratings, and internal wiring diagrams if applicable, for the following items:

1. Engine
2. Alternator
3. Radiator and radiator fan size
4. Radiator drain valve and extension hose
5. Antifreeze
6. Engine oil
7. Engine crankcase fumes disposal tube
8. Fuel filter
9. Diesel Fuel Additives for increasing Cetane # and fuel stabilizer.
10. Water separator
11. Fuel prime pump – hand operated
12. Analog fuel pressure gauge
13. Fuel pump suction pressure data and maximum external restriction data
14. Head loss calculations for the proposed fuel piping and accessories
15. Flexible fuel lines
16. Jacket coolant heater and hose isolation valves
17. Oil drain valve and extension hose
18. Air cleaner and differential pressure indicator
19. Emergency Generator Control Panel
20. Modbus RTU communication card with wiring diagrams and a Modbus register map for the emergency generator controller
21. Main Circuit Breaker and trip unit
22. Engine cranking battery
23. Battery cable size and lengths. Show the cable Voltage Drop during engine cranking.
24. Battery rack
25. Battery charger
26. Exhaust silencer, elbow, and rain cap
27. Exhaust system stainless steel flexible connector
28. Thermal blankets for silencer
29. Vibration isolators
30. Weather protective enclosure
31. Base fuel tank, if applicable
32. Warranty statement

33. The distributor will provide a written statement concerning the availability of repair parts and the physical address of the parts counter or parts warehouse that is open to the public, 5 days per week, Monday through Friday.

Provide Operation Manual and Installation Manual as follows:

1. Provide one paper book copy and one electronic copy of the Manufacturer's Operation Manual and the Installation Manual for the emergency generator and automatic transfer switch at each Toll Building. Provide a set of manuals for each emergency generator provided under this contract. Deliver the manuals to the Engineer at the same time the manuals are electronically submitted.

2. If the manuals are incomplete, or are lacking in meaningful operational or installation instructions, or do not cover the model or type of equipment being provided, then the Department may REJECT the manuals and indicate on the shop drawing review forms the nature of the deficiencies. The contractor will then collect the deficient materials from the Engineer, correct the deficiencies, and then re-submit the materials for another review.

3. If the manuals are incomplete, or are lacking in meaningful operational or installation instructions, or do not cover the model or type of equipment being provided, the submission will be rejected.

T639A-6 Documentation.

Provide service and repair manual and the parts manual for each generator as follows:

1. Provide one digital copy and one paper book copy of the emergency generator manufacturer’s parts manual for each emergency generator provided under this contract. The parts manual must show the original equipment manufacturers part numbers for all parts and accessories on the engine, radiator, main alternator, starter, charging alternator, and generator control panel.

2. Provide one digital copy and one paper book copy of the emergency generator manufacturer’s service and repair manual and include the following.

3. Include the manufacturer’s suggested preventive maintenance service activities, suggested intervals between each service, and the required parts and tools to perform the service.

4. Include separate chapters on each subsystem or major component that make up the emergency generator package. Each chapter will provide exploded view diagrams, required tools, and step by step procedures to repair or replace each component in the subsystem.

If the manuals are incomplete, are lacking in meaningful parts information or step by step repair instructions, or do not cover the model or type of equipment being provided, then the manuals will be rejected and require re-submission.

T639A-7 Warranty.

The packaged emergency generator system must be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of system start-up. The warranty will include parts, shipping costs, rigging costs, engine fluids, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

Regular and scheduled maintenance will be performed by the Department’s maintenance contractor. Requirements for consumables such as oil and filters to be original equipment manufacturer brands are not acceptable and must not void the manufacturer’s warranty of the equipment.

T639A-8 Quality.

The emergency generator must be a standard product of the original equipment manufacturer. The vendor that provides the emergency generator package must be an authorized manufacturer's representative for the brand of emergency generator that is provided.

Perform an operational test on the emergency generator and automatic transfer switch before the site is turned over to the Department. After all the site systems and equipment have been installed, placed into service, and individually commissioned by the appropriate party, provide functional testing with all the systems and equipment running simultaneously to verify that the normal operation of any one system or piece of equipment does not interfere or aggravate the normal operation of any other system or equipment. Perform the operational testing with a Department representative present to observe the process.

T639A-9 Construction Requirements.

T639A-9.1 General: Install in accordance with manufacturer's written instructions.

The original equipment manufacturers field service personnel will perform the initial start-up of the emergency generator and place the unit in service. The warranty document will show the Florida Turnpike Enterprise as the owner.

Install integral base fuel tank.

Diesel Fuel. Deliver and install #2 diesel fuel oil with less than 15 ppm of sulfur to fill the diesel fuel tank 90% full. Include fuel additives in proper quantities to increase the Cetane number to 50 minimum, increase the lubricity, and stabilize the fuel. Also add biocide to prevent bacteria and fungi from growing within the fuel tank. After testing the emergency generator, refill the tank to 90 % full.

Identification - Provide engraved plastic nameplates in accordance with the Specifications.

Provide equipotential bonding to the nearest counterpoise loop per the Specifications.

T639A-9.2 Field Quality Control: Provide field inspection and testing as follows:

1. Over voltage and Under voltage operational test.

The original equipment manufacturers field service personnel will perform the following operational test. Open the generator main circuit breaker before performing the over voltage and under voltage tests.

The manual voltage adjustment on the generator control panel will be used to adjust the generator output voltage up to 120% of nominal voltage to test the over voltage protective device. When the output voltage reaches 120% of nominal for 1 second, the emergency generator shall automatically shut down and the Over Voltage Alarm on the control panel shall initiate. Reset the fault and verify the alarm clears

The manual voltage adjustment on the generator control panel will be used to adjust the generator output voltage down to 80% of nominal voltage to test the under voltage protective device. When the output voltage reaches 80% of nominal for 1 second, the emergency generator shall automatically shut down and the Under Voltage Alarm on the control panel shall initiate. Reset the fault and verify the alarm clears

Return the manual voltage adjustment on the generator control panel to 100% of nominal output voltage after the testing is complete.

2. Load Bank Tests:

A 4-hour continuous load bank test will be performed after the unit is placed into service and all accessories are installed and the permanent fuel system is installed. The test shall

be performed with resistive load banks, in the presence of the engineer and if required, the local fire marshal. The test shall be performed during regular business hours only - Monday - Friday, 8:00 AM to 5:00 PM. Run the emergency generator at the following % loads and time periods.

a. 0.5 hour at 50% load
b. 0.5 hour at 75% load
c. 3 hours at 100%
d. Block load at 100% load and verify voltage & frequency dip
e. 0% load for 10 minutes to cool down
f. During test a written log shall be maintained at 15-minute intervals with the following:
g. Ambient Air Temperature
h. Amperes
i. Hertz
j. Oil Pressure and temperature
k. Water Temperature
l. Battery Charging DC voltage and Amps
m. Exhaust Stack Temperature
n. Noise Level in dba (each side)
o. Differential pressure across the radiator

Test the alarm and shutdown circuits by simulating the faults, temperatures, and liquid levels. Verifying the alarm lights energize and the alarm horn sounds. Also verify the alarm silence feature works properly.

After testing the emergency generator, refill the tank to 90 % full.

T639A-9.3 Manufacturer's Field Services: The manufacturers field service representative shall visit the job site a minimum of three times (sign in each time) after construction begins to coordinate the installation with the Contractor. Provide assistance with concrete pad sizes and shapes, routing and connection points for the control wiring, and proper silencer installation methods.

T639A-9.4 Adjusting and Cleaning: Adjust the generator output voltage and engine speed. Record for future use.

Touch up paint any scratches on the enclosures or housings in accordance with the manufacturer’s instructions. Clean the engine and generator surfaces of grease and oil.

T639A-9.5 Demonstration: Provide systems demonstration in accordance with Acceptance Procedures for Toll Facilities.

Simulate a utility power outage by interrupting normal power and demonstrate that the system operates automatically to provide standby power to the building. Also simulate a generator over voltage fault condition and observe the engine shutting down, the generator breaker tripping open, and the OV fault lamp illuminated. Clear the faults, close the generator main circuit breaker and restore the emergency generator to the automatic operating mode.

T639A-10 Method of Measurement.

The Contract unit price for each RTC toll site emergency generator will include furnishing, placement, testing and commissioning of all equipment. Also includes providing all tools, labor, equipment, hardware, operational software packages and firmware, supplies, fuel, parts, support, shop drawings, manuals, warranty documentation, and demonstrations, also including all acceptance procedures and incidentals necessary to complete the work. The cost of the fuel tank, fuel, Automatic Transfer Switch and fire extinguishers at each RTC toll site

location will also be included in the cost of the toll site emergency generator.

T639A-11 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 639-13- Emergency Generator-Permanent XX-XX KW - each

TECHNICAL SPECIAL PROVISION

FOR

ACCEPTANCE PROCEDURES FOR TOLL FACILITIES AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T731
ACCEPTANCE PROCEDURES FOR TOLL FACILITIES AT RTC TOLL SITES

T731-1 Description.

This Technical Special Provision sets forth general administrative and procedural requirements for acceptance of Toll Sites with Roadside Tolling Cabinet(s) for toll gantry(ies) and toll site work.

T731-2 Record Documentation.

T731-2.1 General: Provide Record Drawings, Maintenance Manuals, and Equipment Operational Instructions/Demonstrations. Provide each record documentation in a bound or filed format with prominent identification on the cover, ready for continued use and reference.

The record documents must contain the following identification as a minimum:

T731-2.2 Operating Instructions and Maintenance Manuals:

1. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
2. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy- duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder.
3. Submit three (3) copies of each completed manual on equipment and systems, in final form, to the Engineer.
4. Operating instructions and maintenance manuals for each piece of equipment, for each cabinet's operating systems, and each electric or electronic system, must include the following at a minimum:
    a. Equipment or system function
    b. Operating characteristics
    c. Limiting conditions
    d. Performance curves
    e. Engineering data and tests
    f. Complete nomenclature and number of replacement parts
    g. Copies of warranties
    h. Copies of inspection and test reports
    i. Wiring diagrams
    j. Recommended "turn around" cycles
    k. Inspection procedures
    l. Shop Drawings and Product Data
    m. Fixture lamping schedule
    n. Inspection and test reports
5. Provide manufacturer's information for each component of an equipment or system including:
    a. Printed operating and maintenance instructions
    b. Assembly drawings and diagrams required for maintenance
    c. Parts manuals
    d. List of items recommended to be stocked as spare parts
6. Provide information detailing essential maintenance procedures, including:
    a. Routine operations
    b. Trouble-shooting guide

c. Disassembly, repair, and reassembly
d. Alignment, adjusting and checking

7. Provide information on equipment and system operating procedures, including:
a. Start-up procedures
b. Equipment or system break-in
c. Routine and normal operating instructions
d. Regulation and control procedures
e. Instructions on stopping
f. Shut-down and emergency instructions
g. Summer and winter operating instructions
h. Required sequences for electric or electronic systems
i. Special operating instructions

8. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

9. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

10. Coordination Drawings: Provide each Contractor's coordination drawings. Provide as-installed color-coded piping diagrams, where required for identification.

11. Valve Tags: Provide charts of valve tag numbers, with the location and function of each valve.

12. Circuit Directories: For electric and electronic systems, provide complete circuit directors of panelboards, including the following:
a. Electric service
b. Controls
c. Communication

T731-2.3 Record Drawings:

1. Maintain a set of documents that indicates the actual installation and/or location where the installation and/or location varies substantially from the Work as originally shown due to Addenda, Alternates, Change Orders, Field Orders, etc. Make note of concealed elements that would be difficult to measure and record at a later date.

2. Note related Change Order numbers where applicable.

3. Review the completed Project Record Drawings and ascertain that all data furnished on the prints is accurate and truly represents the Work as actually installed.

4. Submit the record drawing prints, including those changed and unchanged, to the Engineer for compliance review.

5. Make all necessary changes to the record drawings based on the Engineer’s review.

T731-3 As-Built Documents.

Provide As-Built Plans prior to issuing Final Acceptance of each toll facility in accordance with the Chapter 5.12 Final As-Built Plans Process of the Construction Project Administration Manual (TOPIC No. 700-000-000).

As-Built Plans must document changes to contract plans and include the following at a minimum:

1. Changes to site layout such as barrier, sidewalks, equipment foundations, dry wells, maintenance pull-off areas, limits of gravel, and driveways.

2. Actual routing and elevations of underground conduit and duct.

3. Actual locations and elevations of pull boxes and manholes.

4. Actual locations of components, grounding electrodes, and inspection wells.

5. Actual locations and sizes of electrical equipment, devices, and boxes.

6. Actual locations, sizes and routing of raceways, conductors, and cabling.

7. Any panelboard changes and circuit number changes including approved combining of circuits and any changes in the home run outlet boxes.

T731-4 Manufacturer and Supplier Warranties.

All manufacturer and equipment supplier warranties shall commence on the Date of Final Acceptance of the total Contract.

Written warranties made to the Department are in addition to implied warranties, and shall not limit duties, obligations, rights, and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Department can enforce such other duties, obligations, rights, or remedies.

The initiation of warranty for Security, AC, Communication, and Standby Power Systems will commence only when these systems are functioning properly and accepted in writing by the Department.

Complete all repairs or replacements resulting from a breach of warranty promptly.

Submit written warranties to the Department prior to the Date of Final Acceptance. If the Department designates a commencement date for warranties other than the Date of Final Acceptance, or a designated portion of the Work, submit written warranties on the Department's request.

Submit properly executed warranties from the supplier or manufacturer, or a combination thereof.

T731-5 Final Cleaning.

Immediately prior to Final Acceptance, clean each surface or unit of Work to normal "clean" condition expected for a first-class cleaning and maintenance program. Comply with manufacturer's written instructions for cleaning operations. Cleaning includes but is not limited to the following:

1. Remove labels which are not required as permanent labels, including all gum and glue residue.

2. Clean exposed exterior and interior hard-surface finishes, to a dirt-free condition, free of dust, stains, films, and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces. Restore reflective surfaces to original reflective condition. Buff out scratches and marks on exposed metal surfaces.

3. Wipe surfaces of mechanical and electrical equipment clean; remove excess lubrication and other substances.

4. Remove noticeable paint marks and construction stains in concrete slabs and sidewalks.

5. Clean light fixtures and lamps to function at full efficiency. Replace any damaged lens.

Clean each toll site in accordance with Section 4-6 of the Specifications and the following:

6. Remove litter and foreign substances which includes removal of stains, petrochemical spills, and other foreign deposits.

7. Sweep paved areas to a broom-clean condition.

8. Rake grounds that are neither planted nor paved, to a smooth, even-textured surface, breaking up or removing clumps of material.

9. Clean exposed exterior of cabinets and wire troughs, to a dirt-free condition, free of

dust, stains, and films.

T731-6 Toll Site Acceptance.

T731-6.1 General: Toll site acceptance procedures include the following:

1. Verification of pre-substantial completion
2. Toll Site Interim Acceptance
3. Toll Site Final Acceptance

Contractor access is prohibited into the toll site after Toll Site Interim Acceptance except as required for Final Acceptance procedures.

T731-6.1.1 Verification of Pre-Substantial Completion: Use the checklists included in this TSP to document the completion of all toll site items. The Engineer will verify that all items on the appropriate checklists are completed, and all outstanding items are corrected and recorded as complete on the checklist. The checklists for Roadside Tolling Cabinet (RTC) sites is titled "Toll Site Acceptance Checklist – Type 3 (RTC with Non-Accessible Gantry Sites)". Additional checklists 731-6-1 through 731-6-5 for operational walk-through are also included here.

A copy of the checklists may be obtained from the Engineer at the pre-construction conference.

T731-6.1.2 Toll Site Interim Acceptance: Toll Site Interim Acceptance procedures includes the following:

1. Primary Walk-through(s)
2. Operational Testing Walk-through(s)
3. Equipment Demonstrations for Maintenance Personnel

Complete the following prior to the Primary Walk-through:

1. Verify that all items on the appropriate checklists identified in T731-6. are completed and all outstanding items are corrected and recorded as complete on the checklist.

2. The roadway pavement surface course and permanent striping in its final alignment for the toll loop pavement area (100 feet of pavement centered on the gantry) are installed and accepted by the Department and, the approach and departure roadway is available for the Toll Equipment Contractor's (TEC's) use:

a. 3500 feet of roadway at each mainline tolling gantry (2000 feet of approach and 1500 feet of departure).

b. 2500 feet of roadway at each ramp tolling gantry (1500 feet of approach and 1000 feet of departure) or as length of ramp permits for the TEC testing activities' posted speed.

3. Complete sodding per the roadway component plans around each toll site.

4. Provide at least two portable toilets at each toll site for the exclusive use of the FTE and the TEC personnel, during toll equipment installation, commissioning, and testing.

T731-6.1.2.1 Primary Walk-Through: Primary Walk-Through is conducted by the Engineer and the FTE Toll Systems personnel in conjunction with the Contractor's representative to ensure that the toll site has been constructed in compliance with the contract documents and that all elements of the toll site meet the needs of the Department and TEC.

Primary Walk-through shall be repeated until all the requirements as delineated in the contract documents for the toll site have been completed by the Contractor and verified by FTE Toll Systems.

Allow five (5) working days for the Engineer to provide a list of any deficiencies after each Primary Walk-Through. Correct deficiencies identified by the Engineer before proceeding to Operational Testing Walk-Through.

T731-6.1.2.2 Operational Testing Walk-Through: Operational Testing Walk-Through is conducted by the Engineer and the FTE Tolls personnel in conjunction with the Contractor's representative demonstrating successful operational tests and performance verification.

Before the Operational Tests begin, the facility must be clean and all unused materials and equipment must have been removed. After successful completion of the operational tests, the toll facility and equipment will be locked and secured by the Department.

Provide all labor, materials, equipment and services necessary to perform operational tests and performance verification testing for system acceptance.

The contractor will perform the operational tests and a Department representative will observe the process.

1. Stand Alone Tests: Test stand-alone functions of all electrical devices. If any unit fails to pass the stand-alone test, correct the unit or replace another unit instead and then repeat the test.

2. System Acceptance: occurs after all electrical devices have been installed, individually commissioned and Stand Alone Tests have been completed.

a. The systems and equipment will be functionally tested with all the systems and equipment running simultaneously to verify that the normal operation of any one system or piece of equipment does not interfere or aggravate any other system or equipment.

3. An important component of this process is providing the Department with the operation manuals, service manuals, parts manuals, spare parts, keys, system settings, software on discs, and warranty documents for each piece of equipment provided in accordance with the contract documents.

4. A report that shows all systems are functioning properly and the normal operation of any one system or piece of equipment does not interfere or aggravate any other system or equipment will be provided to the Department. The checklists below will be used as the report.

a. If the system or component being tested does not function properly or interferes or aggravates any other system or equipment, then the system will receive a "Fail" grade. Repair or adjust and retest any systems that Fail the operational test.

b. If the system fails the operational test three times, then remove the system or components and replace with a different system or components. Retest the replacement system or components to ensure it is satisfactory

5. Ensure the following systems are energized and operating normally with no alarms:

a. Electrical power distribution system
b. Emergency Power Off Station
c. Emergency generator and fuel tank - ready to operate
d. Automatic transfer switch
e. UPS
f. Cabinet AC systems
g. Lighting
h. [redacted]
i. Outdoor Communications Cabinet
j. Fiber Optic Communications System
k. [redacted]

	Checklist 731-6-1 Lighting	**Pass or Fail**
1.	Operate the light switches/toggle switches in each area to verify that the lights are controlled in accordance with the plans.	
2.	Operate the outdoor lights and site lighting. Cover the outdoor photocell and observe the outdoor lights as they illuminate. Uncover the outdoor photocell and observe the outdoor lights turn off.	
3.	Confirm that cabinet lighting is activated by door open/close.	

Checklist 731-6-2 RTC Access Control System Commissioning Procedure		**Pass or Fail**
1.	Verify the door key(s) for the toll equipment building are available and are on site.	
2.	Open the circuit breaker(s) in the panelboard that will serve the future access control system. Verify the panelboard directory card description is accurate. Leave the breaker open.	
3.	Inspect the cabinet doors latching hardware. Verify each device is present and installed.	
4.		
5.	Use an Ohm Meter to measure the continuity of the request to exit switch contacts in the [redacted]. When the sensor detects the presence of a person on the secure side of the door, the request to exit contacts should be closed and the Ohm Meter should measure less that 0.1 Ohm. When the sensor does not detect a person near the door, the request to exit contacts should be open and the Ohm Meter should measure greater than 1 Mega Ohm.	
6.	With the access-controlled door closed, open the door from the outside (unsecured side) by using the key to unlock it. Verify the key will lock and unlock the door.	
7.	Review the construction plans and verify that each access control raceway and junction box are present.	
8.	Turn over the door keys to the Department representative.	

	Checklist 731-6-3 A/C System Lead/Lag Operational Test	Pass or Fail
1.	Check the setting of the thermostat and verify it is set for 75 degrees Fahrenheit. Reprogram thermostat if necessary.	
2.	Measure the dry bulb temperature and relative humidity in the toll equipment building near the center of the room for 1 hour. Ensure the temperature is maintained between 73 degrees and 78 degrees and the relative humidity remains less than 50%.	
3.	Verify that only one A/C unit is running and that one A/C unit running with the 1st stage compressor running will cool the toll equipment building to 75 degrees and less than 50% relative humidity.	
4.	Open the circuit breaker that serves the A/C unit that is running. This is the "Lead" unit. Verify the panelboard directory card description is accurate and agrees with the Name Plate Label affixed to the unit.	
5.	Monitor the other A/C unit (the Lag unit) and verify it starts and begins to cool the room within 60 seconds.	
6.	Close the circuit breaker that serves the A/C unit in step 1 above. Verify the unit is re-energized.	
7.	Repeat steps 4, 5, and 6 for the other A/C unit.	
8.	Measure and record the full load Amperage of each A/C unit when operating with the compressor at 1st stage cooling level. Also measure and record the full load Amperage of each A/C unit when operating at 2nd stage cooling. Verify the full load Amperage when operating in 2nd stage cooling is at least 10% greater than when operating in 1st stage cooling.	Amps 1st ____ Amps 1st ____ Amps 2nd ____ Amps 2nd ____
9.	Turn over the operator manuals and parts manuals to the FTE representative.	

	Checklist 731-6-4 UPS Operational Test	Pass or Fail
1.	Ensure the UPS unit is operating normally with no active alarms and the external UPS Bypass Switch in the NOT BYPASSED mode. Also ensure the clean power panel is energized by the output from the UPS.	
2.	Review the configuration settings that are programmed into the UPS. Verify the settings agree with those provided by FTE during equipment start-up.	
3.	The Department representative will change the default UPS password.	
3.	The FTE representative will telephone Sunwatch and verify: a) The UPS network interface card is communicating and operating satisfactorily. b) The on-site Department provided Network switch is communicating and operating satisfactorily.	a) b)
4.	Locate the circuit breaker(s) that serve the UPS and the external UPS Bypass switch. Ensure the panelboard directory card description is accurate and it agrees with the Name Plate Label affixed to the UPS unit.	
5.	Place the UPS in the Internal Bypass mode. Verify the following: a) The LCD display on the UPS indicates the Bypass Mode. b) Ensure Sunwatch received the "UPS Internal Bypass" alarm? c) Ensure the Department's Network Switch did not re-boot due to loss of power.	a) b) c)
6.	Place the UPS On-Line (not in Internal Bypass). Verify the following: a) The LCD display on the UPS indicates the Normal Mode. b) Ensure Sunwatch received the "UPS No Longer In Internal Bypass" alarm? c) Ensure the Department Network Switch did not lose power or re-boot due to a power disruption.	a) b) c)
7.	Place the UPS external maintenance bypass switch in the "UPS Bypassed" position. Ensure the Department network Switch did not lose power or re-boot.	
8.	Place the UPS external maintenance bypass switch in the "UPS" position. Ensure the Department network Switch did not lose power or re-boot due to a power disruption.	

	Checklist 731-6-4 UPS Operational Test	**Pass or Fail**
9.	Open the circuit breaker that serves the UPS. Verify the following: a) The LCD display on the UPS indicates the reserve battery mode and displays the number of reserve minutes remaining. b) Ensure Sunwatch received the "UPS On Battery" alarm. c) Ensure the Department Network Switch did not lose power or re-boot due to a power disturbance.	a) b) c)
10.	Close the circuit breaker that serves the UPS. Verify the following: a) The LCD display on the UPS indicates the normal mode. b) Verify Sunwatch received the "UPS Normal" alarm. c) Ensure the Department Network Switch did not lose power or re-boot due to a power disturbance.	a) b) c)
11.	Turn over the operator manuals, parts manuals, system passwords, and warranty documentation to the Department representative.	

Checklist 731-6-5 RTC Engine Generator with Base Tank and Automatic Transfer Switch		Pass or Fail
1.	Open the circuit breaker(s) that serves the engine generator block heater and the battery charger. Verify these items are de-energized. Verify the panelboard directory card description is accurate. Close the circuit breaker(s) that serves the block heater and battery charger.	
2.	Review the configuration settings that are programmed into the generator control panel. Verify the settings agree with those provided by Department during equipment start-up.	
3.	The Department representative will change the default generator controller password.	
4.	Review the configuration settings that are programmed into the Automatic Transfer Switch control panel. Verify the settings agree with those provided by Department during equipment start-up.	
5.	The Department representative will change the default Automatic Transfer Switch control panel password.	
6.	Verify the generator controller start/stop switch is in the AUTO REMOTE position. Open the ATS main circuit breaker to simulate a utility power outage. Record the elapsed time between the power outage and power being restored by the generator set & ATS. The maximum acceptable elapsed time is 10 seconds to restore power.	_____ Seconds
7.	The Department representative will contact Sunwatch and verify the "Toll Site on Backup Power" alarm is active.	
8.	While the toll site is being powered from the generator set, verify each UPS is on line, providing power, and the UPSs have no active alarms showing on the operator interface.	
9.	Close the ATS main circuit breaker to simulate a return of utility power. Record the elapsed time between the power restoration and the ATS operating to restore normal utility power. The maximum acceptable elapsed time for the ATS to switch back to Utility power is 15 minutes.	_____ Minutes
10.	Test and observe the High level, Low level, and Leak alarms.	
11.	Use the SCADA control panel operator interface to view the level in the fuel tank. The SCADA system should indicate that the fuel level is between 90% and 95% full.	
12.	Turn over the generator and ATS operator manuals, parts manuals, service manuals, and warranty documents to the Department representative.	

Complete all items on the Operational Testing Walk-through punch lists. Touch-up and otherwise repair and restore marred exposed finishes on the interior of the building. Complete all touch-up painting in the interior. Touch-up and otherwise repair and restore marred exposed finishes on outdoor equipment.

Allow five (5) working days for the Engineer to provide a list of any deficiencies. Correct deficiencies identified by the Engineer before proceeding to Toll Site Interim Acceptance.

Upon successful completion of the Operational Testing Walk-Through, make final change-over of permanent locks and transmit keys to the Engineer.

T731-6.1.2.3 Equipment Demonstrations for Maintenance Personnel: Provide a competent and experienced person (or persons) thoroughly familiar with the Work to demonstrate to, and instruct the Department's personnel in operation, adjustment and maintenance of products, equipment and systems. This instruction shall include normal start-up, run, stop, and emergency operations, location and operation of all controls, alarms and alarm systems, etc. The instruction shall include tracing the system in the field and on the diagrams in the instruction booklets so that the Department's operating personnel will be thoroughly familiar with both the system and the data supplied. Provide instruction at mutually agreed upon times.

Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance. For equipment that requires seasonal operation, provide similar instruction during other seasons.

If installers and/or Contractor's personnel are not experienced in operational procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following: (Items listed are examples only and not all inclusive)

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments.

As part of instruction for operating equipment, demonstrate the following procedures: (Items listed are examples only and not all inclusive)

1. Start-up
2. Shut down
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization

Contractor access is prohibited into the tolling site after the TEC has started installation of the tolling equipment.

T731-7 Prerequisites for Toll Site Final Acceptance.

Complete clean up requirements. Touch-up and otherwise repair and restore marred exposed finishes on the interior of the building. Complete all touch-up painting in the interior.

Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.

Obtain concurrence from Engineer that the following items have been completed:

1. All additional spare parts as specified in the Contract Documents have been provided to the Department.

2. All special tools for items such as louver vanes, adjustable dampers, thermostats, allen-head locking devices, as specified in the Contract have been provided to the Department.

3. Record documentation has been provided to the Department in accordance Section T731-2 of this Technical Special Provision.

4. As-Built documentation for the toll facility has been provided to the Department in accordance Section T731-3 of this Technical Special Provision.

5. Manufacturer and supplier warranties have been provided to the Department in accordance Section T731-4 of this Technical Special Provision.

T731-8 Toll Site Final Acceptance

Toll site Final Acceptance must be scheduled after the TEC commissioning has been completed. Toll site Final Acceptance includes completion of the following items:

1. Remove temporary facilities from the site, including portable toilets, construction tools, equipment, and any debris.

2. Inspect the toll site in the presence of Engineer and obtain concurrence from Engineer.

T731-9 Method of Measurement

The work specified in this Technical Special Provision will not be measured separately, but will be included in the pay item for the Outdoor Communications Cabinet.

T731-10 Basis of Payment

The work specified in this Technical Special Provision will not be paid for directly but will be considered as incidental work.

TOLL SITE ACCEPTANCE CHECKLIST
TYPE 3 (RTC NON-ACCESSIBLE GANTRY SITES)

(**ALL** Items must be completed, without deficiencies, and field verified prior to Department acceptance)

Document and report any deficiencies immediately.

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
A	**GANTRY and ASSOCIATED MOUNTING INFRASTRUCTURE:**			
1	Toll gantry upright and truss with cable tray supports have been installed per Contract Documents (CDs).			
2	W-members have been installed per CDs.			
3	All gantry member connections have been installed per the approved shop drawings.			
4	Horizontal support pipes (quantity/size) and hardware (pipe saddle plates, u-bolts, nuts, washers, and bolts) have been installed per CDs.			
5	Toll equipment J-arms, quantity, sizes, and tolerances have been provided and installed per CDs.			
6	Contractor has provided spare horizontal support pipes and mounting hardware per CDs. Contractor has provided spare J-arms and mounting hardware per CDs.			
7	Toll equipment J-arm mounting hardware (pipe saddles, mounting plates, u-bolts, nuts, washers, and bolts) have been provided and installed per CDs and shop drawings.			
8	Measure the vertical clearance from the bottom of each J-arm to the final roadway surface directly below. Document any J-arms mounted beyond the 13"+/- distance from the nominal position and when the bottom of the J-arm is not 18'-6" above the final pavement directly below. The Contractor must submit a remediation plan for review by the Department for any deficiencies.			
9	Verify the lightning protection system has been installed per CDs. Measure and confirm resistance to ground is within specification requirements.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
10	Inspect and verify all infrastructure provided and installed by the Contractor is free from rust and/or corrosion.			
11	Verify any Contractor provided and installed hardware does not have any signs of galling or damage.			
B	**GANTRY ELECTRICAL, WIRE TROUGHS, and AVI READER MOUNTING FRAME:**			
1	Fittings, couplings, bushings, and reducers at conduit ends have been installed per CDs.			
2	Strut channels have been installed per CDs. Strut channel ends are installed with PVC caps rated for outdoor use by the strut channel manufacturer.			
3	Rigid conduit and sweeps have been properly installed and secured to the gantry upright.			
4	Ground mounted power, data, and AVI wire troughs have been installed per CDs.			
5	AVI Reader ground-mounted frame with supporting AVI conduit strut channel supports have been installed per CDs.			
6	Rigid conduit has been installed and properly spaced on the strut channel frames per the CDs. All conduit has been installed with pull ropes and correct associated labels.			
7	Rigid conduit terminations in each cable tray have been properly connected, grounded, and sealed.			
8	Equipment cable trays have been securely mounted to the w-members and terminated per the CDs.			
9	Gantry upright cable trays have been securely mounted to the gantry upright per the CDs.			
10	Longitudinal cable trays with dividers for data, AVI readers, and power are supported per the CDs. Cable trays have been properly connected and grounded with manufacturer approved mounting hardware.			
11	Cable tray waterfall fittings have been properly installed per CDs.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
12	When vertical junction boxes (pencil pull boxes) are shown in the CDs, verify the metallic conduit entering and leaving each vertical junction box (pencil pull box) have been installed and secured to: - Gantry upright and supports - Pencil pull boxes			
13	Conduit runs from upright to roadside and/or median pull box per CDs have been properly installed, secured, and sealed.			
14	AVI Reader frame has been installed per CDs and includes: - Galvanized strut channel - Strut channel mounting hardware - Ground bar with mounting hardware - Grounding conductor bonded to counterpoise			
15	Each AVI Reader's infrastructure (fiberglass enclosure and mounting plate) has been properly installed and grounded.			
C	**GANTRY TO OUTDOOR COMMUNICATIONS CABINET (OCC) CONDUIT CONNECTIONS:**			
1	Verify the gantry wire trough connectivity per CDs: [redacted] - Each conduit is terminated with a bushing and grounded within the wire trough			
2	Conduit stub-ups are precisely aligned, spaced, and arranged within the OCC "Working Space".			
3	All conduit have been installed with pull ropes and correct associated labels.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
D	**GANTRY TO ROADSIDE TOLLING CABINET (RTC) CONDUIT CONNECTIONS:**			
1	Verify the gantry wire trough connectivity per CDs: - AVI Reader conduit to the RTC Working Space, and future RTC pull box - Data conduit to the RTC Working Space and future RTC pull box - Power conduit to the RTC Working Space, and future RTC pull box - Each conduit is terminated with a bushing within the associated wire trough			
2	When vertical junction boxes (pencil pull boxes) are shown in the CDs, verify the pencil pull box connectivity to the RTC: - AVI Reader conduit to the RTC Working Space, and future RTC pull box via the data pull boxes - Data conduit to the RTC Working Space and future RTC pull box via the data pull boxes - Power conduit to the RTC Working Space, and future RTC pull box via the power pull boxes			
3	All conduit have been installed with pull ropes and correct associated labels.			
4	Conduit stub-ups are precisely aligned, spaced, and arranged within the RTC Working Space per CDs.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
E	**TOLL LOOP INFRASTRUCTURE:**			
1	Toll loop pavement (FC-12.5) and final striping have been installed per CDs.			
2	Toll loop conduit stub-ups with pull ropes have been installed and sealed per CDs.			
3	Field verify each conduit is free and clear of debris or foreign material.			
4	Toll header curb has been installed per CDs.			
5	Toll loop pull boxes have been installed per CDs.			
6	Verify the 3" interconnect conduits with pull ropes between the toll loop pull boxes have been installed per CDs.			
7	Verify conduit home runs with pull ropes from the toll loop pull boxes to the Roadside Tolling Cabinet (RTC) and future RTC pull box have been installed per CDs.			
8	Applies to concrete pavement ONLY: Field verify each loop conduit with pull rope has been sealed, routed, and stubbed up to the location specified in CDs.			
9	Field verify the cable distances for furthest toll equipment as per CDs.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
F	**SITE ELECTRICAL:**			
1	Utility power (pad mounted transformer) has been installed, tested and certified by the CEI and service provider. Document physical address.			
2	Stand-by power generator with base fuel tank has been installed, grounded, tested, and certified per CDs. - Generator control panel - Generator circuit breaker - Generator batteries - Jacket water heater [redacted]			
3	Ground wells have been installed, tested and certified per CDs.			
4	Verify each metal wire trough, power distribution frame(s) (PDFs), and emergency generator with base fuel tank are connected to their associated ground wells.			
5	Field verify the fuel tank is 90% full. The contractor must provide a transmittal to the CEI certifying the sulfur content of the diesel fuel, the Cetane number, and the type and amount of biocide added to the fuel.			
6	Power Distribution Frame (PDF) has been installed per CDs. - Meter - Electrical Distribution Panel (EDP) - Transfer Switch [redacted] - Lighting - Fire extinguisher with cabinet			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
G	**OUTDOOR COMMUNICATIONS CABINET (OCC):**			
1	OCC has been installed, mounted, and grounded per the CDs. Cabinet must include: - (2) cabinet mounted air conditioning units (ACs) - AC units lead lag controller - Sun shields - Slide out shelf - Lighting - UPS devices with network interface cards [redacted] - ITS fiber distribution panel - Telco (as applicable) [redacted] - Convenience receptacle - Stand-by power from generator - Door contacts - Leak detector			
2	Conduit between the OCC and RTCs have been installed within the Working Spaces / pull box. - Clean power [redacted] - ITS FOC - Telco [redacted] - Clean power - Stand-by power - Coiled CAT 5Es conductors inside OCC for future connections to RTC(s)			
3	Conduit stub-ups are precisely aligned, spaced, and arranged within the OCC and RTC Working Spaces per CDs.			
4	UPS units have been installed, tested, and certified. A network interface card must be installed for external [redacted]. Field verify the UPS alarms have been received at SunWatch located next to Turkey Lake Headquarters.			
5	[redacted] raceway have been installed and terminated at the proper cabinet position and location.			

TOLL SITE NAME: Date: ___ / ___ /20__

CEI Inspector Name(s):

FTE Inspector Name(s): FPID: XXXXXX-X/X

DIRECTION (XB): MP: Station:

Item ID	Inspection Item	Item Completed YES / NO	Tolls Accepted YES / NO	Field Observations and Issues Noted Begin note with: (Not Started, Work In Progress, or Completed)
H	**OCC AC SYSTEM:**			
1	New exterior AC units have been installed, tested, and certified with an operational control system including the lead lag controller per the CDs.			
2	Field test both AC units can operate in both lead and lag operations per CDs. Verify lead lag controller has been programmed per the CDs.			
3	Condensate dry wells and piping has been installed and tested per CDs.			
I	**OCC FIBER OPTIC COMMUNICATIONS INFRASTUCTURE and DEVICES:**			
1	Fiber distribution panel and fiber optic cable connection from the backbone-to-OCC have been installed, tested, and certified per CDs.			
2	Connection from the backbone-to-OCC has been installed per CDs: - Fiber optic manhole splices per CDs. - Pull boxes - Conduit, including empty spares - Termination in the patch panel has been completed - Tone wire, (not installed in Tolls' spare conduit) - Warning tape - Standard route markers have been installed per Standard Specification 630 - Each FOC lateral has a minimum of (1) one standard route marker at the midpoint and (1) one at each turn (3 minimum)			
J	**RFIs and Shop Drawings:**			
1	All RFIs have been answered and accepted.			
2	All shop drawings have been submitted, accepted, and closed out.			
3	All CEI submittals as per CDs have been received and accepted.			
P	**DATE OF TOLL SITE DEPARTMENT FINAL ACCEPTANCE:**			
1	Document date of acceptance.			

TECHNICAL SPECIAL PROVISION

FOR

TOLL SITE DRY WELL AND ACCESSORIES AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T737
TOLL SITE DRY WELL AND ACCESSORIES AT RTC TOLL SITES

T737-1 Description.

Furnish and install the condensate drainage and refrigerant piping systems complete with all supports, hangers, specialties, and accessories as shown on Plans and herein specified.

T737-2 Materials.

T737-2.1 General: Provide new materials free from defects and of American manufacture, and clearly marked with manufacturer's name and weight, classification, or working pressure of pipe and fitting.

T737-2.2 Pipe:

The following schedule covers the materials which shall be furnished and installed unless otherwise specified under the system section:

Materials	Service
PVC non-pressure pipe in accordance with Section 948	Condensate Piping
Precast Concrete Pipe Class IV in accordance with Section 449	Precast Concrete Pipe (for Dry Well)

T737-2.3 Pipe Fittings:

1. All PVC socket type connections shall be made with PVC solvent cement complying with ASTM D 2564.

2. Air Gap Fitting: Coated cast iron air gap fitting with integral cast air ports, female threaded inlet and outlet.

T737-2.4 Pipe Hangers and Supports: Provide hangers and supports for the different applications as follows:

1. Plumber's strap shall not be used.

2. Pipe Saddles: 18 gauge galvanized iron, 12 inches long (min.) installed at all points where insulated lines bear on hangers.

3. Supports shall be generally capable of maintaining the installed load plus 500 lb. Support copper tubing at 6-foot (max.) intervals horizontally. Support PVC piping every 4 feet.

T737-2.5 Pipe Sleeves for Toll Equipment Buildings:

1. Interior: Galvanized sheet metal, 22 gauge. Provide for pipe passing through walls or floors before pouring concrete. Plastic sleeves are permitted.

2. All sleeves shall be large enough to allow full thickness of insulation through sleeves for insulated piping, and for two layers of 30 lb. felt wrapping around un-insulated piping.

T737-2.6 Condensate Dry Well: Provide precast concrete pipe for dry well, with the bell end supporting a H-20 traffic rated manhole cover and frame as shown on the Plans.

T737-3 Submittals and Shop Drawings.

Submit manufacturer's technical data sheets and shop drawings for approval on all pipe, fittings, valves, hangers and supports, sleeves and specialties as listed in this Technical Special Provision before any work is commenced. Submit plumbing and piping erection drawings.

T737-4 Construction Requirements.

T737-4.1 General: The Plans are generally diagrammatic. They do not show every bend, offset, elbow or other fittings which may be required in the piping for installation in the space allotted. Careful coordination of the work of this Technical Special Provision with that of other Divisions is necessary to avoid conflicts.

Line and Grade: Install gravity lines at uniform grade to low point after field verification of low point invert.

T737-4.2 Delivery, Storage, and Handling:

1. Provide factory-applied plastic endcaps on each length of pipe and tube. Maintain endcaps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.

2. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.

3. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

T737-4.3 Pipe Sleeves:

1. Place all sleeves for piping prior to the pouring of concrete or in time to set in place as masonry walls are erected.

2. After piping is installed through the sleeves, complete with insulation or wrapping, the sleeves shall be sealed water-tight with an approved mastic or caulking compound.

T737-4.4 Jointing Pipe:

1. Provide nipples of same material and weight as pipe used. Part of standard weight nipples is less than 1-1/2 inches.

2. Provide reducing fittings where changes in pipe sizes occur.

3. Provide unions or flanges in all service lines at each piece of equipment, specialty, valves or at other locations required for ready disconnect.

4. Provide all necessary drain piping from the low point of each of the systems, and other miscellaneous piping required by the various systems to make a complete installation. Drains shall not be smaller than connection at equipment and no drain shall be smaller than 3/4 inch.

T737-4.5 PVC Pipe:

1. Remove all burrs from cut ends of PVC piping with knife, deburring tool or file.

2. Visually inspect the inside of pipe and fitting sockets and remove all dirt, grease or moisture with chemical cleaner and wipe clean with cloth prior to application of solvent.

3. All thermoplastic pipe installed underground shall be installed in accordance with ASTM D2321.

T737-4.6 Pipe Hangers and Supports:

1. Provide brackets, rolls, clamps and supplementary steel as required for proper support of pipelines. Design hangers to allow for expansion and contraction of pipelines and of adequate size to permit covering to run continuously through hangers. Support piping at equipment independently so that no weight will be supported by equipment. Coordinate location of hangers with light fixtures. Wire brush all steel or iron supports and prepare surfaces under this Technical Special Provision for painting.

2. Special Supports: All clamps, hangers and supports required by equipment manufacturers, shall be furnished and installed as per their recommendations.

3. Plumber's tape, straps, chain, wire hangers, or perforated bar must not be allowed as a means for hanging pipe.

T737-4.7 Equipment Connections:

1. Make connections between equipment and the piping systems as shown and specified.

2. Make connections between any piece of equipment and any piping system by means of unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance.

T737-4.8 Condensate Dry Well:

1. Field coordinate with civil site and grading plans, utility plans, and all other trades for the exact location of the condensate dry well.

2. Do not locate dry well in the direct path of the site conduits.

T737-5 Method of Measurement.

Toll site dry well and associated condensate piping will include furnishing, placement, and testing of all materials, equipment, and for all tools, labor, equipment, hardware, supplies, parts, support, shop drawings, manuals, warranty documentation, and demonstrations. Also include all acceptance procedures and incidentals necessary to complete the work.

The work specified in this Technical Special Provision will not be measured separately, but will be included in the pay item for the Outdoor Communications Cabinet.

T737-6 Basis of Payment.

The work specified in this Technical Special Provision will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

FIRE EXTINGUISHERS AND ACCESSORIES AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T738
FIRE EXTINGUISHERS AND ACCESSORIES AT RTC TOLL SITES

T738-1 Description.

Furnish all labor, materials, services, testing, and equipment necessary to provide and install fire extinguishers with associated mounting accessories at Toll Facilities in accordance with the Plans and Specifications.

T738-2 Materials.

T738-2.1 Standards: Fire extinguishers and accessories must meet the following applicable industry standards:

1. National Fire Protection Association (NFPA): NFPA 10 - Portable Fire Extinguishers.
2. All fire extinguishers shall be Underwriters' Laboratories (UL) approved and labeled or by other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7 to provide procurement flexibility.

Furnish and install a multi-purpose, dry chemical stored pressure type UL listed fire extinguisher with the following material characteristics:



Furnish and install wall bracket-mounted fire extinguishers where indicated on the Plans. Furnish and install weatherproof surface mounted fire extinguisher cabinets at locations indicated on the Plans in accordance with the following:

1. Size: To suit type of unit being housed.
2. Frame Finish: Metal trim.
3. Door: Metal trim with 1/4-inch clear acrylic or tempered safety glass.
4. Signage: Identify extinguisher cabinets with manufacturer's standard red lettering applied to cabinet door, spelling "FIRE EXTINGUISHER".

T738-3 Submittals and Shop Drawings.

Submit manufacturer's technical data indicating compliance with the requirements and installation instructions for fire extinguishers, weatherproof cabinets, and accessories. Submit attachment details for exterior wall mounted, interior wall mounted and power distribution frame mounted fire extinguishers.

T738-4 Quality Assurance.

Provide new UL-listed fire extinguishers bearing UL "Listing Mark" for type, rating, and classification of extinguishers indicated. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

T738-5 Construction Requirements.

Verify servicing, charging, and tagging of all fire extinguishers. Install the fire extinguishers and mounting accessories in strict accordance with the original design, approved shop drawings, NFPA 10, and requirements of agencies having jurisdiction, anchoring all components firmly into position.

T738-6 Method of Measurement.

The work specified in this Technical Special Provision will not be measured separately, but will be included in the pay item for Panelboards.

T738-7 Basis of Payment.

The work specified in this Technical Special Provision will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

GENERAL REQUIREMENTS FOR TOLL SITE FACILITIES' ELECTRICAL INFRASTRUCTURE AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T740
GENERAL REQUIREMENTS FOR TOLL FACILITIES'
ELECTRICAL INFRASTRUCTURE AT RTC TOLL SITES

T740-1 Description.

This Technical Special Provision includes general electrical requirements specifically applicable to toll site infrastructure.

T740-2 Materials.

1. All electrical equipment and materials used on this project shall be fully rated and new (not used or reconditioned). Electrical equipment and machinery shall be of the most current designs and models.

2. Unless otherwise noted, all material shall be listed / labeled by UL or another National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

3. Where multiple items of the same equipment or materials are required, furnish and install products of the same Manufacturer.

4. Material and equipment shall be provided complete and shall function up to the specified capacity or function. Should any material or equipment, as a part or as a whole, fail to meet the performance requirements, the material or equipment shall be replaced or repaired to bring the performance up to the specified requirements. Damages to the finish or the paint by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Department.

5. Where tamperproof screws are specified or required, Phillips head or Allen head screws are not acceptable as tamperproof. For each size or type used, provide the Department with three tools. If existing tamper proof equipment exists on the job site, the screw heads shall match the existing.

T740-3 Standards.

Systems, equipment, materials, and accessories that are assembled or installed in a toll equipment building (TEB) shall comply with the following:

1. Florida Building Code, Current Edition in effect.

2. Florida Fire Prevention Code and the publications as referenced in NFPA 1 – Uniform Fire Code (the Current Edition in effect) and NFPA 101 – Life Safety Code (the Current Edition in effect).

T740-4 Submittals and Shop Drawings.

T740-4.1 Submittals and Shop Drawings:

1. Submit specific shop drawings which indicate the fabrication, assembly, installation, and erection of systems' components. Drawings that are part of the Plans shall not be considered a substitute for required shop drawings.

2. The Plans describe specific sizes for the electrical systems' basis of design. These sizes are based on specific items of power consuming equipment (lights, motors for fans, etc.). Coordinate the requirements of each load with each load's actual nameplate data and manufacturer's published electrical criteria.

3. Coordinate with the approved shop drawings from all required disciplines and verify final electrical characteristics before roughing in the power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in the Plans, make adjustments to the wiring, disconnects, and branch circuit protection to match the installed equipment's requirements.

4. Submit a detailed site conduit drawing at a scale of 1" = 20' prior to the start of Work. Prepare a separate set of drawings for each toll site and show the site-specific name in the title block. Show routing of each conduit from origin to termination point. Coordinate the exact location of conduit stub-ups within the available working spaces.

5. Provide the following:

a. Show locations of conduits, racking, junction boxes, panelboards, safety switches, receptacles, light switches, control panels, UPS units, bypass switches, and surge protection devices,.

b. Submit detailed conduit routing drawings at a scale of ¼" = 1' for the enlarged site plan prior to the start of Work. Prepare a separate set of drawings for each toll site and show the site-specific name in the title block. Show conduit stub-ups under the OCC Cabinet and RTC Cabinets. Show routing of each conduit from origin to termination point. Coordinate the exact location of conduit stub-ups with the available working spaces.

c. Submit an arc flash hazard analysis, in accordance with the latest version of the Standard for Electrical Safety in the Workplace, NFPA 70E. An arc flash hazard analysis determines the arc flash protection boundary and the personal protection equipment (PPE) that people within the arc flash boundary must use. Field install arc flash and shock warning labels on each piece of new electrical distribution equipment such as panelboards, safety switches, motor control centers, and automatic transfer switches. The labels must indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions.

T740-4.2 As-Built Documents: In the As-Built documents, show all components including but not limited to:

1. Raceways 3/4" and above, cable tray systems, including dimensions from fixed lines such as slab edges
2. Site underground raceways and duct banks
3. Pull boxes and manholes including elevations
4. Lighting
5. Junction boxes 6"x6" and larger must be shown in exact location
6. Any combining of circuits (which is only allowed by specific permission) or change in homerun outlet box must be indicated
7. Circuit number changes
8. Conductors and cables, cable sizes, raceway sizes, etc.
9. Panelboard changes, including load changes
10. Location of lighting control devices such as photocell controls, switches, etc.
11. Wireway and cable tray systems
12. Exact location of driven grounding electrodes
13. Locations of grounding and lightning protection ground loops
14. SCADA system control panels and associated electrical devices, connections, and power supplies as depicted on the Toll Facility Plans
15. Riser diagrams exactly as installed

16. Panelboards, equipment racks, disconnects, and switches and surge-protective devices

17. Update the Toll Facility Plan notes to match with items actually furnished, actual installation methods, etc.

T740-5 Warranty.

1. The warranty will cover the materials and workmanship required to complete the project. The warranty shall be provided by the Contractor to the Department and shall include labor and materials for a minimum period of one year from date of Final Acceptance of the total Contract unless extended by the Contractor's proposal.

2. Where extended warranties or guarantees are called for herein, furnish three copies to be inserted in the Operation and Maintenance Manuals.

3. All preventative maintenance and normal service will be performed by the Department's maintenance personnel after Final Acceptance. This shall not alter the Contractor's one year warranty or the manufacturer's warranty of the installed equipment.

T740-6 Construction Requirements.

T740-6.1 General:

1. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. Provide all items to form a complete and operating system.

2. Electrical distribution systems for toll facilities must be selectively coordinated systems. The protective features of the electrical distribution system will automatically and selectively isolate a faulted or overloaded circuit from the remainder of the electrical system. Only the closest protective device to the fault will operate to isolate the fault without affecting other parts of the system.

3. Obtain all new physical addresses that may be required for the initiation of new electric and/or communication services and pay any required costs and fees. Coordinate and verify power company service requirements prior to material procurement and installation of service equipment.

4. Occupied buildings must remain in operation while the new work is being performed. Schedule work for a minimum outage to the Department. Reroute existing conduit and wiring in areas under construction such that the building systems remain active and useable for the building occupants. Notify the Engineer and facility manager 48 hours before any shut-down of existing systems.

5. Coordinate with the Contractor for construction phasing. Renovation projects require the existing electrical systems to remain operational while the renovation work takes place.

6. Verify that the physical dimensions of the equipment will allow for proper installation in the space allotted on the drawings and with NEC working clearances.

7. Verify finish dimensions at the project site in preference to using dimensions noted on the Plans.

8. Electrical equipment shall be protected from the weather during shipment, storage, and construction per the manufacturer's recommendations. Should any equipment be subjected to damage by water, it shall be replaced without additional cost to the Department.

9. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair the

damaged equipment (in compliance with industry standards) at no additional cost to the Department. Any equipment and/or testing required for the repairs shall be provided by the Contractor.

T740-6.2 Supervision of the Work:

1. A qualified and experienced electrical superintendent shall be in charge of the work in progress at all times. If, in the judgment of the Department's representative, the electrical superintendent is not performing duties satisfactorily, the General Contractor shall immediately replace him upon receipt of a letter of request from the Department. Once a satisfactory electrical superintendent has been assigned to the work, he shall not be withdrawn by the Electrical Contractor without the written consent from the Department.

2. Provide field superintendent(s) who have a minimum of four years previous successful experience on projects of comparable sizes and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected.

T740-6.3 Coordination: Provide the labor and materials required to electrically connect all the items and equipment served by the power distribution systems in the toll facilities and tolling gantries that are identified in the Contract Documents. Include all required coordination and supervision where work connects to or is affected by the work of others.

T740-6.4 Provision for Openings: Perform the following for all toll equipment buildings depicted on the Toll Facility Plans.

1. Locate openings required for work. Provide sleeves, guards or other approved methods to allow passage of items installed.

2. Coordinate with roofing Contractor on installation of electrical items which penetrate the roof or are mounted on the roof. Roof penetrations shall be installed so as to not void the roof warranty.

3. Where work pierces any waterproofing, it shall maintain the integrity of the waterproofing. Coordinate the work which pierces the waterproof barrier with the General Contractor.

4. Coordinate with Fabricated Structures Manufacturer on installation of electrical items which penetrate the Toll Equipment Building floor, walls and ceiling.

5. Field verify all conduits installation penetrating the foundation to ensure that conduit layout is completed prior to the foundation pour.

T740-6.5 Concrete Pads: Furnish and install reinforced concrete pads for transformers. Unless otherwise noted, pads shall be four (4) inches high and shall exceed the dimensions of the equipment being set on them, including future sections, by six (6) inches on each side. The concrete pads will be reinforced with 6x6-W1.4xW1.4 welded wire mesh. Trowel all surfaces smooth.

T740-6.6 Cutting and Patching:

1. Provide cutting and patching necessary for the installation of electrical infrastructure.

2. Materials impacted by cutting and patching must be refinished to match specified finish.

3. Schedule work to avoid as much cutting and patching as practical.

T740-6.7 Trenching and Backfilling:

1. Place backfill at new grades to match adjacent undisturbed surface.

2. See Section 120 of the Specifications for trenching, backfilling, and compaction requirements.

3. Comply with OSHA Standard 29 C.F.R.s. 1926. 650 Subpart P for trench excavation.

T740-6.8 Delivery, Handling, Protection of Materials, and Storage:

1. Ship, deliver, and store products in the manufacturer's protective packing to prevent damage.
2. Handle equipment carefully to prevent damage to components, breakage and denting or scoring of surfaces and finishes.
3. Store all equipment and products in clean, dry spaces. Protect all equipment from dirt, fumes, water, chemicals, construction debris and physical damage. Any equipment exposed directly to moisture will not be acceptable and shall be replaced.
4. Replace damaged products and equipment. Repair and repaint marred and damaged finishes to original factory finish as directed by manufacturer and as specified.
5. Keep all conduits and other openings protected against entry of foreign matter.

T740-6.9 Installation: Install / use in accordance with any instructions included in the listing or labeling. Furnish and install supports and anchorage of electrical equipment.

T740-6.10 Waste Materials Disposal: Comply fully with Florida Statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal.

T740-7 Shop Drawings Processes.

T740-7.1 Description: Shop drawing submittals - List the project title and the Contractor information on the first sheet of each shop drawing. Include the site-specific name of the building or site, the subcontractors, Engineers, contact names, and telephone numbers.

1. Submit a shop drawing that includes Specification sheets, catalog sheets, schematics, manuals, etc. for each separately numbered Specification Section in the Index of the Technical Special Provisions (TSP). If the project will not use any products from a TSP Section, then submit the shop drawing with a note indicating "No products or materials from this TSP Section will be installed on this project."
2. The following shop drawing sections must be compatible and operate together as a system when depicted on the Toll Facility Plans:
   a. Dual AC Control System and Sequence of Operation
   b. Ductless Split System Air Conditioners
   c. Fuel Oil Piping for TEB sites only
   d. Concrete Protected Above Ground Fuel Storage Tank for TEB sites only
   e. Supervisory Control and Data Acquisition
   f. Panelboards
   g. Emergency Generator
   h. Static Uninterruptible Power Supply
   i. Automatic Transfer Switch
   j. Service Entrance Automatic Transfer Switch for RTC sites with on-site-power

3. The following shop drawing sections must be compatible and must be coordinated for installation of the electrical conduits entering toll equipment buildings when depicted on the Toll Facility Plans:

a. Fabricated Structures

b. Common Work Results for Electrical

4. Submittal product data shall be presented in a clear and thorough manner. Clearly mark each sheet to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete or cross out non-pertinent data. Markings shall be made with arrows, circles or underlining. Highlighting is not acceptable.

5. Partial shop drawings for a TSP Section are not acceptable and will not be reviewed. Ensure each shop drawing submittal is complete and includes all the products, materials, manuals, etc. specified in the particular TSP Section.

6. Drawings, riser diagrams, wiring diagrams, and schematic diagrams shall include identification of the project name, and the specific site name when multiple sites are included in the same project.

7. Product Data: Technical product data is required for all items as called for in the specifications regardless if item furnished is as specified.

a. Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.

b. In order to facilitate review of product data, they shall be clearly annotated, indicating by cross reference the Contract drawings, note, and/or Specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the Contract Documents. Identify product data as to the item and/or location (i.e. "surge suppression switchboard MDP").

c. See specific sections of the Specifications for further requirements.

d. Re-Submit any technical data or shop drawing rejected by the Engineer of Record or the Department.

T740-8 Substitutions.

T740-8.1 Description: General, administrative and procedural requirements for substitutions of products specified in the toll site electrical, communications, and safety and security infrastructure TSP sections including toll equipment building TSP subsections where applicable.

T740-8.1.1 Definitions:

Substitutions: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:

1. Is not the specified manufacturer and/or model.

2. Accomplishes the same result as the specified product / basis of design product but requires more space and / or power.

3. Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.

4. Affects the project schedule or cost.

T740-8.1.2 Permitted Substitute Equipment or Products (with "or equal"):

Substitutions are permitted for manufactured items or equipment identified by part numbers or catalog numbers items specifically identified with the tag "or equal". Substitutions must conform to the following:

1. Substituted item is equal or superior to specified product in all aspects.
2. Substitutions will be provided at no additional cost to the Department.
3. Warranties for the substitution must be equal to or greater than the warranties specified.
4. Submit shop drawings and applicable calculations for the substituted item and all system and layout impacts, to the Engineer of Record for review. The shop drawings and applicable calculations must be signed and sealed by the Specialty Engineer or the Contractor's Engineer of Record. Submit in accordance with the requirements of 5-1.4.1 through 5-1.4.3, as appropriate.
5. Provide substituted item, equipment, product etc. and all changes to product, design, layout including the effort required to develop shop drawings and calculations at no additional cost to the Department.
6. Warranties for the substitution must be equal to or better than the warranties specified.
7. Substitutions must have the same space/layout profile and must not require changes to other design systems and / or their functionality. When the substituted item does not meet this criterion, the substitution will need to conform to the additional requirements below.

T740-8.1.3 Permitted Substitute Equipment or Products (without "or equal"):

Substitutes proposed for an item, equipment, product, etc. that has not been identified with a tag "or equal" must at a minimum conform to the following additional criteria:

1. Substituted item must be equal or superior to specified product in all aspects.
2. Provide analysis of systems and layouts that may be affected by the substitution. Provide shop drawings, manufacturer's catalog cuts and operating instructions, calculations to demonstrate that the toll site and all associated systems continue to function at or a better level compared to the basis of design.

If a new request for substitution is submitted for an item that impacts previously approved requests for submission for any reason, the Department will require that the new and/or previously approved requests / documentation be re-submitted.

T740-8.2 Request for Substitution:

T740-8.2.1 Representation: In submitting a substitute item, equipment, product, etc. that has not been listed on Contract drawings, in Contract Documents or in an addendum, verify / perform the following:

1. Substituted item is equal or superior to specified product in all aspects.
2. Coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
3. Waive all Claims for additional costs related to substitution which may subsequently become apparent.

4. Provide the same warranties for the substitution as for the product specified.

5. Absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, mechanical, structural, architectural, civil, etc.

6. Absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting Contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or mis-sized equipment. In the event of additional engineering costs the billing structure shall be agreed upon prior to review by all involved parties.

7. Absorb any costs related to impacts to the project schedule or cost as a result of the use of the substituted item.

T740-8.2.2 Submittals: Submit separate requests for substitutions for each individual product, material, equipment, etc. that is defined as a substitution.

The submittal must consist of a dated written request for substitution as required below. The request must be very specific as to what specified item the request for substitution is submitted for.

Include the following in each request for substitution submittal:

1. Name of product, material, equipment, process etc. to be substituted.

2. Drawings, product data, calculations signed and sealed by a Professional Engineer licensed in the State of Florida, performance data and/or other information necessary for the Engineer to determine that the equipment meets all Specifications and requirements.

3. Compliance statement. Each request for substitution shall include the following compliance statement typed on letterhead of submitting company:

a. Submittal complies with all aspects/requirements of Contract Documents: (Yes/No) If No, state deviances.

b. Submittal complies with all applicable codes: (Yes/No) If No, state deviances.

c. Submittal does not require change to any other element of the work: (Yes/No) If No, state required change.

d. Meets or exceeds the performance of specified product: (Yes/No) If No, state required change.

e. Affects project schedule: (Yes/No) If Yes, quantify impact.

T740-8.3 Consideration and Acceptance: The Engineer's decision on acceptance or rejection of substitutions will be final.

Substitutions will be considered on basis of design, concept of work, and overall conformance with information given in Contract Documents, including but not limited to:

1. Design criteria, which shall be equal or superior to the specified item.

2. Finishes, which shall be identical or superior to finishes of specified product.

3. Lenses or louvers, which shall be identical size, thickness and type material specified.

4. Physical size and dimension which are identical or within design criteria limitations.

5. Photometric data, which shall be identical or superior in quantity and quality.

6. Trim detail, electrical, and mechanical qualities, shall be identical or within design criteria limitations as determined by the Engineer.

Approval of a substituted item or listing a substituted item as an approved substitution does not modify or act as a waiver in any way, of the requirements of the Contract Documents.

T740-9 Method of Measurement.

The work specified in this Section will not be measured separately and will be included in the pay items for the OCC, Panelboards and Generator at RTC Sites for each pay item's associated electrical work.

T740-10 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES FOR RTC SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

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SECTION T741A
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS
AND CABLES FOR RTC SITES

T741A-1 Description.

Furnish and install electrical power conductors (wire), cable, wiring connectors, and connections, as shown in the Plans.

T741A-2 Coordination.

Schedule and arrange electrical work in a neat, well-organized manner without interference with the work scheduling of other trades.

1. Coordinate Work with other trades.
2. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.
3. Determine required separation between cable and other work.
4. Determine cable routing to avoid interference with other work.

T741A-3 Materials.

T741A-3.1 Toll Site Project Conditions: Conductor sizes on the Plans are based on copper.

Electrical power conductors 10 AWG and smaller may be spliced in order to construct longer circuits. Electrical power conductors 8 AWG and larger may not be spliced.

The current carrying capacity of electrical power conductors shall be determined using the tables in NEC Article 310. Calculating the current carrying capacity of conductors by assuming a lower ambient temperature than the one shown in the header of the Ampacity table(s) in Article 310 is not permissible, unless the lower ambient temperature is written and described in the Contract Documents.

Aluminum wiring is not permitted.

Ensure all sizes are given in American Wire Gauge (AWG) or in thousand circular mils (kcmil).

Conductors shall be marked with color codes as described in this Section.

T741A-3.2 Conductors: Install THHN/THWN insulated copper conductors rated for 600 Volts, with PVC insulation, and a nylon thermoplastic outer jacket. Ensure the solid or stranded conductors are made of annealed copper and rated for 90°C in dry locations, and 75°C for wet or below grade locations. Ensure the conductors are UL 83 Listed and are suitable for use in residential, commercial, and industrial environments. All systems and low voltage conductors shall be stranded conductors.

Install XHHW or XHHW-2 insulated copper conductors rated 600 Volts, with XLPE insulation to protect the conductor against high temperatures and wet locations. Ensure the solid or stranded conductors are made of annealed copper and rated for 90°C in dry locations, and 75°C for wet or below grade locations. Ensure the conductors are UL 44 Listed and are suitable for use in residential, commercial, and industrial environments.

Type TC Multiconductor Power and Control Tray Cable.

a. The individual conductors shall be stranded copper with XHHW-2 insulation.

b. The overall cable jacket will consist of a flame retardant, moisture

resistant, and sunlight resistant PVC covering.

c. The cable shall be listed for installation indoors, outdoors, in cable trays, raceways, and for direct burial in the ground.

d. Type TC cable may be installed as open wiring in lengths not to exceed fifty feet between the cable tray and the device or equipment served. Open wiring shall be secured and supported at intervals less than six feet.

e. Type TC Cables with three individual conductors sized between 12 AWG and 10 AWG shall be constructed with a green colored grounding conductor, a white neutral conductor, and a black phase conductor.

f. Type TC Cables with four individual conductors sized between 12 AWG and 10 AWG shall be constructed with a green colored grounding conductor, a white neutral conductor, a black phase conductor, and a red phase conductor.

T741A-3.3 Wiring Connectors: Install fully insulated mechanical connectors, UL 486B Listed, and rated for 600 Volts maximum for 8 AWG and larger conductors in dry locations.

Install PVC insulated spring pressure cable connectors (wire nuts), UL 486C Listed, and rated 600 Volts maximum for 10 AWG and smaller conductors in dry locations.

Electrical conductor splices and/or taps below grade level are not acceptable for non-emergencies. For emergency conductor repairs below grade, install wrap-around UF splice kits with splice closure sleeves filled with sealing gel that entirely encapsulates the mechanical connector to seal out moisture. The underground splice kit shall be qualified to ANSI C119.1 for underground splicing and shall be rated for use on 600 Volt connections.

Communications cables, coaxial cables, and Ethernet cables shall be installed in continuous lengths and shall not be spliced in the field.

T741A-4 Submittals.

Meet the requirements of Section 5 of the Specifications for any required submittals. Provide submittals to the Engineer for review by the Department in accordance with Section 5 of the Specifications and the Contract Documents.

Submit data sheets and catalog sheets describing each type of conductor, connector, splicing material, and terminal lug that will be installed on the project.

Include descriptive names for the conductors that indicate the system or equipment they serve. i.e. “generator feeders”, “service entrance conductors”.

T741A-5 Qualifications.

Manufacturer must specialize in manufacturing products specified in this Section with minimum five years’ experience.

T741A-6 Construction Requirements.

T741A-6.1 Examination:

Examine the Contract Documents and the site of the proposed work carefully before starting work.

Verify that interior of any cabinets are protected from weather.

Verify that mechanical work likely to damage wire and cable has been completed.

Verify that raceway installation is complete and supported.

Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final approved submittal for equipment to assure proper number and size of the conductors. (As for multiple speed motors, different motor starter arrangements,

etc.).

T741A-6.2 Preparation: Completely and thoroughly swab raceway before installing wire.

T741A-6.3 General: Install products in accordance with manufacturer's instructions.

Route wire and cable as required to meet the Project Conditions.

Install cable in accordance with the NECA "Standard of Installation".

Use solid conductor wire for feeders and branch circuits 10 AWG and smaller and use stranded conductors for #8 AWG and larger. Bonding grounding conductor can be solid copper. All systems and low voltage conductors shall be stranded conductors.

Use conductors 12 AWG or larger for power and lighting circuits.

Increase branch conductor sizes as required to maintain a branch circuit voltage drop of less than 3% to the load served when the branch circuit is operating at full rated load.

Ensure all 120V, 20A circuit homeruns over 50ft. are #10 cu. minimum unless noted otherwise.

Ensure all 120V, 20A circuit homeruns over 150ft. are #8 cu. minimum, unless noted otherwise.

Pull all conductors into the raceway at the same time. Do not exceed the manufacturer’s recommended pulling tensions.

a. Do not pull wire until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.

b. Ensure the minimum bending radius of insulated wires or cables is not less than the minimum recommended by the manufacturer or the NEC.

c. Where coaxial or fiber optic conductors are installed, special requirements apply as outlined under that specific system detail specifications.

Use suitable wire pulling lubricant for wire. Ensure compound or lubricant does not cause the conductor or insulation to deteriorate.

Neatly train and lace wiring inside boxes, equipment, and panel boards.

Ensure conductor sizes indicated on circuit homeruns or in schedules are installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.

T741A-6.4 Vertical Risers: Provide vertical cable riser supports that are spaced per NEC 300.

T741A-6.5 Control and Signal Circuits:

1. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, THWN/THHN.

2. For control and signal circuits 50 VAC and below, conductors, at the Contractor’s option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the contract documents.

3. All control and signal circuit conductors shall be stranded copper conductors.

T741A-6.6 Taps/Splices/Connectors/Terminations:

1. Clean conductor surfaces before installing lugs and connectors.

2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3. Conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wire ways, junction boxes, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices. No splices shall be made

in in-ground pull boxes (without written approval of engineer).

4. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pull boxes at proper vertical spacing.

5. A calibrated torque wrench shall be used for all bolt tightening.

6. Clean conductor surfaces with a wire brush before installing lugs and connectors.

7. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

T741A-6.7 Field Quality Control:

1. Perform inspections and tests listed in the NETA ATS, Section 7.3

2. Perform an Insulation Resistance test – documenting the results using the Conductor Insulation Resistance template on all power system conductors larger than 10 AWG. Turn over written test results to the CEI within 48 hours of completing the test. Turn over written test results to the CEI within 48 hours of completing the test. A copy of the Conductor Insulation Resistance template may be obtained from the Engineer at the pre-construction conference.

T741A-7 Color Coding.

All feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for the system throughout the toll site. Feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

Unless otherwise approved, or to match the existing, the color-codes must be as follows:

T741A-7.1 Utility or Generator Power:

120/240 Volt, 1 phase, 3 wire

a. Line 1 = black
b. Line 2 = red
c. Neutral = white
d. Equip Ground = green

T741A-7.2 UPS Power / Clean Power:

120/240 Volt, 1 phase, 3 wire

a. Line 1 = black
b. Line 2 = red
c. Neutral = white with yellow stripe
d. Equip ground = green with yellow stripe

T741A-8 Method of Measurement.

The quantity to be paid for will be the Plan quantity of each conductor and cable, in feet, completed and accepted. Measurement will be based on the overall length of each conductor between pull boxes, equipment, equipment cabinets, and terminal devices. Add 10 feet of slack for each pull point and terminal device.

Do not include length of conductors or cables on the toll gantry; they are incidental to the gantry.

Do not include length of conductors or cables inside toll site cabinets; they are incidental to those items.

T741A-9 Basis of Payment.

Prices and payments will be full compensation for all work specified in this Section, including all materials, equipment and tests.

Payment will be made under:

Item No. 639-7-114	Electrical Power Service, Toll Facility Conductors and Cables, No. 10 And Smaller - per foot
Item No. 639-7-115	Electrical Power Service, Toll Facility Conductors and Cables, No. 8 to No. 6 - per foot
Item No. 639-7-116	Electrical Power Service, Toll Facility Conductors and Cables, No. 4 to No. 2 - per foot
Item No. 639-7-117	Electrical Power Service, Toll Facility and Cables, No. 1 to No. 1/0 - per foot
Item No. 639-7-118	Electrical Power Service, Toll Facility Conductors and Cables, No. 2/0 to No. 3/0 - per foot
Item No. 639-7-121	Electrical Power Service, Toll Facility Conductors and Cables, 350KCMIL to 400 KCMIL - per foot

TECHNICAL SPECIAL PROVISION

FOR

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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Date: _____
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City, State, Zip Code: _____

SECTION T741B
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
AT RTC TOLL SITES

T741B-1 Description.

Furnish and install Grounding and Bonding for Electrical Systems at RTC Toll Sites in accordance with the details shown in in the Plans. Furnish all labor, materials, services, testing, and equipment necessary to provide and install Grounding and Bonding for Electrical Systems at each toll site including the following elements:

1. Grounding electrodes and grounding electrode conductors.
2. Inspection wells.
3. Equipment grounding conductors.

T741B-2 Materials.

T741B-2.1 Grounding System Description:

1. Bond together the following items to form the grounding system for the power distribution system.

a. Concrete-encased electrode consisting of 20 feet of #4 AWG copper minimum size, bare copper conductor imbedded in a building footer or equipment slab and terminated at the neutral bar at the first service disconnecting means. Ensure this grounding electrode conductor is continuous and not spliced.

b. A continuous and un-spliced main bonding jumper shall connect the equipment ground bar and the metal service entrance disconnect enclosure to the neutral bus bar.

c. Rod electrodes – Copper clad steel rods, 5/8-inch diameter, and UL Listed. A minimum of two rods are required for each electrical service.

d. Couplings or connectors used to join multiple ground rods together shall be of the threaded type.

e. The lightning protection system ground ring in accordance with NFPA 780.

T741B-2.2 Rod Electrodes:

1. Material: Copper-clad steel, sectional with threaded couplings
2. Diameter: 5/8 inch
3. Length: 20 feet total length

T741B-2.3 Exothermic Connections: Use exothermic welding to bond the grounding electrode conductors to the ground rods.

T741B-2.4 Grounding Conductors:

1. Material: Stranded or solid copper
2. Grounding Electrode Conductor: Sized to meet NFPA 70 requirements.

T741B-2.5 Grounding Inspection Wells:

1. Within non-paved areas, install non-traffic rated ground rod access wells that are manufactured from 20,000 PSI high density polymer concrete and meet ASTM C-857 specifications with a minimum size of 12” x 12” x 12”. Install a high-density polymer concrete cover for each access well.

2. Install traffic rated ground access wells in paved areas and on roads or shoulders. The access wells shall be traffic rated H-20 with 10 inch diameter cast iron top and cast iron cover, with 12 inch minimum cast iron riser.

T741B-2.6 Performance Requirements:

1. Grounding Rod Resistance: Use the fall of potential three-point method and test each ground rod individually before connecting it to the system. Ensure the maximum resistance to ground (earth) does not exceed 25 Ohms. If a ground rod measures greater than 25 Ohms to ground then a second ground rod should be installed nearby, but not closer than the depth of the 1st rod, and then bond the two rods together with a direct buried conductor. Turn over the test reports to the Engineer within 1 week of performing the test.

2. The resistance to ground should be consistent between the ground rods. Any rod that measures more than 20% different than the surrounding rods should be investigated.

3. After bonding all the power system grounding components together, use the "Clamp on Method" to measure the resistance to ground of the completed system. Ensure the maximum resistance to ground (earth) does not exceed 5 Ohms. Drive additional ground rods if necessary to meet the requirements. Promptly turn over the test reports to the Engineer.

T741B-3 Submittals.

1. Product Data: Submit data sheets for all grounding electrodes, clamps, bonding straps, ground bars, exothermic welding products, and inspection wells.

2. Submit a site specific One-Line Grounding Plan that indicates all grounding electrode conductor connection points and grounding conductor sizes at the service disconnect, automatic transfer switch (ATS), back-up generator, and the uninterruptable power supply (UPS) when depicted on the Toll Facility component plans.

3. Show the locations of the grounding system inspection wells on the Electrical Site Plan. Inspection wells in paved areas will be "traffic rated" H-20.

T741B-4 Qualifications.

1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years of experience.

T741B-5 Construction Requirements.

T741B-5.1 Examination:

1. Verify existing conditions prior to beginning the work.

2. Verify that final backfill and compaction has been completed before driving rod electrodes.

T741B-5.2 Installation:

1. Install rod electrodes at locations indicated on the plans. The service entrance ground rod electrodes shall consist of two 20 ft driven rods spaced 20 feet apart or more.

2. Provide a grounding inspection well at each driven rod location in the power distribution system (not for lightning protection system). The top of the inspection well will be flush with the finished grade.

3. A main bonding jumper shall connect the neutral bus to the ground bus at the first service disconnect.

4. The main grounding electrode conductor shall be installed in one continuous length and shall not be spliced or broken at any point until it terminates at the neutral bus within the first service disconnecting means.

5. Provide bonding to meet NFPA 70 and Regulatory Requirements (i.e., metal duct work, metal piping, gas piping etc.).

6. Bond together metal siding not attached to a grounded structure and bond to ground.

7. Equipment Grounding Conductor: Provide a separate, green, insulated conductor within each feeder and branch circuit raceway. Terminate each end on a suitable lug, bus, or bushing.

T741B-5.3 Field Quality Control: Measure the continuity of each grounding electrode conductor after it is installed and prior to connecting it to the system. The maximum acceptable continuity resistance is 0.02 Ohms.

T741B-6 Method of Measurement.

The work specified in this section will not be measured separately and will be included in the pay items for the Toll Gantry, OCC, Panelboards and Generator at RTC Sites for the associated grounding and bonding each pay item's electrical system.

T741B-7 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AT RTC SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T741C
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AT RTC SITES

T741C-1 Description.

Furnish all labor, materials, services, testing, and equipment necessary to provide and install hangers and supports for electrical systems at each toll site including the following:

1. Hardware for the support of conduit, tubing, and cable
2. Wireway supports and wire trough supports
3. Anchors and fasteners

T741C-2 Materials.

T741C-2.1 Materials and Finishes:

1. Provide products with adequate corrosion resistance based on the environment where the products are installed. All steel products must be hot-dipped galvanized except for stainless steel products.

2. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of the supported equipment and the conduit. Consider the weight of the wires in the conduit when selecting products.

T741C-2.1 Regulatory Requirements:

1. Conform to requirements of NFPA 70, the National Electrical Code.

2. Furnish products listed and classified by Underwriters Laboratories, Inc. and acceptable to the Department as suitable for purpose specified and shown.

3. ASTM A123 - Specifications for Zinc Coatings on Iron and Steel products.

T741C-2.2 Anchors and Fasteners:

1. Concrete surfaces and structural elements: Use expansion anchors, preset inserts, and self-drilling anchors.

2. Steel Structural Elements: Use beam clamps that will not damage the protective zinc coating of galvanized steel.

3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.

4. Solid Masonry Walls: Use expansion anchors, preset inserts, and self-drilling anchors.

5. Sheet Metal: Use galvanized sheet metal screws.

6. Wood Elements: Use galvanized wood screws.

T741C-2.3 Steel Strut Channel:

1. The cross-sectional width dimension of the steel strut channel (channel) must be a minimum of 1-1/2”. The depth will be as required to satisfy the load requirements. Channel with 1-1/2” depth or greater must be rolled from 12-gauge steel.

2. Attachment holes, when required, must be factory punched on hole centers equal to the channel cross sectional width dimension and must be a maximum of 9/16” diameter.

3. Channel attachment nuts must be designed to pre-locate in the strut channel and provide a bearing surface on the turned down lips while making positive contact with the side walls of the channel.

4. Steel channel sections must be rolled from AISI C1018 commercial grade steel and be in conformance with ASTM A569.

5. Stainless steel channel sections must be available in either 304 or 316 stainless steel.

6. Steel channel used for modular metal framing and conduit supports must be in compliance with the Federal Specification W-C-582 and Federal Specification WW-H-171.

7. Install steel strut channel in straight sections only and do not be bent in the field.

8. Install hot dipped galvanized after fabrication channel or stainless steel channel for exterior applications. Install painted steel or hot dipped galvanized channel for indoor applications. Steel channel that is hot dipped galvanized after fabrication must have a minimum Zinc thickness of 1.5 ounces per square foot on each surface according to ASTM A123 - Specifications for Zinc Coatings on Iron and Steel products.

9. Install bolt nut and washer assemblies in accordance Section 460-5 of the Specifications.

10. Repair damaged zinc finish on field cut and field drilled galvanized steel strut channel by using cold galvanizing methods. The cold galvanizing compound must be pre-mixed and composed of a liquid organic zinc compound. After application, the dried zinc compound film must be 95% metallic zinc.

11. Provide protective end caps on channel ends. The protective caps must be made of soft PVC and manufactured by the same company that manufactured the channel.

T741C-2.4 Conduit Supports and Fasteners:

1. Support conduit securely and fasten to the structure it is installed upon. The conduit mounting hardware must be manufactured by the same company that manufactured the channel for the environment they were designed.

a. Hangers, clamps, straps, and hardware for supporting conduit must be listed in accordance with UL 2239 – Hardware for the Support of Conduit Tubing, and Cable by UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

b. Hardware for supporting boxes must be UL 514A listed by UL or other NRTL.

c. Cable ties or Ty-wraps must not be used to support conduit or junction boxes.

2. Conduit supports and support fasteners and bolts used outdoors or in wet locations must be manufactured from carbon steel and must be hot dipped galvanized after fabrication and according to ASTM A123.

T741C-3 Shop Drawings and Submittals.

Provide catalog sheets showing fastening details as applicable.

Provide steel strut channel product data including strut channel frame support material, attachment details for attaching to the concrete pad and attachment details for attaching equipment to the strut channel frame.

Provide mounting details for raceways and boxes, fire extinguisher cabinets and accessories mounted to the frames.

Provide manufacturer's installation instructions including application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

Submit strut channel frame support material certifications and scaled drawings ½" = 1' showing the support frame design.

T741C-4 Construction Requirements.

T741C-4.1 Installation:

1. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

2. Do not use powder-actuated anchors to secure electrical equipment.

3. Obtain permission from Engineer before drilling or cutting structural members or galvanized metal.

4. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

5. Install Power Distribution Frame and AVI Mounting Frame in accordance with the following:

a. Attachment holes, when required, must be factory punched on hole centers equal to the channel cross sectional width dimension and must be a maximum of 9/16" diameter.

b. Channel attachment nuts must be designed to pre-locate in the channel and provide a bearing surface on the turned down lips while making positive contact with the side walls of the channel.

c. Steel channel must be installed in straight sections only and must not be bent in the field.

d. Install protective end caps on channel ends.

6. Install surface-mounted cabinets and panelboards with minimum of four anchors.

7. Threaded rod hangers must be galvanized continuous thread type, minimum 3/8" diameter. Increase size as required to support assembly. Bending of rod hangars is not permitted.

8. Conduit support racks must be minimum of 24", increase, distance as required for quantity of conduits and spare capacity) provide space on each rack for 25 percent additional conduits. Group conduits on channel racking adjacent to each other at sides, allowing all remaining unused space at center as spare capacity. Do not exceed 1" spacing between conduits.

9. In general conduit supporting devices such as spring type conduit clips are not acceptable. Conduit clips with snap close strap are acceptable for use in dry interior concealed locations only. Back-to-back arrangement or attachment to other raceways, piping, etc. is not permitted.

10. All hangers, clips and accessories for supporting must be listed by UL or other NRTL.

11. Support systems must meet requirements for seismic loads. Refer to general Conditions of the specifications.

12. Support conductors not in raceways directly from the structure with devices listed by UL or other NRTL as intended for such use. Cable ties used with listed support devices within plenum air environments must be plenum rated by UL or other NRTL.

T741C-5 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

IDENTIFICATION FOR ELECTRICAL SYSTEMS AT RTC SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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City, State, Zip Code: _____

SECTION T741D
IDENTIFICATION FOR ELECTRICAL SYSTEMS AT RTC SITES

T741D-1 Low Voltage Electrical Power Conductors and Cables.

Furnish of all labor, materials, services, testing, and equipment necessary to provide and install identification for electrical systems including, nameplates and labels, wire and cable markers, and conduit markers.

T741D-2 Materials.

T741D-1.1 Regulatory Requirements:

1. Conform to requirements of ANSI/NFPA 70.

2. Furnish products listed and classified by Underwriters Laboratories, Inc., and acceptable to authority having jurisdiction as suitable for purpose specified and shown.

T741D-1.2 Nameplates: Equip the following items with nameplates: Wire troughs, and conduits at the base of the gantry. All motors, motor starters, push button stations, control panels, time switches, disconnect switches, transformers, panelboards, all circuit breakers in panelboards greater than 400 Amps, contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical systems junction and pull boxes (larger than 4 11/16”), terminal cabinets, terminal boards, and equipment racks. Describe the associated panel and circuit number on the nameplate.

Provide nameplates for all equipment in accordance with the following:

1. Nameplates for normal power: Laminated phenolic plastic, chamfer edges, red (and black version) front white core, with lettering etched through the outer covering. White engraved letters on red (and black version) background.

2. Nameplates for emergency power (where applicable): Laminated phenolic plastic. Red front, with white core, with lettering etched through outer covering, white engraved letters on red background.

3. Letter Size:

   a. Use 1/4-inch-high letters for identifying individual equipment and loads.

   b. Use 1/2-inch-high letters for identifying grouped equipment and loads.

   c. Use 1-inch-high letters for identifying Service Disconnecting means.

4. Provide nameplates that adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown and shop drawing submitted for approval. Nameplates for panelboards must include the panel designation, voltage and phase of the supply. For example, “Panel A, 120/208V, 3-phase, 4-wire”. In addition, provide phenolic label in panel to describe where the panel is fed from. For example, “Fed from MDP-1:3:5”. The name of the machine on the nameplates for a particular machine shall be the same as the names used on all motor starters, and disconnect switches for that machine.

5. Field install Arc Flash and Shock Warning labels on each piece of new electrical distribution equipment such as panelboards, safety switches, and automatic transfer switches. The labels will indicate the flash hazard boundary, the flash hazard at 18 inches, the PPE level requirements, and the approach restrictions.

6. Provide adhesion labels on inside door of each fused switch indicating NEMA fuse classification and the size fuse installed.

T741D-1.3 Wire Markers: Furnish and install wire markers for each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection. Wire markers shall be in accordance with the following:

1. Cloth, tape, split sleeve, or tubing type wire markers.
2. Legend.

a. Power and Lighting Circuits at both ends of each conductor. Branch circuit numbers or feeder numbers as indicated on the construction plans. Including the neutral conductor. i.e. the conductor connected to circuit breaker #2 will be labeled with a wire marker showing "2". The neutral associated with this circuit will also be labeled with a wire marker showing "2".

b. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

T741D-1.4 Conduit/Junction Box Color Code: Color code all conduit system junction boxes (except those subject to view in public areas) as listed below:

Table 1 Color Code Requirements

Color Code for Junction Boxes	Krylon Paint #
System Emergency 120/208 volt	Light Red 2110
Fire Alarm	Popsicle Orange 2410
Normal Power 120/240 volt	Glossy Black 1601
Fiber Optics	Plum Purple 1929
Sound System	Daisy Yellow 1813
Intercom	True Blue 1910
Computer/Data	Gold 1701
BAS	Light Beige 2502
FIDS / BIDS	Beige 2504
[redacted]	[redacted]
Telephone	Light Green 2011
Grounding	Fluorescent Green 3106

Paint conduits (not subject to public view) longer than 20 feet with the color paint band identified in the table above, 20 ft. on center as follows:

1. Paint band shall be 4" in length.
2. Evenly align paint bands where conduit is parallel and on conduit racking.
3. Apply paint neatly and uniformly.
4. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

5. Junction boxes and conduit located in public areas (i.e. areas that can be seen by the public) shall be painted to match the surface they are installed upon.

T741D-1.5 Conduit/Junction Box Color Code: Provide markers/markings for all new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) as listed below:

1. Use black permanent marker for identification.
2. Paint half of the cover plate with appropriate color as noted in **Table 1**, and mark the other half with the associated panel/circuit or system description as identified below.
3. Adequately describe the conduit's / junction box's associated panel and circuit reference number(s) (i.e. ELRW-2, 4, 6) or systems (i.e. fire alarm, SCADA, etc.).

Identify conduit not installed in public areas with circuit numbers as noted in **Table 1**. Provide spacing of 20 feet on center, adjacent to color identification bands.

T741D-1.6 Device Cover Plate Identification: Provide self-adhesive clear printed labels with Black typed letters (pre-printed, dot matrix, or laser) at the locations identified below. Labels printed with Ink Jet printers are not acceptable.

1. Each new switch and receptacle cover plate.
2. Each existing switch and receptacle cover plate in areas of remodel/renovation.
3. Each new communications cover plate.
4. Each existing communications cover plate in areas of remodel/renovation.

Adequately describe receptacle plates with its associated panelboard and circuit reference (i.e., L1A-3).

Adequately describe system plates with its associated terminal board, or terminal cabinet, termination cable identifier, and assigned user code number, (i.e., TTB-LS2-***).

T741D-1.7 Underground Warning Tape: Install 4-inch-wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines

T741D-1.8 Signage: Provide laminated phenolic plastic signage as follows:

1. Chamfer edge, white core, face color as specified in **Table 1**
2. Lettering must be etched through the outer covering
3. Lettering size: 1" lettering
4. Locations:
    a. More than one service per NEC (if applicable)
    b. Emergency Generator Systems per NEC (if applicable)

T741D-3 Shop Drawings and Submittals.

1. Submit data sheets and catalog sheets for each label and marker.
2. Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

T741D-4 Construction Requirements.

T741D-1.1 Preparation: Degrease and clean surfaces to receive nameplates.

T741D-1.2 Application:

1. Install nameplate parallel to equipment lines.
2. Secure nameplate to equipment front using stainless steel pop rivets.
3. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
4. Paint colored band on each conduit longer than 6 feet (2 m).

5. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

6. Identify junction boxes and outlet boxes.

7. Nameplates installed inside on dead front cover shall be self-adhesive tape. (Do not drill or install screws in dead front covers unless prior approval is granted by equipment manufacturer).

8. Exterior nameplates installed on wire troughs and all outdoor electrical equipment must be provided with an epoxy-based adhesive.

9. Install wire markers at all connections and terminations.

T741D-5 Method of Measurement.

Identification of electrical systems will not be measured separately and is included in the pay items for the OCC, Panelboards and Generator along with conductors and cabling associated with the electrical equipment.

T741D-6 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

LIGHTNING PROTECTION AT RTC SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T741E
LIGHTNING PROTECTION AT RTC SITES

T741E-1 Description.

Provide a Class I lightning protection system to protect the toll equipment gantry(ies), the fuel tank, generator set, outdoor metal enclosures, outdoor equipment racks and any outdoor equipment that extends higher than 10 feet above grade level.

Provide a Class I lightning protection system as described in NFPA 780, LPI 175, UL 96A, NEC, and the Plans and Specifications to protect toll equipment building (TEB), the toll equipment gantry(ies), the fuel tank, generator set, outdoor metal enclosures, outdoor equipment racks and any outdoor equipment that extends higher than 10 feet above grade level.

T741E-2 Materials.

T741AE-2.1 Regulatory Requirements:

1. Conform to requirements of NFPA 780, LPI 175 and NEC.
2. Furnish products listed and classified by Underwriters Laboratories, Inc. UL 96A, and acceptable to authority having jurisdiction as suitable for purpose specified and shown.

T741AE-2.2 Conductors

1. Grounding ring electrode conductors and underground conductors must be copper and the minimum acceptable size is 98,600 circular mils, with 24 strands.
2. Down conductors must be copper.
3. Air Terminals: Aluminum or copper with a threaded 5/8-inch diameter base and pointed at the tip. Air terminals will be solid and not hollow.

T741AE-2.3 Fasteners: Conductor fasteners must be of the same material as the conductor, having ample strength to support conductor.

T741AE-2.4 Ground Rods: Lightning protection system ground rods will be sectional, 5/8" diameter, copper clad steel ground rods. The copper cladding must be a minimum of 0.010 inch thick.

T741E-3 Submittals and Shop Drawings.

1. Submit shop drawings for review before site work begins. Include drawings of the entire site that shows the location of all site components and interconnections between each component and each piece of equipment bonded to the system. Include locations of air terminals, cabling, ground rings, ground rods, down conductors.
2. Submit product data sheets on cabling, ground rings, ground rods, down conductors, fasteners, cable connectors and exothermic welding products.

T741E-4 Qualifications.

Submit written evidence showing manufacturer and installer’s qualification to the Department prior to beginning work.

1. Manufacturers: Firms regularly engaged in manufacture of lightning protection systems, whose products have been in satisfactory use in similar service for not less than 5 years.
2. Installer: Firms holding an EC License in the State of Florida with at least five (5) years of successful installation experience on projects with electrical installation work similar to that required for the project.

T741E-5 Construction Requirements.

T741AE-5.1 Construction Requirements: Only experienced installers familiar with requirements of NFPA 780, the Lightning Protection Institute Standard of Practice 175, and Underwriters' Laboratories are permitted to install the lightning protection system.

1. This work includes all equipment to protect the toll site against damage by lightning whether or not specifically called for herein.

2. Install a 98,600 circular mil, 24 strand, bare copper lightning protection grounding electrode conductor around each toll structure extending out to each piece of equipment on the site. Install the conductor in direct contact with the earth and a minimum of 30 inches below grade.

3. Ground each metal support column on toll equipment structures (i.e. gantries) at two separate points near the base of the columns. Each grounding point must have a grounding pad and a separate down conductor and separate ground rod. The ground rods must be bonded together below grade.

4. The grounding lugs at the base of the gantry columns must be installed by the gantry fabricator. Field welding to galvanized metal gantries is not acceptable.

5. The ground rods will extend into the earth vertically not less than 20 feet.

6. Install in an inconspicuous manner with conductors coursed to be concealed as much as possible.

7. All metallic equipment within 6 feet of any lightning conductor shall be bonded to conductor.

8. Install lightning protection conductors that require physical protection in schedule 80 PVC conduit.

9. The following lightning protection systems at each site will be bonded together by a 98,600 circular mil, 24 strand, direct buried copper conductor.

   a. Toll gantry columns
   b. Emergency generator, enclosure, and fuel tank with any metal piping
   c. Metal enclosures and wireways

10. The completed system will be inspected by an independent 3rd party and must receive a UL Master Label or The Lightning Protection Institute Inspection Program (LPI-IP) Certificate.

T741AE-5.2 Conductor Connections and Splices:

1. Connections above grade level will be made with mechanically bolted fittings of aluminum, copper, or tin-plated bronze.

2. Connections below grade will be made by welding.

T741AE-5.3 Testing:

1. Use the fall of potential three-point method and test each ground rod individually before connecting it to the system. Ensure the maximum resistance to ground (earth) does not exceed 25 Ohms. If a ground rod measures greater than 25 Ohms to ground then a second ground rod should be installed nearby, but not closer than the depth of the 1st rod, and then bond the two rods together with a direct buried conductor. Turn over the test reports to the Engineer within 1 week of performing the test.

2. The resistance to ground should be consistent between the ground rods. Any rod that measures more than 20% different than the surrounding rods should be investigated.

3. After bonding all the lightning protection system ground rods together and connecting the ground rings, use the “Clamp on Method” to measure the resistance to ground of

the completed lightning protection ground rod system. Ensure the maximum resistance to ground (earth) does not exceed 5 Ohms. Drive additional ground rods if necessary to obtain a resistance to ground reading of 5 Ohms or less. Turn over the test reports to the Department within 1 week of performing the test.

T741E-6 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

ELECTRICITY METERING AND UTILITY SERVICE ENTRANCE AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T742A
ELECTRICITY METERING AND UTILITY SERVICE ENTRANCE
AT RTC TOLL SITES

T742A-1 Description.

Furnish all labor, materials, services, testing, and equipment necessary to provide and install Electric Metering and Utility Service Entrance Equipment at each RTC Toll Site which includes:

1. Service racks
2. Metering transformer cabinets
3. Meter bases

T742A-2 Materials.

742A-2.1 Standards: Electric Metering and Utility Service Entrance Equipment must meet the following:

1. NECA Standard of Installation (National Electrical Contractors Association)
2. NFPA 70 - National Electrical Code
3. Listed and classified by Underwriters Laboratories, Inc. and acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

742A-2.2 System: 240/120 Volts, 200 Amp, 1 phase, 3 wire, 60 Hertz, with grounded neutral, or as shown on the plans.

742A-2.3 Meter Bases: Furnish meter bases as follows:

1. Meter bases shall be fabricated from aluminum and then painted by the manufacturer.
2. The meter base shall contain in integral bypass that allows the meter to be removed and replaced without interrupting power to the building.
3. Neutral lugs must be sized to accommodate grounding conductors.

742A-2.4 Pad for Utility Transformer: Furnish and install the utility transformer pad sized and configured as required by the Utility.

742A-2.5 Secondary Connection Cabinet: If the quantity of underground service entrance conductors is greater than the utility pad mounted transformer lugs can accept, provide a secondary connection cabinet installed by the Electrical Contractor between the utility transformer and the service entrance point on the building.

Ensure the customer's service entrance conductors and the utilities service entrance conductors are properly joined inside this enclosure. Contact the utility company for the specifications and requirements of this cabinet.

742A-2.6 Service Disconnect: The service disconnect must comply with the following:

1. Vertically mounted main circuit breaker within an ATS, panelboard or as depicted in the plans.
2. Fuses must not be used as overcurrent protection for the power distribution system.
3. Contain a set of auxiliary contacts. The contacts will be open when the service disconnect is open and closed when the service disconnect is closed.
4. The service entrance feeder conduits must utilize rigid metal conduit elbows coated with PVC or Bitumen.

T742A-3 Quality.

Perform Work in accordance with Utility Company written requirements. Maintain one copy of each document on site.

T742A-4 Submittals and Shop Drawings.

Submit shop drawings in accordance with Section 5, and General Requirements for Toll Site Electrical Infrastructure.

Provide ratings and dimensions of transformer cabinets and meter bases. Include the Utility contact information, the electric meter base configuration and the utility transformer pad details in the engineering submittals.

T742A-5 Construction Requirements.

742A-5.1 Pre-Installation Meeting: A pre-installation meeting must be scheduled with the Engineer and the Utility Company representative.

Review service entrance requirements and details with Utility Company representative at the pre-installation meeting.

742A-5.2 Field Measurements: Verify that field measurements are as indicated on Utility Company drawings.

742A-5.3 Installation: Install transformer pad, metering transformer cabinets, and meter base as required by the local Utility Company.

Service entrance conductors between the utility transformer and the toll facility must be continuous and must not be spliced or tapped.

Toll sites must have dedicated secondaries from the utility transformer to the utility power meter and must not be shared with non-tolling electrical loads.

T742A-6 Method of Measurement.

The quantity paid will be the plan quantity for Electric Metering and Utility Service Entrance furnished, installed, and accepted at each toll facility.

T742A-7 Basis of Payment.

Price and payment will be full compensation for all work specified in this Subsection.

Payment will be made under:

Item No. 639-7-122	Electrical Power Service, Toll Site Electric Metering and Utility Service Entrance - per each

TECHNICAL SPECIAL PROVISION

FOR

PANELBOARDS AT RTC TOLL SITES

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SECTION T742B
PANELBOARDSAT RTC TOLL SITES

T742B-1 Description.

Furnish and install Emergency Panelboards (EDP and EP1), Power Distribution Frame (PDF) including accessories as shown in the Plans and all associated electrical conduit and cabling.

T742B-2 Materials.

742B-2.1 Standards: Panelboards must meet the following applicable industry standards:

1. NECA Standard of Installation (published by the National Electrical Contractors Association)
2. NEMA AB1 - Molded Case Circuit Breakers
3. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies
4. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
5. NEMA PB 1 - Panelboards
6. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
7. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association)
8. NFPA 70 - National Electrical Code
9. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor,
10. Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7

742B-2.2 Qualifications: Manufacturer must be a company specializing in manufacturing the products specified in this sub-section with minimum three years experience.

742B-2.3 Maintenance Materials: Meet the requirements of Acceptance Procedures for Toll Facilities at RTC Toll Sites.

Furnish two keys for each panelboard.

742B-2.4 Panelboards: Provide EDP and EP1 panelboards as follows:

1. Provide NEMA PB 1, circuit breaker type panelboard with a vertically mounted main circuit breaker, a minimum of 18 one pole branch breaker spaces,.
2. Manufacturers: EDP and EP1 panelboards must meet the requirements of the contract documents and must be from one of the following manufacturers or an approved equal:
    a. Schneider/Square D Co.
    b. ABB/General Electric
    c. Eaton/Cutler-Hammer
3. Panelboard Bus: Provide an equipment ground bus in each panelboard. Copper, ratings as indicated.
4. Integrated Short Circuit Rating: All panelboards, bussing and breakers must be fully-rated, selectively coordinated to safely interrupt available short circuit currents. The AIC ratings shown on the drawings are the minimum ratings that can be provided.

5. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL or other NRTL listed as Type HACR for air conditioning equipment branch circuits.

6. Main Circuit Breaker Accessories: The vertically mounted main circuit breaker will be equipped with auxiliary contacts, 1a/1b, rated 6 Amps at 24 VDC.

742B-2.5 Enclosure:

1. Exterior and Wet Locations: NEMA 3R or 4X stainless steel.

2. Cabinet Front: Flush or Surface type as indicated, fastened with concealed trim clamps, hinged door with flush lock, hinged cover, welded metal directory frame, finished in manufacturer's standard gray enamel.

3. The number of utilized breaker spaces must not exceed 80% of the full breaker space capacity. 20% of the breaker spaces must remain empty.

4. Use bolt-on type circuit breakers securely fastened to the bus bars using bolts. Plug-on type or clip-on type circuit breakers are not acceptable.

5. Provide a typed circuit directory card that accurately identifies each circuit and a spare unused directory card for future use. Provide directory cards from the same manufacturer as the panelboard. Place the spare directory card behind the typed directory card in the welded metal directory card holder.

6. For nameplates of normal power, provide laminated phenolic plastic, chamfer edges, black front white core, with lettering etched through the outer covering. White engraved letters on black background.

7. For nameplates of emergency power, provide laminated phenolic plastic, chamfer edges, red front white core, with lettering etched through the outer covering. White engraved letters on red background.

T742B-3 Submittals and Shop Drawings.

Submit shop drawings in accordance with Section 5, General Requirements for Toll Site Electrical Infrastructure and the following:

1. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, withstand ratings, dimensions, and enclosure details as applicable for the following:

a. Power Distribution Frame product data including strut channel frame support material, attachment details for attaching to the concrete pad and attachment details for attaching equipment to the PDF.

b. Panelboard, circuit breakers, panel components, etc.

c. Light fixture

d. Raceway and boxes mounted to the frame

e. Fire extinguishers, cabinets, and accessories

2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Standards. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

3. Shop Drawings: Submit scaled drawings ½” = 1’ showing the physical location of each panelboard. Indicate panelboard outline and support point dimensions, support frame design, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes. Include conduit routing and actual circuiting arrangements.

T742B-4 Documentation Requirements.

Provide record documents in accordance with Acceptance Procedures for RTC Toll Facilities and the following:

Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

If installed circuit breakers differ from the basis of design in the plans, perform a final coordination study, using a recognized software program to confirm that the installed equipment meets the coordination study requirements.

T742B-5 Warranty.

The panelboards under this specification section will be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of acceptance. The warranty will include parts, shipping costs, rigging costs, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

Provide warranty documentation in accordance with Acceptance Procedures for RTC Toll Facilities.

T742B-6 Construction Requirements.

742B-6.1 Panelboards: Furnish and install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation" and the following:

1. Install panelboards plumb.
2. Provide filler plates for unused spaces in panelboards.
3. Provide typed or neatly handwritten circuit directory for each branch circuit panelboard. Revise the directory to reflect any circuiting changes required to balance the phase loads. Provide (1) additional blank circuit directory for each branch circuit panelboard.
4. Circuit breakers must be molded case type unless noted otherwise on the plans.
5. Install the panelboards at the location and elevation depicted on the plans.

Panelboard Identification - Provide engraved plastic nameplates in accordance with the Specifications.

742B-6.2 Field Quality Control: Prior to energizing the installed panelboard perform the following:

1. Clean the interior of the enclosure and remove all dirt and debris.
2. Perform an insulation resistance test using a MegaOhm Meter between each phase bus and ground. Investigate any reading of less than 1 MegaOhm.
3. Adjusting: Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
4. Clean installed work in accordance with Acceptance Procedures for Toll Facilities and the following:
5. Clean electrical parts to remove conductive and deleterious materials.
6. Remove dirt and debris from inside the enclosures.
7. Clean finishes and touch up damaged paint.

T742B-7 Method of Measurement.

The Contract unit price for panelboards, furnished and installed, will include furnishing, placement, and testing of the panelboards, automatic transfer switch, surge protection devices

and all associated electrical equipment, conduit and cabling.

Also included are incidental work identified in the TSPs such as documentation, fire extinguisher, automatic transfer switch, power distribution frame strut channel with lighting, furnished and installed, grounding and bonding and lightning protection system for panelboards and all its components, wiring devices and identification of electrical systems associated with all equipment located on the power distribution frame, and incidentals necessary to complete the work.

The cost of general requirements for toll facilities electrical infrastructure associated with all equipment on the power distribution frame must also be included in the cost of the panelboards.

T742B-8 Basis of Payment.

Price and payment will be full compensation for all work specified in this subsection, including all materials, equipment, and accessories.

Payment will be made under:

Item No. 639-7-124	Electrical Power Service, RTC Toll Site Panelboards and Power Distribution Frame – per each

TECHNICAL SPECIAL PROVISION

FOR

WIRING DEVICES AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

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SECTION T742C
WIRING DEVICES AT RTC TOLL SITES

T742C-1 Description.

Furnish and install wiring devices as shown in the Plans. Wiring devices include:

1. Wall switches / Snap switches
2. Receptacles
3. Twist-Locking receptacles
4. Device plates and box covers

T742C-2 Materials.

T742C-2.1 Standards: Wiring devices must meet the following applicable industry standards:

1. NECA - Standard of Installation
2. NEMA WD 1 - General Requirements for Wiring Devices
3. NEMA WD 6 - Wiring Device - Dimensional Requirements
4. NFPA 70 - National Electrical Code

T742C-2.2 Qualifications: Manufacturer must be a company specializing in manufacturing the Products specified in this section with minimum three years experience.

T742C-3 Wall Switches / Snap Switches.

T742C-3.1 Wall Switches / Snap Switches: Provide products that comply with NEMA WD 1, and are commercial specification grade, UL 20 Listed, and rated for AC only general-use.

Configuration:

1. Single pole single throw or 3 ways.
2. Switches shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.
3. Provide same series switch for other configurations.
4. Ratings:
    a. Voltage: 120-277 volts, AC
    b. Dielectric voltage test: Withstands 1500 Volts for 1 minute.
    c. Temperature rise: The maximum temperature rise shall not exceed 30 degrees C.
    d. Flammability: Rated V-2 per UL 94.
    e. Current: 20 Amps continuous current unless indicated otherwise on the plans.

T742C-3.2 Lighting Timer Switches: Provide 125V, 20A 4-hour twist type time delay switch in metal weatherproof box.

T742C-4 Straight Blade Receptacles.

Provide products that comply with NEMA WD 1, and are UL 498 Listed, commercial specification grade.

Features and benefits:

1. Shall be corrosion-resistant, with plated steel strap locked into the face and back body to resist pulling away from face/body assembly.
2. The brass power contacts shall be 0.032 inch thick, and utilize triple-wipe action.
3. Easily accessible break-off, line-contact connecting tab for fast, easy split-circuit

wiring.

4. Impact-resistant nylon face and thermoplastic back body.

5. Accepts #14 - #10 AWG solid or stranded copper or copper-clad wire.

6. The terminal compartments shall be isolated from each other for positive conductor containment.

7. Shall be equipped with an auto-ground clip to assure positive grounding.

8. Configuration:

9. Simplex (single) or duplex outlets.

10. Receptacles installed outdoors shall be rated Weather Resistant and shall be of the ground fault circuit interrupter type.

11. Receptacles shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.

12. Ratings: Receptacles shall be rated as follows:

a. 20 Amp, 125 Volt, NEMA 5-20R

b. Receptacles shall meet UL 94 Flammability requirements.

c. Receptacles shall have a dielectric voltage withstand rating of 2000 Volts

d. Temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

T742C-5 Twist-Lock Receptacles.

Provide products that comply with NEMA WD 1, and are UL 498 Listed, commercial specification grade, meets federal specification W-C-596, and have the following features and benefits:

Configuration:

1. Simplex (single)

2. Twist lock receptacles shall be connected to the conductors using screw type mechanical pressure connectors. Spring type pressure connections are not acceptable.

3. Ratings:

a. 20 Amp, 125 Volt, 2 horsepower, NEMA L5-20R with dielectric voltage withstand rating of 2000 Volts and temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

b. 30 Amp, 250 Volt, 2 horsepower, NEMA L6-30R with dielectric voltage withstand rating of 2000 Volts, and temperature rise of 30 degrees C after 100 cycles of overload at 150% of rated current.

4. Receptacles shall meet UL 94 Flammability requirements of HB or better

T742C-6 Wall Plates / Cover Plates.

1. Cover Plates: Smooth thermoset plastic plates.

2. Provide labels on each wall plate and receptacle plate that show the branch circuit numbers and panelboard that serves them.

3. Weatherproof Cover Plate: Cast zinc cover plate with a “While-In-Use” cast zinc hinged weather proof and padlockable door.

T742C-7 Wiring Device Color.

Device colors shall be ivory when served by normal power, red when served by generator power, and orange when served by the critical power system.

T742C-8 Submittals and Shop Drawings.

T742C-8.1 Shop Drawings: Submit shop drawings in accordance with Section 5, General Requirements for Toll Site Electrical Infrastructure, and the following.

Shop Drawings: Call out the use or location for each device, such as “Receptacles above tolling cabinets”, “general use receptacles in toll building”, “twist-locking receptacle” etc on each shop drawing.

Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations and ratings. Provide specification sheets for each type of wiring device.

Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product

T742C-8.2 Warranty: The wiring devices under this specification section will be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of acceptance. The warranty will include parts, shipping costs, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

T742C-9 Construction Requirements.

T742C-9.1 Examination: Verify that outlet boxes are installed at proper height. Coordinate outlet heights with interior elevations.

Verify that wall openings are neatly cut and will be completely covered by wall plates.

Verify that floor boxes are adjusted properly.

Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

Verify that openings in access floor are in proper locations.

T742C-9.2 Preparation: Provide extension rings to bring recessed outlet boxes flush with finished surface.

Clean debris from outlet boxes.

T742C-9.3 Installation:

Install in accordance with NECA "Standard of Installation".

Install devices plumb and level.

Install switches with OFF position down.

Install receptacles with the grounding pole on the bottom.

Connect wiring device grounding terminal to outlet box and branch circuit equipment grounding conductor.

Install decorative plates on switch, receptacle, and blank outlets in finished areas.

Connect wiring devices by wrapping the solid conductor around the screw terminal and tightening the screw snugly. Back wiring/back stabbing is not acceptable. Stranded conductors shall be terminated with compression style lugs.

Install cast iron plates on outlet boxes and junction boxes in unfinished areas and on surface mounted outlets.

Install wiring devices as indicated on the Drawings, and as called for below.

Switches and receptacles shall be installed and located as follows, unless noted otherwise on Drawings.

Switches: Centerline 46" above finished floors.

Receptacles: Centerline 18" above finished floors generally; Verify and coordinate exact height and locations with plans and elevations.

Where light switches are located adjacent to doors, they shall be installed on "knob" side of door. Field-verify door swings.

Provide identification in accordance with the Specifications.

T742C-9.4 Field Quality Control:

Inspect each wiring device for defects.

Operate each wall switch with circuit energized and verify proper operation.

Verify that each receptacle device is energized.

Test each receptacle device for proper polarity.

Test each GFCI receptacle device for proper operation.

T742C-9.5 Adjusting: Adjust devices and wall plates to be flush and level.

T742C-9.6 Cleaning: Clean exposed surfaces to remove splatters and restore finish.

T742C-10 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

AUTOMATIC TRANSFER SWITCH AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T742D
AUTOMATIC TRANSFER SWITCH AT RTC TOLL SITES

T742D-1 Description.

Furnish and install automatic transfer switch as shown in the Plans.

T742D-2 Quality Assurance.

Perform Work in accordance with NFPA 110.

The Automatic Transfer Switch must be a standard product of the original equipment manufacturer. The vendor that provides the Automatic Transfer Switch must be an Automatic Switch Company authorized manufacturer's representative. The Automatic Transfer Switch and the emergency generator shall be provided by the same vendor.

T742D-3 Materials.

T742D-3.1 Standards: Automatic Transfer switches must meet the following applicable industry standards:

1. NFPA 70 - National Electrical Code
2. NEMA ICS 1 General Standards for Industrial Control and Systems
3. NEMA ICS 2 Standards for Industrial Control Devices, Controllers, and Assemblies
4. NEMA ICS 6 Enclosures for Industrial Controls and Systems
5. U.L. – 1008, 7th Edition. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.
6. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)
7. NFPA 101 – Life Safety Code
8. NFPA 110 – Emergency and Standby Power Systems

Furnish products listed and classified by UL or other NRTL

T742D-3.2 Qualifications:

1. Manufacturer: Use products from a Company specializing in manufacturing the Products specified in this section with minimum three years' experience, and with service facilities within 100 miles of Project.
2. Supplier: Authorized distributor with a minimum of five years' experience.

T742D-3.3 Automatic Transfer Switch(es): Provide a service entrance rated ATS for tolling sites with on-site power and roadside tolling cabinets (RTC). Include a molded case circuit breaker with a thermal magnetic trip unit in-line with the utility/normal service entrance feeder. Service entrance rated automatic transfer switches shall operate as delayed transition when transferring between power sources, with an adjustable time delay in the neutral position.

The service entrance rated automatic transfer switch will switch between utility/normal power and emergency generator power. The phase conductors will be switched. The neutral conductors will not be switched and will be a solid neutral connection.

Ensure the neutral bus bar is insulated from the metal enclosure.

Provide an equipment ground bar that is bonded to the metal enclosure.

Equip with a microprocessor-based control system to provide all the operational functions. Include a real-time clock with battery back-up.

1. Include a controller with a 20-character, LCD display, with keypad, which allows access to the system. Provide password protection functionality.

2. Provide with an equipment grounding bar sized to accept the conductors as shown on the electrical drawings.

3. Factory test to ensure proper operation and compliance with the specification requirements.

4. Provide as double-throw, actuated by electrical operators momentarily energized. The transfer switch must be capable of transferring successfully in either direction.

5. Provide normal and emergency main contacts that are positively interlocked mechanically and electrically to prevent simultaneous closing. Provide main contacts that are mechanically locked in both the normal and emergency positions without the use of hooks, latches, or magnets.

6. Provide such that control components and wiring are accessible from the front.

7. Provide 600-Volts SIS switchboard type for all control wires. Identify all control wire terminations with tubular, sleeve-type markers.

8. Equip each transfer switch with copper/aluminum solderless bolted pressure-type lugs rated for 90 degrees C.

9. Provide Belleville compression-type washers for bolted connections.

10. Terminate control wires with locking spade-type connectors.

11. Provide solid-state components with an operating range of -20°C to +55°C and meet IEEE Standard 472-1974.

12. Withstand Ratings:

a. Switch(es) shall be listed by Underwriters' Laboratories, Inc. or other NRTL, Standard UL-1008, 7th Edition with 3-cycle short circuit closing and withstand values for specific manufacturers breaker as follows:

Table 1- RMS Symmetrical Amperes at 480 VAC

Switch Rating in Amperes	Closing and Withstand Ratings
100 - 400	22,000
600 - 800	65,000
1000 - 1200	85,000

b. During the 3-cycle closing and withstand tests, there must be no contact welding or damage, and there must be contact continuity across all phases after completion of testing. The 3-cycle tests shall be performed without the use of current limiting fuses. Use test procedures in accordance with UL-1008, and certified by Underwriters' Laboratories, Inc. or other NRTL.

T742D-3.3.1 Enclosures: Provide enclosure that meets or exceeds UL-1008 minimum wire bending space and supplied with three-point door latches. Furnish NEMA Type 4X enclosures for exterior applications. Equip with a door-mounted interior pocket, housing an operations and maintenance manual. Enclosure finish with manufacturer's standard gray enamel paint.

T742D-3.3.2 SCADA Components to be Installed within the ATS Enclosure:

Monitor the incoming utility/normal power feeder and monitor the incoming emergency generator feeder with power meters (Watts, Volts, Amps, pf) located remotely on the SCADA PM panel.

Mount the following accessories inside the ATS:

1. Current transformers (CT's) for the phase conductors in the incoming utility/normal service entrance feeder, and install current transformers (CT's) for the phase conductors in the incoming emergency generator feeder. Provide solid core CT's, wound type current transformers, Class B, with a 5 Amp secondary rating, accuracy class 0.5%, with a minimum burden of 10 VA.

2. Provide a CT shorting type terminal block for use with the utility/normal current transformers, and install a CT shorting type terminal block for use with the emergency generator CT's.

3. Provide voltage sensing leads for the remote normal power meter (PMN) to measure the voltage of the incoming utility/normal feeder, and provide voltage sensing leads for the remote emergency power meter (PME) to measure the voltage of the incoming emergency generator feeder. The voltage sensing leads will connect to voltage sensing terminal blocks with 2 Amp fuses for over current protection. One terminal block for use with the PMN and one terminal block for use with the PME.

4. SCADA components that are factory installed in the ATS and that will be monitored by the SCADA system:

5. Auxiliary contacts on the main circuit breaker to detect the breaker position.

6. Auxiliary contacts on the ATS to detect the position of the ATS by the SCADA system.

7. Surge protection devices, factory installed inside the ATS enclosure. One SPD will protect the utility/normal incoming feeder, and one SPD will protect the incoming emergency generator feeder. Provide SPD's with NO/NC auxiliary contacts that change state with the SPD requires service. The SCADA system will monitor the position of the SPD contacts.

T742D-3.3.3 Product Options and Features:

1. Adjustable, 1-phase sensing of the normal source and emergency source. Factory set to pick up at 90% and drop out at 80% of rated voltage. The adjustable frequency picks up at 95% and dropout at 93% of rated frequency. The switch shall also include phase sequence monitoring on the normal and emergency source.

2. Time delay to override momentary normal source power outages. This will delay the engine start signal and transfer switch operation. Adjustable 0 - 999 seconds. Field adjusted to 1 second during start-up.

3. Time delay on transfer to emergency. Adjustable 1-300 seconds. Field adjusted to 1 second during start-up.

4. Time delay to control contact transition time on transfer to either source.

   a. Adjustable 1-120 seconds. (Delayed Transition Only)
   b. Field adjusted to 2 seconds.

5. Time delay on retransfer to normal, adjustable 0-9999 seconds, with engine overrun to provide adjustable 0–9999 second unloaded engine operation after retransfer to normal. Field adjust the retransfer to normal time delay to 900 seconds. Field adjust the unloaded engine cool down time delay to 300 seconds.

6. "Load Test Switch" to simulate a normal power failure. (Maintained type)

7. Contact to close on failure of normal source to initiate engine starting or other customer functions.

8. Contact to open on failure of normal source to initiate engine starting or other customer functions.

9. Green pilot light to indicate switch in normal position.

10. Red pilot light to indicate switch in emergency position.

11. Plant exerciser with (10) 7-day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise the generating plant. Adjustable type with minimum of 1-minute increments and battery back-up. Also include selection of either "no load" (ATS will not transfer during exercise period) or "load" (ATS will transfer during exercise period). Field adjust to 'LOAD" such that the ATS will transfer to emergency during the plant exercise period.

12. An LCD display, with 1% accuracy, shall show all three separate phase to phase voltages simultaneously, for both the normal and emergency source. A digital LCD frequency readout shall display frequency for both the normal and emergency source.

13. (2) Auxiliary contacts rated 10 Amp, 120 volts AC closed when the ATS is in the normal position. Wired to a terminal strip.

14. (2) Auxiliary contacts rated 10 Amp, 120 volts AC, closed when the ATS is in the emergency position. Wired to a terminal strip.

15. Adjustable relay to prevent transfer to emergency until voltage and frequency of generating plant have reached acceptable limits. Factory set at 90% of rated value.

16. Automatic synchronizing check relay to prevent retransfer from emergency to normal until the normal and emergency sources are within acceptable limits.

T742D-3.4 Automatic Sequence of Operation: Provide the following sequence of operation:

1. Should the voltage of the normal source drop below a preset value (adjustable 70-100%) set at 80% on any phase after a time delay (adjustable 0.5-6 seconds) set at 3 seconds to allow for momentary dips, the engine starting contacts shall close to start the generating plant.

2. The transfer switch shall transfer to emergency when the generating plant has reached a preset value (adjustable 90-100%) set at 90% of rated voltage and frequency.

3. After restoration of normal power on all phases to a preset value (adjustable 70-100%) set at 90% of rated voltage, an adjustable time delay period of 0-31 minutes (factory set at 5 minutes) shall delay retransfer to allow stabilization of normal power. If the emergency power source should fail during this time delay period, the switch shall automatically return to the normal source.

4. After retransfer to normal, the emergency generator shall be allowed to operate at no load for a 5-minute period before shutting down.

5. Transfer switches shall transfer to emergency within the time limits as required by the National Electrical Code for each branch of emergency power system.

6. When more than one Automatic Transfer Switch is connected to an emergency generator, each ATS shall be programmed to switch from normal power to emergency power sequentially. The Normal to Emergency time delay shall be adjustable 1-300 seconds and shall be adjusted as shown below:

7. The Normal to Emergency time delay shall be set to 1 second for an ATS serving a critical power system.

8. The Normal to Emergency time delay shall be set to 11 seconds for an ATS serving a non-critical power system.

T742D-3.5 Surge Suppression/Protection: Provide UL-1449 third edition listed surge protection devices (SPD) in accordance with the requirements of Specification Section T742E.

Factory install a surge protection device for each incoming utility/normal service entrance feeder, and factory install a surge protection device for the incoming emergency generator feeder serving the transfer switch. The factory installed SPDs will be located on the inside of the ATS enclosure.

T742D-4 Documentation and Maintenance Materials.

Submit the following documentation:

1. Operation Data:
    a. Include instructions for operating the equipment.
    b. Include instructions for operating equipment under emergency conditions when the emergency generator is running.
2. Maintenance Data:
    a. Include routine preventative maintenance instructions and a lubrication schedule.
    b. Provide a list of special tools, maintenance materials, and replacement parts that should be stocked.
3. Maintenance Materials:
    a. Provide maintenance materials and operator's manuals.
    b. Provide two (2) of each special tool required for maintenance or manual operation.

T742D-5 Maintenance Service.

Furnish service and maintenance of each transfer switch for one year from the date of Substantial Completion.

T742D-6 Shop Drawings and Submittals.

Submit shop drawings and include the following:

1. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, withstand ratings, dimensions, and enclosure details.
2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

T742D-7 Warranty.

The complete system provided under this specification section will be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of system start-up.

The warranty will include parts, shipping costs, rigging costs, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

Regular and scheduled maintenance will be performed by the Department's maintenance

contractor. Maintenance work by the maintenance contractor shall not void the manufacturer's warranty of the equipment.

Requirements for consumables such as filters to be original equipment manufacturer brands are not acceptable and shall not void the manufacturer's warranty of the equipment.

T742D-8 Construction Requirements.

T742D-8.1 Delivery, Storage, And Handling:

Deliver, store, protect and handle products to site in accordance with General.

Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

T742D-8.2 Examination:

Verify site conditions are suitable for the ATS.

Verify that surface is suitable for transfer switch installation.

T742D-8.3 Installation:

Install transfer switches in accordance with manufacturer's instructions.

Provide all associate control wiring to the generator as required.

Identification - Provide engraved plastic nameplates in accordance with the Specifications.

Provide all interface control wiring and conduit as required to provide require emergency operation of equipment on project as applicable, i.e. elevators, building automation system, fire alarm control panel, smoke control system, etc.

T742D-8.4 Manufacturer's Field Services:

The manufacturers field service representative shall visit the job site a minimum of three times (sign in each time) after construction begins to coordinate the installation with the E.C and G.C. Provide assistance with concrete pad sizes and shapes, proper mounting instructions for each ATS and the quantity and routing of ATS control wiring.

Program each ATS with settings as provided by the Department.

T742D-8.5 Demonstration:

Provide systems demonstration under provisions of the Specifications.

Demonstrate the proper operation of each transfer switch in normal and emergency modes. Operate each ATS manually in the presence of the Department's representative.

T742D-9 Method of Measurement.

The work specified in this Section will not be measured but will be included in the pay item for panelboards.

T742D-10 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

SURGE-PROTECTIVE DEVICES AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T742E
SURGE-PROTECTIVE DEVICES AT RTC TOLL SITES

T742E-1 Description.

Furnish and install Surge Protection Devices (SPDs), 1 KV or less, to protect the normal electrical distribution system, the emergency electrical distribution system, the critical power electrical distribution system, and end-use electrical equipment from the effects of transient voltage surges. Install the surge protection devices as shown on the plans or specified in this section.

T742E-2 Materials.

T742E-2.1 Standards: SPDs must meet the following applicable industry standards:

1. UL 1449 3rd Edition, Standard for Surge Protective Devices
2. UL 1283, Standard for Electromagnetic Interference Filters
3. UL 96A Installation Requirements for Lightning Protection Systems
4. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, C62.45-2002
5. IEEE Std. 1100-2005 Section 8.6.1
6. ANSI C84.1, American National Standard for Electric Power Systems and Equipment - Voltage Ratings (60 Hertz).
7. NFPA 780 - Lightning Protection Code, latest edition
8. NFPA 70 - National Electrical Code (NEC), current adopted year. Article 285
9. American National Standards Institute (ANSI) approved ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, 2009 edition (ANSI/NETA Acceptance Testing Specifications -2009).
10. UL 497, Standard for Protectors for Paired-Conductor Communications Circuits
11. UL 497A, Standard for Secondary Protectors for Communications Circuits
12. UL 497B, Standard for Protectors for Data Communications and Fire-Alarm Circuits
13. UL 497C, Standard for Protectors for Coaxial Communications Circuits
14. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

T742E-2.2 Definitions: The following definitions are used in this section:

ATS	Automatic Transfer Switch
I Nominal (In)	Nominal discharge current rating as required by UL 1449, 3rd Edition
MCOV	Maximum Continuous Operating Voltage
VPR	Voltage Protection Rating (Clamping voltage)
SCCR	Short Circuit Current Rating
SPD	Surge Protective Device

T742E-2.3 System Description: Provide surge protective devices (SPDs) for the following systems and equipment:

1. Each main electrical service panel and MDP as shown on the drawings. Include branch circuit breakers in the main service panel to disconnect and protect the surge protective device and its connecting conductors.
2. Each emergency electrical distribution panel (EDP).
3. Each distribution and branch panel as shown on the drawings. Include branch circuit breakers in the distribution and branch panels to disconnect and protect the Surge Protective Device and its connecting conductors.
4. Site lighting circuits.
5. Electronic equipment installed as identified in the Contract Documents, including electronic time clocks, controls systems, access control system, telephone, CCTV, SCADA control panel, etc.
6. Communications and signaling circuits that travel outdoors will be protected with low voltage, fast acting, surge protection devices.
7. On each emergency power feeder entering the enclosures and before the emergency feeder is connected to Automatic Transfer Switch.
8. On all telephone lines, DSL lines, T1 lines where they enter the enclosure or at the telephone board.
9. Additional locations as required by NFPA 780.

Existing SPDs shown on the drawings shall remain active unless noted for replacement.

Provide the best type of SPD that matches these specifications and matches the equipment being protected.

Install SPDs on the inside or outside of control panels and electrical equipment.

T742E-2.4 Surge Protective Devices: Furnish SPDs manufactured by one of the following:

1. Advanced Protection Technologies
2. Emmerson/Liebert
3. L.E.A. International
4. Approved equal - Any product that meets or exceeds the performance of the above manufacturers will be considered.

Furnish SPDs rated for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage
5. Operating Temperature: 30 to 120 deg F (0 to 50 deg C)
6. Humidity: 0 to 85 percent, no condensing
7. Altitude: Less than 20,000 feet (6090 m) above sea level

T742E-2.4.1 Service Entrance Surge Protective Device: Furnish surge protective device with the following minimum features and accessories:

1. Each SPD shall be UL 1449 third edition listed and labeled as a Type 1 suppressor intended for use without the need for external or supplemental overcurrent protection.
2. Each SPD shall be labeled with 20kA I-nominal (In) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

3. Each SPD shall be of modular construction such that each of the SPD modules may be field replaced without the need to remove the entire SPD enclosure.

4. Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist the conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24", the Contractor responsible for installation must contact the specifying electrical engineer for additional installation instructions.

5. Each SPD shall be installed with a branch circuit breaker as a disconnecting means or provide an integral factory installed disconnect switch as a disconnecting means.

6. Each SPD will have the following modes of protection: Line to Line, Line to Neutral, Line to Ground, and Neutral to Ground.

7. The SPD shall include visual LED indicator lights for power and protection integrity.

8. Each SPD shall contain one set of form C contacts that change state when the SPD requires service.

9. Minimum Surge Current Capability: 200 kA per phase with less than 1 nanosecond response time.

10. Connection Means: Permanently wired, connected on the load side of the service entrance overcurrent protection, and meet the SPD manufacturer's instructions for overcurrent protection (breaker or fuse size).

11. Protection modes and UL 1449 3rd Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

a. Line to Neutral:	700V for 120/240V, 1PH, 3W
b. Line to Ground:	700V for 120/240V, 1PH, 3W
c. Neutral to Ground:	700V for 120/240V, 1PH, 3W
d. Line to Line:	1200V for 120/240V, 1PH, 3W

T742E-2.4.2 Surge-Protective Device for Distribution Panelboards: Furnish surge protective device with the following minimum features and accessories:

1. UL 1283 listed as an Electromagnetic Interference Filter

2. SPD shall be UL 1449 Third Edition, labeled as Type 1 intended for use without need for external or supplemental overcurrent controls or labeled as Type 2 with manufacturer approved over current protection

3. SPD shall be UL 1449 Third Edition labeled with 20kA nominal discharge current (I_n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780

4. SPD marked with a 200kA short-circuit current rating (SCCR)

5. Modes of Protection: Line to Neutral, Line to Ground, Line to Line, and Neutral to Ground

6. The SPD shall include visual LED indicator lights for power and protection integrity

7. Arrangement with wire connections to phase buses, neutral bus, and ground bus

8. Each SPD shall contain one set of form C contacts that change state when the SPD requires service

9. Minimum Surge Current Capability: 150 kA per phase

10. Protection modes and UL 1449 3rd Edition VPRs for circuits with voltages of 120/240V, 1-Phase, 3-Wire shall not exceed:

a. Line to Neutral: 700V for 120/240V, 1PH, 3W
b. Line to Ground: 700V for 120/240V, 1PH, 3W
c. Neutral to Ground: 700V for 120/240V, 1PH, 3W
d. Line to Line: 1200V for 120/240V, 1PH, 3W

T742E-2.4.3 Surge-Protective Device Direct Wired (120 VAC): Furnish surge protective device with the following minimum features and accessories:

1. SPD shall be UL 1449 3rd Edition listed/recognized
2. 15 & 30 Amp, 120 V rated. All continuous current bearing components must be either 15 or 30 Amp rated, minimum; depending on Location Load usage
3. SPDs shall provide three suppression modes: Line-to-neutral, line-to-ground, and neutral-to-ground
4. SPD shall provide a pulse life rating of 3,000 amperes (8/20µs waveform) every thirty (30) seconds for 2,000 occurrences
5. Peak Single-Impulse Surge Current Rating: 20kA per mode, 60kA per protected circuit
6. SPD shall include visual LED diagnostic indicator for power and protection integrity
7. SPD shall allow for chase nipple or DIN RAIL mounting

T742E-2.4.4 Data Line, Ethernet, RS 422, and RS-232 Surge-Protective Device: Furnish surge protective device with modular DIN RAIL design and the following minimum features and accessories:

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable.
2. Plug-in replaceable DIN RAIL modules
3. Employs hybrid circuitry that combines metal oxide varistors with silicon avalanche diodes
4. Let through voltages for SPD's protecting the following circuits shall not exceed the following:

a. Ethernet – 10 Volts
b. Power over Ethernet – 75 Volts
c. RS 485 – 10 Volts
d. RS 232 – 27 Volts
e. Coaxial – 90 Volts
f. 4 – 20 milliAmp – 30 Volts
g. Peak Single-Impulse Surge Current Rating: 10 kA per mode

5. Subject to compliance with requirements, provide products by one of the following for data line SPDs:

a. Advanced Protection Technologies/Surgeassure
b. Superior Electric/Stabiline
c. Circa Telecom
d. Emerson Network Power
e. Scientific Atlantic
f. Surge Suppression Incorporated

T742E-2.4.5 Telephone Line Surge-Protective Device: Furnish surge protective device with modular design and the following minimum features and accessories:

1. Listed and meets the requirements of UL 497A, UL 497B, or UL 497C as applicable
2. Plug-in replaceable modules design to fit on standard M1-50, 66 connecting block
3. Must be installed with matching ground rail or external ground post for extending metallic frame to building ground
4. The SPD's will be rated for Nominal line voltage of 150 Volts, Maximum line voltage of 170 Volts, and the maximum clamping voltage shall be 190 Volts
5. The nominal discharge current with an 8x20 µs impulse will be 5kA

T742E-2.4.6 Ethernet Surge Protective Devices (SPD): Furnish SPD's for each Ethernet cable that is routed underground or to a different outdoor enclosure. Ethernet SPD's will be rated for data transmission speeds up to 10 GB per second without signal degradation. Ethernet cables will contain four sets of unshielded twisted pairs of copper conductors. The SPD will provide common mode, and differential mode protection.

1. The SPDs will be UL Listed in accordance with UL 497A, UL 497B, or UL 497C.
2. Provide plug-in replaceable DIN rail mounted SPD modules that are the "in-line" type that is connected in series with the Ethernet communications conductors.
3. The SPD's shall employ hybrid circuitry that combines silicone avalanche diodes with gas discharge modules. The SPD response time shall be one nano-second or less.
4. The nominal discharge current (In) shall be 4 kV / 2 kA, and the maximum surge current rating shall be 16 kA.

T742E-2.4.7 Modbus (RS-485) communications Surge Protective Devices (SPD): Furnish SPD's for each Modbus communication circuits. Each Modbus circuit will consist of one twisted shielded pair of copper conductors with operating voltages of -7V to +12V.

1. The SPD's will be DIN rail mounted and connected "In-Line" in series with the Modbus communication circuits
2. The SPD's will meet the requirements of IEC 61643-21 with certification to UL 497B
3. The SPD's will contain three stage high energy surge suppression. Stage 1 will consist of parallel connected gas discharge tubes. Stage 2 will have a series connected impedance. Stage 3 will consist of parallel connected transorb diodes
4. The SPD maximum continuous operating voltage (MCOV) will be 15 VDC
5. The clamping voltage must be < 27 VDC
6. The typical breakdown voltage will be 18 VDC
7. The surge current rating will be 15 kA, and the response time will be one nano-second or less
8. The IEC maximum discharge current, I nominal (8x20 µs) will be 10 kA.

T742E-2.4.8 24 VDC Signaling circuits, and 4-20 milli-Amp current circuit Surge Protection Devices:

1. The SPD's will be DIN rail mounted and connected "In-Line" in series with the signaling communication circuits.
2. The SPD's will meet the requirements of IEC 61643-21 with certification to UL 497B.
3. The SPD's will contain three stage high energy surge suppression. Stage 1 will consist of parallel connected gas discharge tubes. Stage 2 will have a series connected impedance. Stage 3 will consist of parallel connected transorb diodes.
4. The SPD maximum continuous operating voltage (MCOV) is 28 VDC.
5. The clamping voltage must be < 46 VDC.
6. The typical breakdown voltage will be 33 VDC.
7. The surge current rating will be 15 kA.
8. The IEC maximum discharge current, I nominal (8x20 μs) will be 10 kA.

T742E-2.5 Enclosures: Furnish NEMA Type 1 enclosures for all enclosures inside of the building and NEMA Type 4X enclosures for exterior applications.

T742E-3 Quality.

All SPDs shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment for a minimum of five years.

Manufacturing facility shall operate a Quality System Certified as ISO 9001:2008 (or latest version) Compliant.

The SPD manufacturer shall provide requested technical assistance through support (including on-site as needed) by a factory-trained representative.

Source Limitations: Obtain SPDs and accessories for like applications through one source from a single manufacturer located in the United States.

Product Options: Drawings indicate size, dimensional requirements, and electrical performance of SPDs and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements".

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

T742E-4 Submittals and Shop Drawings.

T742E-4.1 Submittals and Shop Drawings:

1. Submit in accordance with Section 5, General Requirements for Toll Site Electrical Infrastructure, and the following:
2. Product Data: For each type of product indicated. Include rated capacities, bill of materials of number of MOVs installed per phase with MOV part number and surge current rating, operating weights, operating characteristics, furnished specialties, and accessories.
3. Product Certificates: SPD submittals shall include Listing documentation, signed by product manufacturer certifying compliance with the following standards:
4. UL 1283 compliance verified information is posted at www.UL.com, under Certifications, searching using UL Category Code: FOKY.

5. UL 1449 3rd Edition certification listing and classification page, VPR, MCOV, In, and Type 1 information is posted at www.UL.com, under Certifications, searching using UL Category Code: VZCA. SCCRs are posted in manufacturer's UL docs.

6. UL 497, UL 497A, UL 497B, UL 497C as applicable.

7. Field quality-control test reports, including the following:

a. Test procedures used.

b. Measure the continuity of each conductor between the equipment being protected and the SPD. The maximum resistance is 1 milliohm.

c. Failed test results and corrective action taken to achieve requirements.

8. Operation and Maintenance Data: For Surge protective Devices to include in emergency, operation, and maintenance manuals.

9. Warranties specified in this Section.

T742E-4.2 Operation and Maintenance Data Submittals: Submit operation and maintenance (O&M) data as called for in Acceptance Procedures for Toll Facilities. O&M data to include:

1. All approved shop drawings, product data, and/or cutsheets.

2. Installation, connection, and maintenance information on each type of surge suppression.

3. Procedure and/or timetable for recommended periodic inspection of devices to determine continued usefulness, as applicable.

T742E-5 Warranty.

Provide warranties in accordance with the following:

1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

2. For Data line SPDs, Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge SPDs that fail in materials or workmanship within two years from date of Substantial Completion.

3. Any SPD, that shows evidence of failure or incorrect operation during the warranty period (to include failure of visual failure indicators) shall be replaced or repaired by the manufacturer during the warranty period. The manufacturer shall provide replacement units to the Department for installation.

T742E-6 Construction Requirements.

T742E-6.1 Construction Requirements: Install SPDs that bear the UL seal and are marked in accordance with the referenced standard for the intended use. Install SPDs located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 780 and NFPA 70) and in compliance with the standards listed in T742-9.1.

T742E-6.2 Verification of Project Conditions: Prior to installation coordinate and verify existing project conditions and progress as follows:

1. Verify proper grounding is in place.

2. Verify proper clearances, space, etc. is available for SPD.

3. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge suppression device.

4. Existing Utilities:

a. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

b. Notify Department not less than two days in advance of proposed utility interruptions.

c. Do not proceed with utility interruptions without Department's written permission.

T742E-6.3 General: Provide, install, and connect an SPD's at the first electrical service disconnecting means. Branch breakers in the MDP shall serve as the disconnecting means for the SPD.

Provide, install and connect an SPD at each branch panelboard that serves outdoor equipment. Branch breakers in the panelboard shall serve as the disconnecting means for the SPD.

Provide, install and connect an SPD to protect the emergency generator feeder at each Automatic Transfer Switch (ATS) in project. The SPD will include an integral disconnecting means installed by the SPD manufacturer.

Provide, install, and connect SPD at location where CCTV, access control and communication equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect SPD equipment to equipment being protected and maintain U.L. listing.

Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.

Installation of SPD equipment and its grounding must be in accordance with the manufacturer's recommendations to assure short and proper ground paths.

Install external SPDs with a maximum of 24" length leads. Position the SPD as close to the circuit breaker used as possible. Utilize the breakers closest to the SPD mounting. Install the leads slightly twisted together, but as short and straight as possible with no kinks or coils and an eight-inch minimum bending radius.

T742E-6.4 Installation of SPDs: Except for CCTV, access control and communication equipment, install SPDs as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.

SPDs must be close-nippled to the device being protected in a position nearest the neutral bus (if present) to minimize wire lead length between SPD and the buses or control breaker to which the SPD connects. SPD leads must not extend beyond the SPD manufacturer's recommended maximum lead length without specific approval of the engineer.
Install SPDs in a neat, workmanlike manner. Lead dress must be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.

Install SPDs in a manner that allows simple replacement within short periods of downtime.

Except for point of use type SPDs, install a means of disconnecting the SPD at the panel. At the MDP locations, provide a dedicated 60 amp, breaker for the SPD device. At the distribution secondary and/or subpanels location, provide dedicated 30 Amp, breaker for the SPD device. Change rating of CB's noted above as required to properly provide system as recommended by manufacturer.

T742E-6.5 SPD for Service Entrance and PanelBoards: Install the SPD externally to the distribution equipment with the leads as short and straight as possible. Gently twist

conductors together. Installer may reasonably rearrange breaker locations to ensure short and straightest possible leads to the SPD. If any lead lengths exceed 24", the Contractor responsible for installation must contact the specifying electrical engineer and the surge protective device manufacturer or distributor for installation assistance.

T742E-6.6 Telephone Circuits: Systems utilizing telephone company pairs as a transmission medium shall be provided with SPD conforming to respective device in Part 2 of this specification.

SPDs shall be installed at each point where interface is made to telephone company pairs.

In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:

Where the modem or coupling device is furnished by the telephone company the SPDs shall be installed on the system side of the modem or coupling device.

Where the modem or coupling device is furnished by the system contractor, the SPD shall be installed on the telephone line side of the modem or coupling device.

T742E-6.7 Signaling, Communications and Data Conductors: Any signaling conductor, CCTV conductor, Ethernet conductor, Power over Ethernet (PoE) conductor, or SCADA system conductor that is routed in an exterior environment shall be protected by a surge protection device (SPD). The SPD's will be mounted indoors where possible.

T742E-6.8 Placing System into Service: Before energizing any SPD, the installer shall measure the electrical system voltage and frequency and verify that each SPD is properly rated for use with measured voltage and frequency.

T742E-6.9 Field Quality Control: Verify that electrical wiring installation complies with manufacturer's written installation requirements.

Testing: Perform the following field tests and inspections.

1. After installing surge protective devices, but before the electrical circuitry has been energized, measure the continuity of each lead. Measure between the equipment being protected and the point of connection to the SPD.

2. Complete startup checks according to manufacturer's written instructions.

T742E-7 Demonstration.

Department's maintenance personnel to adjust, operate, and maintain SPDs.

T742E-8 Method of Measurement.

The work specified in this Section will not be measured but will be included in the pay items for panelboards and outdoor communications cabinet.

T742E-9 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

LIGHTING FIXTURES AND LAMPS AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T742F
LIGHTING FIXTURES AND LAMPS AT RTC TOLL SITES

T742F-1 Description.

Furnish and install lighting fixtures and lamps as shown in the Plans.

T742F-2 Materials.

742F-2.1 Standards: Lighting fixtures and lamps must meet the following applicable industry standards:

1. NEMA WD 6 - Wiring Devices-Dimensional Requirements
2. NFPA 70 - National Electrical Code
3. NFPA 101 - Life Safety Code

742F-2.2 Qualifications: Manufacturer must be a company specializing in manufacturing the products specified in this sub-section with minimum three years documented experience.

742F-2.3 Luminaires: Provide luminaires in accordance with the lighting fixture schedule in the Plans.

742F-2.4 Exterior LED Light Fixtures: Provide Flat face, low profile, wall mount, exterior light fixtures in accordance with the Plans and the following:

The baseplate must be manufactured from marine grade die-cast aluminum. The baseplate flange shall interlock and wrap around the lens base to prevent water intrusion. Lens: The lens must be made from ultraviolet stabilized, high impact resistant, virgin injection molded polycarbonate. Ensure the lens is held in place by a push/turn/lock in place device that does not require tools. The lens and lens base will be secured with a single, concealed, captive fastener with a center pin.

Gasketing: A self-adhesive neoprene gasket must seal between the baseplate to the mounting surface.

The LED light source color temperature must be 3500 degrees Kelvin with a minimum CRI of 82.

T742F-3 Submittals and Shop Drawings.

Submit documents in accordance with Section 5 and General Requirements for Toll Site Electrical Infrastructure. Submit manufacturer's operation and maintenance instructions for each product.

T742F-4 Construction Requirements.

742F-4.1 Installation: Furnish and install luminaires in accordance with the following:

Install exterior mounted luminaires, at height as indicated on Drawings, as scheduled.

Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within the luminaire.

Bond products and metal accessories to the branch circuit equipment grounding conductor.

Surface mounted fixtures and boxes shall be supported to superstructure and/or strut channel frame with all-thread rod.

Light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels.

Provide low voltage transformers and power supplies for all low voltage light fixtures.

742F-4.2 Field Quality Control: Operate each luminaire after installation and connection. Inspect for proper connections and operation.

Aim and adjust luminaires as indicated.

742F-4.3 Cleaning: Clean installed work in accordance with Acceptance Procedures for Toll Facilities at RTC Toll Sites and the following:

1. Clean electrical parts to remove conductive and deleterious materials.
2. Remove dirt and debris from inside the enclosures.
3. Clean photometric control surfaces as recommended by manufacturer.
4. Clean finishes and touch up damaged areas.

T742F-5 Acceptance Procedures.

Demonstrate luminaire operation for minimum of two hours during Primary Walk Through. See Acceptance Procedures at Toll Facilities for RTC Toll Sites.

Re-lamp any luminaires that have failed lamps at Substantial Completion

T742F-6 Method of Measurement.

The work specified in this Section will not be measured but will be included in the pay item for panelboards.

T742F-7 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

STATIC UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR OUTDOOR COMMUNICATION CABINETS AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T742G
STATIC UNINTERRUPTIBLE POWER SUPPLY SYSTEMS FOR OUTDOOR COMMUNICATION CABINETS AT RTC TOLL SITES

T742G-1 Description.

Provide all labor, materials, services, testing, and equipment necessary to provide Static Uninterruptible Power Supply (UPS) systems with internal bypass at each RTC toll site.

T742G-2 Materials.

T742G-2.1 Standards:

1. UL 1778 - Underwriters Laboratory. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.
2. FCC rules, part 15 – Limits for a Class A digital device
3. IEEE C62.41 - Guide on Surge Voltages in AC Power Circuits Rated up to 600V
4. IEEE 519 – Recommended Practices for Harmonic Control in Electrical Power Systems
5. NFPA 70 - National Electrical Code

T742G-2.2 UPS System Requirements: Provide two, separate, rack-mounted uninterruptible power supply (UPS) systems within each Outdoor Communications Cabinet (OCC).

T742G-2.2.1 UPS System for OCC Equipment: Provide critical/clean power to the electrical equipment within the OCC with a 2000 VA, 1800 Watts, UPS system in accordance with the following:

1. Provide UPS with 120 Volt input, 120 Volt output, 60 Hz, single phase, 2 wire, plus ground.
2. Provide continuous, high quality, conditioned, 120 Volt AC sinewave output power to the electrical equipment within the OCC.
3. Output power from the UPS will be distributed by a cord and plug connected Power Distribution Unit (PDU) with twelve 120 Volt simplex receptacles, NEMA 5-15R/NEMA 5-20R.
4. The UPS will protect the electrical equipment in the OCC from power disturbances on the power distribution system due to power blackouts, brownouts, surges, or noise interference.
5. AC INPUT SUPPLIED TO THE UPS SYSTEM:
    a. Input Voltage: 120 Volts, single phase, 2 wire - plus ground.
    b. Input AC power for the UPS will be delivered by a 10 foot long, factory installed, cord and plug. The plug will be a twist lock, NEMA L5-20P.
    c. Ensure that the UPS will be served by a dedicated feeder that is not spliced or tapped by other feeders.
    d. Voltage Range: The incoming AC power voltage range will be between 60 Volts and 150 Volts. Nominal voltage is 120 Volts AC.
    e. Frequency range: The UPS will operate when the AC frequency is between 40 Hz and 70 Hz. Nominal frequency is 60 Hz.

f. Frequency: Auto-sense input frequency when first powered up and operate within the following frequency specifications. UPS must be capable of cold start with default frequency of 60Hz. Once started, the frequency operating window must be 40-70Hz. Provide three frequency settings in the Configuration program: Auto frequency sensing (factory default setting), 50Hz frequency conversion and 60Hz frequency conversion.

g. Input Power Factor: >0.99 lagging at rated load.

h. Input Current Harmonic Distortion: THD must be less than or equal to 5% at nonlinear, full load operation.

i. Input current rating: The input current rating will be 16 Amps at 120 Volts.

j. Inrush Current (initial startup, no load): Provide a UPS with a maximum inrush current of 6 times the full load peak input current.

k. Surge Immunity & Protection: UPS must conform to ANSI C62.41, Category B.

6. AC OUTPUT FROM THE UPS SYSTEM:

a. The UPS output voltage will be 120 Volts, AC, single-phase, 60 Hz, 2 wire, plus ground.

b. Output power will be delivered from a 120 Volt AC, 20 Amp, twist lock simplex receptacle, NEMA L5-20R located on the back of the UPS.

c. Output power from the UPS will be distributed by a cord and plug connected Power Distribution Unit (PDU) equipped with twelve 120 Volt simplex receptacles, NEMA 5-15R/NEMA 5-20R. The PDU will accept power from the UPS by a 10 ft long cord and plug. The plug will be a twist lock type plug, NEMA L5-20P.

d. The PDU will be mounted vertically within the Outdoor Communications Cabinet.

e. Voltage Regulation: +/- 1% steady state.

f. Frequency Regulation: ±3.5 Hz synchronized to utility. ±0.1 Hz free running or on-battery operation.

g. Frequency slew rate: 1.0 Hz per second, maximum.

h. Voltage Distortion: Less than 2% total harmonic distortion (THD) typical into a 100% linear load, less than 5% THD typical into a 100% non-linear load.

i. Load Power Factor Range: The load power factor range shall be 0.65 lagging to 1.0 (unity) without power derating.

j. The maximum UPS output power rating will be 2000 VA, 1800 Watts.

k. Inverter Overload Capability

Overload Percent	Duration Inverter must support rated load
105% to 125% 125% to 150% 150% to 200%	60 seconds 50 seconds 2 seconds

l. Voltage Transient Response: The transient response of the output voltage with resistor step loading will be +/-5% for input supply from off to on and for a load from 0% to 100% and 100% to 0%. Transient response in the output voltage with resistor step loading will be +/-4% for input supply from off to on and for a load from 20% to 100% and 100% to 20%.

m. Transient Recovery Time: To nominal voltage within 60 ms.

n. AC-AC Efficiency: The UPS must be EPA Energy Star Qualified with a 93% AC –AC at full rated linear load.

o. Programmable and Controllable 120 Volt Receptacle Outlets: The UPS will have four simplex receptacle outlets, 120 Volt AC, 20 Amps, These receptacle outlets will be programmable and/or controllable. These outlets will be user customizable to perform load shedding based upon the remaining battery capacity, time on battery operation, battery time remaining, and overload condition when on battery power. The user shall be able to program these receptacles for sequential restart of connected equipment based on the amount of time after input/normal power is restored. The user can also program these receptacles to always be turned off. To prevent unauthorized equipment from being plugged into the UPS.

7. BATTERY

a. Internal Battery: The batteries will consist of flame retardant, valve regulated, non-spillable, lead acid cells.

b. Reserve Time: Beginning with fully charged batteries, and the ambient temperature at 77° F, the UPS will provide high quality, conditioned, output power for 4 minutes at full (100% rated) load with no AC input power to charge the batteries.

c. The UPS will provide high quality, conditioned, output power for 12.3 minutes when the output load is 50% of the full rated load with no AC input power to charge the batteries. The UPS shall be capable of interfacing with an external battery cabinet to extend the reserve time capabilities.

d. Battery Recharge: The UPS will have a three stage battery charger designed to prolong the battery life. After a full battery discharge, the battery charger will recharge the batteries to 90% capacity within four (4) hours.

T742G-2.2.2 UPS System for RTC Cabinet: Provide critical/clean power to the Roadside Tolling Cabinet (RTC) with a 5000 VA, 5000 Watts, UPS system, rack mounted within the OCC, as follows:

1. Provide an UPS system with 120/240 Volt input, single phase, and 120/240 Volt output, 60 Hz, single phase, 3 wire, plus ground.

2. Provide continuous, high quality, conditioned, 120/240 Volt AC, 60 Hz, sinewave output power to the tolling equipment within the RTC.

3. Output power from the UPS will be distributed by a hard wired, feeder circuit routed underground to the RTC.

4. The UPS will protect the tolling equipment within the RTC from power disturbances on the normal power distribution system due to power blackouts, brownouts, surges, or noise interference.

5. AC INPUT SUPPLIED TO THE UPS

a. Input Voltage: 120/240 Volts, single phase, 60 Hz, 3 wire - plus ground.

b. Input AC power for the UPS will be delivered by a hard wired feeder circuit.

c. Ensure that the UPS will be served by a dedicated feeder that is not spliced or tapped by other feeders.

d. Voltage Range: The UPS will operate properly when the incoming AC power voltage is between 176 Volts and 280 Volts. Nominal voltage is 120/240 Volts AC.

e. Frequency range: The UPS will operate properly when the AC frequency is between 40 Hz and 70 Hz. Nominal frequency is 60 Hz.

f. Input current harmonic distortion: Total Harmonic Distortion (THD) shall be less than, or equal to 3% when operating at linear full load operation. THD shall be less than or equal to 5% when operating at non-linear full load operation.

g. Inrush Current: Upon initial startup with no load, the UPS shall have a maximum inrush current of 6 times the full load input current.

h. Voltage: The point at which the UPS transfers to battery operation must be dependent on the amount of load that the UPS is supporting. The UPS must operate from the following voltage ranges without drawing power from the batteries:

i. Low Line Voltage Range

j. From 0 to 50%load the low line voltage is constant.

k. From 51-100% load the low line voltage increases at a linear rate.

l. For loads over 100%, the low line voltage remains constant.

Load		Low Line Voltage
100% to 51%	L-N Transfer	60 - 90 ± 3.1VAC
	L-N Comeback	68 - 98 ± 3.1VAC
50% to 0%	L-N Transfer	60 ± 3.1VAC
	L-N Comeback	68 ± 3.1VAC

High Line Voltage Range	
High Line Voltage	120/208V Models
High Line Transfer	149.5 ± 3.1VAC
High Line Comeback	142.5 ± 3.1VAC

m. Frequency: Auto-sense input frequency when first powered up and operate within the following frequency specifications. UPS must be capable of cold start with default frequency of 60Hz. Once started, the frequency operating window must be 40-70Hz. Provide three frequency settings in the Configuration program: Auto frequency sensing (factory default setting), 50 Hz frequency conversion and 60 Hz frequency conversion.

n. Input Power Factor: >0.99 lagging at rated load.

o. Input Current Harmonic Distortion: THD must be less than or equal to 3% at linear, full load operation. THD must be less than or equal to 5% at nonlinear, full load operation.

p. Inrush Current (initial startup, no load): Provide with a maximum inrush current of 6 times the full load peak input current.

q. Surge Immunity & Protection: UPS must conform to ANSI C62.41, Category B.

6. AC OUTPUT FROM THE UPS

a. The UPS output voltage will be 120/240 Volts, AC, single-phase, 60 Hz, 3 wire, plus ground.

b. Output power from the UPS will be distributed by a hard wired, feeder circuit (L1, L2, N, G) routed underground to the RTC.

c. Voltage Regulation: +/- 1% steady state.

d. Voltage Distortion: Less than 2% total harmonic distortion (THD) typical into a 100% linear load, less than 5% THD typical when into 100% non-linear load.

e. Frequency Regulation: 60 Hz, +/- 3.5 Hz when synchronized to the bypass power. +/- 0.1 Hz when running on battery power.

f. Frequency slew rate: Slew rate shall be 1.0 Hz per second maximum.

g. The maximum UPS output power rating will be 5000 VA, 5000 Watts at 0.9 lagging power factor.

h. Load power factor range: The load power factor range shall be 0.65 lagging to 1.0 unity without power derating.

i. Inverter overload capability: The inverter shall support the output load for 5 minutes when it is overloaded between 105% and 125%, and the inverter will continue to support the output load when it is overloaded between 125% and 150% for 60 seconds.

j. Voltage Transient Response: The transient response of the output voltage with resister step loading will be +/- 5% for input supply from off to on, and for a load from 0% to 100%, and from 100% to 0%. Transient response in the output voltage with resister step loading will be +/- 4% for input supply from off to on, and for a load from 20% to 100%, and 100% to 20%.

k. Transient recovery time: The output voltage will recover to nominal voltage within 60 milli-seconds.

l. AC – AC efficiency: The UPS unit shall be EPA Energy Star Qualified. The efficiency of the UPS shall be 93% at full rated linear load.

7. BATTERY

a. Internal Battery: The batteries will consist of flame retardant, valve regulated, non-spillable, lead acid cells.

b. Reserve Time: Beginning with fully charged batteries, and the ambient temperature at 77°F, the UPS will provide high quality, conditioned, output power for 4.5 minutes at full (100% rated) load with no AC input power to charge the batteries.

c. The UPS will provide high quality, conditioned, output power for 12.5 minutes when the output load is 50% of the full rated load with no AC input power to charge the batteries. The UPS shall be capable of interfacing with an external battery cabinet to extend the reserve time capabilities.

d. Battery Recharge: The UPS will have a three stage battery charger designed to prolong the battery life. After a full battery discharge, the battery charger will recharge the batteries to 90% capacity within four (4) hours.

T742G-2.3 Environmental Conditions:

1. Ambient Temperature: When the UPS is operating, the ambient temperature range shall be between 32° F and 104° F. There shall be no degradation in the performance of the UPS when operating in this temperature range. Automatic derating of the output power rating shall occur if the UPS is operated in a higher ambient temperature than 104° F.

2. Storage Temperature. The UPS can be stored (not operating) when ambient temperatures are between 5° F and 104° F.

3. Relative humidity: When operating, or when in storage, between 0 to 95% non-condensing.

4. Altitude: The UPS will operate normally without power derating when the altitude is 10,000 feet or lower.

5. Audible Noise: The audible noise of the operating UPS will be 48 dBA, or less, at 1 meter from the front, sides, or rear of the UPS.

T742G-2.4 Modes of Operation: The UPS must operate as a true on-line double-conversion system in the following modes:

1. Normal - In normal operation incoming AC power will be supplied to the input power factor corrected rectifier that converts the AC power to DC power for the inverter. In this mode, power shall also be derived from the incoming power for the battery charger. The battery charger maintains a float-charge on the battery. The inverter will use DC power from the rectifier to regenerate filtered and regulated AC sinewave power for the connected loads. If incoming AC power is interrupted, or if the voltage or frequency is not within nominal range, the inverter will use DC battery power to generate 120 Volt AC output power until the incoming power is restored, or until the battery is discharged.

2. Back-up - Upon failure of incoming AC power, the critical AC load is supplied by the inverter, which without any switching obtains power from the battery. There will be no interruption in power to the critical load upon failure or restoration of normal incoming power to the UPS.

3. Recharge - Upon restoration of incoming AC power, the input rectifier will automatically restart and resume supplying DC power to the inverter. The battery charger will resume charging of the battery .

4. Automatic Restart - After a utility / mains AC power outage and complete battery discharge, automatically restart the UPS and resume supplying power to the critical load and to the battery charger which will automatically recharge the battery upon restoration of utility / mains AC power. This feature must be capable of being disabled by the user.

5. Automatic Restart - Upon restoration of normal incoming AC power, after an incoming AC power outage, and complete battery discharge, the UPS will automatically restart and resume supplying power to the critical load. In addition, the battery charger will automatically recharge the battery. This feature must be enabled (factory default) and will be capable of being disabled by the user.

6. Bypass - The internal bypass will provide an automatic transfer of the critical AC power from the inverter to the bypass source in the event of an overload, PFC failure, internal over temperature, DC bus overvoltage, or inverter failure. .

7. ECO –The UPS will allow the user to enable and place the UPS in ECO mode of operation to reduce the electrical power consumption. The ECO mode operation shall be an Active type, whereas the UPS will power the connected equipment through the bypass path and the UPS inverter shall be on and operating at no load in order to stay synchronized with the bypass to ensure rapid transfers to inverter power when input power falls outside of the user customizable parameters. The UPS shall also have a user customizable requalification time that input power must remain within the ECO mode parameters before transferring back to ECO operation.

T742G-2.5 Cabinet: Ensure the UPS unit(s) are comprised of: A user interface module, an input PFC converter, an IGBT inverter, a battery charger, input filter, an internal bypass circuit, sealed battery cells, and shall be housed in a rack mountable NEMA 1 enclosure and must meet the requirements of IP20. The UPS cabinet shall be cleaned, primed, and painted with the manufacturer's standard color.

T742G-2.6 Cooling: Provide forced-air cooled UPS from an internally mounted, continuously operating fan. Fan speed must be controlled by the UPS from 50% to 100%. Air intake must be through the front of the unit and exhausted out the rear of the unit.

T742G-2.7 Input Converter: Incoming AC power will be converted to a regulated DC output by the input converter for supplying DC power to the inverter. The input converter will provide input power factor correction and input current distortion reduction.

1. AC Input Current Limit: Provide the input converter with AC input current limiting, whereby the maximum input current is limited to 125% of the full load input current rating.

2. Input Protection: Provide the UPS with built-in protection against under voltage, over current, and overvoltage conditions including low-energy surges introduced on the primary AC source. The UPS can sustain input surges without damage per criteria listed in IEEE C62.41, Category C, Level 3.

3. Battery Recharge: Provide a three-stage battery charger designed to prolong battery life. After a full battery discharge, the battery charger will recharge the batteries to 90% capacity within three (3) hours. Provide DC overvoltage protection so that if the DC voltage exceeds the pre-set limit, the UPS will shut down automatically and the critical load will be transferred to bypass.

T742G-2.8 Inverter: Provide an UPS inverter with a pulse width modulated (PWM) design capable of providing the specified AC output. The inverter must convert DC power from the input converter output or from the battery into precise sinewave AC power for supporting the critical power AC loads.

1. Overload: The inverter shall be capable of supplying current and voltage for overloads exceeding 100% and up to 200% of full load current. A visual indicator and audible alarm indicate overload operation. For greater currents or longer time duration, the inverter has electronic current-limiting protection to prevent damage to components. The inverter is self-protecting against any magnitude of connected output overload. Inverter control logic senses and disconnects the inverter from the critical AC load without the requirement to clear protective devices.

2. Inverter DC Protection: The inverter shall be protected by the following DC shutdown levels.

    a. DC Overvoltage Shutdown

    b. DC under voltage shutdown (End of discharge)

    c. DC under voltage warning (Low battery reserve). The factory default will be set at 2 minutes. This setting is user configurable from 2 to 20 minutes.

3. Output Frequency: The output frequency of the inverter shall be controlled by an oscillator. The inverter will maintain the output frequency to ± 0.1% of nominal frequency during battery mode, frequency converter mode, or when otherwise not synchronized with incoming utility / normal power.

4. Output Protection: The UPS inverter shall employ electronic current limiting circuitry.

5. Battery Over Discharge Protection: To prevent battery damage from over discharging, the UPS control logic controls the shutdown voltage set point. This point is dependent on the rate of discharge and the amount of charge remaining in the battery.

T742G-2.9 Display and Controls: The UPS must be provided with a microprocessor based unit status display, and controls section designed for convenient and reliable user operation. The monitoring functions such as voltage, current, UPS status, and alarm indicators shall be displayed on a full color graphical LCD display. The display must be menu driven navigation and use control buttons for ease of navigation and selection of the configurable parameters.

1. System: The UPS display shall also include LED based system indicators. The system level indicators shall be: Run indicator, and Alarm indicator.

a. The Run indicator LED is green in color and indicates the following:

i. If the LED is on and solid (not blinking) then the UPS is providing output power.

ii. If the LED is blinking, then the inverter is starting.

iii. If the LED off, then the UPS is not providing output power.

b. The UPS Alarm indicator is a multi-color LED indicator to notify the user that a UPS fault condition has occurred.

i. If the LED is yellow, then an alarm has occurred.

ii. If the LED is red, then a fault has occurred.

iii. If the LED is off, then there is no active alarm or fault.

2. Controls: UPS startup and shutdown operations shall be accomplished by using the power button on the front panel of the UPS. The display shall be menu driven navigation and use four control buttons for ease of navigation and selection of the configurable parameters.

a. Control Buttons: The UPS display control button functionality shall be as follows.

i. ESC Button: This button shall return to the previous menu or abort any change before confirming the change.

ii. Up/Left arrow button: This button shall move the cursor up or left, or increase the value displayed when changing parameters. This button will also be used to scroll up for navigating the screens.

iii. Down/Right arrow button: This button will move the cursor down or right, or decrease the value displayed when changing parameters. This button shall also be used to scroll down for navigating the screens.

iv. Enter button: This button shall enter the next level menu or confirm the parameter changes.

b. Display Menu Structure: The UPS display shall have the following menu structure with the following status and configuration screens.

i. UPS Flow Screen (Default screen): The UPS flow screen shall be the default screen after system startup. It shall display an overview screen showing status information, the active (green) power path, and non-working power path (gray). Details in this default screen include operating mode, the input voltage and frequency, output voltage and frequency, battery capacity, estimated battery time remaining, and loading percentage. To prolong the display life, the UPS LCD display will dim and display a screen saver after two minutes of no user interaction if there are no active alarms. Pressing the ENTER shall wake up

the display and this action shall not perform any operation. If an alarm or fault occurs, the display shall also wake up the display.

ii. Main Menu: The main menu shall list 6 submenu selections, from left to right, then top to bottom:

a) Status
b) Settings
c) Control
d) Log
e) About
f) Maintenance

iii. Status Menu: The Status screens shall provide the following information.

a) Input
    - L-N Voltage (V)
    - L-N current (A)
    - Frequency (Hz)
    - Power Factor
    - Energy (kWh)
    - Input black count (count of input voltage lost)
    - Input brown count (count of PFC overload to battery)

b) Bypass
    - L-N Voltage (V)
    - Frequency (Hz)

c) Battery
    - Battery status
    - Battery voltage (V)
    - Battery current (A)
    - Backup time (min)
    - Remaining capacity (%)
    - Discharge count (# of discharges for the battery module)
    - Total discharge time (min)
    - Battery running time (day)
    - Battery replacement time (date of last replacement)
    - External battery cabinet group number
    - Battery average temp (°C)
    - Battery highest temp (°C)
    - Battery lowest temp (°C)

d) Output
    - L-N Voltage (V)
    - L-N current (A)
    - Frequency (Hz)
    - Energy (kWh)
    - Load
    - Sout (apparent output power)

Pout (active output power)
Power factor
Load percent (%)
Time since startup (Days, Hours, Minutes)

3. Settings: The UPS Configuration screens shall provide the following customizable parameters: The default values are listed first.

Output

Voltage selection
Startup on Bypass (Enable/Disable)
Frequency selection (Auto bypass Enable, Auto bypass Disable, 50 Hz no bypass, 60 Hz no bypass)
Bypass voltage upper limit
Bypass voltage lower limit
Run mode (normal mode, or ECO load
ECO voltage range
ECO frequency range
ECO requalification time

Battery

External battery AH
External battery cabinet group No. (0 – 10)
Low battery time
Battery replaced time
Battery periodic test enable
Battery Note duration (month)
Discharge protect time
Equal charge enable
Max charge current
Temperature compensation
Replace battery

4. Monitor

a. Language
b. Date
c. Time
d. Display orientation (Auto rotate, Rack, Tower)
e. Audible alarm (enable, disable)
f. Change settings password

5. System

a. Auto restart
b. Auto restart delay
c. Guaranteed shutdown
d. Start with no battery
e. Remote control
f. Any mode shutdown auto restart enable
g. Output contact NO/NC
h. Input contact NO/NC
i. Dry contact 5 output. (Low battery, On bypass, On battery, UPS fault)

j. Dry contact 6 output. (Low battery, On bypass, On battery, UPS fault)
k. Dry contact 1 output. (Low battery, On bypass, On battery, UPS fault)
l. Dry contact 2 output. (Low battery, On bypass, On battery, UPS fault)
m. Sleep mode
n. IT system compatibility
o. Outlet Parameter Options
p. Apply same settings across outlets
q. Turn on Outlet
r. Turn on Delay
s. Outlet Settings based on discharging time
t. Threshold of turning off the outlet
u. Turn on when power returns
v. Outlet settings based on capacity
w. Threshold of turning off the outlet
x. Turn on when power returns

6. Control: The UPS shall have the following controls from the display.
a. UPS On/Off/Bypass
b. Turn UPS On
c. Turn UPS Off
d. Turn on Bypass (manually transfer to bypass power)
e. Audible Alarm
f. Turn audible alarm On (test alarm)
g. Turn audible alarm Off (alarm silence)
h. Battery test
i. Start battery self test
j. Clear faults
k. Reset power statistics

7. Log: The UPS shall have an event log to record 255 events and shall be viewable from the display.
a. View Log
b. Navigate the event log to view the last 255 events
c. Clear Log
d. Once the event log is full, the controller will begin replacing the first event logged to provide a FIFO process for maintaining event history. The event history shall record and display the number of events out of the 255, as well as the time from when viewing the event, and the event that occurred.

8. About: The UPS shall have an About screen to display the UPS model number, serial number, time since startup, hardware version, and firmware version.

9. Maintenance: The UPS shall have the ability to display the network information of the RDU101 SNMP/webcard when installed. The information available shall be MAC address and IP address.

10. Automatic Battery Test: The UPS shall feature an automatic battery test with the factory default test interval set at every 8 weeks. The battery test shall ensure the capability of the battery to supply power to the inverter while loaded. If the battery fails the test, the UPS shall display a warning message to indicate the internal batteries need to be replaced. The

automatic battery test feature shall be capable of being disabled or configured to operate every 8, 12, 16, 20 or 26 weeks through the UPS Configuration Program or from the LCD display.

T742G-2.10 Bypass: Provide a bypass circuit as an integral part of the UPS.

1. UPS 5KVA: Provide double pole device which includes a make-before-break transfer, and provide a maximum detect and transfer time of 4-6 milli-seconds. Design the bypass circuit to ensure the simultaneous transfer of the L1 and L2 poles. Configure the bypass to wrap around the PFC converter, battery charger, DC-DC converter, inverter, and battery. Use the rear panel mounted UPS input circuit breaker for the bypass circuit and route bypass power through the UPS input filters and surge suppression circuit. The bypass circuit default position must be in the Bypass mode (utility).

2. UPS 2KVA: Provide bypass control logic which contains an automatic transfer control circuit that senses the status of the inverter logic signals and operating and alarm conditions. Configure the bypass control circuit to provide a transfer of the load to the bypass source if available and if the inverter is capable of powering the load (i.e. if there is an overload condition, if the unit is in manual bypass source, or if the voltage or frequency is out of tolerance).

3. Automatic Transfers: Activate the bypass automatically with the transfer control logic, transferring the critical AC load to the bypass source, after the transfer logic senses one of the following conditions:

a. UPS Overload
b. UPS over temperature
c. PFC failure
d. Inverter failure
e. DC bus overvoltage

i. Once the overload condition is reduced, the load shall automatically be transferred back to inverter power.

ii. UPS 5KVA: An over temperature requires manual transfer back to inverter power after cooling.

T742G-2.11 Internal Battery: Use a valve regulated, non-spillable, lead acid cells (VRLA) as a stored energy source for the specified UPS system. House the battery internal to the UPS cabinet, and size to support the inverter at rated load and power factor, with an ambient temperature of 25 °C (77 °F) for a minimum of 3 minutes reserve time. The expected life of the battery shall be 3 – 5 years or a minimum 260 complete discharge cycles. Ensure that the UPS battery can be replaced easily by the owner/operator. The UPS will allow connections for up to 10 external battery cabinets to provide extended run time. The internal battery must be user replaceable and includes a blind-mate style connector located on the rear of the battery kit. The expected life of the battery must be 3-5 years or a minimum 260 complete discharge cycles.

T742G-2.12 Optional External Battery Cabinet: UPS 5KVA: The UPS shall allow for connecting of up to six external battery cabinets to provide extended run time.

T742G-2.13 Output Distribution: Output distribution requirements for each UPS located in an OCC is as follows:

1. UPS 5KVA - Output power will be 120/240 Volts, AC, single-phase, 60 Hz, 3 wire, plus ground. Output power from the UPS will be distributed by a hard wired feeder circuit (L1, L2, N, G) routed underground to the RTC.

2. UPS 2KVA - Output Distribution shall be integral to the UPS and located on the rear of the unit. The UPS unit will have four (4) programmable 120 Volt, NEMA 5-20R,

simplex receptacle outlets that can be controlled/programmed on/off individually. The UPS unit will also have one (1) 120 Volt, NEMA L5-20R, simplex receptacle that is not programmable and is energized when the UPS is operating normally.

T742G-2.14 Communications: Communications requirements for each UPS located in an OCC must be in accordance with the following:



the Department's managed network switch (Brocade switch) within the OCC. Network communication cables for each UPS is as follows:

a. UPS 5KVA - Install a category 6 cable, 4 pair, copper UTP, CMP rated, network communication cable with RJ45 connectors.

b. UPS 2KVA - . Install a category 6 cable, 4 pair, copper UTP, CMP rated, network communication cable with RJ45 connectors.

2. Intellislot Relay Interface Card: The optional Intellislot Relay Interface Card shall provide contact closure for remote monitoring of alarm conditions in the UPS. Contacts are available for On battery, On bypass, Low battery, Summary alarm, UPS on fault, and On UPS. The contacts will be rated for 24 VAC or 24 VDC at 1 Amp. Connections shall be to a terminal block connector with a cable provided by the end user.

3. Terminal Block Connections: The UPS shall be equipped with a terminal block located on the rear panel to provide low voltage signals for On battery, Low battery, Any-mode shutdown, and Battery mode shutdown.

4. Any-Mode Shutdown: The purpose of Any-Mode Shutdown will be to shut down the UPS output by turning off the rectifier, inverter, and bypass so that there is no output power to the electrical loads. Any mode shutdown can be operated locally and remotely, as described below.

a. Local Any-mode shutdown can be entered from the battery mode shutdown device on the back of the unit.

b. Remote Any-mode shutdown can be initiated by a battery mode shutdown button mounted at a remote location.

5. Remote Power Off shall be performed by either NO or NC contacts of Any-mode shutdown, depending on the settings in the configuration program. A current limited source
(+ 12 VDC, 50 milli-Amps) shall be available from the UPS. The connection to the UPS for remote power off shall be by a terminal block connector.

6. Battery Mode Shutdown: Battery mode shutdown shall permit shutting down the UPS by turning off the rectifier, inverter, and bypass so that there is no output power to the electrical loads when the UPS is on battery. Battery mode shutdown shall be able to be performed locally and remotely. The battery mode shutdown signal will not cause an immediate shutdown, it will instead start a 2 minute shutdown timer. This timer can not be stopped once it is triggered. If normal utility power returns during the count down timer, then the UPS will still

shut down, and must remain shut down for 10 seconds. The auto-restart setting will then dictate whether the UPS turns back On when normal utility power is restored.

7. USB Port: A USB communications port (Version 2.0) shall be provided on the rear of the UPS, and shall meet the HID Power Device standard, version 1.0 or later. All models must work with the Power Management system in Microsoft® Windows® 11 or later. They must also support the equivalent functions in Linux, and Mac OSX®

8. Serial Port: A serial port (RS-232) with an RJ-45 connector will be provided on the rear of the UPS. This will allow for command line interface.

T742G-3 Shop Drawings and Submittals.

1. Submit plan views and elevation views of each UPS cabinet with overall dimensions and clearances required for maintenance procedures. Provide heat output and cooling air requirements.

2. The specified UPS system will be supplied with Safety Instructions, Warning Sheet, WEEE recycling sheet (ISO 14001 compliance), a printed copy of the Quick Start Guide, and a printed copy of the factory test report.

3. The User Manual will be downloaded from the manufacturer's web site. The User Manual will include installation drawings and instructions, a functional description of the equipment with block diagrams, safety precautions, illustrations, step by step operating procedures, and routine maintenance guidelines.

4. A warranty statement and repair parts availability statement will be submitted to the department.

T742G-4 Replacement Parts.

Replacement parts will available through a local distributor within 100 miles of the job site. The replacement parts including power modules and battery modules for the UPS model installed at the job site will be available 24 hours a day, 7 days a week, 365 days a year.

T742G-5 Quality Assurance.

T742G-5.1 Manufacturers Qualifications: Minimum of ten years experience in the design, manufacture, and testing of solid-state UPS systems is required. The manufacturer shall be certified to ISO 9001.

T742G-5.2 Factory Testing: Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification. These tests include operational discharge and recharge tests on the internal battery to guarantee rated performance.

T742G-5.3 Fabrication: All materials and components used to manufacture the UPS will be new, of current manufacture, and not in prior service except as required during factory testing. The UPS is constructed of replaceable subassemblies. All active electronic devices are solid-state. All relays must be provided with dust covers.

T742G-5.4 Wiring: Wiring practices, materials and coding must be in accordance with the requirements of the standards listed in Section 2.1 above and other applicable codes and standards. All wiring must be copper.

T742G-6 Installation.

Install UPS assemblies in accordance with the manufacturer's recommendations. Include a UPS operation and maintenance manual in the cabinet where the UPS is installed that includes cabinet wiring schematics, electrical interconnection drawings, parts layout and parts lists.

T742G-7 Testing.

The following inspections and test procedures will be performed by factory trained field service personnel during the UPS start-up and commissioning

T742G-7.1 Visual Inspection:

1. Inspect equipment for signs of shipping or installation damage.
2. Verify installation per drawings.
3. Inspect cabinets for foreign objects.

T742G-7.2 Mechanical Inspection:

1. Check all power modules are correctly fitted.
2. Check all battery modules are correctly fitted.
3. Check all terminal screws, nuts, and/or spade lugs for tightness.

T742G-7.3 Electrical Inspection:

1. Confirm that the input voltage and phase rotation is correct.
2. Verify that the input and output receptacles and connections or not damaged.

T742G-8 Warranty.

Provide warranties in accordance with Section 685-5 and the following:

Shipping charges for repair parts during the warranty period will not be charged to the Department.

The UPS manufacturer shall provide a written warranty statement to the department that states: “During the warranty period a factory trained service technician will be dispatched and arrive at the site where the UPS is located within 4 hours of receiving a request for service by the Department.”

The warranty and the written warranty statement shall be included in the shop drawings.

T742G-9 Method of Measurement.

The UPS 2 KVA and 5 KVA will not be measured separately and will be included in the pay item for the OCC.

T742G-10 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

SECTION T745
SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM
AT RTC TOLL SITES

T745-1 Description.

Furnish all labor and materials necessary to provide, install and test a Supervisory Control and Data Acquisition System at each toll site.

T745-2 Materials.

T745-2.1 SCADA System: must meet the following applicable industry standards:

1. FCC rules, part 15 – Limits for a Class A digital device.
2. IEEE C62.41 - Guide on Surge Voltages in AC Power Circuits Rated up to 600V.
3. MODBUS over serial line specifications and implementation guide V1.0.
4. UL requirements throughout document include UL or other National Recognized Testing Laboratory (NRTL) approved by the United States Department of Labor, Occupational Safety and Health Administration (OSHA) under the requirements of 29CFR1910.7.

Provide a SCADA system at each toll site consisting of a SCADA Control Panel (SCP) to monitor various parameters and conditions associated with the toll site:

1. Electrical distribution system
2. Emergency generator
3. ATS
4. Fuel tank
5. TEB or OCC Cabinet AC systems
6. RTC enclosure(s)
7. OCC enclosure
8. Power panel

Provide analog sensors, monitors, and position indicating contacts installed in the equipment or in the enclosures to provide inputs to the SCADA control panel. The remote sensors, monitors and components will be connected to the SCADA control panel with communication cables in raceways to form a complete system.

A technician from Florida's Turnpike Enterprise will load the final programming at the SCADA control panel for final acceptance and commissioning tests.

Provide conduit and cabling in accordance with the SCADA Diagram included in the Plans.

The SCADA Control Panel must be manufactured by a UL508 Panel fabrication shop.

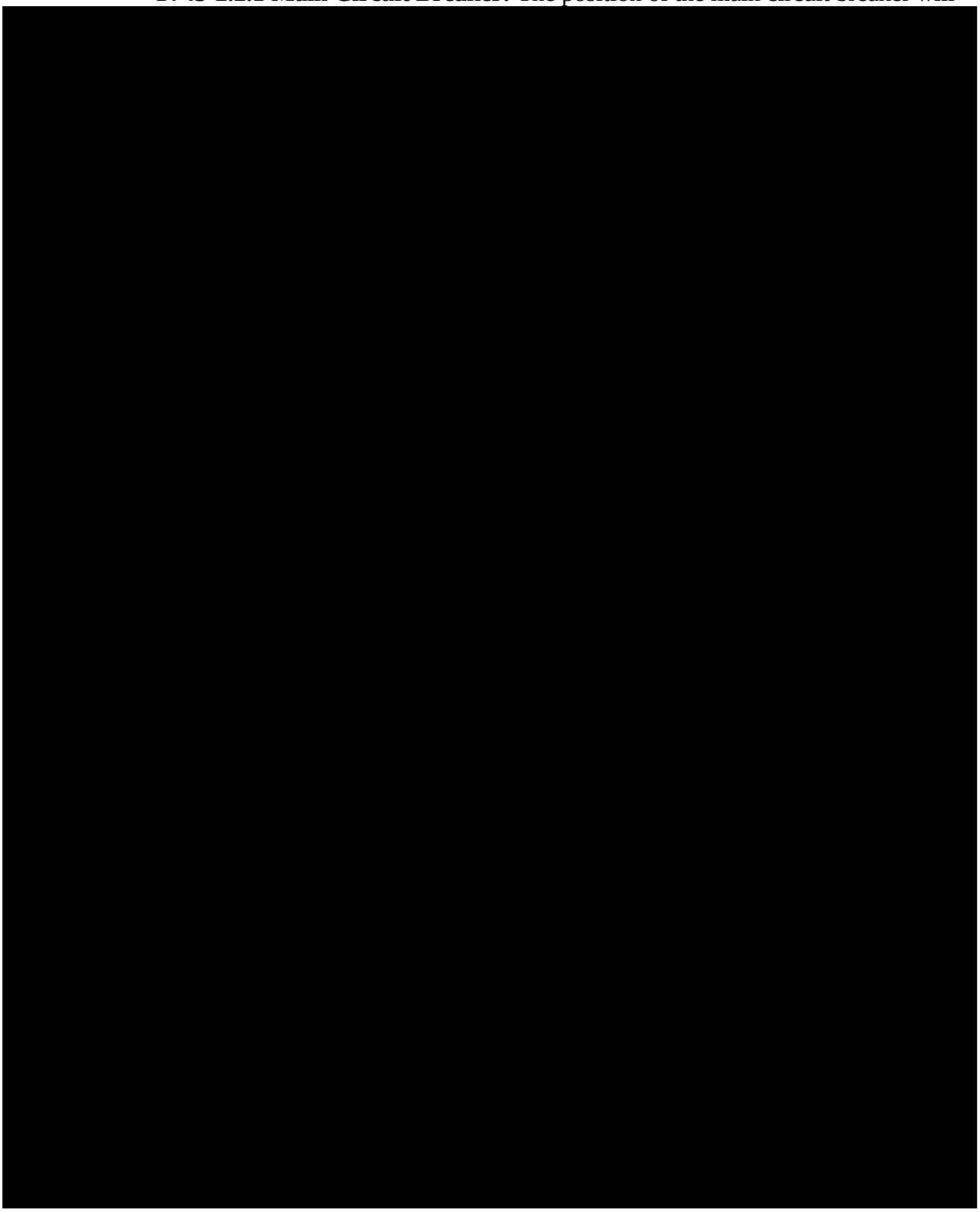
The SCADA Control Panel must use IEEE 802.3u, 100 Mbps, Fast Ethernet protocol to communicate with the Department's managed network switch.

Some equipment, such as the UPS units, will send information indirectly to the SCADA system.

T745-2.2 Power Distribution Frame Monitoring Equipment: Furnish and install the equipment monitored by the SCADA system and the associated monitoring equipment located on the power distribution frames. Power distribution frame monitoring cables must communicate back to the SCADA Control Panel in the OCC via the PLC located in the Power Meters

Enclosure (PMs) for toll facilities with on-site power. Power distribution frames at toll facilities with off-site power will interface directly with the SCADA Control Panel since a Power Meters Enclosure will not be present.

T745-2.2.1 Main Circuit Breaker: The position of the main circuit breaker will





T745-2.2.3 Emergency Generator: The emergency generator electrical and mechanical parameters will be monitored by the SCADA Power Meters Enclosure. The emergency generator controller will communicate with the SCADA system by using a MODBUS RTU serial communications protocol.

1. The emergency generator circuit breaker position will be monitored by using auxiliary contacts on the generator circuit breaker. The auxiliary contacts will be open when the circuit breaker is open and closed when the circuit breaker is closed. A 24 VDC signal from the SCADA control panel will be routed through the auxiliary contacts.
2. A control relay in the SCADA control panel will be capable of remotely starting and stopping the emergency generator.

T745-2.2.4 Automatic Transfer Switch: The position of the Automatic Transfer Switch (ATS) will be monitored by AB, NO/NC auxiliary dry contacts within the ATS. The A contact will be closed when the ATS is in the Normal position and the B contact will be open the ATS is in the Normal position. The AB contacts will change state when the ATS moves to the Emergency position. A 24 VDC signal from the SCADA Power Meters Enclosure will be routed through the auxiliary contacts.



T745-2.2.5 SPDs: The alarm contacts on the surge suppression devices at the Automatic Transfer Switch (ATS), emergency distribution panel (EDP), and Emergency Panelboard (EP1) will be monitored by the SCADA system.

T745-2.2.6 AC Units: The branch circuit current for each AC unit in the RTCs

T745-2.3 RTC Cabinet Monitoring: Furnish the following RTC SCADA components and associated monitoring equipment and turn over to the Engineer.

T745-2.3.1 RTC SCADA Module: Each RTC will contain a

T745-2.3.2 Doors: The door positions for each RTC will be monitored by DPDT door position dry contact tamper switches. The door tamper switches contacts will be open when the door(s) are open and closed when the door(s) are closed.

T745-2.3.3 AC Units: The RTC air conditioning units will be continuously monitored by the SCADA System. The operating information and alarms will be transmitted to the SCADA System on a two conductor, 18 AWG, stranded, tinned copper, overall foil shielding cable that has a PVC outer jacket.

T745-2.3.4 Leak Detector: A leak detector will monitor the bottom of the

T745-2.4 OCC Monitoring: Furnish and install the equipment monitored by the SCADA System and the associated monitoring equipment located the OCC Cabinets. All cabling for power and data that serve each RTC that emanate from the OCC must be terminated in the

OCC and be coiled at a length equal to the length of the conduit between the OCC and each RTC plus twenty feet of slack. Furnish and install the following:

T745-2.4.1 SCADA Control Panel: Each OCC will contain a [redacted]



T745-2.4.2 AC Units: The OCC air conditioning units will be continuously monitored by the SCADA System. The operating information and alarms will be transmitted to the SCADA System on a two conductor, 18 AWG, stranded, tinned copper, overall foil shielding cable that has a PVC outer jacket.

T745-2.4.3 Doors: The door positions for each OCC will be monitored by DBDT door position dry contact tamper switches. The door tamper switches contacts will be open when the door(s) are open and closed when the door(s) are closed.

T745-2.4.4 UPS: The uninterruptible power supply (UPS) unit(s) will be monitored using Network Interface Cards (NIC). The NIC card(s) will be factory provided and will communicate with Department's network switch using the 10Base T Ethernet protocol.

T745-2.4.5 SCADA Control Panel AC Input: A control power circuit will be installed for the SCADA control panel. The branch circuit will be a 120 VAC, 20 Amp circuit that originates from the UPS inside the OCC.

T745-2.4.6 Leak Detector: A leak detector will monitor the bottom of the [redacted]

T745-3 Submittals and Shop Drawings.

Submit shop drawings in accordance with Section 5, General Requirements for Toll Site Electrical Infrastructure, and the following:

1. A separate set of shop drawings must be submitted for each SCADA system at each site. Each set of shop drawings associated with each site will show the unique name of the RTC site in the title blocks. Typical information associated with multiple sites will be rejected for insufficient information.

2. Include the following information in each set of SCADA shop drawings.

3. Hardware Product Information Submittal: Hardware product information must include, but not be limited to: catalog cut sheets, data sheets, performance surveys, test reports, equipment lists, material list, diagrams, pictures, and descriptive material. The product information must cover all items including mechanical devices, mounting components, wiring, terminal strips, connectors, accessories, and spare parts. The submittal information must show the standard and optional product features, as well as all performance data and specifications.

4. Prior to commencement of manufacture (or shipment for stock items), the SCADA System Provider must submit for review product information for all equipment and material specified in this Section. Include specification sheets on each remote sensor, power meter, or interface card that will communicate or provide status to the SCADA system.

5. Connection Diagrams:

a. Show the placement, labeling and wiring of components within panels, cabinets, and consoles. Wire lists and wireless diagrams will not be accepted. Components must be shown arranged in the physical layout (not necessarily to scale), as it would appear to a person servicing the equipment. Wiring designations, and routing designations, will follow the projects drawings standards. The connection diagrams will be submitted on 11” x 17” paper.

b. The SCADA System Provider will submit connection diagrams for all new panels, cabinets, and consoles Loop diagrams may not be substituted for connection diagrams.

6. Interconnection Diagrams:

a. Interconnection diagrams will be site specific and will show the external wiring between terminals of associated equipment, control panels, motor control centers, terminal boxes, field switches, field sensors, meters, critical power panels, and any other device, panel, or enclosure. Interconnection diagrams must clearly depict all cable types, conductors, and cable tags. Cable tagging must conform to project standards.

b. The SCADA System Provider must prepare and submit interconnection diagrams for all major system components.

7. Panel Fabrication and Layout Drawings (PLFD)::

a. As a minimum, PLFD will include front, back, and section views; the locations of all mounted components; drawing scale; nameplate engraving schedule; and structural materials and supports. A bill of material will also be provided on the drawing, or as a separate document. All drawings will be scaled. Overall dimensions and minimum clearances must be shown. Sufficient detail must be included to demonstrate material choices, outward appearance, construction methods, and seismic force resistance.

b. Complete shop drawings will be submitted for all panels, cabinets, and consoles which are fabricated, or modified, for this project. Reviewers will have the right to make modifications to the interior and exterior layouts of panels as part of the shop drawing review. No additional compensation will be provided to the SCADA System Provider for

changes. The SCADA System Provider will budget for one redesign of the panel layout to incorporate the reviewers' changes.

T745-4 Warranty.

The manufacturer will warrant all components against defects in materials and workmanship for two years. The warranty will cover all parts for two years and onsite labor for two years.

T745-4.1 Quality Assurance:

1. Control Panel Integrator Qualifications
2. Minimum of ten years' experience in the design, manufacture, and testing of solid-state PLC systems is required.
3. FACTORY TESTING
4. Before shipment, the manufacturer fully and completely tests the system to assure compliance with the specification.

Products submitted other than listed part numbers are the responsibility of the contractor for system integration and revised PLC programming to make any substitute product integrate into the SCADA system.

T745-5 Construction Requirements.

T745-5.1 Fabrication: All materials and components making up the SCADA system will be new, of current design, and not in prior service except as required during factory testing. The SCADA system will be constructed of replaceable subassemblies.

T745-5.2 Wiring: Wiring practices, materials, and coding will be in accordance with the requirements of the National Electrical Code (NFPA 70) and the National Electrical Manufacturer Association.

Cables with shields and/or drain wires will have the shield and/or drain wire grounded at the SCADA control panel end only.

Each cable or conductor installed for the SCADA system will be field labeled at both ends of the cable or conductor. Labels will be installed within 6 inches of the ends of each cable or conductor. Ensure the labels are self-laminating and the label material is vinyl with white matte finish and black 12-point text that is heat and solvent resistant. Contact the Tolls Engineering Department for wire naming conventions and label syntax.

Wiring inside the SCADA control cabinet will be routed through PVC wide finger wiring ducts.

The white wiring ducts will have removable covers. The wiring duct will be equal to Panduit, Type G wide finger wiring duct.

T745-5.3 Field Quality Control: Upon completion of the work, test the installation to ensure that the installation is entirely free of ground faults, short circuits, and open circuits and that it is in satisfactory working condition. Furnish all labor, materials, and apparatus necessary for making the required tests.

Remove and replace any defective material or workmanship discovered as a result of these tests at no expense to the Department and make subsequent re-tests to the satisfaction of the Engineer.

The following inspections and test procedures will be performed by trained field service personnel during the SCADA system start-up and commissioning:

1. Visual Inspections
    a. Inspect equipment for signs of shipping or installation damage.

b. Verify installation per drawings.

c. Inspect cabinets for foreign objects.

2. Mechanical Inspections

a. Check all I/O modules are correctly fitted.

b. Check all power supply modules are correctly fitted.

c. Check all terminal screws, nuts, and/or spade lugs for tightness.

3. Electrical Inspections

a. Confirm input voltage is correct.

b. Confirm each remote sensor, meter, and interface card is functioning correctly.

4. Install and/or test the following items before notifying the Department that the SCADA system is ready to be programmed:

a. SCADA system control panel installed and energized.

b. The tolling communications cabinet is installed.

c. The power serving the OCC is energized.

d. Testing of the OCC fiber optic cables in accordance with specifications 633 – Intelligent Transportations Systems - Fiber Optic Cable Interconnect, has been completed satisfactorily.

e. Network switch is installed and energized.

T745-5.4 Replacement Parts Stocking:

Replacement parts must be available through a local distributor within 100 miles of the job site. The parts and materials within the SCADA control cabinet must be available 24 hours a day, 7 days a week, 365 days a year from a local distributor. Include the local distributors name on the shop drawings.

T745-6 Method of Measurement.

The work specified in this Section will not be measured but will be included in the pay item for OCC.

T745-7 Basis of Payment.

The work specified in this Section will not be paid for directly but will be considered as incidental work.

TECHNICAL SPECIAL PROVISION

FOR

OUTDOOR COMMUNICATIONS CABINETS AT RTC TOLL SITES

FINANCIAL PROJECT NO.: _____-_-__-__

This item has been digitally signed and sealed by _____ on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Date: _____
Fla. License No.: _____
Firm Name: _____
Firm Address: _____
City, State, Zip Code: _____

LEVEL 2

SECTION T746
OUTDOOR COMMUNICATIONS CABINETS AT RTC TOLL SITES

T746-1 Description.

Furnish and install RTC Toll Site Outdoor Communications Cabinets along with the required accessories as shown in the Plans.

T746-2 Materials.

T746-2.1 Materials: Provide UL or other NRTL Listed NEMA 3R 316 stainless steel enclosure and the following:

1. Cabinet with an open bottom. Louvers and vents are not permitted
2. Single front and rear access doors - Gasketed doors with continuous hinge held closed by 3-point latching mechanism with door stop kits
3. Enclosure lighting activated by door open/close
4. Cabinet must be structurally designed to comply with FBC requirements for Risk Category II buildings and structures. Wind loads for the cabinet used in structural calculations must be the 3-second wind velocity (gusts) per FBC Section 1620 “High Velocity Zones - Wind Loads” for Miami-Dade County.
5. Cabinet must have a means of bonding, such as a lug, to the site grounding system
6. Cabinet must be installed on a minimum 3” high open base /riser/pedestal
7. Sunshields constructed of the same material and gauge metal as the cabinet, covering all exposed sides of the enclosure with 1” standoff separators
8. Full length EIA-310 compliant 19-inch rack rails for mounting equipment in the front and back. Cabinet must have a minimum 36 usable rack units (RU) available vertically. All mounting rails to be configured as square hole cage nut type 12-24 Black
9. Slide out shelf occupying 1RU
10. Two (2) sets of Equipment Support Brackets or a 4-post rack unit frame
11. Three (3) sets of 3-inch Horizontal Wire Management
12. [redacted]
13. One (1) UPS for the OCC components furnished and installed
14. One (1) UPS for each RTC furnished and installed
15. Fiber Distribution Panel (Fiber Patch Panel)
16. Include the following wiring devices in each OCC:
    a. Two (2) 15A simplex receptacles for dedicated use of the AC units each with a NEMA type matching the plug from the AC units
    b. One (1) 20A NEMA 5-20R receptacle for convenience power
    c. One (1) 20A NEMA L5-20R receptacle for the OCC UPS
17. One (1) vertical Power Distribution Unit (PDU) furnished and installed
    a. PDU shall be single phase monitored, surge protected
    b. PDU shall be NEMA 5-20R compliant and have a minimum of (12) NEMA 5-20R, standard simplex outlets
    c. The PDU input power cord must come factory installed from the manufacturer with L5-20P plug (field retrofitted cords will not be accepted)
    d. PDU shall be vertically mounted directly to the OCC using mounting hardware or tool-less feature

T746-2.2 Air Conditioner Units: Provide two (2) factory-installed side-mounted AC units each at 230V, 1-phase. Unit, size, make and model must be as indicated on the Plans. Shop-mount each unit on different sides of the enclosure (never on the same side or on the front or back).

T746-2.3 Fiber Distribution Panel (FDP): Provide Fiber Distribution Panel (FDP) in accordance with the following:

1. Manufacturers Provide a product from one of the following, or approved equal, meeting the requirements in the contract documents:

a. LEVITON OPT-X 2000i SDX 2RU Rack Mount Enclosures with four (4) SDX adapter plates (5F100-2LC), OS2 fiber type, SC duplex adapter type with pre-terminated pigtails, four (4) splice trays (heat shrink, plastic holders 12 fibers), and cable clamp kit. Accessories include cable strain relief kit and fiber management ring kit.

b. CORNING CCH-02U closet connector housing, two rack units, supplied with four pre-terminated CCH pigtail splice cassettes (CCH-CS12-59-P00RE)

2. 19"-EIA width rack mountable, FDP(s) suitable for loose tube, single or ribbon fiber optic cables housed inside of the communications cabinet.

3. Provide one (1) FDP be provided per lateral fiber drop, or interconnect, with the following features:

a. One (1) fiber distribution and splice enclosure must occupy 2RU, and must accommodate at least four (4) Pre-terminated splice cassette /pigtail splice modules / splice trays, as supplied by the FDP manufacturer for the make and model of the FDP.

b. Slide out tray

c. See through, removable top cover

d. Removable tinted polycarbonate front door

e. Strain relief brackets, routing clips and guides

f. Mounting brackets for proper installation

4. Each pre-terminated cassette, pigtail splice module / splice tray must be in accordance with the following:

a. Six (6) SC/UPC duplex, single-mode, ceramic insert composite ports

b. Twelve (12) single mode factory polished pre-terminated pigtails

c. Twelve (12) single fiber heat-shrink splice protectors

d. Protective braided tubing for incoming cable

e. Grommets and cable ties for additional strain relief

f. Mounting hardware for use with the fiber optic distribution panel (FDP)

5. Provide (12) single mode SC to SC jumpers for each set of two FOC buffers entering an OCC with the length necessary to patch through all lateral fibers color-to-color.

6. The FDP must be mounted at the position next below the top cable management position within the OCC.

7. The number of fiber ports must comply with the number of strands per cable sheath being dropped to the toll equipment building.

8. Provide adjustable front and rear equipment mounting rails to properly mount the FDP. The mounting rails must be square hole cage nut with #12-24 hardware.

T746-3 Submittals and Shop Drawings.

T746-3.1 Calculations and Shop Drawings: Submit shop drawings in accordance with Section 5 and General Requirements for Toll Site Electrical Infrastructure for cabinet installation on pad. Submittal of shop drawings must include manufacturer's installation manual.

Substitutions that are different than the basis of design for the cabinet and / or AC units provide supporting materials to show equivalency as identified in General Requirements for Toll Site Electrical Infrastructure. Confirm that each AC unit can independently maintain the temperature within the cabinet.

T746-3.2 Data Sheets: Provide data sheets for the cabinet and all accessories, din rail, cable management, Fiber Distribution Panel, UPS, SCADA and all associated components.

T746-4 Warranty.

The OCC, AC units and lighting under this specification section will be warranted by the manufacturer against defects in material and workmanship for a period of 1 year from the date of acceptance. The warranty will include parts, shipping costs, rigging costs, labor, and travel expenses, to replace the equipment or repair the equipment in place, in accordance with the manufacturers published service manuals.

Warranty for the individual components in the OCC will be in accordance with the specification section for each component.

T746-5 Construction Requirements.

The communications cabinets must be properly bonded and grounded to the existing or new grounding system.

T746-5.1 OCC: The OCC must be mounted securely to the toll equipment pad in accordance with the plans and approved shop drawings.

1. Install in accordance with NECA "Standard of Installation".
2. Install enclosures and boxes plumb.
3. Install cabinet fronts plumb.
4. Use the factory mounting holes to secure and support cabinets and enclosures. Do not field drill mounting holes.

T746-5.2 Cleaning and Testing: The completed OCC assembly (enclosure, penetrations, AC and all associated elements) must be subjected to a hose-down water test in the field to confirm that the entire assembly conforms to NEMA 3RX standards and is at a minimum waterproof. The hose-down water test must be executed after the enclosure and all its associated elements have been constructed on site and with the Department and the CEI present to witness the test. This test must occur during the primary walk-through. Water must be directly hosed on all areas susceptible to water intrusion, such as the exterior interface between the AC units and the enclosure, interior interface between the AC units and the enclosure (hose water through/inside the cooling unit), around all doors, penetrations (conduit/wireway/etc.), and any other areas that were factory or field cut, welded, or sealed. If there is water intrusion in any water amount or any indication thereof, the OCC enclosure assembly will not be accepted.

Cleaning of the cabinet and all installed accessories must be in accordance with Acceptance Procedures for Toll Facilities and the following:

1. Clean electrical parts to remove conductive and harmful materials.
2. Remove dirt and debris from enclosure.
3. Clean finishes and touch up damage.

T746-6 Method of Measurement.

The Contract unit price for each OCC, furnished and installed, will include furnishing, placement, and testing of the cabinet, all its components, systems, materials, equipment, accessories, and for all tools, labor, equipment, hardware, supplies, shop drawings, utility

connections, grounding and bonding for OCC and RTC Cabinets, documentation, associated surge protection devices, SCADA system components, uninterruptable power supply(ies), AC units with dry well(s), wiring devices associated with OCC and RTC Cabinets, lightning protection system associated with OCC and RTC Cabinets, identification of electrical systems associated with OCC and RTC Cabinets, and incidentals necessary to complete the work. The cost of the Acceptance Procedures for Toll Facilities at each RTC toll site location and general requirements for toll facilities electrical infrastructure associated with OCC and RTC Cabinets must also be included in the cost of the OCC.

T746-7 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 676-2-810	Outdoor Communications Cabinet, Furnish & Install, Toll Site – per each

Appendix 4

SIGNING AND PAVEMENT MARKING AT TOLL SITES

See ***GTR 222*** for additional requirements.

The purpose of this Appendix is to establish the minimum requirements for signing and pavement markings design in relation to toll sites. Signing and pavement markings applicable to toll sites are included in this Appendix for use on associated projects. This includes signage for AET and existing cash toll sites where signing and pavement marking improvements are required. Additional details are available in Florida's Highway Sign Library (https://www.fdot.gov/traffic/TrafficServices/SignLibrary/Sign-Library.shtm) and on the Florida's Turnpike Design website (https://floridasturnpike.com/business-oportunities/design/). Please contact the Florida's Turnpike Enterprise Traffic Design Engineer (407-264-3150) for additional information as needed.

SHEET INDEX

101-1 INTRODUCTION TO APPENDIX 4
102-2 ALL ELECTRONIC TOLLING ENTRANCE/EXIT RAMP TYPICAL SIGNING LAYOUT
102-3 ALL ELECTRONIC TOLLING MAINLINE TOLL TYPICAL SIGNING LAYOUT
102-4 ALL ELECTRONIC TOLLING TOLL-BY-PLATE SIGN PANELS
102-7 ALL ELECTRONIC TOLLING FIXED TOLL AMOUNT SIGN PANELS
104-1 DUAL DEDICATED MAINLINE TOLL PLAZA SIGNING AND PAVEMENT MARKING LAYOUT
104-2 RAMP TOLL PLAZA TYPICAL SUNPASS SIGNING AND PAVEMENT MARKINGS
104-3 TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS
104-4 TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS
104-5 TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS
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106-1 TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS
106-2 TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS
106-3 TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS
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107-1 CASH LANE TOLL PLAZA SIGNING LAYOUT
107-2 COIN LANE TOLL PLAZA SIGNING LAYOUT
107-3 SUNPASS LANE TOLL PLAZA SIGNING LAYOUT
107-4 TOLL PLAZA SPECIAL DETAILS
107-5 TOLL PLAZA SPECIAL DETAILS
107-6 PLAZA AREA SIGNING DETAILS SIGN PANELS
107-7 PLAZA & GANTRY AREA SIGNING DETAILS SIGN PANELS
108-3 SPECIAL SIGN DETAILS
109-1 MISCELLANEOUS DETAILS SIGN PLACEMENT

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

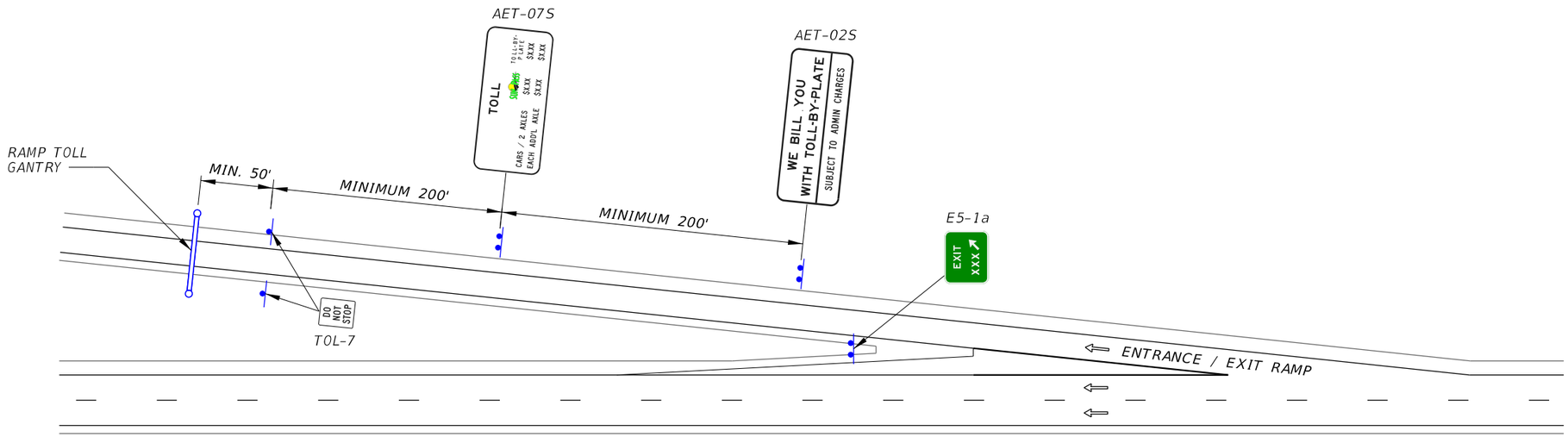
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

INTRODUCTION TO APPENDIX 4

SHEET NO. 101-1

FOR REFERENCE ONLY

See FDM Exhibit 230-16b



Typical Entrance / Exit Ramp Signing
Adjacent to Toll Gantry

N.T.S.

NOTES:

1. *MINIMUM SPACING DISTANCES FOR SIGNS SHALL CONFORM TO THE TRAFFIC ENGINEERING MANUAL AND F.A.C. RULE CHAPTER 14-51, TABLE 1.*
2. *TWO (2) TOL-7 (DO NOT STOP) SIGNS ARE REQUIRED PER DIRECTION OF TRAVEL.*
3. *PLACEMENT OF AET-07S AND AET-02S SIGNS MAY BE BEFORE OR AFTER THE GANTRY, IF FIELD CONSTRAINTS WARRANT IT.*
4. *STRIPING FOR MULTI-LANE RAMP TOLL SITE MUST CONFORM TO STRIPING SHOWN ON SHEET NO. 102-3.*

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

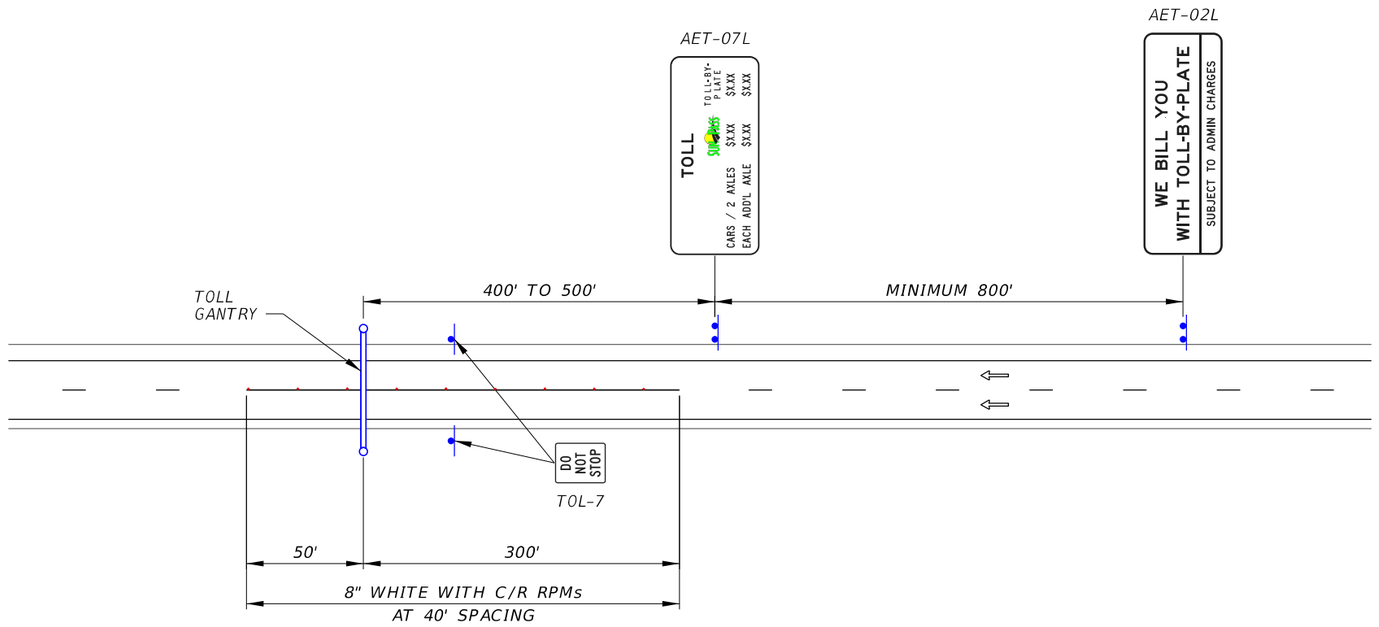
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

ALL ELECTRONIC TOLLING
ENTRANCE/EXIT RAMP
TYPICAL SIGNING LAYOUT

SHEET NO. 102-2

FOR REFERENCE ONLY

See FDM Exhibit 230-16c



Mainline Toll Gantry

N.T.S.

NOTES:

1. MINIMUM SPACING DISTANCES FOR SIGNS SHALL CONFORM TO THE TRAFFIC ENGINEERING MANUAL AND F.A.C. RULE CHAPTER 14-51, TABLE 1.
2. TWO (2) TOL-7 (DO NOT STOP) SIGNS ARE REQUIRED PER DIRECTION OF TRAVEL.
3. PLACEMENT OF AET-07L AND AET-02L SIGNS MAY BE BEFORE OR AFTER THE GANTRY, IF FIELD CONSTRAINTS WARRANT IT.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

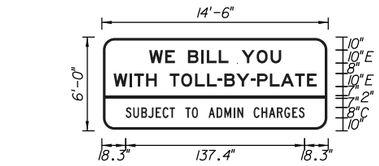
ALL ELECTRONIC TOLLING
MAINLINE TOLL
TYPICAL SIGNING LAYOUT

SHEET NO.
102-3

SIGN NAME	AET-02S	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			none
WIDTH	14'-6"	WIDTH	2"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



INSET=0.75"

RAMP APPLICATIONS

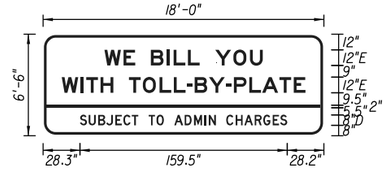
NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		W	E		B	I	L	L		Y	O	U		L											
SPACE	36.3	12.3	7.5	10	10.1	4.4	9.2	7.5	10	11.6	10.7	8.1	36.3	101.4											
COPY		W	I	T	H		T	O	L	L	–	B	Y	–	P	L	A	T	E		L				
SPACE	8.9	12.3	3.5	9.2	8.1	10	8.9	10.7	9.2	8.2	5.1	9.2	10.9	5.1	9.8	8.3	11	9.2	7.5	8.9	156.2				
COPY		S	U	B	J	E	C	T		T	O		A	D	M	I	N								
SPACE	18.3	5.8	6.2	5.2	5.8	5.3	5.4	4.1	8	5	4.7	8	6.2	6.1	7	2.9	4.5	8							
COPY															C	H	A	R	G	E	S		L		
SPACE															6.1	5.6	6.2	5.7	6.1	5	4.5	18.3	137.4		
COPY																									
SPACE																									
COPY																									
SPACE																									

SIGN NAME	AET-02L	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			none
WIDTH	18'-0"	WIDTH	2"		
HEIGHT	6'-6"	RADII	9"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



INSET=0.75"

MAINLINE APPLICATIONS

NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		W	E		B	I	L	L		Y	O	U		L											
SPACE	47.2	14.8	9	12	12.1	5.3	11	9	12	13.9	12.8	9.7	47.2	121.7											
COPY		W	I	T	H		T	O	L	L	–	B	Y	–	P	L	A	T	E		L				
SPACE	14.3	14.8	4.2	11	9.7	12	10.7	12.8	11	9.8	6.1	11	13.1	6.1	11.8	10	13.2	11	9	14.4	187.3				
COPY		S	U	B	J	E	C	T		T	O		A	D	M	I	N								
SPACE	28.3	6.8	7.4	6.1	7	6.2	6.5	5	8	6	5.7	8	8	7.2	8.2	3.2	5.4	8							
COPY															C	H	A	R	G	E	S		L		
SPACE															7.2	6.6	8	6.6	7.2	5.8	5.4	28.2	159.5		
COPY																									
SPACE																									
COPY																									
SPACE																									

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

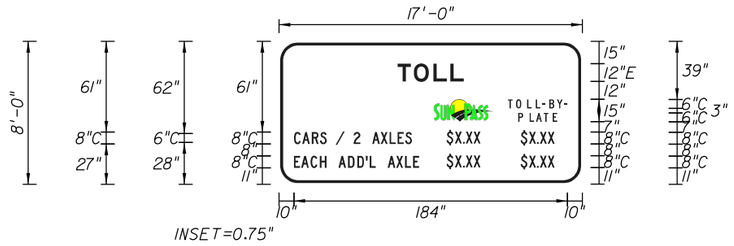
ALL ELECTRONIC TOLLING TOLL-BY-PLATE SIGN PANELS

SHEET NO.
102-4

SIGN NAME	AET-07S
QUANTITY	1
WIDTH	17'-0"
HEIGHT	8'-0"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	White
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
SP_LOGO	0	104.1	42.1	40	15

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



INSET=0.75"

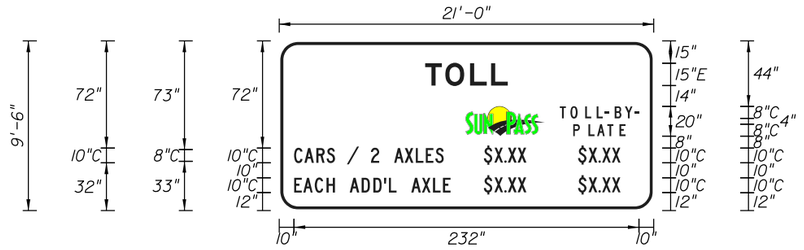
RAMP APPLICATIONS

COPY		T	O	L	L		L																				
SPACE	79.7	10.9	13.3	11.3	9	79.8	44.5																				
COPY		T	O	L	L	–	B	Y	–		L																
SPACE	154	5.4	7.5	5.8	4.2	4.8	5.1	5	2.2	10	40																
COPY		P	L	A	T	E		L																			
SPACE	160.8	7.7	4.4	5.1	6.1	3.1	16.8	26.3																			
COPY		C	A	R	S		/		2		A	X	L	E	S		L										
SPACE	10	5.6	6.4	5.6	4.5	6	6.1	6	4.5	8	5.7	6	5.4	5.2	4.5	114.5	79.5										
COPY		$	X	.	X	X		L																			
SPACE	112.7	5.6	5.4	1.9	5.3	4.7	68.4	22.9																			
COPY		$	X	.	X	X		L																			
SPACE	162.5	5.6	5.4	1.9	5.3	4.7	18.6	22.9																			
COPY		E	A	C	H		A	D	D	'	L		A	X	L	E		L									
SPACE	10	4.9	6.2	6.3	4.5	8	6.4	6.3	5.7	2.7	4.1	8	5.7	6	5.4	4.1	109.8	84.3									
COPY		$	X	.	X	X		L																			
SPACE	112.7	5.6	5.4	1.9	5.3	4.7	68.4	22.9																			
COPY		$	X	.	X	X		L																			
SPACE	162.5	5.6	5.4	1.9	5.3	4.7	18.6	22.9																			

SIGN NAME	AET-07L
QUANTITY	1
WIDTH	21'-0"
HEIGHT	9'-6"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	White
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
SP_LOGO	0	125.3	50	53.3	20

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



INSET=0.75"

MAINLINE APPLICATIONS

COPY		T	O	L	L		L																				
SPACE	98.1	13.7	16.6	14.2	11.3	98.1	55.8																				
COPY		T	O	L	L	–	B	Y	–		L																
SPACE	188.7	7.2	9.9	7.7	5.6	6.5	6.8	6.7	2.9	10	53.3																
COPY		P	L	A	T	E		L																			
SPACE	197.8	10.3	5.8	6.9	8.1	4.1	19	35.2																			
COPY		C	A	R	S		/		2		A	X	L	E	S		L										
SPACE	10	7	8	7	5.6	8	8.2	8	5.6	10	7.1	7.5	6.7	6.5	5.6	141.2	100.8										
COPY		$	X	.	X	X		L																			
SPACE	137.7	7	6.7	2.4	6.6	5.9	85.7	28.6																			
COPY		$	X	.	X	X		L																			
SPACE	201.1	7	6.7	2.4	6.6	5.9	22.3	28.6																			
COPY		E	A	C	H		A	D	D	'	L		A	X	L	E		L									
SPACE	10	6.1	7.8	7.9	5.6	10	8	7.9	7.1	3.3	5.1	10	7.1	7.5	6.7	5.1	136.8	105.2									
COPY		$	X	.	X	X		L																			
SPACE	137.7	7	6.7	2.4	6.6	5.9	85.7	28.6																			
COPY		$	X	.	X	X		L																			
SPACE	201.1	7	6.7	2.4	6.6	5.9	22.3	28.6																			

NOTE TO DESIGNER:

1. COORDINATE TOLL RATE WITH TURNPIKE TRAFFIC ENGINEER PRIOR TO FABRICATION OF SIGN PANEL.

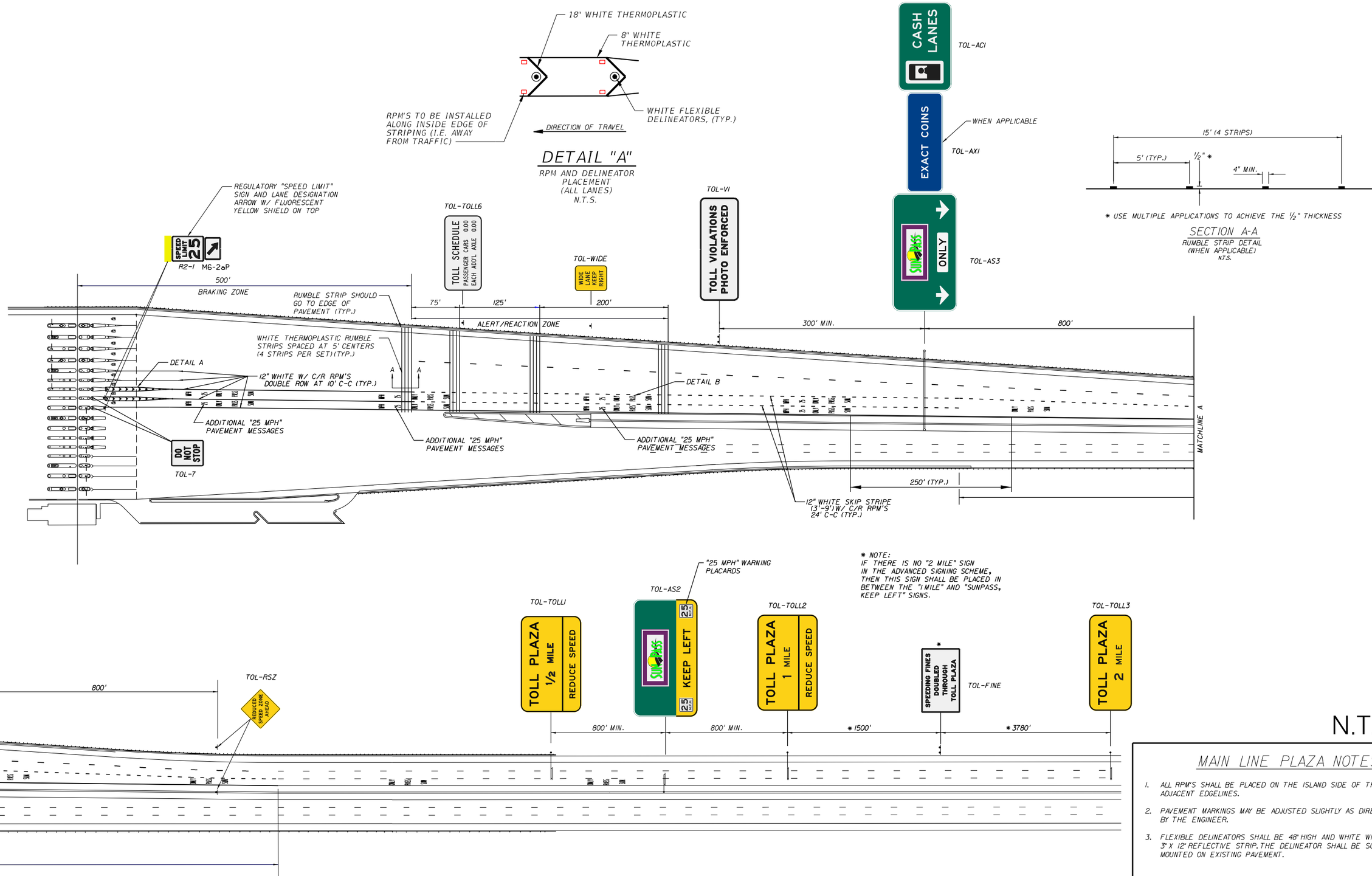
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

ALL ELECTRONIC TOLLING FIXED TOLL AMOUNT SIGN PANELS

SHEET NO. 102-7



N.T.S.

MAIN LINE PLAZA NOTES:

1. ALL RPM'S SHALL BE PLACED ON THE ISLAND SIDE OF THE ADJACENT EDGELINES.
2. PAVEMENT MARKINGS MAY BE ADJUSTED SLIGHTLY AS DIRECTED BY THE ENGINEER.
3. FLEXIBLE DELINEATORS SHALL BE 48" HIGH AND WHITE WITH A 3" X 12" REFLECTIVE STRIP. THE DELINEATOR SHALL BE SURFACE MOUNTED ON EXISTING PAVEMENT.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

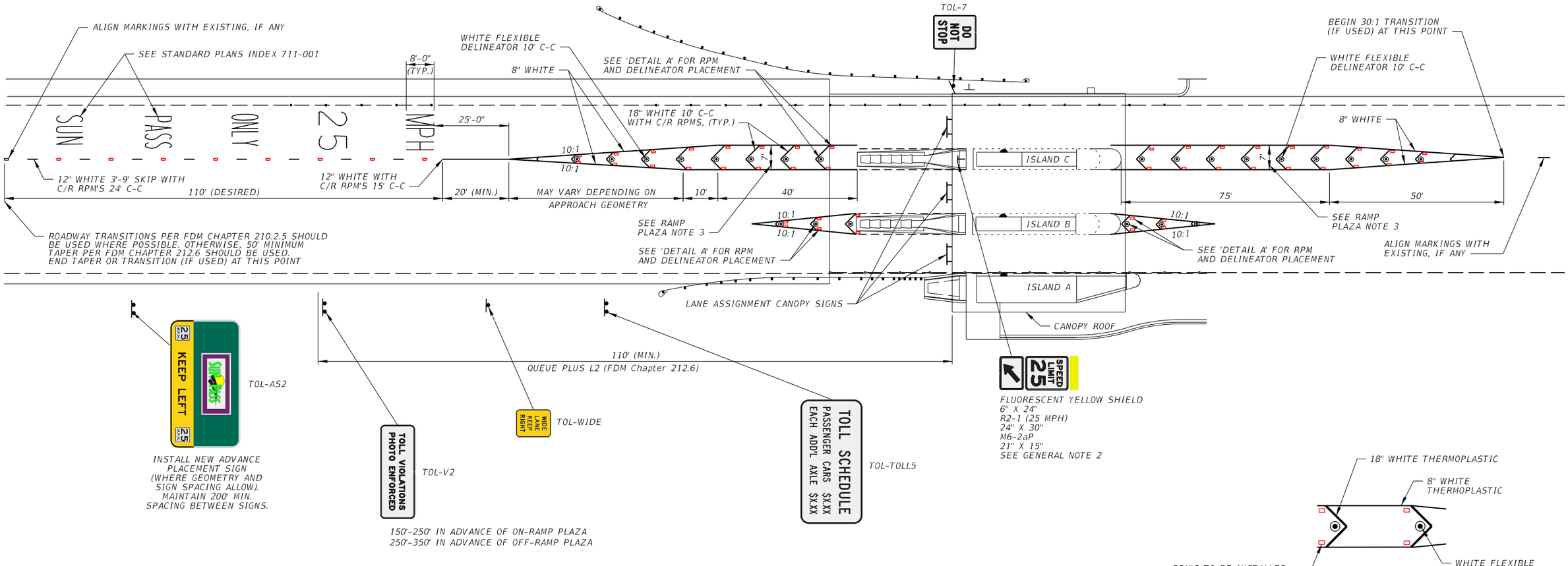
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

DUAL DEDICATED MAINLINE TOLL PLAZA SIGNING AND PAVEMENT MARKING LAYOUT

SHEET NO. 104-1

$USER$ $DATE$ $TIME$ $FILE$



DETAIL "A"

RPM AND DELINEATOR PLACEMENT
(ALL LANES)
N.T.S.

GENERAL NOTES:

1. ALL RPM'S SHALL BE PLACED ON THE ISLAND SIDE OF THE ADJACENT EDGELINES.
2. INSTALL 24"X30" SPEED LIMIT SIGN W/21" X 15" M6-2aP PANEL ON UPPER PART OF CONCRETE ISLAND UPSTREAM OF BOOTH. SIGN SHALL BE MOUNTED CENTERED ON ISLAND WITH A 7' CLEARANCE UNDER SIGN TO PAVEMENT. SIGN SHALL BE ROTATED 22 ½ DEGREES TOWARDS DEDICATED SUNPASS LANE OR AS DIRECTED BY THE ENGINEER.
3. PAVEMENT MARKINGS MAY BE ADJUSTED SLIGHTLY AS DIRECTED BY THE ENGINEER.
4. TOLL COLLECTOR WARNING SIGNS SHALL BE FURNISHED AND INSTALLED (ANCHOR BOLTED) ON THE ISLAND BARRIER WALL AND ON BOOTH FACING EACH STAIRWELL OR WALKWAY ACROSS ISLAND. SIGNS ATTACHED TO BOOTH SHALL BE FASTENED WITH STAINLESS STEEL SCREWS. PLACEMENT SHALL PROVIDE OPTIMUM VISIBILITY.
5. FLEXIBLE DELINEATORS SHALL BE 48" HIGH, WHITE WITH 3" X 12" REFLECTIVE STRIP. THE DELINEATOR SHALL BE SURFACE MOUNTED ON EXISTING PAVEMENT.

RAMP PLAZA NOTES:

1. RIGHT SIDE DEDICATED LANE SHALL BE MIRROR-IMAGE OF THIS EXHIBIT.
2. TOLL COLLECTOR SIGNS SHALL BE INSTALLED ON ISLANDS BORDERING DEDICATED USE SUNPASS LANES ONLY.
3. FOR A DEDICATED LANE ON THE OUTSIDE OF THE PLAZA AND WITH AN EXISTING LANE WIDTH OF TWELVE FEET OR GREATER, THE CHANNELIZATION ISLAND SHALL BE WIDENED ONE FOOT FROM WHAT IS SHOWN ABOVE TO PROVIDE A MINIMUM STRIPED LANE WIDTH OF ELEVEN FEET.
4. FOR A DEDICATED LANE IN THE INTERIOR OF THE PLAZA AND WITH AN EXISTING LANE WIDTH OF TWELVE FEET OR GREATER, THE ADJACENT CHANNELIZATION ISLANDS SHALL BE WIDENED TO NARROW THE DEDICATED LANE TO TEN FEET.

N.T.S.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

RAMP TOLL PLAZA TYPICAL SUNPASS SIGNING AND PAVEMENT MARKINGS

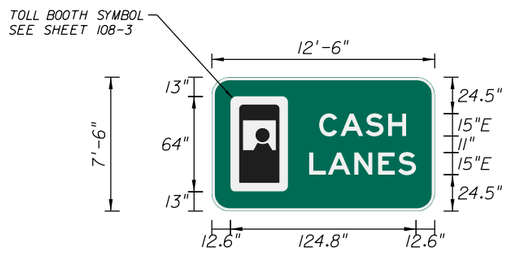
SHEET NO.
104-2

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-AC1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-6"	WIDTH	2"		
HEIGHT	7'-6"	RADII	12"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	12.6	13	38	64

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

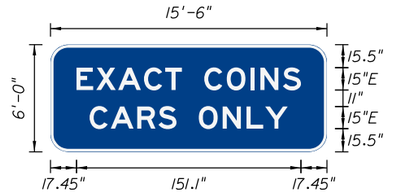
COPY		C	A	S	H		L																
SPACE	72.1	14.3	16.9	15.2	12.2	19.3	58.6																

COPY		L	A	N	E	S		L															
SPACE	65.5	12.5	17.8	16.1	13.3	12.2	12.6	71.9															

SIGN NAME	TOL-AX1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	15'-6"	WIDTH	2"		
HEIGHT	6'-0"	RADII	12"		
LEGEND	White	COLOR	White		
COLOR	Blue				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

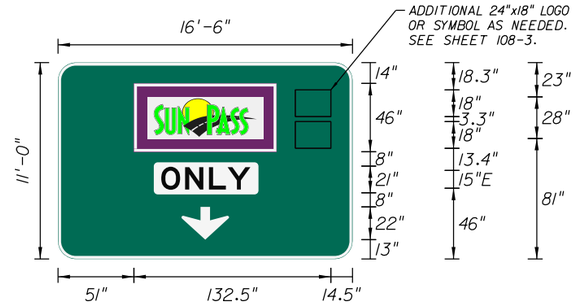
COPY		E	X	A	C	T		C	O	I	N	S		L									
SPACE	17.5	13.4	14.7	17.4	14.3	11.3	15	15.2	16	6.6	15.1	12.2	17.5	151.1									

COPY		C	A	R	S		O	N	L	Y		L											
SPACE	26.3	14.3	17.8	14.3	12.2	15	16	16	12.5	15.3	26.3	133.4											

SIGN NAME	TOL-AS1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-6"	WIDTH	2"		
HEIGHT	11'-0"	RADII	12"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	159.5	95.7	24	18
SunPassLarge	0	60	81	78	28
OtherETC	0	159.5	74.3	24	18
LogoPanelLarge	0	51	72	96	46
ARDOWN	0	83	13	32	22

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

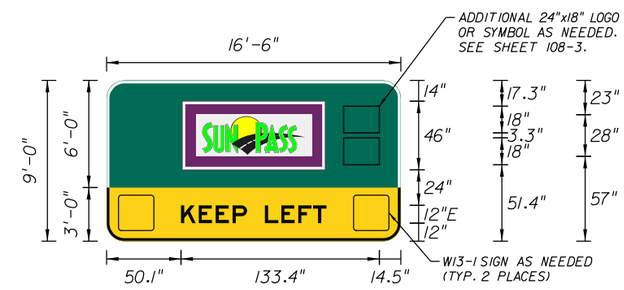
COPY		O	N	L	Y		L																
SPACE	75.1	12.8	12.8	10	12.2	75.1	47.9																

SIGN NAME	TOL-AS2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-6"	WIDTH	2"		
HEIGHT	9'-0"	RADII	12"		
LEGEND	/Black	COLOR	White/ Black		
COLOR	Green/Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	159.5	72.7	24	18
SunPassLarge	0	60	57	78	28
OtherETC	0	159.5	51.3	24	18
LogoPanelLarge	0	51	48	96	46

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NOTE:
1. ALTERNATE "AHEAD" MESSAGE ALSO SHOWN ON LINE 3.



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		K	E	E	P		L	E	F	T		L											
SPACE	50.1	11.9	11.4	11.4	9.7	12	11	11.4	10	9	50.1	97.8											

COPY		A	H	E	A	D		L															
SPACE	68.3	14.3	12.8	10.3	14.3	9.7	68.3	61.4															

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

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		- - -

TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS

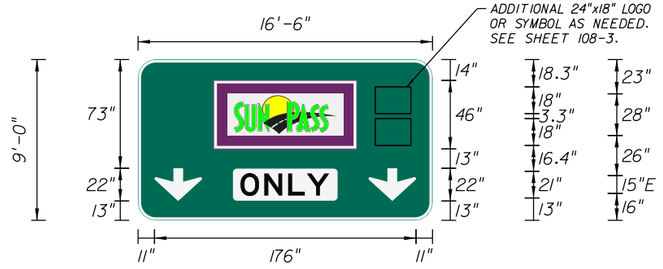
SHEET NO. 104-3

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-AS3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-6"	WIDTH	2"		
HEIGHT	9'-0"	RADII	12"		
LEGEND	White/ Black	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	159.5	71.7	24	18
SunPassLarge	0	60	57	78	28
OtherETC	0	159.5	50.3	24	18
LogoPanelLarge	0	51	48	96	46
ARDOWN	0	11	13	32	22
ARDOWN	0	155	13	32	22

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



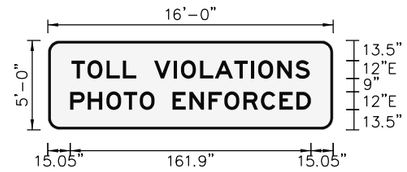
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		O	N	L	Y		L																
SPACE	75.1	12.8	12.8	10	12.2	75.1	47.9																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-V1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



MAINLINE APPLICATION

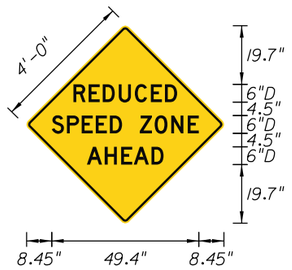
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		V	I	O	L	A	T	I	O	N	S		L					
SPACE	15.9	10.7	12.8	11	9	12	13.1	4.9	12.8	10	13.2	11	4.9	12.8	12.1	9.7	15.9	160.2						
COPY		P	H	O	T	O		E	N	F	O	R	C	E	D		L							
SPACE	15.1	11.8	12.5	11.8	10.7	10.1	12	11.4	12.8	10.7	12.8	11.8	12.5	11.4	9.7	15.1	161.9							
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-RSZ	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	5'-6"	WIDTH	0"		
HEIGHT	5'-6"	RADII	0"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



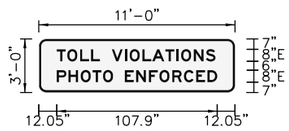
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		R	E	D	U	C	E	D		L													
SPACE	15.7	5.1	4.7	5.4	5.4	5.4	4.7	4.1	15.7	34.9													
COPY		S	P	E	E	D		Z	O	N	E		L										
SPACE	8.4	5.1	5	4.7	4.7	4.1	6	5	5.6	5.5	3.7	8.4	49.4										
COPY		A	H	E	A	D		L															
SPACE	20.3	6	5.5	4.2	6	4.1	20.3	25.8															
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-V2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	11'-0"	WIDTH	1.5"		
HEIGHT	3'-0"	RADII	5"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	.	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



RAMP APPLICATION

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		V	I	O	L	A	T	I	O	N	S		L					
SPACE	12.6	7.1	8.6	7.4	6	8	8.7	3.3	8.6	6.6	8.8	7.4	3.3	8.6	8.1	6.5	12.6	106.8						
COPY		P	H	O	T	O		E	N	F	O	R	C	E	D		L							
SPACE	12	7.8	8.3	7.8	7.1	6.7	8	7.6	8.6	7.1	8.6	7.8	8.3	7.6	6.5	12	107.9							
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS

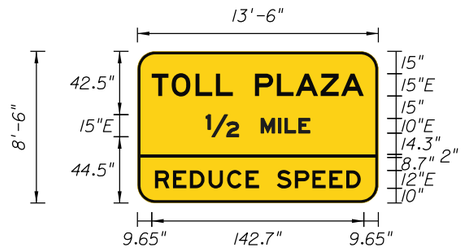
SHEET NO. 104-4

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-TOLL1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	13'-6"	WIDTH	2"		
HEIGHT	8'-6"	RADII	12"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



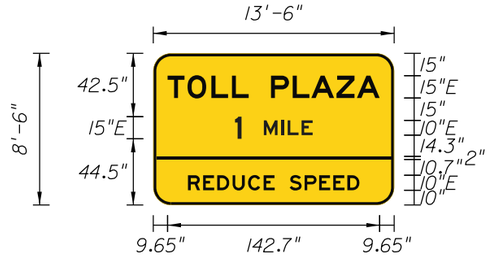
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		P	L	A	Z	A		L																				
SPACE	9.7	13.4	16	13.8	11.3	15	14.7	12.5	16.9	13.8	15.3	9.7	142.7																				
COPY		12		M	I	L	E		L																								
SPACE	46.1	22	15	11.8	4.3	9.4	7.3	46.1	69.8																								
COPY		R	E	D	U	C	E		S	P	E	E	D		L																		
SPACE	11.8	12.1	11.4	12.5	12.5	12.5	9	12	12.1	11.8	11.4	11.4	9.7	11.8	138.4																		
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME	TOL-TOLL2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	13'-6"	WIDTH	2"		
HEIGHT	8'-6"	RADII	12"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



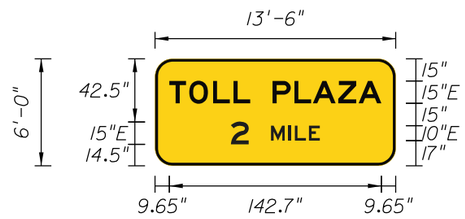
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		P	L	A	Z	A		L																				
SPACE	9.7	13.3	16	13.8	11.3	15	14.7	12.5	16.9	13.8	15.3	9.7	142.7																				
COPY		1		M	I	L	E		L																								
SPACE	54.9	4.4	15	11.8	4.3	9.4	7.3	54.9	52.2																								
COPY		R	E	D	U	C	E		S	P	E	E	D		L																		
SPACE	23.4	10.1	9.5	10.4	10.4	10.4	7.5	10	10.1	9.8	9.5	9.5	8.1	23.3	115.3																		
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME	TOL-TOLL3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	13'-6"	WIDTH	2"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		P	L	A	Z	A		L																				
SPACE	9.7	13.3	16	13.8	11.3	15	14.7	12.5	16.9	13.8	15.3	9.7	142.7																				
COPY		2		M	I	L	E		L																								
SPACE	51.1	12	15	11.8	4.3	9.4	7.3	51.1	59.8																								
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME		QTY		SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH		WIDTH			
HEIGHT		RADII			
LEGEND		COLOR			
COLOR					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY																																	
SPACE																																	
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REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
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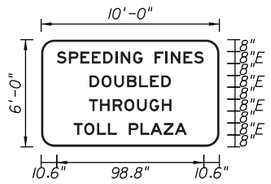
TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS

SHEET NO.
104-5

SIGN NAME	TOL-FINE	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			none
WIDTH	10'-0"	WIDTH	1.5"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



FOR RAMP OR MAINLINE APPLICATION

NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		S	P	E	E	D	I	N	G		F	I	N	E	S		L															
SPACE	10.6	8.1	7.8	7.6	7.6	8.3	3.5	8.3	6.5	8	7.4	3.5	8.6	7.1	6.5	10.6	98.8															
COPY		D	O	U	B	L	E	D		L																						
SPACE	32.5	8.1	8.6	8.6	8.1	7.4	7.6	6.5	32.6	54.9																						
COPY		T	H	R	O	U	G	H		L																						
SPACE	32.2	7.4	8.6	7.8	8.6	8.3	8.3	6.5	32.3	55.5																						
COPY		T	O	L	L		P	L	A	Z	A		L																			
SPACE	21.9	7.1	8.6	7.4	6	8	7.8	6.6	9	7.4	8.2	22	76.1																			
COPY																																
SPACE																																
COPY																																
SPACE																																

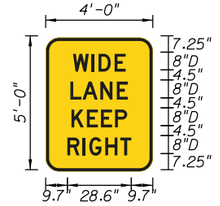
SIGN NAME	TOL-WIDE	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	4'-0"	WIDTH	1.5"		
HEIGHT	5'-0"	RADII	6"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NOTES:

1. ALTERNATE MESSAGE FOR "RIGHT" IS SHOWN ON LINE 6



FOR RAMP OR MAINLINE APPLICATION

NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		W	I	D	E		L																								
SPACE	12.1	8.3	3.2	7.2	5	12.2	23.7																								
COPY		L	A	N	E		L																								
SPACE	11.1	5.4	8	7.4	5	11.1	25.8																								
COPY		K	E	E	P		L																								
SPACE	11.5	7	6.3	6.3	5.4	11.5	25																								
COPY		R	I	G	H	T		L																							
SPACE	9.7	6.8	3	7.2	6.6	5	9.7	28.6																							
COPY																															
SPACE																															
COPY		L	E	F	T		L																								
SPACE	12.2	6.4	6.4	5.9	4.9	12.2	23.6																								

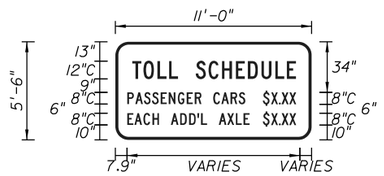
SIGN NAME	TOL-TOLL5	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	11'-0"	WIDTH	2"		
HEIGHT	5'-6"	RADII	9"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NOTE TO DESIGNER:

1. COORDINATE TOLL RATE WITH TURNPIKE TRAFFIC ENGINEER PRIOR TO FABRICATION OF SIGN PANEL.



RAMP APPLICATION

NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		T	O	L	L		S	C	H	E	D	U	L	E		L																
SPACE	10.9	7.5	9.4	7.8	6.1	12	8.5	9.1	9.3	8.1	9.1	9.3	7.8	6.1	11	110.1																
COPY		P	A	S	S	E	N	G	E	R		C	A	R	S		L															
SPACE	7.9	5.4	5.8	5.4	5.8	5.4	6.1	6.1	5.4	4.5	8	5.4	6.2	5.4	4.5	44.7	79.4															
COPY		$	X	.	X	X		L																								
SPACE	99.2	5.9	VARIES	2.9	VARIES	VARIES	VARIES	VARIES																								
COPY		E	A	C	H		A	D	D	'	L		A	X	L	E		L														
SPACE	7.9	4.8	6.1	6.1	4.5	8	6.2	6.1	5.5	2.5	4.1	8	5.6	5.8	5.2	4.1	41.5	82.6														
COPY		$	X	.	X	X		L																								
SPACE	99.2	5.9	VARIES	2.9	VARIES	VARIES	VARIES	VARIES																								
COPY																																
SPACE																																

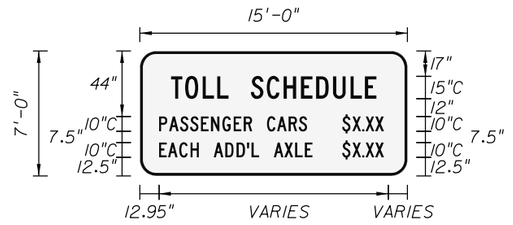
SIGN NAME	TOL-TOLL6	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	15'-0"	WIDTH	2"		
HEIGHT	7'-0"	RADII	11"		
LEGEND	Black	COLOR	Black		
COLOR	White				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NOTE TO DESIGNER:

1. COORDINATE TOLL RATE WITH TURNPIKE TRAFFIC ENGINEER PRIOR TO FABRICATION OF SIGN PANEL.



MAINLINE APPLICATION

NO. OF LIGHT FIXTURES		FIXTURE SPACING		PHOTOMETRIC CURVE		WATT		VOLTAGE	

COPY		T	O	L	L		S	C	H	E	D	U	L	E		L																
SPACE	20.9	9.4	11.9	9.7	7.6	15	10.6	11.4	11.7	10.2	11.4	11.7	9.7	7.6	20.9	138.1																
COPY		P	A	S	S	E	N	G	E	R		C	A	R	S		L															
SPACE	12.9	6.8	7.3	6.8	7.3	6.8	7.6	7.6	6.8	5.6	10	6.8	7.8	6.8	5.6	67.6	99.6															
COPY		$	X	.	X	X		L																								
SPACE	136	7.4	VARIES	2.9	VARIES	VARIES	VARIES	VARIES																								
COPY		E	A	C	H		A	D	D	'	L		A	X	L	E																
SPACE	12.9	6	7.6	7.6	5.6	10	7.8	7.6	6.9	3.1	5.1	10	7	7.3	6.5	5.1																
COPY		$	X	.	X	X		L																								
SPACE	20	7.4	VARIES	2.9	VARIES	VARIES	VARIES	VARIES																								
COPY																																
SPACE																																

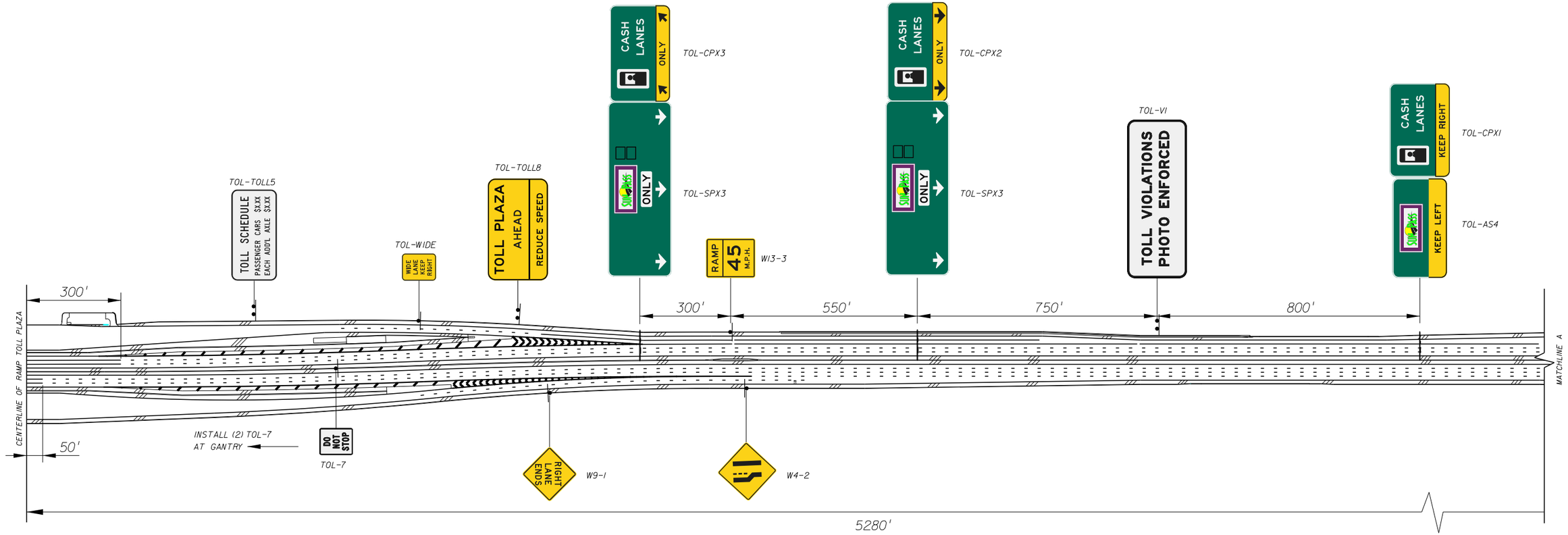
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

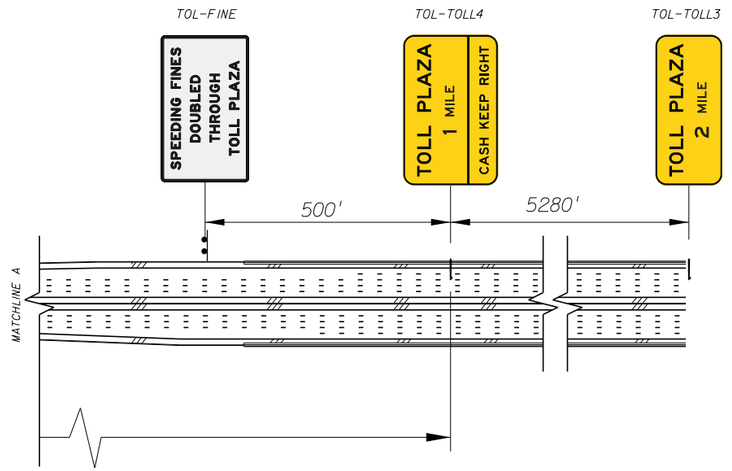
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

TOLL PLAZA SIGNING DETAILS APPROACH SIGN PANELS

SHEET NO.
104-6





N.T.S.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

ORT MAINLINE TOLL PLAZA SIGNING LAYOUT

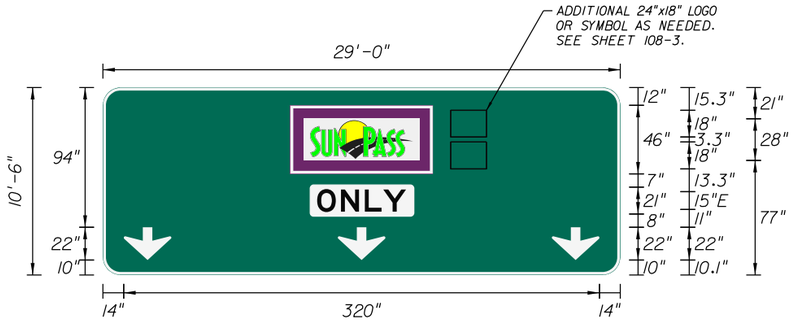
SHEET NO.
105-1

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-SPX3
QUANTITY	1
WIDTH	29'-0"
HEIGHT	10'-6"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	Green
LEGEND	White
BORDER	White

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	180	234	92.7	24	18
SunPassLarge	0	135	77	78	28
OtherETC	180	234	71.3	24	18
LogoPanelLarge	0	126	68	96	46
ARDOWN	0	14	10	32	22
ARDOWN	0	158	10	32	22
ARDOWN	0	302	10	32	22

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH

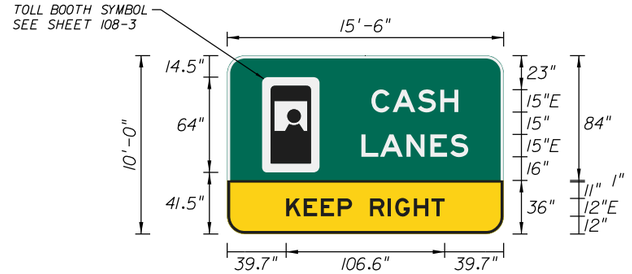


COPY		O	N	L	Y		L																
SPACE	150.1	12.8	12.8	10	12.2	150.1	47.9																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-CPX1
QUANTITY	1
WIDTH	15'-6"
HEIGHT	10'-0"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	Green, Yellow
LEGEND	White, Black
BORDER	White, Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	23.8	41.5	38	64

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH

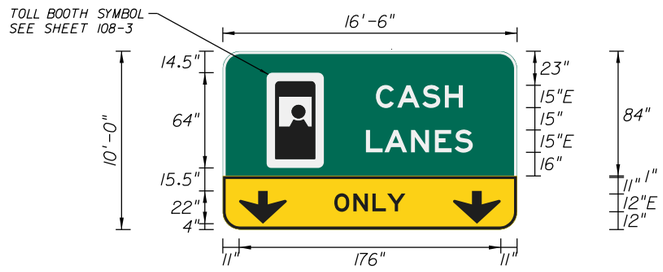


COPY		C	A	S	H		L																
SPACE	97.3	14.2	16.9	15.1	12.1	30.4	58.3																
COPY		L	A	N	E	S		L															
SPACE	90.4	12.4	17.9	16	13.3	12.2	23.8	71.8															
COPY		K	E	E	P		R	I	G	H	T		L										
SPACE	39.7	11.9	11.4	11.4	9.7	12	12.1	4.9	12.5	11.8	9	39.7	106.6										
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-CPX2
QUANTITY	1
WIDTH	16'-6"
HEIGHT	10'-0"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	Green, Yellow
LEGEND	White, Black
BORDER	White, Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	29.8	41.5	38	64
ARDOWN	0	11	4	32	22
ARDOWN	0	155	4	32	22

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH

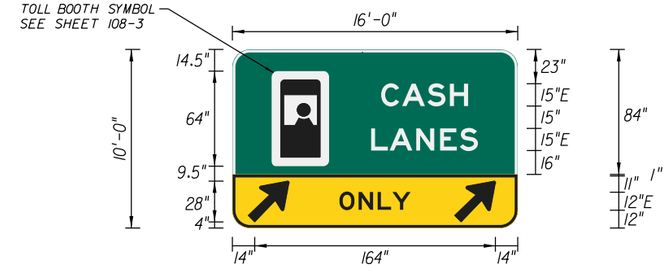


COPY		C	A	S	H		L																
SPACE	103	14.2	16.9	15.1	12.1	36.7	58.3																
COPY		L	A	N	E	S		L															
SPACE	96.2	12.4	17.9	16	13.3	12.2	30	71.8															
COPY		O	N	L	Y		L																
SPACE	75.1	12.8	12.8	10	12.2	75.1	47.8																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-CPX3
QUANTITY	1
WIDTH	16'-0"
HEIGHT	10'-0"
BORDER WIDTH	2"
BORDER RADII	12"
PANEL COLOR	Green, Yellow
LEGEND	White, Black
BORDER	White, Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	26.8	41.5	38	64
ARSHRT	45	12.8	4	22.3	35.4
ARSHRT	45	158	4	22.3	35.4

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH



COPY		C	A	S	H		L																
SPACE	100	14.2	16.9	15.1	12.1	33.7	58.3																
COPY		L	A	N	E	S		L															
SPACE	93.2	12.4	17.9	16	13.3	12.2	27	71.8															
COPY		O	N	L	Y		L																
SPACE	72.1	12.8	12.8	10	12.2	72.1	47.8																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

ORT SIGNING DETAILS MAINLINE SIGN PANELS

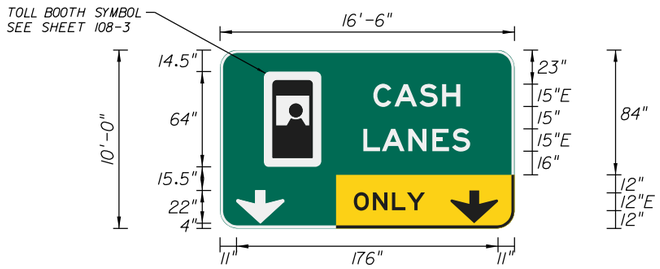
SHEET NO. 105-2

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-CPX4	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-6"	WIDTH	2"		
HEIGHT	10'-0"	RADII	12"		
LEGEND	White/ Black	COLOR	White/ Black		
COLOR	Green/Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	29.8	41.5	38	64
ARDOWN	0	11	4	32	22
ARDOWN	0	155	4	32	22

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



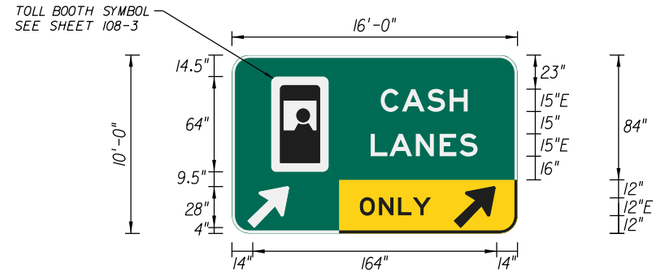
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	A	S	H		L																										
SPACE	103	14.2	16.9	15.1	12.1	36.7	58.3																										
COPY		L	A	N	E	S		L																									
SPACE	96.2	12.4	17.9	16	13.3	12.2	30	71.8																									
COPY		O	N	L	Y		L																										
SPACE	90	12.8	12.8	10	12.2	60.2	47.8																										
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME	TOL-CPX5	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	16'-0"	WIDTH	2"		
HEIGHT	10'-0"	RADII	12"		
LEGEND	White/ Black	COLOR	White/ Black		
COLOR	Green/Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	26.7	41.5	38	64
ARSHRT	45	14	5.5	20	22.5
ARSHRT	45	160	5.5	20	22.5

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



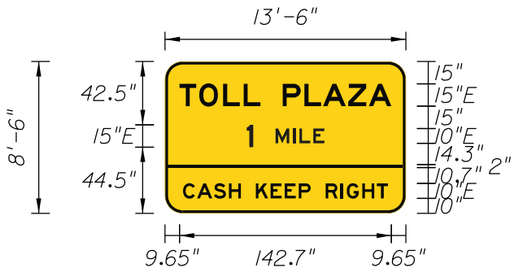
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	A	S	H		L																										
SPACE	100	14.2	16.9	15.1	12.1	33.7	58.3																										
COPY		L	A	N	E	S		L																									
SPACE	93.2	12.4	17.9	16	13.3	12.2	27	71.8																									
COPY		O	N	L	Y		L																										
SPACE	86	12.8	12.8	10	12.2	58.2	47.8																										
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME	TOL-TOLL4	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	13'-6"	WIDTH	2"		
HEIGHT	8'-6"	RADII	12"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		P	L	A	Z	A		L																				
SPACE	9.7	13.3	16.1	13.8	11.3	15	14.7	12.4	17	13.8	15.3	9.7	142.7																				
COPY		1		M	I	L	E		L																								
SPACE	54.9	4.4	15	11.8	4.3	9.4	7.3	54.9	52.2																								
COPY		C	A	S	H		K	E	E	P		R	I	G	H	T		L															
SPACE	12.1	9.5	11.3	10.1	8.1	10	9.9	9.5	9.5	8.1	10	10.1	4.1	10.4	9.8	7.5	12.1	137.9															
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

SIGN NAME		QTY		SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH		WIDTH			
HEIGHT		RADII			
LEGEND		COLOR			
COLOR					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	
COPY																																	
SPACE																																	

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

ORT SIGNING DETAILS MAINLINE SIGN PANELS

SHEET NO. 105-3

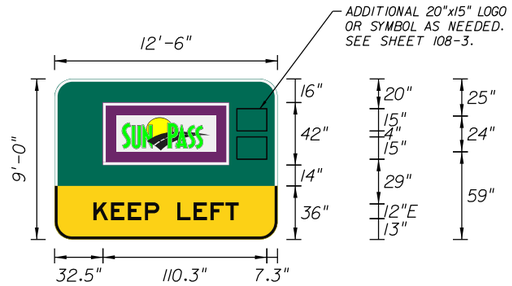
$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-AS4	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-6"	WIDTH	2"		
HEIGHT	9'-0"	RADII	12"		
LEGEND	/Black	COLOR	White/Black		
COLOR	Green/Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	122.8	73	20	15
SunPassSmall	0	41.5	59	67	24
OtherETC	0	122.8	54	20	15
LogoPanelSmall	0	32.5	50	85	42

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NOTE:
1. ALTERNATE MESSAGES ALSO SHOWN ON LINE 3, 4, AND 5 BELOW.



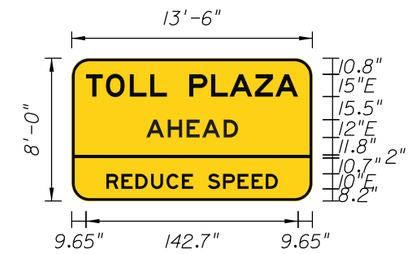
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		K	E	E	P		L	E	F	T		L																											
SPACE	26.1	11.9	11.4	11.4	9.7	12	11	11.4	10	9	26.1	97.8																											
COPY																																							
SPACE																																							
COPY		K	E	E	P		R	I	G	H	T		L																										
SPACE	21.7	11.9	11.4	11.4	9.7	12	12.1	4.9	12.5	11.8	9	21.7	106.7																										
COPY		C	E	N	T	E	R		L	A	N	E		L																										
SPACE	12.1	12.5	11.4	11.8	11	11.4	9.7	12	10	14.3	12.8	9	12.1	125.9																										
COPY		A	H	E	A	D		L																																
SPACE	44.3	14.3	12.8	10.3	14.3	9.7	44.3	61.4																																
COPY																																							
SPACE																																							

SIGN NAME	TOL-TOLL8	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			none
WIDTH	13'-6"	WIDTH	2"		
HEIGHT	8'-0"	RADII	12"		
LEGEND	Black	COLOR	Black		
COLOR	Yellow				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		T	O	L	L		P	L	A	Z	A		L																										
SPACE	9.7	13.3	16.1	13.8	11.3	15	14.7	12.4	17	13.8	15.3	9.7	142.7																										
COPY		A	H	E	A	D		L																																
SPACE	50.2	14.5	12.6	10.5	14.5	9.6	50.1	61.6																																
COPY		R	E	D	U	C	E		S	P	E	E	D		L																								
SPACE	23.4	10.1	9.5	10.4	10.4	10.4	7.5	10	10.1	9.8	9.5	9.5	8.1	23.3	115.3																								
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							

SIGN NAME		QTY		SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH		WIDTH			
HEIGHT		RADII			
LEGEND		COLOR			
COLOR					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							

SIGN NAME		QTY		SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH		WIDTH			
HEIGHT		RADII			
LEGEND		COLOR			
COLOR					

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH

NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							
COPY																																							
SPACE																																							

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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ORT SIGNING DETAILS MAINLINE SIGN PANELS

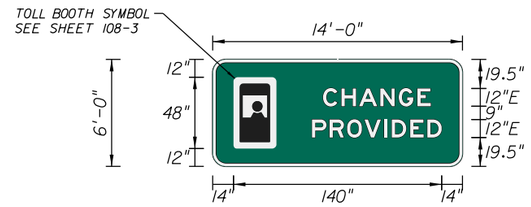
SHEET NO. 105-4

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-C1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_CAN	0	14	12	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



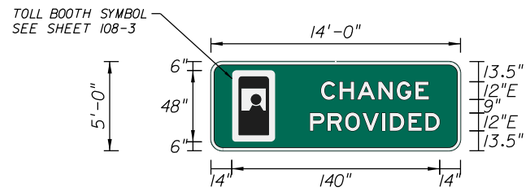
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L															
SPACE	74	12.5	11.8	14.3	12.5	12.5	9	21.4	72.6															
COPY		P	R	O	V	I	D	E	D		L													
SPACE	66.6	11.8	11.8	11.8	13.1	5.3	12.5	11.4	9.7	14	87.4													
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-C2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_CAN	0	14	6	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



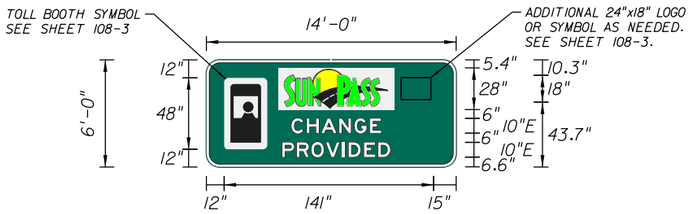
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L															
SPACE	74	12.5	11.8	14.3	12.5	12.5	9	21.4	72.6															
COPY		P	R	O	V	I	D	E	D		L													
SPACE	66.6	11.8	11.8	11.8	13.1	5.3	12.5	11.4	9.7	14	87.4													
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-CS1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	1.75"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	129	43.7	24	18
SunPass_CAN	0	48.2	38.6	78	28
TB_CAN	0	12	12	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



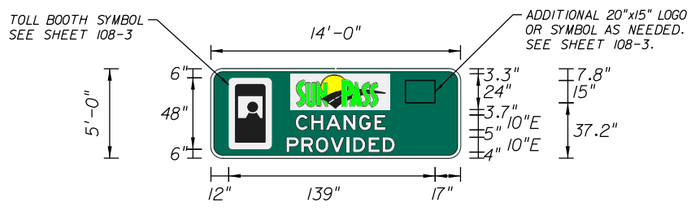
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L															
SPACE	57.1	10.4	9.8	11.9	10.4	10.4	7.5	50.5	60.4															
COPY		P	R	O	V	I	D	E	D		L													
SPACE	51	9.8	9.8	9.8	10.9	4.4	10.4	9.5	8.1	44.3	72.7													
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-CS2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	1.75"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
SunPass_CAN	0	53.9	22.7	67	24
OtherETC	0	131	37.2	20	15
TB_CAN	0	12	6	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L															
SPACE	57.1	10.4	9.8	11.9	10.4	10.4	7.5	50.5	60.4															
COPY		P	R	O	V	I	D	E	D		L													
SPACE	51	9.8	9.8	9.8	10.9	4.4	10.4	9.5	8.1	44.3	72.7													
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

REVISIONS			
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STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS

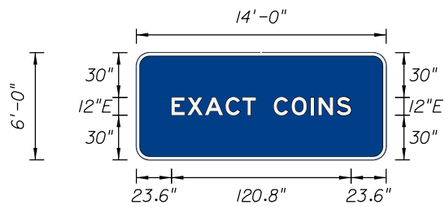
SHEET NO. 106-1

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-X1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	White	COLOR	White		
COLOR	Blue				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



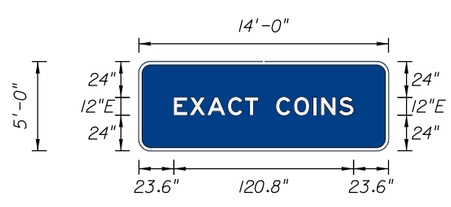
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L										
SPACE	23.6	10.7	11.8	13.9	11.4	9	12	12.1	12.8	5.3	12.1	9.7	23.6	120.8										
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-X2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Blue				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



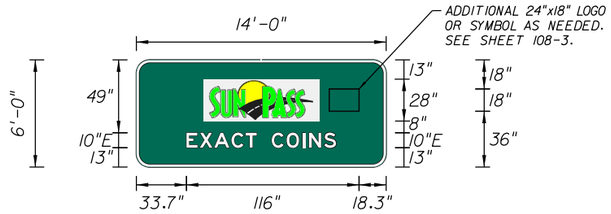
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L										
SPACE	23.6	10.7	11.8	13.9	11.4	9	12	12.1	12.8	5.3	12.1	9.7	23.6	120.8										
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-XS1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	1.75"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	129.7	37.5	24	18
SunPass_CAN	0	45	31	78	28

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



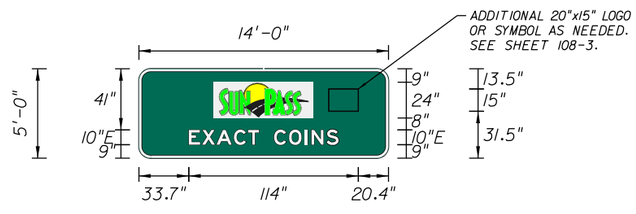
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L										
SPACE	33.7	8.9	9.8	11.6	9.5	7.5	10	10.1	10.7	4.4	10.1	8.1	33.7	100.7										
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

SIGN NAME	TOL-XS2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	1.75"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
SunPass_CAN	0	50.5	27	67	24
OtherETC	0	127.6	31.5	20	15

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L										
SPACE	33.7	8.9	9.8	11.6	9.5	7.5	10	10.1	10.7	4.4	10.1	8.1	33.7	100.7										
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								
COPY																								
SPACE																								

REVISIONS			
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STATE OF FLORIDA
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ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS

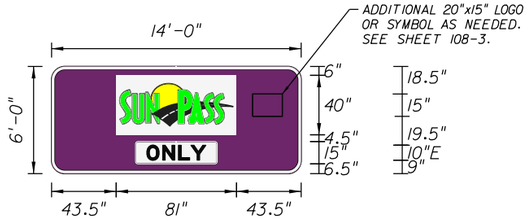
SHEET NO. 106-2

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-S1	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	6'-0"	RADII	9"		
LEGEND	Black	COLOR	White		
COLOR	Purple				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	135.2	38.5	20	15
SunPassSmall	0	52.1	34.6	63.8	22.9
LogoPanelSmall	0	43.5	26	81	40

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



FOR SINGLE DEDICATED USE ONLY

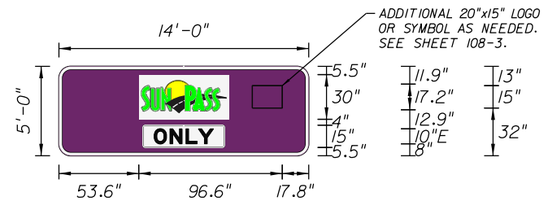
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		O	N	L	Y		L																		
SPACE	64	10.7	10.7	8.3	10.2	64.1	39.9																		
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									

SIGN NAME	TOL-S2	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	14'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	Black	COLOR	White		
COLOR	Purple				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	130.2	32	20	15
SunPassSmall	0	60.1	30.9	47.8	17.2
LogoPanelSmall	0	53.6	24.5	60.7	30

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



FOR SINGLE DEDICATED USE ONLY

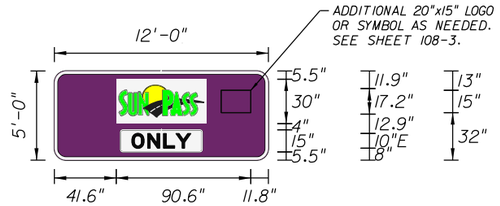
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		O	N	L	Y		L																		
SPACE	64.1	10.7	10.7	8.3	10.2	64	39.9																		
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									

SIGN NAME	TOL-S3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	Black	COLOR	White		
COLOR	Purple				

SYMBOL(S)	ANGLE	X	Y	WID	HT
OtherETC	0	112.2	32	20	15
SunPassSmall	0	48.1	30.9	47.8	17.2
LogoPanelSmall	0	41.6	24.5	60.7	30

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



FOR SINGLE DEDICATED USE ONLY

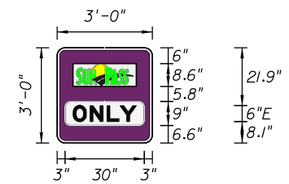
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		O	N	L	Y		L																		
SPACE	52.1	10.7	10.7	8.3	10.2	52	39.9																		
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									

SIGN NAME	TOL-S4	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	3'-0"	WIDTH	0.75"		
HEIGHT	3'-0"	RADII	3"		
LEGEND	Black	COLOR	White		
COLOR	Purple				

SYMBOL(S)	ANGLE	X	Y	WID	HT
SunPassLarge	0	6	21.4	24	8.6

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE		AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		O	N	L	Y		L																		
SPACE	6	6.4	6.4	5	6.1	6	23.9																		
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									
COPY																									
SPACE																									

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
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TOLL PLAZA SIGNING DETAILS MAINLINE CANOPY MOUNTED SIGN PANELS

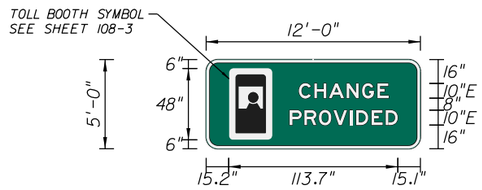
SHEET NO. 106-3

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-C3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-0"	WIDTH	2"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
TB_ADV	0	15.2	6	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE	AVERAGE LENGTH



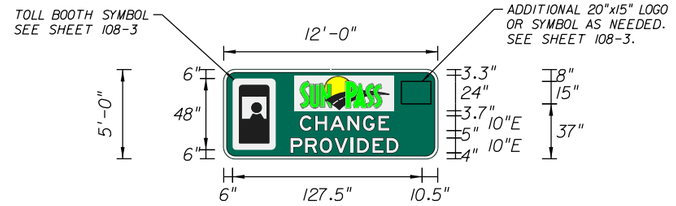
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L													
SPACE	62.3	10.4	9.8	11.9	10.4	10.4	7.5	21.3	60.4													
COPY		P	R	O	V	I	D	E	D		L											
SPACE	56.2	9.8	9.8	9.8	10.9	4.4	10.4	9.5	8.1	15.1	72.7											
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME	TOL-CS3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-0"	WIDTH	1.75"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
SunPass_CAN	0	47.8	32.7	67	24
OtherETC	0	113.5	37	20	15
TB_CAN	0	6	6	29	48

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE	AVERAGE LENGTH



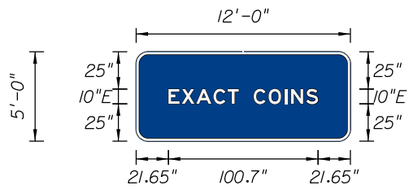
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		C	H	A	N	G	E		L													
SPACE	51.1	10.4	9.8	11.9	10.4	10.4	7.5	32.5	60.4													
COPY		P	R	O	V	I	D	E	D		L											
SPACE	45	9.8	9.8	9.8	10.9	4.4	10.4	9.5	8.1	26.3	72.7											
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME	TOL-X3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-0"	WIDTH	1.75"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Blue				

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE	AVERAGE LENGTH



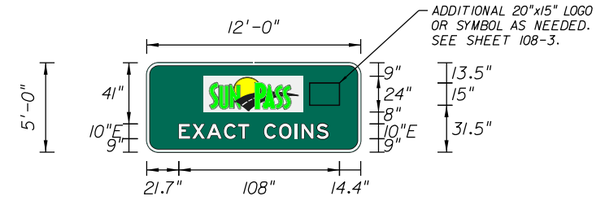
NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L								
SPACE	21.7	8.9	9.8	11.6	9.5	7.5	10	10.1	10.7	4.4	10.1	8.1	21.7	100.7								
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

SIGN NAME	TOL-XS3	QTY	1	SIGN NUMBER	STATION(S)
PANEL		BORDER			
WIDTH	12'-0"	WIDTH	1.75"		
HEIGHT	5'-0"	RADII	8"		
LEGEND	White	COLOR	White		
COLOR	Green				

SYMBOL(S)	ANGLE	X	Y	WID	HT
SunPass_CAN	0	38.5	27	67	24
OtherETC	0	109.6	31.5	20	15

SIGN NUMBER	NUMBER OF POSTS	CLEARANCE Edge Of Lane	COLUMN SIZE	AVERAGE LENGTH



NO. OF LIGHT FIXTURES | FIXTURE SPACING | PHOTOMETRIC CURVE | WATT | VOLTAGE

COPY		E	X	A	C	T		C	O	I	N	S		L								
SPACE	21.7	8.9	9.8	11.6	9.5	7.5	10	10.1	10.7	4.4	10.1	8.1	21.6	100.7								
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						
COPY																						
SPACE																						

REVISIONS

DATE	DESCRIPTION	DATE	DESCRIPTION

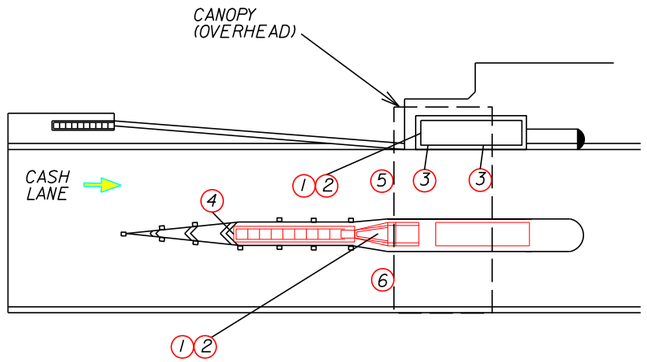
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

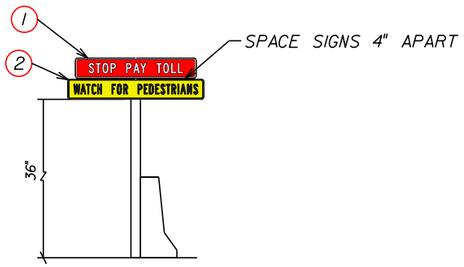
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

TOLL PLAZA SIGNING DETAILS RAMP CANOPY MOUNTED SIGN PANELS

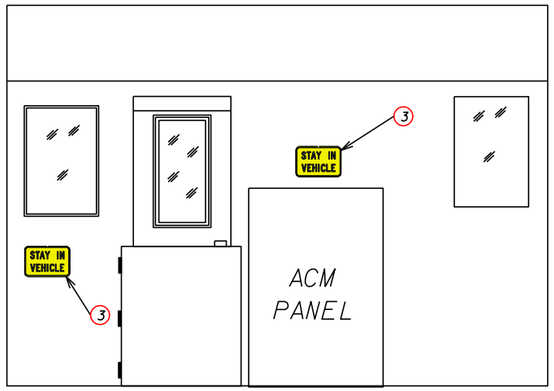
SHEET NO. 106-4

$USER$ $DATE$ $TIME$ $FILE$





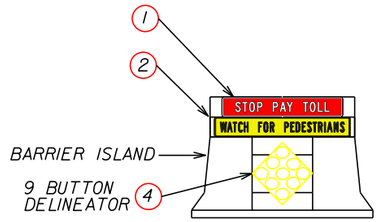
FRONT VIEW



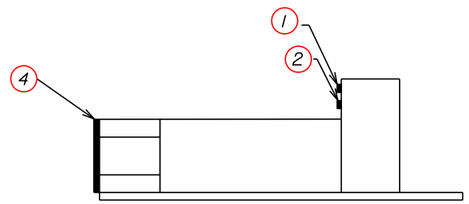
PARTIALLY STAFFED
SIGN PLACEMENT DETAIL

TOLL PLAZA SIGN SYMBOL LEGEND

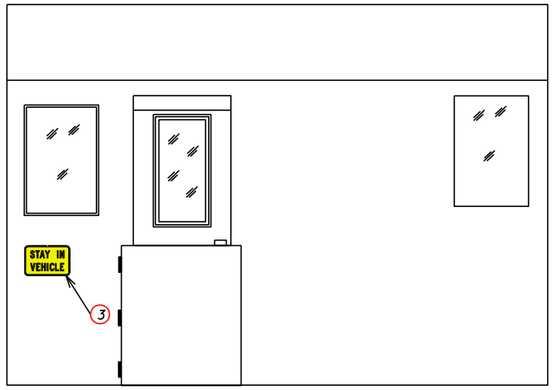
	LEGEND OR DESCRIPTION	REMARKS
1	STOP PAY TOLL	MOUNT ON ISLAND GATORHEAD OR GROUND MOUNT
2	WATCH FOR PEDESTRIANS	MOUNT ON ISLAND GATORHEAD OR GROUND MOUNT
3	STAY IN VEHICLE	MOUNT ON TOLL BOOTH OR ACM
4	9 BUTTON DELINEATOR	MOUNT ON BLUNT END OF CONCRETE ISLAND AND ATTENUATOR
5	LANE DESIGNATION SIGN	MOUNT ON CANOPY
6	LANE DESIGNATION SIGN	MOUNT ON CANOPY



GATORHEAD FRONT VIEW



GATORHEAD SIDE VIEW



STAFFED 24 HOURS
SIGN PLACEMENT DETAIL

N.T.S.

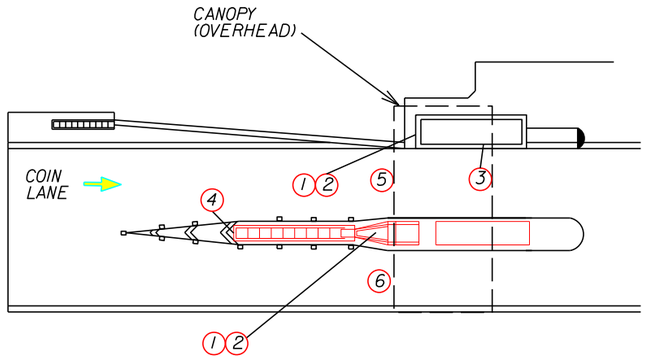
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

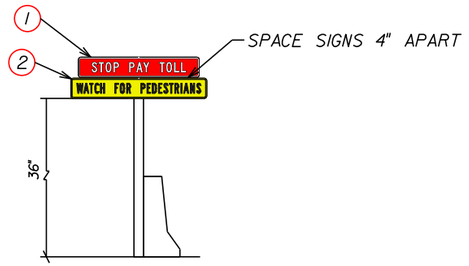
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

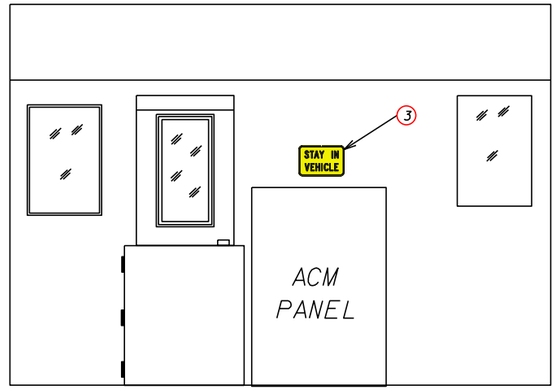
CASH LANE TOLL PLAZA SIGNING LAYOUT

SHEET NO.
107-1





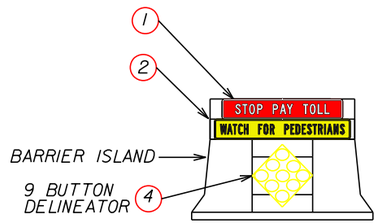
FRONT VIEW



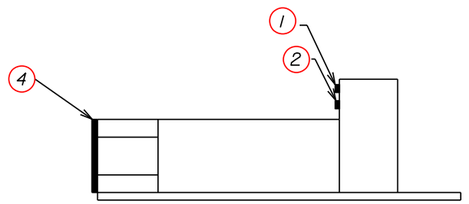
UNSTAFFED COIN LANE
SIGN PLACEMENT DETAIL

TOLL PLAZA SIGN SYMBOL LEGEND

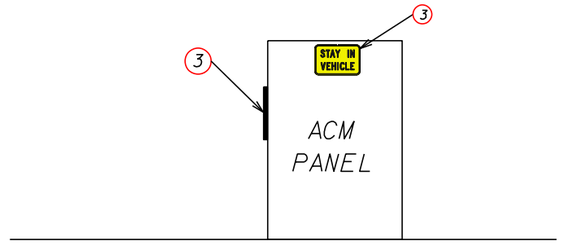
	LEGEND OR DESCRIPTION	REMARKS
1	STOP PAY TOLL	MOUNT ON ISLAND GATORHEAD OR GROUND MOUNT
2	WATCH FOR PEDESTRIANS	MOUNT ON ISLAND GATORHEAD OR GROUND MOUNT
3	STAY IN VEHICLE	MOUNT ON TOLL BOOTH OR ACM
4	9 BUTTON DELINEATOR	MOUNT ON BLUNT END OF CONCRETE ISLAND AND ATTENUATOR
5	LANE DESIGNATION SIGN	MOUNT ON CANOPY
6	LANE DESIGNATION SIGN	MOUNT ON CANOPY



GATORHEAD FRONT VIEW



GATORHEAD SIDE VIEW



UNSTAFFED COIN LANE - NO BOOTH
SIGN PLACEMENT DETAIL

N.T.S.

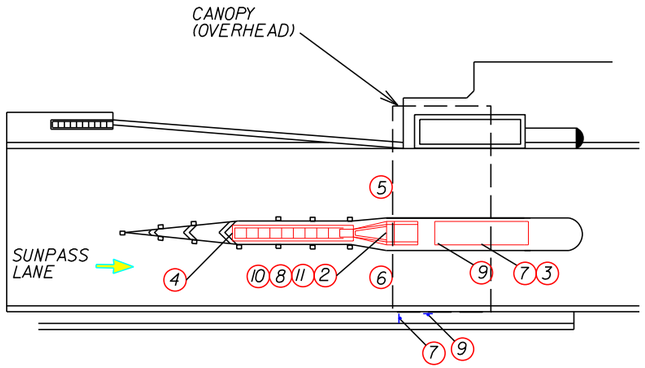
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

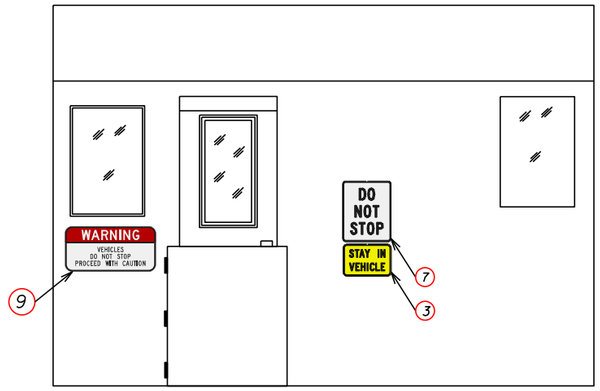
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

COIN LANE TOLL PLAZA SIGNING LAYOUT

SHEET NO.
107-2

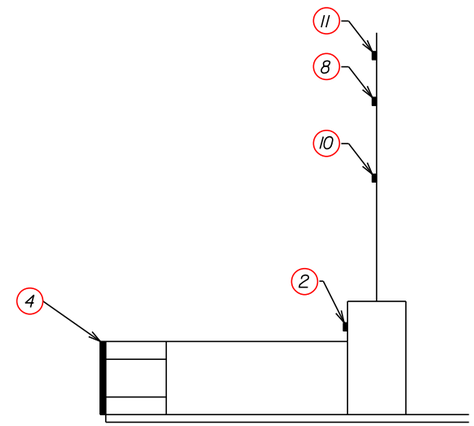




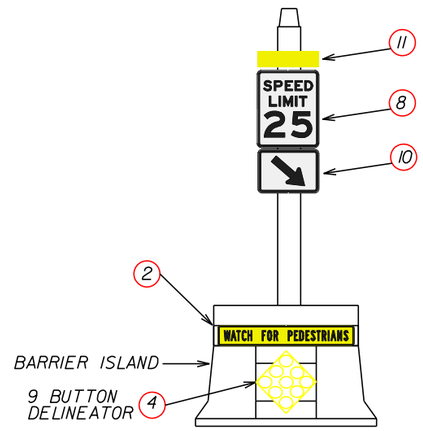
SUNPASS LANE AND BOOTH
SIGN PLACEMENT DETAIL

TOLL PLAZA SIGN SYMBOL LEGEND

	LEGEND OR DESCRIPTION	REMARKS
1	STOP PAY TOLL	MOUNT ON ISLAND GATORHEAD
2	WATCH FOR PEDESTRIANS	MOUNT ON ISLAND GATORHEAD
3	STAY IN VEHICLE	MOUNT ON TOLL BOOTH OR ACM
4	9 BUTTON DELINEATOR	MOUNT ON BLUNT END OF CONCRETE ISLAND AND ATTENUATOR
5	LANE DESIGNATION SIGN	MOUNT ON CANOPY
6	LANE DESIGNATION SIGN	MOUNT ON CANOPY
7	DO NOT STOP	TOLL BOOTH OR GROUND MOUNT (IF NO BOOTH)
8	25 MPH	MOUNT ON ISLAND GATORHEAD
9	WARNING VEHICLES DO NOT STOP PROCEED WITH CAUTION	GROUND MOUNT ACROSS FROM WALKWAYS ON EACH SIDE AT A HEIGHT OF 5'-0"
10	ARROW (M6-2aP)	MOUNT ON ISLAND GATOR HEAD
11	YELLOW PANEL	MOUNT ON ISLAND GATOR HEAD



GATORHEAD SIDE VIEW



GATORHEAD FRONT VIEW

N.T.S.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

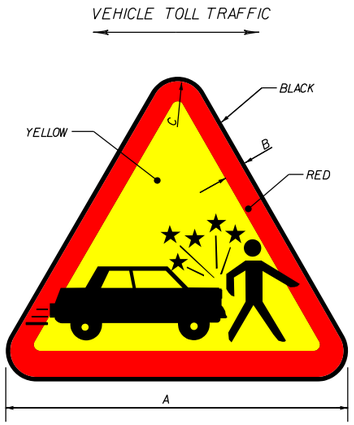
SUNPASS LANE TOLL PLAZA SIGNING LAYOUT

SHEET NO.
107-3

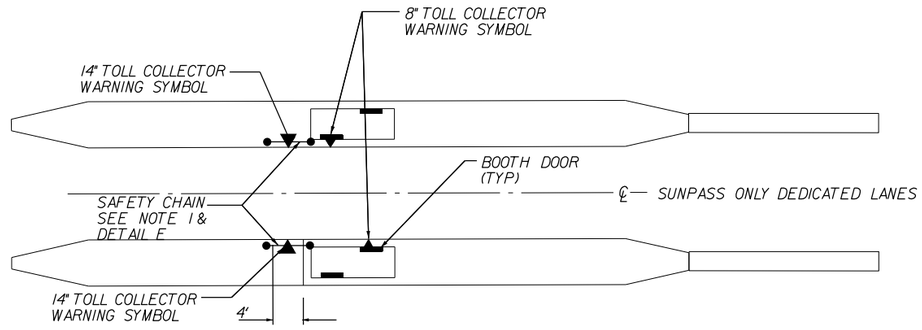
$USER$ $DATE$ $TIME$ $FILE$

SYMBOL DIMENSIONS			
OVERALL SIZE	A	B	C
8"	8"	.6"	.6"
14"	14"	1"	1"

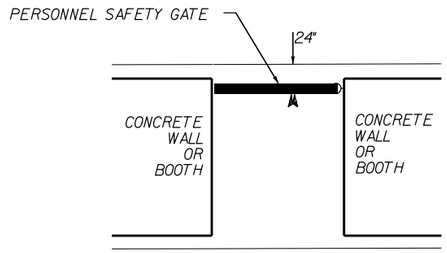
NOTE: SYMBOLS SHALL BE PLACED IN BOOTH DOORWAYS AND WALKWAYS AS SHOWN ON PLANS. SURFACES SHALL BE THOROUGHLY CLEANED PRIOR TO APPLICATION.



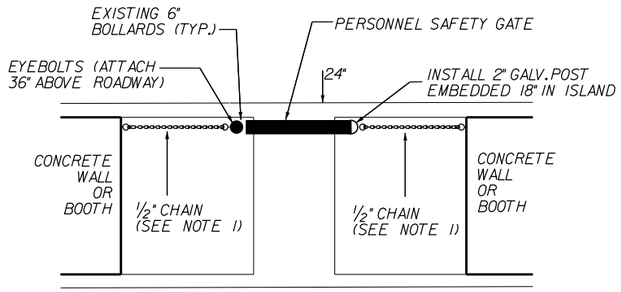
TYPICAL TOLL ATTENDANT WARNING SYMBOL
NTS



DETAIL "C"
TYPICAL ISLAND LOCATIONS FOR TOLL COLLECTOR WARNING SYMBOLS DEDICATED AND MIXED USE LANES
N.T.S.



DETAIL "D"
FOR MAINLINE PLAZA CROSSWALKS WITHOUT BOLLARDS. (DEDICATED LANES ONLY)
N.T.S.



DETAIL "E"
FOR MAINLINE PLAZA CROSSWALKS WITH BOLLARDS. (DEDICATED LANES ONLY)
N.T.S.

NOTES:
1. SAFETY CHAINS SHALL CONSIST OF 1/2" YELLOW COLORED, VINYL-COATED STEEL CHAIN, SNAPHOOK, SHACKLES, EYEBOLTS, AND ANCHORS. THE SAFETY CHAINS SHALL BE ANCHORED TO CONCRETE WALL, MASONRY, OR BOLLARDS BY LAG SHIELDS AND 3/8" EYEBOLTS. STEEL BOLLARDS SHALL BE FIELD GALVANIZED AROUND HOLES AND YELLOW PAINT SHALL BE TOUCHED UP. CHAINS ARE TO BE INSTALLED ON DEDICATED LANE SIDE OF ISLANDS ONLY. INSTALL 2" GALVANIZED POSTS WITH END CAPS WHERE THERE ARE NO BOLLARDS AS SHOWN IN DETAIL-E. NO SAFETY CHAINS OR POSTS SHALL BE LOCATED TO INTERFERE WITH THE OPERATION OF ELECTRONIC VEHICLE SEPERATOR EQUIPMENT.

NOTES:
1. SIGNS SHALL BE MOUNTED ONLY ON ISLANDS BORDERING SUNPASS DEDICATED LANES.
2. SIGN TOL-3 (SEE DRAWING 107-6), ON ISLAND, TO BE FASTENED ON VERTICAL CONCRETE WALL WITH LAG SHIELDS. SIGN SHALL BE MOUNTED SO AS TO NOT OBSTRUCT ELECTRIC OUTLETS, JUNCTION BOXES, OR CONTROL CABINETS.
3. SIGN TOL-3 (SEE DRAWING 107-6), ON CONCRETE BOOTH, SHALL BE MOUNTED ABOVE WINDOW NEXT TO BOOTH DOOR AND CENTERED ON CONCRETE COLUMN. SIGN SHALL BE MOUNTED WITH LAG SHIELDS. CLEARANCES SHALL COMPLY WITH STANDARD PLANS, INDEX 700-101.
4. SIGN TOL-3 (SEE DRAWING 107-6) SHALL BE POST MOUNTED ADJACENT TO SIDEWALK BETWEEN ADMINISTRATION BUILDING AND NEAREST TOLL LANE.

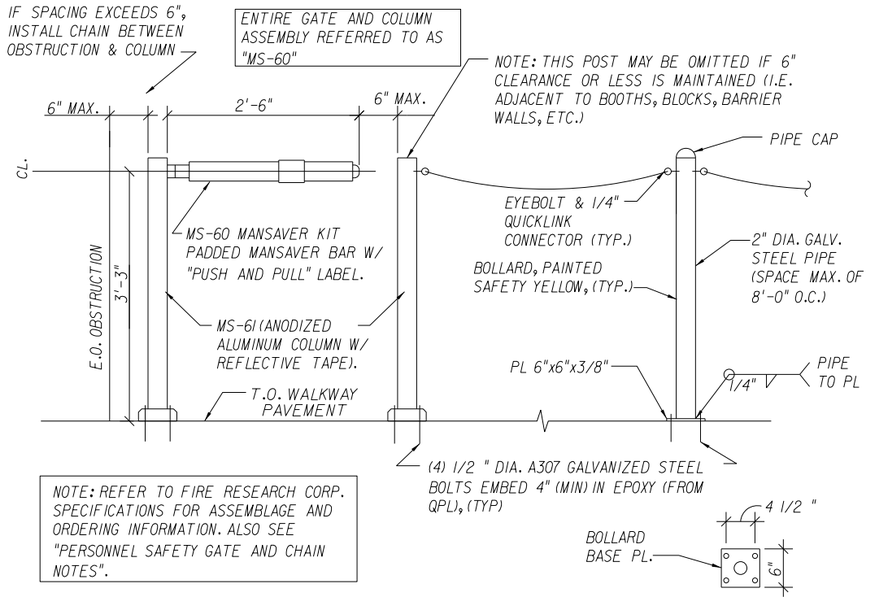
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

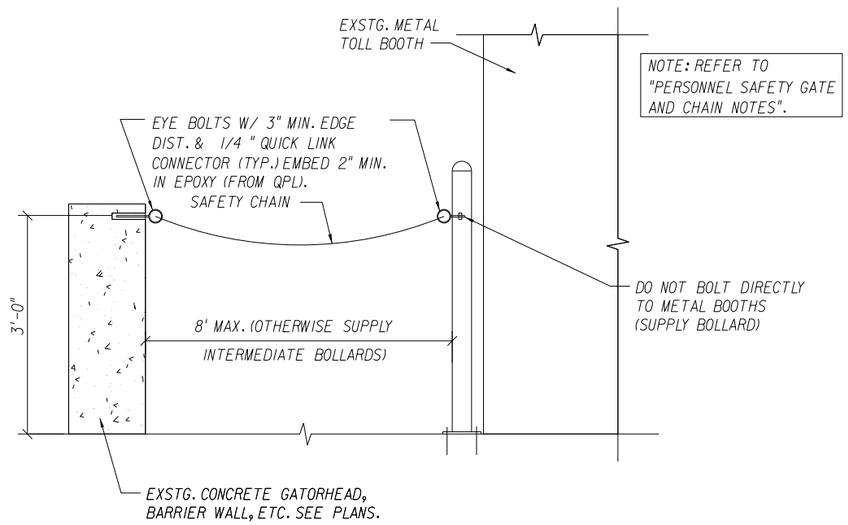
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

TOLL PLAZA SPECIAL DETAILS

SHEET NO. 107-4





1. PERSONNEL SAFETY GATES SHALL BE INSTALLED WHERE INDICATED ON PLANS. THESE GATES SHALL BE CONSTRUCTED WITH SAFETY BARS AS MANUFACTURED BY FIRE RESEARCH CO. (1-800-645-0074) OR EQUAL, AND SOLD UNDER THE BRAND NAME MANSAVER, MODEL MS-60. BARS SHALL BE PADDED WITH YELLOW VINYL COVERINGS AND SHALL BE THIRTY (30) INCHES IN LENGTH, INCLUDING THE DOUBLE ACTING HINGE. EACH GATE SHALL CONSIST OF ONE (1) ALUMINUM (6061-T6) MANSAVER BAR (MS-60 MANSAVER KIT) ATTACHED TO THE TOP OF AN EXTRUDED ALUMINUM (6065-T6) 3-INCH SQUARE CROSS SECTION ALUMINUM POST (MS-6I) WITH AN ALUMINUM CAST KNUCKLE WITH A BASE FOR ANCHORING TO THE WALKWAY AREA. BASE PLATE SHOULD BE ANCHORED TO CONCRETE W/ (4)- 1/2 " DIA. A307 GALVANIZED STEEL ANCHOR BOLTS, EMBED 4" IN EPOXY. AN ADDITIONAL DUPLICATE POST SHALL BE PROVIDED WITH EACH GATE TO MOUNT. SIMILARLY TO THE WALKWAY PAVEMENT AT THE UNCONNECTED OR FREE END OF THE MANSAVER BAR. THIS ADDITIONAL POST MAY OR MAY NOT BE REQUIRED TO BE INSTALLED BASED ON FIELD CONDITIONS. THE POST AND GATE ASSEMBLY (TOGETHER) ARE REFERRED TO AS THE "MANSAVER BAR AND UPRIGHT STANCHION KIT", MODEL MS-60.

2. AN EYE BOLT SHALL BE MOUNTED AT THE TOP OF EACH POST FOR CONTINUATION OF SAFETY CHAIN. CAPS SHALL BE PROVIDED IN THE TOP OF THE POSTS. POSTS SHALL BE INSTALLED LEVEL. THE CENTERLINE OF THE MANSAVER BAR SHALL BE THIRTY -NINE (39) INCHES ABOVE THE WALKWAY PAVEMENT. POST EYE BOLTS SHALL ALSO ACCOMMODATE THE THIRTY-SIX INCH (36") MOUNTING HEIGHT (ABOVE THE ISLAND) FOR SAFETY CHAIN.

3. CHAIN SHALL BE 4/0 STRAIGHT LINK COIL CHAIN POLY-COATED BLU-KROME MODEL NO. 14033-1117 AS MANUFACTURED BY COOPER (919-362-7541) OR EQUAL. THE CHAIN COLOR SHALL BE SAFETY YELLOW. THE CHAIN SHALL BE LOCATED ON THE ISLAND NO LESS THAN TWELVE (12) INCHES AND NO GREATER THAN EIGHTEEN (18) INCHES OFF THE EDGE OF THE ISLAND CURB ADJACENT TO THE LANE. THE CHAIN SHALL BE LOCATED APPROXIMATELY THIRTY-SIX (36) INCHES OFF THE SURFACE OF THE ISLAND, I.E., APPROXIMATELY FORTY-TWO (42) INCHES ABOVE THE LANE PAVEMENT. CHAIN SHALL BE ATTACHED TO THE BOLLARD EYE BOLTS AT BOTH ENDS WITH ONE-QUARTER (1/4) INCH QUICK LINK CONNECTORS, PART NO. 764-0536, AS MANUFACTURED BY COOPER, OR EQUAL. CHAIN SHALL BE INSTALLED SUCH THAT THERE IS MINIMAL CHAIN SAG ALLOWING REMOVAL OF THE CHAIN.

4. BOLLARDS: THE CONTRACTOR SHALL INSTALL THIRTY-SIX (36) INCH HIGH BOLLARDS OF TWO (2) INCH DIAMETER GALVANIZED STEEL PIPE AT SPACING NO GREATER THAN EIGHT (8) FEET APART. BOLLARDS SHALL BE CAPPED AND BE WELDED TO 6"x6"x3/8" BASE PLATE. BASE PLATE SHOULD BE BOLTED TO EXISTING CONCRETE SLAB W/ (4)- 1/2 " DIA. A307 GALVANIZED STEEL ANCHOR BOLTS, EMBED 4" IN EPOXY. PIPE SHALL BE PAINTED SAFETY YELLOW WITH A PAINT APPROPRIATE FOR APPLICATION TO GALVANIZED SURFACES. BOLLARDS SHALL BE ATTACHED PERMANENTLY TO THE ISLAND SURFACE AND SHALL NOT BE EASILY REMOVED WITHOUT POWER EQUIPMENT. USE OF EXISTING BOLLARDS IS ENCOURAGED BUT NOT AT THE EXPENSE OF DEVIATING FROM REQUIREMENTS HERE IN.

5. CHAIN ATTACHMENT: CHAIN AND QUICK LINKS SHALL BE CONNECTED TO BOLLARDS WITH EYE BOLTS. CHAIN SHALL NOT PASS THROUGH A RING ON THE BOLLARD BUT SHALL TERMINATE AT ONE, OR BOTH SIDES OF THE BOLLARD AS NECESSARY, WITH A QUICK LINK CONNECTOR. CHAIN MAY NOT BE ATTACHED TO AUTOMATIC COIN MACHINES, GATE HOUSINGS, ANY SUNPASS OR MISCELLANEOUS EQUIPMENT, OR PREFABRICATED TOLL BOOTHS.

6. SAFETY CHAIN CLEARANCES: TOLL EQUIPMENT (I.E. GATES, AUTOMATIC COIN MACHINES, SUNPASS EQUIPMENT, ETC.) OPERATION AND TECHNICIAN ACCESS SHALL NOT BE AFFECTED BY THE PLACEMENT OF CHAIN OR BOLLARDS. BOLLARD PLACEMENT SHALL BE NO FURTHER THAN NINE (9) INCHES AND NO CLOSER THAN SIX (6) INCHES FROM GATE HOUSINGS AND SHALL NOT CONFLICT WITH THE ENTRY AND EXIT OF PERSONNEL FROM TUNNEL STAIR WELLS. IF AUTOMATIC COIN MACHINES (ACMS) HAVE NOT BEEN REMOVED PRIOR TO SUNPASS CONVERSION, THE CONTRACTOR SHALL SUPPLY THE NECESSARY LENGTH OF CHAIN AND QUICK LINK CONNECTORS TO THE TURNPIKE TO CLOSE THE GAP WHERE THE ACM OR TOLL BOOTH ONCE OCCUPIED. IF ONLY AN ACM IS PRESENT ON THE ISLAND AND IT HAS NOT BEEN REMOVED PRIOR TO SUNPASS CONVERSION, THE CONTRACTOR SHALL INSTALL A POST ON THE ISLAND OR FLOOR PLATE ON EITHER SIDE OF THE ACM FOR CHAIN TERMINATION.

7. PERSONNEL SAFETY GATES: THE CONTRACTOR SHALL PROVIDE AND INSTALL PERSONNEL SAFETY GATES WHERE INDICATED ON PLANS. SAFETY BAR CENTERLINE HEIGHT SHALL BE THIRTY-NINE (39) INCHES ABOVE THE WALKWAY. THE SAFETY GATE SHALL ALWAYS BE ORIENTED SUCH THAT THE GATE HINGE IS LOCATED TO THE RIGHT SIDE ON APPROACH TO THE DEDICATED LANE (I.E., TO THE LEFT IF DEPARTING THE DEDICATED LANE.)

8. WALKWAY WIDTH AND CHANNELIZATION OF PERSONNEL: THE WALKWAY MAY BE GREATER WIDTH THAN THE WIDTH OF THE GATE, IN WHICH CASE THE CONTRACTOR SHALL "CHANNELIZE" ANY OPENINGS AROUND THE GATE BY CONNECTING ADDITIONAL CHAIN FROM THE SQUARE TUBULAR COLUMN BOLTED TO THE SAFETY BAR TO THE CLOSEST ALLOWABLE CONNECTION POINT, OR FROM THE SQUARE TUBULAR COLUMN LOCATED ADJACENT TO THE SWINGING GATE ARM AT THE CLOSEST ALLOWABLE CONNECTION POINT. THE DESIRABLE AND MAXIMUM WIDTH OF GAP BETWEEN THE SAFETY GATE ARM AND THE ADJACENT COLUMN IS SIX (6) INCHES. IN INSTANCES WHERE THE WALKWAY IS LESS THAN FOUR (4) FEET IN WIDTH, THE CONTRACTOR MAY RELOCATE THE SQUARE TUBULAR COLUMN WHICH IS NOT ATTACHED TO THE SAFETY BAR AND MOUNT IT ON THE ISLAND ADJACENT TO THE WALKWAY, OR ELIMINATE IT COMPLETELY IF THERE IS AN ADJACENT AND ALLOWABLE MOUNTING SURFACE WHICH DOES NOT ALLOW A GAP GREATER THAN SIX (6) INCHES IN WIDTH.

9. CHAIN AND GATE LAYOUT AND FIELD ISSUE RESOLUTION: THE CONTRACTOR SHALL USE GOOD JUDGMENT AND FOLLOW THE CRITERIA HEREIN AND AS INDICATED ON THE PLANS IN LAYOUT AND ATTACHMENT OF THE CHAIN AND PERSONNEL GATES WITHIN THE WALKWAYS. ANY QUESTIONABLE SITUATION WHICH REQUIRES CLARIFICATION IN THE FIELD SHALL BE BROUGHT TO THE ATTENTION OF THE DEPARTMENT'S FIELD REPRESENTATIVE AND TO THE ENGINEER.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

TOLL PLAZA SPECIAL DETAILS

SHEET NO. 107-5

SIGN NAME	TOL-1
QUANTITY	1
WIDTH	1'-6"
HEIGHT	1'-0"
BORDER WIDTH	0.5"
BORDER RADII	1.5"
PANEL COLOR	Fluorescent Yellow
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



SIGN NAME	
QUANTITY	
WIDTH	
HEIGHT	
BORDER WIDTH	
BORDER RADII	
PANEL COLOR	
LEGEND	
BORDER	

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH

COPY		S	T	A	Y		I	N		L											
SPACE	2.4	2.1	1.7	2	1.9	2.9	1	1.6	2.4	13.2												

COPY		V	E	H	I	C	L	E		L												
SPACE	2.4	2.3	2	2.3	1	2.1	2	1.5	2.4	13.2												

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

SIGN NAME	
QUANTITY	
WIDTH	
HEIGHT	
BORDER WIDTH	
BORDER RADII	
PANEL COLOR	
LEGEND	
BORDER	

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

SIGN NAME	TOL-2
QUANTITY	1
WIDTH	4'-0"
HEIGHT	0'-8"
BORDER WIDTH	0.5"
BORDER RADII	1"
PANEL COLOR	Red
LEGEND	White
BORDER	White

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



COPY		S	T	O	P		P	A	Y		T	O	L	L		L						
SPACE	5.2	2.9	2.7	3.2	2.2	4	2.9	2.7	2.5	3.9	2.7	3.2	2.7	2	5.2	37.6						

COPY																						
SPACE																						

COPY																						
SPACE																						

COPY																						
SPACE																						

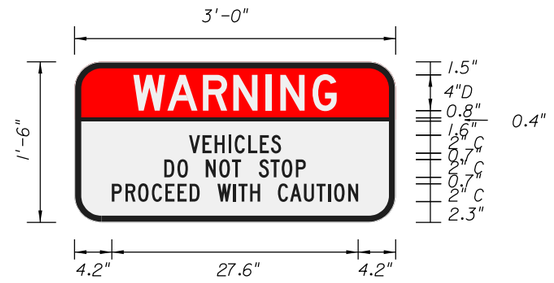
COPY																						
SPACE																						

COPY																						
SPACE																						

SIGN NAME	TOL-3
QUANTITY	1
WIDTH	3'-0"
HEIGHT	1'-6"
BORDER WIDTH	0.75"
BORDER RADII	3"
PANEL COLOR	Red/White
LEGEND	White/Black
BORDER	Black/Black

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH



COPY		W	A	R	N	I	N	G		L												
SPACE	6.6	3.8	4	3.4	3.7	1.6	3.6	2.7	6.6	22.8												

COPY		V	E	H	I	C	L	E	S		L											
SPACE	12.8	1.5	1.4	1.6	0.7	1.5	1.3	1.3	1.1	12.8	10.4											

COPY		D	O		N	O	T		S	T	O	P		L								
SPACE	10.1	1.5	1.2	2	1.5	1.4	1	2	1.3	1.3	1.6	1.1	10	15.9								

COPY		P	R	O	C	E	E	D		W	I	T	H		C	A	U	T	I	O	N		L
SPACE	4.2	1.5	1.4	1.5	1.5	1.4	1.4	1.1	2	1.8	0.6	1.3	1.1	1.9	1.4	1.6	1.4	1.3	0.7	1.6	1.1	4.2	27.6

COPY																						
SPACE																						

COPY																						
SPACE																						

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

PLAZA AREA SIGNING DETAILS SIGN PANELS

SHEET NO.
107-6

$USER$ $DATE$ $TIME$ $FILE$

SIGN NAME	TOL-4
QUANTITY	1
WIDTH	4'-6"
HEIGHT	0'-8"
BORDER WIDTH	0.5"
BORDER RADII	1"
PANEL COLOR	Fluorescent Yellow
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT

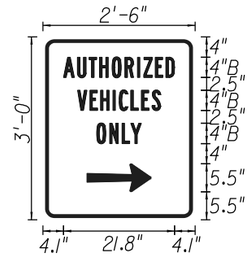
SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



SIGN NAME	TOL-8
QUANTITY	1
WIDTH	2'-6"
HEIGHT	3'-0"
BORDER WIDTH	0.75" INSET: 0.5"
BORDER RADII	1.875"
PANEL COLOR	White
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT
ARLONG	0	8.7	5.5	12.6	5.5

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH



1. TO BE LOCATED AT MAINTENANCE PULL-OFF AREAS
2. SEE CURRENT GTR FOR MOUNTING CRITERIA

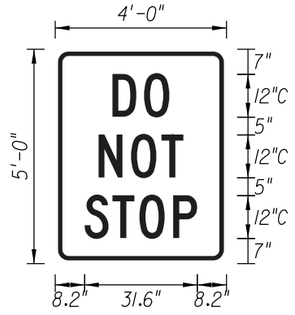
COPY		W	A	T	C	H		F	O	R		P	E	D	E	S	T	R	I	A	N	S	
SPACE	2.4	2.7	2.3	2.1	2.3	1.7	4	2.1	2.6	1.7	4	2.4	2.1	2.4	2.1	2.3	2.1	2.4	1.1	2.7	2.4	1.7	2.4
COPY	L																						
SPACE	49.2																						
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

COPY		A	U	T	H	O	R	I	Z	E	D		L										
SPACE	4.1	2.7	2.3	2.1	2.4	2.6	2.4	1.2	2.3	2.1	1.7	4.1	21.8										
COPY		V	E	H	I	C	L	E	S		L												
SPACE	6.8	2.4	2.1	2.4	1.2	2.3	2.1	2.1	1.7	6.9	16.3												
COPY		O	N	L	Y		L																
SPACE	10.6	2.6	2.4	1.7	2.1	10.6	8.8																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	TOL-7
QUANTITY	1
WIDTH	4'-0"
HEIGHT	5'-0"
BORDER WIDTH	1.25"
BORDER RADII	3" INSET: 0.75"
PANEL COLOR	White
LEGEND	Black
BORDER	Black

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE STEEL		AVERAGE LENGTH



1. FOR RAMP AND MAINLINE USE
2. SEE CURRENT GTR FOR MOUNTING CRITERIA

COPY		D	O		L																		
SPACE	16	8.9	7.1	16	16																		
COPY		N	O	T		L																	
SPACE	12.2	9.1	8.5	6.1	12.1	23.7																	
COPY		S	T	O	P		L																
SPACE	8.2	7.8	7.6	9.5	6.7	8.2	31.6																
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

SIGN NAME	
QUANTITY	
WIDTH	
HEIGHT	
BORDER WIDTH	
BORDER RADII	
PANEL COLOR	
LEGEND	
BORDER	

SYMBOL(S)	ANGLE	X	Y	WID	HT

SIGN NUMBER	CLEARANCE EDGE OF LANE	COLUMN SIZE		AVERAGE LENGTH

Sign Names TOL-5 and TOL-6 are reserved for future use.

COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							
COPY																							
SPACE																							

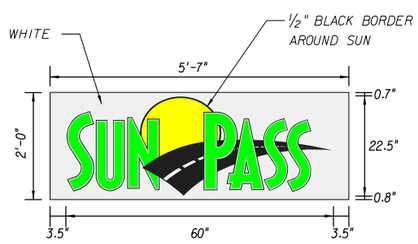
REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

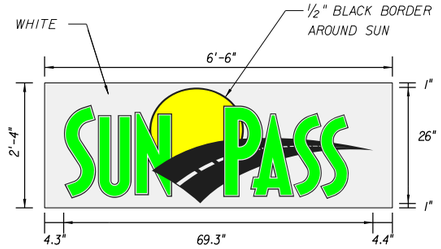
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

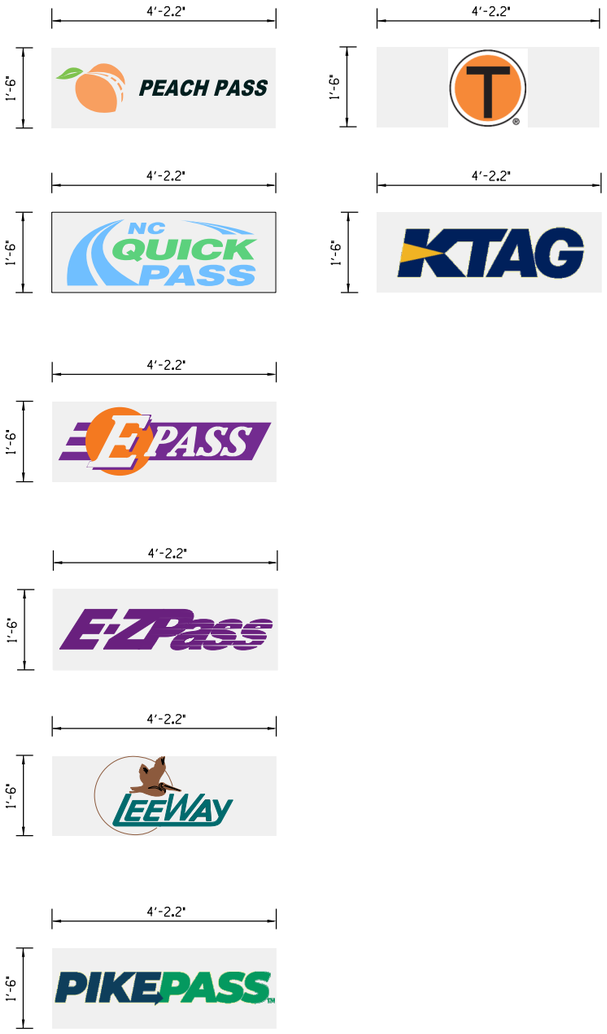
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

PLAZA & GANTRY AREA SIGNING DETAILS SIGN PANELS

SHEET NO. 107-7

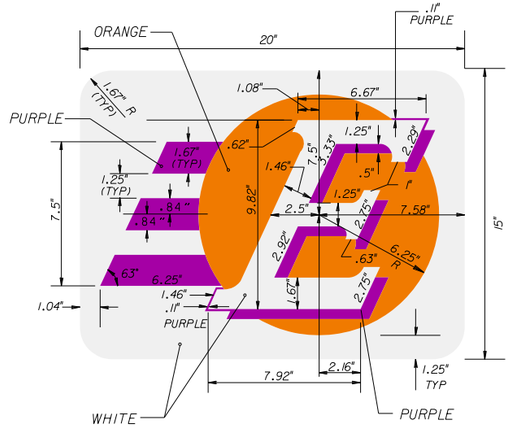


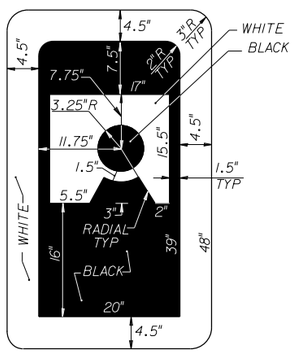




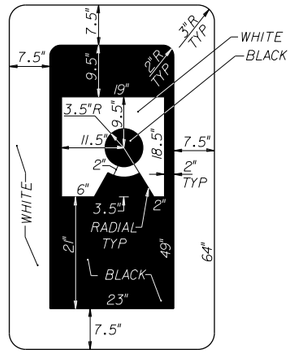
GENERAL NOTES FOR SUNPASS SHIELD ON MIXED-USE LANES

1. THE DEPARTMENT WILL PROVIDE THE LOGO IN MICROSTATION FORMAT FOR USE IN SIGN FABRICATION. SEE FDOT HIGHWAY SIGN LIBRARY.
2. THE LOGO SHALL NOT BE FABRICATED BY HAND CUT OUT METHOD.
3. ALL SIGN COLORS SHALL BE STANDARD HIGHWAY COLORS AS SPECIFIED IN THE MUTCD.





TOLL ATTENDANT SHIELD
FOR CANOPY MOUNTED SIGNS
29" X 48"



TOLL ATTENDANT SHIELD
FOR APPROACH SIGNS
38" X 64"

GENERAL NOTES FOR EPASS SHIELD:

1. EPASS LOGO COLORS:

   WHITE
   PURPLE, 3M VIOLET NO. 893 OR APPROVED EQUAL.
   ORANGE, 3M ORANGE NO. 886 OR APPROVED EQUAL.

2. NARROW PORTIONS OF SPECIAL DESIGN COPY IN EPASS LOGO SHALL HAVE MINIMUM THICKNES OF 1.00 INCH.
3. ALL DIMENSIONS ARE IN INCHES.
4. THIS SHIELD SHALL BE ATTACHED BY RIVETING METHOD ONLY. NO ADHESIVES OR OTHER MEANS ARE ALLOWED.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

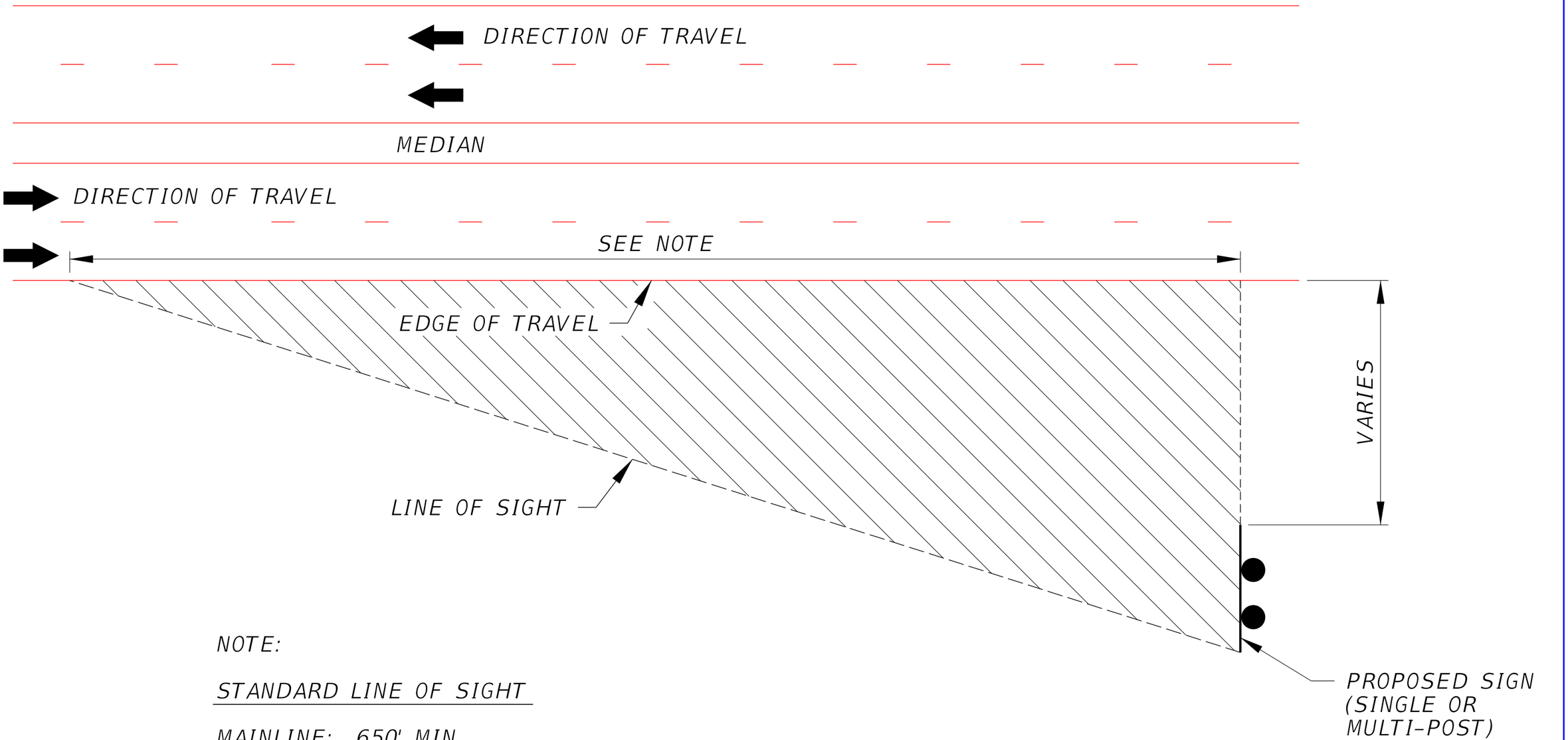
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

SPECIAL SIGN DETAILS

SHEET NO.
108-3

$USER$ $DATE$ $TIME$ $FILE$



NOTE:

STANDARD LINE OF SIGHT

MAINLINE:	650' MIN.
RAMP:	500' MIN.
PLAZA:	200' MIN.

INDICATES LIMITS OF VEGETATION REMOVAL OR TRIMMING

N.T.S.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
		- - -

MISCELLANEOUS DETAILS
SIGN PLACEMENT

SHEET NO. 109-1