

# Turnpike Lighting & Electrical Design Guidance

## Electrical Systems

### Electrical Design:

- The design of all electrical systems (Lighting, Traffic Signals, ITS, etc.) must comply with **FAC 61G15-33, Responsibility Rules of Professional Engineers Concerning the Design of Electrical Systems**. These responsibilities are applicable to all new projects and any major modifications or renovations.
- Elements to be analyzed include, but are not limited to:
  - Voltage drop calculations
  - Load analysis and calculations
  - Arc flash hazard analysis
  - Short circuit analysis
  - Device coordination
- All electrical systems design elements must be prepared, reviewed, signed, and sealed by a Professional Engineer licensed in the State of Florida. The Professional Engineer must be competent in electrical engineering through training and/or experience. The design analyses must be submitted with each phase submittal as part of the *Lighting Design Analysis Report (LDAR)* for lighting improvements and the *Power Design Analysis Report (PDAR)* for ITS improvements.
- Complete all electrical system design analysis using accepted industry power system analysis software (i.e., ETAP, SKM, etc.). If calculations by hand are used, engineering judgment, assumptions, and methods must be clearly explained in the report. Include in the report all supplemental information used or referenced in the power design analysis.

### Load Analysis:

- Submit a complete load analysis, including, but not limited to the calculation of cabinet loads, circuit loads, and total loads for each service to determine and evaluate the appropriate capacity and rating for all components of the electrical system.
- For any major modifications or renovations, calculations should include the existing load (prior to modification), the load being removed, the load being added, and the new total load. Provide a load analysis any time an electrical load is added to existing infrastructure. Field verify all existing loads by metering or calculate based on existing conditions.
- Provide new service points and load centers with a minimum of 20 percent spare capacity.
- Provide the manufacturer's product data cut sheets containing equipment power requirements in the report. Also provide in the report: generator sizing calculations, UPS sizing calculations, and any other calculations affected by power loads for the project.

### **Arc Flash Hazard Analysis:**

- Provide an arc flash hazard analysis for new electrical distribution equipment (panelboards, transformers, load centers, disconnects, etc.), per the latest version of ***NFPA 70E, Standard for Electrical Safety in the Workplace (Current Edition)***.
- Conduct an arc flash hazard analysis to determine the arc flash protection boundary and the personal protective equipment (PPE) that personnel within the arc flash boundary must use.
- Update the arc flash hazard analysis when a major modification or renovation takes place.
- Instruct the contractor to field install arc flash and shock warning labels on each piece of new/modified electrical distribution equipment as needed. The labels must indicate:
  - Flash hazard boundary
  - Flash hazard at 18 inches
  - PPE level requirements
  - Approach restrictions.
- Provide as part of the report and in the plans all labels proposed for use on electrical equipment. Information table can be provided to show information for each piece of equipment to be labeled and a typical label, in lieu of showing labels individually.

### **Short Circuit Analysis and Device Coordination:**

- Conduct a short circuit analysis to determine the maximum fault current on each piece of new electrical distribution equipment and the proper fault current interrupting capacity.
- Provide documentation from the utility power service provider on the maximum available fault current at the utility service transformer and utilize this value in the short circuit analysis.
- Software programs or hand methods used must be capable of calculating the maximum short circuits at all electrical equipment locations to ensure equipment ratings are adequate.
- Update the short circuit analysis when a major modification or renovation takes place or if an electrical load is added to existing infrastructure.
- Provide the AIC ratings for all equipment as part of the contract documents to meet or exceed the short circuit analysis results.
- Design electrical distribution equipment as fully rated and selectively coordinated systems. The protective features of the electrical distribution system should automatically and selectively isolate a faulted or overloaded circuit from the remainder of the electrical system. Only the closest protective device to the fault should operate to isolate the fault without affecting other parts of the system.