Index 536-001 Guardrail

Design Criteria

FDOT Design Manual (FDM), *215;* ***AASHTO Roadside Design Guide****,* 4th Edition; ***NCHRP Report 350***, Test Level 3 Criteria; ***AASHTO Manual for Assessing Safety Hardware (MASH)****,* Test Levels 2 & 3 Criteria; ***Task Force 13, Guide to Standardized Roadside Hardware***

Design Assumptions and Limitations

For guardrail requirements, including hazard setbacks, crash test level classification, and placement in relation to curb, shoulder gutter, and the Edge of Traveled Way, see ***FDM 215.4***.

For guardrail requirements regarding Box Culverts, also see ***FDM 215.4****.*

A. General:

Index 536-001 defines guardrail segments including General Guardrail, Low-Speed Guardrail, End Treatments, and Approach Transition Connections to Rigid Barrier that will be used together to design a complete guardrail configuration on a project-specific basis.

The design of guardrail requires that certain segments and features be shown and labeled correctly in the plans, where the requirements of the Index are not violated including section geometry, adjacent pavement, and grading.

For guardrail connections to Rigid Barrier, ***Index 536-001*** applies only to newly constructed bridge Traffic Railings and Concrete Barriers or where the complete Approach Transition Connection to Rigid Barrier details shown in this Index can be installed without conflicting with existing Traffic Railings, structures, or bridge approach slabs.

For guardrail systems connecting to existing bridge Traffic Railings that conflict with ***Index 536-001*** details, use the details, layouts, and length table methodology shown in ***Indexes 536-002***, ***521-404***, and ***521-405***.

B. Shielding Hazards – Determining Length of Need and Begin/End Guardrail Stations:

The standard method of determining guardrail placement for shielding hazards is based on the Runout Length and the Length of Need calculation in the ***AASHTO Roadside Design Guide (RDG)***, 4th Edition.

See the FDOT 'Guardrail Length of Need (LON)' program (Excel spreadsheet) for additional information and assistance with determining Begin/End Guardrail Stations for shielding various hazard configurations. The program is located in the Design Tools column of the Standard Plans website.

See ***FDM 215*** for the Clear Zone concept, hazard definitions, and warrants for roadside barrier usage.

The back of single-faced guardrail, including posts and other hardware exposed to traffic, requires shielding if located within the Clear Zone. Additionally, Trailing Anchorages require shielding if located on the approach end of guardrail and within the Clear Zone. For example guardrail configurations for shielding hazards, including ends of rigid barriers, see ***Index 536-001*** layouts and Examples 1 & 2 below.

C. End Treatments:

An End Treatment segment is required for all exposed guardrail ends where the guardrail does not smoothly connect into another barrier type. End Treatments are divided into three types:

1. Trailing Anchorages: Place a Trailing Anchorage on the downstream ends of all guardrail runs with respect to the nearest traffic lane, except where the location is within the approach Clear Zone of an opposing traffic lane. Locate the end post of the Trailing Anchorage at least 25 feet downstream of any hazards being shielded. Trailing anchorages may be used with both flush shoulders and raised curb conditions

2. Approach Terminals: Place an Approach Terminal on the approach ends of guardrail runs for locations within the Clear Zone of an adjacent traffic lane.

   Place Approach Terminals straight and parallel to the adjacent traffic lane, as shown in the Index. When placing guardrail within tight radial roadway segments, such as freeway entrance or exit ramps, locate Approach Terminals outside of the radial segment (i.e., extend guardrail length to allow for a tangent section of guardrail).

a. Terminal Types: Approach Terminals are defined in the Index and classified as Parallel and Double Faced.

   i. Parallel Approach Terminals (TL-2 or TL-3): Use for basic single-faced guardrail applications, including both flush shoulder and curbed conditions as shown in the Index.
   NOTE: TL-2 Approach Terminals may be used for curbed conditions per the Index (connected to a TL-3 guardrail run).

   ii. Double Faced Approach Terminals (TL-3 Only): Use with Double Faced Guardrail segments, typically for median applications.

b. Length of End Treatment, 'LE': Predefined Approach Terminal lengths for corresponding crash Test Levels are defined in the Index and should be used in the Plans where possible. This allows for universal planning that is compatible for all Approach Terminal products listed on the APL.

c. Length of End Treatment, Custom Design Lengths: Where longitudinal space for Approach Terminals is limited, the designer may stipulate a location-specific 'Design Length' as shown on the manufacturer's APL drawings. The 'Design Length' is the shortest length of Approach Terminal required to function correctly as a crashworthy End Treatment, and it mostly consists of the proprietary segment of the Approach Terminal. When using the location-specific 'Design Length' method, the designer is responsible for ensuring the

planned length accommodates the 'Design Length' as well as the midspan panel splice connection to the adjoining guardrail segment.

In the roadway plan view, specify the 'Design Length' required within the Approach Terminal callout as well as make a reference to the Summary of Guardrail Table note (e.g. "Design Length ≤ 25 Ft., See Summary of Guardrail note"). In the Summary of Guardrail note, explain the Design Length requirement per manufacturer's APL Drawing (e.g. "Device requires a Design Length ≤ 25 Ft. per the manufacturer's APL Drawing").

d. Grading and Clear Area: Provide for the extended grading and front slope break locations shown per ***Index 536-001***. All areas defined by the Index as having a 1:10 maximum slope must have no aboveground obstructions.

e. Gating and Non-Gating: By default, design Approach Terminals using a gating (break-away) design. A gating design assumes redirective capability and Length of Need begin at the third post from the end (Post 3). Only where constrained conditions prevent sufficient upstream extension, design Approach Terminals with a non-gating terminal. Non-gating terminals provide redirective capability and Length of Needs beginning at the end post (Post 1). When using a non-gating Approach Terminal, include the “non-gating” designation in the plan view callout and Summary of Guardrail Table comments.

NOTE: Prior to using a non-gating terminal, verify availability of applicable options on the APL (MASH generally required).

3. Crash Cushions (C.C.): Where applicable, use a Crash Cushion on the approach ends of guardrail as a substitute for Approach Terminals. Crash Cushion usage should be considered for locations with an expected high frequency of severe impacts, such as within the gore area of a high speed facility. Additionally, some Crash Cushions may provide reduced barrier system length and maintenance cost advantages. See Index 544-001 for additional Crash Cushion information.

Per the Basis of Estimates, a separate Pay Item is required for all End Treatments.

D. Approach Transition Connection to Rigid Barrier (Apprh. Trans.):

Approach Transition Connection segments are used for connecting guardrail to the approach end of Rigid Barriers, including both Concrete Barrier and Traffic Railings. See the Index for design options including requirements for alignment, grading, and the Length of Approach Transition, 'LA', as required per the crash Test Level selected.

The minimum length for a complete guardrail system for shielding a Rigid Barrier approach end is tabulated as 7¼" plus 'LA' plus 'LE' (See Example 2 and ***Index 536-001***). To further minimize length, 'LA' may be replaced as described in Paragraph C.2.c above (only where needed). Where constrained conditions will not fit a complete guardrail system, consider the shorter Crash Cushion options per Index 544-001.

When connected to Rigid Barrier, guardrail systems with a total length greater than 150 feet will generally require a lateral taper to the corresponding ***FDM*** offset. See Index ***536-001*** for the permitted guardrail taper locations.
NOTE: The Approach Transition Connection to Rigid Barrier must remain parallel to the traffic lane prior to permitted taper location.

When connected to Rigid Barrier, guardrail systems with a total length of 150 feet or less do not require a lateral taper to the ***FDM*** offset and may run parallel to the Rigid Barrier's shoulder line.

The small lateral offset difference between Rigid Barrier Shoulder Line (at the toe) and the Face of Guardrail at their connecting point may be considered negligible and ignored for plan view labeling purposes (as noted in the Index).

Per ***Specification 536,*** payment for the single-faced Approach Transition Connection includes the required Alignment Curb and curb transition, as shown in ***Index 536-001***. Payment for any additional curb type begins at Section F-F or G-G as shown in the Index.

For guardrail connections to Rigid Barrier ends that are outside of the Clear Zone and do not require shielding, the shorter Trailing End Transition Connection (Trailing Trans.) may be used per ***Index 536-001*** details.

Per the Basis of Estimates, a separate Pay Item is required for all Transition Connections to Rigid Barrier (Approach or Trailing).

For connections to existing bridge Traffic Railings that conflict with ***Index 536-001*** details, use ***Indexes 536-002***, ***521-404***, and ***521-405***.

E. Pipe Rail:

Pipe Rail segments are required where Steel Posts will be located within 4 feet of sidewalks or shared use paths in the final condition. Do not place Pipe Rail inside of End Treatment and Approach Transition segments ('LE', 'LT', 'LA', and Crash Cushion segments); specify timber posts where needed. Pipe Rail also must not be used for TL-2 guardrail, so timber posts are the required pedestrian treatment for TL-2 guardrail. Pipe Rail requires a separate Pay Item.

Where possible, provide the Contractor an option of either Timber or Steel Posts by including Pipe Rail in the Plans quantities (i.e. assume Steel Posts are used, unless the design prohibits the use of Steel Posts for other reasons).

Where Pipe Rail cannot be used due to project-specific restrictions, specify use of timber post guardrail and end treatments instead.

F. Rub Rail:

Place Rub rail on the median side of Double-Faced Guardrail, where approaching median slopes are greater than 1:10 per the Index. Additionally, rub rail may be used where justification is provided showing that the location has a high propensity for vehicle underride or a high percentage of motorcycle traffic. Do not place Rub Rail inside of End Treatment segments (‘LE’ or Crash Cushion segments). Rub Rail requires a separate Pay Item.

G. Deep Posts:

Where right-of-way is restricted (i.e. constrained condition), Deep Posts may be used with the slope break located at the post centerline as defined per the Slope Break Condition in the Index. Due to unique challenges with maintenance and erosion at the slope break, Deep Post usage requires a special approval per ***FDM 215***.

Deep Posts are only permitted for segments with a post spacing of 6'-3" or less. Deep Posts require a separate Pay Item (Special Guardrail Post).

H. Modified Mounts - Special Posts:

When the required post spacing results in placement of posts atop concrete structures, concrete sidewalks, or subsurface utilities, use the Special Steel Posts, Frangible Leave-Outs, or Encased Post options, respectively, as defined in the Index and ***Specification 536***. Before using Special Posts, first consider alternative design geometry. Do not place Special Posts inside of End Treatment segments ('LE', 'LT', and Crash Cushion segments). Special Posts require a separate Pay Item.

Frangible Leave-Outs require steel posts. Where practical, specify steel posts in adjoining guardrail runs for consistency.

Encased Posts are intended only to avoid conflicts with single point or laterally running underground obstructions. Limit placement to 3 consecutive Encased Posts.

I. Guardrail Taper Rate:

Guardrail locations will typically run parallel to traffic lanes, but certain conditions, such as a median crossover or a change in typical section, will require a change in guardrail offset. Use a linear taper (a.k.a. flare) to accommodate such changes in guardrail offsets. See the layouts in the Index as well as Example 1 below, where tapers are denoted by 'Begin/End Taper Station' callouts.

The 'Begin/End Taper Station' and offset callouts will define the linear Taper Rate for construction.

For Design Speeds ≤ 45 MPH, use a maximum 1:10 Taper Rate.
For Design Speeds > 45 MPH, use a maximum 1:15 Taper Rate.

Where space is limited, Taper Rates may be refined by following the guidance of the AASHTO ***RDG***.

J. Median Crossover Guardrail- Tapered Guardrail for Dual Bridge Traffic Railing Shielding:

The Median Crossover Guardrail layout includes a taper segment, which reduces the Length of Need required for shielding the opposing lane's concrete railing while also using Double Faced Guardrail to shield the opposing lane's traffic. For details, see the example layouts in the Index, the LON program, and Example 1 below. When using an Approach Transition Connection to Rigid Barrier, use a Crossover Guardrail layout if the following conditions apply:

1. The end of an opposing lane's concrete Rigid Barrier is within the Clear Zone, aligned laterally across the median (typical with a dual bridge configuration and narrow median).
2. The back of guardrail system is within the Clear Zone of the opposing lane's traffic
3. The guardrail system, including the End Treatment, will be designed for the minimum length.

NOTE: For guardrail systems only meeting the above criteria of (1.) and (2.) and that will be designed to continue beyond the minimum length, a basic Double-Faced Guardrail segment would be used.

When measuring the length of a Crossover Guardrail layout, tabulate the entire run of guardrail, including the length of the Approach Transition Connection, as Double Face Guardrail. See Example 4 below for an example layout showing measurement limits.

This Median Crossover Guardrail system may supersede offset requirements shown in ***FDM 215***.

K. Reduced Post Spacing and/or Nested W-Beam Segments:

Where hazards must be located closer than 5 feet behind the Face of Guardrail, Reduced Post Spacing may be used to decrease the required Setback Distance (the anticipated deflection distance of an impacted guardrail system). See ***FDM***, Table 215.4.2., for the decreased required Setback Distance per each Reduced Post Spacing.

Provide Reduced Post Spacing along the entire portion of the hazard(s) requiring a decreased Setback Distance. Extend the Reduced Post Spacing segment a minimum of 12'-6" both upstream and downstream of the hazard(s) being shielded. Do not use Reduced Post Spacing inside of End Treatment segments (‘LE’ or Crash Cushion segments).

Per ***FDM***, Table 15.4.2, further reduction of the required Setback Distance may be achieved through Nested W-Beam panel segments (doubling of W-Beam panels per location). Nested W-Beam is only permitted within reduced post spacing segments, and it must extend the full length of the reduced post spacing segment.

Provide begin and end station callouts for the items above. Plan view labeling of Nested W-Beam is not required where already shown in the Index (i.e. within the Approach Transition Connection to Rigid Barrier). Separate guardrail length tabulations are not required for Reduced Post Spacing and/or Nested W-Beam segments, and separate Pay Items are not required.

L. Additional Offset Blocks:

Instead of the default single Offset Block, call out either two or three Offset Blocks such that the resulting post placement, moved farther behind the Face of Guardrail, will avoid a post conflict with an obstacle (e.g. sidewalks, gutter, underground utilities, concrete drainage structures, or other permanent obstacles).

Each additional Offset Block will move the post 7.5 inches further behind the Face of Guardrail. When considering Setback Distances to hazards per ***FDM***, Table 215.4.2, add 7.5 inches to the required Setback Distance for each additional Offset Block used.

Do not use additional Offset Blocks for TL-2 Guardrail or Approach Terminal or Trailing Anchorage segments ('LE' or 'LT'). A separate Pay Item is not required for Additional Offset Blocks.

M. Radial Guardrail:

Typical barrier design requires that guardrail be placed parallel to the direction of traffic, following the maximum Taper Rate requirements of Part I. However, radial guardrail may sometimes be required to shield hazards near existing project constraints, such as side streets, driveways, canals, or railroad crossings. The following two options apply for radial guardrail:

1. CRT (Controlled Release Terminal) System: Per the Index details, the CRT System is the primary option for radial guardrail. It's a crash-tested system, designed to absorb impact energy through use of breakaway posts and increased deflection distances.

   Use the standard CRT system whenever all requirements shown in the Index can be met, including standard geometry and the clear area limits. Ensure that the perpendicular 25'-0" linear segment shown is provided outside of the radius. The required angle between the primary guardrail run and perpendicular segment is 90°±15°.

   Per the Plans Content Requirement below, label the Begin/End CRT System including a Standard radius. Include the Pay Item for the CRT End Treatment.

2. General Guardrail Radius: If option 'a' above will not fit due to project constraints, and after all other barrier and project geometry options have first been considered, a General Guardrail Radius may be used at locations with Design Speed ≤ 45mph. A General Guardrail Radius consists of Standard Posts, Standard Offset Blocks, and shop-bent panels. Provide site-specific justification for use of a General Guardrail Radius in the project documentation.

   Per the Plans Content Requirements below, label the Begin/End Radius along with the radius value (example, R=8'). Use Standard shop-bent panel radius of 8', 16', 24', or 32'. Per ***Specification 536***, shop-bent panels are included in the cost of General Guardrail. A separate Pay Item is not required for a General Guardrail Radius. Terminate guardrail with the applicable end treatment, placed outside of the radius. A Trailing Anchorage may be used for driveways.

NOTE: Do not place radial guardrail systems within Approach Transition Connection to Rigid Barrier or Approach Terminal segments ('LA' or 'LE').

N. Slope Guards:

Where no other wall or structure is used to delineate the abutment's drop-off, place Slope Guards between bridge approaches as shown in the Index layouts and label

them per the examples shown below in Example 1. End Treatments are not required.

NOTE: Slope Guards are intended to provide drop-off delineation and deter maintenance vehicles from traveling beyond the slope edge; Slope Guards are not considered crashworthy for roadway vehicles.

Include Slope Guards as individual guardrail length entries in the Summary of Guardrail table. Assume the guardrail type to be the same as the majority of adjacent guardrail used (typically General TL-3 or Low-Speed TL-2). Include the Approximate Station and length for each Slope Guard entry, and label each a “Slope Guard” in the Design Notes column.

O. Minimum Guardrail Length Requirements:

Provide for the minimum guardrail length per the requirements of ***FDM 215*** (lengthen as required to shield hazards per Part B). Additionally, the minimum guardrail length is governed by the sum of all required segment lengths used, such as Transition Connections to Rigid Barrier and End Treatments (‘LA’, ’LC’, ‘LE’, & ‘LT’). For additional details and segment lengths, see the Index and Example 2 below.

Plan Content Requirements

For the Plans sheets listed below, show the guardrail system to scale, including a depiction of the post, offset block, and panel type in its design location.

A. Typical Sections

Design and label the 'Lateral Offset' from the Face of Curb or Edge of Traffic Lane as it corresponds to the Guardrail Sections sheet in the Index.

Meet the offset requirements of the ***FDM*** and the adjacent grading requirements as shown in the Index.

B. Cross Sections

Meet the offset requirements of the ***FDM*** and the adjacent grading requirements as shown in the Index.

C. Roadway Plan

Begin/End Station & Offset: Label the Station and Offset (From the Station Reference, Centerline or Baseline) for the Face of Guardrail at the locations with corresponding Begin/End Stations shown in the Index, including the following:

1. Begin/End GR. Stations label the limits of the guardrail length measurement, generally located at centerline of Post (1) in End Treatments and/or at the Terminal Connector splice of an Approach Transition Connection segment. See the Index layouts for details.

   If Low-Speed (TL-2) guardrail is required, change this label to "Begin/End TL-2 GR."

   If Double Faced Guardrail is required, change this label to “Begin/End Dbl. Faced GR.” Label the guardrail face on the side that follows a prescribed offset from the nearest travel lane.

2. Begin/End Taper Stations label the offset Face of Guardrail locations for the start and end of linear tapers (e.g. for a change in typical section or for a Crossover Taper segment). The Guardrail Taper Rate requirements of Part I above will govern these transitions.

3. Begin/End CRT(8, 16, 24, or 32) Ft. R. Station labels the starting point for the Standard Controlled Release Terminal (CRT) System and the radius, 'R'.

4. Begin/End General Guardrail Radius(8, 16, 24, or 32) Ft. R. Stations label the starting and stopping point for a general guardrail radius with shop-bent panels and the radius, ‘R’.

5. Begin/End Pipe Rail Stations label the limits of Pipe Rail length measurement, generally located at centerline of the Terminal Posts (offset not required).

6. Begin/End Rub Rail Stations label the limits of Single-Sided Rub Rail length measurement, generally located at centerline of the Terminal Posts (offset not required). NOTE: This is not depicted in the Index.

   For Double Face Guardrail, place labels pointing to the face of guardrail on the side requiring the Rub Rail.

7. Begin/End Double-Sided Rub Rail Stations label the limits of Double-Sided Rub Rail length measurement, generally located at centerline of the Terminal Posts (offset not required). NOTE: This is not depicted in the Index.
8. Begin/End Half Sp. Stations label the limits of Reduced Post Spacing at 3'-1½". The overall length of this segment must be a multiple of 6'-3" (offset not required).
9. Begin/End Quarter Sp. Stations label the limits of Reduced Post Spacing at 1'-6¾". The overall length of this segment must be a multiple of 6'-3" (offset not required).
10. Begin/End Nested W-Beam Stations label the limits of Nested (or doubled) W-Beam panels (offset not required).

Label the Station & Offset at the Face of Guardrail for the following end features:

1. TL-2 Parallel Terminal
2. TL-2 Dbl. Faced Terminal
3. TL-3 Parallel Terminal
4. TL-3 Dbl. Faced Terminal
5. C.C.
6. Trailing Anchor.
7. CRT End Treatment
8. TL-2 Apprh. Trans.
9. TL-3 Apprh. Trans.
10. Trailing Trans.

NOTE: The above labels may be included with the Begin/End Guardrail Station callouts (typically at same location).

Label the Station and Offset at the Face of Guardrail for the following guardrail miscellaneous features:

1. Encased Post
2. Special Steel Post
3. Frangible Leave-Out
4. Deep Post
5. Two Offset Blocks

6. Three Offset Blocks
7. GR. Slope Guard

D. Summary of Guardrail Table:

Tabulate the individual Pay Items as defined in the Basis of Estimates Manual (***BOE***) and ***Specification 536***. Produce the Summary of Guardrail table. See the CADD Production Support Office website for details.

The location call outs of guardrail segments will be listed as Station to Station, but the length of the corresponding segments must be measured along the centerline of the panels and include the effect of curvature. See Example 4 and Example 5 below for geometry details.

For guardrail measurement in constrained conditions, verify that the total length of a guardrail equals the basic guardrail length (General or Low-Speed Guardrail), at a multiple of 6'-3", plus the applicable End Treatment length(s) and Approach Transition Connection length.

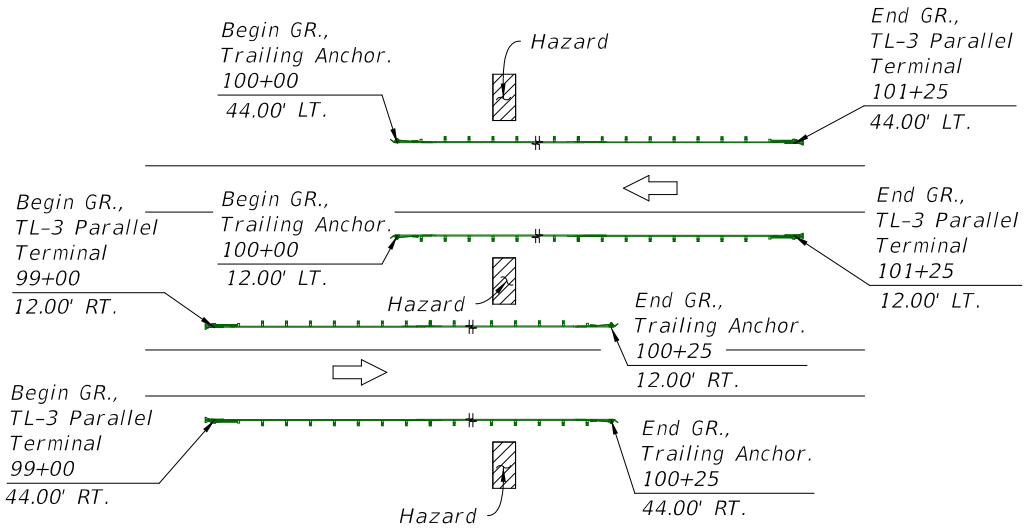
Per ***Specification 536***, Guardrail is measured end-to-end, including the full lengths of the adjoining Approach Terminals, Trailing Anchorages, and Transition Connections to Rigid Barrier. Additional Pay Items, which cover costs over-and-above that of Guardrail, are required as applicable for these End Treatments and Transition Connections to Rigid Barrier. For the Guardrail end locations using Crash Cushions, see ***Index 544-001***. See Examples 3 & 4 below for callout details.

Payment

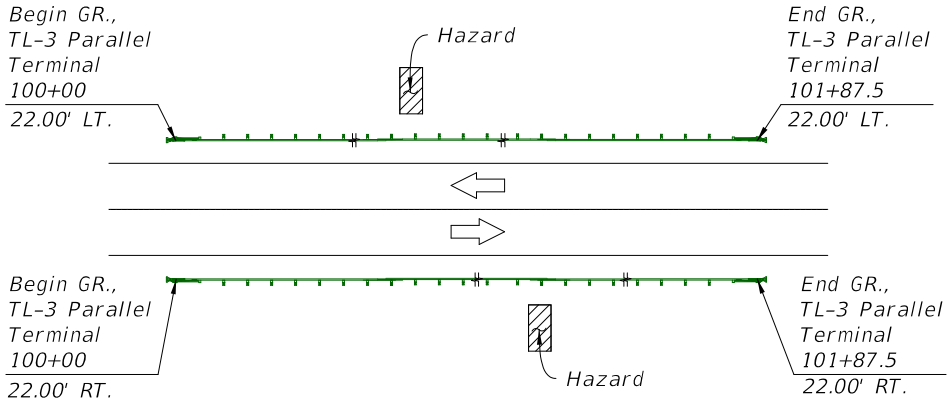
Item number	Item Description	Unit Measure
536-1-XXX	Guardrail	LF
536-5-XXX	Rub Rail	LF
536-6-XXX	Pipe Rail	LF
536-7-XXX	Special Guardrail Post	EA
536-8-XXX	Trans. Connection to Rigid Barrier (Approach or Trailing End)	EA
536-73-XXX	Removal of Existing Guardrail	LF
536-85-XXX	Guardrail End Treatment	EA

EXAMPLES

Example 1 Basic Layouts for Shielding Hazards (1 of 3)

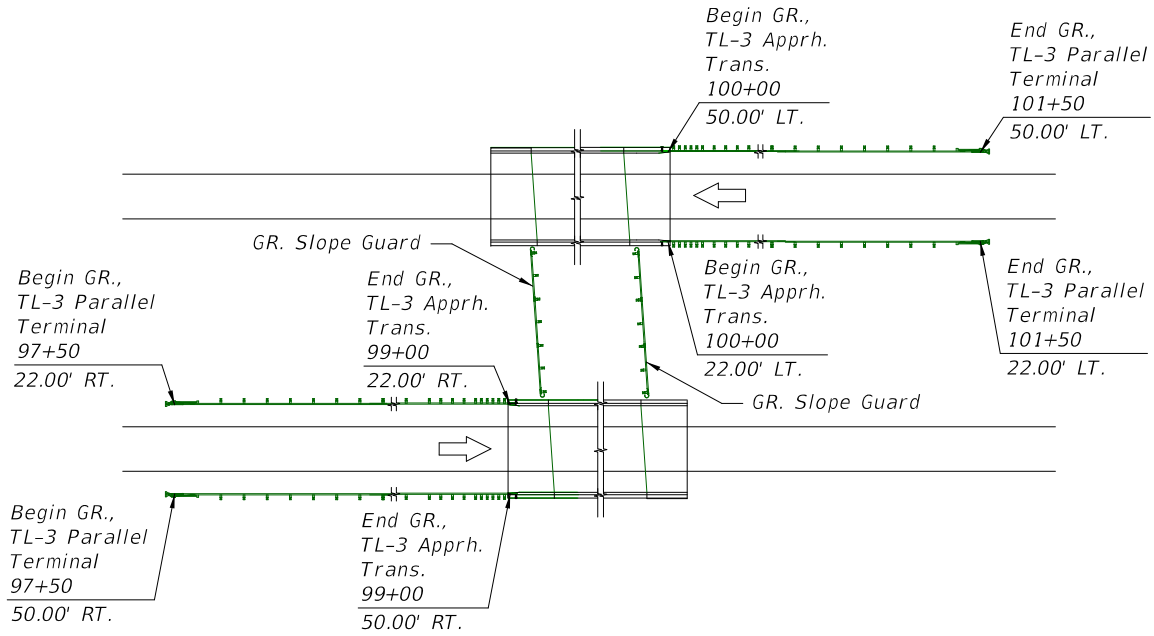


TYPICAL HAZARD SHIELDING EXAMPLE: ROADSIDE AND MEDIAN BACK OF GUARDRAIL OUTSIDE OF OPPOSING LANE'S CLEAR ZONE ('LON' Program Part 'A')

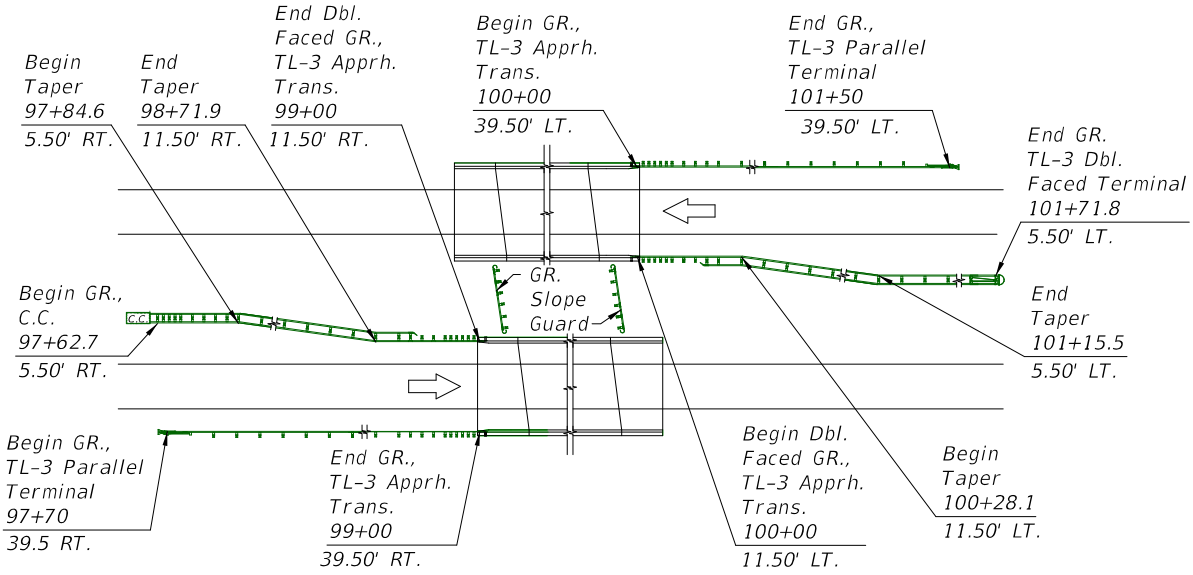


TYPICAL HAZARD SHIELDING EXAMPLE: 2-LANE, 2-WAY ROAD HAZARD OR GUARDRAIL END WITHIN OPPOSING LANE'S CLEAR ZONE ('LON' Program Parts 'A' & 'B')

Example 1 Basic Layouts for Shielding Hazards (2 of 3)

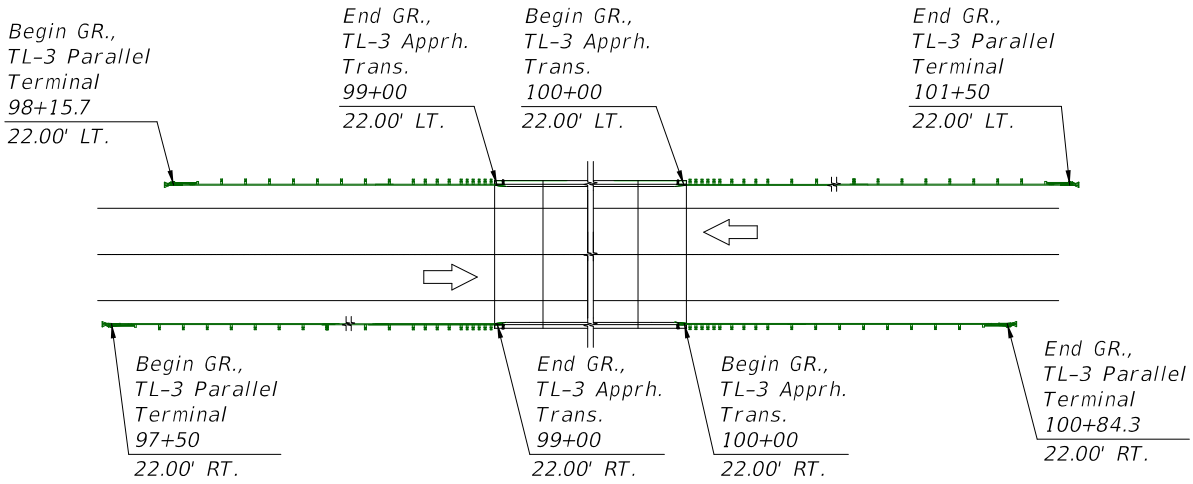


BRIDGE RAILING SHIELDING EXAMPLE:
OPPOSING LANE'S CONCRETE RAILING OUTSIDE OF CLEAR ZONE
('LON' Program Part 'E')

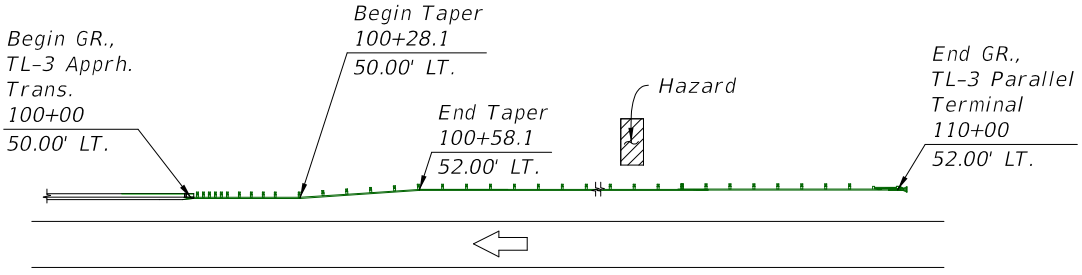


BRIDGE RAILING SHIELDING EXAMPLE: 'CROSSOVER GUARDRAIL'
OPPOSING LANE'S CONCRETE RAILING WITHIN CLEAR ZONE
('LON' Program Part 'C', 'D', or 'E')

Example 1 Basic Layouts for Shielding Hazards (3 of 3)

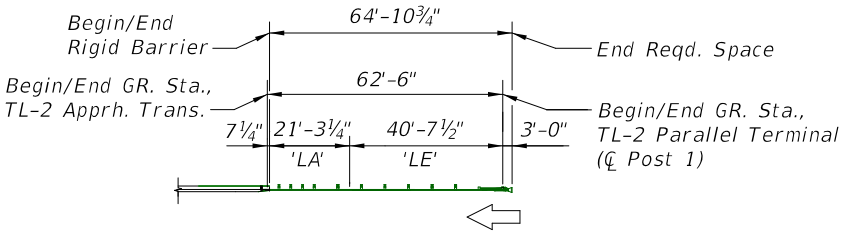


BRIDGE RAILING SHIELDING EXAMPLE: 2-WAY, 2-LANE ROAD CONCRETE RAILING WITHIN OPPOSING LANES' CLEAR ZONE
(Min. Length Guardrail Shown for Far Lane Shielding)
('LON' Program Part 'E')

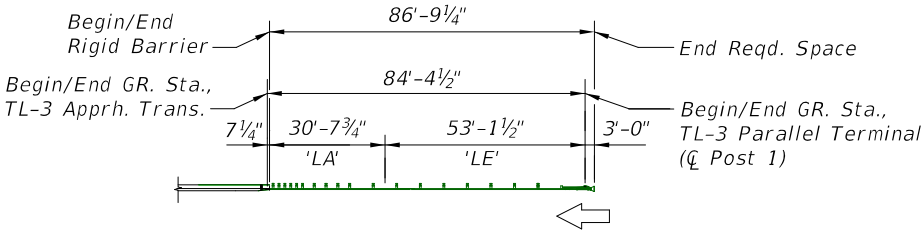


TAPER TO DIFFERING GUARDRAIL OFFSET EXAMPLE:
(Where General or Low-Speed guardrail run has a different offset from the Approach Transition Connection)
('LON' Program Part 'E')

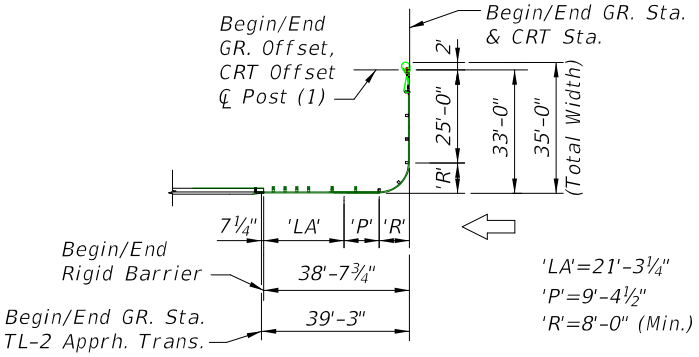
Example 2 Minimum Lengths for Shielding Rigid Barrier Ends



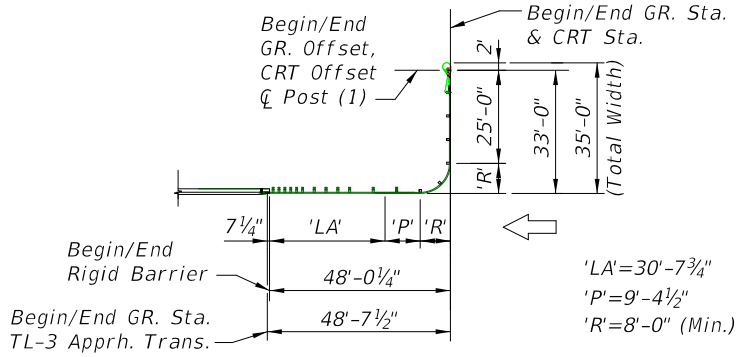
PARALLEL SYSTEM, TL-2 - *MINIMUM LENGTH



PARALLEL SYSTEM, TL-3 - *MINIMUM LENGTH



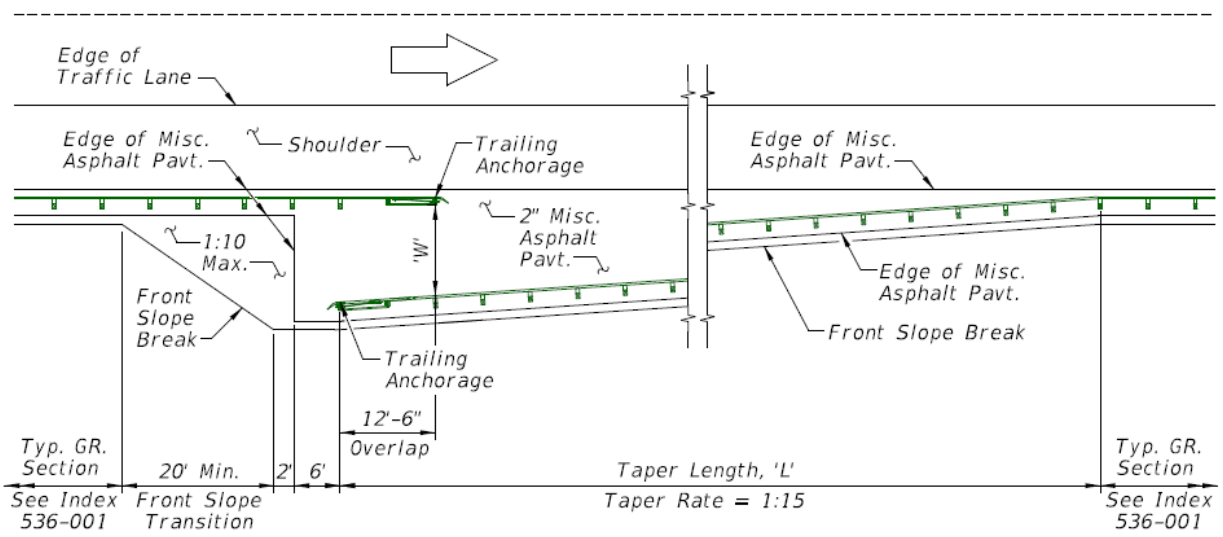
RADIAL CRT SYSTEM, TL-2 - *MINIMUM LENGTH & WIDTH
(Adjust dimensions for larger radius, 'R', as required)



RADIAL CRT SYSTEM, TL-3 - *MINIMUM LENGTH & WIDTH
(Adjust dimensions for larger radius, 'R', as required)

*Assumes no extension for additional hazard shielding is required

Example 3 Guardrail Maintenance Opening



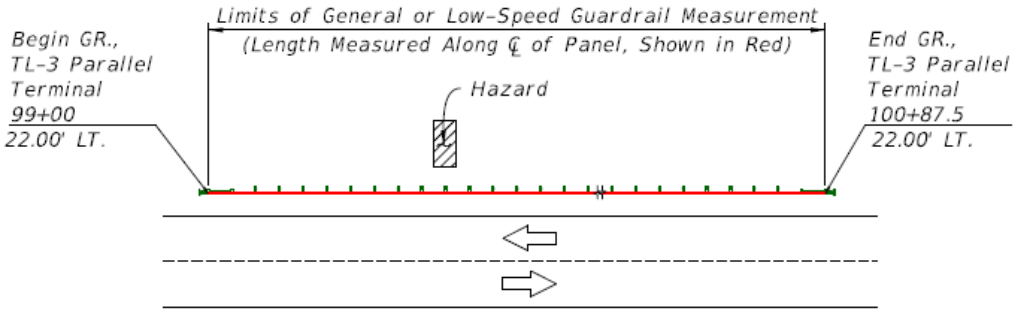
MAINTENANCE OPENING
ON LIMITED ACCESS FACILITIES

Opening Width, 'W'	Taper Length, 'L'
6'-0"	125'-0"
8'-0"	156'-3"
10'-0"	181'-3"
12-0"	212'-6"
14'-0"	243'-9"
20'-0"	331'-3"
30'-0"	481'-3"

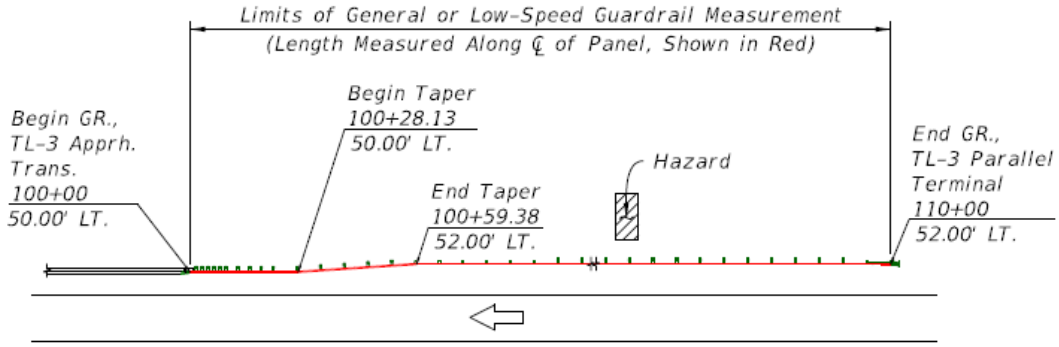
NOTES:

1. *See the Guardrail Sections in Index 536-001, Sheet 6 for the miscellaneous asphalt pavement and front slope break locations behind the guardrail.*
2. *The miscellaneous asphalt pavement area shown must not be steeper than 1:10. See the FDM for the roadway and shoulder cross slope requirements.*

Example 4 Guardrail Length (LF) Measurements (1 of 2)

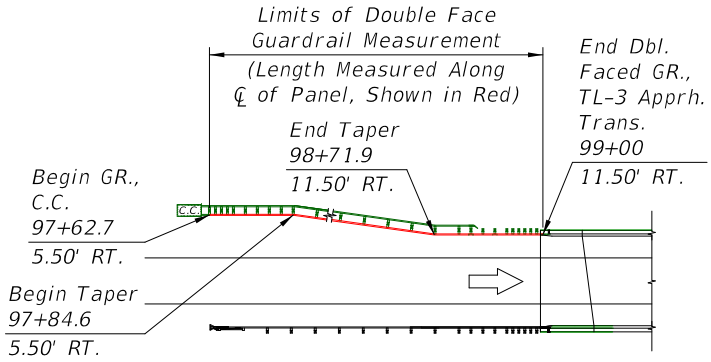


GUARDRAIL LENGTH MEASUREMENT EXAMPLE:
END TREATMENTS AND BASIC RUN
Include End Treatment lengths added as the basic connecting guardrail type, such as General or Low-Speed Guardrail (End Treatment Pay Items consider costs as over-and-above basic guardrail)

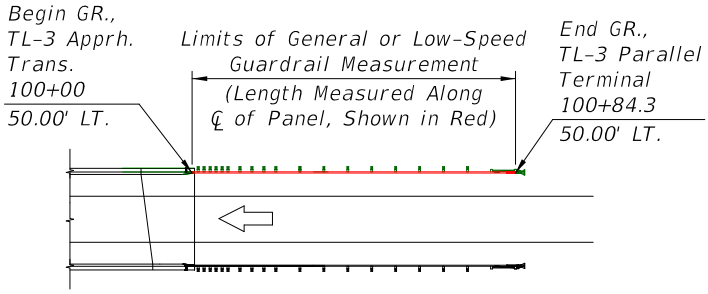


GUARDRAIL LENGTH MEASUREMENT EXAMPLE:
APPROACH TRANSITION CONNECTION, BASIC RUN, & END TREATMENT
Include End Treatment and Approach Transition Connection lengths added as the basic connecting guardrail type, such as General or Low-Speed Guardrail (End Treatment and Approach Transition Connection Pay Items consider costs as over-and-above basic guardrail)

Example 4 Guardrail Length (LF) Measurements (2 of 2)

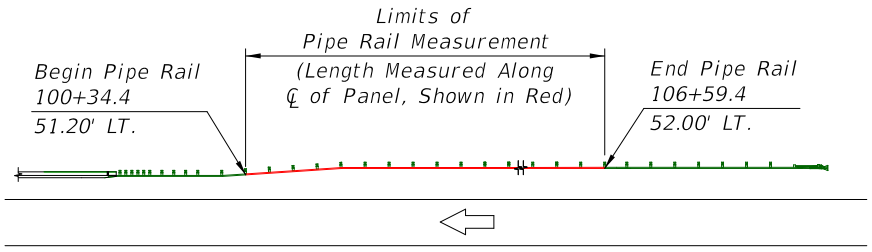


GUARDRAIL LENGTH MEASUREMENT EXAMPLE:
'GUARDRAIL CROSSOVER' APPROACH TRANSITION CONNECTION
Tabulate the layout as Double Face Guardrail, including the Approach Transition. (Measure to Begin/End GR. as shown at Post (1) per Index 544-001; the Design Length of Crash Cushions per the APL Drawing is not included)

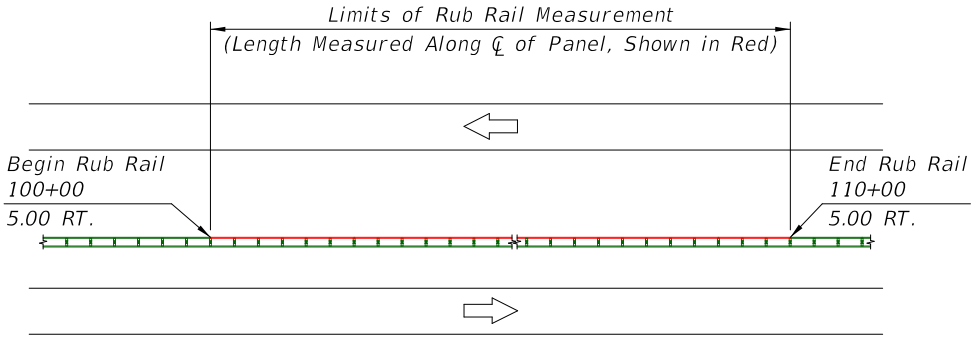


GUARDRAIL LENGTH MEASUREMENT EXAMPLE:
APPROACH TRANSITION CONNECTION AND END TREATMENT ONLY
Tabulate the End Treatment and Approach Transition lengths as basic W-Beam General Guardrail. (End Treatment and Approach Transition Connection Pay Items consider costs as over-and-above basic guardrail)

Example 5 Miscellaneous Pay Item Length (LF) Measurements



PIPE RAIL LENGTH MEASUREMENT EXAMPLE



RUB RAIL LENGTH MEASUREMENT EXAMPLE

Common Design Features – Checklist (NOTE: Not All-inclusive)

Check Item:	**Description:**	**Key Reference(s)**
Shielding Hazards	Meet shielding requirements for hazard types, depending on offsets and project type	FDM 215, Clear Zone, Minimum Lateral Offsets, Aboveground Hazards, Drop-off Hazards, Canal Hazards, Rigid Barrier Ends
Length of Need	Extend Guardrail upstream of hazards per 'Length of Need' (‘LON’) requirements	Part B; FDOT ‘LON’ Design Tool (Excel Spreadsheet), AASHTO RDG Equation 5-3
Trailing Extension	Extend Guardrail 25'-0" downstream of hazards or overlapping barrier run	Part C (Trailing Anchorage) Index 536-001, Sheet 9
Guardrail Lateral Offset	Meet Guardrail lateral offset placement requirements	FDM 215.4.6.1; FDM Figure 215.4.6
Hazard Setback	Meet barrier setback requirements; Include reduced post spacing if needed	Part K; FDM 215.4.6.1; FDM Table 215.4.2
Taper Rates	Keep Guardrail Parallel to the roadway, or meet the maximum taper rate requirements	Part I
Grading and Slope Breaks	Meet minimum grading requirements of Standard (maximum slopes and slope break locations behind guardrail)	Index 536-001, Sheets 6-8 & 12
Trailing Anchorage	Call for on downstream ends of guardrail as required.	Part C; Index 536-001, Sheet 9
Approach Terminal	Call for on upstream ends of guardrail as required. Use per APL drawings with no add-ons or modification. Keep parallel to roadway.	Part C; Index 536-001, Sheets 7-8; APL drawings
Approach Transition Connection to Rigid Barrier	Call for when connecting guardrail to Concrete Barrier or bridge Traffic Railing as required. Place exactly as shown in the Standards, including the "Alignment Curb" shape and location. Keep parallel to roadway. Taper guardrail to the required upstream lateral offset depending on the connecting curb type option as shown in the Standard.	Part D; Index 536-001, Sheets 13-18
Guardrail Length	Include as-needed to fit sum of all Standard segments (e.g. ‘LA’, ‘LE’, ‘LT’), meet ‘LON’ requirements, and meet FDM minimum.	Part O; Example 2; FDM 215.4.1.2 Index 536-001 (segments)
Guardrail Accessories	Include items, such as Pipe Rail and Rub Rail, where required. Do not place within End Treatment segments.	Part E & F; Index 536-001, Sheet 6, 21, & 22
Special Posts	Include special posts where required for mounting or avoiding obstructions. Do not place within End Treatment segments.	Part G & H, Index 536-001, Sheet 5, 6, & 23
Plans/Report Requirements	Include Summary of Guardrail table to list Pay Item components. In plan view, label Begin/End GR station & offset and other features. Identify End Treatments and Apprh. Trans. segments with single station for each (same locations as Begin/End GR. station).	Plans Content Requirements; Index 536-001 (match callout points throughout); FDOT BOE Chapter 8