Chapter 2

Design Geometrics and Criteria

The following are changes, additions or deletions to the January 2003, Topic #625-000-007, Plans Preparation Manual (PPM) - English, for use on Turnpike projects only.

2.1.5 Cross Slopes

Replace first sentence

First sentence should read: "For roadways, the maximum number of through travel lanes with cross slope in one direction is three (3)."

Add the following paragraphs

For new or replacement bridges on six-lane roadways, or roads that have the potential to be widened to six or more lanes, the cross slope of the bridge should be design at 0.03 if possible.

Median through-lane widening, turn lanes, tapered or parallel single lane ramps adjacent to two through-lanes do not automatically warrant a 3% cross slope. Surface drainage will be reviewed and used as the deciding factor. New two lane ramps, however, will be designed with 3% for both lanes through the gore area. Figure 2.1.1 will have "... for the basic through lanes" added to the title.

2.1.6 Pavement Thickness Transition Guidelines

Add the following paragraphs

At bridge and ramp toll plaza approaches, for a 150 foot length before and after the concrete slab, the ultimate pavement design asphalt thickness shall be placed flush with the concrete at the ultimate profile grade. The initial pavement section shall transition to the ultimate thickness at a rate of 0.08%, 1 inch/100 feet.

The ultimate thickness is not needed at mainline plazas as the full initial mainline pavement thickness is used up to the plazas and not reduced by a lower lane factor.

2.3 Shoulders

Add the following paragraph

Where single lane ramps meet cross roads, additional ramp lanes are usually added for accel/decel or right or left turns. Unless these additional lanes are more than 500 feet long measured along the ramp baseline, single lane 6 feet ramp shoulders should be used throughout. A similar 500 feet length would apply to ramp plaza approaches and departures. Frequent short changes in ramp width should not warrant corresponding short changes in ramp shoulder width. The shoulder transitions may be longer than the multi-lane ramp segment.

2.3.1 Limits of Friction Course on Shoulders *Add as paragraph 3*

Median shoulders which slope to the outside (usually with median barrier wall) will be flush with the adjacent travel way friction course to avoid trapping water on the shoulder.

2.3.2 Shoulder Warning Devices (Rumble Strips) *Add as paragraph 5*

The minimum thickness of structural asphalt on shoulders where ground-in rumbles strips are to be used is 1.5 inches.

2.8 Curves

2.8.2 Vertical Curves *Add as paragraphs 2 thru 4*

The minimum vertical curve lengths and minimum K values listed in the notes in PPM Tables 2.8.5 and 2.8.6 require some clarifications and restrictions.

Service Interchanges: Per AASHTO, it is intended that a "platform" about 200 feet in length be provided on the ramp in advance of the gore using the Freeway K values.

System Interchanges: K values for the higher system ramp design speeds should be used except for the "platform" area.

2.8.3 Spiral Curves *Add the following section*

Spiral transition curves may be considered for Turnpike projects where the simple curve radii is less than 3820 feet.

2.15 Lighting Criteria *Add the following paragraphs*

Projects with conventional lighting along the roadside shall be designed for an average initial illumination of 1.7 to 1.8 foot candles. For Toll Plaza approaches an average initial illumination of 2 foot candles shall be used with uniformity ratios the same as Parking Areas.

Projects with high mast lighting shall be designed for an average initial illumination of 1.0-foot candle, both with a maximum-to-minimum uniformity ratio of approximately 9.2:1. Table 2.15.4 Rest area lighting

Lighting Criteria for Service Plaza’s should follow Table 2.15.4. This includes the ramps to and from the Service Plaza’s. See the latest Guide Drawings for details.

2.17 Toll Plazas *Add entire section*

2.17.1 Horizontal Taper Rates

The desirable Horizontal Taper Rates at plazas are as follows:

Mainline Plazas -	Up to 8 total lanes	25:1
	10 to 14 total lanes	20:1
	16 plus total lanes	15:1
Ramp Plazas -	All types	20:1

Note: Tapers adjacent to dedicated or future dedicated SunPass lanes are to be designed for the highest anticipated travel speed.

There will need to be a parallel roadway lane section to accommodate storage queues on the approach side of the toll plazas after the approach flare.

2.17.2 Cross Slopes and Transitions

The normal cross slope for the concrete slab around all plazas is 0%. This serves as a standard datum for vertical clearance, which is constant to the canopy, canopy signs, toll booth slab, coin basket, tunnel, etc. The approach crowned roadway will need to be warped up and widened to meet the plaza slab. The grading for the plaza approaches and departures will be designed for the maximum number of lanes foreseeable with only the lateral limits reduced for the initial construction.

2.17.3 Profile Grades

For ramp plazas the approach grade shall be +1.00% with +0.50% minimum. Departure grades shall be -0.50% minimum and -1.00% desirable. It is desired that plazas be on a crest to keep water from sheet flowing through the plazas, however, straight through grades are commonly used where right of way, profile grade and earthwork act as constraints. For a straight grade through a small plaza, a 0.50% minimum or a 1.50% maximum grade may be used.

Mainline plazas have been built on flat grades, but it is desirable to have at least +0.50% approach and -0.50% departure grades.

Higher speed AVI (Automatic Vehicle Identification) or SunPass lanes may need vertical curves or staggered grade breaks so as not to exceed the "Maximum Change in Grade Without Vertical Curves" shown in the PPM Table, 2.6.2.

When setting the PGL elevation within 300 feet of a mainline toll plaza, the Designer must consider the 3 feet roadway base clearance above SHW (seasonal high water), the finished floor elevation at 1 foot (0.3 m) above the 100 year storm, the wide pavement cross slope, the plaza

perimeter drainage ditches, and the possible expansion of the plaza in the future. As the SHW in Florida may be within 1 foot of natural ground, it is not unusual for the PGL at the plaza to be 5 or 6 feet (1.5 to 1.8 m) above natural ground.

An important location to check for roadway base vertical clearance to SHW is near the midway point on the plaza approach or departure taper. A uniform rise of cross slope from –2.00% to 0.00% times the increasing pavement width would yield calculated EOP (edge of pavement) elevations that would plot as a "sag" curve. To avoid this, a non-uniform cross slope transition rate or a "spline" can be used between a "straight" PGL and a straight, preset, ultimate EOP profile.

2.17.4 Toll Plaza Clear Zones/Horizontal Clearance

Clear zones are a function of design speed that would range from 70 mph (110 kph) to zero. In general, clear zones would be reduced from the basic mainline width up to the approach flare, to a decreasing ramp/auxiliary lane clear zone width in the flare, to a 4 foot clear zone for curb or a 10 foot clear zone for shoulder border where the outside EOP parallels the centerline. This "Use Good Engineering Judgment" approach is also relevant for ramp terminals near cross roads.

The current design practice for toll plazas include the design of toll island attenuators for the full design speed of the approach roadway. However, the Administration Building and other amenities are placed within 10 to 25 feet from the edge of pavement, with no barrier to shield the hazard. This is a design inconsistency. The developed clear zone criteria for the generic toll plaza designs are based on Turnpike site-adapt experience as well as AASHTO and FDOT Criteria on general highway safety. This criteria sets minimum values for clear zones. The purpose of this criteria is to provide a consistent and rational design for toll plaza design. These values are reduced by 10 to 25 feet for ramps and auxiliary lanes so that the clear zone is offset by a near constant offset from the through-lanes. This method of clear zone development is applied to toll plazas and approaches.

Toll plaza approaches (the tapered area between the theoretical through or travel lanes and the edge of pavement) are considered as auxiliary lanes. Furthermore, because of the prolonged length of these tapers for mainline plazas (either one-or two- way), these approaches are considered as ramps with a design speed midway between a stop condition and the design speed of the approach roadway. The rational for application of a lower design speed to the tapered approach assumes that vehicles traveling along the edge of pavement must have made a conscious controlled action to take this path and begin deceleration similar to an exit ramp. The similarities in the development of the clear zone between an exit ramp and a toll plaza are shown in **Figures 2-1** and **Figures 2-2**. At any plaza, a low speed clear zone similar to a low speed collector can be applied for decelerating vehicles depending on the border treatment. This “A” distance as shown on Fig. 2, should be either 5.5 feet from edge of pavement for curb and gutter borders or 10 feet for shoulder borders. Thus the clear zone at any point in a toll plaza or approaches can be defined as the widest offset, either “X” as measured from the projected through lanes; “Z” as measured from the toll plaza tapers; or “A” as measured from the edge of toll plaza.

It should be noted that if the "X" distance is beyond the edge of the toll plaza for a design speed of greater than 45 mph, curb and gutter should not be used as a border treatment.

This tiered classification should only be applied to tolled lanes. Mainline lanes near ramp plazas, AVI express lanes, or untolled lanes at one-way plazas, such as Alligator Alley should continue to maintain standard roadway clear zones or appropriate site barriers. The one apparent inconsistency in this development of safety criteria is the length of great attenuators at the toll islands.

Current practice includes the design of all attenuators for the full design speed of the approach roadway. Safety at the plaza is of utmost importance; therefore, "USE GOOD ENGINEERING JUDGEMENT" and design consistency. See Design Guide Line. Design decisions regarding this issue shall be included in the design documentation file. This practice is consistent with the use of a wider clear zone for the projected through-lanes.

DESIGN GUIDE LINE

Approach Roadway	Design Speed	Bays*
Main Line Plazas	All	9
Ramp Plaza Curved Approach	25-40, Including Sunpass	2
Ramp Plaza from Main Line	50, Including Sunpass	4
Ramp Plaza from Cross Road	25-40	2

*** Quadguard Attenuators Only**

Clear Zone Development

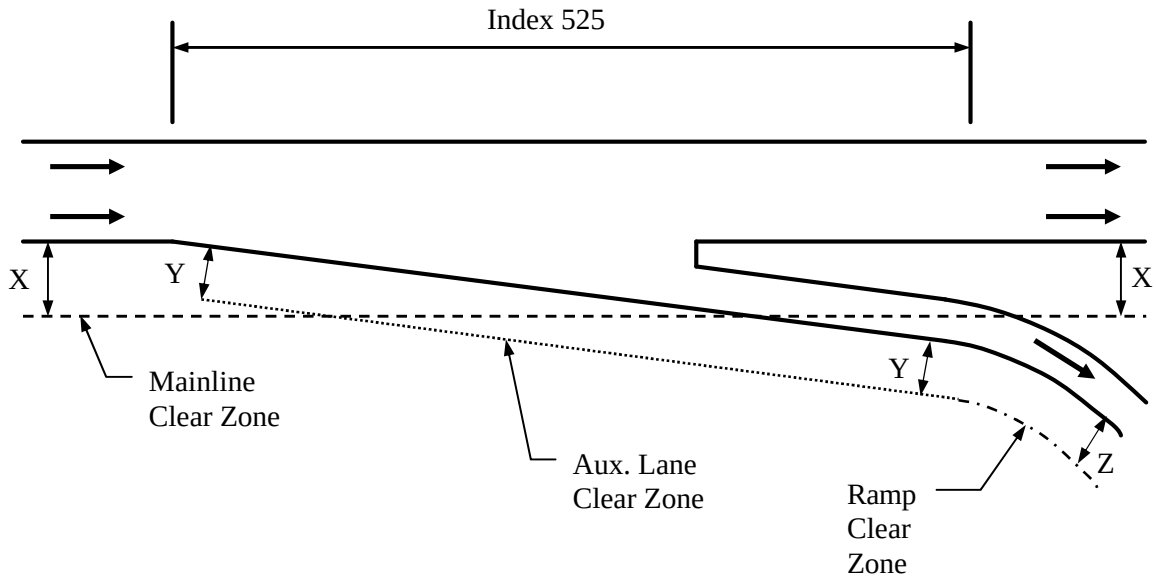


Figure 2-1
Clear Zones At An Exit Ramp

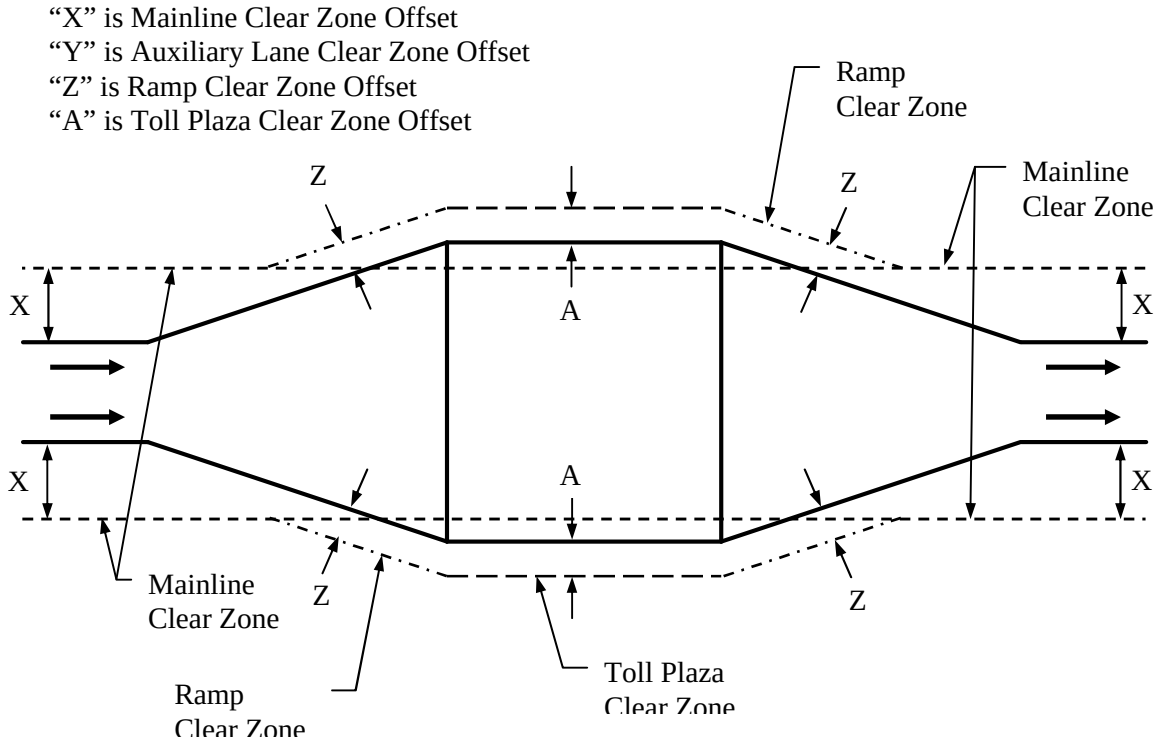


Figure 2-2
Clear Zone Development For A Mainline Toll

2.17.5 Queue Storage Criteria

The standard vehicle length used for queue storage analysis at toll plazas is 25 feet, which has a safety factor of 1.5. The maximum length of queue in a toll lane is 12 vehicles (300 feet) for mainline plazas and 6 vehicles (150 feet) for ramp plazas.

For ramp plaza booths, the minimum distance from the crossroad is 300 feet. However, where the same ramp plaza building takes tolls for both On-ramp movements or On and Off-ramp movements (such as at a "Par-Clo" or a "Trumpet"), the minimum distance will be increased to 500 feet. The distance is increased to provide additional vehicular weaving and storage space. When setting this distance, the possibility of future booth and cross road lane additions and their R/W impacts, a weave analysis, and toll-processing rates shall be considered. A weave analysis is not only important where multiple traffic directions are being accommodated, but also when designated AVI lanes are included.

2.18 Sodding

Add the following paragraphs

SHOULDER SODDING AND REWORKING ON EXISTING FACILITIES

FDOT Design Standards Index 105 is generally applicable to all resurfacing projects and similar projects involving shoulder grassing. Three shoulder treatment methods (R1, R2, and R3) are described in the Index 105. The following explains the specific circumstances that govern which shoulder treatment operation is appropriate for a project.

SODDING

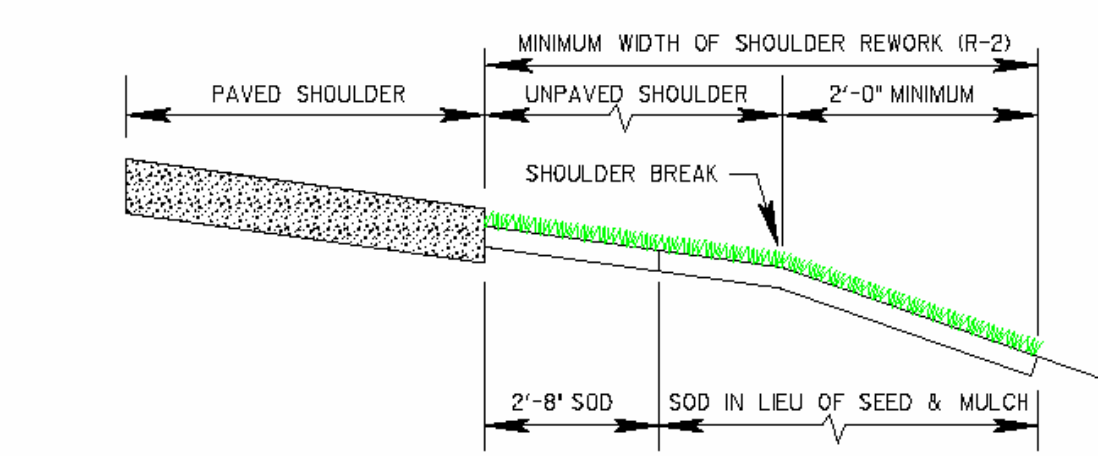
Methods (R1 and R3) relate only to sodding operations and require good existing soil and turf conditions. Under these circumstances, excess excavation material is to be used in filling voids and low areas at the edge of pavement or uniformly distributed over shoulder. **Payment for excavation of turf and the satisfactory disposal of excavated material is included in the contract unit price for Sodding (SY).**

RE-WORK SHOULDERS

Where shoulder deterioration from poor soil and/or turf conditions is encountered, the R2 method of shoulder treatment should be considered. Since Turnpike resurfacing projects normally include milling the shoulder, the re-work method would be generally applicable. The need for re-working shoulders and the limits of the rework should be coordinated with the appropriate Turnpike Area Maintenance representative. Using the re-work method, the shoulder is mixed and grassed for a minimum width equal to the unpaved shoulder width plus 2 feet beyond the shoulder point. **Payment for Re-work Shoulder (SY) includes both the unpaved shoulder width and the 2-foot width beyond the shoulder break point. The sod, water and fertilizer required to cover the entire shoulder re-work area are paid for separately.**

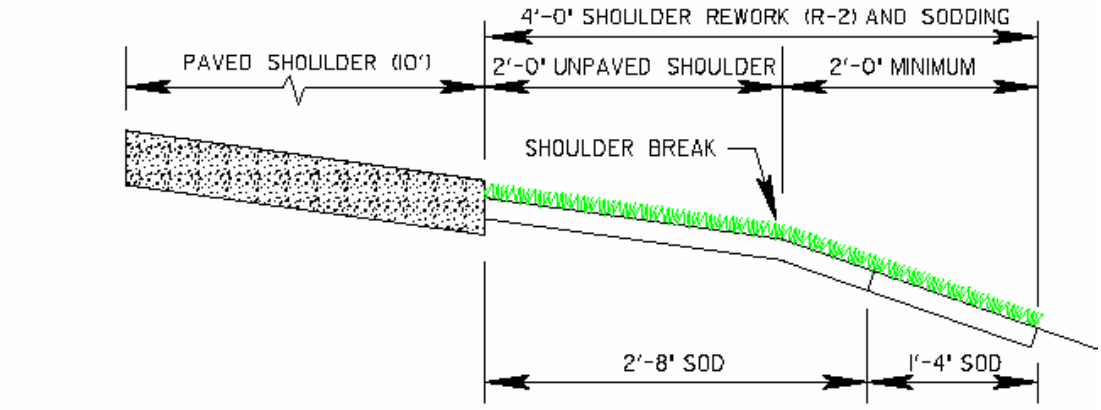
FIGURE 2-3

SHOULDER SODDING AND REWORKING OF EXISTING FACILITIES



Paved Shoulder Width Less Than 10 Feet

R-1	NO SHOULDER REWORK ITEM. *FOR BROWARD CO. ADD PAY ITEM NOTE 575-1-xxa.	1'-4" SOD**	1'-4" SOD TIE-IN**	N/A
R-2	QUANTIFY BOTH THE SOD FOR THE 2'-8" STRIP ALONG THE EDGE OF PAVEMENT AND THE SHOULDER REWORK SOD. SHOW EACH SOD QUANTITY SUBTOTAL AND THEN COMBINE TO SHOW TOTAL QUANTITY.	SODDING*** AND SHOULDER REWORK****		
R-3	NO SHOULDER REWORK ITEM. *FOR BROWARD CO. ADD PAY ITEM NOTE 575-1-xxa.	1'-4" SOD**	1'-4" SOD TIE-IN**	N/A



Standard Mainline Shoulder 12 Feet Wide (10 Feet Paved)

***** In Broward County the excess material displaced by the sodding or re-working shoulder operations shall be hauled off the project. Add the following pay item note to the plans:

PAY ITEM 575-1-xxa The excess material displaced due to excavating for sod placement is to be hauled off of the project and disposed of by the contractor. The costs for hauling and disposal of the excess material is to be included in the costs of the sod.

** Payment for excavation of turf and topsoil for backfill of this material, under R-1 and R-2, is to be included in the contract unit price for sodding (SY).

*** The additional excavated material due to specifying sod in lieu of seed and mulch is included in the contract unit price for sodding (SY).

**** The limits of shoulder re-work are to be specified on the typical section in the contract plan set.