Guardrail Training

July 2016

Design Standards Index 400 - Guardrail

Presenter:

From the FDOT Roadway Design Office in Tallahassee…

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Design Standards Index 400 - Guardrail

Course Breakdown:

Module 1	New Index Sheets Nos. 1-10 (Part A)
Module 2	New Index Sheets Nos. 11-22 (Part B)
Module 3	Instructions for Design Standards (IDS)
Module 4	Design Tool – Length of Need (Excel)

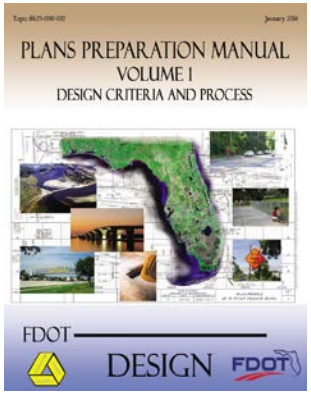
Who's interested in this class?

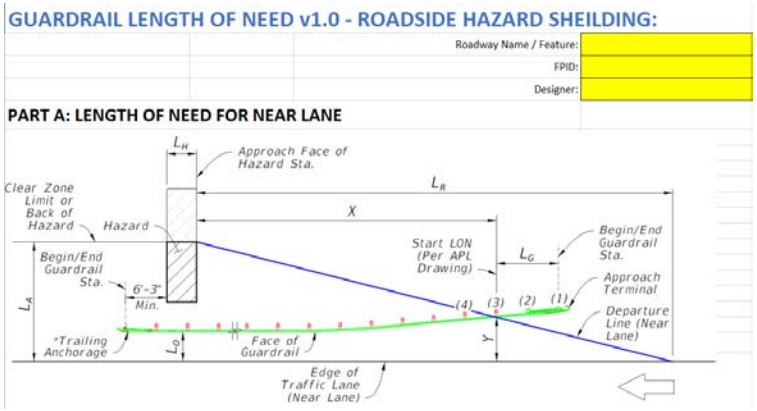
- Roadway Designers?
- Plans Reviewers?
- Project Managers?
- Construction Contractors?
- Maintenance Personnel?

The newly redeveloped Index 400 has many new features to assist contractors with structural aspects and construction, however we've geared this course towards information for Roadway Plans designers and reviewers.

Design Standards Index 400 - Guardrail

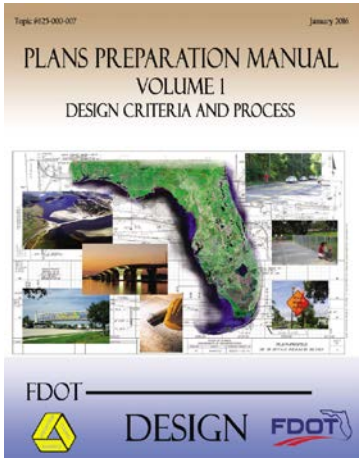
- **Index 400 – Guardrail**
  - **Complete Restructuring Project**
    - New Index Sheets (Redrawn)
    - New Specifications (currently MSPs)
    - New Instructions for Design Standards (IDS)
    - New Length of Need "Design Tool" (Excel Program)
    - Modifications of Existing Indexes for Compatibility (e.g. Index 402, 410, 411)
    - Revised PPM Ch. 2 and 4 (Roadside Safety to Ch. 4)





Design Standards Index 400 - Guardrail

For choosing when to use Guardrail and at what offset to place it, see the PPM Chapter 4 for Roadside Safety.



For more information, see Derwood Sheppard's Portion of the PPM Design Update Training below...

http://www.dot.state.fl.us/rddesign/Training/Webinar16/Pres16.shtm

NEW	February 2016	NEW		
Plans Preparation Manual Updates for 2016 Discussion for the update process, affected bulletins and related volume chapter changes	PDF	WMV 132mb - 142min	Mary Jane Hayden Derwood Sheppard Chester Henson	

Design Standards Index 400 - Guardrail

We're going to give you the Guardrail "crash course"

Here's the Guardrail crash course….

MODULE 1: Index Overview – Sheets 1 thru 10

This Index 400 is a DSR, as of February 1, 2016

Design Standards Index 400 - Guardrail

Why change?...

Clarity. Updates. Effectiveness.

OLD INDEX:

- **34 sheets long**
- lengthy verbiage, 'passive voice'
- old scanned-in drawings
- includes information for the designer
- includes Spec. style language
- has previous **NCHRP350** Guardrail Transition to 'Bridge Railings'
- has only TL-3 guardrail options
- 'Length of Need' uses a simplified method based on previous criteria

NEW INDEX:

- **22 sheets long** (with Table of Contents)
- concise verbiage, 'active voice', note headings
- new drawings to scale, latest labeling practice
- designer information moved to PPM and IDS
- Spec. language moved to the Specifications
- has latest **MASH** tested Guardrail Transitions to 'Rigid Barrier' (Both Railings and Barriers)
- has both TL-3 & TL-2 guardrail options
- 'Length of Need' calculations cover more cases, based on AASHTO RDG criteria

Design Standards Index 400 - Guardrail

Where is it?... *Easiest to Google "FDOT Standards"*

http://www.dot.state.fl.us/rddesign/DesignStandards/Standards.shtm

Office of Design

Office of Design / Design Standards

Design Standards

INDUSTRY REVIEW

Modification Request Origination Form

Industry Review

Status of Proposed Revisions

CURRENT PUBLICATION

Effective July 1, 2016 - June 30, 2017

Year	Design Standards eBook	Design Standards Revisions	Imp
FY 2016-17	DSeB	DSR	RD

Office of Design / Design Standards / Design Standards Revisions FY 2016-17

Design Standards Revisions FY 2016-17

n/a = Non Applicable
n/c = No Change

DSR Reference Number	Revised Sheets (PDF)	Index Title	Design Information: Instructions (IDS) (PDF)	Design Tools (Link)	Data Table Cell Library (ZIP)	Borderless DGNs (ZIP) Terms of Use	Associated Design Bulletin (PDF)
DSR400-01	1-22 of 22	Guardrail	IDS	XLS	N/A	DGN	RDB16-01
DSR410-01	2,10, 1[illegible]8 of 25	Concrete Barrier Wall	N/A	N/A		DGN	
DSR411-01	6 [illegible] 10	Pier Protection Barrier	N/C	N/A		DGN	

Implementation Schedule…

Roadway Design Bulletin 16-01

The Index Sheets and Instructions for Design Standards discussed refer to the February 1st DSR to the 2016-17 Design Standards eBook. The Specifications referred to will soon be available as Modified Special Provisions (MSPs).

The draft Specifications (MSPs) and PPM language are currently in Bulletin 16-01.

These documents are available for use at the option of the Districts for all projects let prior to July 1st, 2017.

If this option is used:

1. Place the *DSR Reference Number on the Key Sheet* as described in the *PPM*, Volume 2, Section 3.2.8
2. Request the applicable *MSPs* from the District Specifications Office and include them in the project Specifications Package.

On July 1st, 2017 this update will become mandatory, as it will be released with the 2017-18 Design Standards eBook.

Design Standards Index 400, Sheet 1

Table of Contents and General Notes:

GENERAL NOTES:

1. INSTALLATION: Construct guardrail in accordance with Specification Section 536.

   This Index, along with the plans and the manufacturers' drawings on the Approved Products List (APL), is sufficiently detailed for installation of General Guardrail, Low-Speed Guardrail, End Treatment assemblies, and their connecting options shown herein. This precludes requirements for shop drawing submittals unless otherwise specified in the plans.

2. COMPATIBILITY: The General Guardrail in this Index is based on the Midwest Guardrail System (MGS) design, with a 31" height at the top of the Panel (2'-1" mounting height at ℄ of Panel) and a midspan panel splice as shown on Sheet 2. Guardrail components included on the APL, which are compatible with this Index, may also be identified as 31" or MGS Guardrail.

3. STANDARD COMPONENTS: Standard guardrail components, including posts, panels, and bolt systems, are based upon English unit conversions of the AASHTO-AGC-ARTBA Joint Committee Task Force 13 Report: A Guide to Standardized Highway Barrier Hardware (http://www.aashtotf13.org/Barrier-Hardware.php).

4. BUTTON-HEAD BOLTS: Install Button-Head Bolts where indicated using bolts, nuts, and washers as defined on Sheet 22. Place washers under nuts; washers are optional against steel flanges. Do not place washers between bolt heads and panels, except where otherwise shown in this Index.

5. HEX-HEAD BOLTS: Install Hex-Head Bolts where indicated using bolts, nuts, and washers in accordance with material properties of Specification Section 967. Place washers under nuts; washers are optional against steel flanges.

6. MISCELLANEOUS ASPHALT PAVEMENT: Install Miscellaneous Asphalt Pavement where indicated in accordance with Specification Section 339.

7. ADJACENT SIDEWALKS & SHARED USE PATHS: When guardrail posts are placed within 4'-0" of a sidewalk or shared use path, use timber posts, or use steel posts only if treated with Pipe Rail as shown on Sheet 20.

   When timber posts are used, one of the following safety treatments is required for the bolt(s) protruding from the back face of the posts:

   a. After tightening the nut, trim the protruding post bolt flush with the nut and galvanize per Specification Section 562.
   b. Use post bolts 15" in length and countersink the washer and nut between 1" and 1½" deep into the back face of the post.
   c. Use 15" post bolts with sleeve nuts and washers.

   When End Treatment posts are within 4'-0" of a sidewalk or shared use path, steel posts are not permitted within the End Treatment segment. Terminate the Pipe Rail outside of End Treatment segments, as noted per Sheet 20.

8. CONNECTION TO EXISTING GUARDRAIL: Where a transition to existing guardrail at 27" height is required, linearly transition the guardrail height over a distance ranging from 25'-0" to 31"-3". Provide an immediate transition to the required midspan splice using the available panel options on Sheet 4.

9. PLAN CALLOUTS: Begin/End Station labels are shown throughout this Index as they correspond to the station and offset callouts specified in the plans.

   In the plans, Begin/End Guardrail Station refers to General TL-3 Guardrail, and it may be abbreviated as Begin/End GR. Sta. Where Low-Speed TL-2 Guardrail is specifically required, the callout in the plans will then specify Begin/End TL-2 GR. Sta.

10. QUANTITY MEASUREMENT: Measure guardrail and corresponding components as defined in Specification Section 536. The Guardrail length is measured along the centerline of installed Panels, between the points labeled Begin/End Guardrail Station shown on the following Index Sheets and defined in the plans (typically measured from the ℄ of the panel's post bolt slots at the approach/trailing ends).

LAST REVISION	REVISION	DESCRIPTION:	FDOT		INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FY 2016-17 DESIGN STANDARDS	GUARDRAIL	400	1 of 22

- Added Table of Contents
- Re-ordered sheets in an intuitive sequence

Design Standards Index 400, Sheet 1

Table of Contents:

SHEET NO.	CONTENTS
1	General Notes; Index Contents
2	General, TL-3 Guardrail – Installed Plan and Elevation
3	Low-Speed, TL-2 Guardrail – Installed Plan and Elevation
4	W-Beam and Thrie-Beam Panel Details
5	Post and Offset Block Details
6	Guardrail Sections – Heights and Adjacent Slopes
7	End Treatment – Approach Terminal Geometry, Parallel and Flared
8	End Treatment – Approach Terminal Geometry, Curbed and Double Faced
9	End Treatment – Trailing Anchorage Type II
10	End Treatment – Component Details
11	End Treatment – Controlled Release Terminal (CRT) System
12	Layout for CRT System – Side Roads and Driveways
13	Approach Transition Connection to Rigid Barrier – General, TL-3
14	Approach Transition Connection to Rigid Barrier – Low-Speed, TL-2
15	Approach Transition Connection to Rigid Barrier – Details
16	Approach Transition Connection to Rigid Barrier – Double Faced Guardrail
17	Layout to Rigid Barrier – Approach Ends
18	Layout to Rigid Barrier – Approach Ends with Double Faced Guardrail Layout to Rigid Barrier – Trailing Ends
19	Rub Rail Details
20	Pedestrian Safety Treatment – Pipe Rail
21	Modified Mount – Special Steel Post for Concrete Structure Mount; Modified Mount – Encased Post for Shallow Mount; Modified Mount – Frangible Leave-Out for Concrete Surface Mount
22	Barrier Delineators – Post Mounted; Clear Space – Reduced Post Spacing for Hazards; ⅝" Button-Head Bolt System

Sheet Organization/Groupings:

2-3) Guardrail run types

4-5) Basic components

6) Guardrail Cross-Sections

7-12) End Treatments:

- Approach "Terminal"
- Trailing "Anchorage"
- CRT (with layouts)

13-16) Transition Connections to Rigid Barriers

17-18) Example guardrail layouts showing how segments above will fit together

19-20) Guardrail supplements

- Rub Rail
- Pipe Rail

21) Modified Post Mounts

22) Miscellaneous Details

Design Standards Index 400, Sheet 1

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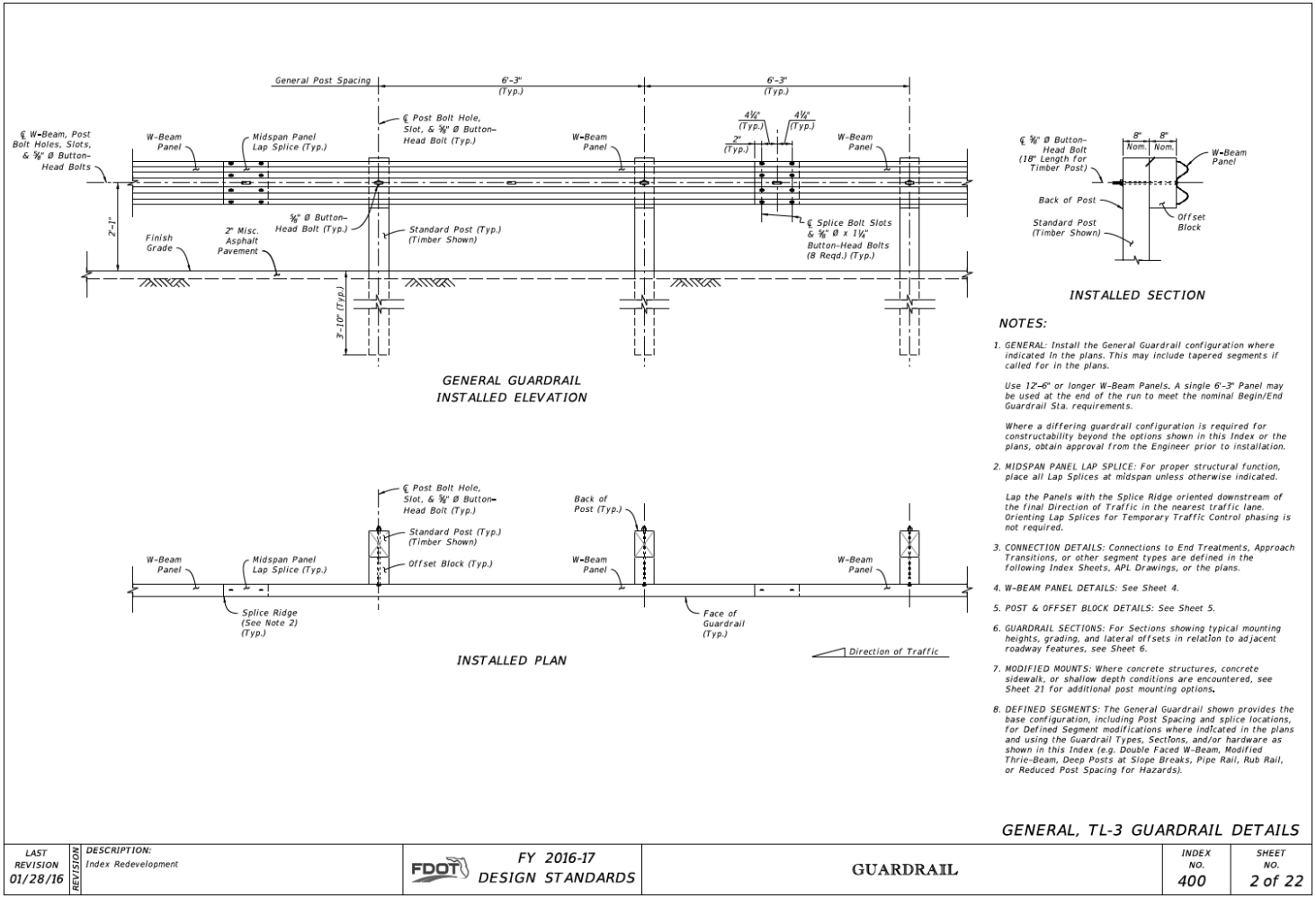
10. QUANTITY MEASUREMENT: Measure guardrail and corresponding components as defined in Specification Section 536. The Guardrail length is measured along the centerline of installed Panels, between the points labeled Begin/End Guardrail Station shown on the following Index Sheets and defined in the plans (typically measured from the ℄ of the panel's post bolt slots at the approach/trailing ends).

NOTES Highlights:

1. Use Spec 536. No project specific shop drawings needed.
2. This is considered 31” height Guardrail (based on MGS design)
3. Components based on AASHTO-AGC-ARTBA Design
4. Post Bolt type
5. Hex Bolt type
6. Asphalt type
7. Options for Contractor when posts fall within 4’ of sidewalk
8. How to connect to existing guardrail (transition)
9. Plans Callouts
10. Guardrail Length Measurement

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:



NOTES:

1. GENERAL: Install the General Guardrail configuration where indicated in the plans. This may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels. A single 6'-3" Panel may be used at the end of the run to meet the nominal Begin/End Guardrail Sta. requirements.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

4. W-BEAM PANEL DETAILS: See Sheet 4.

5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The General Guardrail shown provides the base configuration, including Post Spacing and splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

GENERAL, TL-3 GUARDRAIL DETAILS

LAST REVISION 01/28/16	REVISION	DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 2 of 22

- Configuration for "General" run of W-beam guardrail
- Applicable for TL-3 Design Speed and below

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:


0.000 sec


0.150 sec


0.280 sec

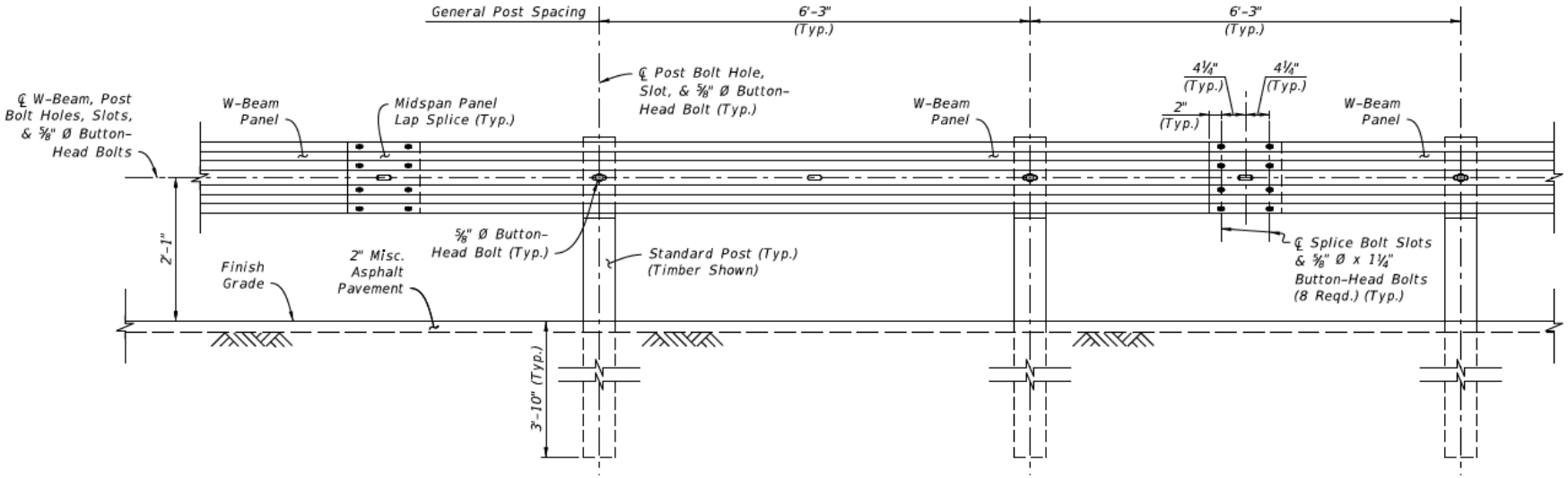

0.480 sec


0.948 sec

- Configuration for “General” run of W-beam guardrail
- Applicable for TL-3 Design Speed and below

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:



GENERAL GUARDRAIL
INSTALLED ELEVATION

General, TL-3 Guardrail is the same as the Previous Standard:

- **31” Height**
- 6’-3” Post Spacing
- Midspan Panel Splice
- 2” Miscellaneous Asphalt Pavt. (Mow Strip)
- 1 Offset Block Per Post

Design Standards Index 400, Sheet 2

General, TL-3 Guardrail Details:

NOTES:

1. GENERAL: Install the General Guardrail configuration where indicated in the plans. This may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels. A single 6'-3" Panel may be used at the end of the run to meet the nominal Begin/End Guardrail Sta. requirements.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

4. W-BEAM PANEL DETAILS: See Sheet 4.

5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

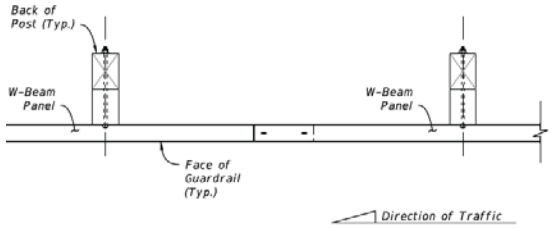
7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The General Guardrail shown provides the base configuration, including Post Spacing and splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

NOTES Highlights:

1. Contractors must use 12'-6" or 25'-0" Panels, but they may use a 6'-3" Panel at the end of the run. **Designers should design the nearest 6'-3" Panel length, measured along CL of panels*

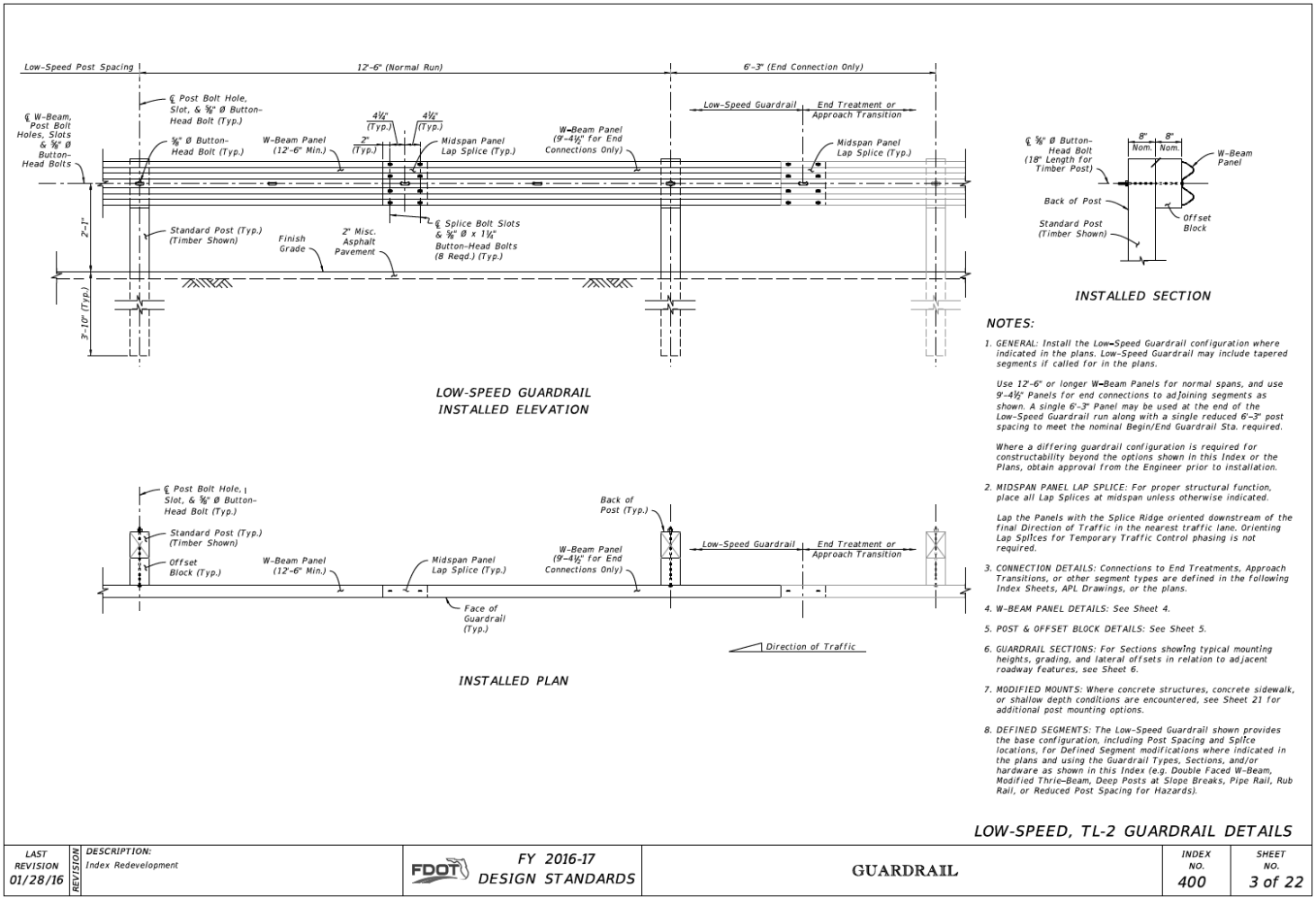
2. Midspan Panel Lap Splices need to have exposed ridge facing downstream. *This orientation is not required for TTC phasing.*



8. General Guardrail is "base configuration" (e.g. post spacing, midspan splice, offset block) It is then "modified" where defined in the plans to add Pipe Rail, Double Faced Guardrail, Rub Rail, Deep Posts etc…)

Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:



NOTES:

1. GENERAL: Install the Low-Speed Guardrail configuration where indicated in the plans. Low-Speed Guardrail may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels for normal spans, and use 9'-4½" Panels for end connections to adjoining segments as shown. A single 6'-3" Panel may be used at the end of the Low-Speed Guardrail run along with a single reduced 6'-3" post spacing to meet the nominal Begin/End Guardrail Sta. required.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the Plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

   Lap the Panels with the Splice Ridge oriented downstream of the final Direction of Traffic in the nearest traffic lane. Orienting Lap Splices for Temporary Traffic Control phasing is not required.

3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

4. W-BEAM PANEL DETAILS: See Sheet 4.

5. POST & OFFSET BLOCK DETAILS: See Sheet 5.

6. GUARDRAIL SECTIONS: For Sections showing typical mounting heights, grading, and lateral offsets in relation to adjacent roadway features, see Sheet 6.

7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The Low-Speed Guardrail shown provides the base configuration, including Post Spacing and Splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

LOW-SPEED, TL-2 GUARDRAIL DETAILS

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 3 of 22

- ***All New!***
- Double the post spacing
- Half the posts for cost savings (where applicable)
- Permitted for design speeds 45 MPH and Less (TL-2)
- Use only for flush shoulder conditions (no raised curbs)

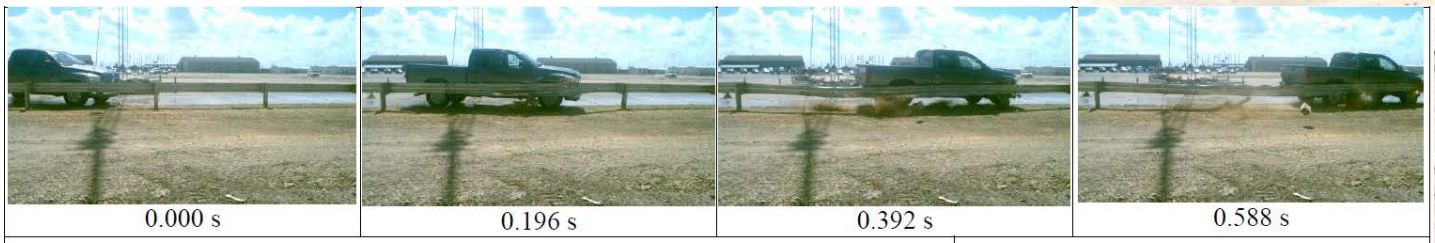
Design Standards Index 400, Sheet 3

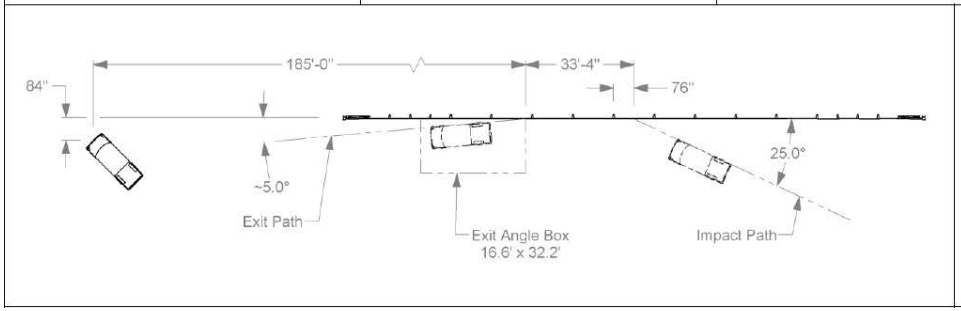
Low-Speed, TL-2 Guardrail Details:

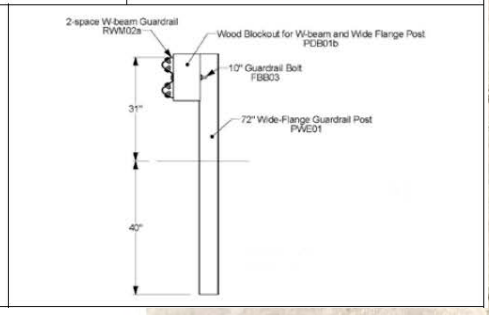
- ***All New!***
- Double the post spacing
- Half the posts for cost savings (where applicable)
- Permitted for design speeds 45 MPH and Less (TL-2)
- Use only for flush shoulder conditions (no raised curbs)

Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:

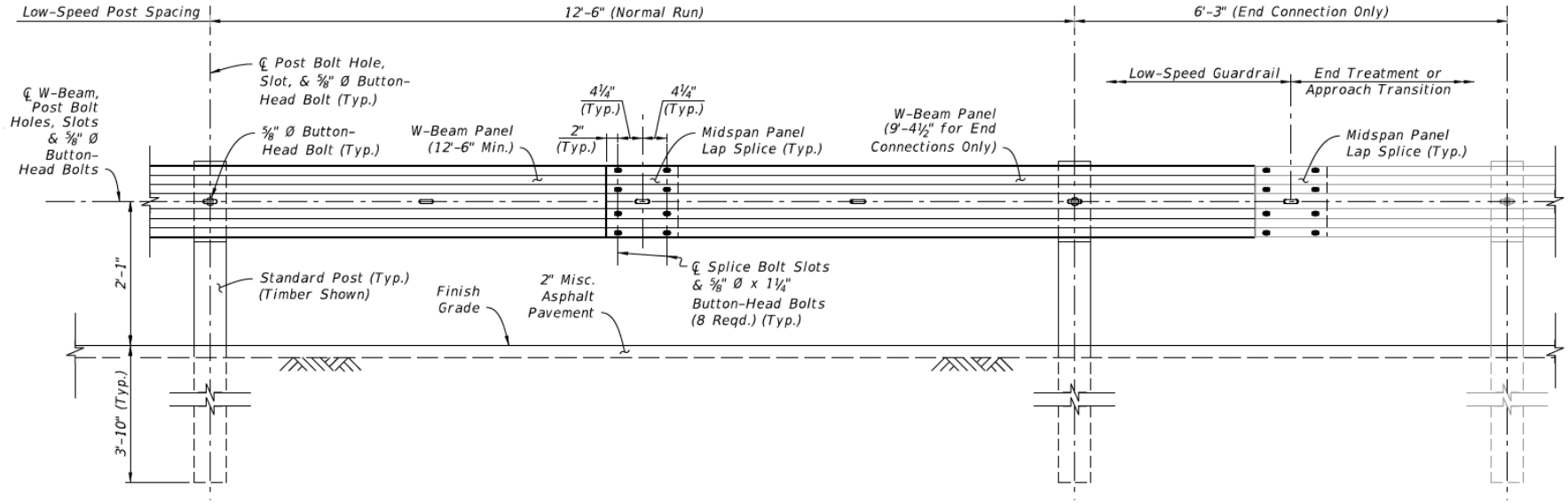






Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:



LOW-SPEED GUARDRAIL
INSTALLED ELEVATION

Low-Speed, TL-2 Guardrail is the same as *General Guardrail*, ***except***:

- **12'-6" Post Spacing**
- **Run ends with a 9'-4½ " Panel** to transition to other segment types (with 6'-3" span and midspan splice)

Design Standards Index 400, Sheet 3

Low-Speed, TL-2 Guardrail Details:

NOTES:

1. GENERAL: Install the Low-Speed Guardrail configuration where indicated in the plans. Low-Speed Guardrail may include tapered segments if called for in the plans.

   Use 12'-6" or longer W-Beam Panels for normal spans, and use 9'-4½" Panels for end connections to adjoining segments as shown. A single 6'-3" Panel may be used at the end of the Low-Speed Guardrail run along with a single reduced 6'-3" post spacing to meet the nominal Begin/End Guardrail Sta. required.

   Where a differing guardrail configuration is required for constructability beyond the options shown in this Index or the Plans, obtain approval from the Engineer prior to installation.

2. MIDSPAN PANEL LAP SPLICE: For proper structural function, place all Lap Splices at midspan unless otherwise indicated.

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3. CONNECTION DETAILS: Connections to End Treatments, Approach Transitions, or other segment types are defined in the following Index Sheets, APL Drawings, or the plans.

4. W-BEAM PANEL DETAILS: See Sheet 4.

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7. MODIFIED MOUNTS: Where concrete structures, concrete sidewalk, or shallow depth conditions are encountered, see Sheet 21 for additional post mounting options.

8. DEFINED SEGMENTS: The Low-Speed Guardrail shown provides the base configuration, including Post Spacing and Splice locations, for Defined Segment modifications where indicated in the plans and using the Guardrail Types, Sections, and/or hardware as shown in this Index (e.g. Double Faced W-Beam, Modified Thrie-Beam, Deep Posts at Slope Breaks, Pipe Rail, Rub Rail, or Reduced Post Spacing for Hazards).

NOTES Highlights:

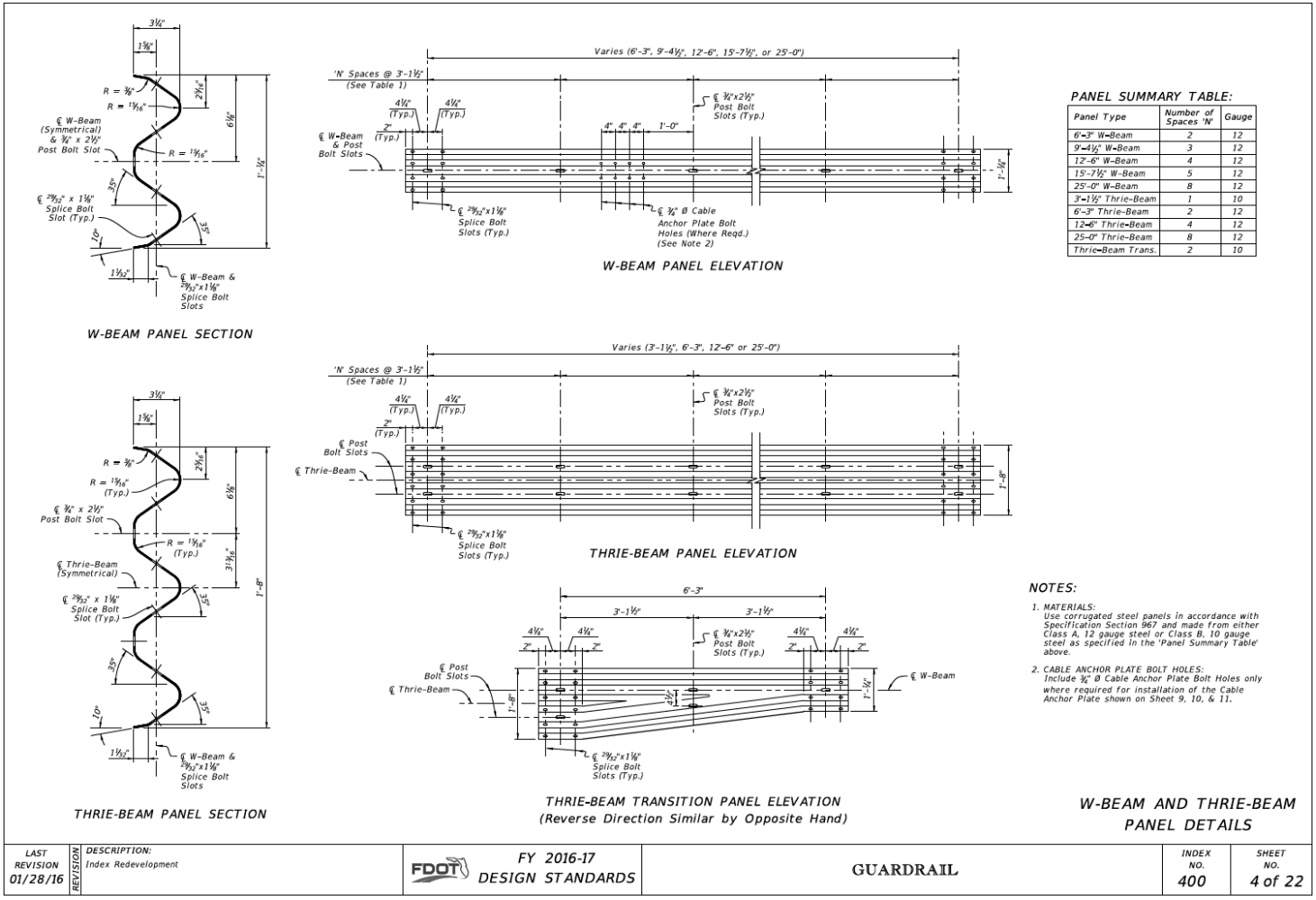
1. Contractors must use 12'-6" or longer Panels with a 12'-6" Post spacing, but they may use a 6'-3" Panel and Post spacing only at the end of the run to meet the Plans station callouts...

**Designers can place this segment to the nearest 6'-3" Panel length, measured along CL of guardrail panels (Similar to General Guardrail).*

Remaining Notes are similar to previously discussed General Guardrail

Design Standards Index 400, Sheet 4

W-Beam and Thrie-Beam Panel Details:



Panel Type	Number of Spaces 'N'	Gauge
6'-3" W-Beam	2	12
9'-4½" W-Beam	3	12
12'-6" W-Beam	4	12
15'-7½" W-Beam	5	12
25'-0" W-Beam	8	12
3'-1½" Thrie-Beam	1	10
6'-3" Thrie-Beam	2	12
12'-6" Thrie-Beam	4	12
25'-0" Thrie-Beam	8	12
Thrie-Beam Trans.	2	10

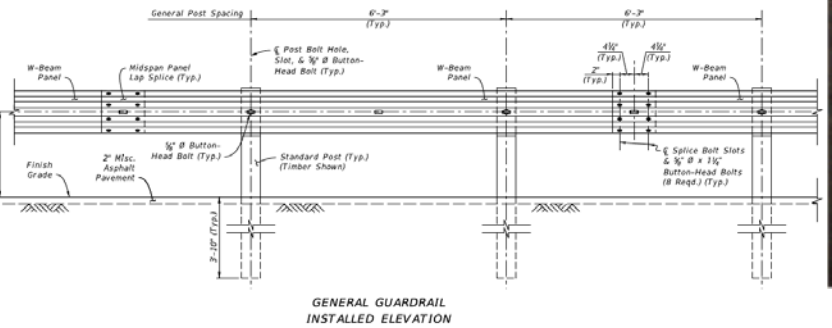
- Panel Options Shown on single Sheet
- Panels are used in General and Low-Speed Guardrail, Approach Transitions, End Treatments Etc…

Design Standards Index 400, Sheet 4

W-Beam and Thrie-Beam Panel Details:

Traditional Panel Jargon:

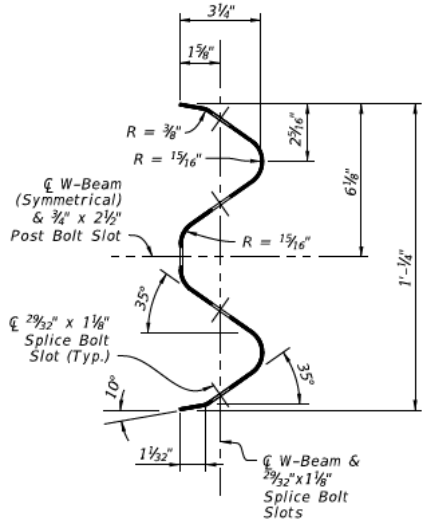
- Double Panel = 25’-0”
- Full Panel = 12’-6”
- Half Panel = 6’-3”
- Quarter Panel = 3’-1½”



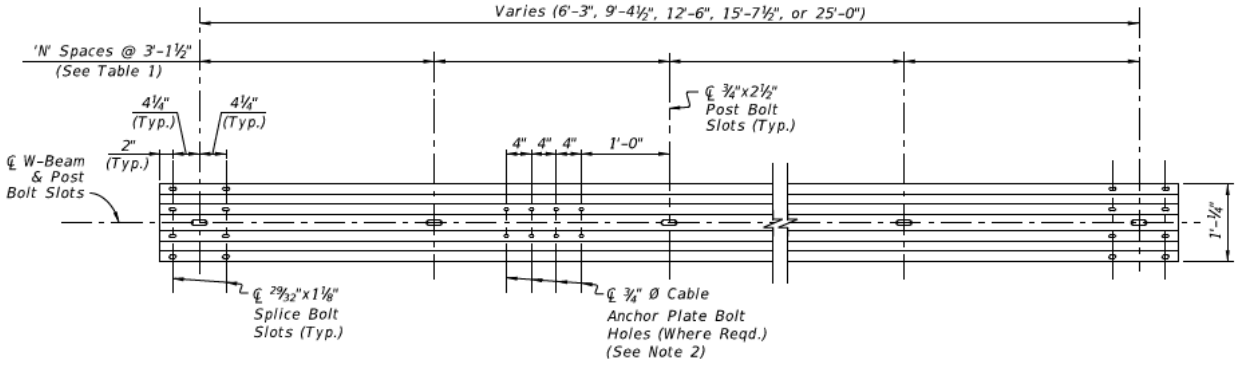
GENERAL GUARDRAIL INSTALLED ELEVATION

Design Standards Index 400, Sheet 4

W-Beam and Thrie-Beam Panel Details:



W-BEAM PANEL SECTION



W-BEAM PANEL ELEVATION

More Flexibility Provided for Contractors:

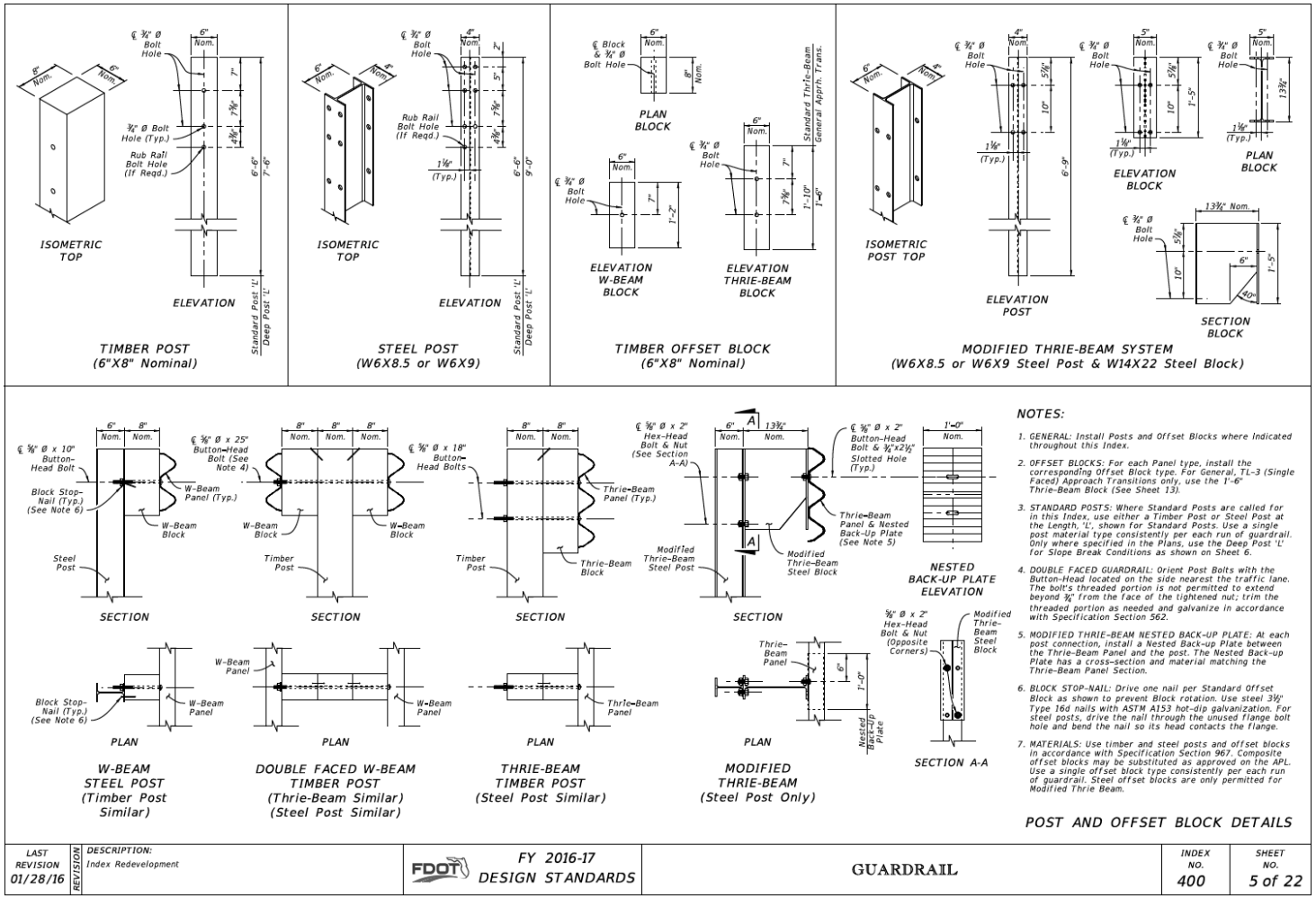
- ***6'-3" Panel*** *may be used at end of run to meet new guardrail length tolerance of ± 3'-1½" (Spec. 536)*
- ***9'-4½" or 15'-7½" Panels*** *may be used to transition to midspan panel lap splices (for connecting to existing older guardrail with splices at post location)*
- ***25'-0" Panels*** *may now be used to reduce the number of splice bolt installations required by half*

PANEL SUMMARY TABLE:

Panel Type	Number of Spaces 'N'	Gauge
6'-3" W-Beam	2	12
9'-4½" W-Beam	3	12
12'-6" W-Beam	4	12
15'-7½" W-Beam	5	12
25'-0" W-Beam	8	12
3'-1½" Thrie-Beam	1	10
6'-3" Thrie-Beam	2	12
12-6" Thrie-Beam	4	12
25-0" Thrie-Beam	8	12
Thrie-Beam Trans.	2	10

Design Standards Index 400, Sheet 5

Post and Offset Block Details:



- Covers all Options for Post and Offset Block Configurations
- New "Consolidated" Steel Post type
- New variations of Post length and offset block height are given

Design Standards Index 400, Sheet 5

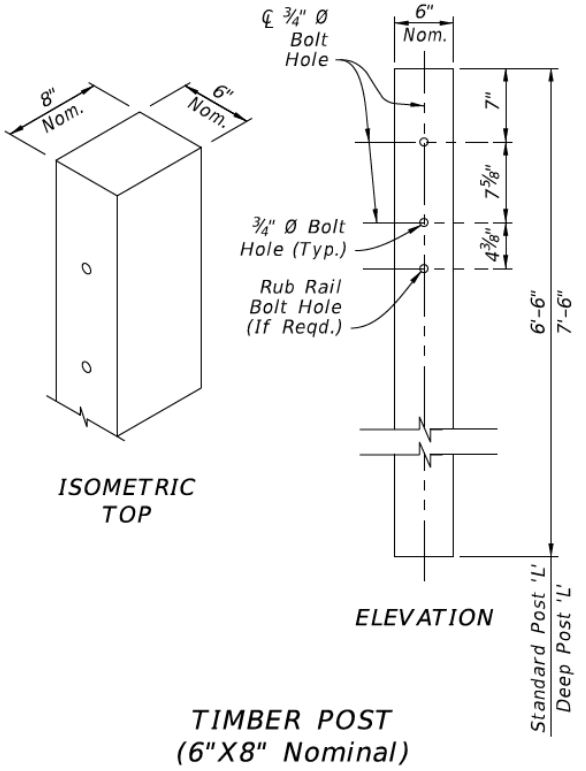
Post and Offset Block Details:

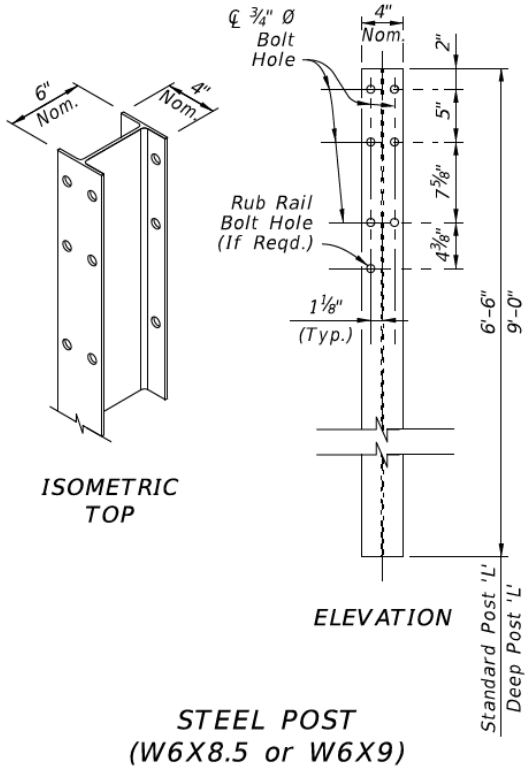
Offset Block Dimension is 6” x 8” Nominal (5.5” x 7.5” Actual)

7.5” is the offset dimension

Design Standards Index 400, Sheet 5

Post Details:



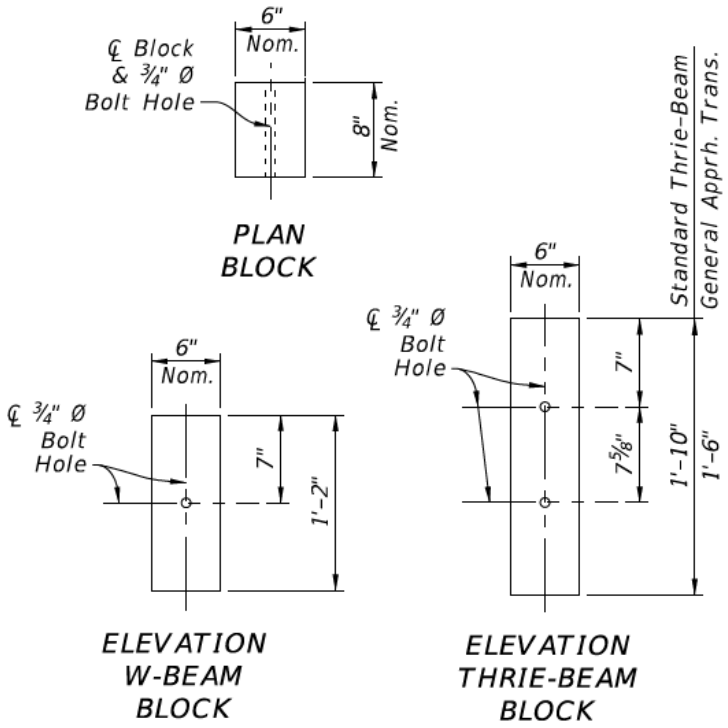


- **2 Post Lengths** (Depths)
  - *Standard 'L'*
  - *Deep Post 'L'*
- ***Standard Post 'L'*** is default for General and Low-Speed Guardrail, End Treatments, Approach Transitions Etc..
- ***Deep Post 'L'*** may be used only for "Slope Break Condition" where Designer calls for it in Plans (we'll cover requirements later)

↑ ***NEW!*** **Consolidated Steel Post Type:** Its universal bolt hole placement now handles, W-Beam, Thrie-Beam, and Pipe Rail (contractors can stockpile)

Design Standards Index 400, Sheet 5

Offset Block Details:

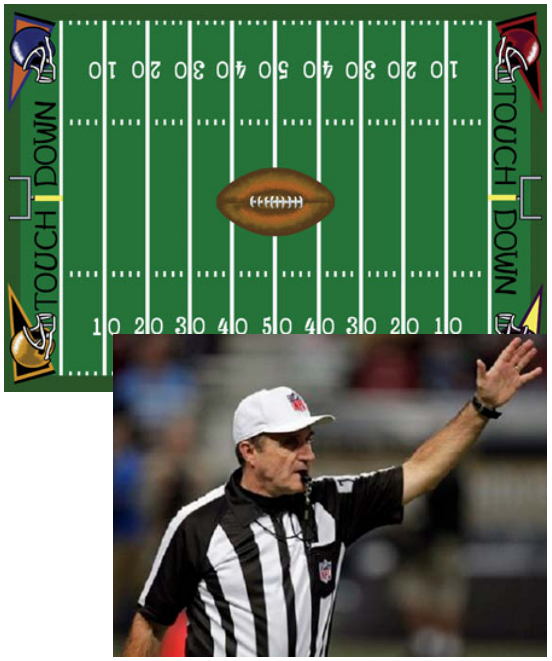


TIMBER OFFSET BLOCK
(6"X8" Nominal)

- Timber Blocks are the Standard
- Steel Blocks are Not Permitted (Except for Modified Thrie-Beam)
- APL *Composite Offset Blocks* may be substituted for timber
- Thrie-Beam Offset Block now has 2 height versions
  - Standard Thrie-Beam height (default)
  - General Approach Transition Connection height (only where shown later in Standard)
    - Per MASH crash testing

Design Standards Index 400, Q1 Review!

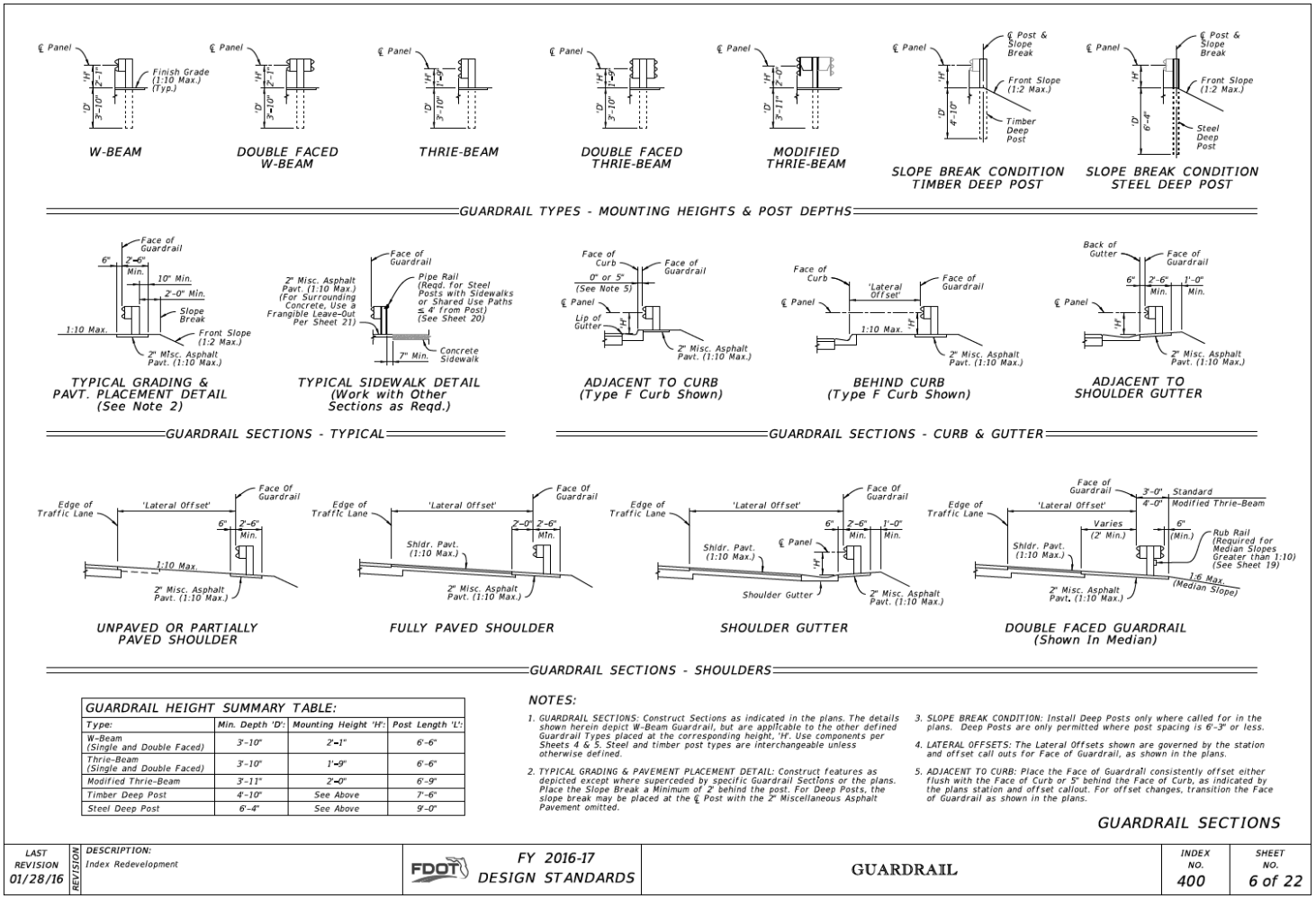
End of 1st Quarter Review Questions!



1. What is the Post Spacing of TL-2, Low-Speed Guardrail?
2. At what Design Speed is TL-2 Guardrail Permitted?
3. What Length Panel must contractors use at the end of a TL-2 Low-Speed Guardrail run? Why?
4. At what length increment must designers plan a General or Low-Speed Guardrail run? (excluding Approach Transitions and End Treatments)
5. When else would a contractor use 9’-4½” or 15’-7½” Panels?
6. What is the “offset” length dimension of a Standard Offset Block?”

Design Standards Index 400, Sheet 6

Guardrail Sections:



Summary:

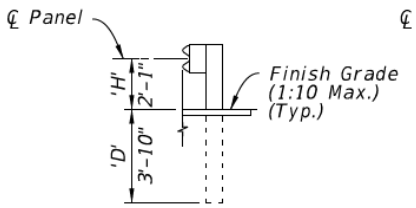
- Guardrail Heights & Depths
- Adjacent Grading (a.k.a. Slopes)
- 2” Misc. Asphalt Mow Strip
- Concrete Sidewalk
- Curb Conditions
- Shoulder Gutter
- Rub Rail

Design Standards Index 400, Sheet 6

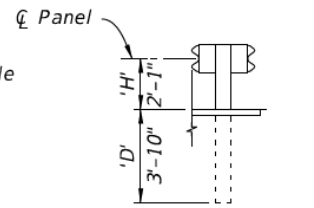
Guardrail Sections:

Types of Guardrail:

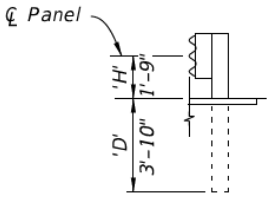
- The **Heights, 'H',** and **Depths, 'D',** are used later in Standard drawings where any of the below guardrail types may be used.



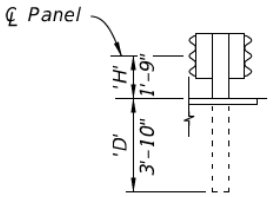
W-BEAM



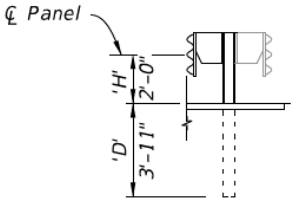
DOUBLE FACED W-BEAM



THRIE-BEAM



DOUBLE FACED THRIE-BEAM



MODIFIED THRIE-BEAM

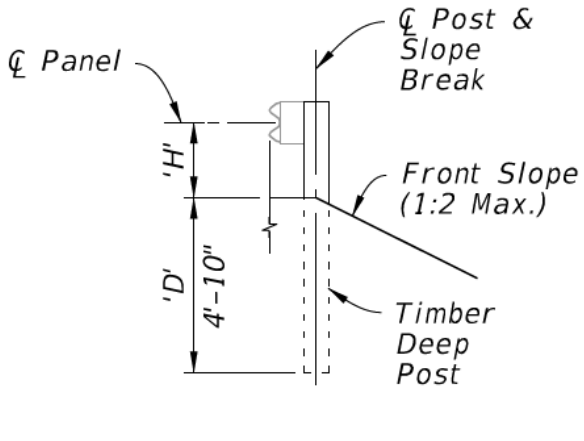
NOTE: Grading at base of post established at 1:10 Max. slope (1:10 or flatter)

Design Standards Index 400, Sheet 6

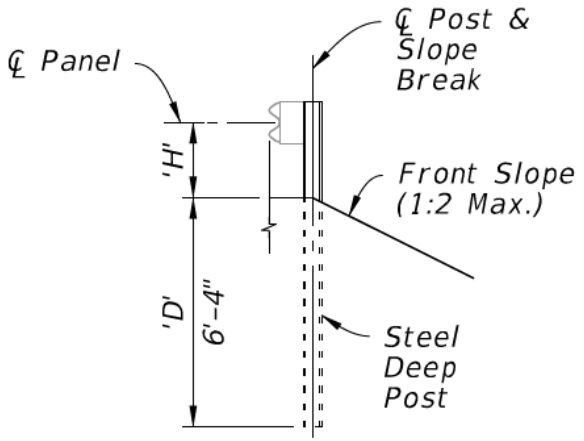
Guardrail Sections:

Slope Break Condition, "Deep Posts" *NEW!*

- **Contractor may only use Deep Posts where called for in the Plans.**



SLOPE BREAK CONDITION
TIMBER DEEP POST



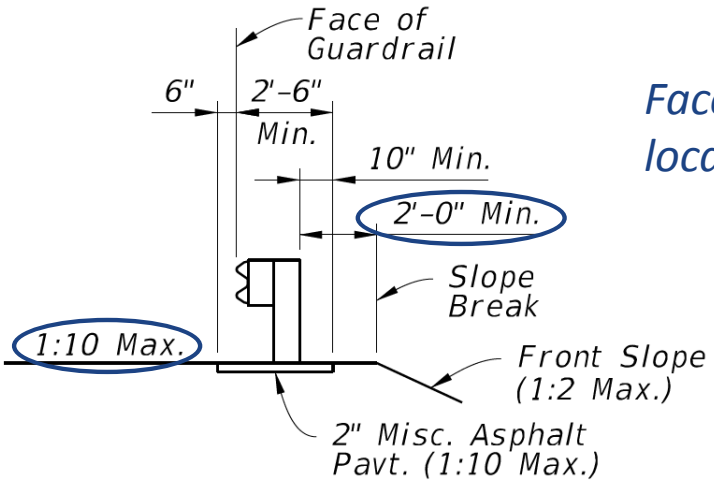
SLOPE BREAK CONDITION
STEEL DEEP POST

PPM 4.4.6.2 "With approval of the District Design Engineer and where right-of-way is restricted (i.e. constrained condition), the Deep Post guardrail option, as detailed in Design Standards, Index 400 Slope Break Condition, may be used in lieu of providing a 2 ft. setback to the slope break point. Coordinate the use of the Deep Post guardrail option with the District Drainage Engineer and District Maintenance Engineer."

Design Standards Index 400, Sheet 6

Guardrail Sections:

Typical Grading and Pavement Placement Detail



TYPICAL GRADING & PAVT. PLACEMENT DETAIL (See Note 2)

Face of Guardrail is always the location callout in Plans

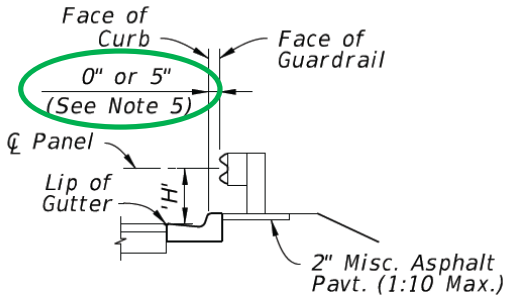
This Provides basic dimensions that may then be superseded by specific differences of other Standard Guardrail Sections.

(e.g. curbed or shoulder gutter sections)

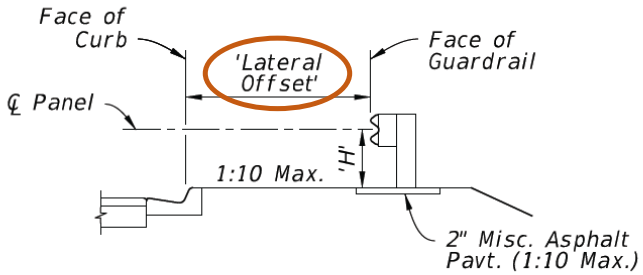
Design Standards Index 400, Sheet 6

Guardrail Sections:

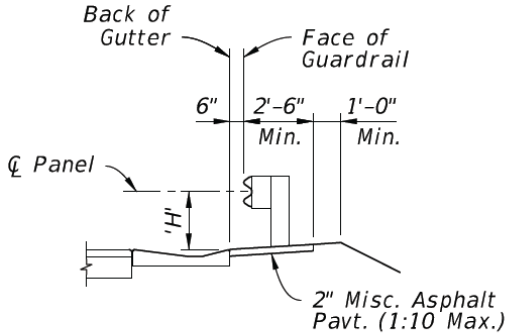
Curb and Gutter Sections



ADJACENT TO CURB
(Type F Curb Shown)



BEHIND CURB
(Type F Curb Shown)



ADJACENT TO
SHOULDER GUTTER

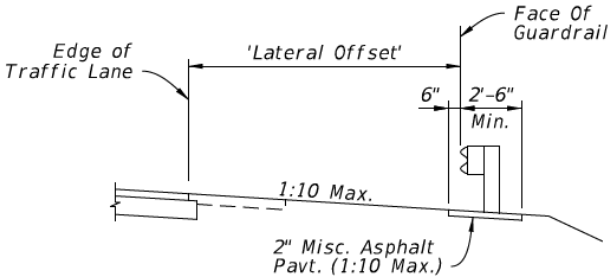
GUARDRAIL SECTIONS - CURB & GUTTER

- Notice where Height, 'H', is measured up from in each scenario
- ***NEW!*** Guardrail placed 'Adjacent to Curb' may now be placed at either *0" or 5"* from Face of curb, defined per the Plans.
  (5" preferred to avoid nuisance hits, such as rearview mirrors)
- Lateral Offsets are defined per the Plans.
  *See PPM Section 2.3 "Shoulders" & Figure 4.4.12 "Offset to Guardrail"

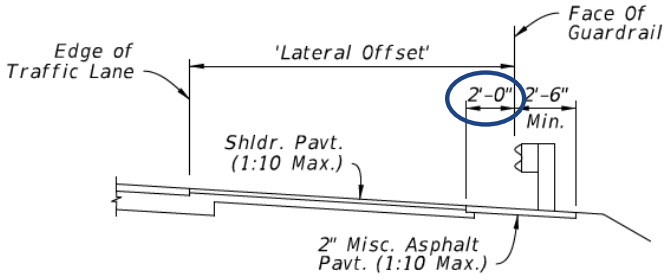
Design Standards Index 400, Sheet 6

Guardrail Sections:

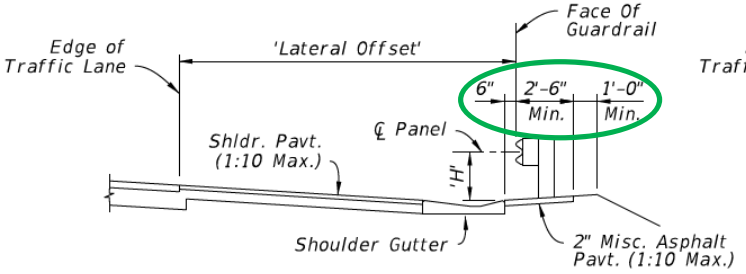
With Shoulder



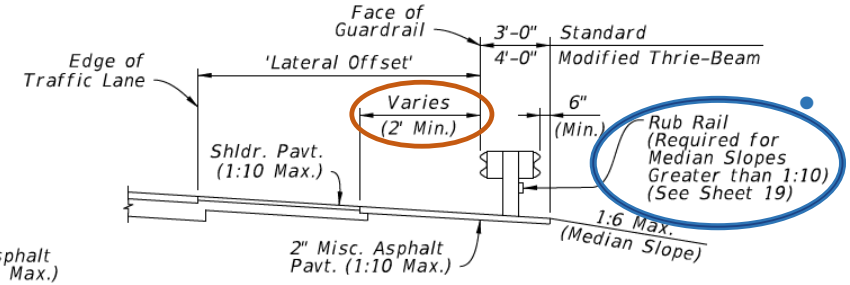
UNPAVED OR PARTIALLY PAVED SHOULDER



FULLY PAVED SHOULDER



SHOULDER GUTTER



DOUBLE FACED GUARDRAIL (Shown In Median)

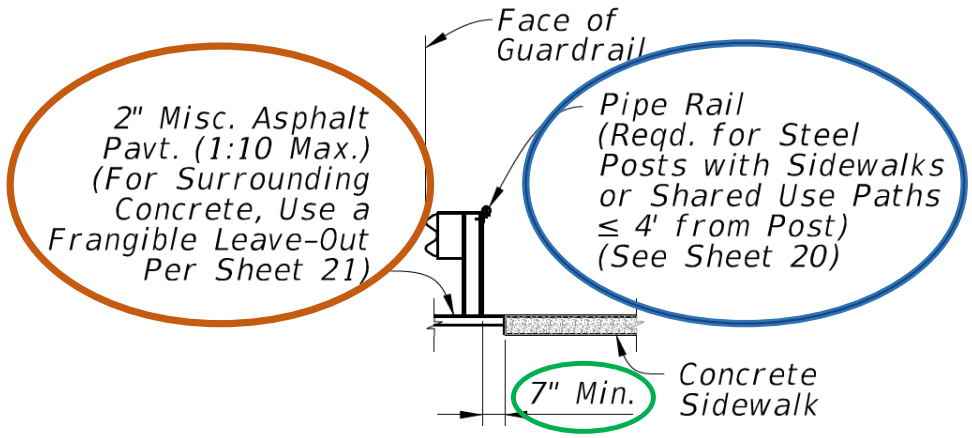
- 2'-0" misc. asphalt to paved Shoulder Connection (supersedes typical)
- Configuration for Drainage, Matches PPM Table 2.3
- "Varies" for 'Crossover' Taper, Bridge Approach Layout
- Rub Rail is now only permitted for median side, slopes between 1:6 & 1:10

Design Standards Index 400, Sheet 6

Guardrail Sections:

Concrete is not permitted around base of post. A low strength "frangible" material must be used (either misc. asphalt of flowable fill)

Concrete Sidewalk *NEW!*



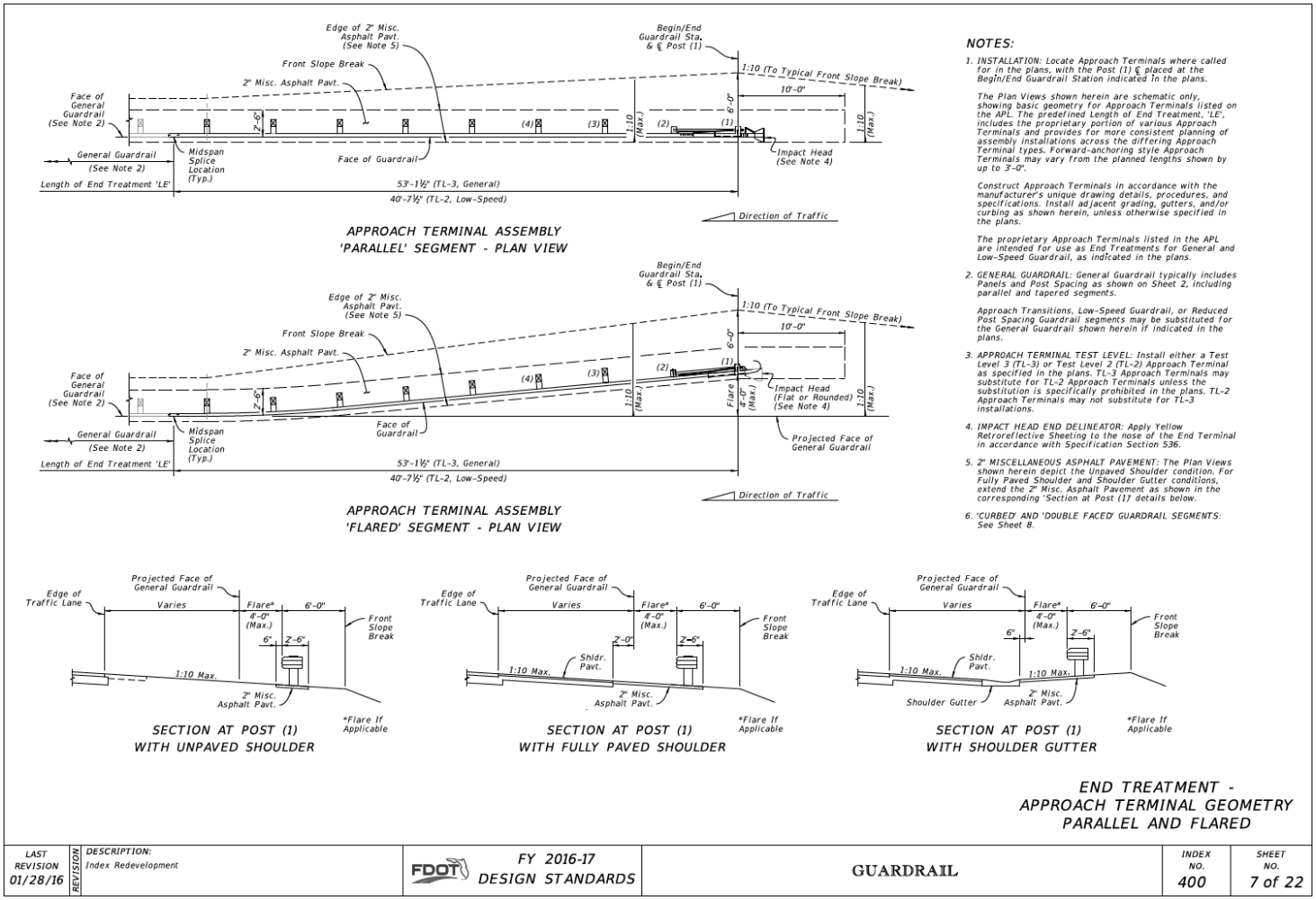
TYPICAL SIDEWALK DETAIL
(Work with Other Sections as Reqd.)

- 7" Clearance is required from the back of post to the rigid concrete to facilitate proper rotation of posts upon vehicle impact
- If 2" Misc. Concrete Can't be placed at post location due to surrounding concrete, use the **"Frangible Leave-Out"** (defined later in the Index)
- When the back of steel posts will be within 4' of a Sidewalk or Shared Use Path, Pipe Rail must be used for pedestrian safety.

  NOTE: requires defining Begin/End Stations and length in the Plans

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Parallel and Flared:



- Shows basic geometry and grading requirements for APL *Approach Terminals*
- Provides pre-defined Lengths 'LE' that will accommodate all APL Terminals (for simpler Plans design)

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Parallel and Flared:

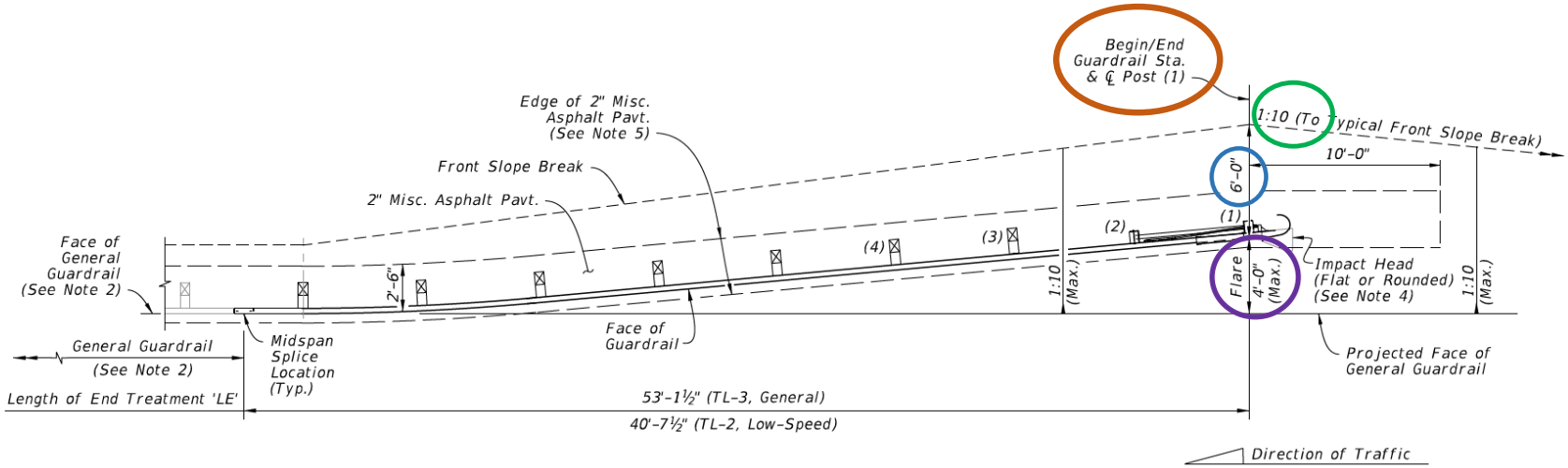
"Soft Stop"

"SKT"

- Shows basic geometry and grading requirements for APL *Approach Terminals*
- Provides pre-defined Lengths 'LE' that will accommodate all APL Terminals (for simpler Plans design)

Design Standards Index 400, Sheet 7

Approach Terminal Geometry, Flared:

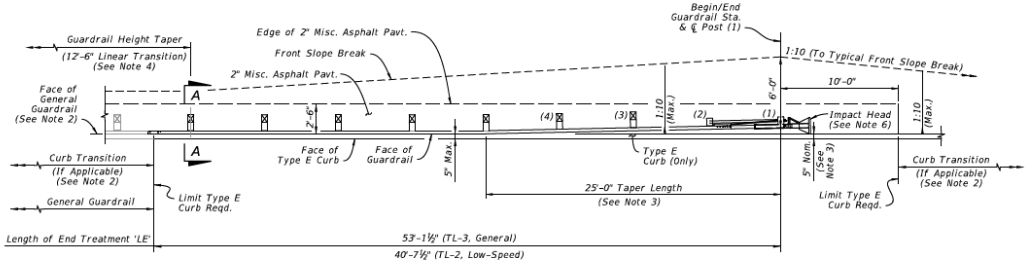


APPROACH TERMINAL ASSEMBLY
'FLARED' SEGMENT - PLAN VIEW

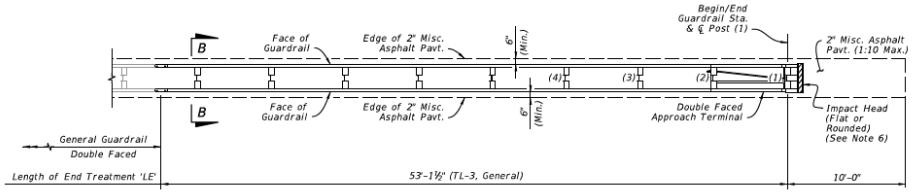
- **Begin/End Guardrail Station** called out – Corresponds to Roadway Plans callout (Plans station & offset given at Face of Guardrail) – *Length of guardrail measured from here*
- Slope Break's Taper Rate back to Typical (Parallel) Slope Break has changed to **1:10** (previous Standard showed 1:15)
- Offset to Slope Break has changed to 6'-0" from face of guardrail (previous Standard showed 3'-0" from back of assembly)
- Maximum flare is still 4'-0", measured at post(1). This might be important for later!

Design Standards Index 400, Sheet 8

Approach Terminal Geometry, Curbed and Double Faced:



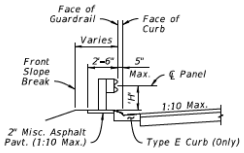
APPROACH TERMINAL ASSEMBLY
'CURBED' SEGMENT - PLAN VIEW



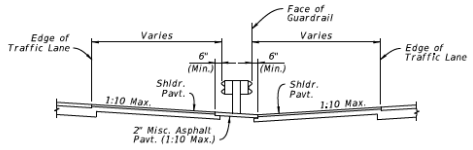
APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW

NOTES:

1. GENERAL: See Notes 1 through 3 on Sheet 7.
2. CURBED SEGMENTS: Type E curb is required within the limits shown. When a different curb type is called for outside of the Type E curb limits, transition the curb shape linearly, over a nominal distance ranging 5'-0" to 10'-0"
3. TAPER LENGTH: For Curbed Segments, taper the guardrail away from the roadway where shown to place the inside edge of the Impact Head at 5" behind the face of the curb. Where additional lateral offset is required to fit the Approach Terminal Assembly hardware, such as a soil plate, place the Impact Head as close to the curb as the hardware allows, not to exceed 2'-0" from the face of curb.
4. GUARDRAIL HEIGHT TAPER: For Curbed Segments, the connecting General Guardrail Mounting Height, 'H', is typically measured from the Lip of Gutter (See Sheet 6 Guardrail Sections, 'Adjacent to Curb'), while the End Terminal Assembly 'H' is measured from the Misc. Asphalt Pavt. (See Section A-A). Linearly taper the difference in Mounting Height over a length of 12'-6", starting where indicated herein.
5. DOUBLE FACED SEGMENT: Connect to Double Faced General Guardrail. Use consistent Posts and Offset Block types as specified in the APL drawings over the entire Length of End Treatment, 'LE'. Posts and Offset Blocks in the adjoining General Guardrail segment may be different from those inside of the 'LE'. A change in post type between timber and steel is permitted, immediately outside of the 'LE' segment.
6. IMPACT HEAD END DELINEATOR: Apply Yellow Retroreflective Sheeting to the nose of the End Terminal in accordance with Specification Section 536.
7. SINGLE FACED 'PARALLEL' AND 'FLARED' SEGMENTS: See Sheet 7.



'CURBED' SECTION A-A
(Height, 'H', Measured from
Misc. Asphalt Pavt.)



'DOUBLE FACED' SECTION B-B
(1:10 Slope or Flatter Reqd.)

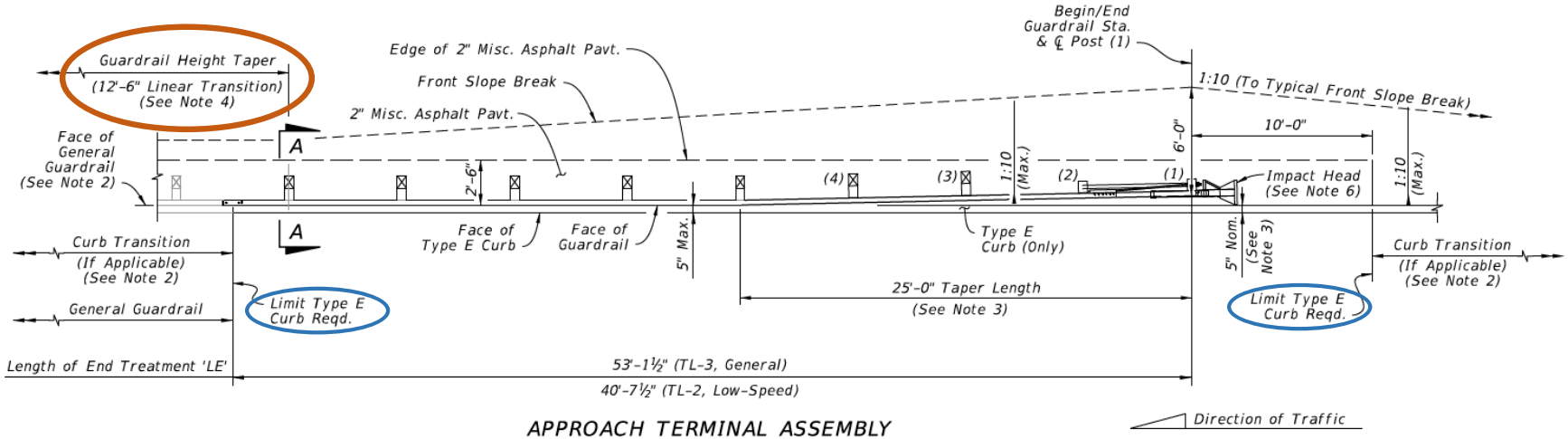
END TREATMENT -
APPROACH TERMINAL GEOMETRY
CURBED AND DOUBLE FACED

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 8 of 22

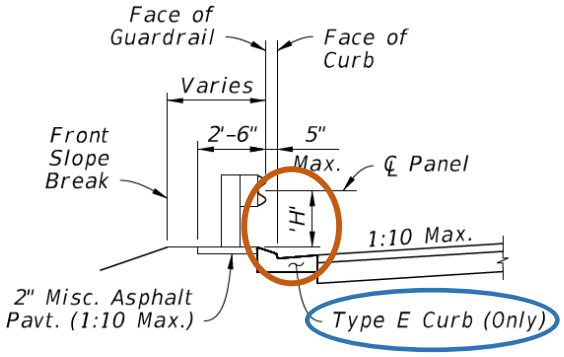
- Same idea as Sheet 7, but shows "Curbed" and "Double Faced" segments

Design Standards Index 400, Sheet 8

Approach Terminal Geometry, Curbed:



APPROACH TERMINAL ASSEMBLY
'CURBED' SEGMENT - PLAN VIEW



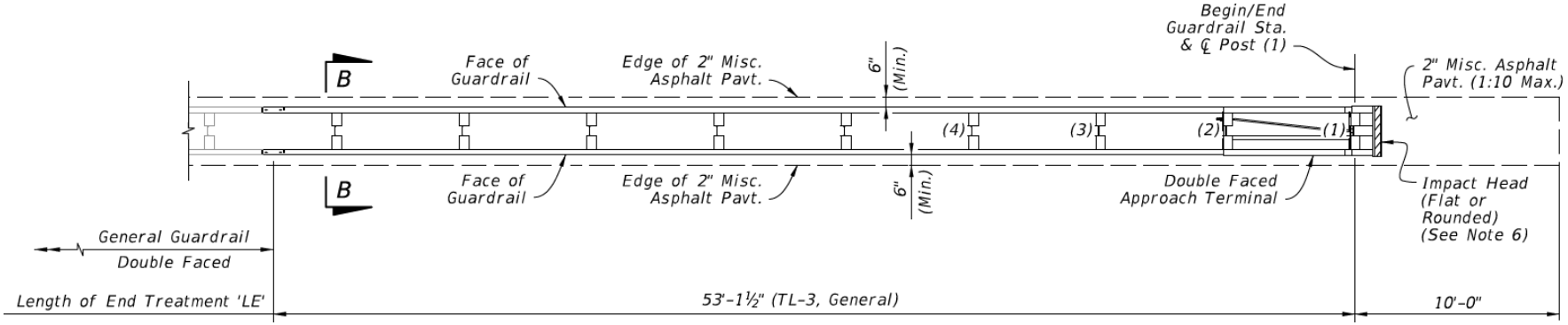
'CURBED' SECTION A-A
(Height, 'H', Measured from
Misc. Asphalt Pavt.)

- **Type 'E' Curb** Required where shown
  - 63'-1½ " for TL-3
  - 50'-7½" for TL-2

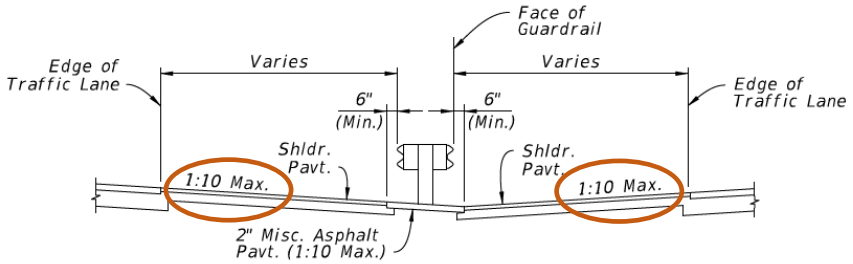
  Show and Label in Plans. Include in Summary of Curb & Gutter.
- **Guardrail Height, 'H',** is measured from the top of curb (not the lip of gutter) for Approach Terminals. This raises the height a bit.
  - Just FYI! *No Action needed from Roadway Designer.*

Design Standards Index 400, Sheet 8

Approach Terminal Geometry, Double Faced:



APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW

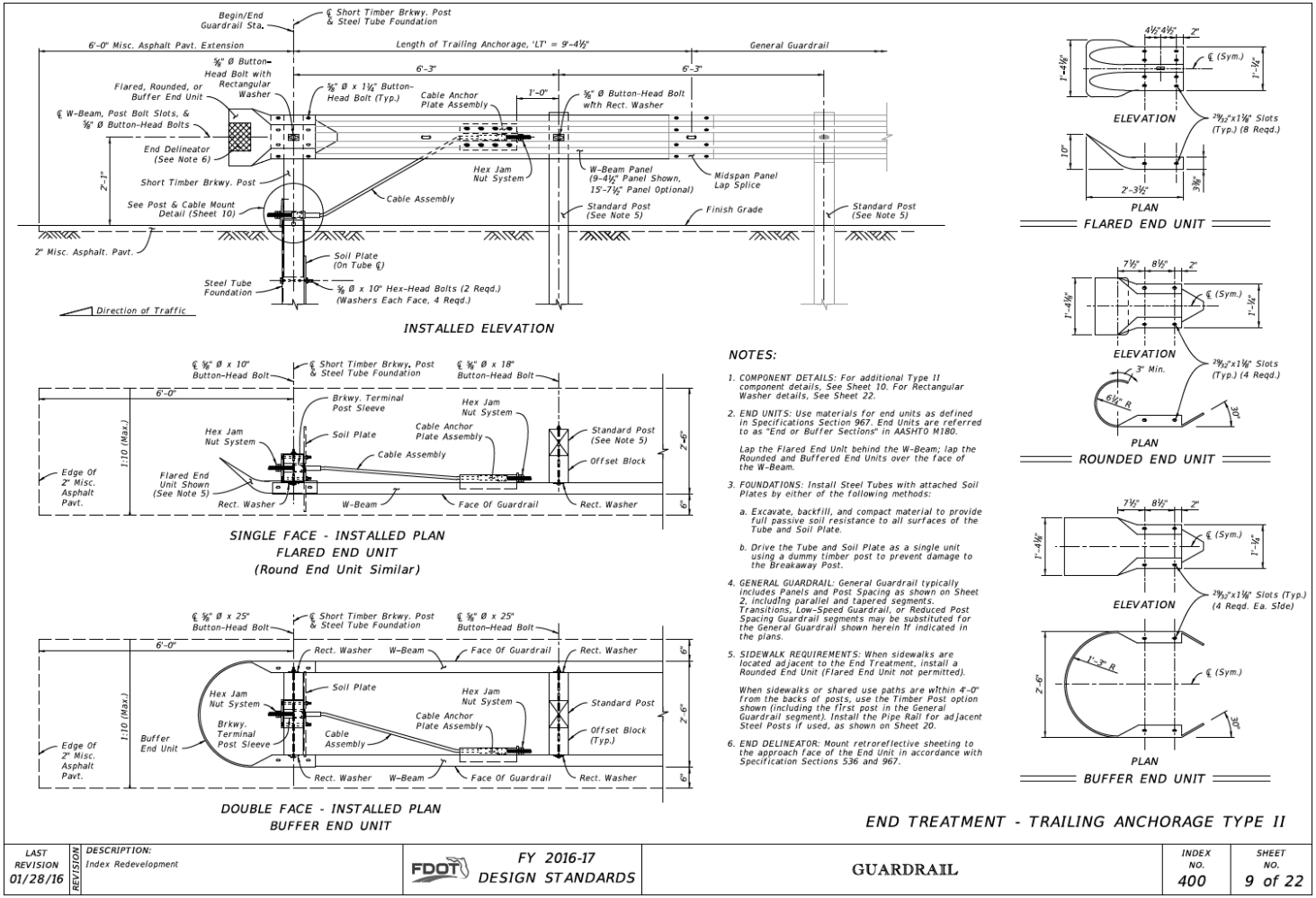


'DOUBLE FACED' SECTION B-B
(1:10 Slope or Flatter Reqd.)

- **'Double Faced'** option has always been available on the APL, but now it's shown in the Standard for better awareness.
  - Crash tested
  - Initial installation cost savings versus crash cushion
- **1:10 Max. cross slope** extends to Approach Terminal on *both sides.*
  - *Drainage structures may be required to convey median water*
  - *Outside of 'LE', transition longitudinally to typical median cross slope at 1:10 Max (in direction parallel to roadway).*

Design Standards Index 400, Sheet 9

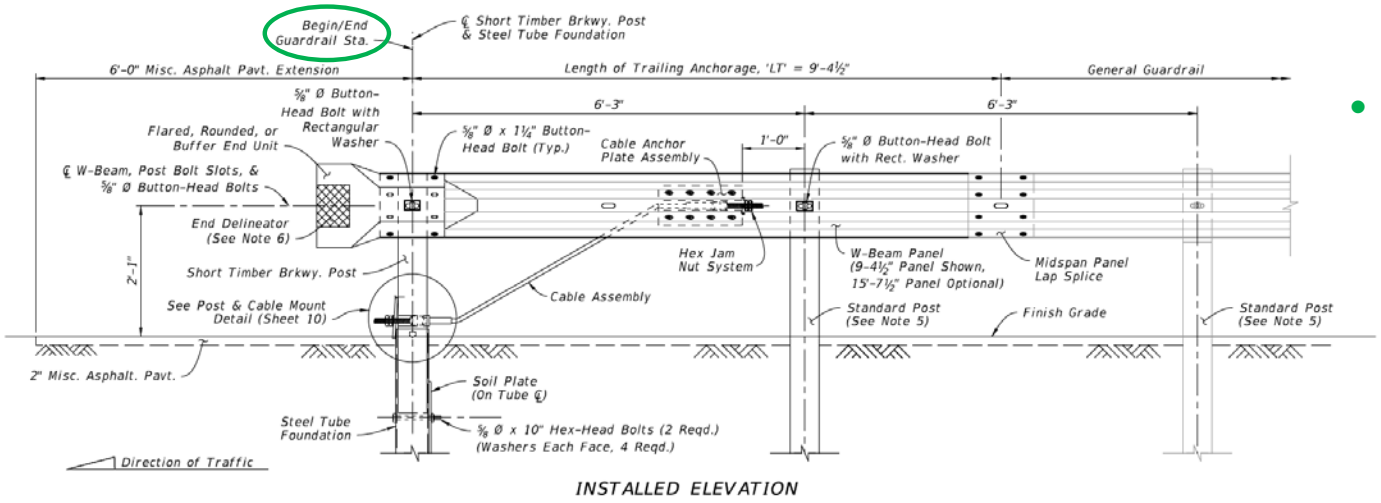
Trailing Anchorage - Type II:



- Apply to "*Trailing*" guardrail ends to "*Anchor*" the guardrail. (Not "head-on" crashworthy like Approach Terminals are)
- Nearly same as previous Standard, just drafted more clearly

Design Standards Index 400, Sheet 9

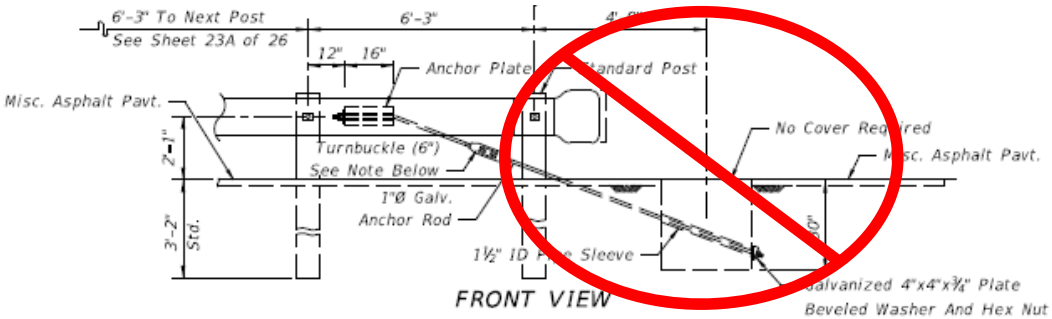
Trailing Anchorage - Type II:



INSTALLED ELEVATION

- Begin/End Guardrail Station called out – Corresponds to Roadway Plans callout (Stationing and Offset given at Face of Guardrail) – Length of guardrail measured from here

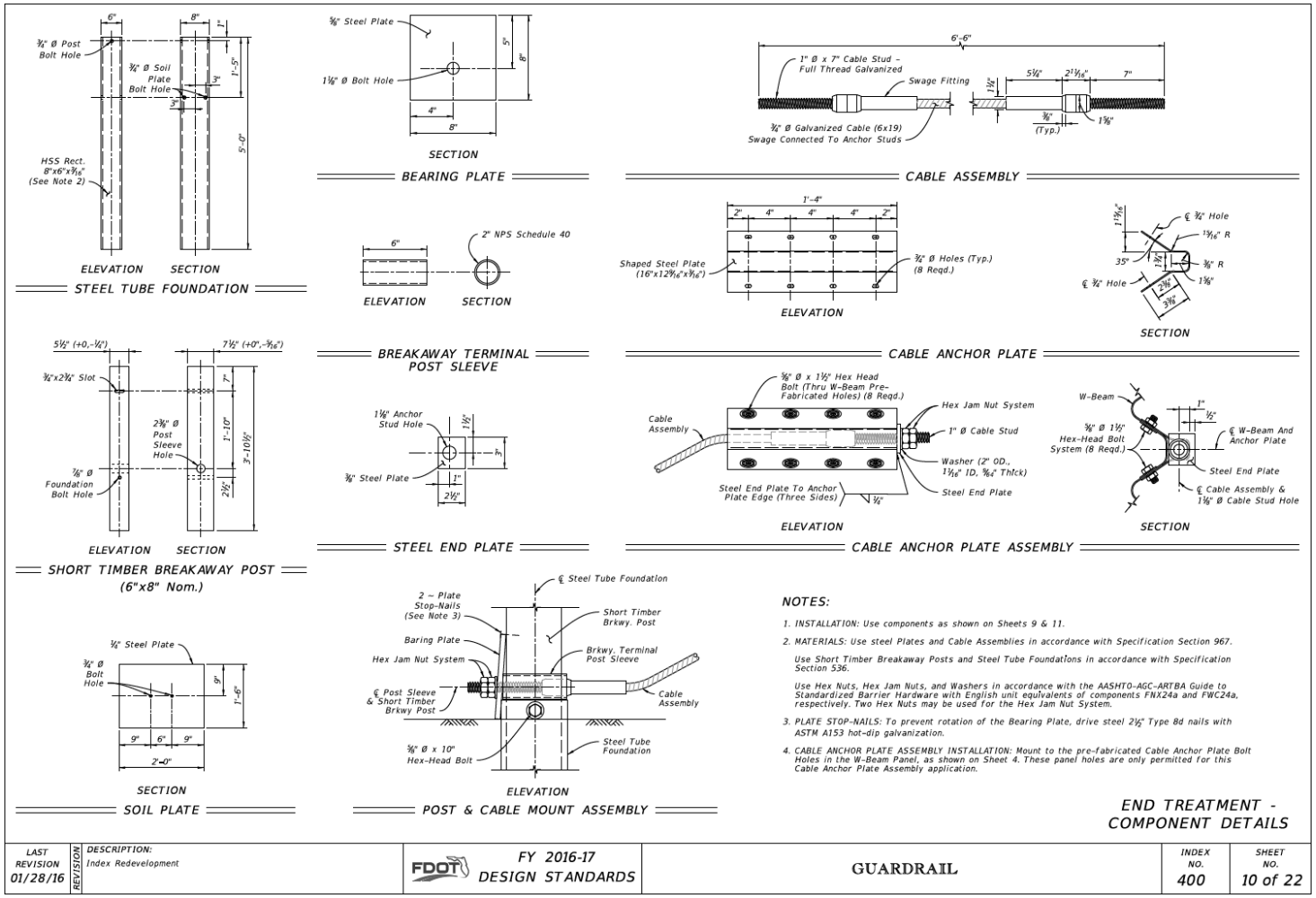
From Previous Standard…



Anchor Block Option Removed

Design Standards Index 400, Sheet 10

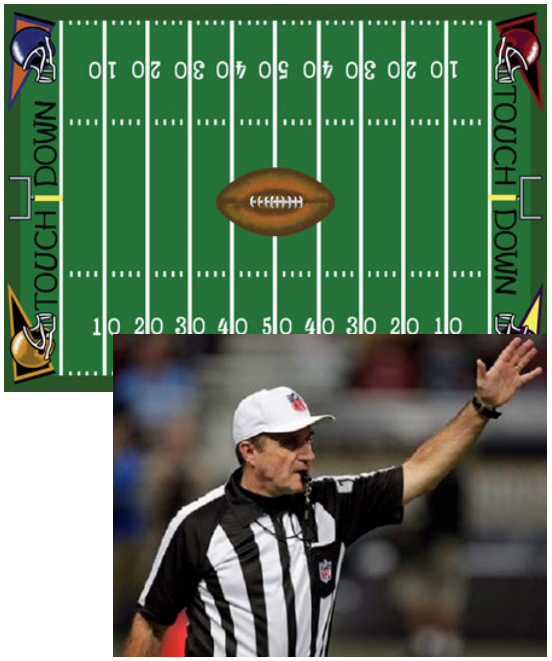
End Treatment Component Details:



- Component Details are used in Type II and CRT End Treatments (on the previous and following pages, respectively)
- Construction Stuff!

Design Standards Index 400, Q2 Review!

End of 2nd Quarter Review Questions!



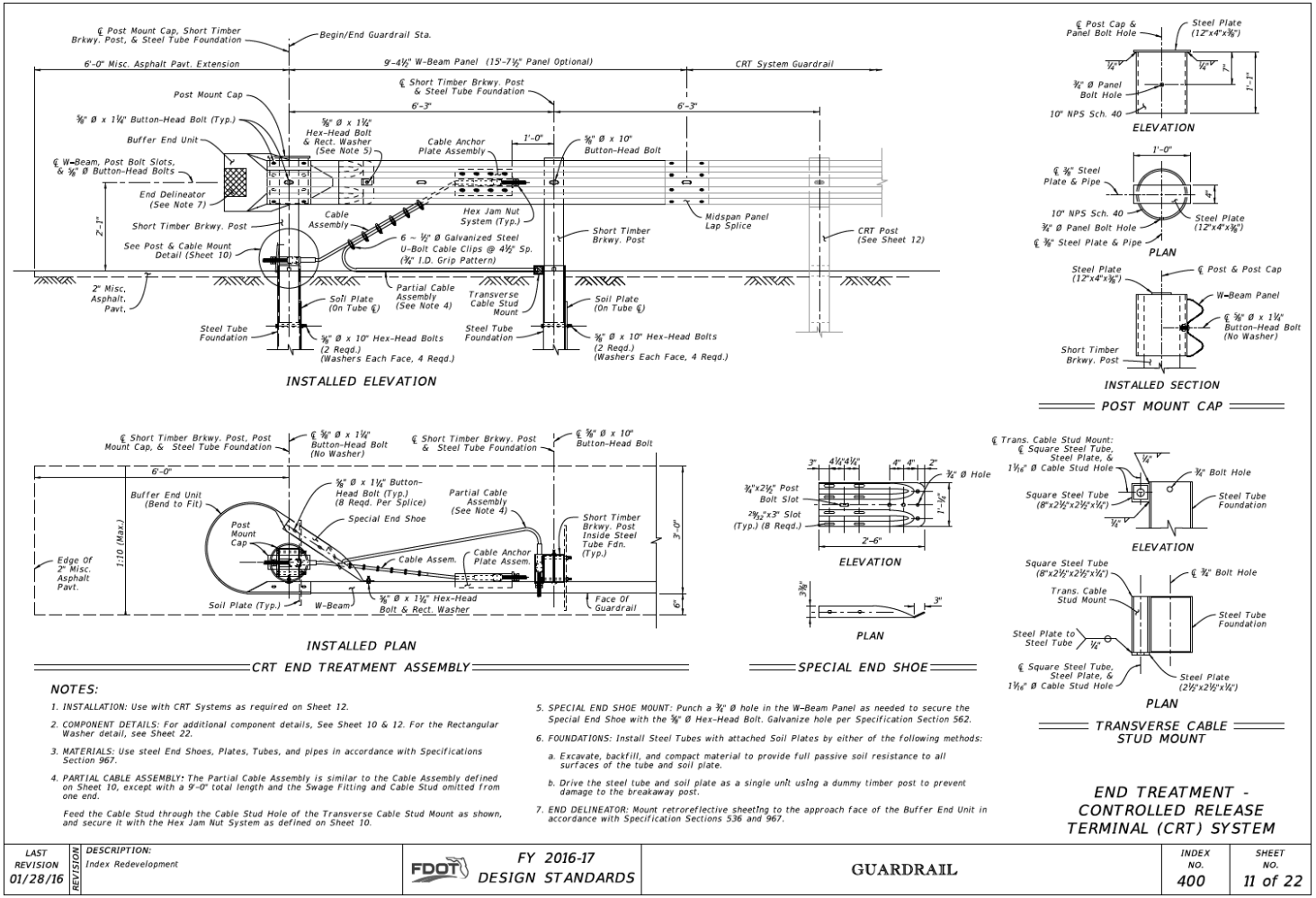
1. What is the minimum distance required from the back of post to the front slope break?
2. For Guardrail adjacent to curb, what's the distance between the face of Guardrail and the face of curb?
3. What is the maximum slope permitted for all approach grading to Guardrail or End Treatments?
4. For what "condition" are Deep Posts intended to be used?
5. To what distance, behind post(1) of an approach terminal, must the 1:10 slope be maintained?
6. What type of curb must be used in front of an Approach Terminal?
7. Where is the "Type II" End Treatment used?

MODULE 2: Index Overview – Sheets 11 thru 22

This Index 400 is a DSR, as of February 1, 2016

Design Standards Index 400, Sheet 11

End Treatment - Controlled Release Terminal (CRT) System:



NOTES:

1. INSTALLATION: Use with CRT Systems as required on Sheet 12.
2. COMPONENT DETAILS: For additional component details, See Sheet 10 & 12. For the Rectangular Washer detail, see Sheet 22.
3. MATERIALS: Use steel End Shoes, Plates, Tubes, and pipes in accordance with Specifications Section 967.
4. PARTIAL CABLE ASSEMBLY: The Partial Cable Assembly is similar to the Cable Assembly defined on Sheet 10, except with a 9'-0" total length and the Swage Fitting and Cable Stud omitted from one end.

   Feed the Cable Stud through the Cable Stud Hole of the Transverse Cable Stud Mount as shown, and secure it with the Hex Jam Nut System as defined on Sheet 10.
5. SPECIAL END SHOE MOUNT: Punch a ¾" Ø hole in the W-Beam Panel as needed to secure the Special End Shoe with the ⅝" Ø Hex-Head Bolt. Galvanize hole per Specification Section 562.
6. FOUNDATIONS: Install Steel Tubes with attached Soil Plates by either of the following methods:
   a. Excavate, backfill, and compact material to provide full passive soil resistance to all surfaces of the tube and soil plate.
   b. Drive the steel tube and soil plate as a single unit using a dummy timber post to prevent damage to the breakaway post.
7. END DELINEATOR: Mount retroreflective sheeting to the approach face of the Buffer End Unit in accordance with Specification Sections 536 and 967.

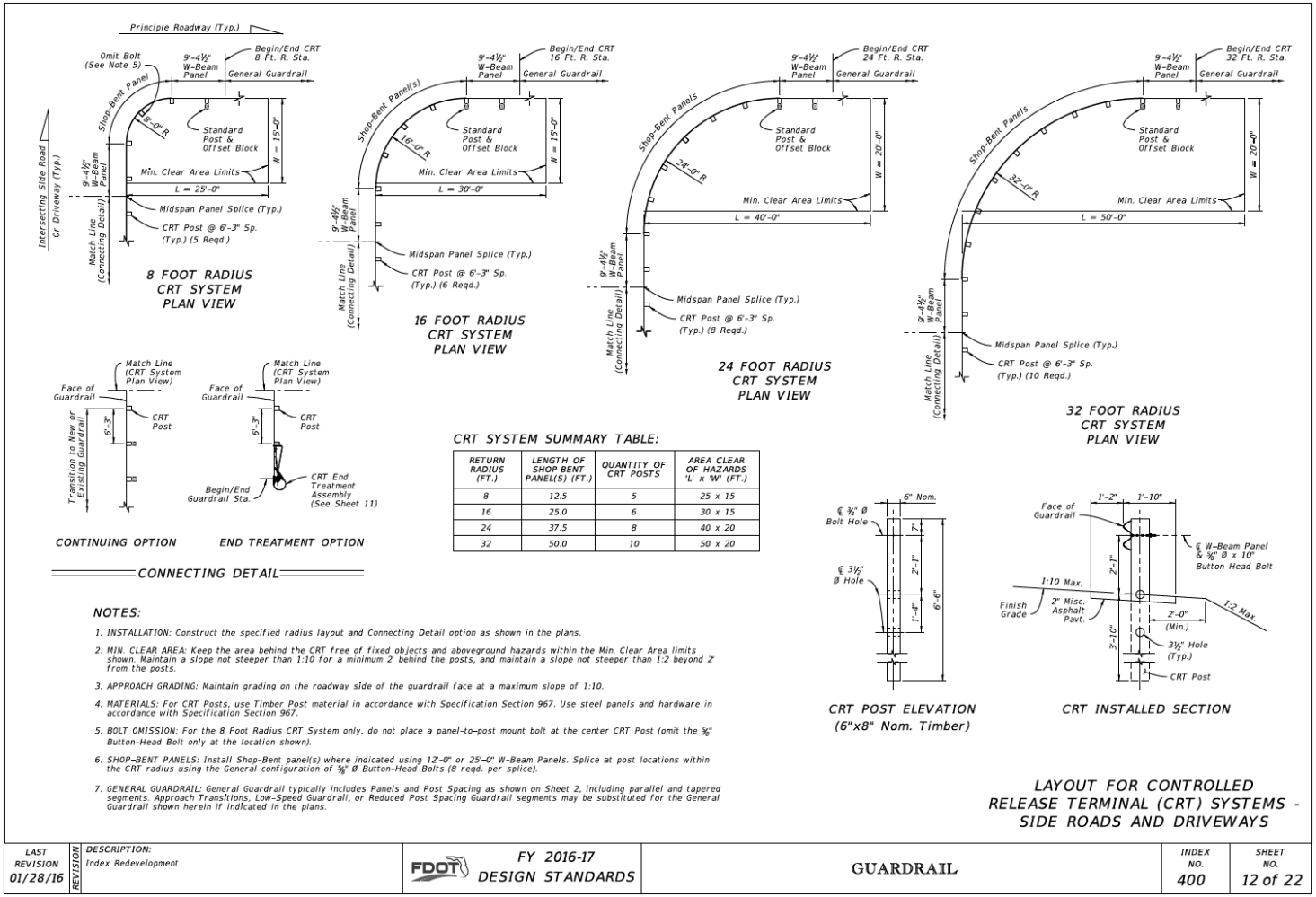
END TREATMENT - CONTROLLED RELEASE TERMINAL (CRT) SYSTEM

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 11 of 22

- For use with short radius guardrail systems as shown on the next sheet.
- This is the same as the previous Standard, only detailed more clearly.

Design Standards Index 400, Sheet 12

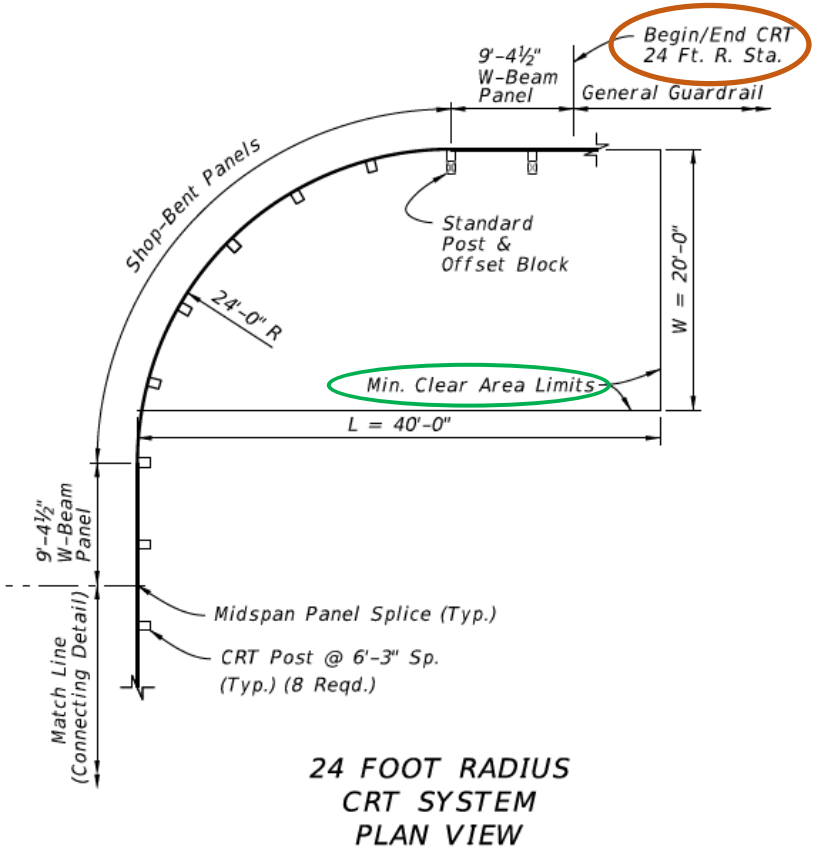
Layout for Controlled Release Terminal (CRT) System:



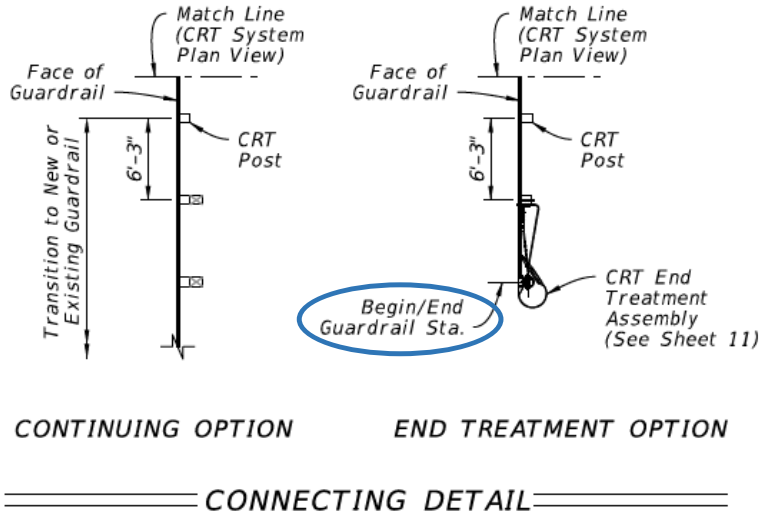
- Used for 90 degree intersection of principle roadway and side road or driveway
- This is nearly the same as the previous standard, only detailed more clearly
- Draw corresponding dimensions and radius in the Plans
- When terminating with a CRT End Treatment, the guardrail extends 15’-7½” from Match Line

Design Standards Index 400, Sheet 12

Layout for Controlled Release Terminal (CRT) System:



24 FOOT RADIUS
CRT SYSTEM
PLAN VIEW



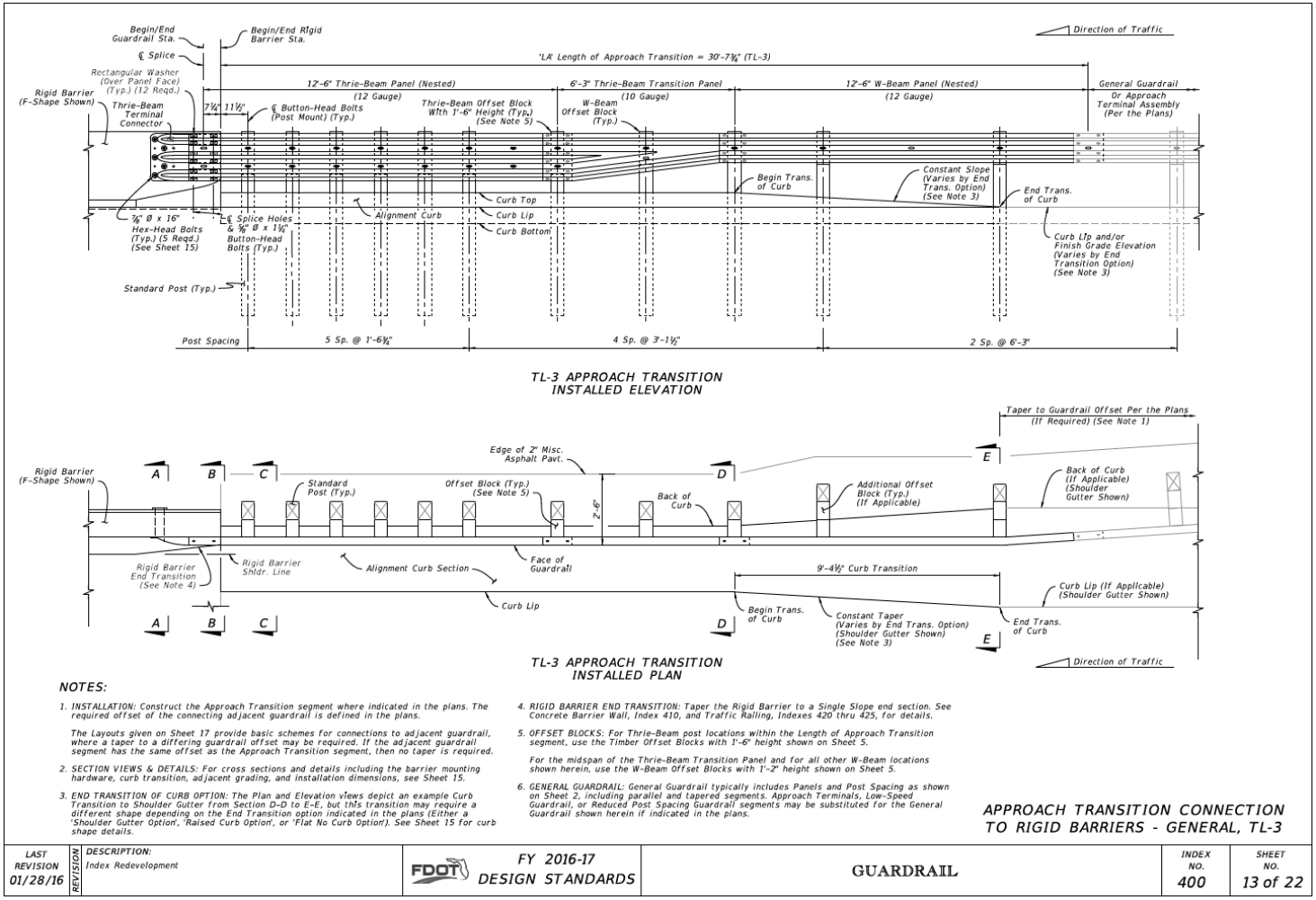
CONTINUING OPTION END TREATMENT OPTION

CONNECTING DETAIL

- Begin/End CRT Station called out – Corresponds to Roadway Plans callout
  (e.g. "Begin CRT 24 Ft. R. Sta. 100+00")
- Begin/End Guardrail Station called out – Corresponds to Roadway Plans callout. It's also shown on Elevation view. – *Length of guardrail measured from here*
- *Min. Clear Area - Maintain 1:10 Slope to 2' behind the posts. Beyond that, maintain an area clear of hazards with a 1:2 or flatter slope.*

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:



NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is defined in the plans.

   The Layouts given on Sheet 17 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, curb transition, adjacent grading, and installation dimensions, see Sheet 15.

3. END TRANSITION OF CURB OPTION: The Plan and Elevation views depict an example Curb Transition to Shoulder Gutter from Section D-D to E-E, but this transition may require a different shape depending on the End Transition option indicated in the plans (Either a 'Shoulder Gutter Option', 'Raised Curb Option', or 'Flat No Curb Option'). See Sheet 15 for curb shape details.

4. RIGID BARRIER END TRANSITION: Taper the Rigid Barrier to a Single Slope end section. See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

5. OFFSET BLOCKS: For Thrie-Beam post locations within the Length of Approach Transition segment, use the Timber Offset Blocks with 1'-6" height shown on Sheet 5.

   For the midspan of the Thrie-Beam Transition Panel and for all other W-Beam locations shown herein, use the W-Beam Offset Blocks with 1'-2" height shown on Sheet 5.

6. GENERAL GUARDRAIL: General Guardrail typically includes Panels and Post Spacing as shown on Sheet 2, including parallel and tapered segments. Approach Terminals, Low-Speed Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the General Guardrail shown herein if indicated in the plans.

APPROACH TRANSITION CONNECTION TO RIGID BARRIERS - GENERAL, TL-3

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 13 of 22

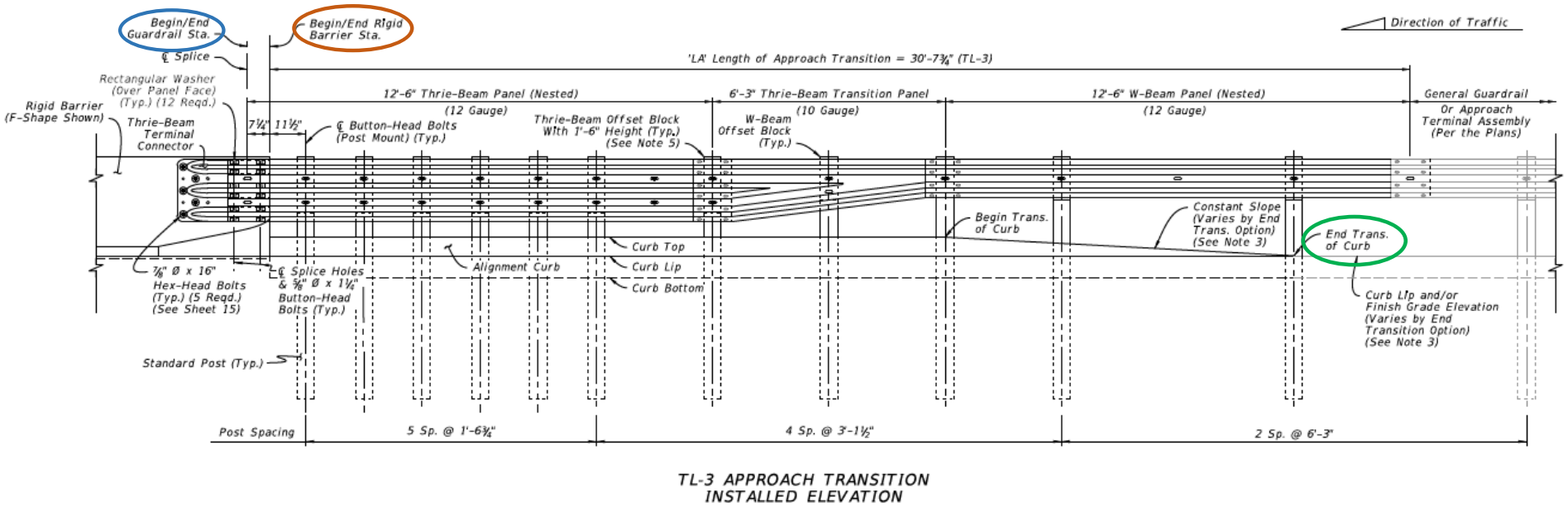
- ***ALL NEW!***
- MASH Tested
- Applicable to all Design Speeds
- About 12’-6” shorter than old “Detail J” from Rigid Barrier (about 25’ shorter including previous barrier overlap)
- New raised ‘Alignment Curb’ required
- Section Views on Sheet 15

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

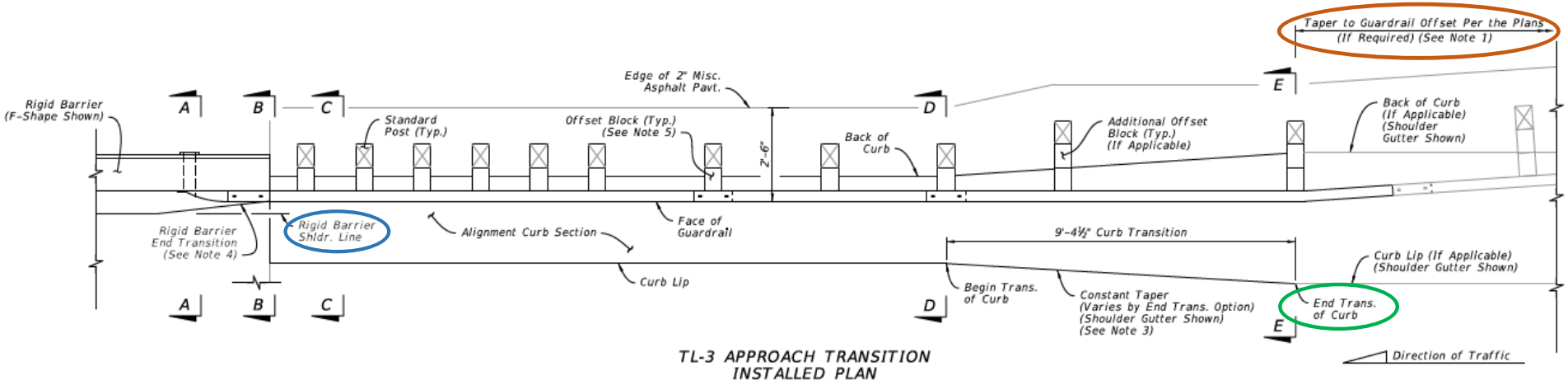


TL-3 APPROACH TRANSITION
INSTALLED ELEVATION

- **Begin/End Guardrail Station** called out – Corresponds to Roadway Plans callout – *Length of guardrail measured from here*
- **Begin/End *Rigid Barrier*** Station called out - *Different from Begin/End Guardrail Station* (governed by Thrie-Beam Terminal Connector with its Edge flush with Rigid Barrier) Guardrail's 7¼" overlap with the Rigid Barrier should be drawn this way in Plans
- **End Transition of Curb** – This is ***where typical curb type begins***, if here on project (e.g. Type F, Shoulder Gutter) **Starts 28'-1½"** from Begin/End Guardrail Station

Design Standards Index 400, Sheet 13

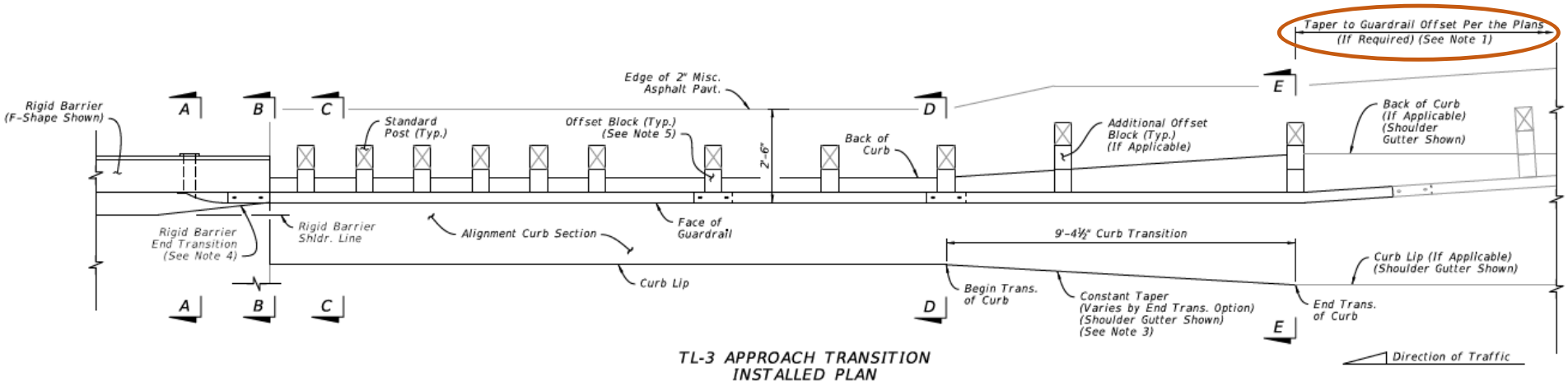
Approach Transition Connection to Rigid Barrier, General TL-3:



- **Rigid Barrier Shoulder Line**: Aligns with "Standard Shoulder Line" of Shoulder Gutter as shown in Index 300. This Shoulder Gutter aligns at Section E-E.
- **Taper to Guardrail Offset per the Plans:** If roadway guardrail has a different lateral offset than the bridge railing guardrail, then your "Begin/End Taper" callout is given at Section E-E. (Starts 28'-1½" from Begin/End Guardrail Station)
  *This leads to typical section, generally meeting PPM Fig 4.4.12
- **End Transition of Curb** – This is ***where typical curb type begins***, if here on project (e.g. Type F, Shoulder Gutter; Starts 28'-1½" from Begin/End Guardrail Station)

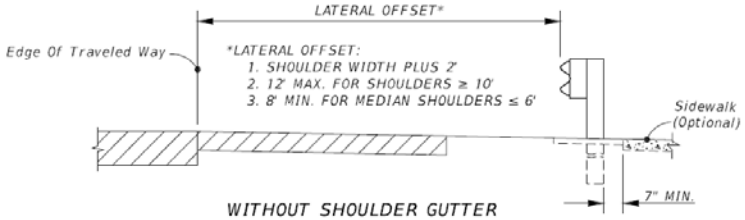
Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

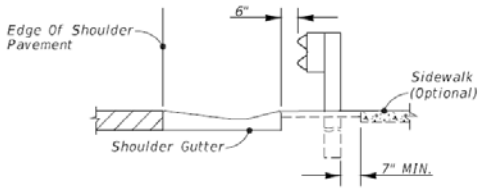


TL-3 APPROACH TRANSITION
INSTALLED PLAN

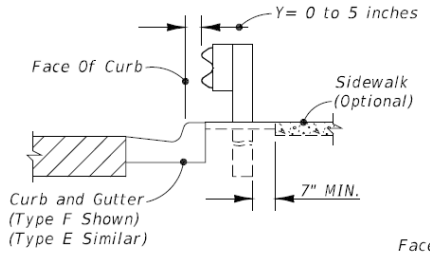
- **Taper to Guardrail Offset per the Plans:** This guardrail taper generally leads to these typical sections. Per PPM 4.4.12…



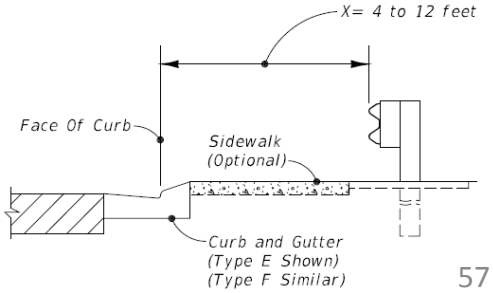
WITHOUT SHOULDER GUTTER



WITH SHOULDER GUTTER



ALL DESIGN SPEEDS



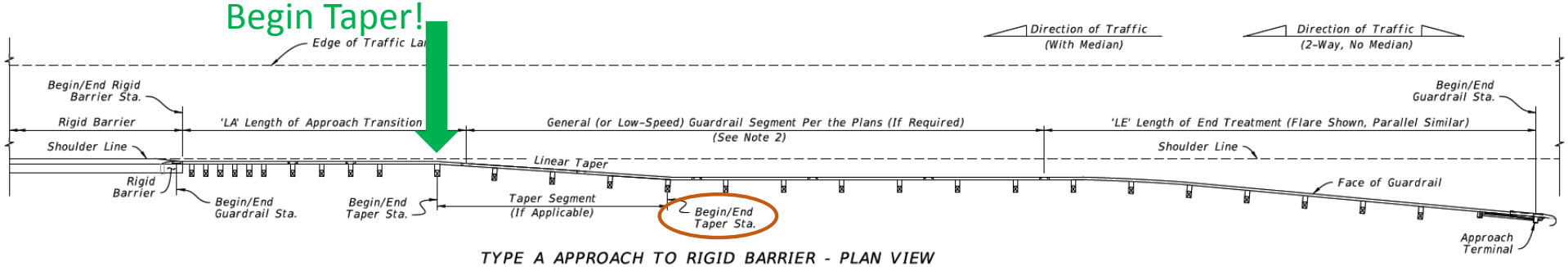
≤ 45 MPH DESIGN SPEED

Design Standards Index 400, Sheet 13

Approach Transition Connection to Rigid Barrier, General TL-3:

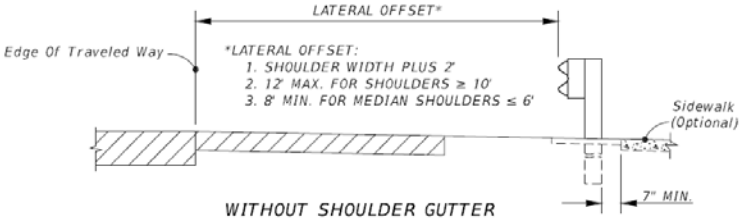
Sneak Peak of Sheet 17… the bigger picture of tapering to typical section!

Section E-E…
Begin Taper!

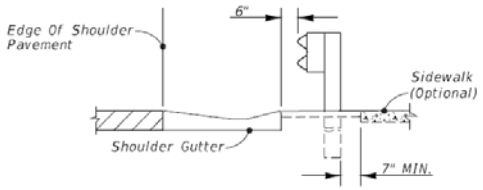


TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(Mirror Horiz. and/or Vert. for Opposite
Direction and/or Side of Road)

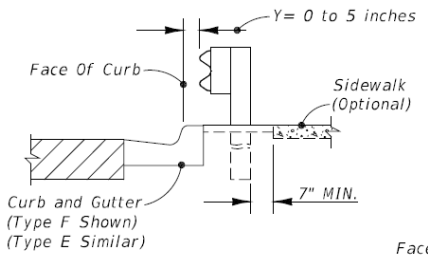
- **Taper to Guardrail Offset per the Plans:** This guardrail taper generally leads to these typical sections. Per PPM 4.4.12…



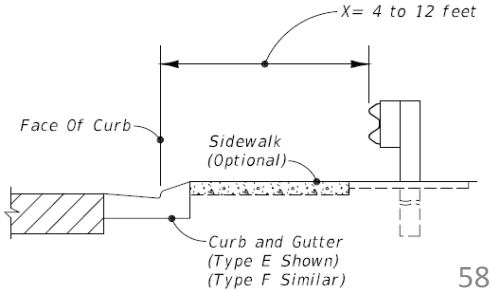
WITHOUT SHOULDER GUTTER



WITH SHOULDER GUTTER



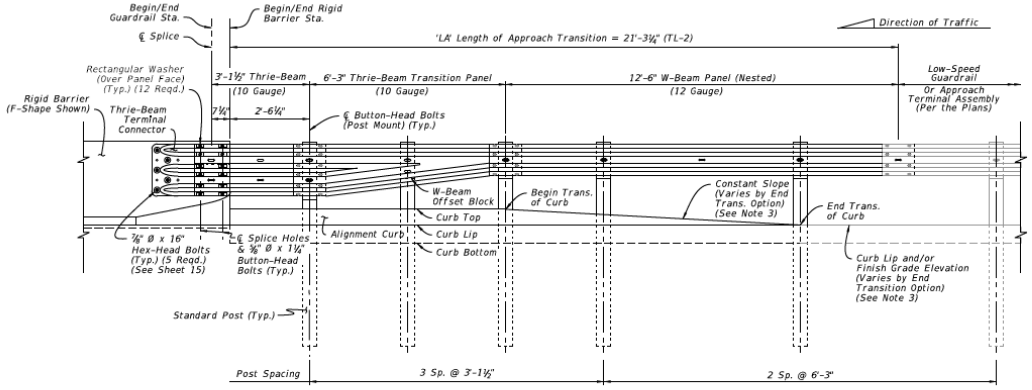
ALL DESIGN SPEEDS



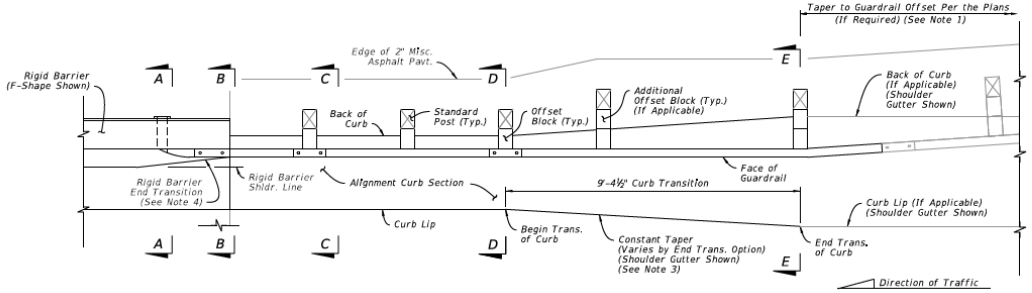
≤ 45 MPH DESIGN SPEED

Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:



TL-2 APPROACH TRANSITION INSTALLED ELEVATION



TL-2 APPROACH TRANSITION INSTALLED PLAN

NOTES:

1. INSTALLATION: Construct the Approach Transition segment where indicated in the plans. The required offset of the connecting adjacent guardrail is defined in the plans.

   The Layouts given on Sheet 17 provide basic schemes for connections to adjacent guardrail, where a taper to a differing guardrail offset may be required. If the adjacent guardrail segment has the same offset as the Approach Transition segment, then no taper is required.

2. SECTION VIEWS & DETAILS: For cross sections and details including the barrier mounting hardware, curb transition, adjacent grading, and installation dimensions, see Sheet 15.

3. END TRANSITION OF CURB OPTION: The Plan and Elevation views depict an example Curb Transition to Shoulder Gutter from Section D-D to E-E, but this transition may require a different shape depending on the End Transition option indicated in the plans (Either a 'Shoulder Gutter Option', 'Raised Curb Option', or 'Flat No Curb Option'). See Sheet 15 for curb shape details.

4. RIGID BARRIER END TRANSITION: Taper the Rigid Barrier to a Single Slope end section. See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

5. LOW-SPEED GUARDRAIL: Low-Speed Guardrail typically includes Panels and Post Spacing as shown on Sheet 3, including parallel and tapered segments. Approach Terminals, General Guardrail, or Reduced Post Spacing Guardrail segments may be substituted for the Low-Speed Guardrail shown herein if indicated in the plans.

APPROACH TRANSITION CONNECTION TO RIGID BARRIER - LOW-SPEED, TL-2

LAST REVISION	REVISION	DESCRIPTION:	FDOT			INDEX NO.	SHEET NO.
02/01/16		Index Redevelopment	FY 2017-18 DESIGN STANDARDS	GUARDRAIL		400	14 of 22

- ***ALL NEW!***
- MASH Tested
- Applicable to **Design Speeds ≤ 45 mph**
- Shorter and less robust design for cost savings
- New raised 'Alignment Curb' required
- Section Views on Sheet 15

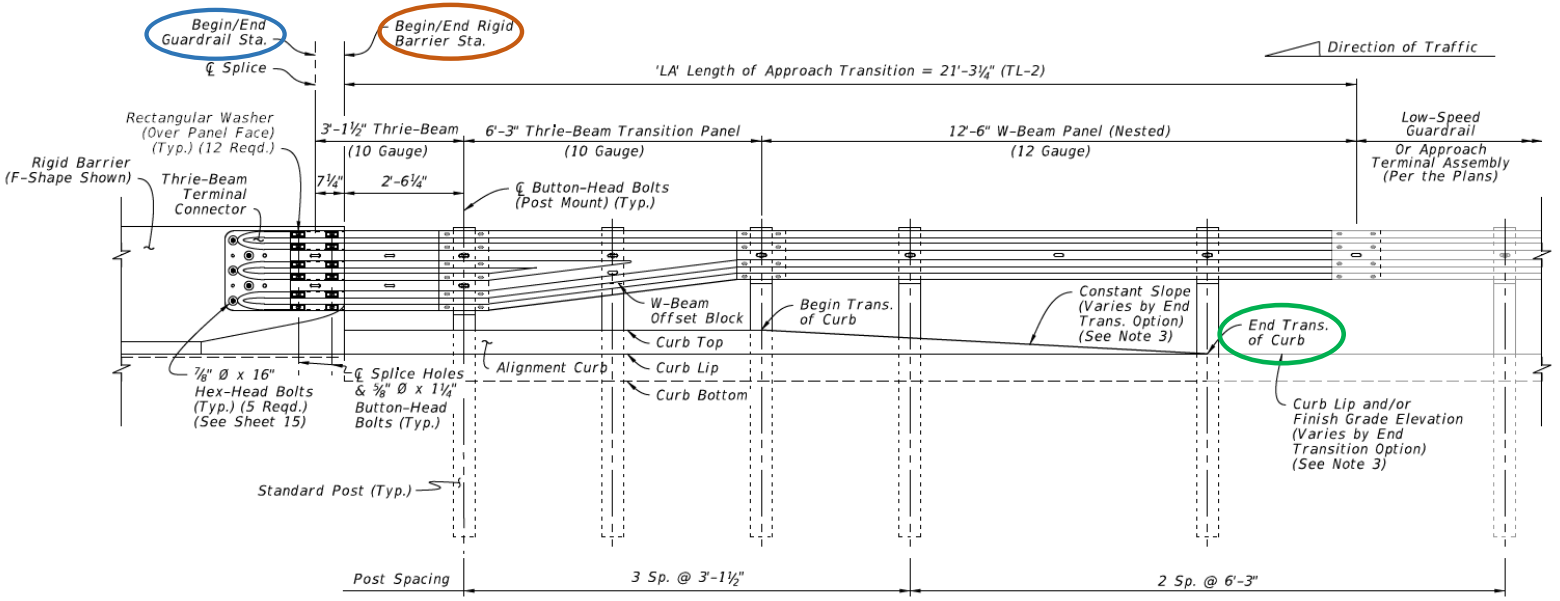
Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:

- ***ALL NEW!***
- MASH Tested
- Applicable to **Design Speeds ≤ 45 mph**
- Shorter and less robust design for cost savings
- New raised 'Alignment Curb' required
- Section Views on Sheet 15

Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:

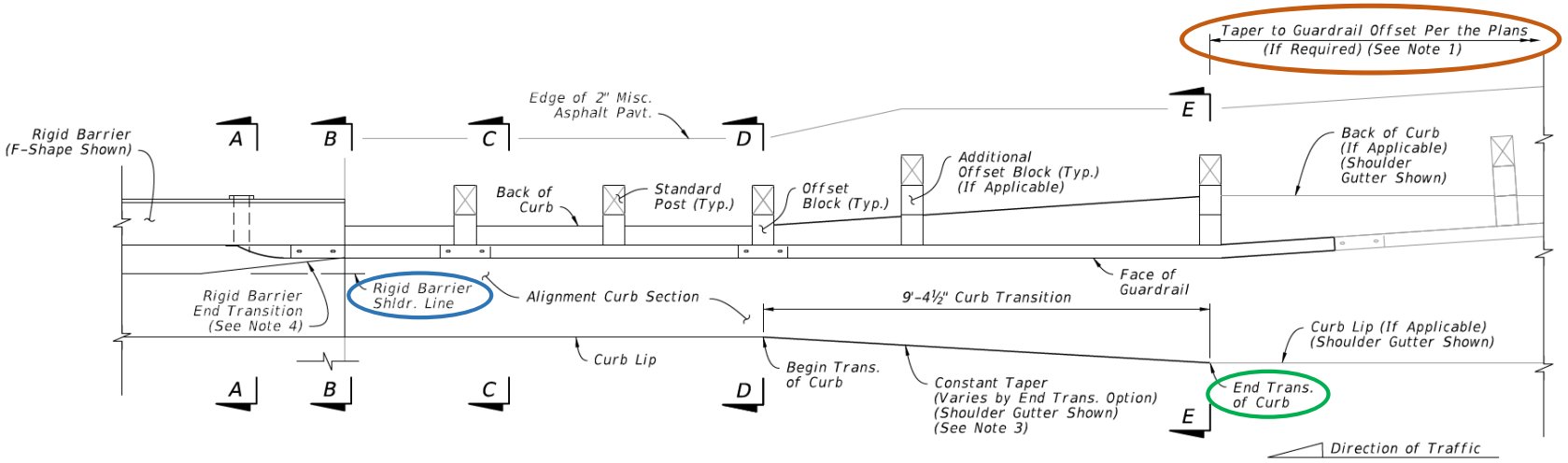


TL-2 APPROACH TRANSITION INSTALLED ELEVATION

- **Similar Connection and Curb Design as the General TL-3 Version!**
- **Begin/End Guardrail Station** called out – Corresponds to Roadway Plans callout – *Length of guardrail measured from here*
- **Begin/End *Rigid Barrier*** Station called out - *Different from Begin/End Guardrail Station*
- **End Transition of Curb –** This is ***where typical curb type begins***, if here on project (e.g. Type F, Shoulder Gutter) **Starts 18'-9"** from Begin/End Guardrail Station

Design Standards Index 400, Sheet 14

Approach Transition Connection to Rigid Barrier, Low-Speed TL-2:

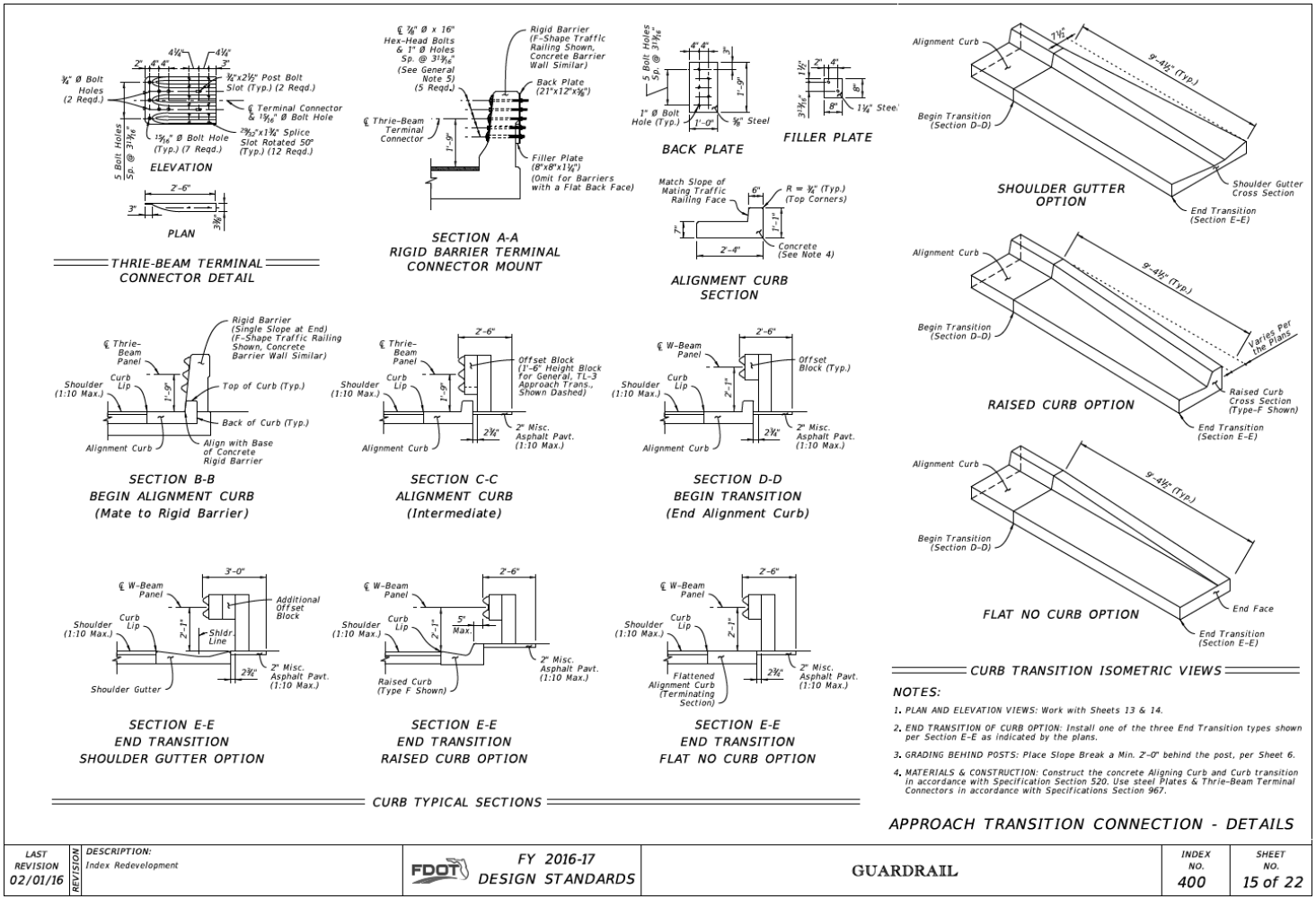


TL-2 APPROACH TRANSITION
INSTALLED PLAN

- **Rigid Barrier Shoulder Line**: Aligns with "Standard Shoulder Line" of Shoulder Gutter as shown in Index 300. This Shoulder Gutter aligns at Section E-E.
- **Taper to Guardrail Offset per the Plans:** If roadway guardrail has a different lateral offset than the bridge railing guardrail, then your "Begin/End Taper" callout is given at Section E-E. (Starts 18'-9" from Begin/End Guardrail Station)
  *This leads to typical section, generally meeting PPM Fig 4.4.12
- **End Transition of Curb** – This is ***where typical curb type begins***, if here on project (e.g. Type F, Shoulder Gutter; Starts 18'-9" from Begin/End Guardrail Station)

Design Standards Index 400, Sheet 15

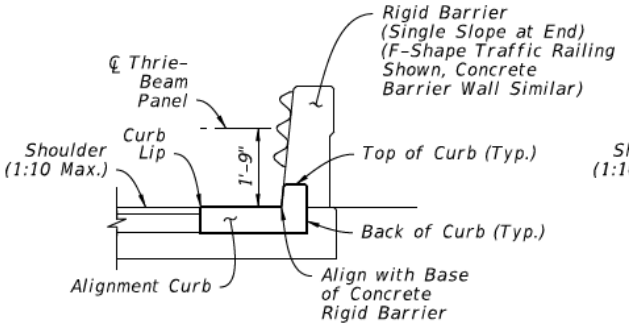
Approach Transition Connection Details:



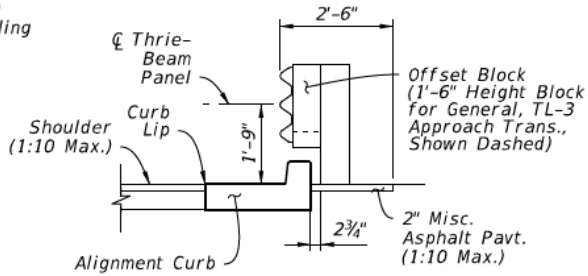
- Shows Cross Section details for Approach Transitions on previous Sheets.
- Provides curb transitions for three types of curb Options
  1. *Shoulder Gutter*
  2. *Raised Curb*
  3. *No Curb*

Approach Transition Connection Details:

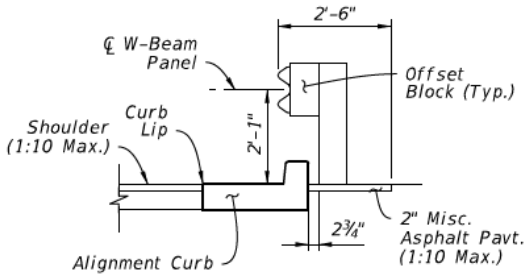
Curb Sections – Alignment Curb Segment



SECTION B-B
BEGIN ALIGNMENT CURB
(Mate to Rigid Barrier)



SECTION C-C
ALIGNMENT CURB
(Intermediate)



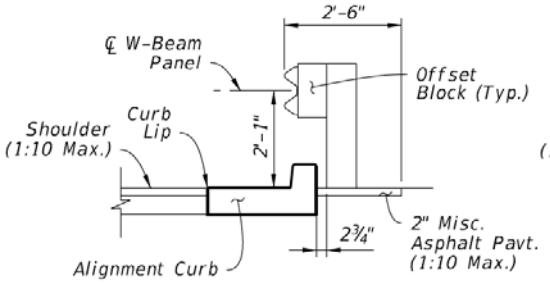
SECTION D-D
BEGIN TRANSITION
(End Alignment Curb)

- **"Alignment Curb"**
  - *aligns* with face of rigid barrier
  - reduces potential for vehicle snagging at start of Rigid Barrier (per TTI recommendation)
  - follows same lateral offset (both curb and face of guardrail) from Section B-B to D-D

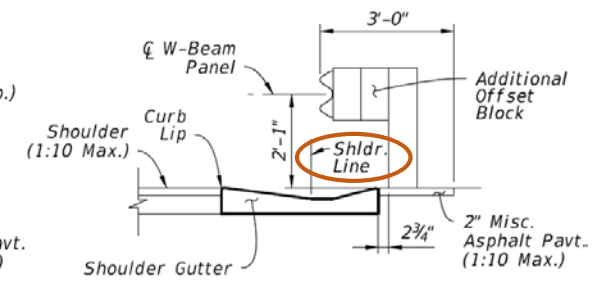
Design Standards Index 400, Sheet 15

Approach Transition Connection Details:

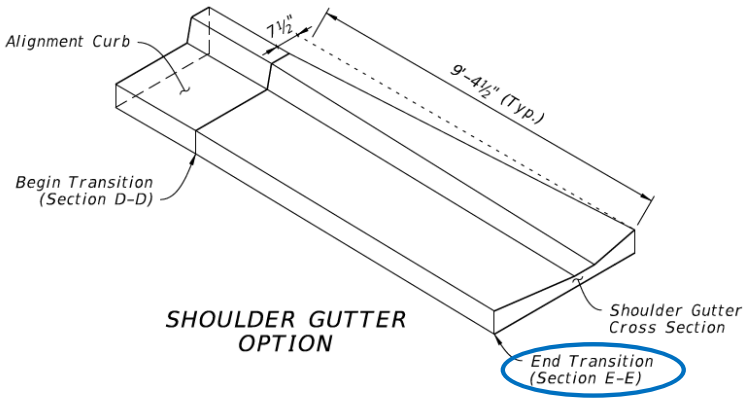
Curb Sections – Transition to Shoulder Gutter Option (1 of 3)



SECTION D-D
BEGIN TRANSITION
(End Alignment Curb)

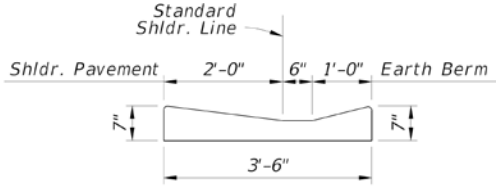


SECTION E-E
END TRANSITION
SHOULDER GUTTER OPTION

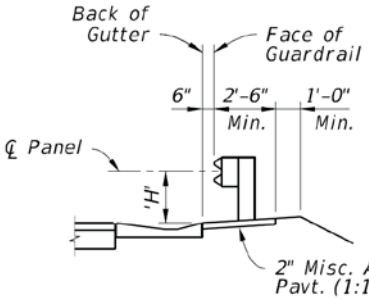


SHOULDER GUTTER OPTION

- **Standard Shoulder Line** per Index 300 – This offset aligns with Rigid Barrier and face of Alignment curb (i.e. the Rigid Barrier's Shoulder Line)
- **Section E-E**, Shoulder Gutter shape is established: Begin guardrail offset taper to typical section as the project's shoulder width requires (Index Sheet 6).
- Typical section generally has face of guardrail at Shoulder Line plus 2' (or back edge of shoulder gutter plus 6"). Guardrail Taper Rate guidance is provided in the IDS.



SHOULDER GUTTER

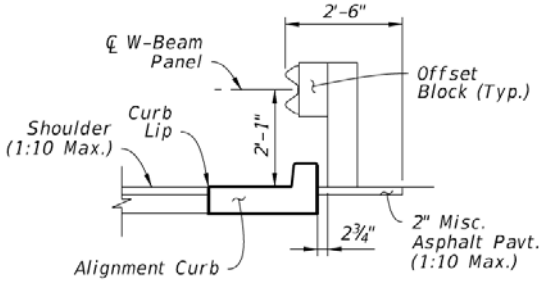


(Final Guardrail Typical Section)

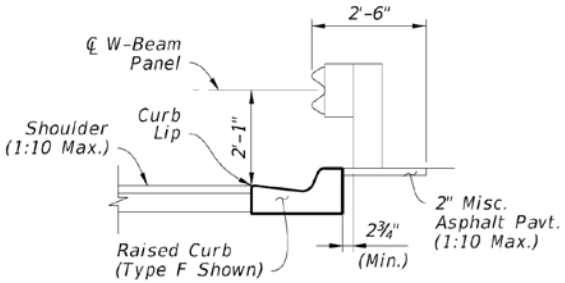
Design Standards Index 400, Sheet 15

Approach Transition Connection Details:

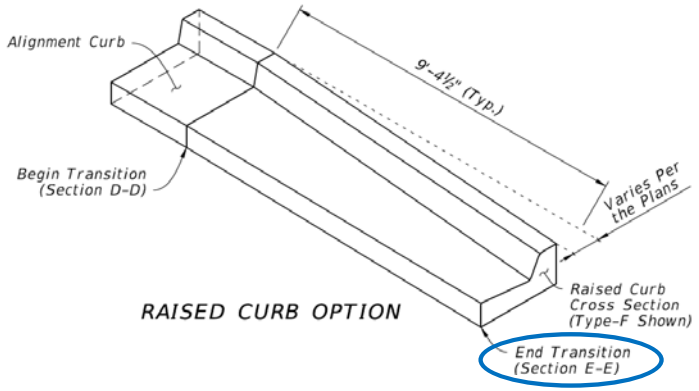
Curb Sections – Transition to Raised Curb Option (2 of 3)



SECTION D-D
BEGIN TRANSITION
(End Alignment Curb)



SECTION E-E
END TRANSITION
RAISED CURB OPTION

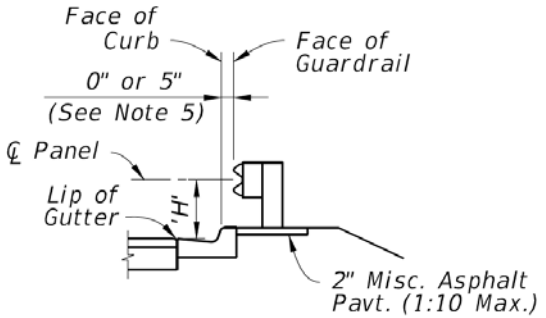


RAISED CURB OPTION

Section E-E, Raised Curb Established (e.g. Type F or Type E). This will generally keep its face aligned with the Rigid Barrier's shoulder line (same as Alignment Curb).

At Section E-E, begin the guardrail offset taper to typical section (Sheet 6).

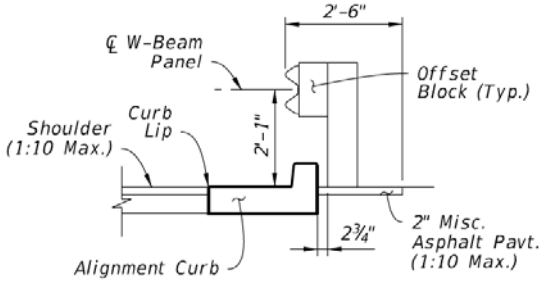
Taper Rate guidance is provided in the IDS.



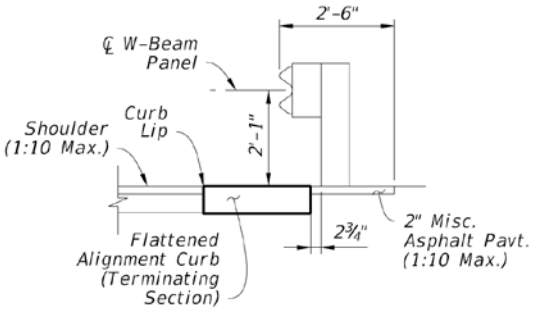
(Final Guardrail Typical Section)

Approach Transition Connection Details:

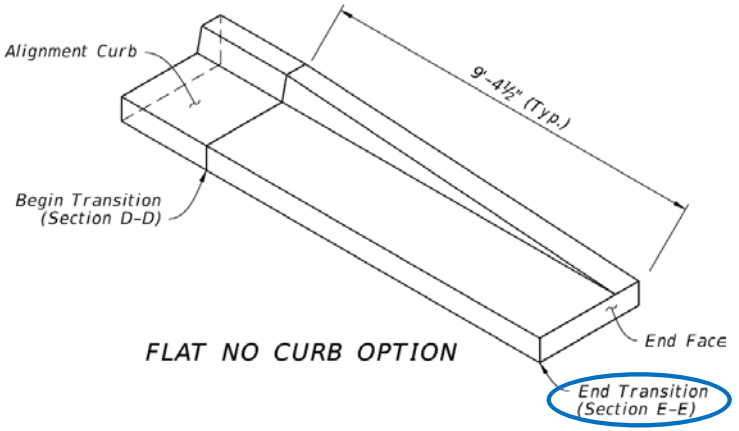
Curb Sections – Transition to No Curb Option (3 of 3)



SECTION D-D
BEGIN TRANSITION
(End Alignment Curb)



SECTION E-E
END TRANSITION
FLAT NO CURB OPTION

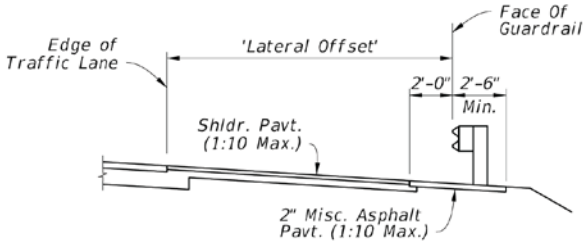


FLAT NO CURB OPTION

Section E-E, Curb is Terminated:

At Section E-E, begin guardrail offset taper to typical section as the project's shoulder width requires (Sheet 6).

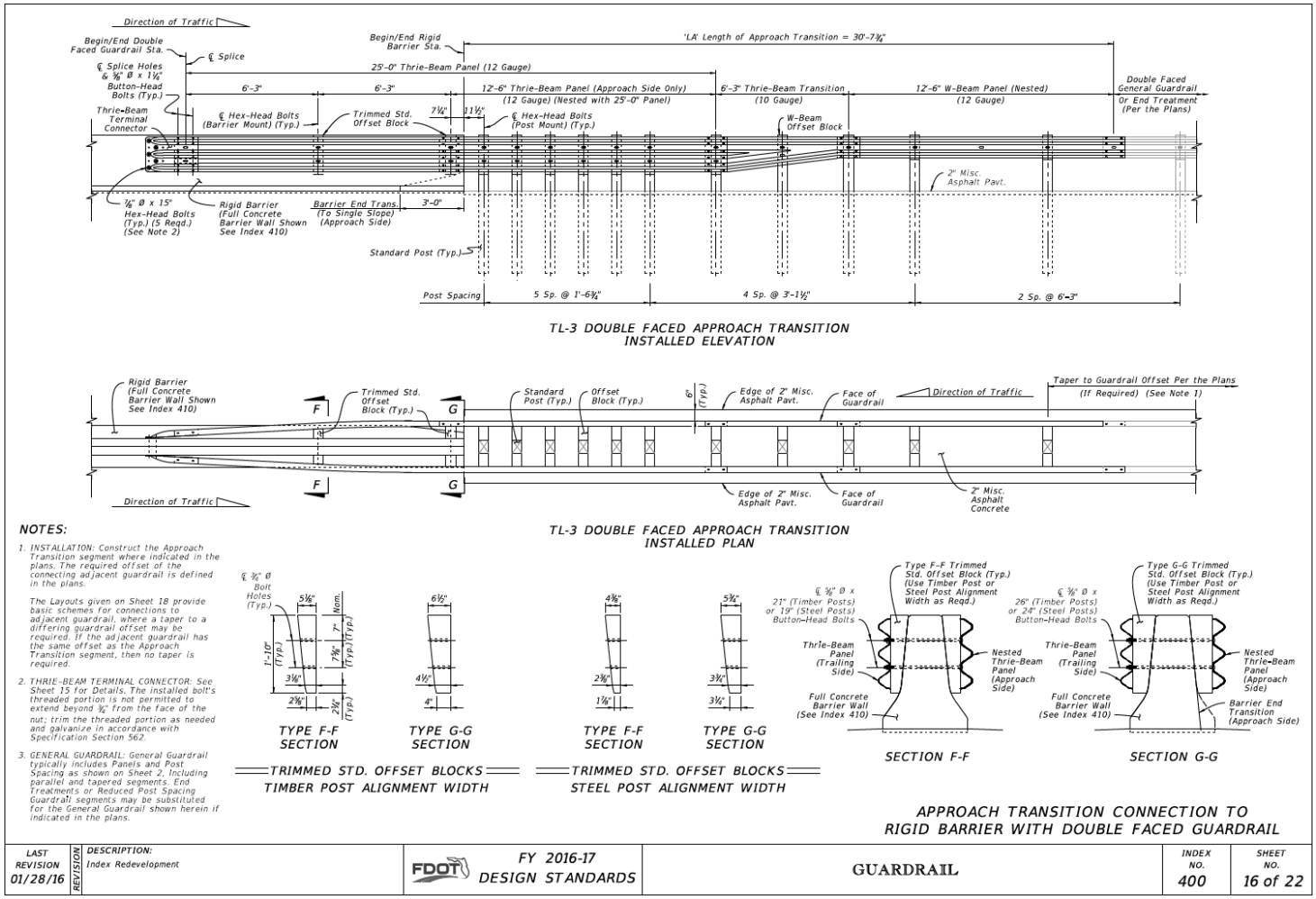
Typical section generally has face of guardrail at Shoulder Line plus 2' (or back edge of shoulder gutter plus 6"). Guardrail Taper Rate guidance is provided in the IDS.



(Final Guardrail Typical Section)

Design Standards Index 400, Sheet 16

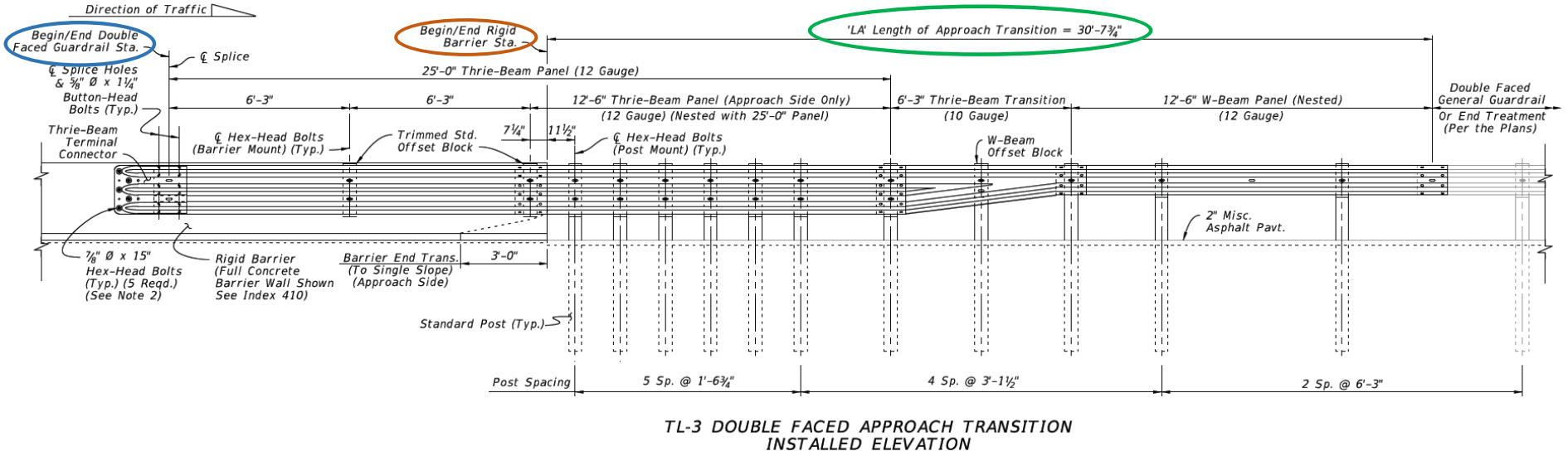
Approach Transition Connection to Rigid Barrier, Double Faced:



- ***ALL NEW!***
- Applicable to all Design Speeds
- "Hybrid" of previous Double Faced Transition and MASH-Tested TL-3 Approach Transition
- Adds 12'-6" barrier overlap needed to transition guardrail to Rigid Barrier Width

Design Standards Index 400, Sheet 16

Approach Transition Connection to Rigid Barrier, Double Faced:

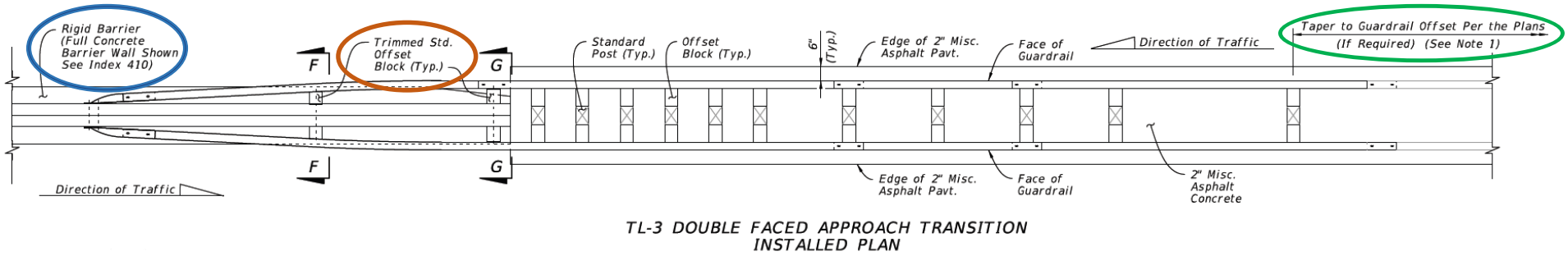


TL-3 DOUBLE FACED APPROACH TRANSITION
INSTALLED ELEVATION

- **Begin/End Double Faced Guardrail Station** called out – Corresponds to Roadway Plans callout – *Length of guardrail measured from here*
- **Begin/End *Rigid Barrier*** Station called out - *Different from Begin/End Guardrail Station* (Required for Double Faced Guardrail width to transition into the narrower Rigid Barrier) Guardrail's 13'-1¼" overlap with the Rigid Barrier should be drawn this way in Plans.
- **Length of Approach Transition, 'LA'** – Has the same post spacing as the 'General' Approach Transition. The curb is omitted, because the guardrail panels are held away from the Rigid Barrier by the added offset blocks (reducing vehicle snagging).

Design Standards Index 400, Sheet 16

Approach Transition Connection to Rigid Barrier, Double Faced:

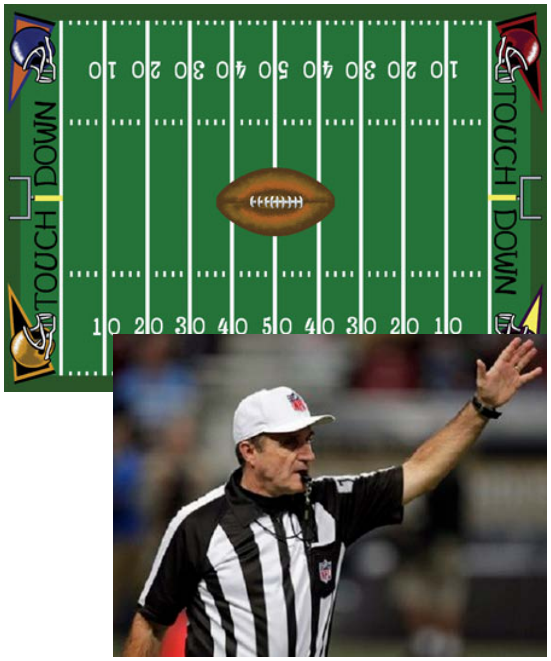


TL-3 DOUBLE FACED APPROACH TRANSITION INSTALLED PLAN

- **Rigid Barrier** – "Full" Double Faced Barrier per Index 410. It is narrower than Double Faced Guardrail System
- **Trimmed Std. Offset Blocks to Rigid Barrier –** Wider guardrail system transitioning to Rigid Barrier width. The reason for the guardrail overlapping with the Rigid Barrier!
- **Taper to Guardrail Offset per the Plans** – Similar to Section E-E in that this is where the Plans will begin transition to a different guardrail offset if needed (40'-7½" from Begin/End Guardrail Sta.)

Design Standards Index 400, Q3 Review!

End of 3rd Quarter Review Questions!



1. When is a CRT configuration used?

2. For Approach Transition Connections, when is the guardrail panel overlap with Rigid Barrier of *about* 12’-6” required?

3. For *single faced* Approach Transition Connections, what is the location difference between the Begin Guardrail Station and the face of the Rigid Barrier? (in inches)

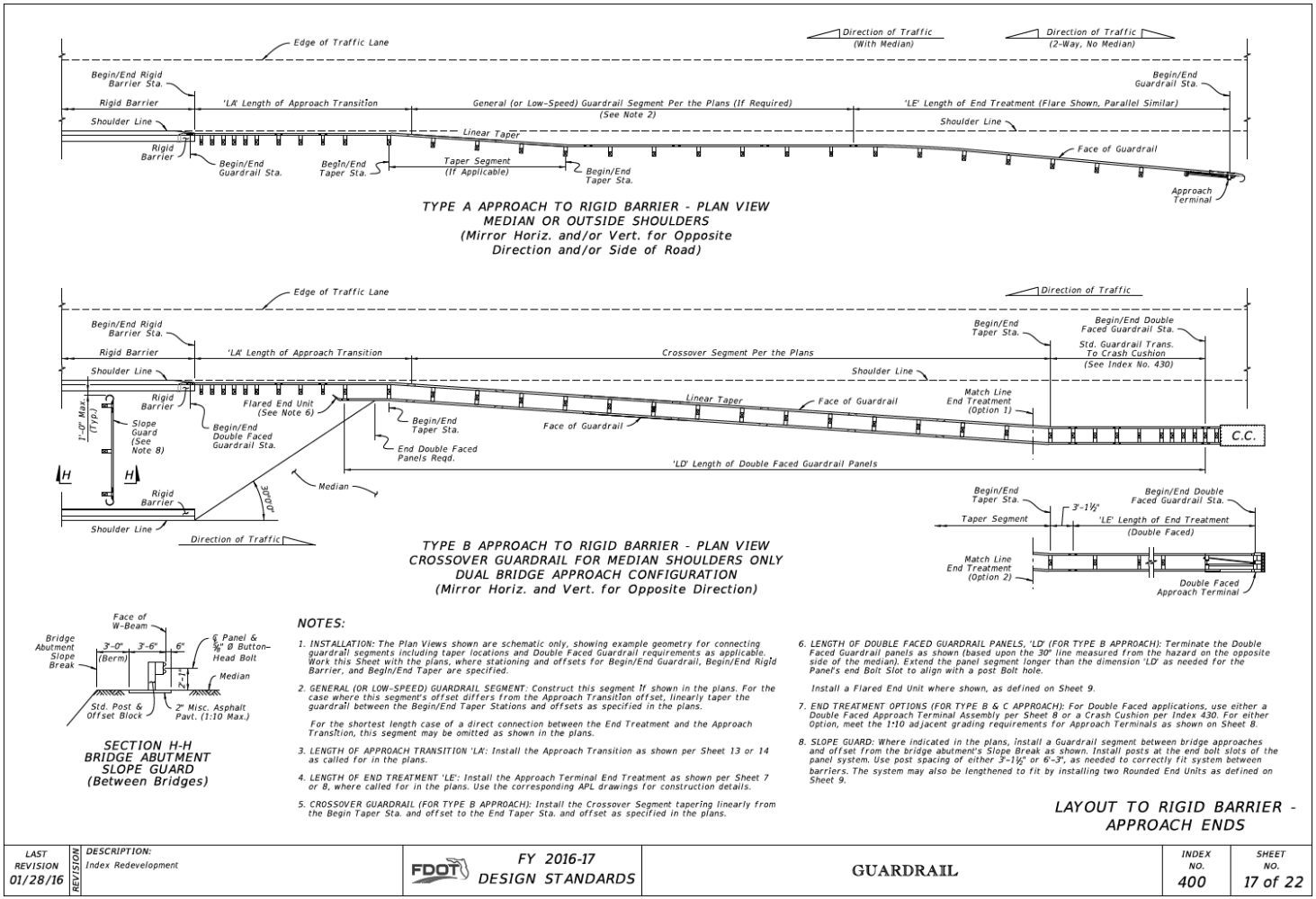
4. All *single faced* Approach Transition Connections require an Alignment Curb underneath… *True or False*?

5. All *double faced* Approach Transition Connections require an Alignment Curb underneath… *True of False*?

6. For single faced Approach Transition Connections, at what ‘Section’ on the Index Sheet do you begin the guardrail Taper (usually headed towards 2’ from shoulder line)?

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, Single Barrier Approach or Median Crossover:



NOTES:

1. INSTALLATION: The Plan Views shown are schematic only, showing example geometry for connecting guardrail segments including taper locations and Double Faced Guardrail requirements as applicable. Work this Sheet with the plans, where stationing and offsets for Begin/End Guardrail, Begin/End Rigid Barrier, and Begin/End Taper are specified.
2. GENERAL (OR LOW-SPEED) GUARDRAIL SEGMENT: Construct this segment if shown in the plans. For the case where this segment's offset differs from the Approach Transition offset, linearly taper the guardrail between the Begin/End Taper Stations and offsets as specified in the plans.

   For the shortest length case of a direct connection between the End Treatment and the Approach Transition, this segment may be omitted as shown in the plans.
3. LENGTH OF APPROACH TRANSITION 'LA': Install the Approach Transition as shown per Sheet 13 or 14 as called for in the plans.
4. LENGTH OF END TREATMENT 'LE': Install the Approach Terminal End Treatment as shown per Sheet 7 or 8, where called for in the plans. Use the corresponding APL drawings for construction details.
5. CROSSOVER GUARDRAIL (FOR TYPE B APPROACH): Install the Crossover Segment tapering linearly from the Begin Taper Sta. and offset to the End Taper Sta. and offset as specified in the plans.
6. LENGTH OF DOUBLE FACED GUARDRAIL PANELS, 'LD' (FOR TYPE B APPROACH): Terminate the Double Faced Guardrail panels as shown (based upon the 30" line measured from the hazard on the opposite side of the median). Extend the panel segment longer than the dimension 'LD' as needed for the Panel's end Bolt Slot to align with a post Bolt hole.

   Install a Flared End Unit where shown, as defined on Sheet 9.
7. END TREATMENT OPTIONS (FOR TYPE B & C APPROACH): For Double Faced applications, use either a Double Faced Approach Terminal Assembly per Sheet B or a Crash Cushion per Index 430. For either Option, meet the 1:10 adjacent grading requirements for Approach Terminals as shown on Sheet 8.
8. SLOPE GUARD: Where indicated in the plans, install a Guardrail segment between bridge approaches and offset from the bridge abutment's Slope Break as shown. Install posts at the end bolt slots of the panel system. Use post spacing of either 3'-1½" or 6'-3", as needed to correctly fit system between barriers. The system may also be lengthened to fit by installing two Rounded End Units as defined on Sheet 9.

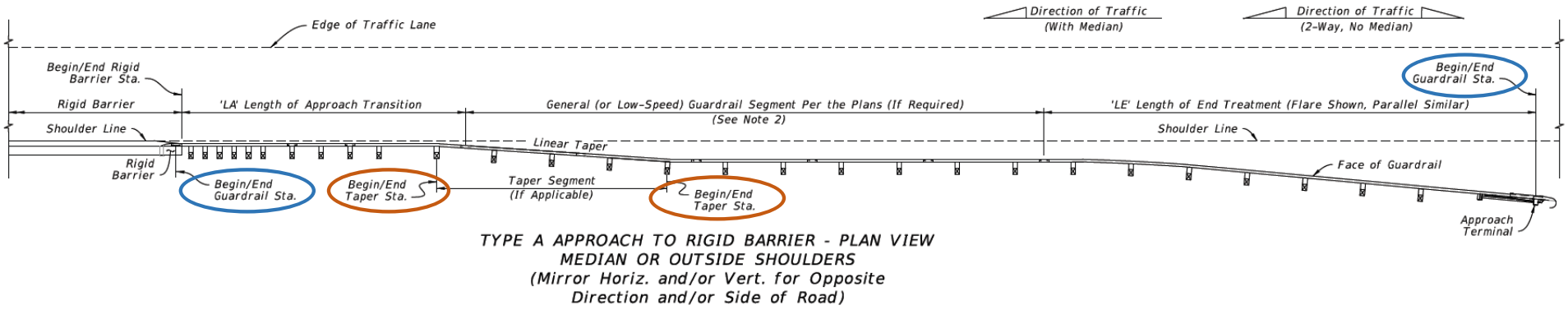
LAYOUT TO RIGID BARRIER - APPROACH ENDS

LAST REVISION	REVISION	DESCRIPTION:			INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FY 2016-17 DESIGN STANDARDS	GUARDRAIL	400	17 of 22

- Provides Example Layout "Types" that will correspond to callouts in the Plans
- Shows how segments in previous sheets connect together

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, Single Barrier Approach:



TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(Mirror Horiz. and/or Vert. for Opposite
Direction and/or Side of Road)

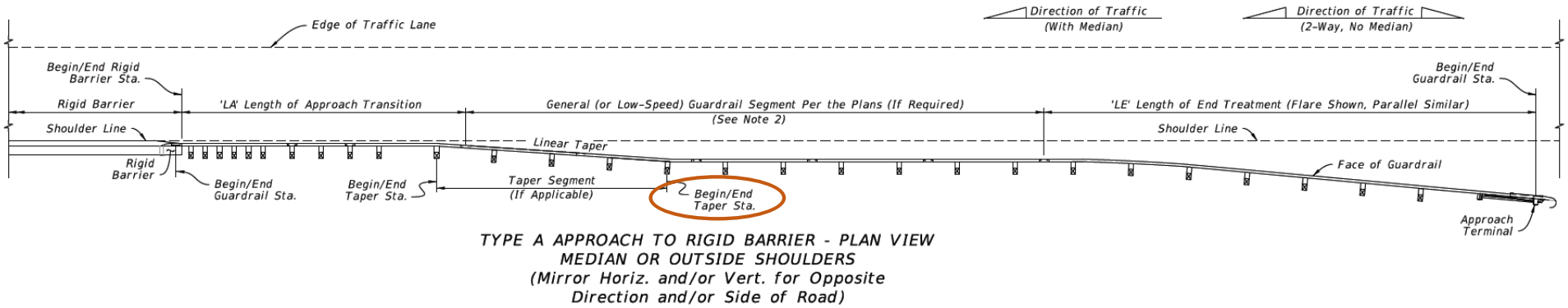
- Shows Approach Transition, General Guardrail, and Approach Terminal End Treatment as one system. NOTE: For shortest case of Rigid Barrier end protection, General Guardrail segment may be omitted (simply 'LA' + 'LE')

- **Begin/End Guardrail Stations** called out – Corresponds to Roadway Plans callout – Corresponds to callouts on preceding sheets – *Defines length of Guardrail*

- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callout –
  This is typically where the Guardrail begins tapering to its typical section on Sheet 6
  (guardrail face usually goes to paved shoulder line plus 2 feet, or it's measured from face of curb).
  *This starts at Section E-E on Sheets 13-15!
  Taper rate guidance is provided in the IDS.

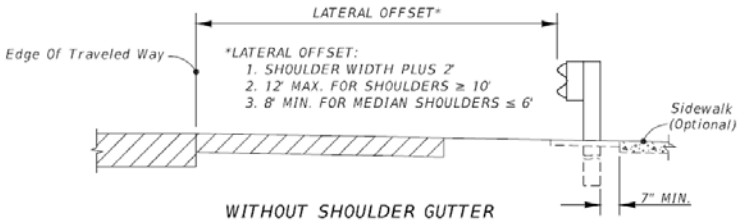
Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, Single Barrier Approach:

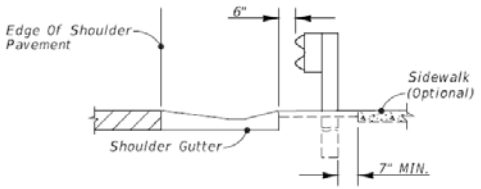


TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(Mirror Horiz. and/or Vert. for Opposite
Direction and/or Side of Road)

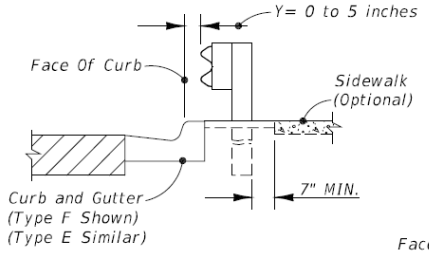
- **Begin/End *Taper Stations*** called out – The circled Taper Sta. will generally look like one of these! From PPM Figure 4.4.12



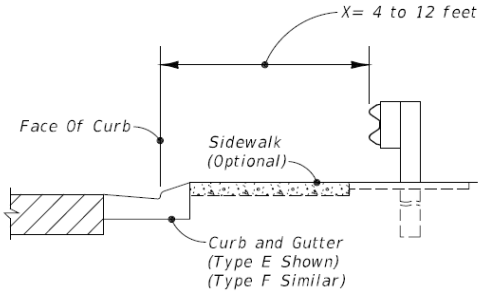
WITHOUT SHOULDER GUTTER



WITH SHOULDER GUTTER



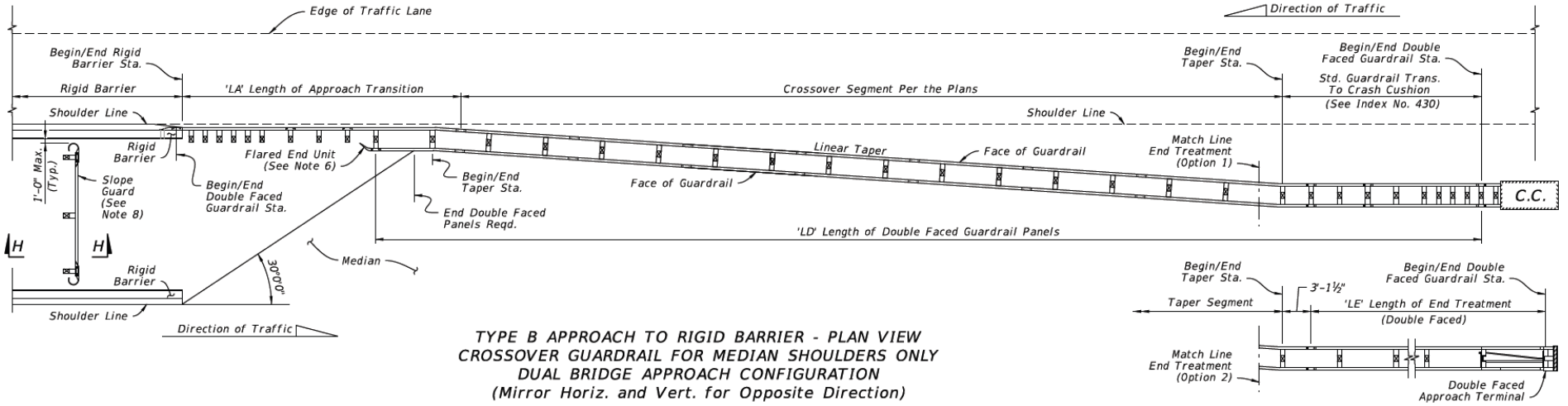
ALL DESIGN SPEEDS



≤ 45 MPH DESIGN SPEED

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, "Median Crossover Guardrail":

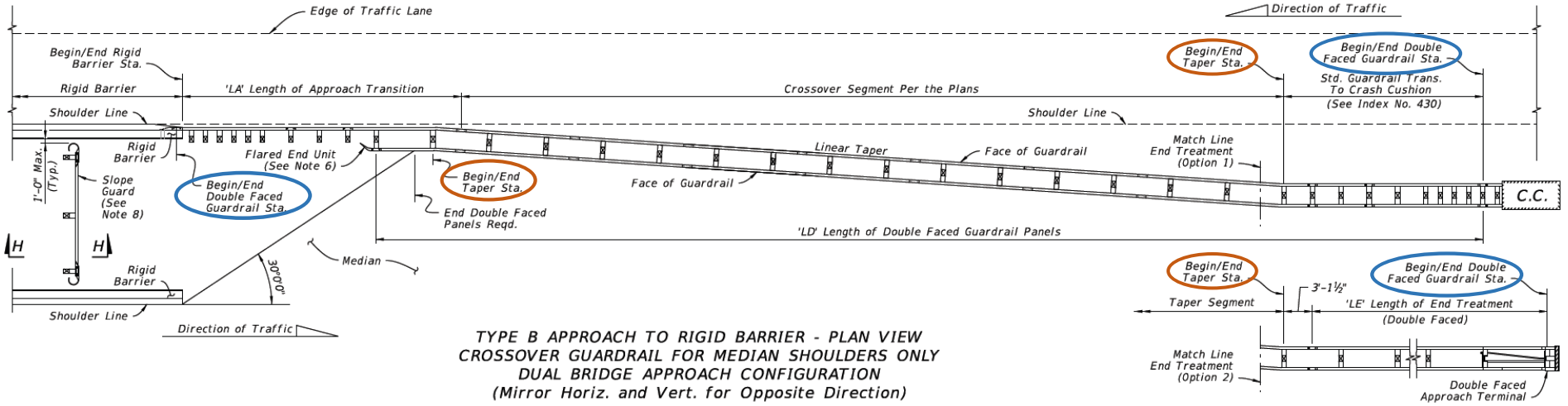


TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- Shows layout for shielding Rigid Barriers of dual bridges, where the concrete railing across the median is within the clear zone (this places the back of the shielding guardrail in the opposing lane's clear zone as well)
- *The "Median Guardrail Crossover" is most efficient design for the shortest Length of Need*
- *The new 'Guardrail Length of Need Program'* assists with this design, providing station and offset information. We'll cover specifics of 'Double Faced Approach Terminals' and 'Crash Cushions' when we discuss this later.

Design Standards Index 400, Sheet 17

Layouts to Rigid Barrier, "Median Crossover Guardrail":



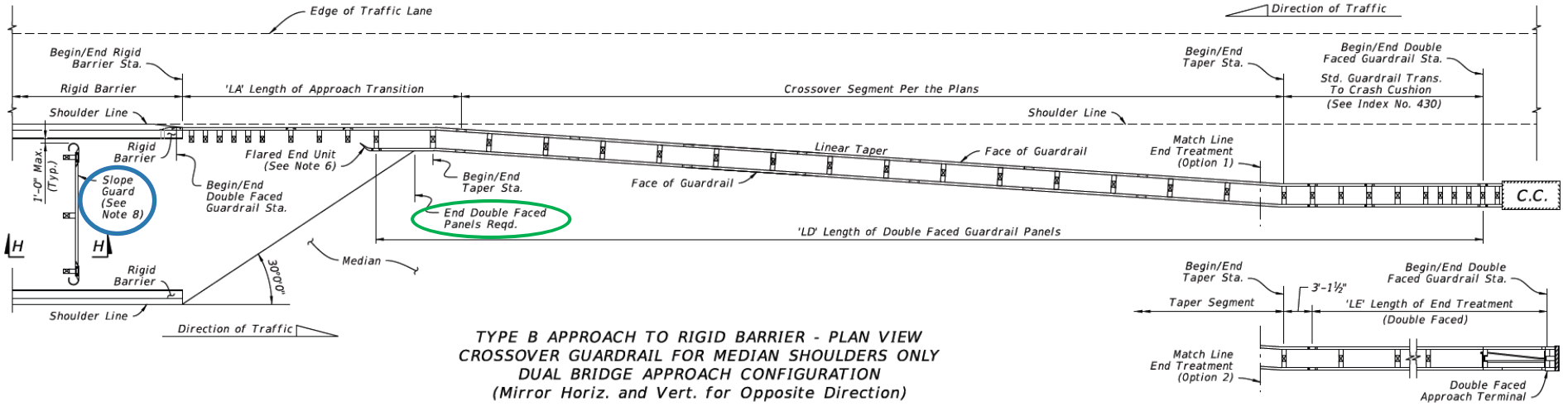
TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- **Begin/End Double Faced Guardrail Stations** called out – Corresponds to Roadway Plans
  NOTE: The Double Faced Guardrail Pay Item applies from the Rigid Barrier Connection to the End Treatment (even over the single faced Approach Transition Connection).

- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callout. The station and offset callouts define the linear taper rate for the contractor.
  NOTE: The *'Guardrail Length of Need Program'* assists with providing these stations and offsets.

Design Standards Index 400, Sheet 17

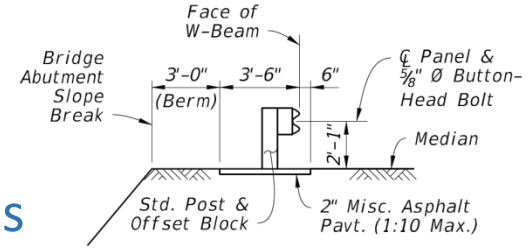
Layouts to Rigid Barrier, "Median Crossover Guardrail":



TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- **End Double Faced Panels Required –** Show how far the double faced panels continue graphically in the Plans (Regarding Payment, the entire layout here is considered Double Faced Guardrail).

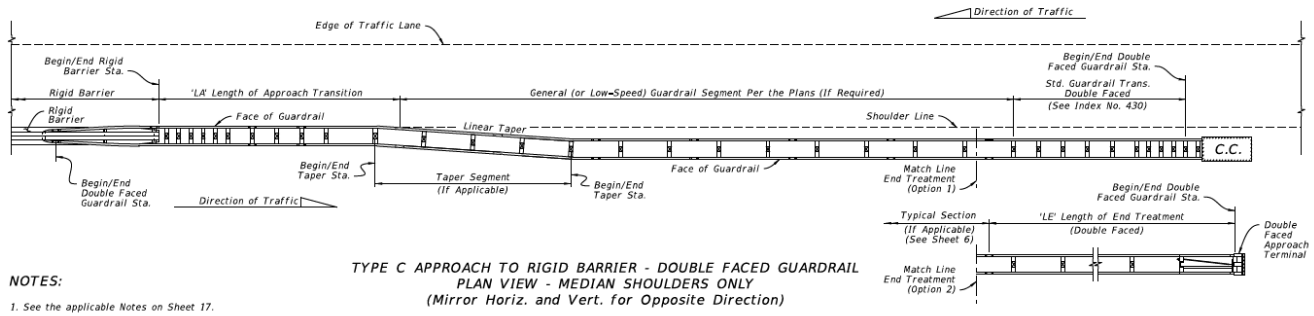
- **Slope Guard-** Place in Plans between bridges at 6'-6" from the slope break. Tabulate an estimated length as the adjacent guardrail type and include in the Plans (separate quantity entry). More info in IDS.



SECTION H-H
BRIDGE ABUTMENT
SLOPE GUARD
(Between Bridges)

Design Standards Index 400, Sheet 18

Layouts to Rigid Barrier, Double Faced Approach and Trailing End:

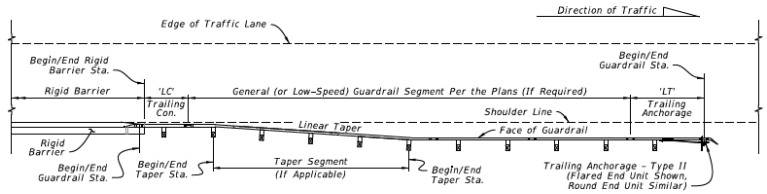


TYPE C APPROACH TO RIGID BARRIER - DOUBLE FACED GUARDRAIL
PLAN VIEW - MEDIAN SHOULDERS ONLY
(Mirror Horiz. and Vert. for Opposite Direction)

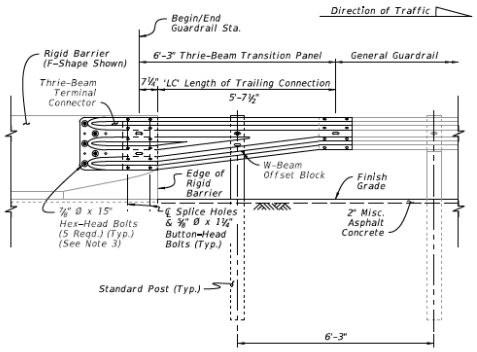
NOTES:

1. See the applicable Notes on Sheet 17.

LAYOUT TO RIGID BARRIER - APPROACH ENDS WITH DOUBLE FACED GUARDRAIL



TYPE D TRAILING CONNECTION FROM RIGID BARRIER
PLAN VIEW - MEDIAN OR OUTSIDE SHOULDER
(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)



TRAILING END TRANSITION CONNECTION
TO RIGID BARRIER - INSTALLED ELEVATION

NOTES:

1. See the applicable Notes on Sheet 17.
2. LENGTH OF TRAILING ANCHORAGE, 'LT': Install the Trailing Anchorage - Type II as shown on Sheet 9, where called for in the plans.
3. THRIE-BEAM TERMINAL CONNECTOR: Install connector and bolts as shown on Sheet 15.
4. RIGID BARRIER SINGLE SLOPE END FACE: See Concrete Barrier Wall, Index 410, and Traffic Railing, Indexes 420 thru 425, for details.

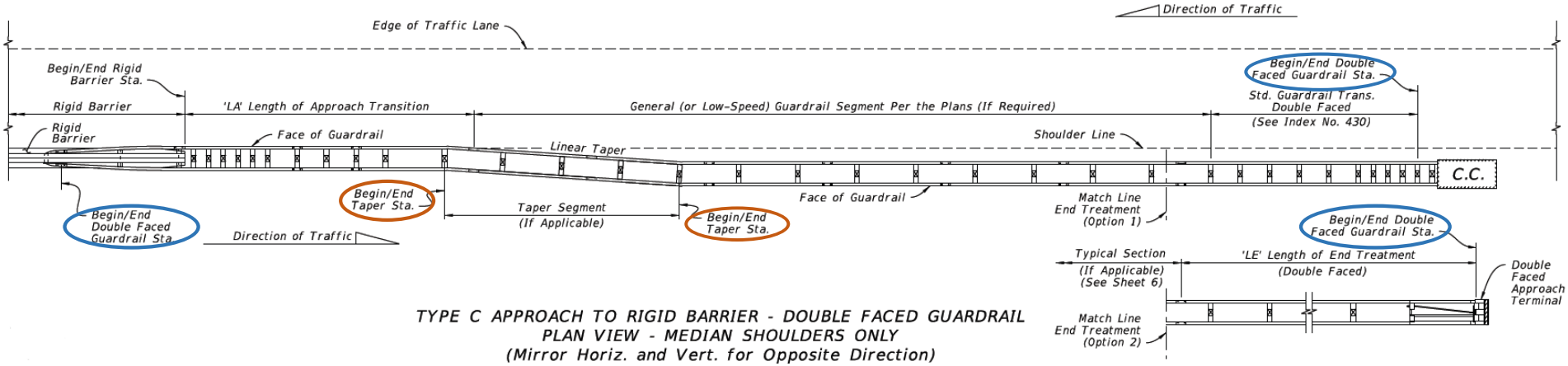
LAYOUT TO RIGID BARRIER - TRAILING ENDS

LAST REVISION 01/28/16	REVISION	DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 18 of 22

- More Example Layout "Types" that will correspond to callouts in the Plans
- Shows how segments in previous sheets connect together

Design Standards Index 400, Sheet 18

Layouts to Rigid Barrier, Double Faced Approach:



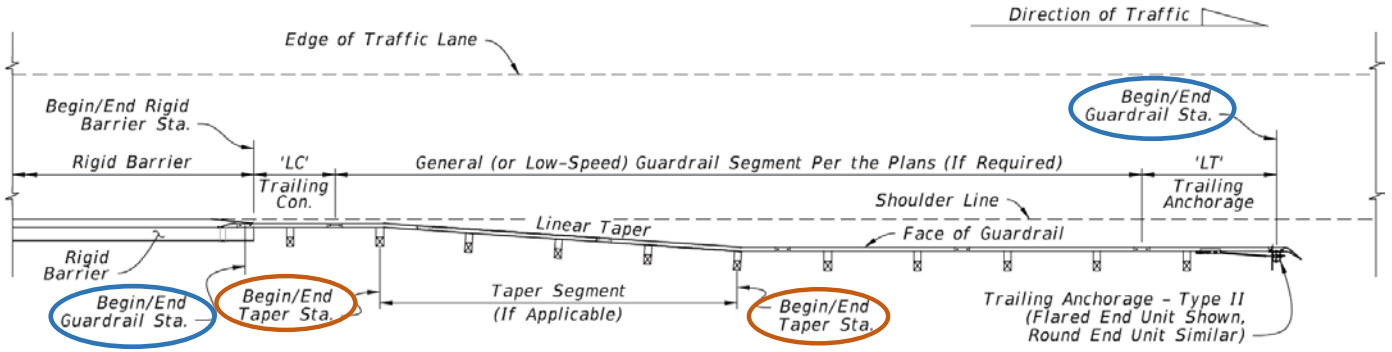
- Shows Approach Transition, General Guardrail, and Approach Terminal End Treatment as one system. NOTE: For shortest case of Rigid Barrier end protection, General Guardrail segment may be omitted (simply 'LA' + 'LE')

- **Begin/End Double Faced Guardrail Stations** called out – Corresponds to Roadway Plans callout – Corresponds to callouts on preceding sheets – *Defines length of Guardrail*

- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callout –
  This is typically where the Guardrail begins tapering to its typical section on Sheet 6 (guardrail face usually goes to paved shoulder line plus 2 feet, or it's measured from face of curb).
  The start of taper location is shown on Sheet 16.
  Taper rate guidance is provided in the IDS.

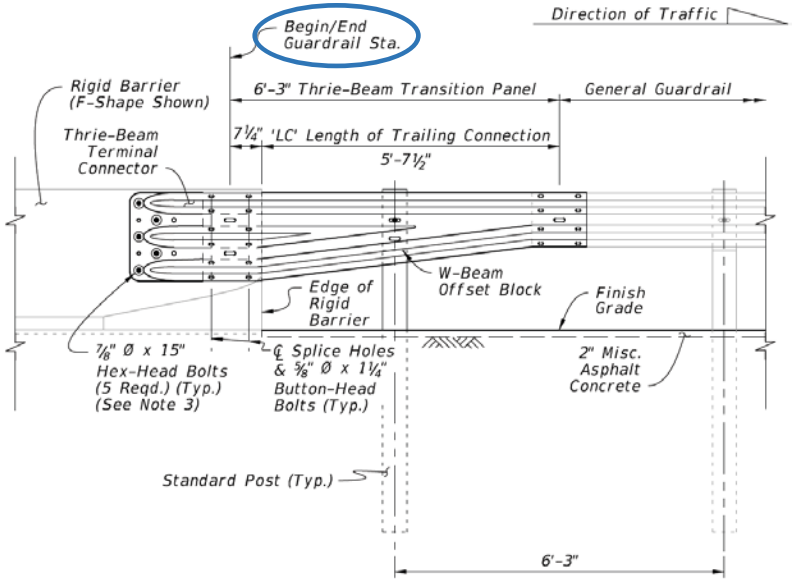
Design Standards Index 400, Sheet 18

Layouts to Rigid Barrier, Trailing End:



TYPE D TRAILING CONNECTION FROM RIGID BARRIER
PLAN VIEW - MEDIAN OR OUTSIDE SHOULDER
(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)

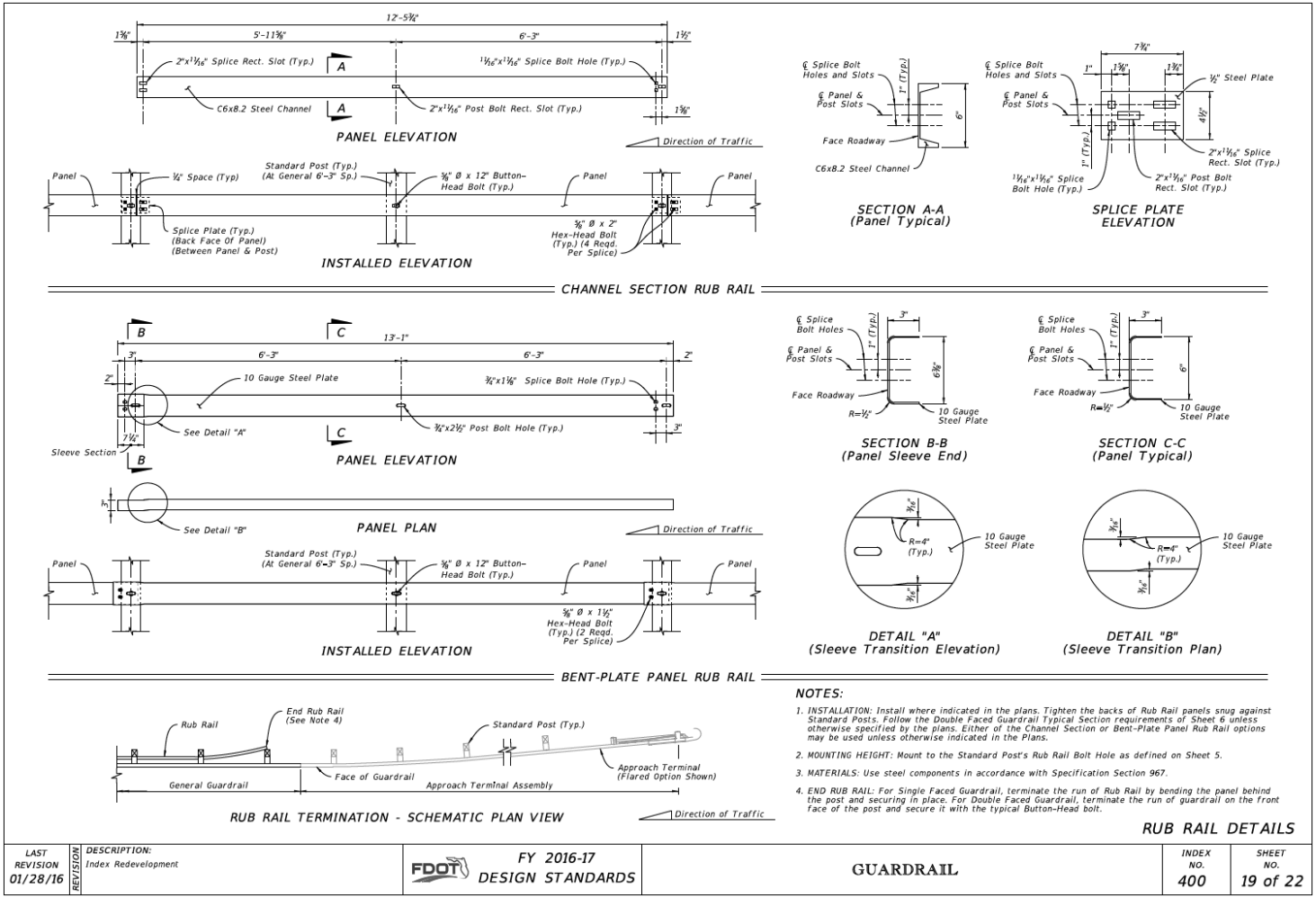
- Shows Trailing Connection, General Guardrail, and Trailing Anchorage (Type II).
- **Begin/End Guardrail Stations** called out – Corresponds to Roadway Plans callouts
- **Begin/End *Taper Stations*** called out - Corresponds to Roadway Plans callouts
- ***ALL NEW – Trailing Connection*** *detailed on same Sheet. Now uses Thrie-Beam Transition Panel to create similar connection as approach end.*



TRAILING END TRANSITION CONNECTION TO RIGID BARRIER - INSTALLED ELEVATION

Design Standards Index 400, Sheet 19

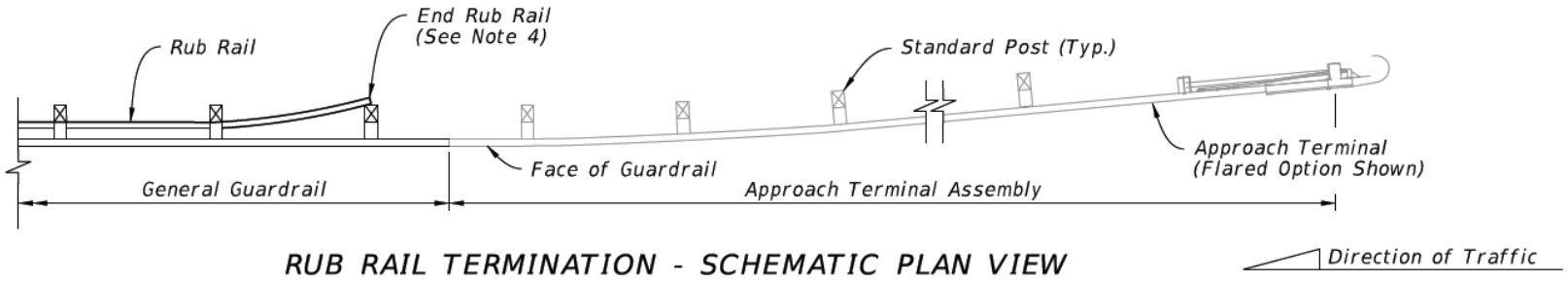
Rub Rail Details:



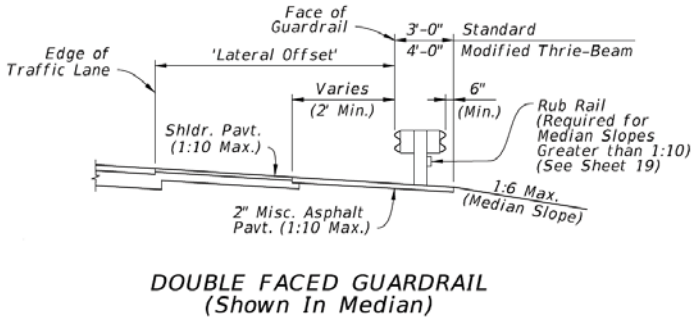
- ***NEW!* Rub Rail Details** are now Provided for same old Rub Rail!
- Previous Standard had referenced AASHTO-ARTBA-TF13 “Guide to… Barrier Hardware”, but this did not show installed Rub Rail in finished condition
- Now added more specific detail about where to begin and end Rub Rail

Design Standards Index 400, Sheet 19

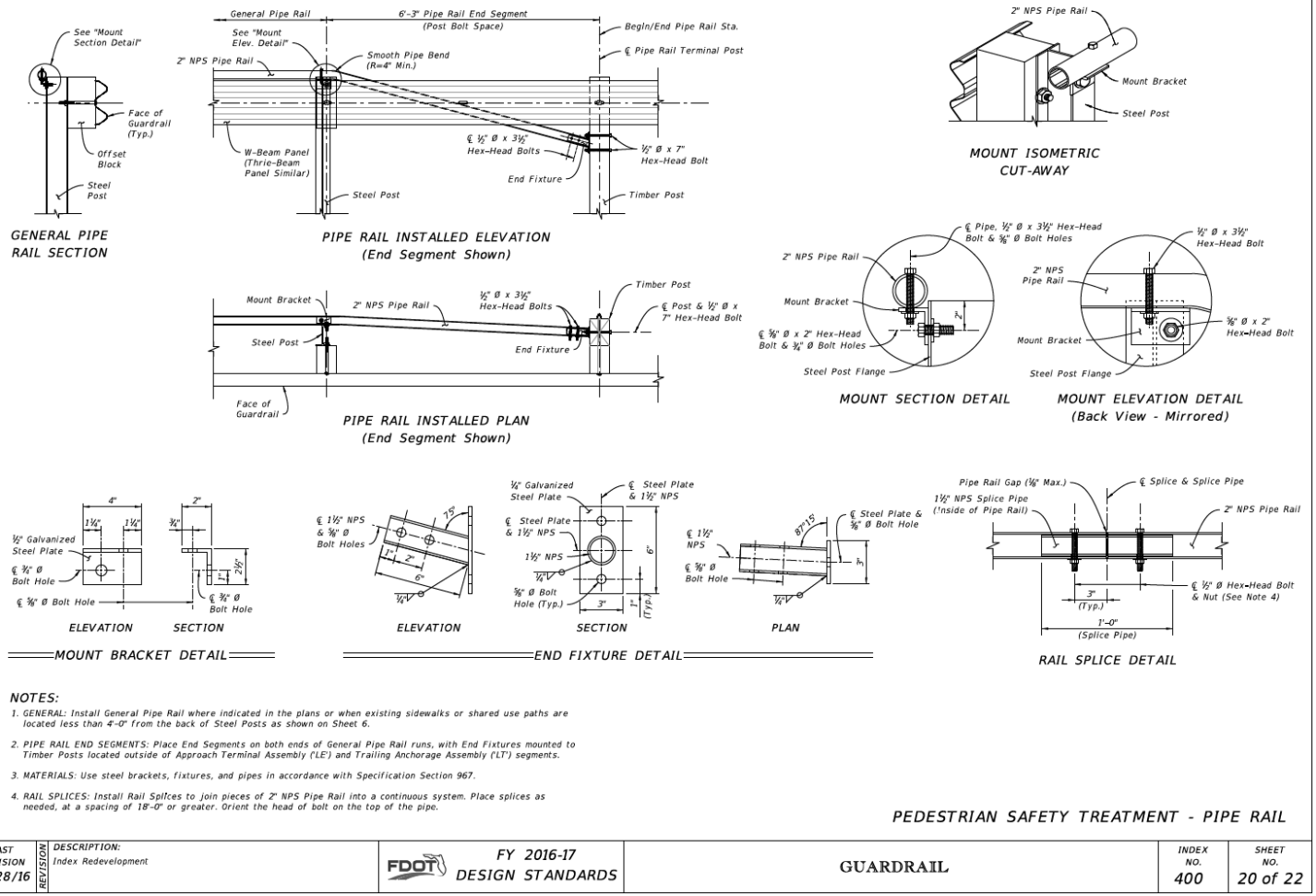
Rub Rail Details:



- Label Begin/End Rub Rail Stations as explained in the IDS
- Terminate Rub Rail outside of End Treatment Segments (Approach Terminal ‘LE’, Trailing Anchorage ‘LT’) and Crash Cushion Transition segments.
- Remember, from Sheet 6, use Rub Rail only for median slopes greater than 1:10 (with a 1:6 Max. slope in general)



Pedestrian Safety Treatment – Pipe Rail:



NOTES:

1. GENERAL: Install General Pipe Rail where indicated in the plans or when existing sidewalks or shared use paths are located less than 4'-0" from the back of Steel Posts as shown on Sheet 6.
2. PIPE RAIL END SEGMENTS: Place End Segments on both ends of General Pipe Rail runs, with End Fixtures mounted to Timber Posts located outside of Approach Terminal Assembly ('LE') and Trailing Anchorage Assembly ('LT') segments.
3. MATERIALS: Use steel brackets, fixtures, and pipes in accordance with Specification Section 967.
4. RAIL SPLICES: Install Rail Splices to join pieces of 2" NPS Pipe Rail into a continuous system. Place splices as needed, at a spacing of 18'-0" or greater. Orient the head of bolt on the top of the pipe.

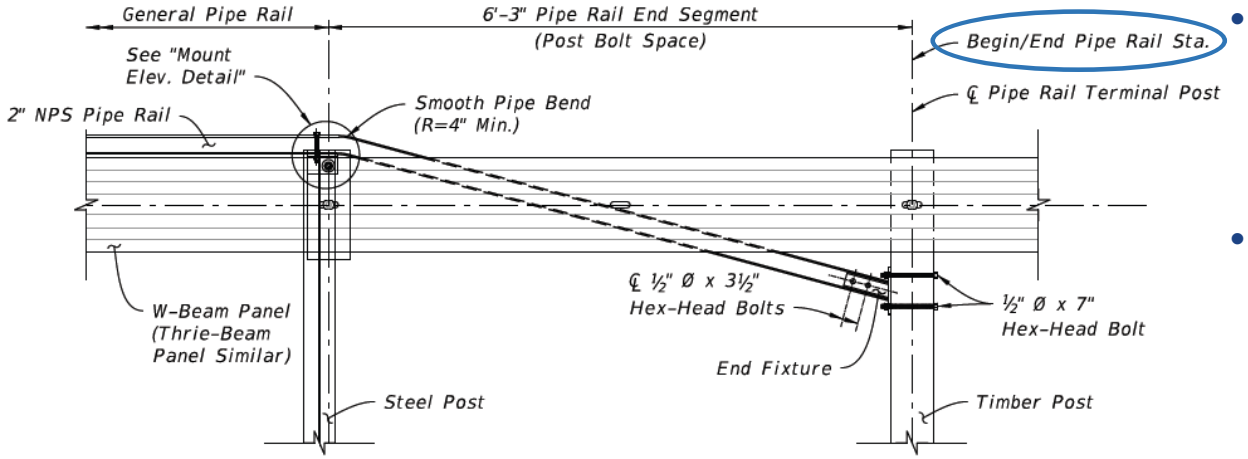
PEDESTRIAN SAFETY TREATMENT - PIPE RAIL

LAST REVISION 01/28/16	REVISION DESCRIPTION: Index Redevelopment	FDOT FY 2016-17 DESIGN STANDARDS	GUARDRAIL	INDEX NO. 400	SHEET NO. 20 of 22

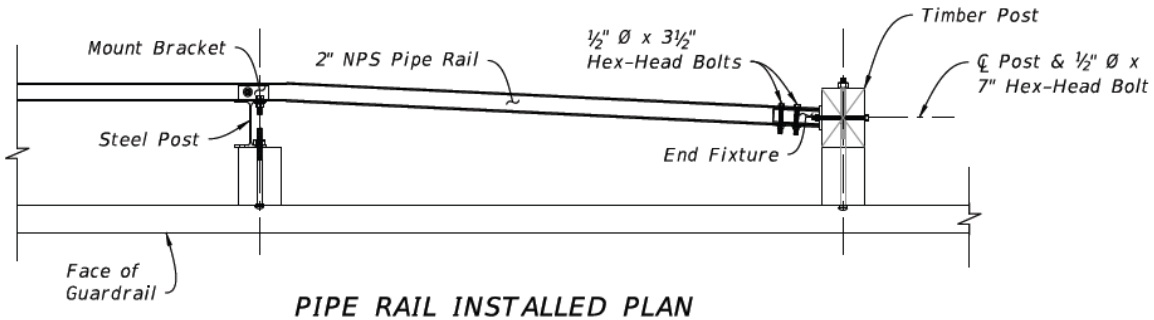
- This is the same as the previous Standard, only detailed more clearly and with more construction issues addressed.

Design Standards Index 400, Sheet 20

Pedestrian Safety Treatment – Pipe Rail:



PIPE RAIL INSTALLED ELEVATION
(End Segment Shown)

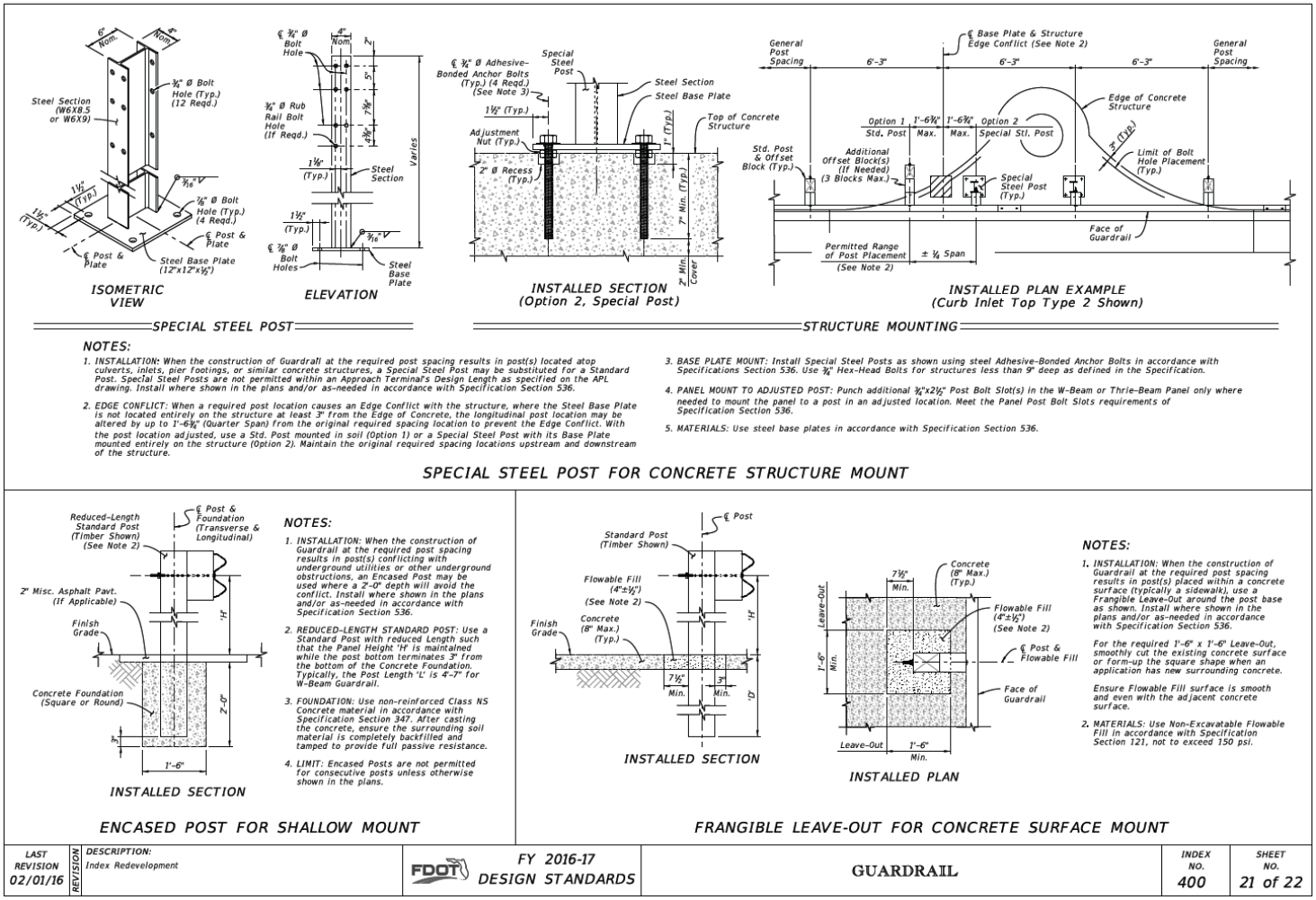


PIPE RAIL INSTALLED PLAN
(End Segment Shown)

- Pipe Rail segments are required where Steel Posts will be located within 4’ of sidewalks or shared use paths
- Designers should generally assume steel posts are used and include pipe rail callouts and quantities in the Plans (to give contractor the post option)
- Pipe Rail must terminate outside of End Treatment segments (At least 3'-1½" outside of 'LE', ‘LA’, 'LT', and/or Crash Cushion segments). Notice that the first post outside of these segments is timber where Pipe Rail is used.
- **Begin/End** Pipe Rail Station corresponds to the Plans callouts

Design Standards Index 400, Sheet 21

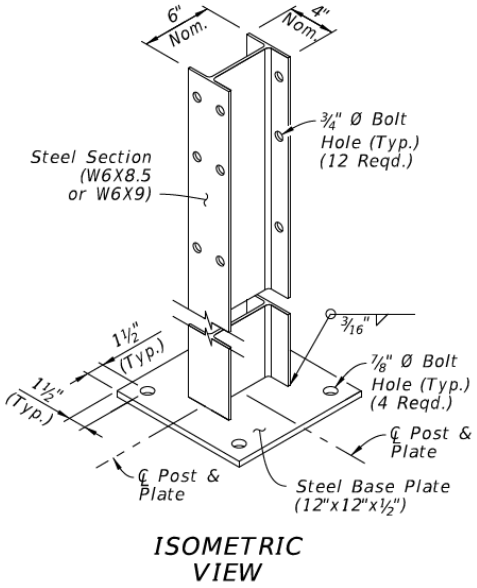
Special Steel Post, Encased Post, Frangible Leave Out:



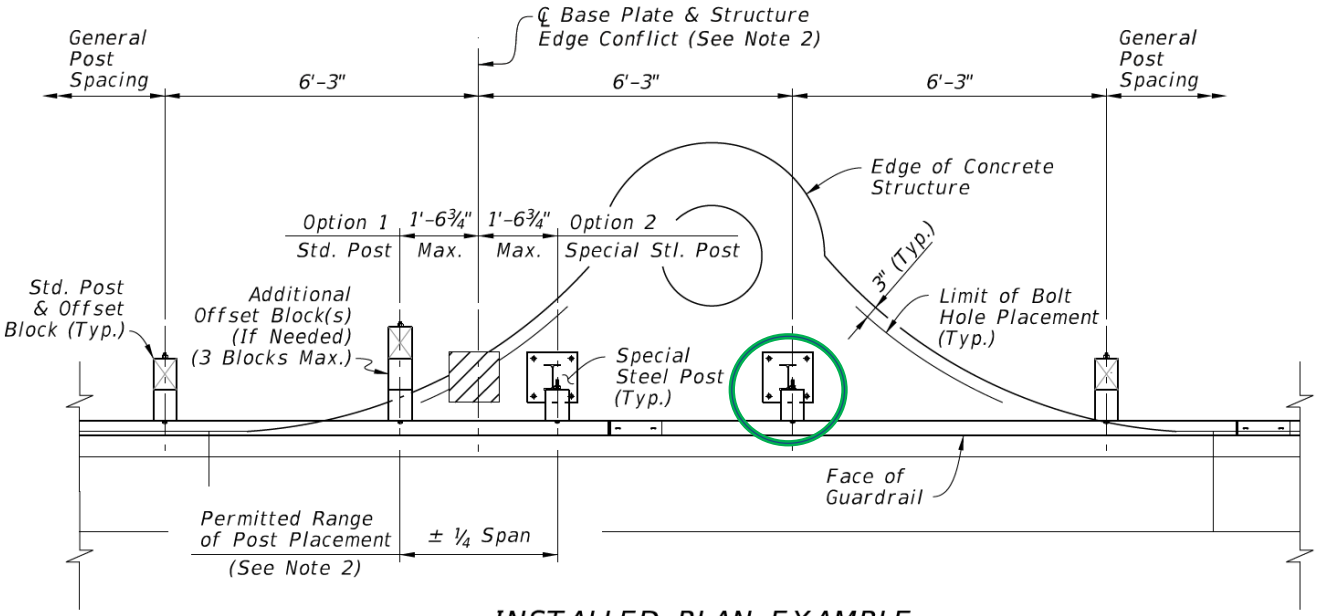
- ***NEW AND IMPROVED!*** (mostly)
- **"Modified Mounts"** allow different post mounting options for the scenarios of:
  - **Posts atop a concrete structure**
  - **Posts over shallow underground utilities**
  - **Post atop concrete surface (sidewalk)**

Design Standards Index 400, Sheet 21

Special Steel Post for Concrete Structure Mount:



ISOMETRIC VIEW

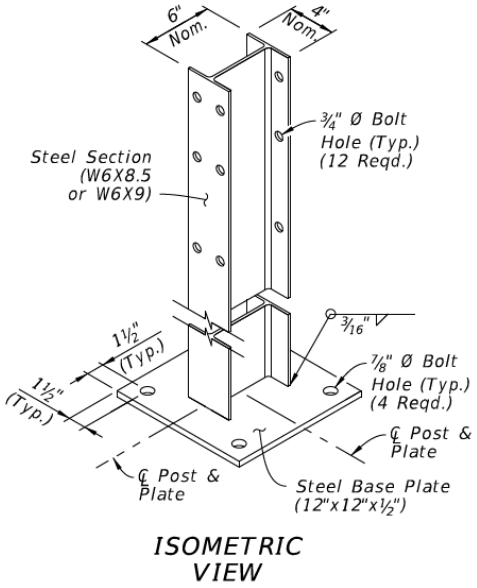


INSTALLED PLAN EXAMPLE
(Curb Inlet Top Type 2 Shown)

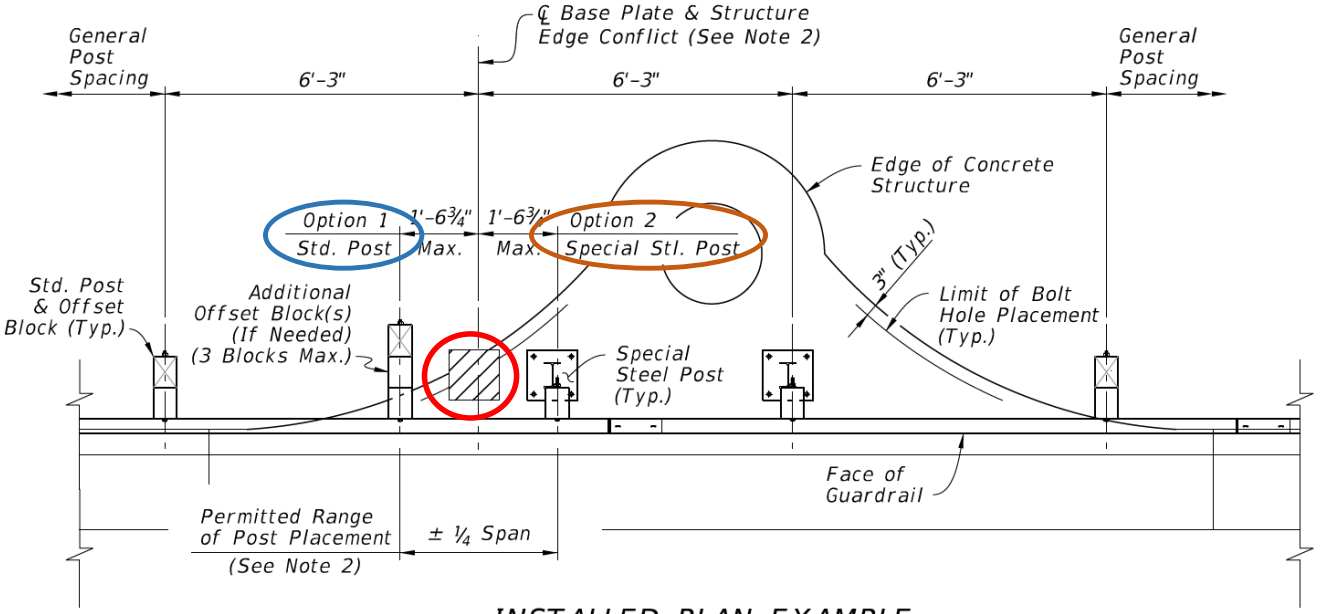
- Contractor may use Special Steel Posts when it is called for in the Plans or as-needed (billed beyond the Plans quantity).
- If a post falls entirely upon a concrete structure (base plate beyond 3" from the edge), a Special Steel Post is used (with base plate mounted into the structure via adhesive-bonded anchor bolts).

Design Standards Index 400, Sheet 21

Special Steel Post for Concrete Structure Mount:



ISOMETRIC VIEW



INSTALLED PLAN EXAMPLE
(Curb Inlet Top Type 2 Shown)

If a post falls on the concrete edge, then this is called an "Edge Conflict", and the contractor has <u>two options</u>:

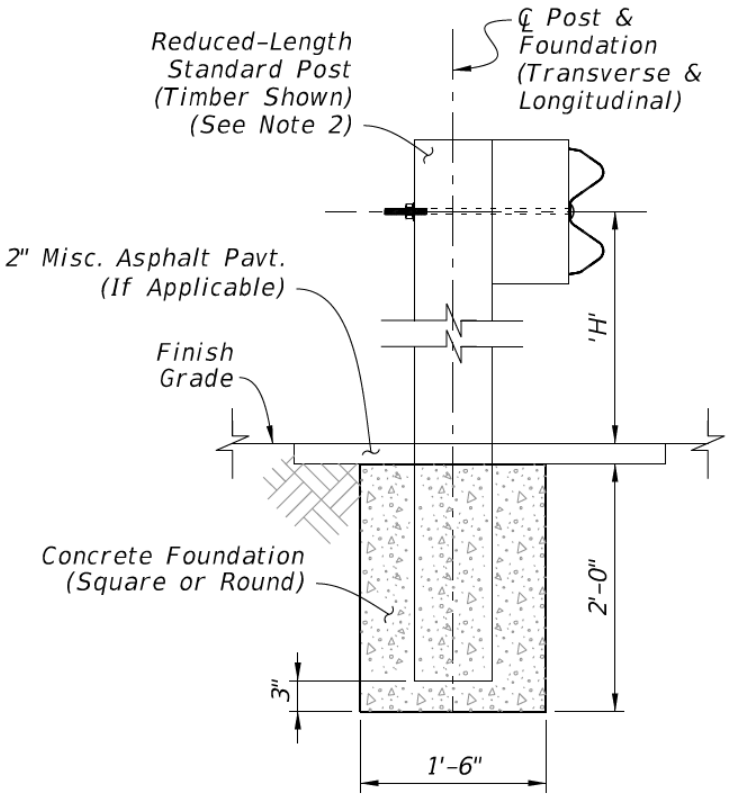
- **Option 1, Standard Post:** Move the post up to a quarter span in the direction away from the structure, and plant the post in the soil

  NOTE: The contractor is allowed to use up to 2 additional Offset Blocks to miss the structure

- **Option 2, Special Steel Post:** Move the post up to a quarter span in the direction of the structure, and use a Special Steel Post with its base plate entirely atop the structure

Design Standards Index 400, Sheet 21

Encased Post for Shallow Mount (Over Underground Obstacles):

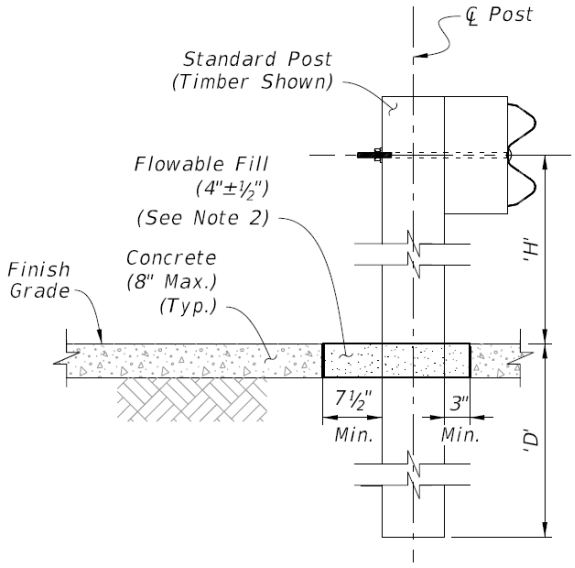


INSTALLED SECTION

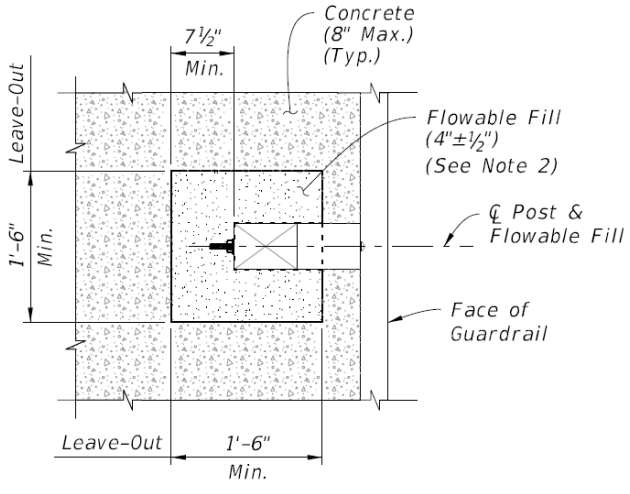
- This option saves 20” of depth versus Standard Posts.
- The contractor has the option to use as-needed (billed beyond the Plans quantity)
- This may only be used for non-consecutive posts
- If the designer happens to know of a definite post-utility conflict, then this may be called out and quantified in the Plans as well (perhaps on a short guardrail run with predictable post locations)

Design Standards Index 400, Sheet 21

Frangible Leave-out for Concrete Surface Mount:



INSTALLED SECTION



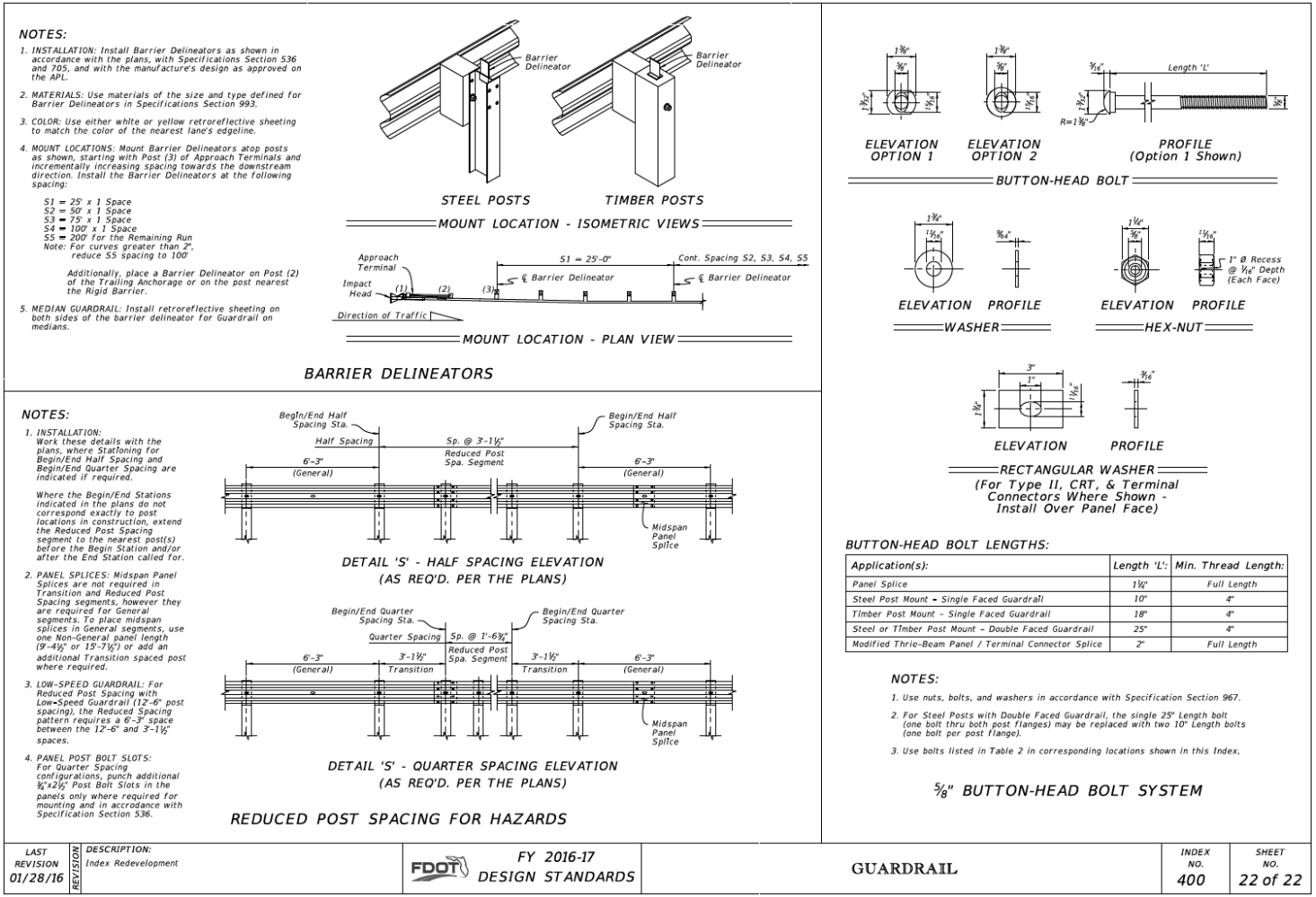
INSTALLED PLAN

- ***ALL NEW!*** If a post falls atop a concrete surface or sidewalk (undesirable), then the contractor must use a "Frangible Leave-Out" around the base of the post.
- The Frangible Leave-out involves blocking out the concrete around the base of the post and backfilling it with low-strength "Flowable Fill" (max 150 psi).

  This allows the post to rotate correctly upon vehicle impact.
- These Leave-outs can either be called out in the Plans for predictable post locations, or the contractor can use them as-needed (billed beyond the Plans quantity).

Design Standards Index 400, Sheet 22

Barrier Delineators, Reduced Post Spacing, Bolt System:



NOTES:

1. INSTALLATION: Install Barrier Delineators as shown in accordance with the plans, with Specifications Section 536 and 705, and with the manufacture's design as approved on the APL.
2. MATERIALS: Use materials of the size and type defined for Barrier Delineators in Specifications Section 993.
3. COLOR: Use either white or yellow retroreflective sheeting to match the color of the nearest lane's edgeline.
4. MOUNT LOCATIONS: Mount Barrier Delineators atop posts as shown, starting with Post (3) of Approach Terminals and incrementally increasing spacing towards the downstream direction. Install the Barrier Delineators at the following spacing:

   S1 = 25' x 1 Space
   S2 = 50' x 1 Space
   S3 = 75' x 1 Space
   S4 = 100' x 1 Space
   S5 = 200' for the Remaining Run
   Note: For curves greater than 2°, reduce S5 spacing to 100'

   Additionally, place a Barrier Delineator on Post (2) of the Trailing Anchorage or on the post nearest the Rigid Barrier.

5. MEDIAN GUARDRAIL: Install retroreflective sheeting on both sides of the barrier delineator for Guardrail on medians.

Barrier Delineator
Barrier Delineator
STEEL POSTS
TIMBER POSTS
MOUNT LOCATION - ISOMETRIC VIEWS
Approach Terminal
Impact Head
S1 = 25'-0"
Cont. Spacing S2, S3, S4, S5
℄ Barrier Delineator
℄ Barrier Delineator
Direction of Traffic
MOUNT LOCATION - PLAN VIEW

BARRIER DELINEATORS

NOTES:

1. INSTALLATION: Work these details with the plans, where Stationing for Begin/End Half Spacing and Begin/End Quarter Spacing are indicated if required.

   Where the Begin/End Stations indicated in the plans do not correspond exactly to post locations in construction, extend the Reduced Post Spacing segment to the nearest post(s) before the Begin Station and/or after the End Station called for.

2. PANEL SPLICES: Midspan Panel Splices are not required in Transition and Reduced Post Spacing segments, however they are required for General segments. To place midspan splices in General segments, use one Non-General panel length (9'-4½" or 15'-7½") or add an additional Transition spaced post where required.
3. LOW-SPEED GUARDRAIL: For Reduced Post Spacing with Low-Speed Guardrail (12'-6" post spacing), the Reduced Spacing pattern requires a 6'-3" space between the 12'-6" and 3'-1½" spaces.
4. PANEL POST BOLT SLOTS: For Quarter Spacing configurations, punch additional ¾"x2½" Post Bolt Slots in the panels only where required for mounting and in accrodance with Specification Section 536.

Begin/End Half Spacing Sta.
Half Spacing
Sp. @ 3'-1½"
Reduced Post Spa. Segment
Begin/End Half Spacing Sta.
6'-3" (General)
6'-3" (General)
Midspan Panel Splice
DETAIL 'S' - HALF SPACING ELEVATION (AS REQ'D. PER THE PLANS)

Begin/End Quarter Spacing Sta.
Quarter Spacing
Sp. @ 1'-6¾"
Reduced Post Spa. Segment
Begin/End Quarter Spacing Sta.
6'-3" (General)
3'-1½" Transition
3'-1½" Transition
6'-3" (General)
Midspan Panel Splice
DETAIL 'S' - QUARTER SPACING ELEVATION (AS REQ'D. PER THE PLANS)

REDUCED POST SPACING FOR HAZARDS

ELEVATION OPTION 1
ELEVATION OPTION 2
Length 'L'
PROFILE (Option 1 Shown)
BUTTON-HEAD BOLT
ELEVATION
PROFILE
WASHER
1" Ø Recess @ 9/16" Depth (Each Face)
ELEVATION
PROFILE
HEX-NUT
ELEVATION
PROFILE
RECTANGULAR WASHER
(For Type II, CRT, & Terminal Connectors Where Shown - Install Over Panel Face)

BUTTON-HEAD BOLT LENGTHS:

Application(s):	Length 'L':	Min. Thread Length:
Panel Splice	1¼"	Full Length
Steel Post Mount - Single Faced Guardrail	10"	4"
Timber Post Mount - Single Faced Guardrail	18"	4"
Steel or Timber Post Mount - Double Faced Guardrail	25"	4"
Modified Thrie-Beam Panel / Terminal Connector Splice	2"	Full Length

NOTES:

1. Use nuts, bolts, and washers in accordance with Specification Section 967.
2. For Steel Posts with Double Faced Guardrail, the single 25" Length bolt (one bolt thru both post flanges) may be replaced with two 10" Length bolts (one bolt per post flange).
3. Use bolts listed in Table 2 in corresponding locations shown in this Index.

⅝" BUTTON-HEAD BOLT SYSTEM

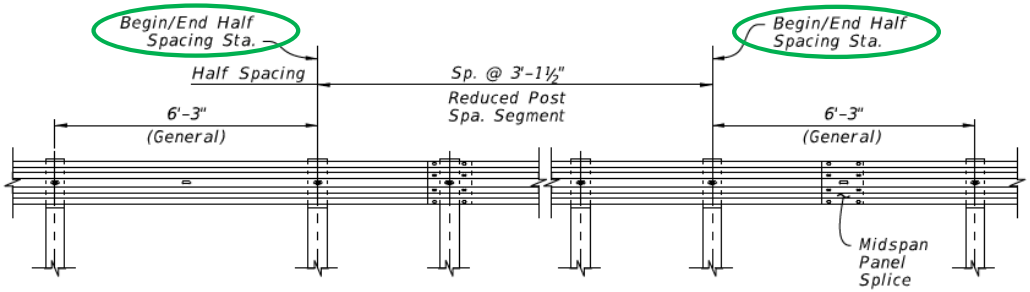
LAST REVISION	REVISION	DESCRIPTION:			INDEX NO.	SHEET NO.
01/28/16		Index Redevelopment	FDOT	FY 2016-17 DESIGN STANDARDS	400	22 of 22

GUARDRAIL

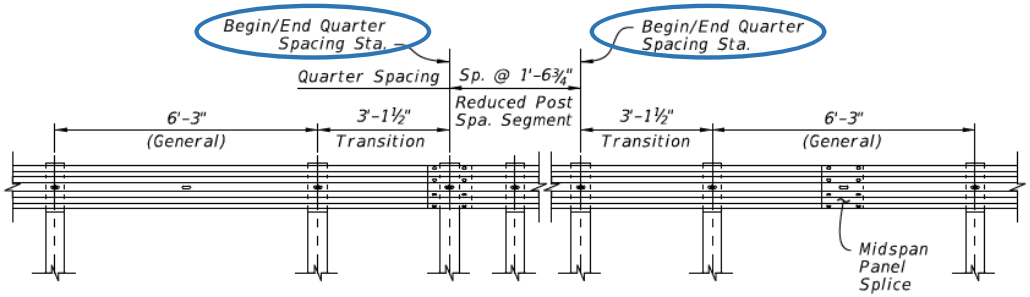
- ***LAST INDEX SHEET!***
- Includes Miscellaneous Details for the Contractor like Barrier Delineation and Standard Bolt Information
- The "Reduced Post Spacing for Hazards" detail simplifies post spacing transitions for designers

Design Standards Index 400, Sheet 22

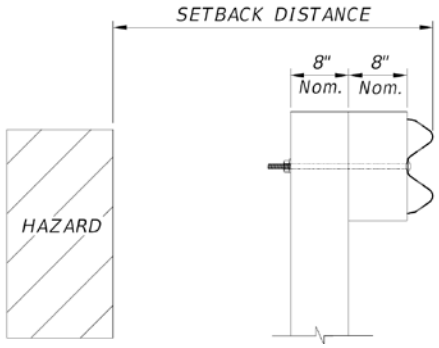
Reduced Post Spacing for Hazards (Reduced Setback Clearance) :



DETAIL 'S' - HALF SPACING ELEVATION
(AS REQ'D. PER THE PLANS)



DETAIL 'S' - QUARTER SPACING ELEVATION
(AS REQ'D. PER THE PLANS)



From PPM: Table 4.4.2 Minimum Barrier Setback:

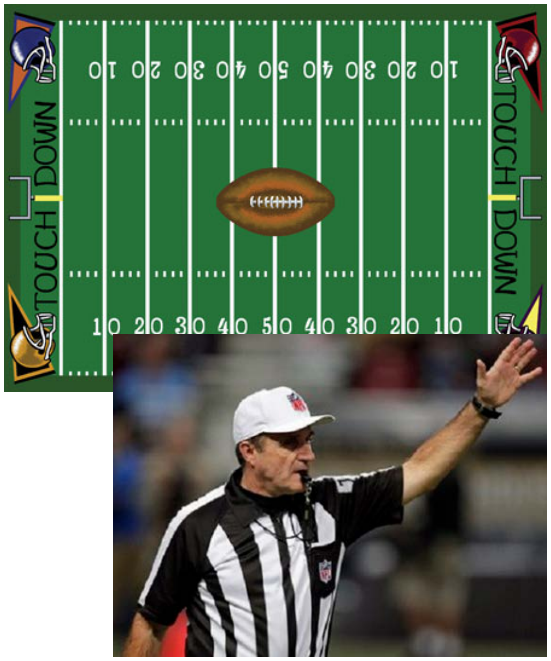
Semi-Rigid Barrier	
W-Beam with Post Spacing @ 6'-3" (TL-3)	5'-0"
W-Beam with Post Spacing @ 3'-1½" (½ Spacing)	3'-10"
W-Beam with Post Spacing @ 1'-6¾" (¼ Spacing)	3'-2"
Nested W-Beams with Post Spacing @ 3'-1½" (½ Spacing)	3'-0"
Nested W-Beams with Post Spacing @ 1'-6¾" (¼ Spacing)	2'-8"
Modified Thrie-Beam with Post Spacing @ 6'-3"	3'-0"

- When an aboveground hazard is within 5'-0" behind the face of guardrail, *reduced post spacing* may be used to reduce the "Setback" requirement to the hazard (see PPM Table below)
- The designer must call out the reduced post spacing as required per the table, and the Design Standard will handle the transition of post spacing before and after
- The Standard extends the reduced post spacing to the nearest post outside of the station range called for.
- The Standard also handles Low-speed Guardrail 12'-6" spacing, explaining that the spacing sequence remains the same, but with the 12'-6" adjacent to the 6'-3" spacing.

Design Standards Index 400, Q4 Review!

End of Game Review Questions!

(Everyone wins!... of course)



1. What station and offset callouts are required to define a Guardrail Crossover for Median configuration?
2. When is Rub Rail required?
3. When is Pipe Rail required?
4. Concerning Pipe Rail, the Roadway Plans should assume steel posts are used (True or False)
5. How many options does a contractor have when a post has an “Edge Conflict” with a structure?
6. When is a Frangible Leave-Out used?
7. When is a Reduced Post Spacing segment used?

MODULE 3:

Instructions for Design Standards (IDS)

Index 400 is a DSR, as of February 1, 2016

Index 400 Guardrail – IDS

Where is it?...

Office of Design

Office of Design / Design Standards / Design Standards Revisions FY 2016-17

Design Standards Revisions FY 2016-17

n/a = Non Applicable
n/c = No Change

Index Number	Revised Sheets (PDF)	Index Title	Design Information: Instructions (IDS) (PDF)	Design Tools (Link)	Data Table Cell Library (ZIP)	Borderless DGNs (ZIP) Terms of Use	Associated Design Bulletin (PDF)
400	1-22 of 22	Guardrail	IDS-00400	XLS	N/A	DGN	RDB16-01
410	2,10, 16-18 of 25	Concrete Barrier Wall		N/A		DGN	
411	6 of 10	Pier Protection Barrier		N/A		DGN	

Index 400 Guardrail – IDS Part B

Length of Need Concept:

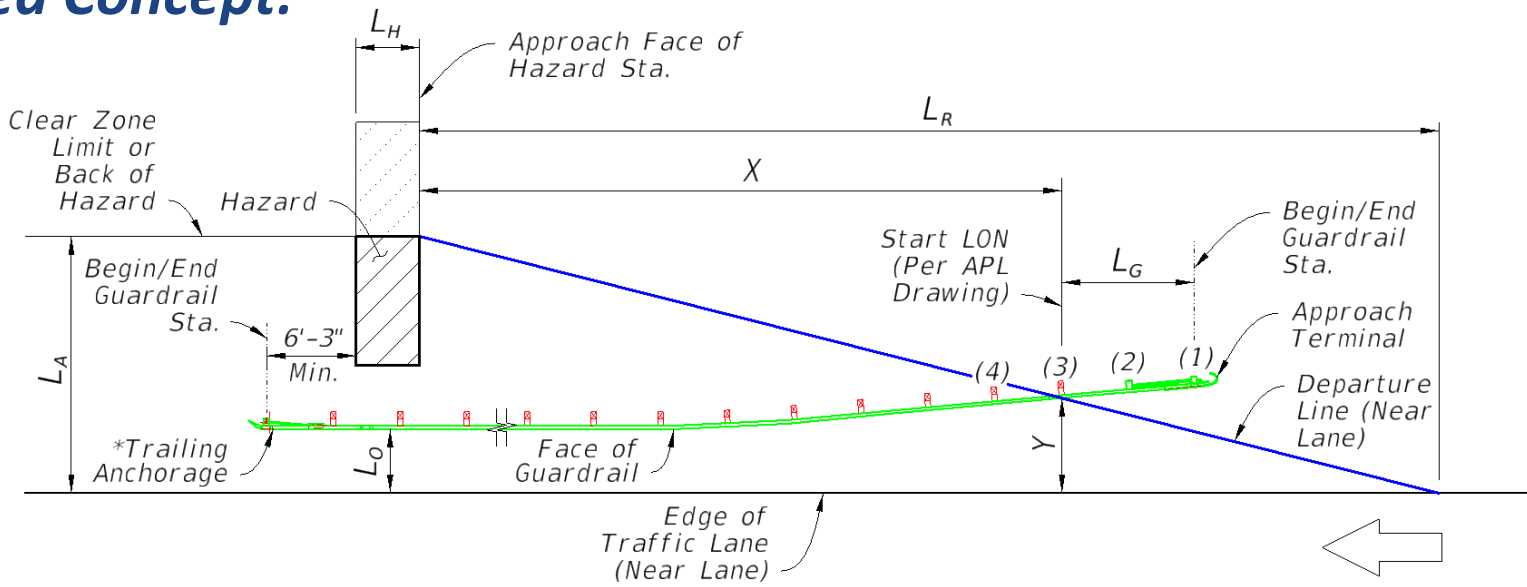
Length of Need (LON) is the length of guardrail required to provide a degree of shielding to prevent errant vehicles from impacting roadside hazards – measured from the hazard's approach face to the approach end of the redirective guardrail segment.

From the Guardrail-LON program:
*"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**"*

A picture is worth a thousand words, so….

Index 400 Guardrail – IDS Part B

Length of Need Concept:

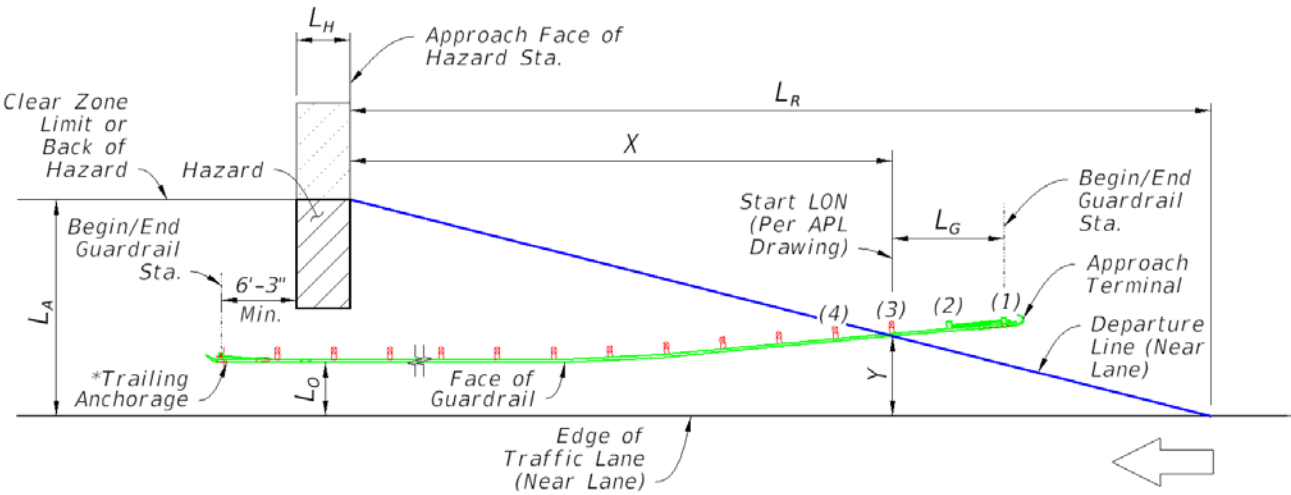


Length of Need, X (Ft.) $$X = \frac{L_A - Y}{L_A / L_R}$$ AASHTO RDG (5-3)

Lateral Area Concern, L_A (Ft.)	*the lesser distance from the 'Edge of Traffic Lane' to the 'Clear Zone Limit' or 'Back of Hazard'*
End Treatment Offset, Y (Ft.)	*the distance from the Edge of Traffic Lane at the start of the guardrail's gating portion "Start LON" (shown at Post 3)*
Runout Length, L_R (Ft.)	*taken from the AASHTO RDG, Table 5-10(b), based on Design Speed (mph) and Traffic Volume (AADT)*

Index 400 Guardrail – IDS Part B

Length of Need



Quick Example:

Design Speed = 45 mph

AADT = 5000 veh/day

Y = 8.5 Ft. (by design, guardrail offset plus flare *effect*)

Back of Hazard = 22 Ft. (from 'Edge of Traffic Lane')

Clear Zone = 24 Ft. (from PPM Table 4.2.1)

Lateral Area Concern, L_A = 22 Ft.

Runout Length, L_R = 160 Ft. (from RDG Table 5-10b)

$$X = \frac{L_A - Y}{L_A / L_R} = (22\text{-}8.5) / (22/160)$$

X = 98.2 Ft.

Table 4.2.1 Clear Zone Width Requirements

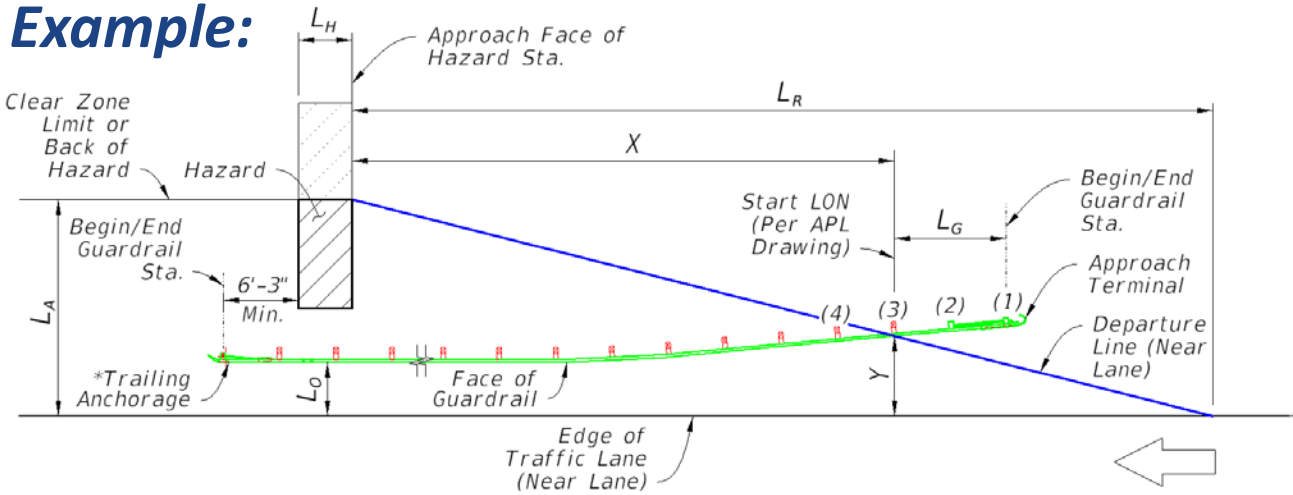
NEW CONSTRUCTION				
	≥ 1500 AADT [1]		< 1500 AADT [1]	
DESIGN SPEED (mph)	TRAVEL LANES & MULTILANE RAMPS (feet)	AUXILIARY LANES & SINGLE LANE RAMPS (feet)	TRAVEL LANES & MULTILANE RAMPS (feet)	AUXILIARY LANES & SINGLE LANE RAMPS (feet)
< 45	18	10	16	10
45	24	14	20	14
50	24	14	20	14
55	30	18	24	14
> 55	36	24	30	18

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
Design Speed (mph)	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

Index 400 Guardrail – IDS Part B

Length of Need, Quick Example:



Notice that L_g, the "Length of Gating", was ignored in the previous Calculation. This is the "break away" stuff, so we only count the "non-gating" *re-directive* segment for Length of Need. We'll talk more about this in Part C.

Also, we'll see more Length of Need Design Examples when we discuss the "Length of Need Design" Tool… Stay tuned!

Index 400 Guardrail – IDS Part C

End Treatments:

"An End Treatment segment is required for all guardrail ends where the guardrail does not transition into another barrier type (e.g. Approach or Trailing End Transition Connections to Rigid Barrier). End Treatments are divided into three types."

End Treatment Types:

1. **Trailing Anchorages**
2. **Approach Terminals**
   i. **Flared**
   ii. **Parallel**
   iii. **Double Faced**
3. **Crash Cushions**

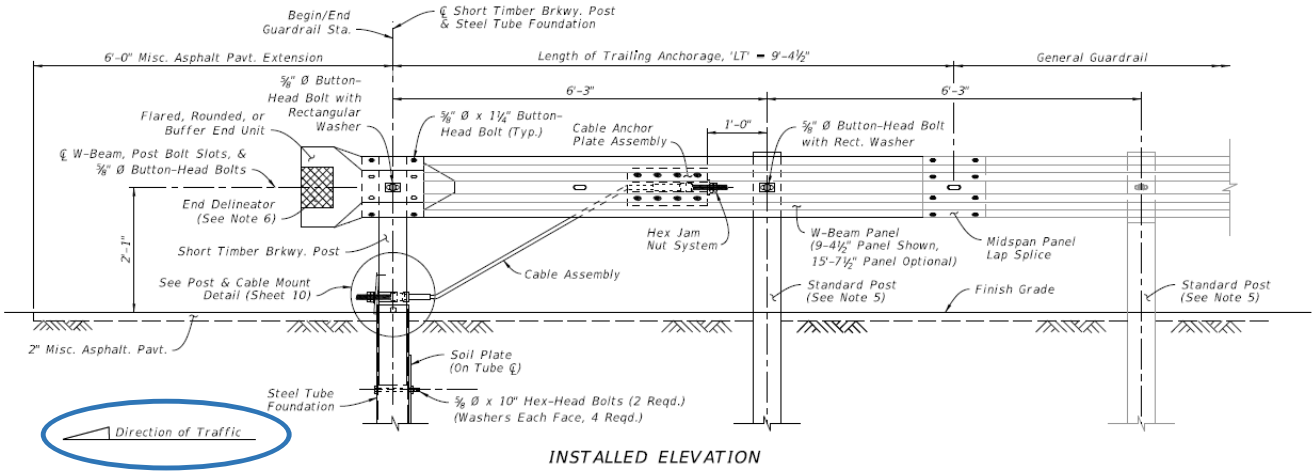
Index 400 Guardrail – IDS Part C

End Treatments – 1. Trailing Anchorage:

FDOT STANDARD DESIGN

"Place a Trailing Anchorage (Type II) on the downstream ends of all guardrail runs with respect to the nearest traffic lane, *except* where the location is within the Clear Zone of an opposing traffic lane."

Index 400, Sheet 9 ➡ **Good Ole' Type II !!**



Index 400 Guardrail – IDS Part C

End Treatments – 2. Approach Terminal:

PROPRIETARY
APL DESIGNS

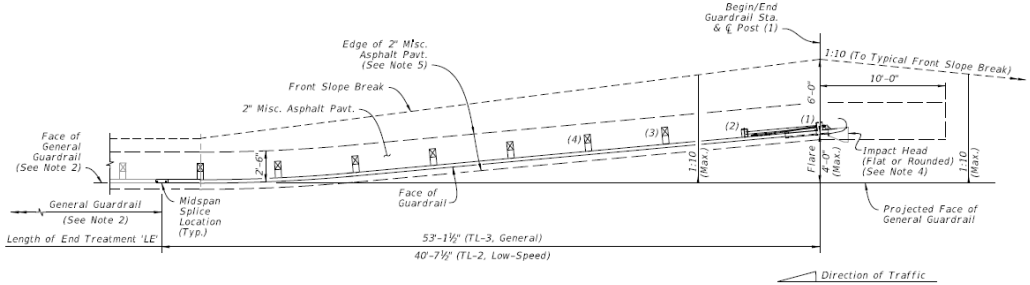
"Place an Approach Terminal on the approach ends of all guardrail runs, for all locations within the Clear Zone of an adjacent traffic lane."

Index 400 Guardrail – IDS Part C

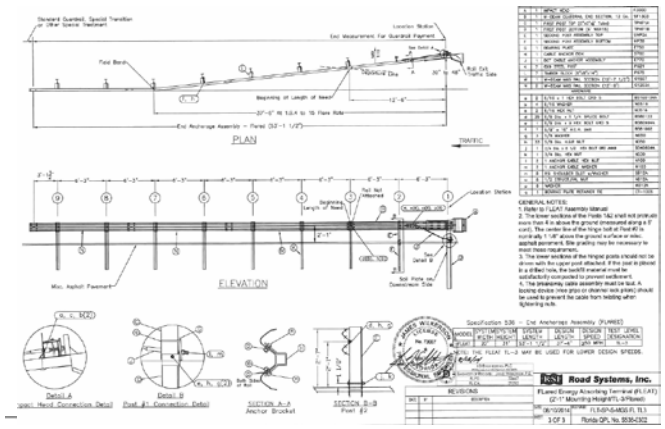
End Treatments – 2. Approach Terminal:

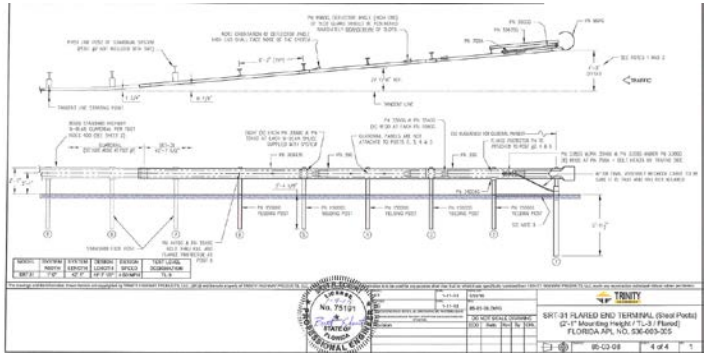
PROPRIETARY APL DESIGNS

1. Flared: Use where raised curbs are not present and lateral clearance is available. This is the preferred option, because it provides shortest Length of Need requirement for shielding hazards and reduces driver propensity to shy away from the End Treatment under normal conditions.



APPROACH TERMINAL ASSEMBLY
'FLARED' SEGMENT - PLAN VIEW



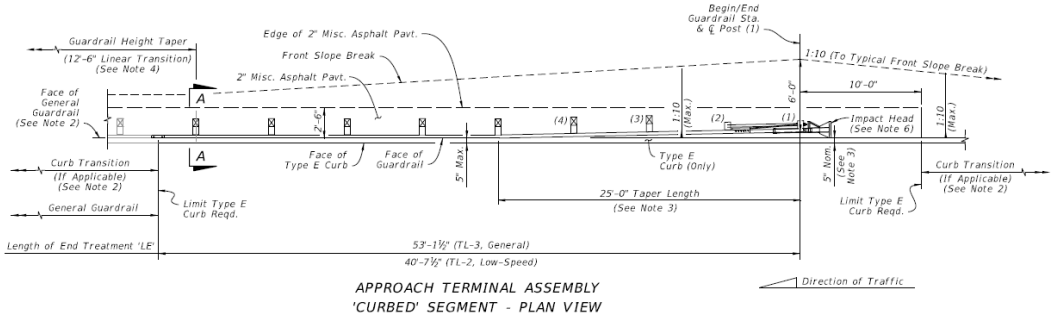


Index 400 Guardrail – IDS Part C

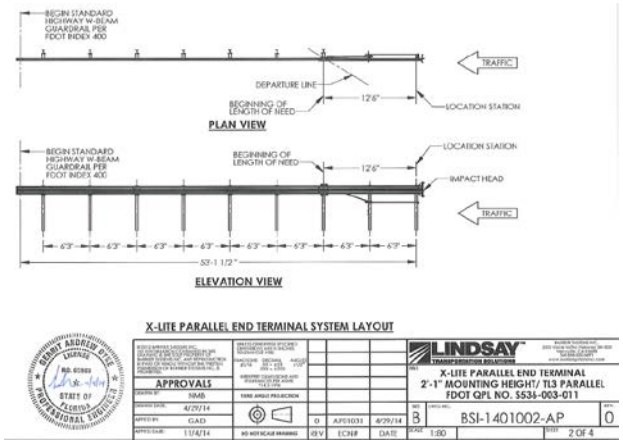
End Treatments – 2. Approach Terminal:

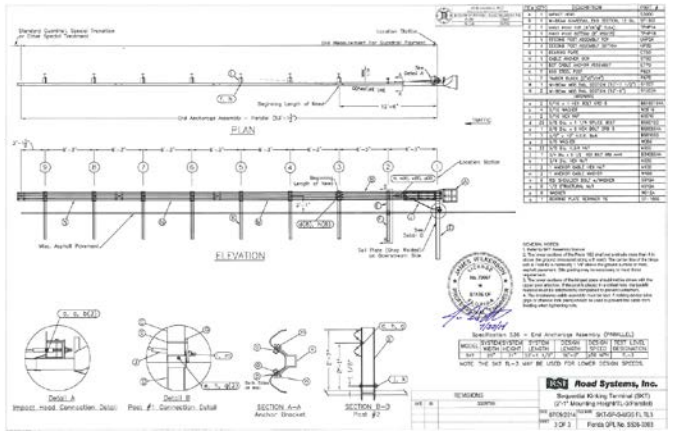
PROPRIETARY
APL DESIGNS

2. Parallel: Use for curbed conditions or where lateral clearance behind the End Treatment is limited.



APPROACH TERMINAL ASSEMBLY
'CURBED' SEGMENT - PLAN VIEW



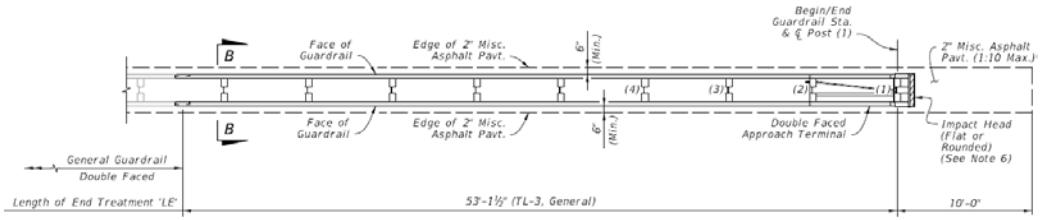


Index 400 Guardrail – IDS Part C

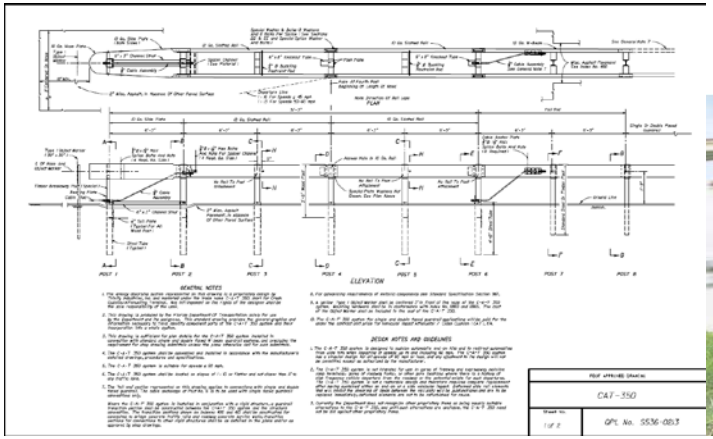
End Treatments – 2. Approach Terminal:

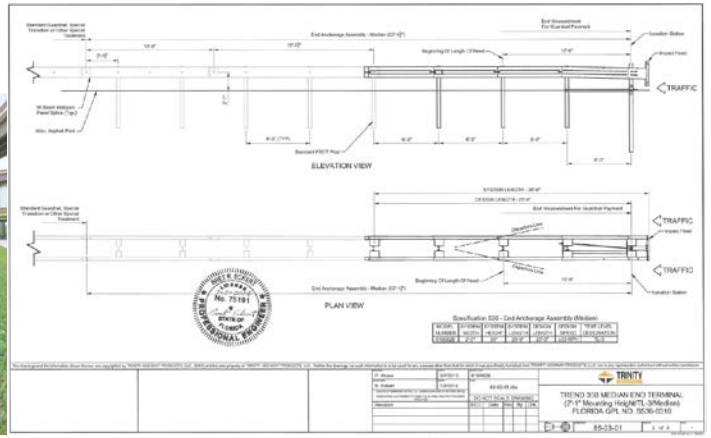
PROPRIETARY
APL DESIGNS

3. Double Faced: Use with Double Faced Guardrail segments. As an alternative, a Crash Cushion may be substituted for a Double Faced Approach Terminal.



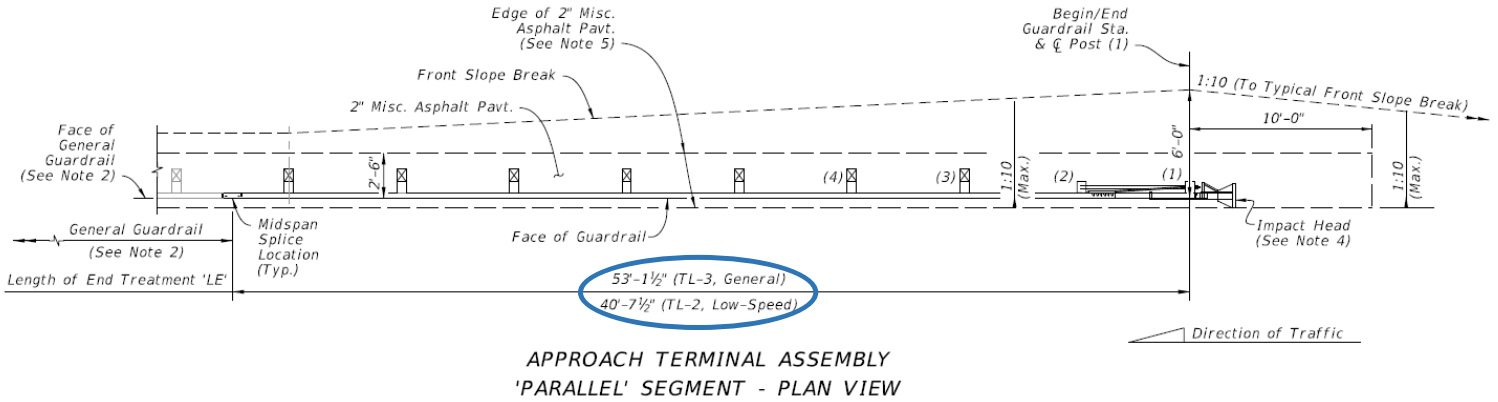
APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW





End Treatments – 2. Approach Terminal:

Predefined Length Concept:
Standard Length of End Treatment, 'LE'



APPROACH TERMINAL ASSEMBLY
'PARALLEL' SEGMENT - PLAN VIEW

'LE' = 53'-1½" for TL-3, and **'LE' = 40'-1½"** for TL-2
Use when possible. These lengths allow all APL Approach Terminals to fit on the Project (contractor's choice).

Allow for at least this much length in the Plans, measured from Post (1)
This length should not overlap with other design segments, like Approach Transitions 'LA' or trailing anchorages 'LT'.

Index 400 Guardrail – IDS Part C

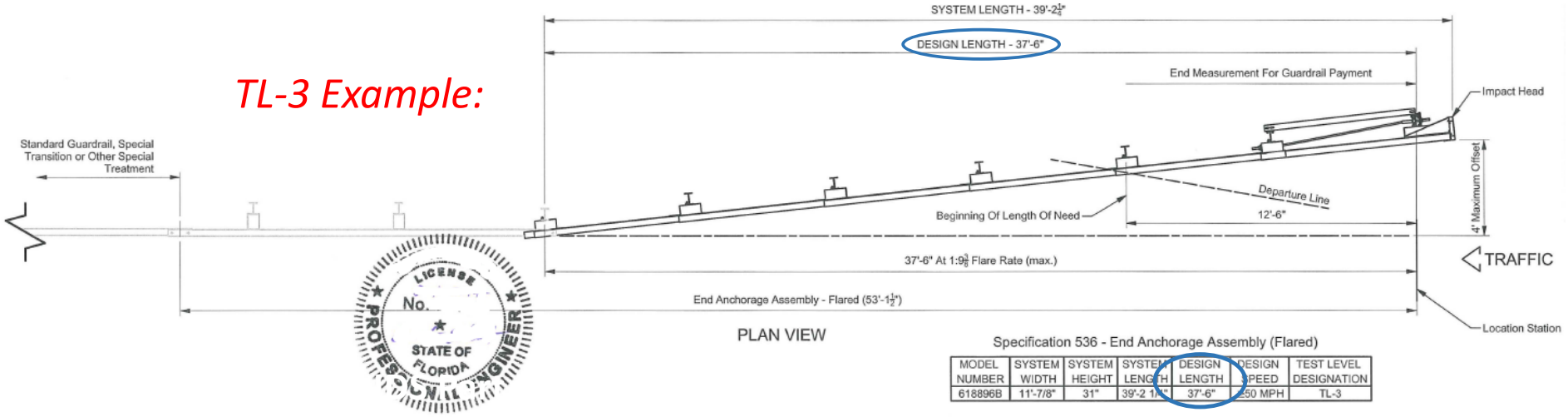
End Treatments – 2. Approach Terminal:

PROPRIETARY APL DESIGNS

<u>Design Length</u> Concept:

Only when Standard 'LE' won't fit, look to APL drawings for shortest 'Design Length':

TL-3 Example:



Specification 536 - End Anchorage Assembly (Flared)

MODEL NUMBER	SYSTEM WIDTH	SYSTEM HEIGHT	SYSTEM LENGTH	DESIGN LENGTH	DESIGN SPEED	TEST LEVEL DESIGNATION
618896B	11'-7/8"	31"	39'-2 1/2"	37'-6"	50 MPH	TL-3

In the Plans, allow for 'Design Length' plus midspan panel lap splice.
In this example, provide 37'-6" plus 3'-1½" **= 40'-7½"** outside of other segments.

Add 'Design Length' notes to the Roadway Plan callout and Summary of Guardrail per the IDS (e.g. "Design Length ≤ 37.5 Ft., See Summary of Guardrail Note").

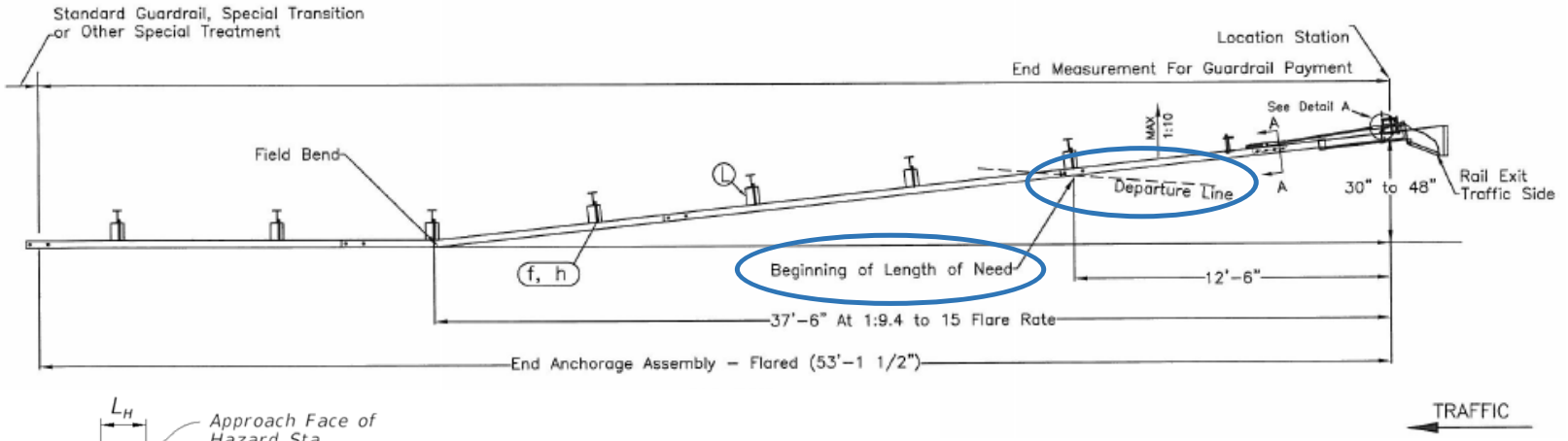
Index 400 Guardrail – IDS Part C

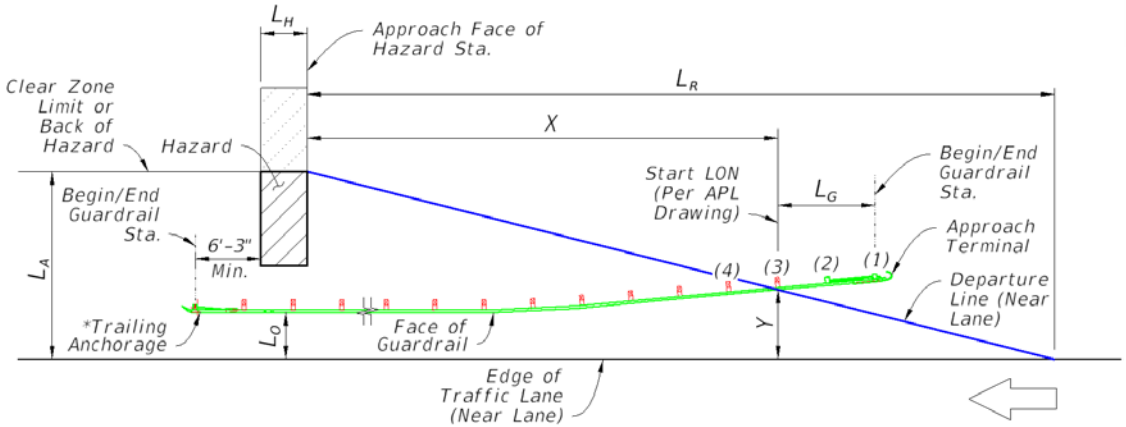
End Treatments – 2. Approach Terminal:

PROPRIETARY APL DESIGNS

Gating Terminal Concept for 'LON' Design:

Most Approach Terminals have break-away "gating" between posts 1 and 3:





⇨Gating Terminals typically require 12'-6" between Post (1) and the start of the Length of Need, X, measurement (See "Departure Line")

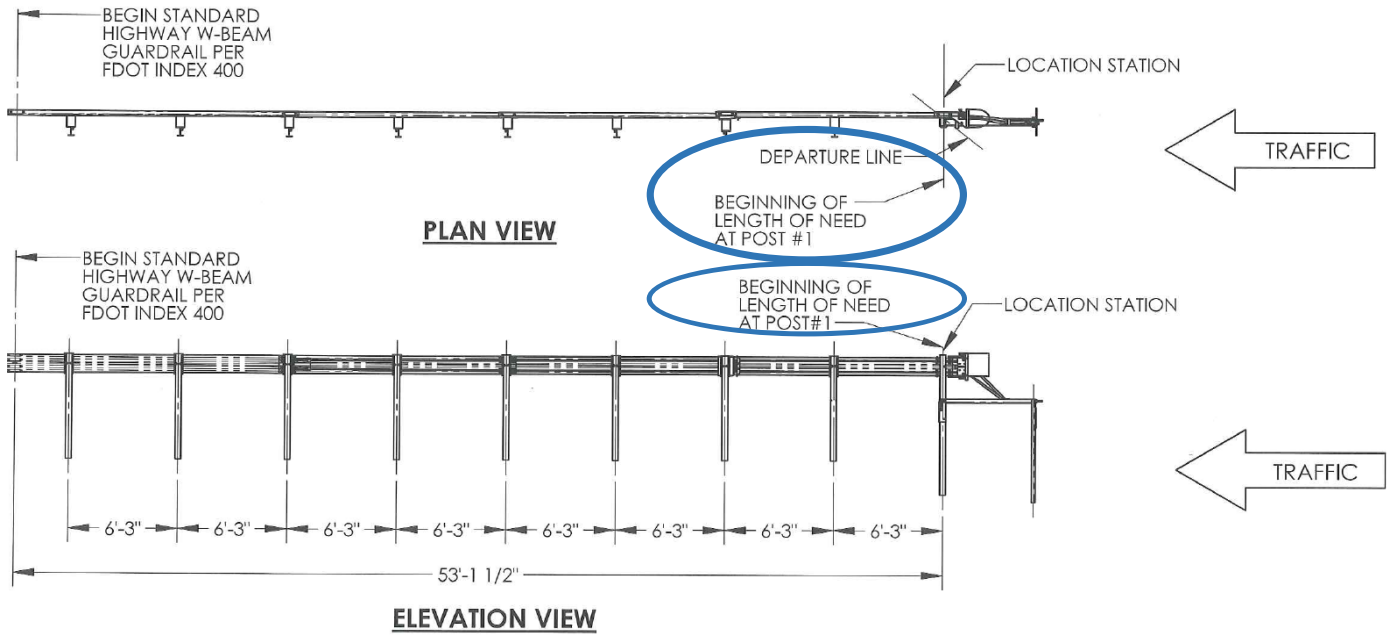
Index 400 Guardrail – IDS Part C

End Treatments – 2. Approach Terminal:

PROPRIETARY
APL DESIGNS

Non-Gating Terminal Concept for 'LON' Design:

Non-Gating Terminals save space by
Starting the Length of Need Measurement at Post (1):



Only specify a Non-Gating Terminal in the Plans where this space savings is required to fit. In the Roadway Plan view, specify "Non-Gating" preceding the Approach Terminal callout. Additionally, add a Summary of Guardrail note per the IDS.

Index 400 Guardrail – IDS Part C

End Treatments – 3. Crash Cushions:

PROPRIETARY
APL DESIGNS

Crash Cushions May be Used for Doubled Faced Guardrail End Treatments

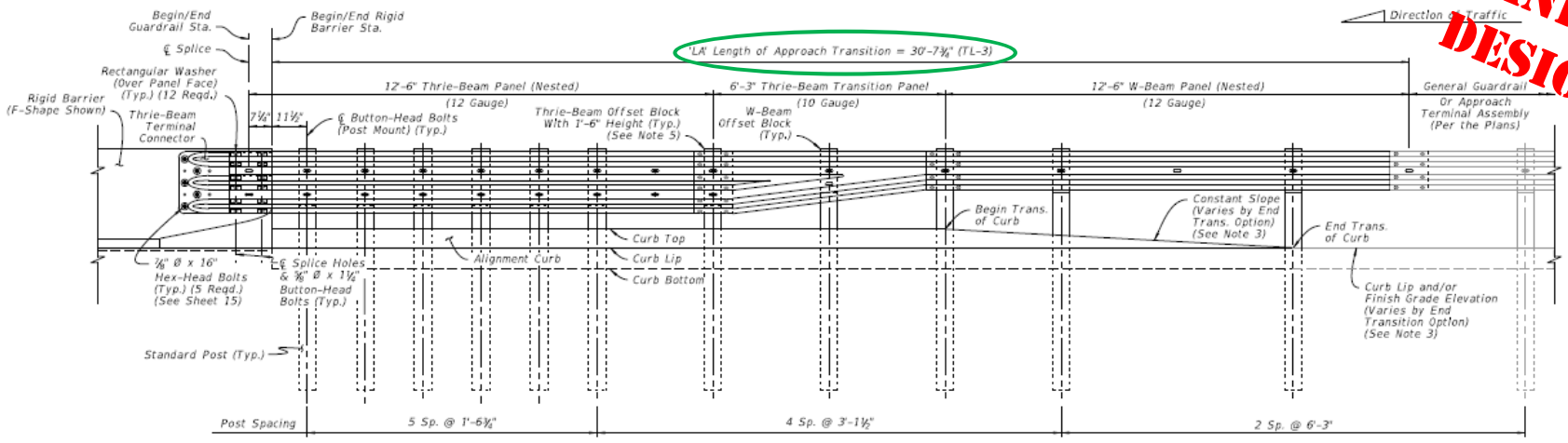
From the IDS:
"Where applicable, use a Crash Cushion on the approach ends of double faced guardrail as a substitute for Double Faced Approach Terminals. Crash Cushion use should be considered for locations with an expected high frequency of severe impacts, such as within the gore area of a high speed facility. Additionally, some Crash Cushions may offer reduced length and maintenance cost advantages."

So, use engineering judgement…
or ask Derwood!

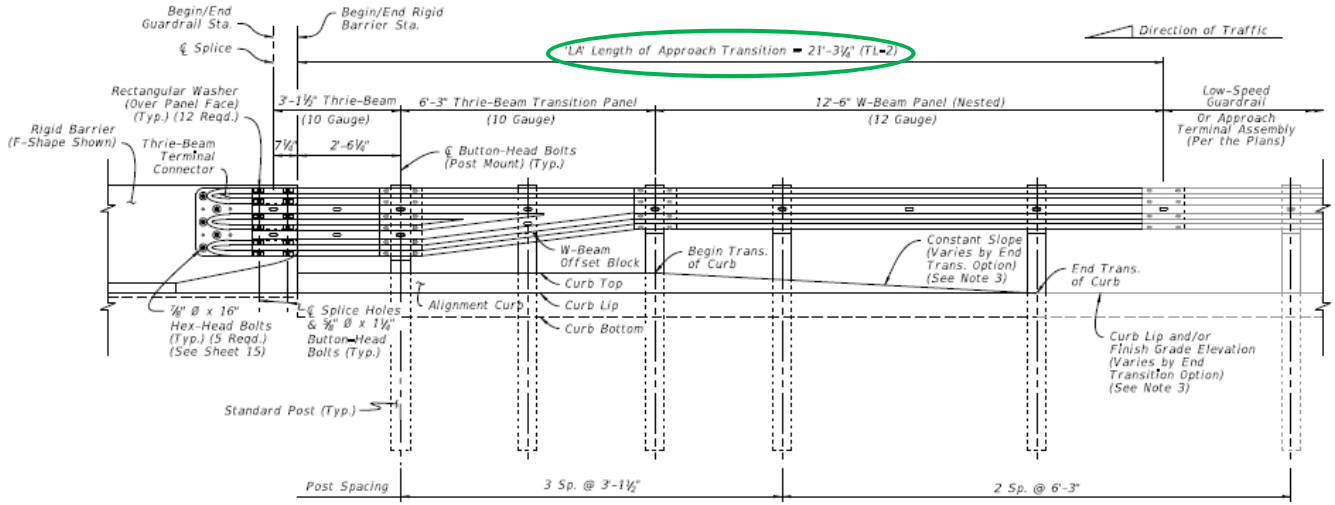
Index 400 Guardrail – IDS Part D

Approach Transition Connections to Rigid Barrier:

FDOT STANDARD DESIGNS



TL-3 APPROACH TRANSITION INSTALLED ELEVATION

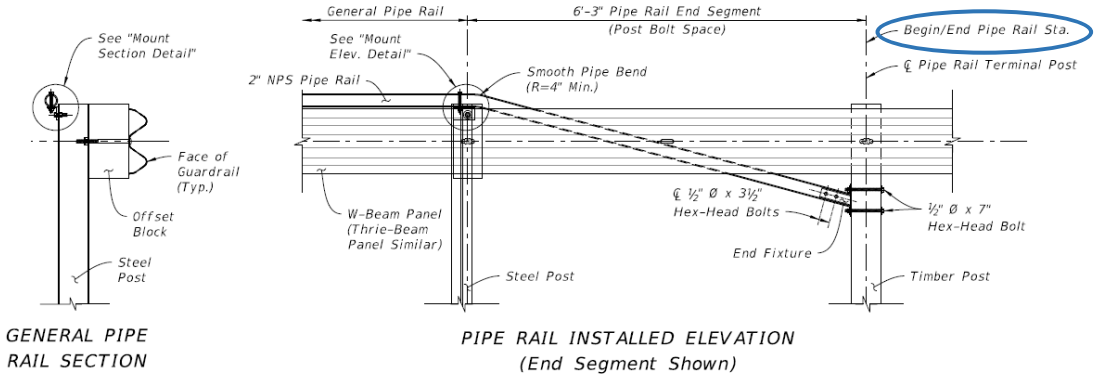


TL-2 APPROACH TRANSITION INSTALLED ELEVATION

- Use to connect guardrail to Rigid Barriers (Concrete Barriers and Traffic Railings)
- In the Plans, provide for at least the lengths, 'LA', shown per Test Level (value shown from Rigid Barrier, for value from Begin Guardrail, add 7¼")

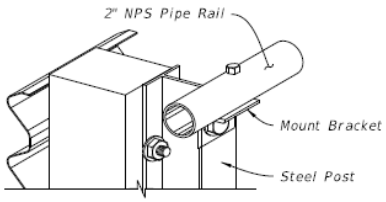
Index 400 Guardrail – IDS Part E

Pipe Rail:



GENERAL PIPE RAIL SECTION

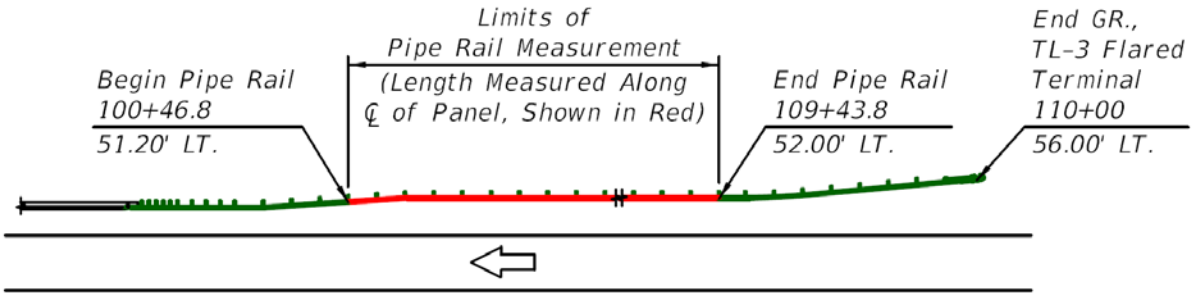
PIPE RAIL INSTALLED ELEVATION (End Segment Shown)



MOUNT ISOMETRIC CUT-AWAY

FDOT STANDARD DESIGN

Pipe Rail Callouts and Length Example:



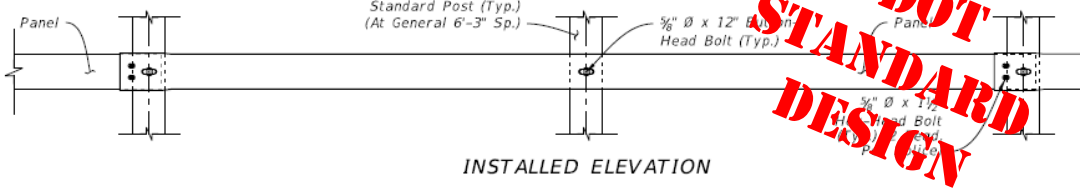
Measure length along the centerline, including curvature effects. Include in the Summary of Guardrail Box (See the BOE Manual, CH 8)

Remember:

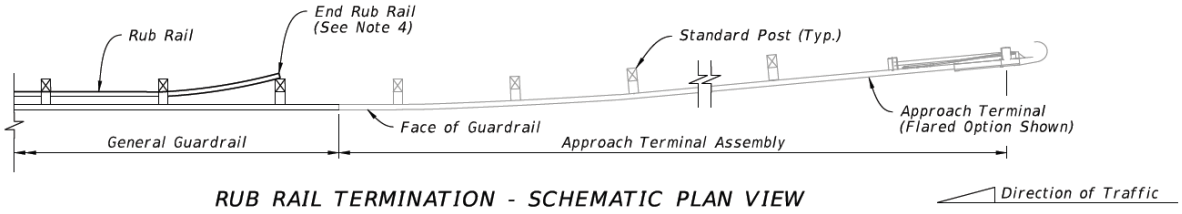
- Pipe Rail segments are required where Steel Posts will be located within 4' of sidewalks or shared use paths
- Designers should generally assume steel posts are used and include pipe rail callouts and quantities in the Plans (to give contractor steel or timber post option)
- Pipe Rail must terminate outside of End Treatment segments (At least 3'-1½" outside of 'LE', 'LT', and/or Crash Cushion segments).
- **Begin/End** Pipe Rail Station corresponds to the Plans callouts

Index 400 Guardrail – IDS Part F

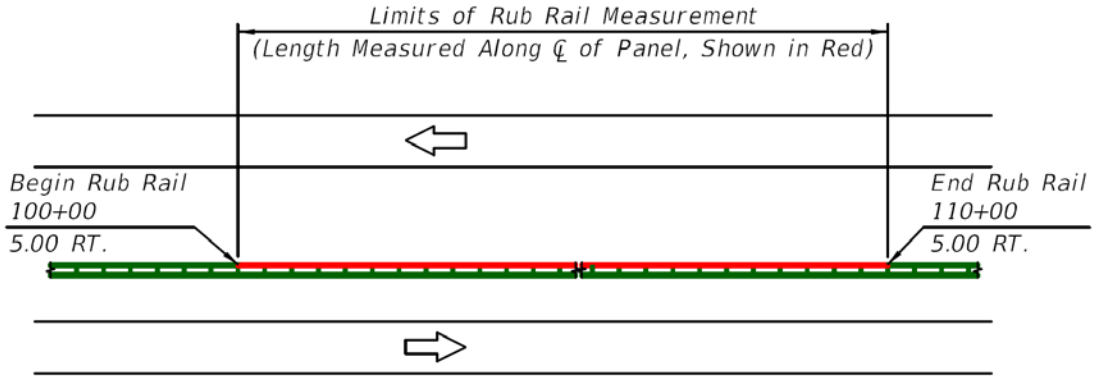
Rub Rail:



FDOT STANDARD DESIGN



Rub Rail Callouts and Length Example:



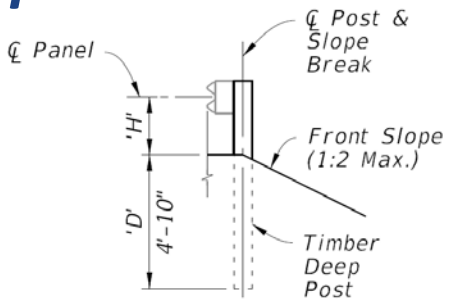
Measure length along the centerline, including curvature effects. Include in the Summary of Guardrail Box (See the BOE Manual, CH 8)

Remember:

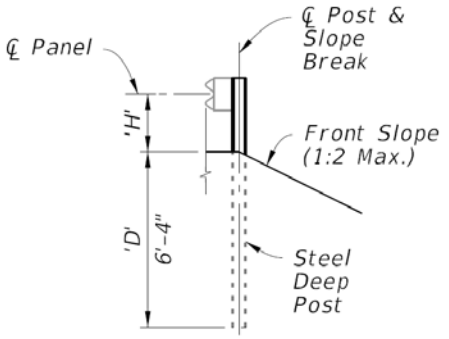
- Use Rub rail only for median slopes greater than 1:10
- Place Rub Rail outside of End Treatment Segments (Approach Terminal 'LE', Trailing Anchorage 'LT') and Crash Cushion Transition segments.

Index 400 Guardrail – IDS Part G

Deep Posts:



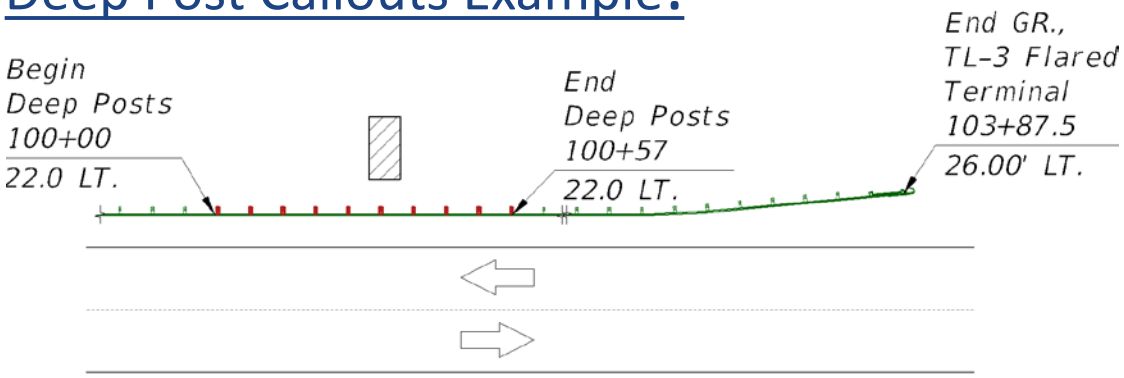
SLOPE BREAK CONDITION
TIMBER DEEP POST



SLOPE BREAK CONDITION
STEEL DEEP POST

FDOT STANDARD DESIGN

Deep Post Callouts Example:



To determine the quantity (EA.) of Deep Posts, divide the length needed by the post spacing (6.25 Ft.) and add one. Place quantity in the Summary of Guardrail Box under Special Guardrail Posts (Deep Posts) See the BOE Manual, CH 8 for details.

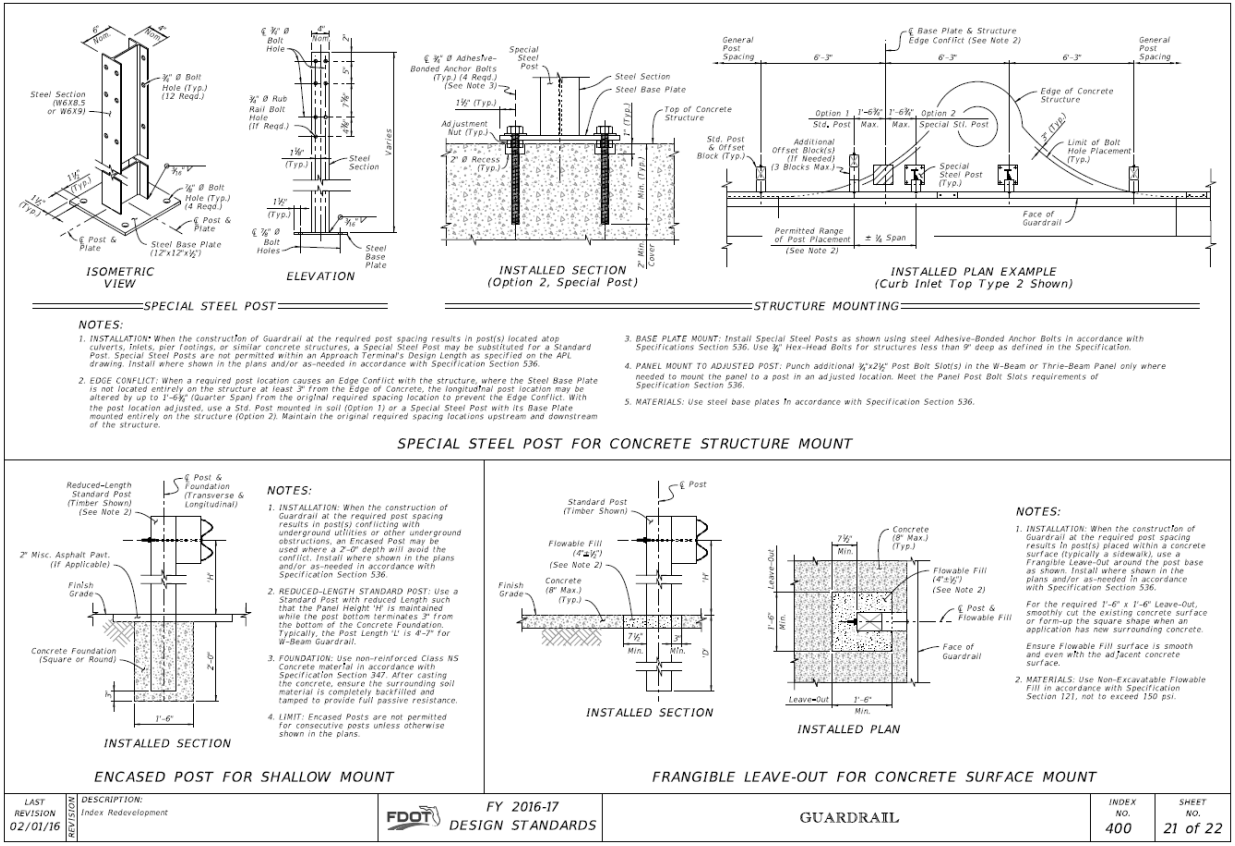
Remember:

- "With approval of the District Design Engineer and 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."
- Deep Posts are only permitted for segments with a post spacing of 6'-3" or less.

Index 400 Guardrail – IDS Part H

Modified Mounts – Special Posts:

FDOT STANDARD DESIGN



The designer can estimate where these posts will be in the Plans to include in the Summary of Guardrail Box and Summary of Pay Items

And/Or…

The contractor will use unforeseen items as-needed (billed beyond Plans quantity)

Remember:

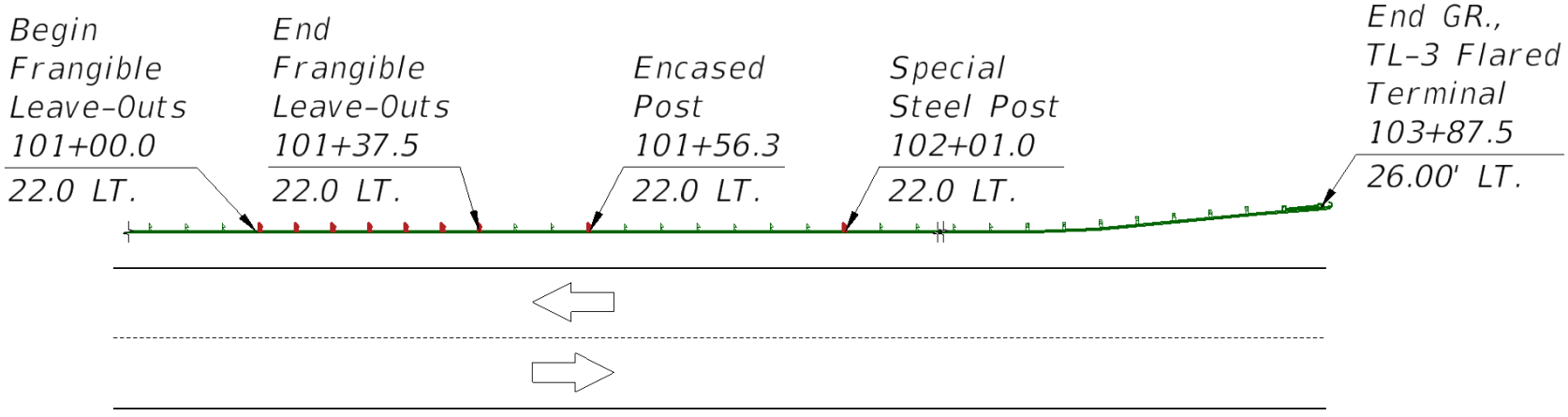
1. **Special Steel Post** (with Base Plate) for Concrete Structure Mount
2. **Encased Post** for Shallow Mount (over underground utilities)
3. **Frangible Leave-Out** for Concrete Surface (sidewalks)

Index 400 Guardrail – IDS Part H

Special Posts:

FDOT STANDARD DESIGN

Special Post Callouts and Length Example:



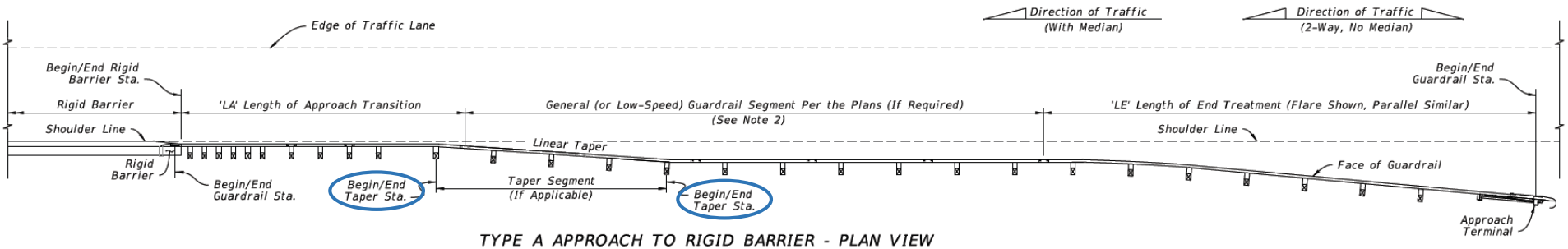
Summary Box Example:

SUMMARY OF GUARDRAIL

LOCATION STA. TO STA.		SIDE	SPECIAL GUARDRAIL POST (DEEP POST) 0536 7 1 EA P	SPECIAL GUARDRAIL POST (DEEP POST) 0536 7 1 EA F	SPECIAL GUARDRAIL POST (SPECIAL STEEL POST) 0536 7 2 EA P	SPECIAL GUARDRAIL POST (SPECIAL STEEL POST) 0536 7 2 EA F	SPECIAL GUARDRAIL POST (ENCASED POST) 0536 7 3 EA P	SPECIAL GUARDRAIL POST (ENCASED POST) 0536 7 3 EA F	SPECIAL GUARDRAIL POST (FRANGIBLE LEAVE-OUT) 0536 7 4 EA P	SPECIAL GUARDRAIL POST (FRANGIBLE LEAVE-OUT) 0536 7 4 EA F	END TREATMENT (FLARED) 0536 85 22 EA P	END TREATMENT (FLARED) 0536 85 22 EA F	DESIGN NOTES	CONSTRUCTION REMARKS
100+00.0	100+57.0	LT	10											
101+00.0	101+37.5	LT							7					
101+56.3		LT					1							
102+01.0		LT			1									
103+87.5		LT									1		4' Flare	

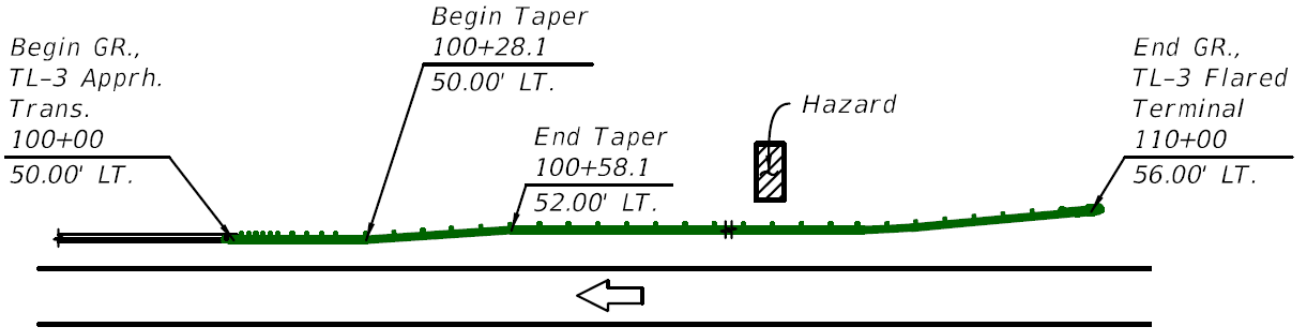
Index 400 Guardrail – IDS Part I

Guardrail Taper Rate:



TYPE A APPROACH TO RIGID BARRIER - PLAN VIEW
MEDIAN OR OUTSIDE SHOULDERS
(Mirror Horiz. and/or Vert. for Opposite Direction and/or Side of Road)

Guardrail Taper Callout Example:



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

Call out a guardrail taper whenever a change in lateral offset from the CL is warranted

Taper Rates are:

Design Speed ≤ 45 MPH = Max. 1:10

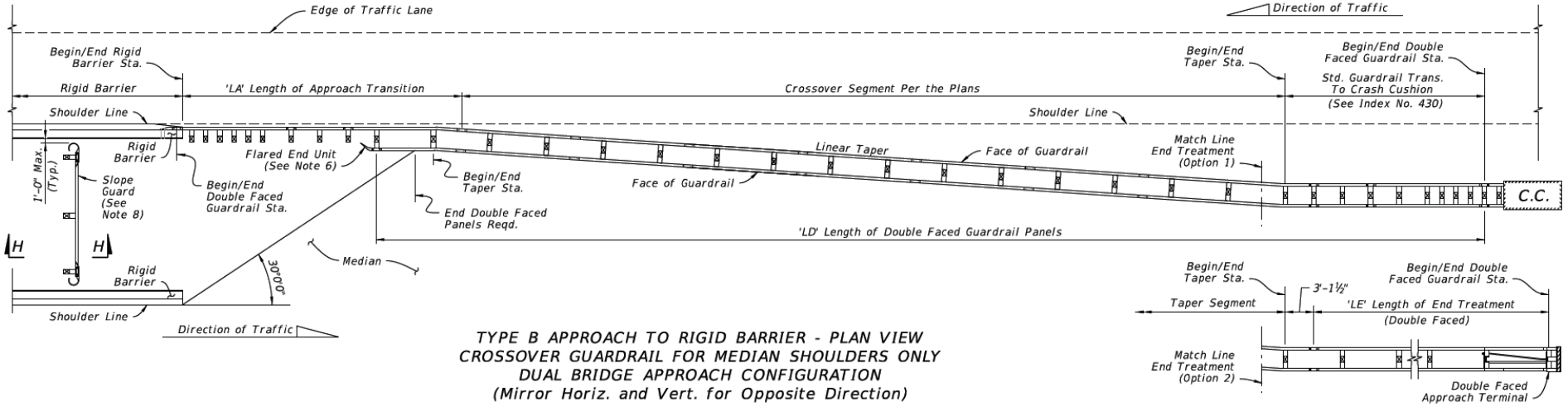
Design Speed > 45 MPH = Max. 1:15

Taper Rates may be refined further per AASHTO RDG

The Station and Offset at the Begin and End of Taper define the linear taper rate for the contractor.

Index 400 Guardrail – IDS Part J

Median Crossover Guardrail (Double Faced):



TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

Use when all of the following conditions are met:

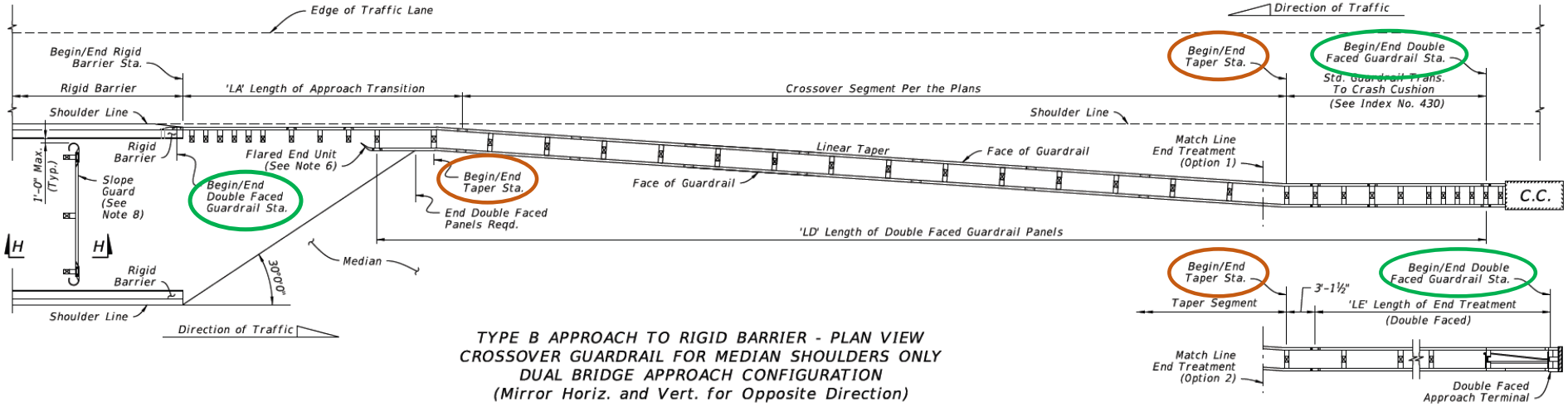
1. The end of an opposing lane's concrete Rigid Barrier is within the Clear Zone, aligned laterally across the median (typical with a bridge configuration).

2. The 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.

Index 400 Guardrail – IDS Part J

Median Crossover Guardrail (Double Faced):

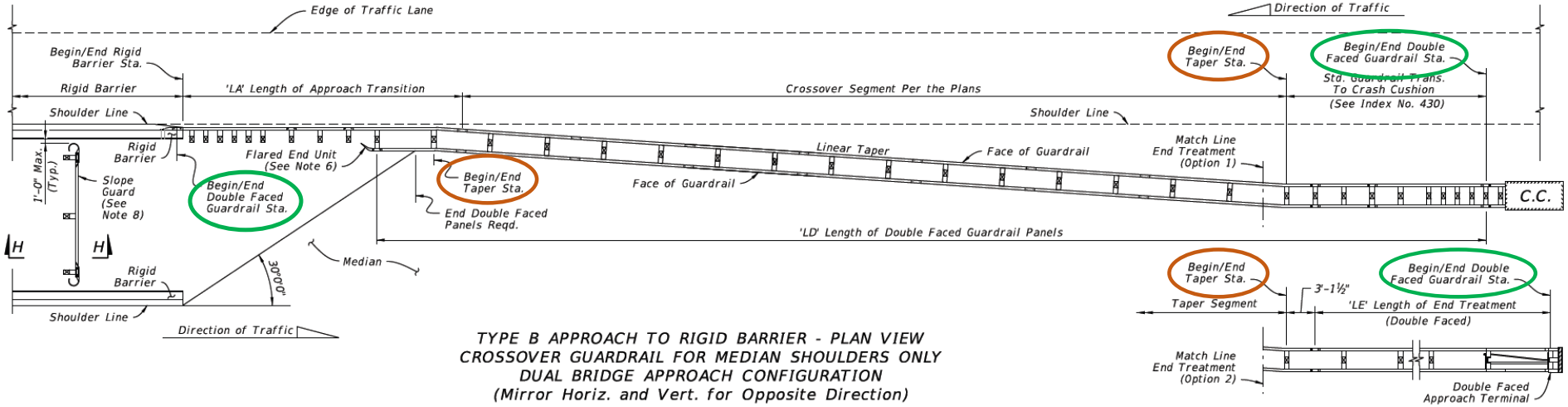


TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- *"This 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."*
- *In the Plans, call out the Begin/End Double Faced Guardrail Stations and Offsets as well as the Begin/End Taper Station and Offsets where shown above.*
- *For quantities, the entire length of guardrail shown above is considered "Double-Faced"*
- *In the Plans, graphically show the double faced guardrail panels as well extending to the point shown above.*

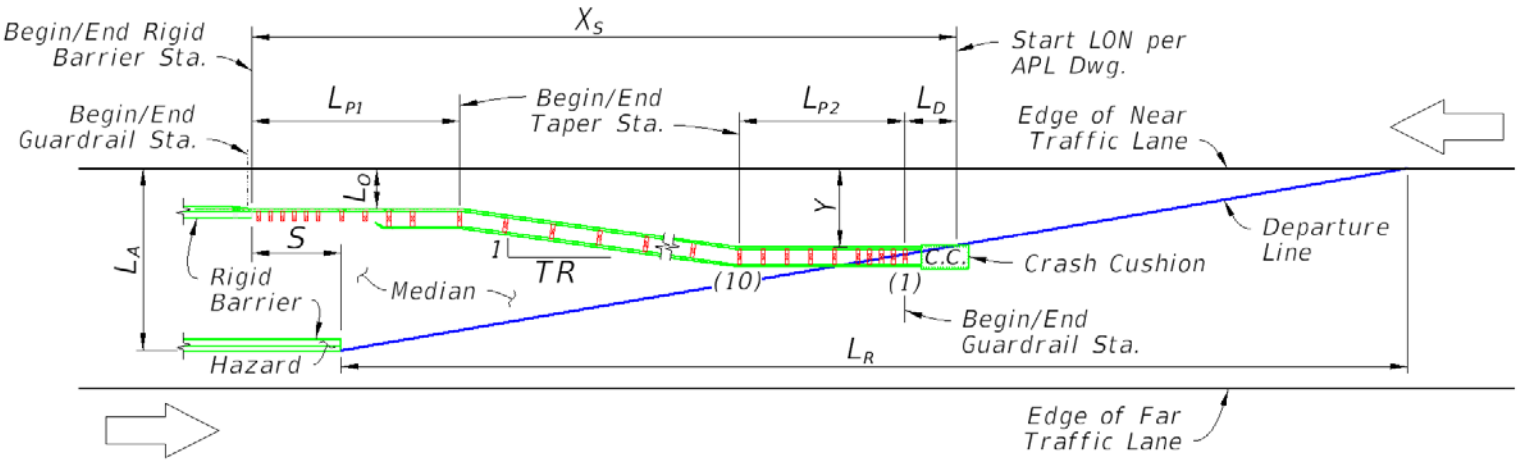
Index 400 Guardrail – IDS Part J

Median Crossover Guardrail (Double Faced):



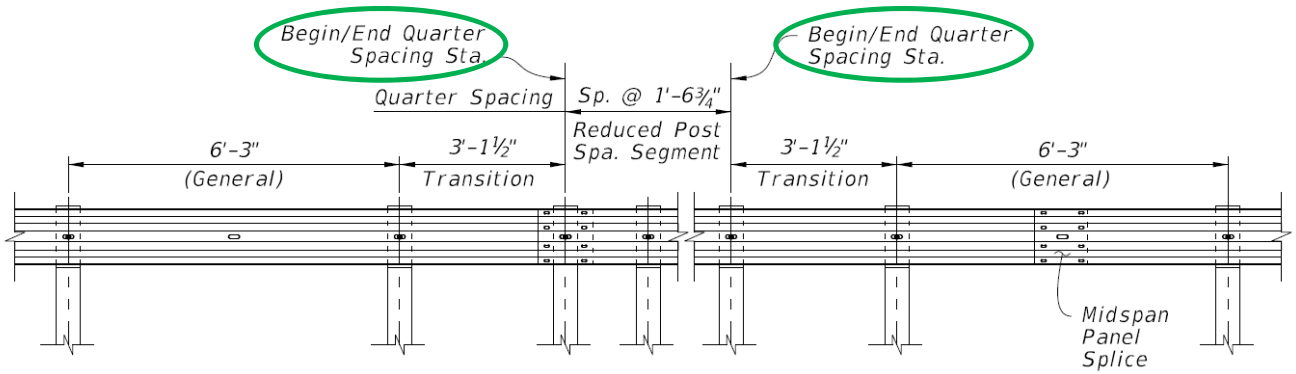
TYPE B APPROACH TO RIGID BARRIER - PLAN VIEW
CROSSOVER GUARDRAIL FOR MEDIAN SHOULDERS ONLY
DUAL BRIDGE APPROACH CONFIGURATION
(Mirror Horiz. and Vert. for Opposite Direction)

- *The FDOT 'Guardrail Length of Need' Excel Program will assist with providing these Station and Offsets above. We will use in the next session...*



Index 400 Guardrail – IDS Part K

Reduced Post Spacing Segments

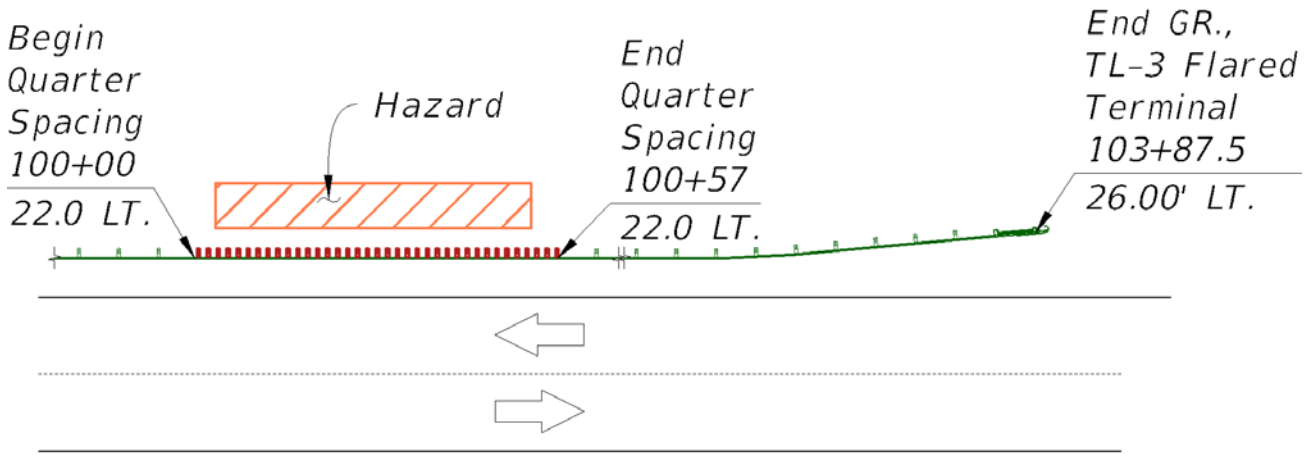


DETAIL 'S' - QUARTER SPACING ELEVATION
(AS REQ'D. PER THE PLANS)

Remember:

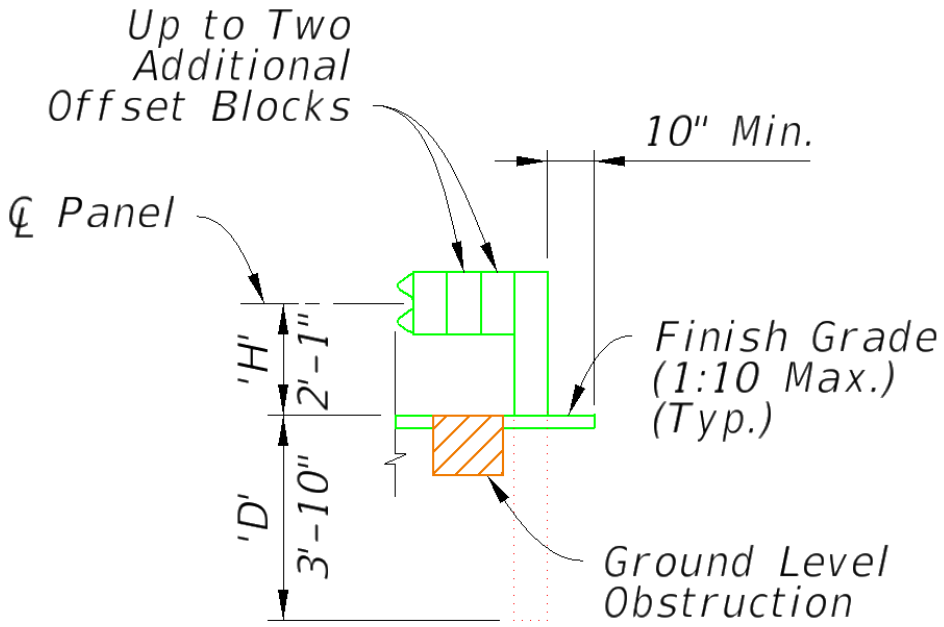
- When a rigid hazard is within 5'-0" of the face of guardrail, reduced post spacing may be used to reduce the "Setback" requirement to the hazard (see PPM Table 4.4.2)
- In the Plans, the designer should call out the reduced post spacing as required
- This is included in the price of Guardrail, so there is no need to place in Summary Boxes

Reduced Post Spacing Callout Example:



Index 400 Guardrail – IDS Part L

Additional Offset Blocks

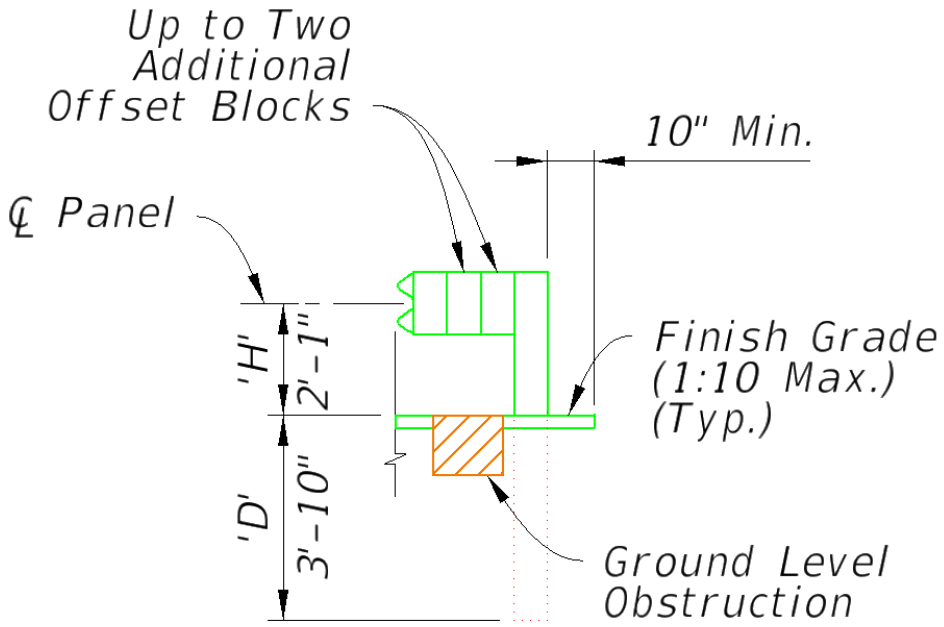


W-BEAM

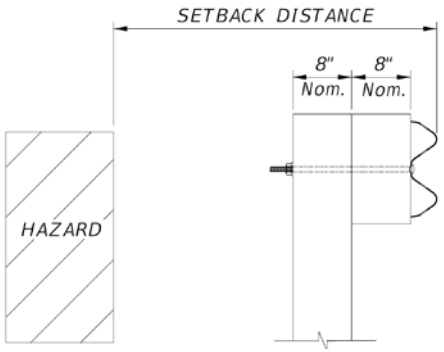
- The designer may call out up to two additional offset blocks where needed to avoid a ground level obstructions (non-consecutive preferred)
- The contractor may also use additional offset blocks as-needed (billed beyond the Plans quantity)
- The Standard handles adjusting the miscellaneous asphalt concrete to keep it at 10” behind the post (slope break point is measured form back of post as well)

Index 400 Guardrail – IDS Part L

Additional Offset Blocks



- *IMPORTANT:* When adding additional offset blocks, the required "Setback" to a Hazard per PPM Table 4.4.2 must be increased by 7.5" per added Offset Block.
  - For Example, if ***<u>two</u> Offset Blocks are added*** to ***W-Beam Guardrail @ 1'-6¾"*** Post Spacing, then the required "Setback" (measured from the Face of Guardrail) is…
    - Adjusted Setback = (3'-2") + (7.5" + 7.5") = **4'-5"**

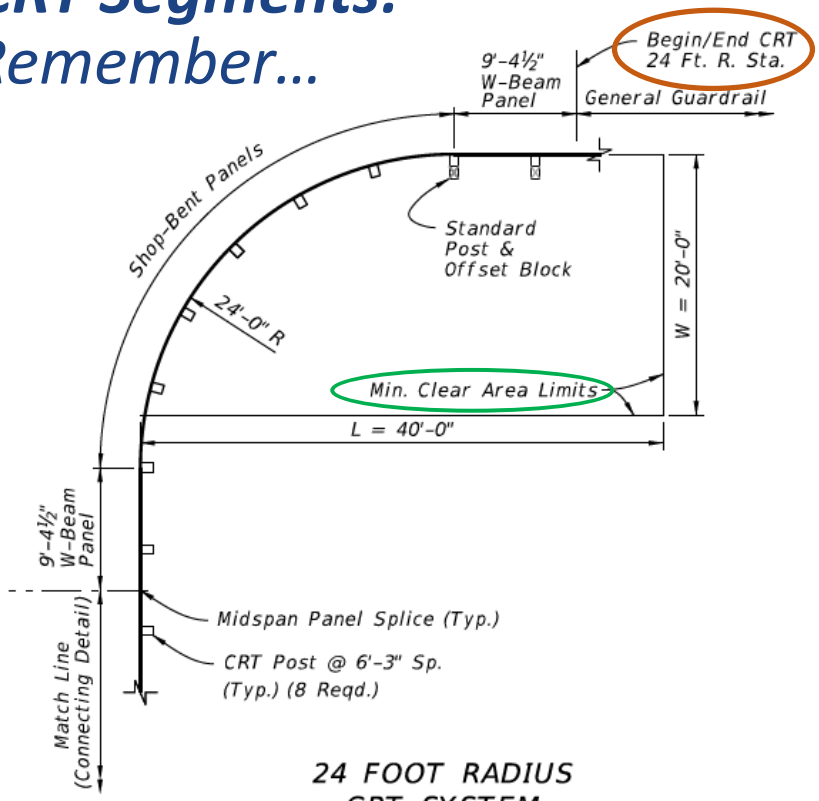


From PPM: Table 4.4.2 Minimum Barrier Setback:

Semi-Rigid Barrier	
W-Beam with Post Spacing @ 6'-3" (TL-3)	5'-0"
W-Beam with Post Spacing @ 3'-1½" (½ Spacing)	3'-10"
W-Beam with Post Spacing @ 1'-6¾" (¼ Spacing)	3'-2"
Nested W-Beams with Post Spacing @ 3'-1½" (½ Spacing)	3'-0"
Nested W-Beams with Post Spacing @ 1'-6¾" (¼ Spacing)	2'-8"
Modified Thrie-Beam with Post Spacing @ 6'-3"	3'-0"

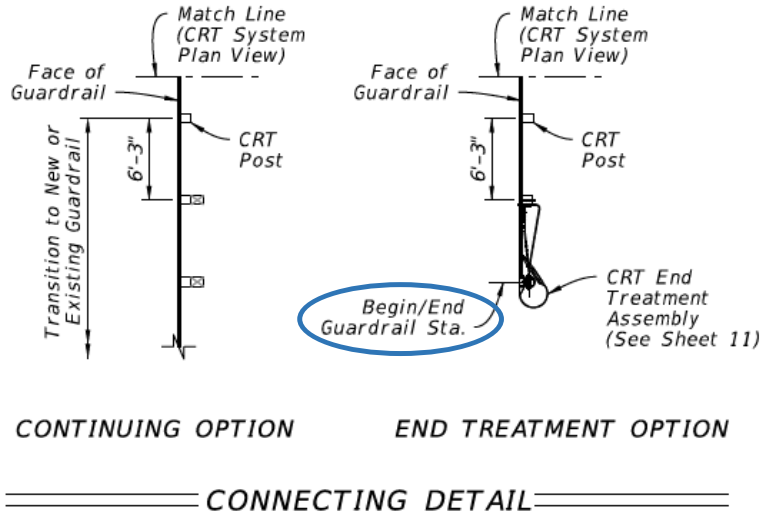
Index 400 Guardrail – IDS Part M

CRT Segments:
Remember…



24 FOOT RADIUS CRT SYSTEM

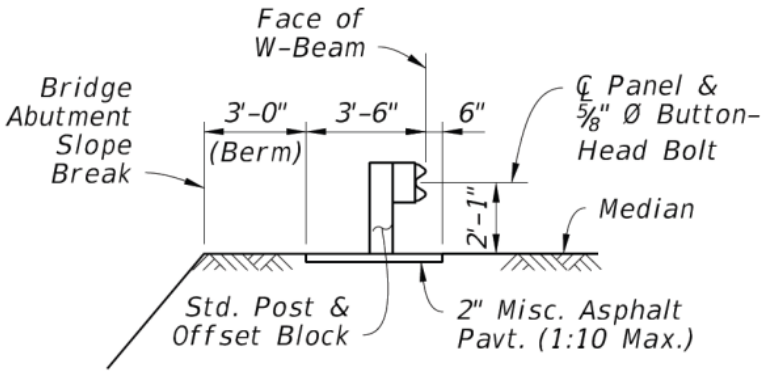
SUMMARY OF GUARDRAIL					
LOCATION	SIDE	END TREATMENT (CRT)		DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.		0536 85 26 EA			
		P	F		
100+00	LT	1			



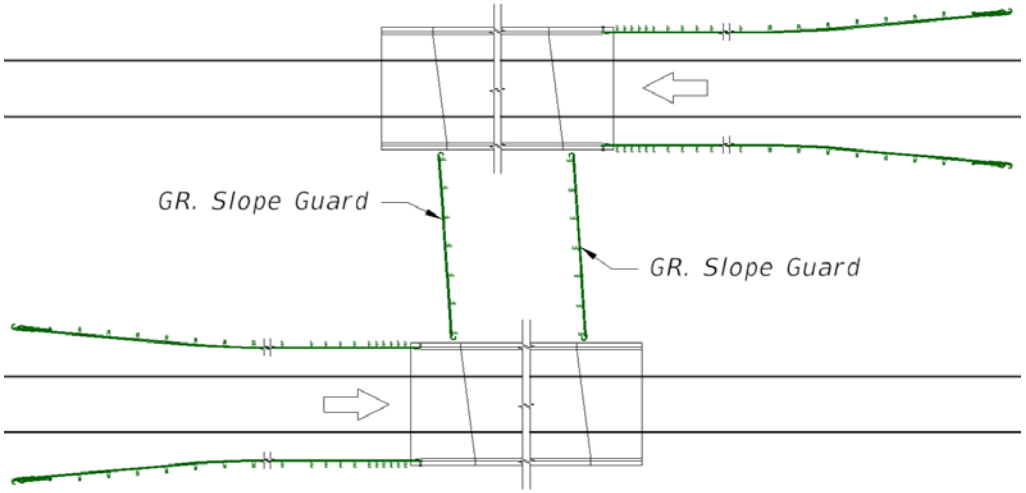
- In the Plan view, call out the CRT segment station and offset (corresponding to Index callout). No need to place in summary box.
- In the Plan view, call out the Guardrail Begin/End Station at Post (1) of the CRT End Treatment (unless there's a transition to existing guardrail). *The callout for **CRT End Treatment** would be included here too.*
- *Min. Clear Area - Maintain 1:10 Slope to 2' behind the posts. Beyond that, maintain an area clear of hazards with a 1:2 or flatter slope.*

Index 400 Guardrail – IDS Part N

Slope Guards:



SECTION H-H
BRIDGE ABUTMENT
SLOPE GUARD
(Between Bridges)



SUMMARY OF GUARDRAIL						
LOCATION			SIDE	GUARDRAIL (W-BEAM, GENERAL, TL-3)	DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.				0536 1 1		
				LF		
				P F		
100+00.0			LT	38	Slope Guard	
100+80.0			RT	38	Slope Guard	

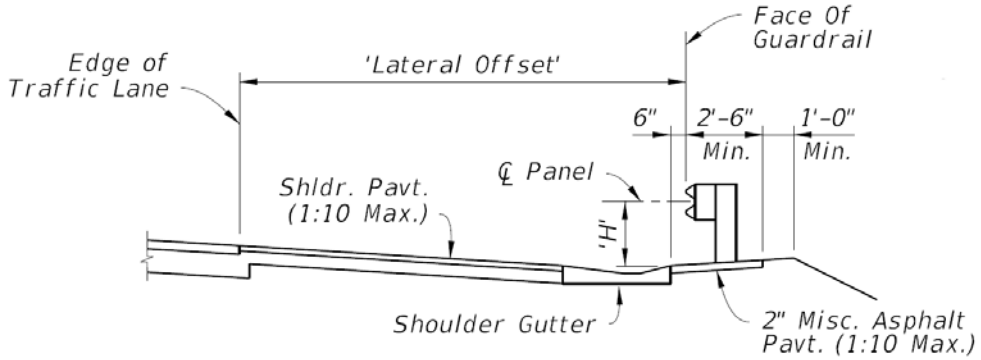
- Call out in Plan view
- Add to Summary of Guardrail Box as an entry to Guardrail W-Beam, General, TL-3 (Or Low-Speed, TL-2 if you happen to be using that instead nearby).

Index 400 Guardrail – Plans Content

General: *"same 'ole same 'ole"*: Show the guardrail system to scale, including the depiction of the post, offset block, and panel type in its design location.

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. (PPM CH2.3 "Shoulders" & 4.4.6.1 "Barrier Offset")

Cross Sections & Typical Sections: Meet the offset requirements of the ***PPM*** and the adjacent grading requirements as shown in the Index.



Index 400 Guardrail – Plans Content

Roadway Plan: 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:

Lots of text! We've seen all these!

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."Instructions for Design Standards Topic No. 625-010-003 Index 400 Guardrail February 2016 6

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 above will govern these transitions.

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

4. Begin/End Pipe Rail Stations label the limits of Pipe Rail length measurement, generally located at centerline of the Terminal Posts.

5. Begin/End Rub Rail Stations label the limits of Rub Rail length measurement, generally located at centerline of the Terminal Posts. NOTE: This is not depicted in the Index.

For Double Face Guardrail, place labels pointing to Face of Guardrail on the side requiring the Rub Rail. If Rub Rail is required on both sides, use a different label on each side or add "(Both Sides)" to the callout.

6. 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".

7. 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".

Index 400 Guardrail – Plans Content

Roadway Plan:

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

1. TL-2 Flared Terminal
2. TL-2 Parallel Terminal
3. TL-2 Dbl. Faced Terminal
4. TL-3 Flared Terminal
5. TL-3 Parallel Terminal
6. TL-3 Dbl. Faced Terminal
7. TL-3 C.C.
8. TL-4 C.C.
9. Type II Anchorage
10. CRT End Treatment
11. TL-2 Apprh. Trans.
12. TL-3 Apprh. Trans.

…Label conventions straight from IDS
…We've seen these
…More examples to come…

NOTE: The above labels may be included with the Begin/End Guardrail Station callouts.

Index 400 Guardrail – Plans Content

Roadway Plan:

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

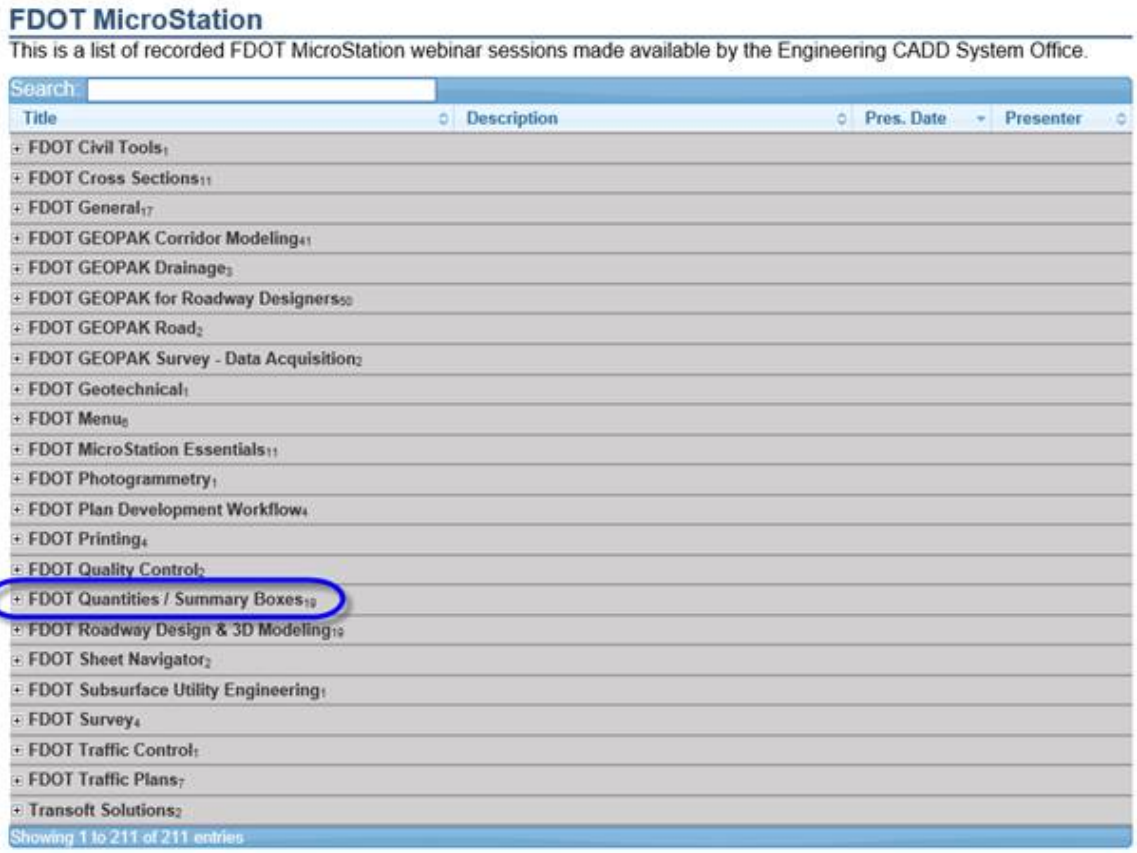
1. Encased Post
2. Special Steel Post
3. Frangible Leave-Out
4. Deep Post
5. Two Offset Blocks
6. Three Offset Blocks
7. GR. Slope Guard.

…Label conventions straight from IDS
…We've seen these
…More examples to come…

Index 400 Guardrail – Plans Content

Summary of Guardrail Table:

Include Pay Items from the FDOT Design Quantities and Estimates System (DQE), the Basis of Estimates Manual (BOE), and Specifications Section 536.



FDOT MicroStation

This is a list of recorded FDOT MicroStation webinar sessions made available by the Engineering CADD System Office.

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+ FDOT GEOPAK for Roadway Designers50			
+ FDOT GEOPAK Road2			
+ FDOT GEOPAK Survey - Data Acquisition2			
+ FDOT Geotechnical1			
+ FDOT Menu8			
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+ FDOT Traffic Plans7			
+ Transoft Solutions2			

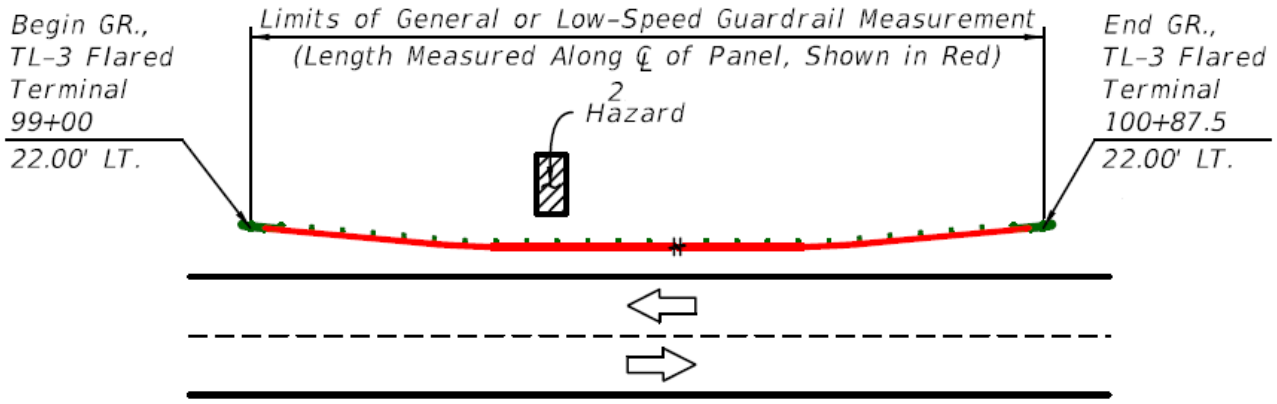
Showing 1 to 211 of 211 entries

- See the BOE, Chapter 8, for more information on Summary Boxes
- The Department's CADD tools, including the Design and Computation Manager and Data Link Manager, may be used to assist in populating the table...

←See the Engineering / CADD Systems Office website for training in the use of Summary Boxes (at left) http://www.dot.state.fl.us/ecso/downloads/webinars/Posted.shtm#loadSection

Index 400 Guardrail – Plans Content

Guardrail Length Measurement Example:



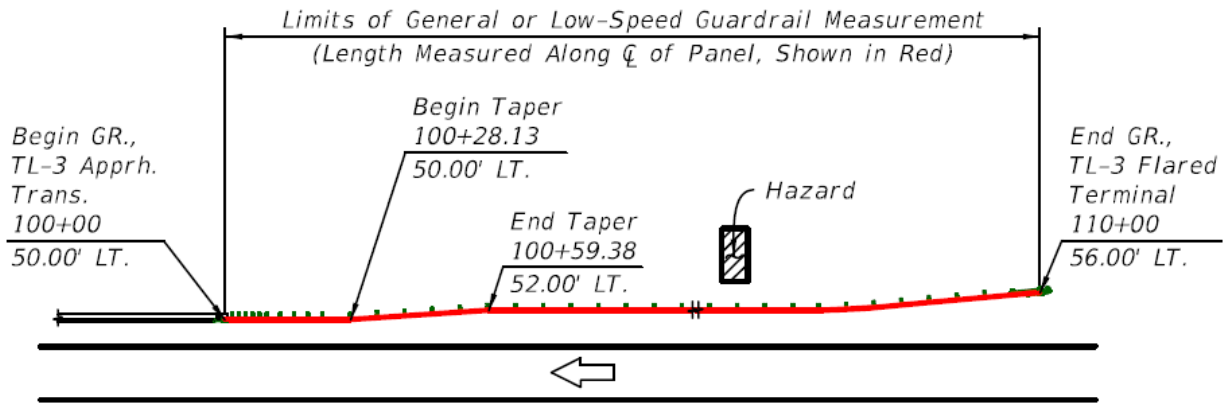
- Include End Treatment lengths added as the basic connecting guardrail type, such as General or Low-Speed Guardrail
- End Treatment Pay Items consider costs as over-and-above basic guardrail

SUMMARY OF GUARDRAIL

LOCATION		SIDE	GUARDRAIL (W-BEAM, GENERAL, TL-3)		END TREATMENT (FLARED)		DESIGN NOTES	CONSTRUCTION REMARKS
STA. TO STA.			0536 1 1		0536 85 22			
			LF		EA			
			P	F	P	F		
99+00.0	100+87.5	LT.	187.5					
99+00.0		LT.			1		4' Flare	
100+87.5		LT.			1		4' Flare	

Index 400 Guardrail – Plans Content

Guardrail Length Measurement Examples:



- Include End Treatment and Approach Transition lengths added as the basic connecting guardrail type, such as General or Low-Speed Guardrail
- End Treatment and Approach Transition Pay Items consider costs as over-and-above basic guardrail

- What's the length of Guardrail? (approx., assuming linear)

  1000 Ft.

- What's the Station for the Approach Transition?

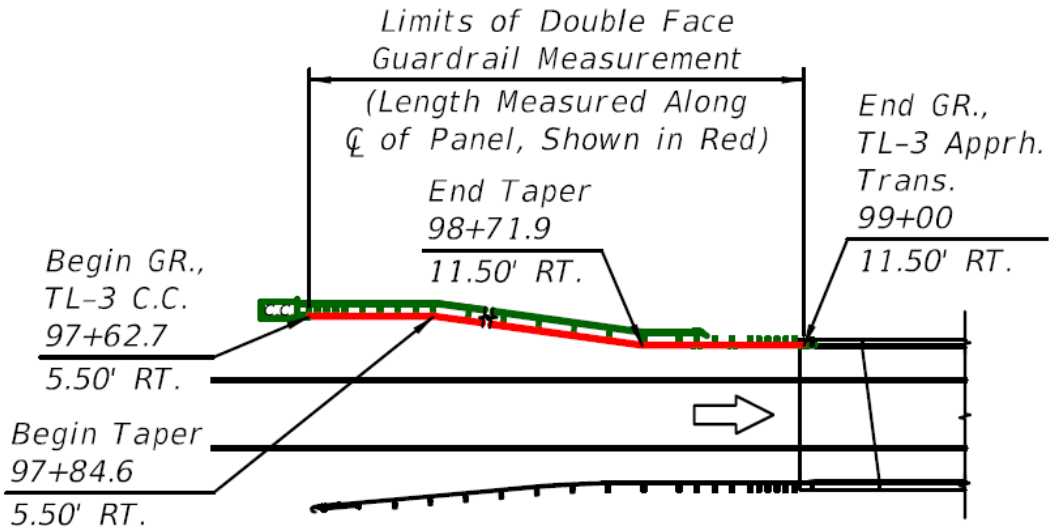
  100+00

- What's the Station and Flare of the End Treatment?

  110+00, 4 foot flare

Index 400 Guardrail – Plans Content

Guardrail Length Measurement Examples:



- Include C.C. "Guardrail Transition" length per Index 430 (to Post 1) and Approach Transition length added as the basic connecting guardrail type, such as General or Low-Speed Guardrail
- Approach Transitions consider costs as over-and-above basic guardrail
- The reduced post spacing for the C.C. "Guardrail Transition" segment is included in the cost of Guardrail.

- What's the linear feet of Guardrail?

  (Pythagorean theorem, anyone?)

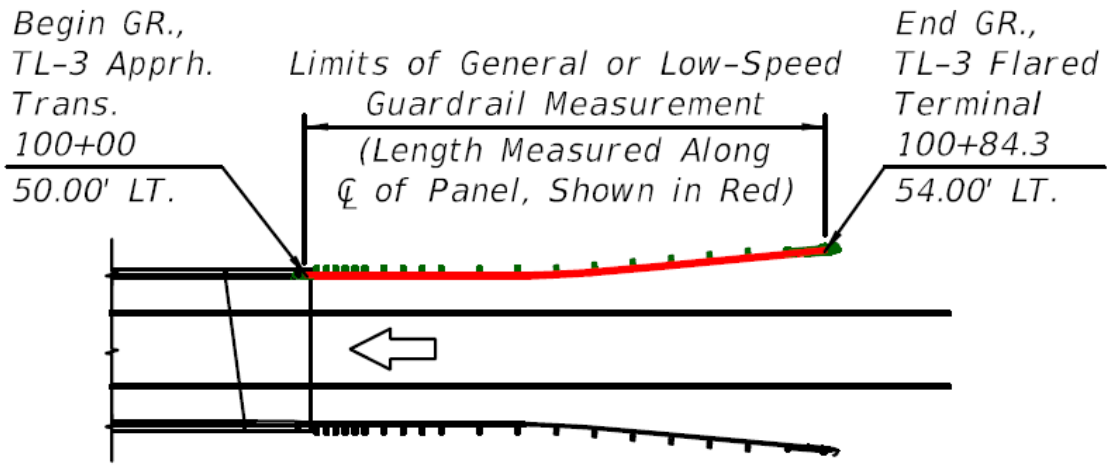
  21.9 + sqrt(6^2 + 87.3^2) + 28.1 = 137.5
- What type of guardrail is this measured length?

  Double Faced
- What Station is the Approach Transition called out at?

  99+00

Index 400 Guardrail – Plans Content

Guardrail Length Measurement Examples:



This is the shortest possible guardrail length per the Design Standard (without using APL Design Lengths)

- This is an Approach Transition plus an Approach Terminal Only…
- What type of guardrail is this measured length?

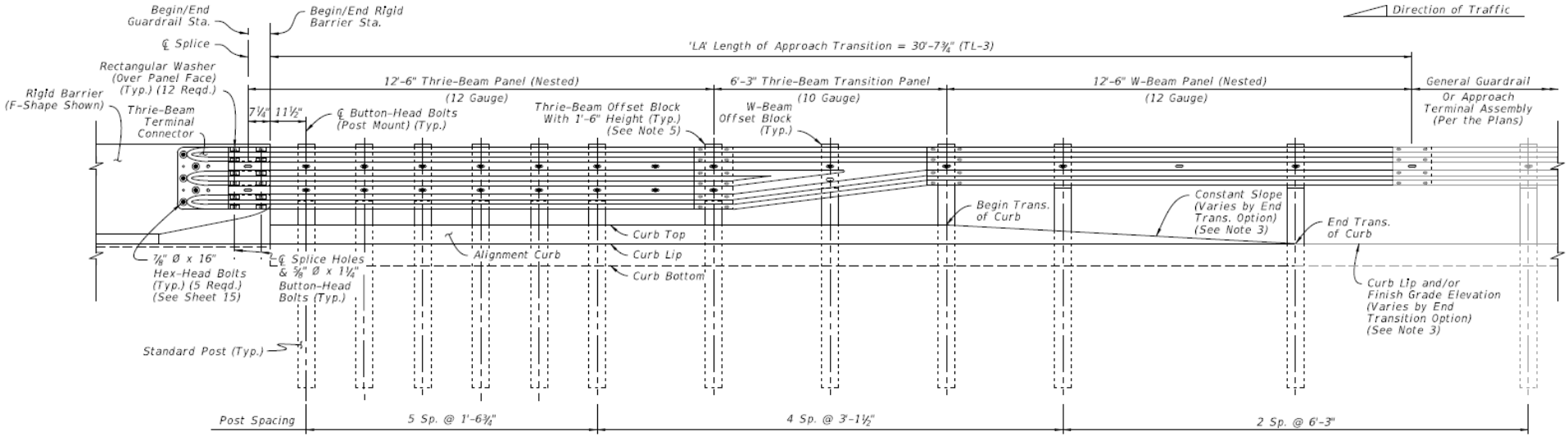
  Single Faced – W-Beam
- How did we come up with this guardrail length?...

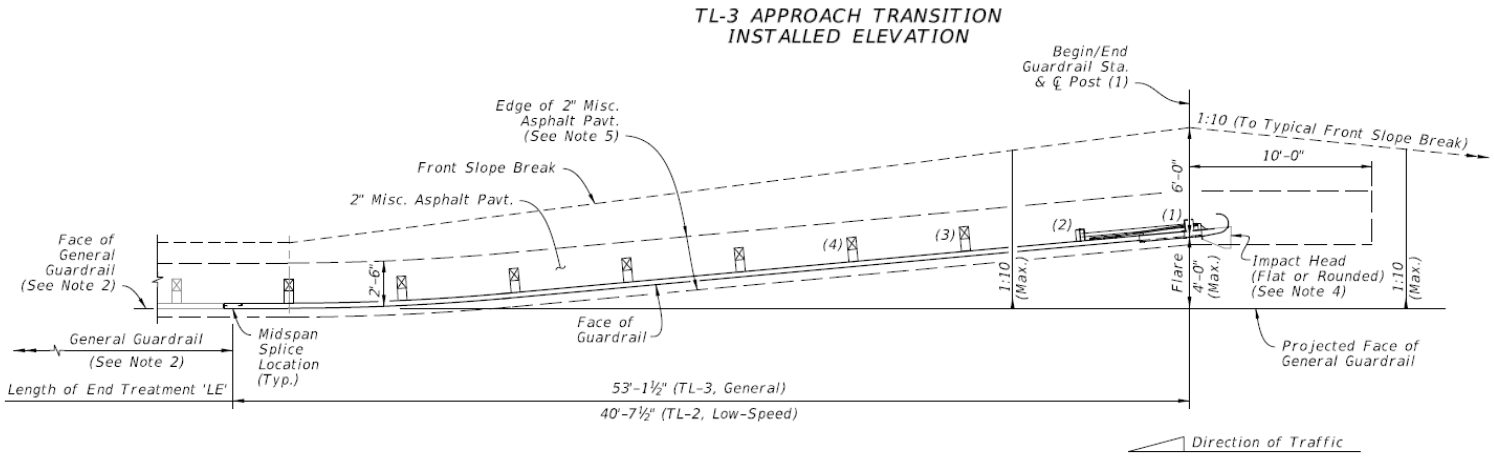
(Next Page)

Index 400 Guardrail – Plans Content

Guardrail Length Measurement Examples:

- What's the shortest length of TL-3 Guardrail needed to shield a Rigid Barrier End?...



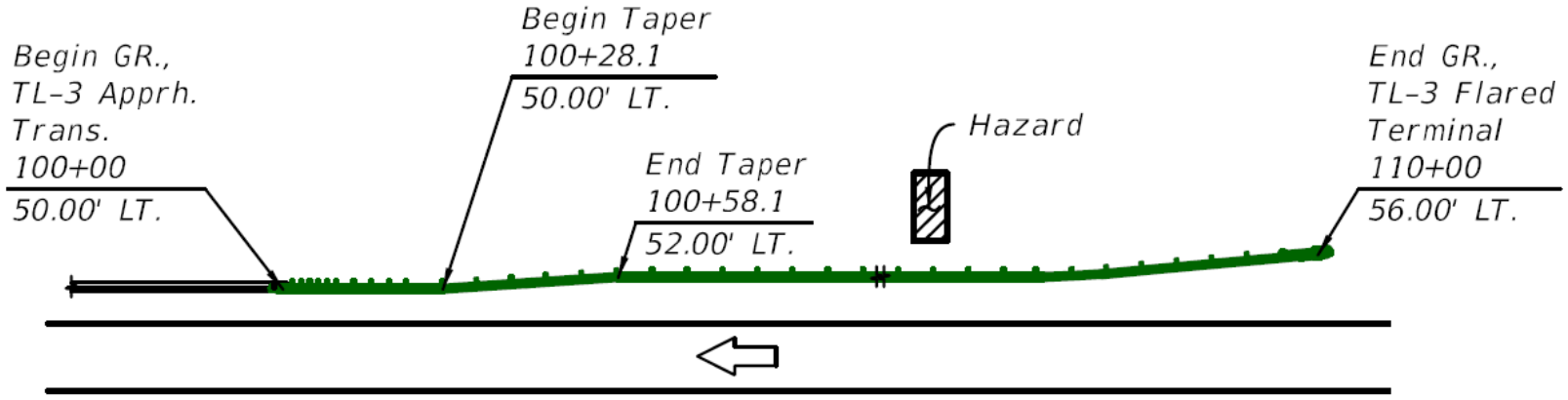


APPROACH TERMINAL ASSEMBLY
'FLARED' SEGMENT - PLAN VIEW

'LA' + 7¼" + 'LE' = 84.3'

Index 400 Guardrail – Plans Content

Taper to Different Guardrail Offset Example:



- What is the likely offset difference between the shoulder line and the Face of Guardrail?

  2 feet per PPM

- What is the approximate Taper Rate shown here?

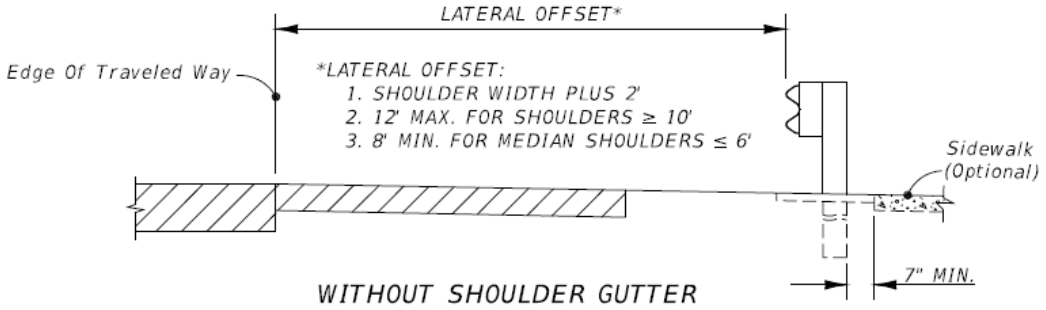
  1:15

- Using the Design Standard drawing for approach transitions, where did this Taper shown begin? (See Next Page)…

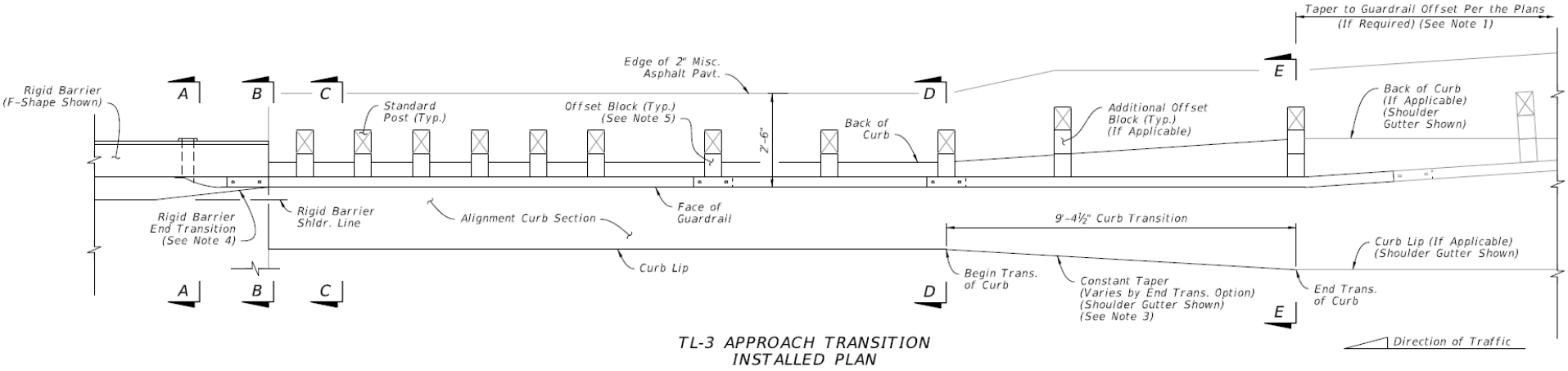
Index 400 Guardrail – Plans Content

Taper to Different Guardrail Offset Example:

PPM Figure 4.4.12:
Guardrail Face in relation to Shoulder Line….



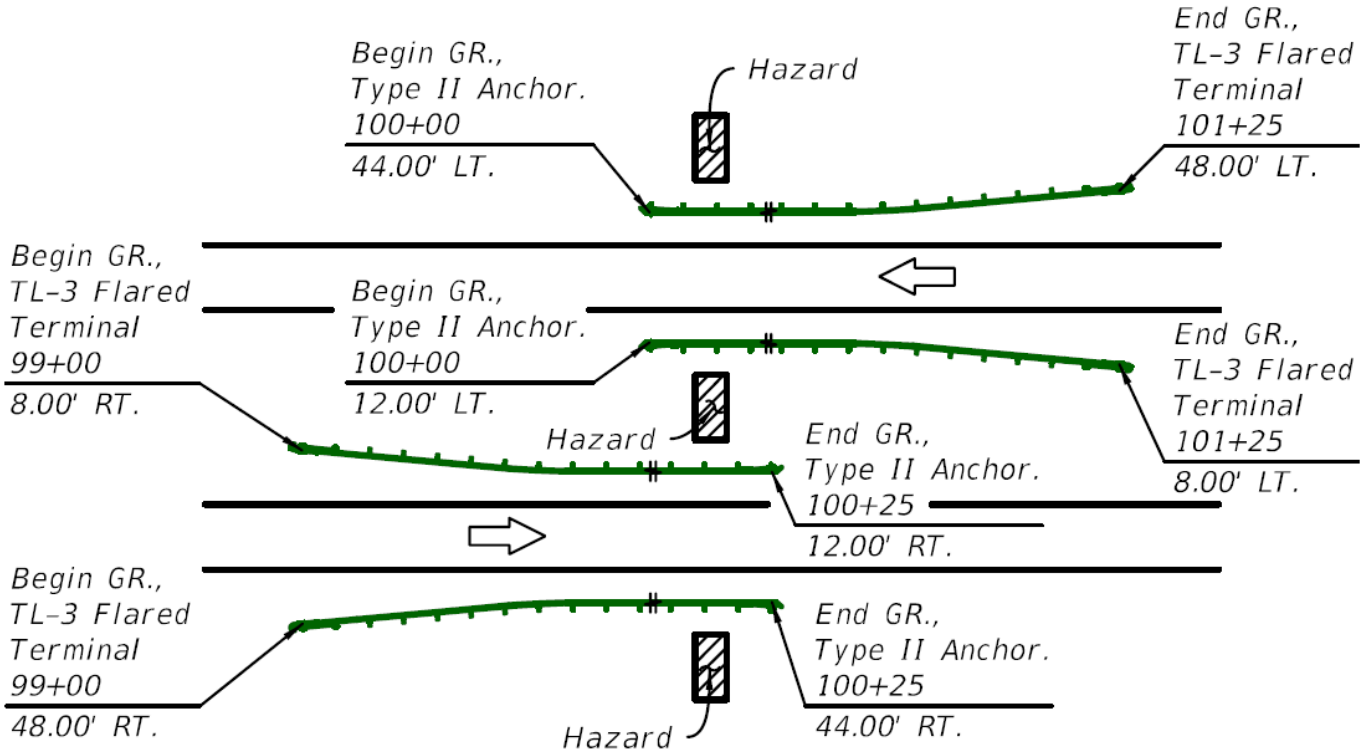
Where does Taper to Guardrail Offset above begin?



(about 28.1 feet from Begin/End Guardrail Sta. using Elevation View… or just add standard panel lengths)

Index 400 Guardrail – Plans Content

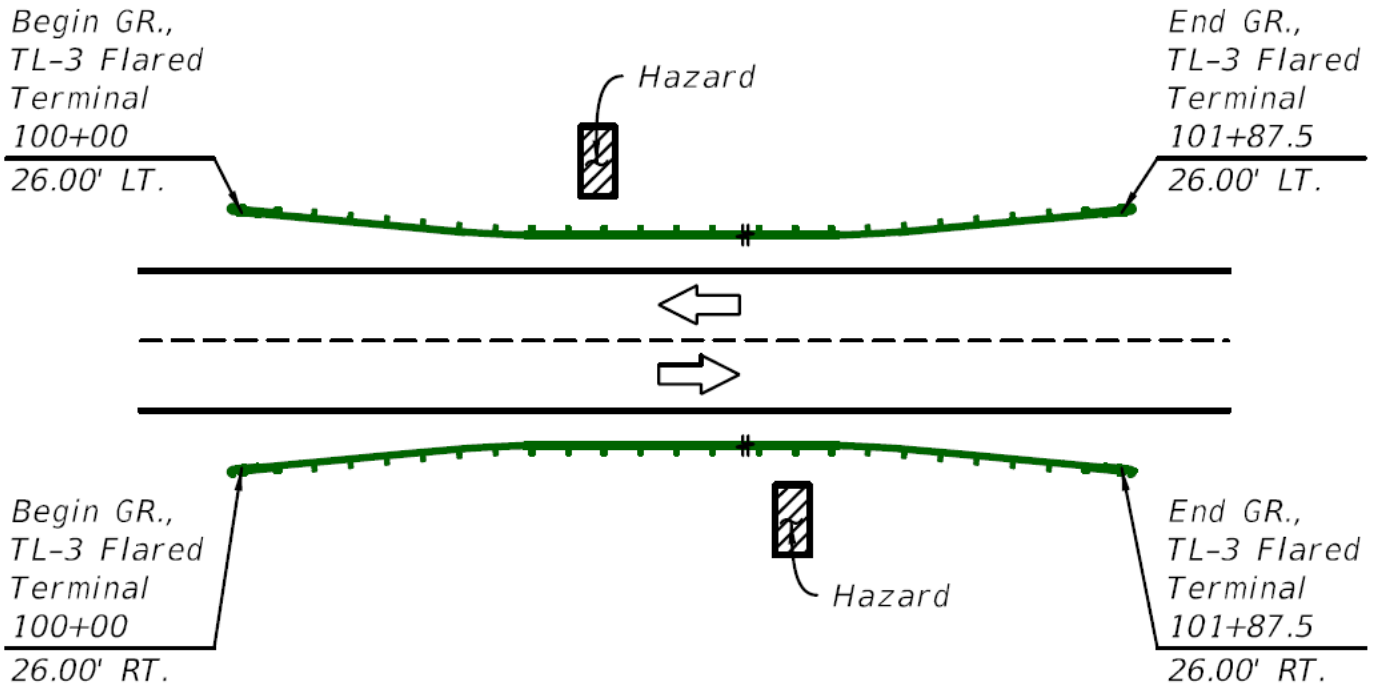
Miscellaneous Guardrail Layout Examples (from IDS):



TYPICAL HAZARD SHIELDING EXAMPLE:
ROADSIDE AND MEDIAN
('LON' Program Part 'A')

Index 400 Guardrail – Plans Content

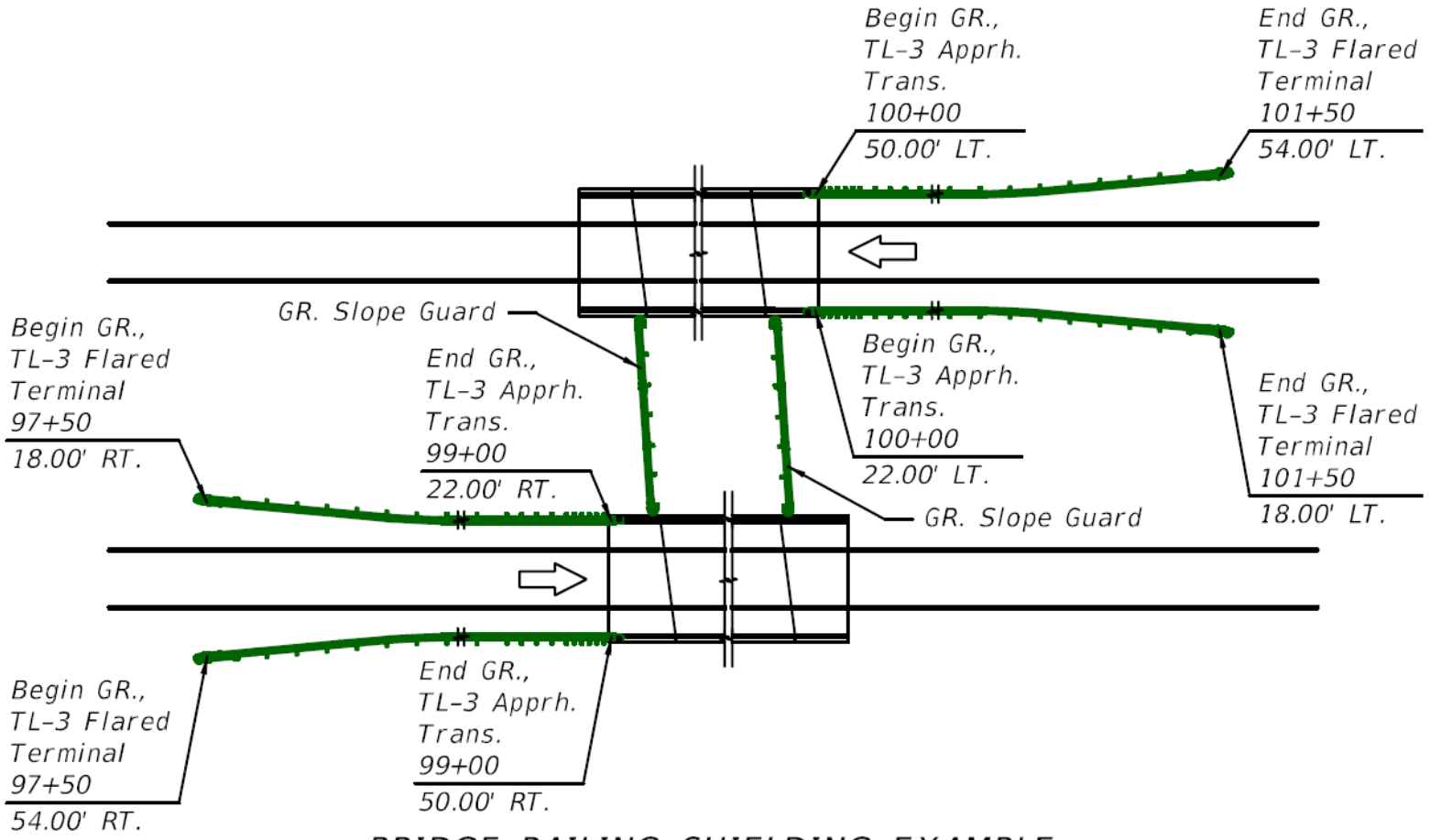
Miscellaneous Guardrail Layout Examples (from IDS):



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

Index 400 Guardrail – Plans Content

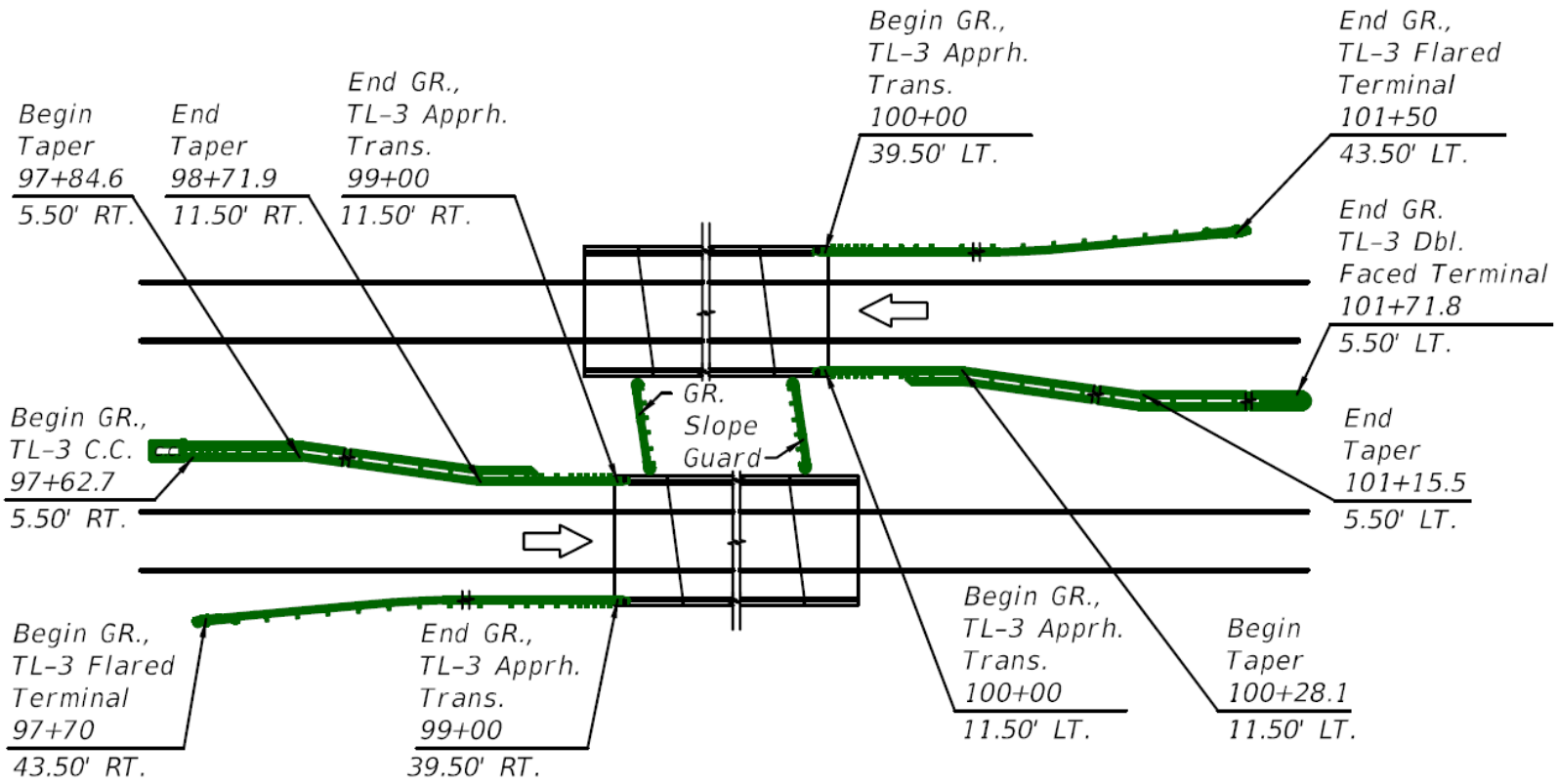
Miscellaneous Guardrail Layout Examples (from IDS):



BRIDGE RAILING SHIELDING EXAMPLE:
OPPOSING LANE'S CONCRETE RAILING
OUTSIDE OF CLEAR ZONE

Index 400 Guardrail – Plans Content

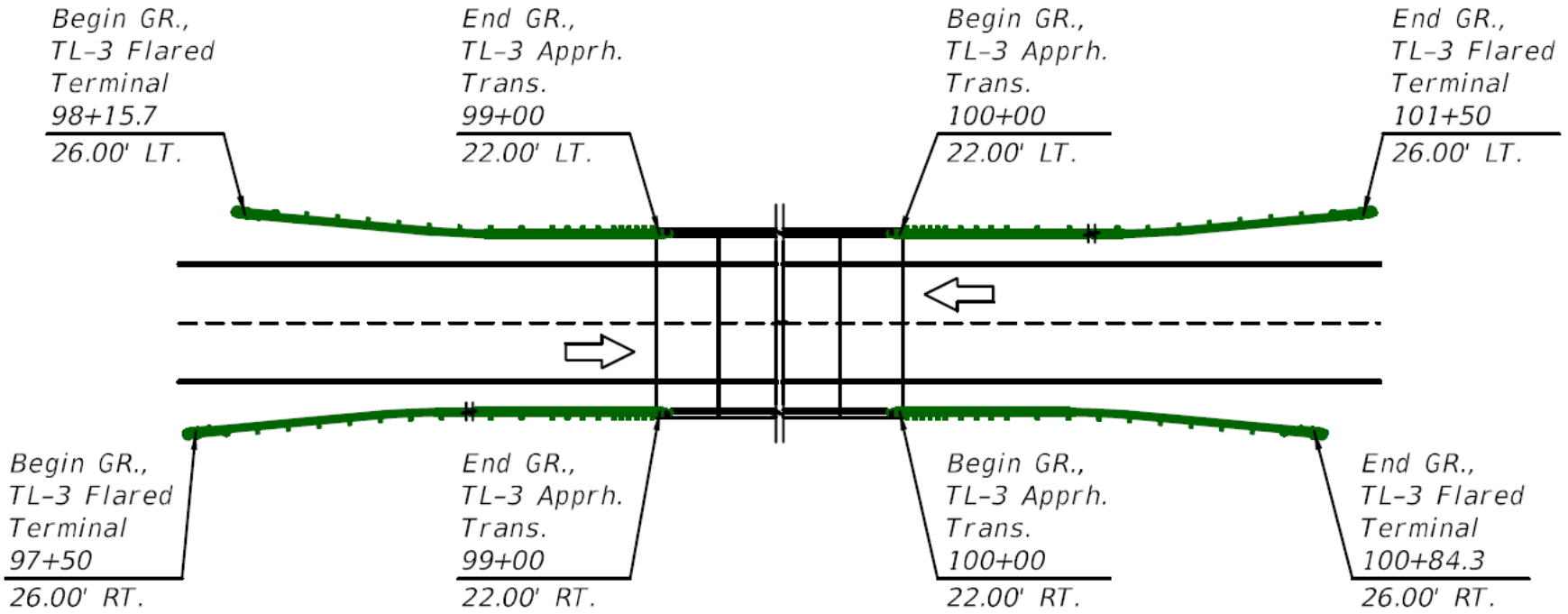
Miscellaneous Guardrail Layout Examples (from IDS):



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

Index 400 Guardrail – Plans Content

Miscellaneous Guardrail Layout Examples (from IDS):



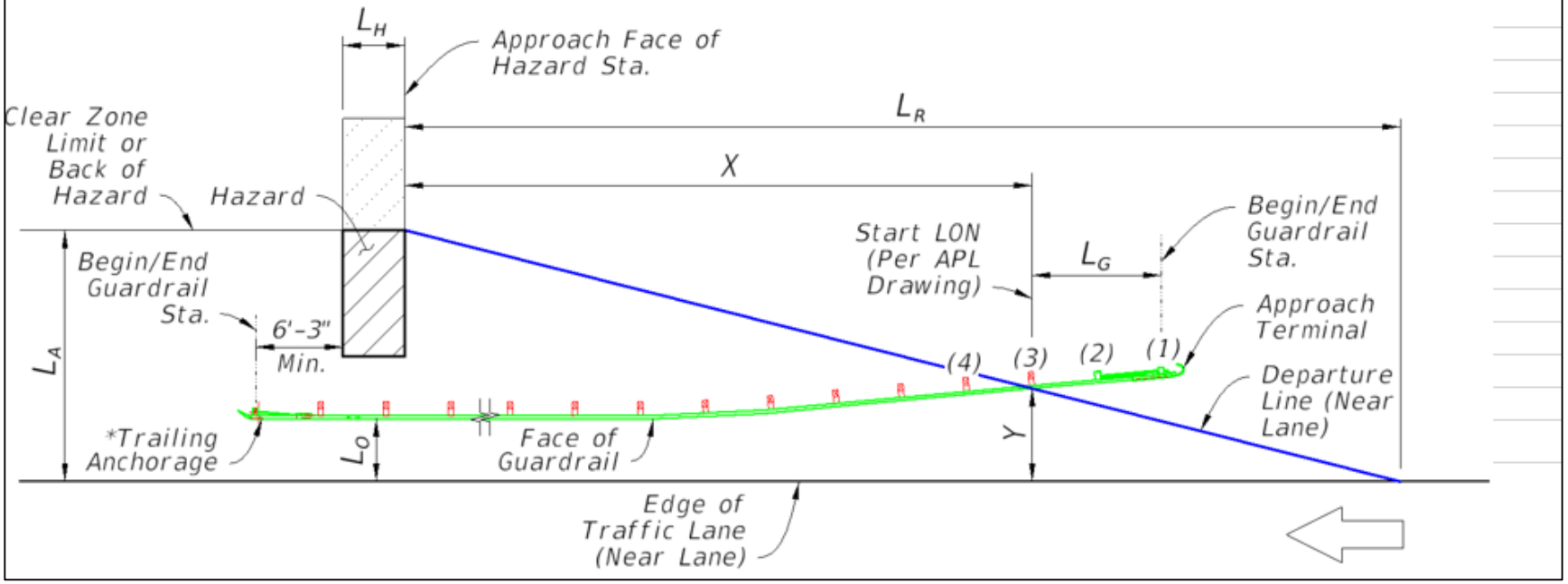
BRIDGE RAILING SHIELDING EXAMPLE:
2-WAY, 2-LANE ROAD; CONCRETE RAILING
WITHIN OPPOSING LANES' CLEAR ZONE
(Min. Length Guardrail Shown)

BEGIN MODULE 4: 'LON' Program

GUARDRAIL LENGTH OF NEED v1.0 - ROADSIDE HAZARD SHIELDING:

Roadway Name / Feature:	
FPID:	
Designer:	

PART A: LENGTH OF NEED FOR NEAR LANE



Guardrail Length of Need v1.0

Where is it?...

Office of Design

Office of Design / Design Standards / Design Standards Revisions FY 2016-17

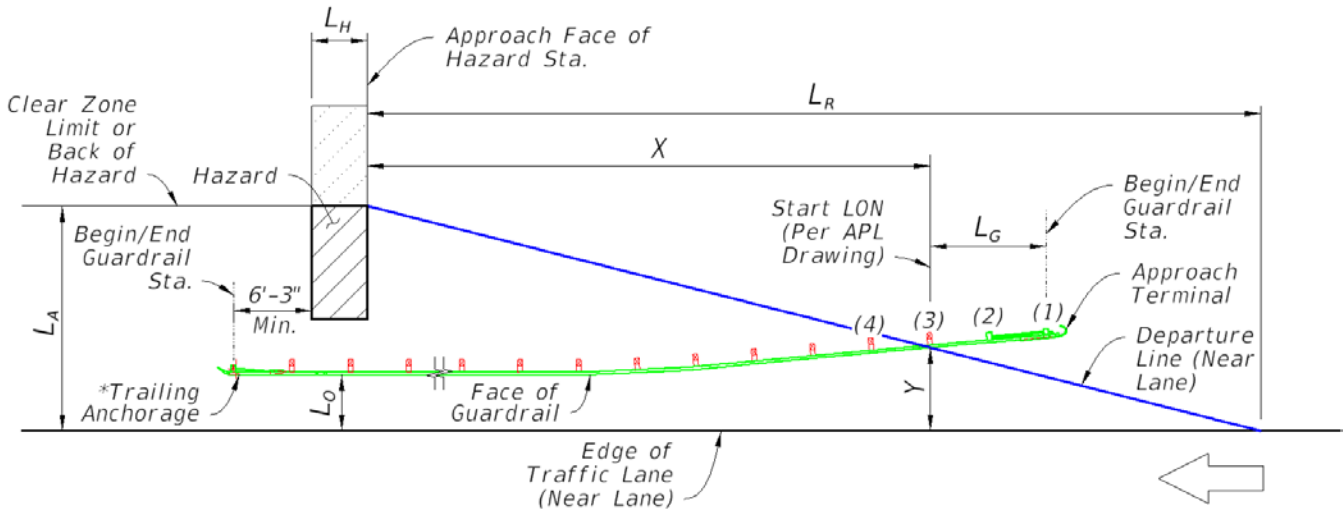
Design Standards Revisions FY 2016-17

n/a = Non Applicable
n/c = No Change

Index Number	Revised Sheets	Index Title	Design Information				
			Instructions (IDS)	Design Tools	Data Table Cell Library	Borderless DGNs	Associated Design Bulletin
	(PDF)		(PDF)	(Link)	(ZIP)	(ZIP) Terms of Use	(PDF)
400	1-22 of 22	Guardrail	IDS-00400	XLS	N/A	DGN	RDB16-01
410	2,10, 16-18 of 25	Concrete Barrier Wall	N/A			DGN	
411	6 of 10	Pier Protection Barrier	N/C			DGN	

Guardrail Length of Need v1.0

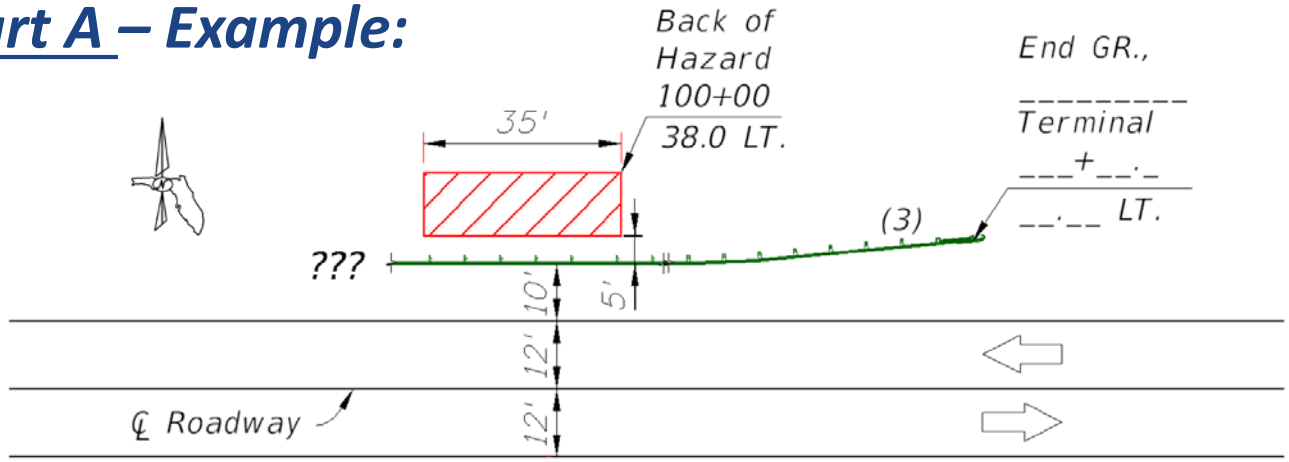
"Part A" Drawing:



	Input:	Comment:
Direction of Near Lane Traffic		*for relative stationing calculations*
AADT (Vehicles Per Day)		
Design Speed (MPH)		
Approach Face of Hazard Station		*enter as total feet (do not input a plus sign)*
Length of Hazard, L_H (Ft.)		
Lateral Area Concern, L_A (Ft.)		*the lesser distance from the 'Edge of Traffic Lane' to the 'Clear Zone Limit' or 'Back of Hazard'*
Lateral Offset of Guardrail, L_O (Ft.)		*the typical guardrail offset from the 'Edge of Traffic Lane,' near the 'Hazard' location (outside of flare)*
Length of Gating, L_G (Ft.)		*"Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4, per the APL Drawings. For "Non-Gating" Terminals, the 'Start LON' is at 'Post 1' (L_G =0).* *NOTE: The flare rate effect on L_G, assumed parallel to the roadway, is negligible and may be omitted.*
Terminal Flare @ Post(1) (Ft.)		*4 Ft. Max. per Index 400 detail, measured offset at Post(1); enter zero for "Parallel" Terminals*
Flare Taper Length (Ft.)		*default value is acceptable at 35'-0", but this may be refined per specific APL drawing (Input used to calculate 'Y')*

Guardrail Length of Need v1.0

Part A – Example:



TYPICAL HAZARD SHIELDING EXAMPLE:
2-LANE, 2-WAY ROAD;
('LON' Program Part 'A')

Given:

Design Speed = 55 mph
AADT = 5000 veh/day
Clear Zone = 30 feet
(PPM Table 4.2.1)
Flare = 4 feet
Terminal Type = Gating

Program Inputs:

Direction Traffic = **WB**
Length of Hazard, L_H = **35**
Lateral Area of Concern, L_A = **26**
Approach Face of Hazard Sta. = **100+00**
Original Guardrail Offset, L_0 = **10**
Length of Gating, L_G = **12.5**
Flare@Post 1 = **4**

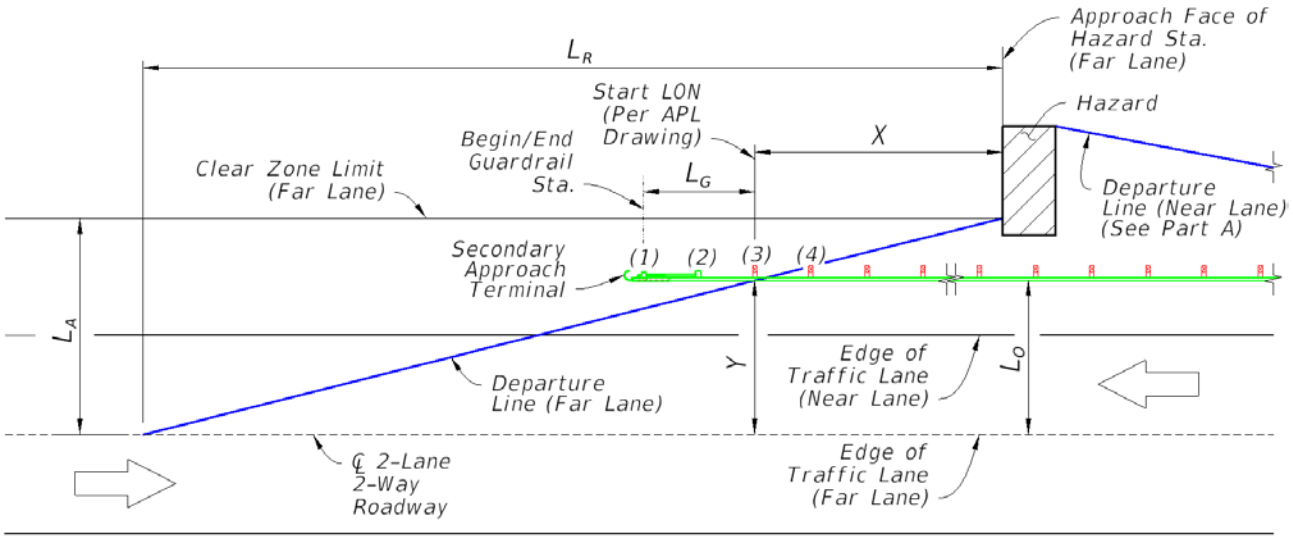
Program Outputs:

Y = **12.6**
Runout Length, L_R = **220**
Length of Need, **X** = **113.6**
Unadjusted Begin/End GR. Sta. =
101+26.1

Type II Trailing Anchorage Applicable? Why?

Guardrail Length of Need v1.0

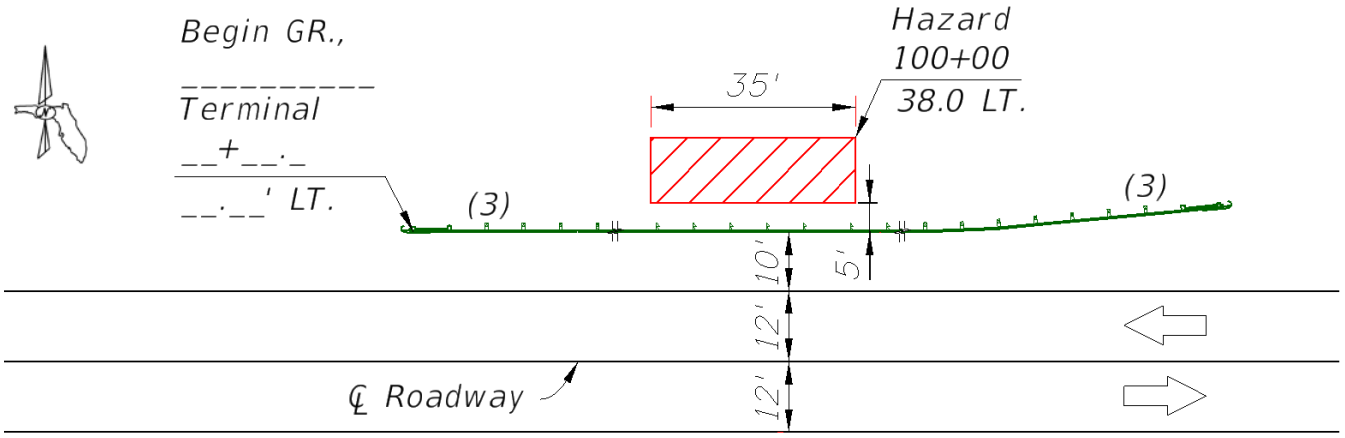
"Part B" Drawing:



	Input:	*Comment:*
PART B Required? (User Input Needed)	***Y/N*** (Toggle)	*Is this a 2-lane, 2-way road with the Hazard in the Far Lane's Clear Zone limit? If "No" Part B will be excluded from the placement calculation output below.*
Lateral Area Concern, L_A (Ft.)		*the lesser distance from the 'Edge of Traffic Lane' (Far Lane) to the 'Clear Zone Limit' or 'Back of Hazard'*
Lateral Offset of Guardrail, L_O (Ft.)		*the typical guardrail offset from the 'Edge of Traffic Lane' (Far Lane), near the 'Hazard' location (outside of flare)*
Length of Gating, L_G (Ft.)		*per the APL Drawings, "Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4. For "Non-Gating" Terminals, the Start LON is at 'Post 1' (L_G =0).* *NOTE: The flare rate effect on L_g, assumed parallel to the roadway, is negligible and may be omitted.*
Terminal Flare @ Post(1) (Ft.)		*4 Ft. Max. per Index 400 detail; measured to Post(1); enter zero for 'Parallel' Terminals*
Flare Taper Length (Ft.)		*default value is acceptable at 35'-0", but this may be refined per specific APL drawing (Input used to calculate 'Y')*

Guardrail Length of Need v1.0

Part B – Example (Far Lane):



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

Given:

Design Speed = 55 mph
AADT = 5000 veh/day
Clear Zone = 30 feet
(PPM Table 4.2.1)
Flare = 0 feet (for example)
Terminal Type = Gating

Program Inputs:

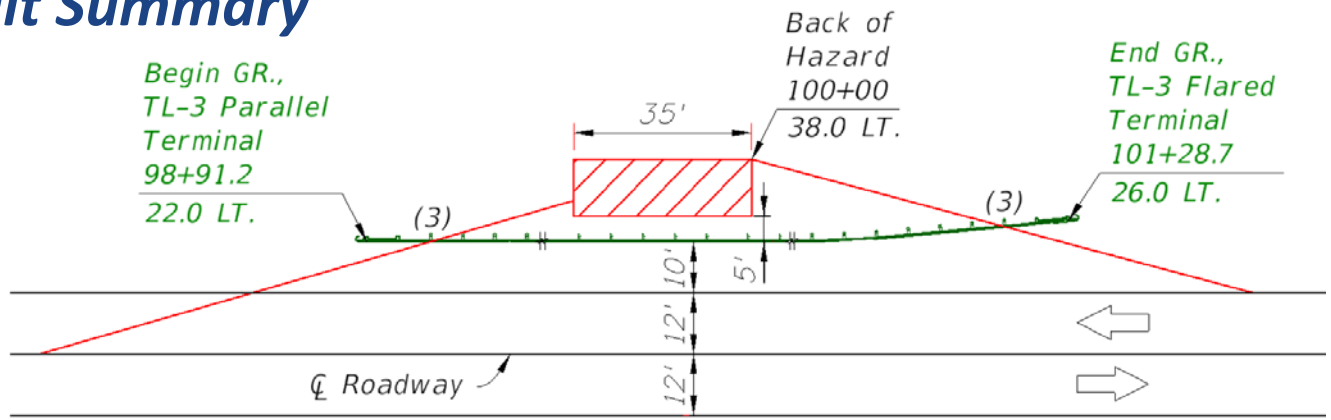
Part B Required? = (Y / N) Toggle
Lateral Area of Concern, L_A= 30
Original Guardrail Offset, L_0 = 22
Length of Gating, L_G = 12.5
Flare@Post 1 0

Program Outputs:

Y = 22
Face of Hazard (Far Lane) Sta. = 99+65
Runout Length, L_R = 220
Length of Need, **X**= 58.7
Unadjusted Begin/End GR. Stat. = 98+93.8

Guardrail Length of Need v1.0

Part A & B – Result Summary



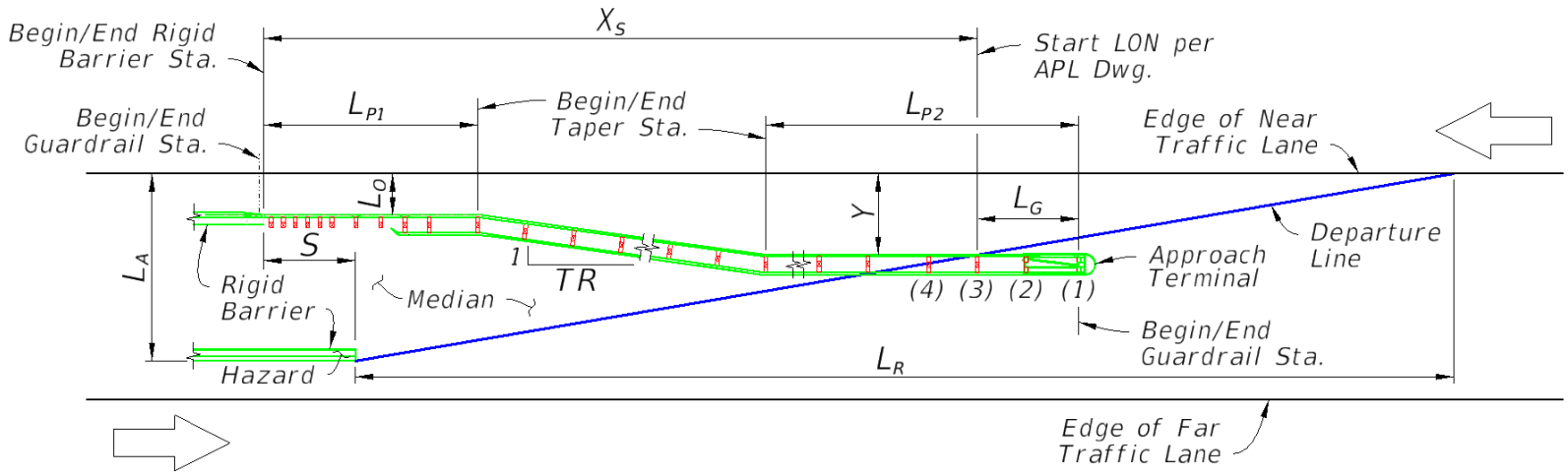
TYPICAL HAZARD SHIELDING EXAMPLE:
2-LANE, 2-WAY ROAD; HAZARD WITHIN
OPPOSING LANE CLEAR ZONE
('LON' Program Parts 'A' & 'B')

Adjusted to Nearest 6'-3"...

DESIGN OUTPUT SUMMARY: GUARDRAIL ROADSIDE HAZARD SHIELDING			
	Limit:	*Output:*	
Adjusted Begin/End Guardrail Sta. @ PRIMARY Approach Terminal (From Part A)	≥	**101+28.7**	***Outputs assume linear stationing:*** *To adjust for curvature, lengthen the guardrail with the Begin/End Guardrail stations placed outside of the stationing limits shown here. Use CADD measurement to bring the final guardrail length to a multiple of 6'-3" panels.*
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :		**14.0**	
Adjusted Begin/End Guardrail Sta. @ Trailing Anchorage (Type II) (From Part A, If Applicable)	-	**N.A.**	
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :		**N.A.**	
Adjusted Begin/End Guardrail Sta. @ SECONDARY Approach Terminal (From Part B, If Applicable)	≤	**98+91.2**	
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :		**10.0**	

Guardrail Length of Need v1.0

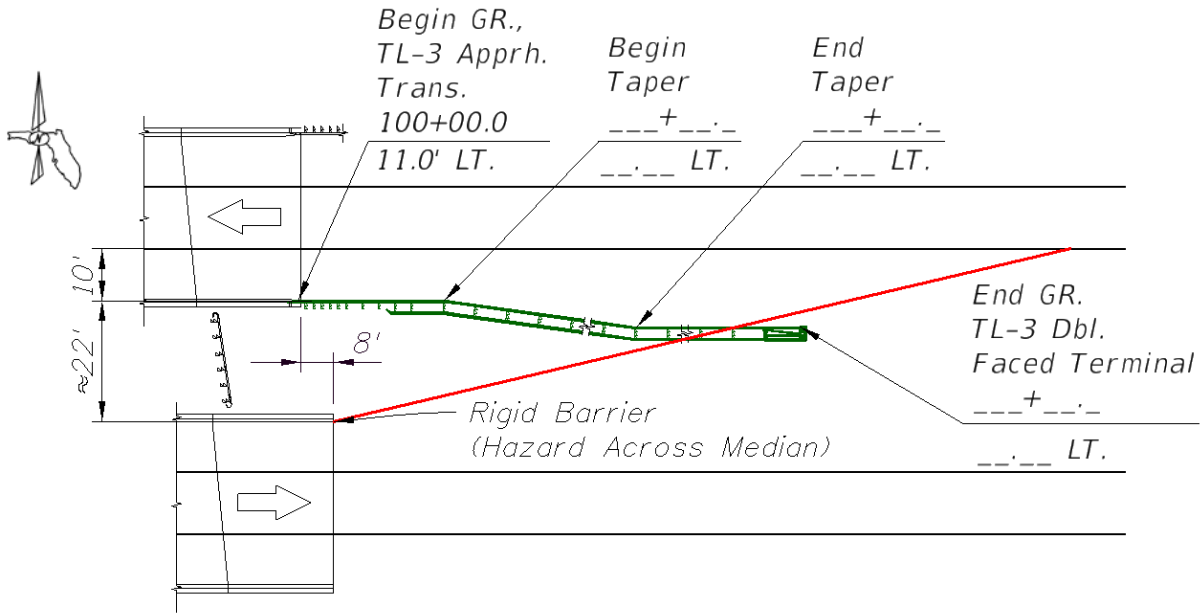
"Part D" Drawing:



	Input:	Comment:
Direction of Near Lane Traffic		*for relative stationing calculations*
AADT (Vehicles Per Day)		
Design Speed (MPH)		
Begin/End Rigid Barrier Sta. (@ guardrail connecting location)		*enter as total feet (do not input a plus sign); located at the end of the 'Rigid Barrier' (not the Begin/End Guardrail Sta.)*
Lateral Offset of Guardrail, L_O (Ft.)		*the starting guardrail offset from the 'Edge of Near Traffic Lane' at the location where the guardrail connects to the 'Rigid Barrier' (determined by the designer)*
Lateral Area Concern, L_A (Ft.)		*the lateral distance from the 'Edge of Near Traffic Lane' to the far edge of the opposing 'Rigid Barrier' (i.e. Concrete Traffic Railing) across the median*
Parallel Approach Trans. Length, L_{P1} (Ft.)		*the length of the guardrail Approach Transition Connection prior to the start of the taper; per Index 400 options, TL-3=27.5 Ft. and TL-2=18.2 Ft. Note: This is measured from the end of the 'Rigid Barrier' (not the 'Begin/End Guardrail Sta.')*
Parallel Approach Terminal Length, L_{P2} (Ft.)		*the length of the parallel segment required for the Approach Terminal, just beyond the taper; Per Index 400, TL-3 = 56.3 Ft.*
Length of Gating, L_G (Ft.)		*"Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4, per the APL Drawings. For "Non-Gating" Terminals, the 'Start LON' is at 'Post 1' (L_G =0).*
Taper Rate of Crossover, 1:TR (Ft.)		*the linear taper rate for the Median Crossover Segment; 1:10 for Design Speeds ≤ 45 MPH and 1:15 for Design Speeds > 45 MPH.*
Rigid Barrier Skew, S (Ft.)		*the longitudinal "skew" distance between the guardrail's connecting Rigid Barrier end and the "Hazard" Rigid Barrier end (across the median). For the direction opposite the drawing dimension, use a negative value.*

Guardrail Length of Need v1.0

Part D – Example - Median Crossover with Terminal:



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

Given:

Design Speed = 65 mph
AADT = 10,000 veh/day
Clear Zone = 36 feet
(PPM Table 4.2.1)
Terminal Type = Gating

Program Inputs:

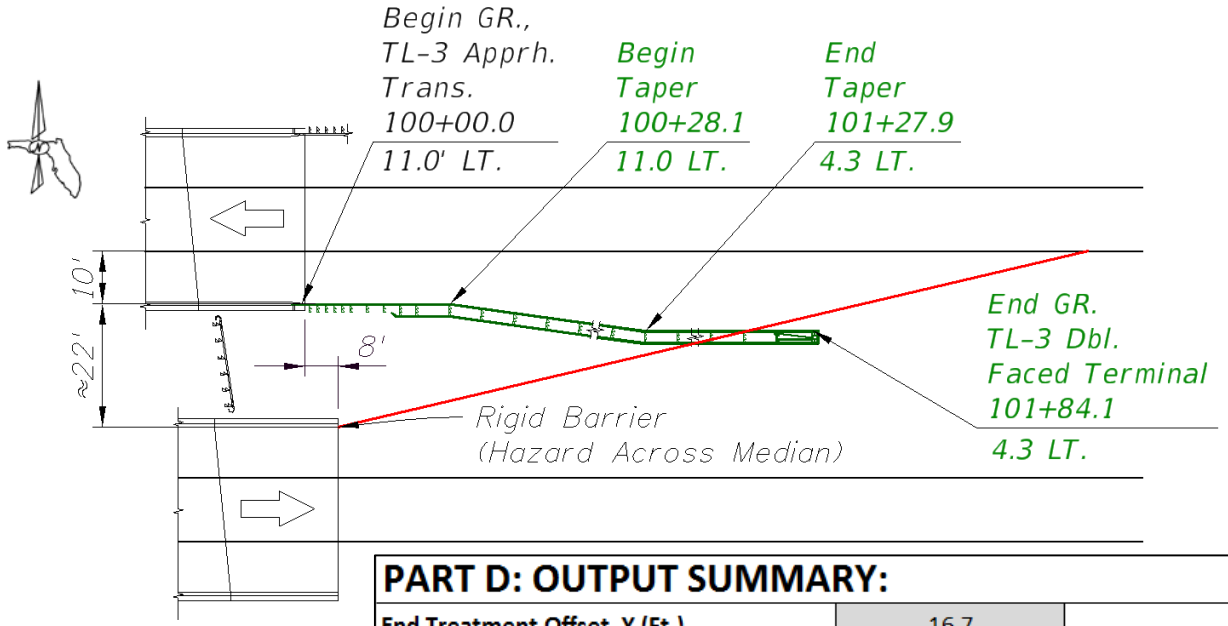
Direction Traffic = WB
AADT = 10,000
Rigid Barrier Sta.= 100+00.6
Original Offset, L_O = 10

Program Inputs (Cont'd):

Lateral Area of Concern, L_A = 32
Parallel Length1, L_{P1} = 27.5
Parallel Length 2, L_{P2} = 56.3
Length of Gating, L_G = 12.5
Taper Rate, 1:**TR** = 15
Bridge Skew, **S** = 8

Guardrail Length of Need v1.0

Part D – Example - Median Crossover with Terminal:



Given:

Design Speed = 65 mph
AADT = 10,000 veh/day
Clear Zone = 36 feet
(PPM Table 4.2.1)
Terminal Type = Gating

PART D: OUTPUT SUMMARY:		
End Treatment Offset, Y (Ft.)	16.7	
Runout Length, L_R (Ft.)	330	
Length of Need, X_S (Ft.)	171.0	
Begin/End Guardrail Sta. @ Connection to Rigid Barrier	100+00.	
Offset from Edge of Near Traffic Lane (Ft.)	10.0	
Begin/End Taper Sta.	100+28.1	
Offset from Edge of Near Traffic Lane (Ft.)	10.0	
Begin/End Taper Sta.	101+27.9	
Offset from Edge of Near Traffic Lane (Ft.)	16.7	
Begin/End Guardrail Sta. @ Post (1)	101+84.1	
Offset from Edge of Near Traffic Lane (Ft.)	16.7	

The outputs assume stationing is linear *and are adjusted to bring tapered segment panel lengths to a multiple of 6'-3".*

The stations provided here may be used directly in the Plans, assuming that roadway curvature does not cause a discrepancy of more than 3'-0" between the these output stations and the actual guardrail panel slot/post locations (Tolerance per Specification Section 536).

If adjustments for curvature are required to bring the stationing closer to the actual panel slot and post locations, use L_{P1} and L_{P2}, adjusted for curvature, and add additional length to the taper segment as needed.

Design Standards Index 400 - Guardrail

For all future FDOT Roadway Design Training, sign up to receive notification e-mails at…

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The **Contact Management System/E-Updates** is a "self service" area where FDOT, Consultants and others can register for information pertinent to their jobs. This replaces several smaller contact databases that are maintained by individual offices. User-ids are the email address one registers with and the passwords are set by the individuals when registering. The passwords never expire.

THANK YOU!

QUESTIONS?

For more information:
richard.stepp@dot.state.fl.us
derwood.sheppard@dot.state.fl.us

GUARDRAIL LENGTH OF NEED v1.0 –

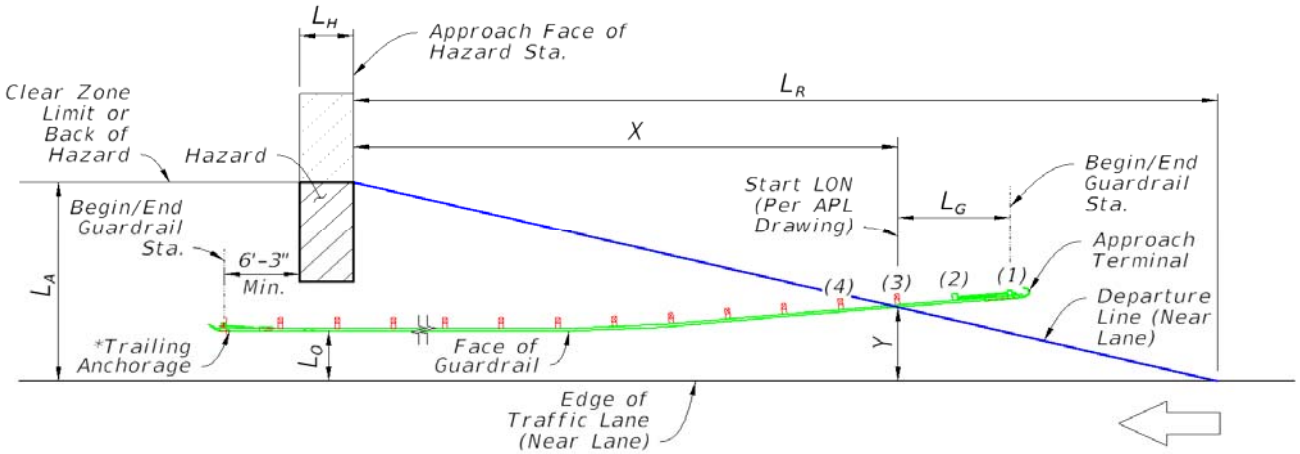
“Paper Program”

FDOT Guardrail Training Supplement

GUARDRAIL LENGTH OF NEED v1.0 - ROADSIDE HAZARD SHIELDING:

Roadway Name / Feature:	
FPID:	
Designer:	

PART A: LENGTH OF NEED FOR NEAR LANE



	Input:	Comment:
Direction of Near Lane Traffic	*Westbound*	*for relative stationing calculations*
AADT (Vehicles Per Day)		
Design Speed (MPH)		
Approach Face of Hazard Station		*enter as total feet (do not input a plus sign)*
Length of Hazard, L_H (Ft.)		
Lateral Area Concern, L_A (Ft.)		*the lesser distance from the 'Edge of Traffic Lane' to the 'Clear Zone Limit' or 'Back of Hazard'*
Lateral Offset of Guardrail, L_O (Ft.)		*the typical guardrail offset from the 'Edge of Traffic Lane,' near the 'Hazard' location (outside of flare)*
Length of Gating, L_G (Ft.)	12.5	*"Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4, per the APL Drawings. For "Non-Gating" Terminals, the 'Start LON' is at 'Post 1' (L_G =0).* *NOTE: The flare rate effect on L_G, assumed parallel to the roadway, is negligible and may be omitted.*
Terminal Flare @ Post(1) (Ft.)	4	*4 Ft. Max. per Index 400 detail, measured offset at Post(1); enter zero for "Parallel" Terminals*
Flare's Taper Length (Ft.)	35	*default value is acceptable at 35'-0", but this may be refined per specific APL drawing (Input used to calculate 'Y')*

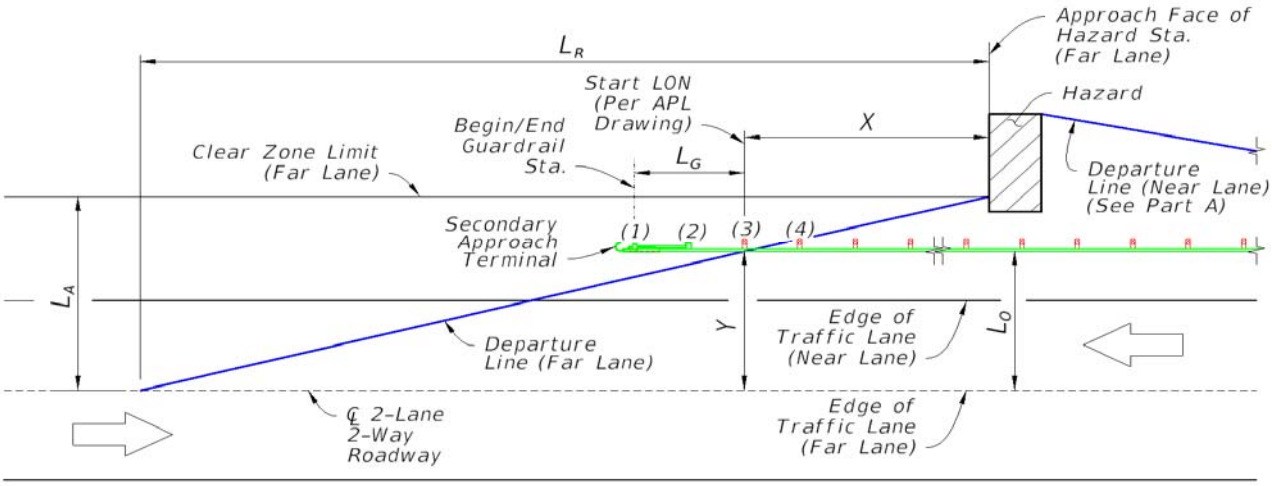
Output:	
End Treatment Offset, Y (Ft.)	
Runout Length, L_R (Ft.)	
Length of Need, X (Ft.)	
Unadjusted Begin/End Guardrail Sta. @ Primary Approach Terminal	
Unadjusted Begin/End Guardrail Sta. @ Trailing Anchorage (If Applicable)	

$$X = \frac{L_A - Y}{L_A / L_R}$$

AASHTO RDG (5-3)

** **NOTE:** If the Trailing Anchorage shown herein is in the Clear Zone of an opposing Traffic Lane, use an Approach Terminal in its place.*

PART B: LENGTH OF NEED FOR FAR LANE - OPPOSING DIRECTION (IF APPLICABLE)
('Part A' Extension, If Required For *2-Lane, 2-Way Road* with Hazard in Far Lane's Clear Zone)



	Input:	*Comment:*
PART B Required? (User Input Needed)	***No***	*Is this a 2-lane, 2-way road with the Hazard in the Far Lane's Clear Zone limit? If "No" Part B will be excluded from the placement calculation output below.*
Lateral Area Concern, L_A (Ft.)		*the lesser distance from the 'Edge of Traffic Lane' (Far Lane) to the 'Clear Zone Limit' or 'Back of Hazard'*
Lateral Offset of Guardrail, L_O (Ft.)		*the typical guardrail offset from the 'Edge of Traffic Lane' (Far Lane), near the 'Hazard' location (outside of flare)*
Length of Gating, L_G (Ft.)	12.5	*per the APL Drawings, "Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4. For "Non-Gating" Terminals, the Start LON is at 'Post 1' (L_G =0).* *NOTE: The flare rate effect on L_g, assumed parallel to the roadway, is negligible and may be omitted.*
Terminal Flare @ Post(1) (Ft.)	0	*4 Ft. Max. per Index 400 detail; measured to Post(1); enter zero for 'Parallel' Terminals*
Flare's Taper Length (Ft.)	0	*default value is acceptable at 35'-0", but this may be refined per specific APL drawing (Input used to calculate 'Y')*

Output:	
End Treatment Offset, Y (Ft.)	N.A.
Direction of Far Lane Traffic	N.A.
Approach Face of Hazard Station (Far Lane)	N.A.
Runout Length, L_R (Ft.)	N.A.
Length of Need, X (Ft.)	**N.A.**
Unadjusted Begin/End Guardrail Sta. @ Secondary Approach Terminal	**N.A.**

$$X = \frac{L_A - Y}{L_A / L_R}$$ AASHTO RDG (5-3)

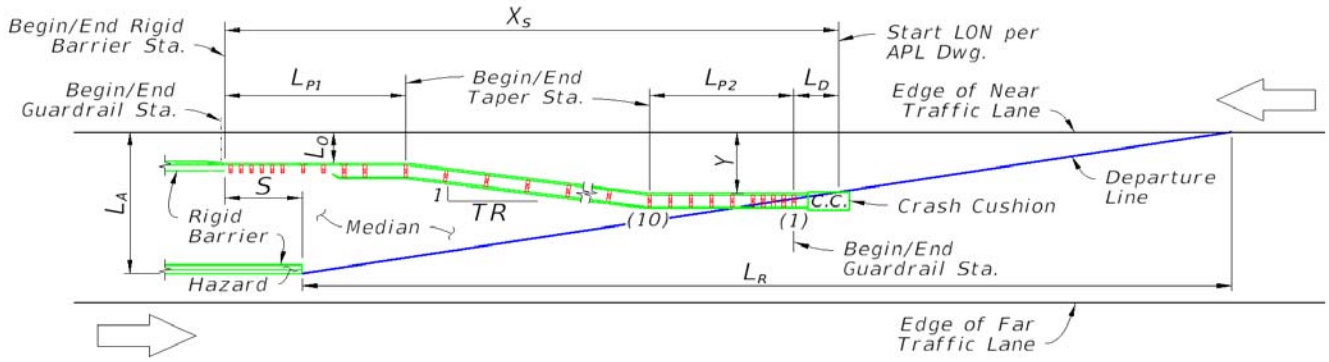
DESIGN OUTPUT SUMMARY: GUARDRAIL ROADSIDE HAZARD SHIELDING

	Limit:	*Output:*	
Adjusted Begin/End Guardrail Sta. @ PRIMARY Approach Terminal (From Part A)	≥		***Outputs assume linear stationing:*** *To adjust for curvature, lengthen the guardrail with the Begin/End Guardrail stations placed outside of the stationing limits shown here. Use CADD measurement to bring the final guardrail length to a multiple of 6'-3" panels.*
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :			
Adjusted Begin/End Guardrail Sta. @ Trailing Anchorage (Type II) (From Part A, If Applicable)	≤		
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :			
Adjusted Begin/End Guardrail Sta. @ SECONDARY Approach Terminal (From Part B, If Applicable)	-		
Guardrail Offset from Nearest Edge of Traffic Lane (Ft.) :			

GUARDRAIL LENGTH OF NEED v1.0 - BRIDGE CONCRETE RAILING SHIELDING

Roadway Name / Feature:	
FPID:	
Designer:	

PART C: CROSSOVER GUARDRAIL WITH '*CRASH CUSHION*' - SHIELDING CONCRETE RAILING ACROSS MEDIAN (WITHIN CLEAR ZONE)



	Input:	Comment:
Direction of Near Lane Traffic	*Westbound*	*for relative stationing calculations*
AADT (Vehicles Per Day)		
Design Speed (MPH)		
Begin/End Rigid Barrier Sta. (@ guardrail connecting location)		*enter as total feet (do not input a plus sign); located at the end of the 'Rigid Barrier' (not the Begin/End Guardrail Sta.)*
Lateral Offset of Guardrail, L_O (Ft.)		*the starting guardrail offset from the 'Edge of Near Traffic Lane' at the location where the guardrail connects to the 'Rigid Barrier' (determined by the designer)*
Lateral Area Concern, L_A (Ft.)		*the lateral distance from the 'Edge of Near Traffic Lane' to the far edge of the opposing 'Rigid Barrier' (i.e. Concrete Traffic Railing) across the median*
Parallel Approach Trans. Length, L_{P1} (Ft.)	27.5	*the length of the guardrail Approach Transition Connection prior to the start of the taper; per Index 400 options, TL-3=27.5 Ft. and TL-2=18.2 Ft. Note: This is measured from the end of the 'Rigid Barrier' (not the 'Begin/End Guardrail Sta.')*
Parallel C.C. Segment Length, L_{P2} (Ft.)	21.9	*the length of the parallel segment required for Guardrail Transition, just beyond the taper. This is the length between Post (1) and Post (10) per Index 430, 21.9 Ft.*
Design Length of Crash Cushion, L_D (Ft.)		*the length between Post (1) and the 'Start LON' (or Departure Line intersection) per the manufacturer's APL Drawing*
Taper Rate of Crossover, 1:TR (Ft.)	15	*the linear taper rate for the Median Crossover Segment; 1:10 for Design Speeds ≤ 45 MPH and 1:15 for Design Speeds > 45 MPH.*
Rigid Barrier Skew, S (Ft.)		*the longitudinal "skew" distance between the guardrail's connecting Rigid Barrier end and the 'Hazard' Rigid Barrier end (across the median). For the direction opposite the drawing dimension, use a negative value.*

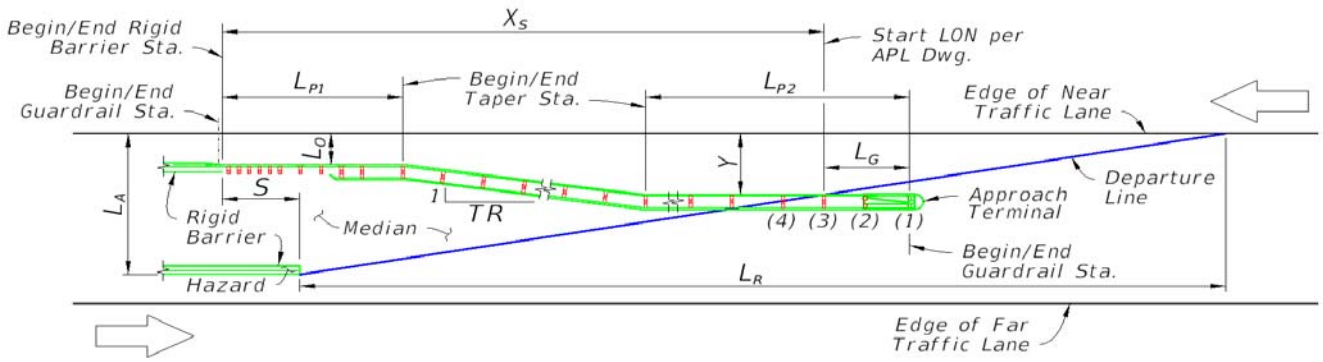
PART C: OUTPUT SUMMARY:

End Treatment Offset, Y (Ft.)		***The outputs assume stationing is linear*** *and are adjusted to bring tapered segment panel lengths to a multiple of 6'-3".* *The output stations may be used directly in the Plans, assuming that roadway curvature does not cause a discrepancy of more than 3'-0" between the these output stations and the actual guardrail panel slot & post locations (Tolerance per Specification Section 536).* *If adjustments for curvature are required to bring the stationing closer to the actual panel slot & post locations, use L_{P1}, L_{P2}, and L_D, adjusted for curvature, and add additional length to the taper segment as needed.*
Runout Length, L_R (Ft.)		
Length of Need, X_S (Ft.)		
Begin/End Guardrail Sta. @ Connection to Rigid Barrier		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Taper Sta.		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Taper Sta.		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Guardrail Sta. @ Connection Post (1)		
Offset from Edge of Near Traffic Lane (Ft.)		

GUARDRAIL LENGTH OF NEED v1.01 - BRIDGE CONCRETE RAILING SHIELDING

Roadway Name / Feature:	
FPID:	
Designer:	

PART D: CROSSOVER GUARDRAIL WITH *'APPROACH TERMINAL'* - SHIELDING CONCRETE RAILING ACROSS MEDIAN (WITHIN CLEAR ZONE)



	Input:	Comment:
Direction of Near Lane Traffic	*Westbound*	*for relative stationing calculations*
AADT (Vehicles Per Day)		
Design Speed (MPH)		
Begin/End Rigid Barrier Sta. (@ guardrail connecting location)		*enter as total feet (do not input a plus sign); located at the end of the 'Rigid Barrier' (not the Begin/End Guardrail Sta.)*
Lateral Offset of Guardrail, L_O (Ft.)		*the starting guardrail offset from the 'Edge of Near Traffic Lane' at the location where the guardrail connects to the 'Rigid Barrier' (determined by the designer)*
Lateral Area Concern, L_A (Ft.)		*the lateral distance from the 'Edge of Near Traffic Lane' to the far edge of the opposing 'Rigid Barrier' (i.e. Concrete Traffic Railing) across the median*
Parallel Approach Trans. Length, L_{P1} (Ft.)	27.5	*the length of the guardrail Approach Transition Connection prior to the start of the taper; per Index 400 options, TL-3=27.5 Ft. and TL-2=18.2 Ft. Note: This is measured from the end of the 'Rigid Barrier' (not the 'Begin/End Guardrail Sta.')*
Parallel Approach Terminal Length, L_{P2} (Ft.)	56.3	*the length of the parallel segment required for the Approach Terminal, just beyond the taper; Per Index 400, TL-3 = 56.3 Ft.*
Length of Gating, L_G (Ft.)	12.5	*"Gating" Terminals typically have a 'Start LON' at Post 3 or Post 4, per the APL Drawings. For "Non-Gating" Terminals, the 'Start LON' is at 'Post 1' (L_G =0).*
Taper Rate of Crossover, 1:TR (Ft.)	15	*the linear taper rate for the Median Crossover Segment; 1:10 for Design Speeds ≤ 45 MPH and 1:15 for Design Speeds > 45 MPH.*
Rigid Barrier Skew, S (Ft.)		*the longitudinal "skew" distance between the guardrail's connecting Rigid Barrier end and the "Hazard" Rigid Barrier end (across the median). For the direction opposite the drawing dimension, use a negative value.*

PART D: OUTPUT SUMMARY:

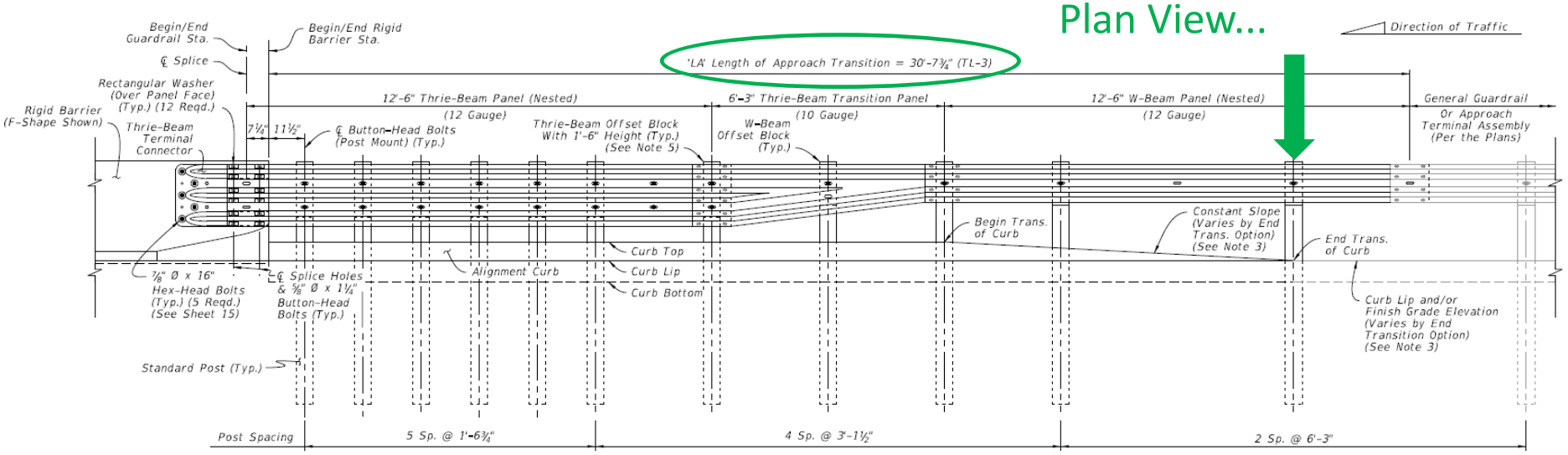
End Treatment Offset, Y (Ft.)		***The outputs assume stationing is linear*** *and are adjusted to bring tapered segment panel lengths to a multiple of 6'-3".* *The stations provided here may be used directly in the Plans, assuming that roadway curvature does not cause a discrepancy of more than 3'-0" between the these output stations and the actual guardrail panel slot/post locations (Tolerance per Specification Section 536).* *If adjustments for curvature are required to bring the stationing closer to the actual panel slot and post locations, use L_{P1} and L_{P2}, adjusted for curvature, and add additional length to the taper segment as needed.*
Runout Length, L_R (Ft.)		
Length of Need, X_S (Ft.)		
Begin/End Guardrail Sta. @ Connection to Rigid Barrier		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Taper Sta.		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Taper Sta.		
Offset from Edge of Near Traffic Lane (Ft.)		
Begin/End Guardrail Sta. @ Post (1)		
Offset from Edge of Near Traffic Lane (Ft.)		

Length of Need v1.0 - Supplement

DESIGN TOOL PARTS C or D –
How to find variable L_{P1}:

From Index 400…
Sheet 13 (Sheet 14 Similar)

Taper Begins Here per Plan View…



TL-3 APPROACH TRANSITION INSTALLED ELEVATION

TL-3: 'LA' = 30'-7¾"

L_{P1} = 'LA' – ¼ Panel =

L_{P1} = (30'-7¾") – (¼)(12'-6") =

L_{P1} = **27.5'**

TL-2: 'LA' = 21'-3¼"

L_{P1} = 'LA' – ¼ Panel =

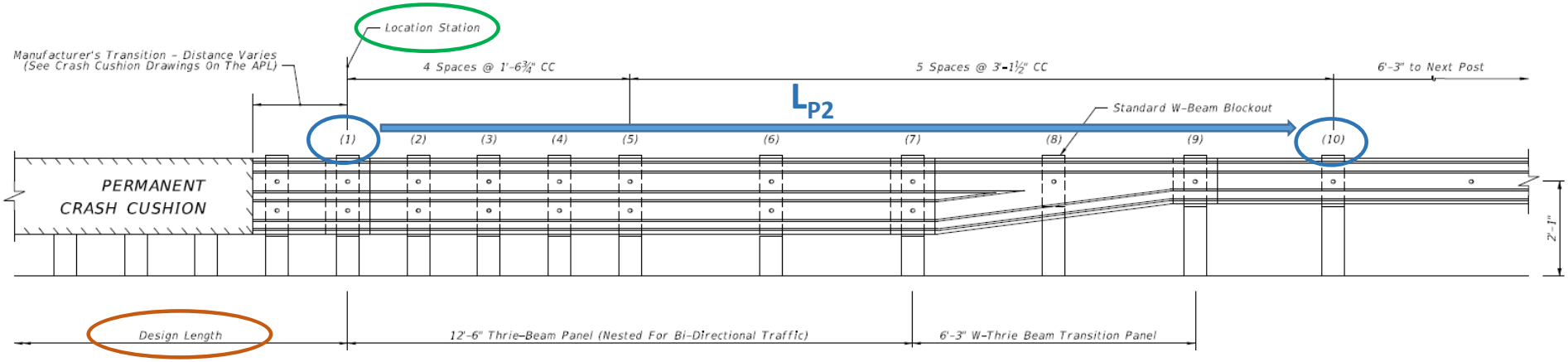
L_{P1} = (21'-3¼") – (¼)(12'-6") =

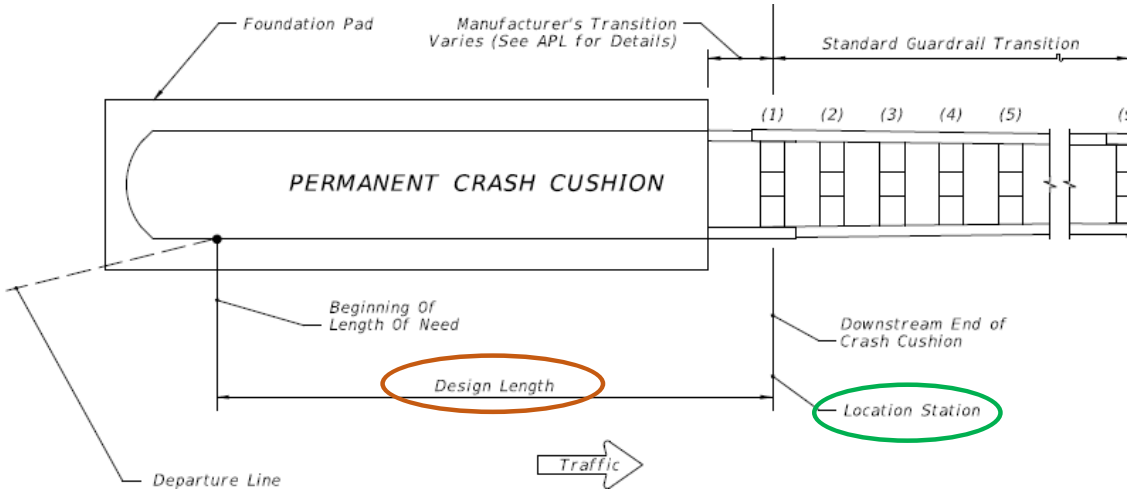
L_{P1} = **18.2'**

Length of Need v1.0 - Supplement

DESIGN TOOL PART C, CRASH CUSHIONS – *From Index 430…*

How to find variables L_{P2} and L_D:



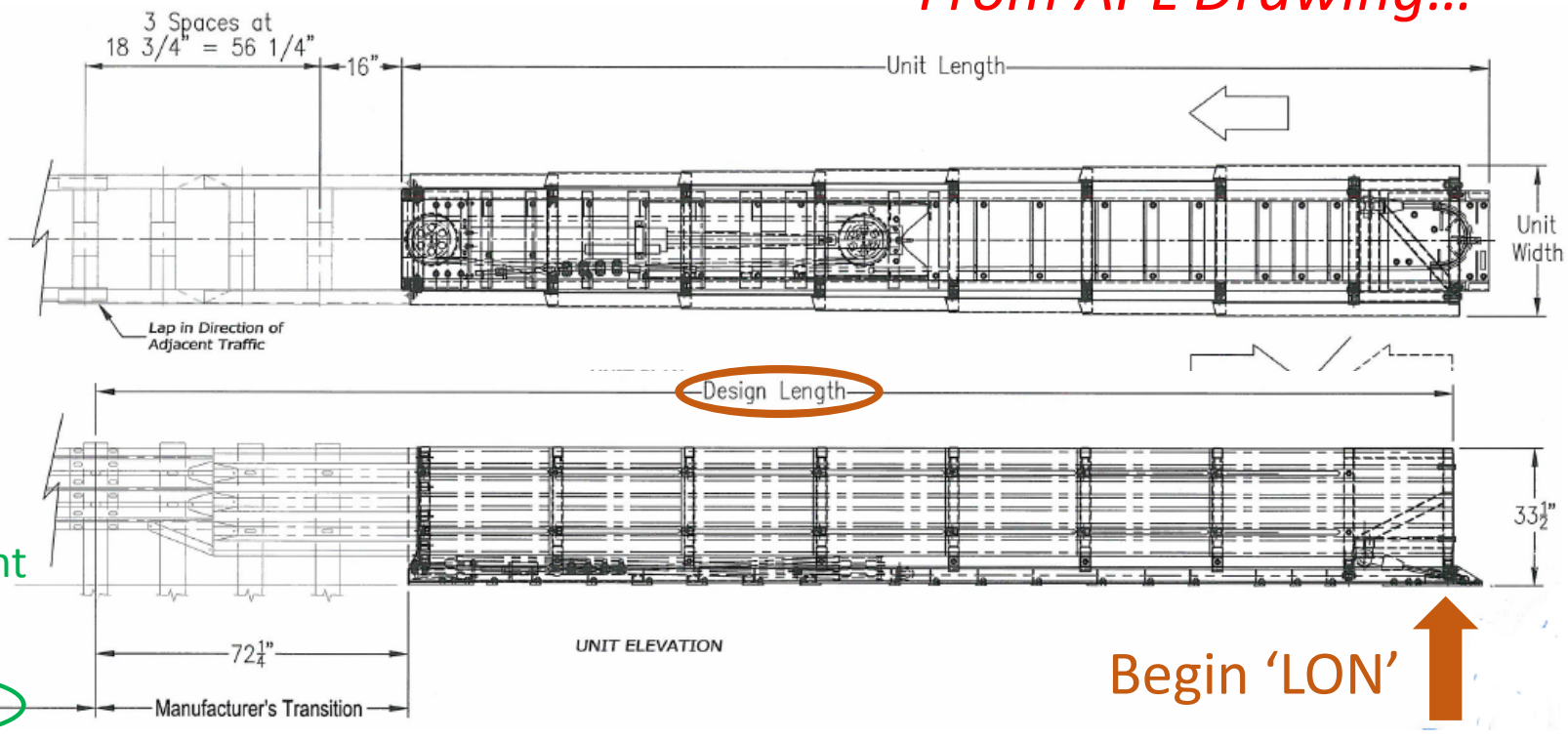


- "Location Station" is Begin/End Guardrail length measurement point
- L_{P2} is the distance between Post(1) and Post(10).
  The "Taper" Begins at Post (10).
  L_{P2} = 21'-10½"
- L_D is the Crash Cushion's Design Length per the chosen APL Drawing. This is the distance from Post(1) to manufacturer's Begin Length of Need point (outside of the Guardrail length measurement).

Length of Need v1.0 - Supplement

DESIGN TOOL PART C, CRASH CUSHIONS – How to find L_D:

From APL Drawing…



Post (1) on Standard - Begin Guardrail Measurement (to left)

Begin 'LON'

Specifications							
Model Number	Unit Width	Unit Length	Foundation Width	Foundation Length	Design Length	Workzone Speeds	Test Level Designation
SCI70GM	36"	164"	48"	180"	236"	≤ 45 mph	TEST LEVEL 2
SCI100GM	37"	260"	48"	276"	332"	≥ 50 mph	TEST LEVEL 3

Note: For Low Speed Facilities with Workzone Speed of ≤ 45 mph Use a TL-2 System
For High Speed Facilities with Workzone Speed of ≥ 50 mph Use a TL-3 System

L_D = Design Length

Length of Need v1.0 - Supplement

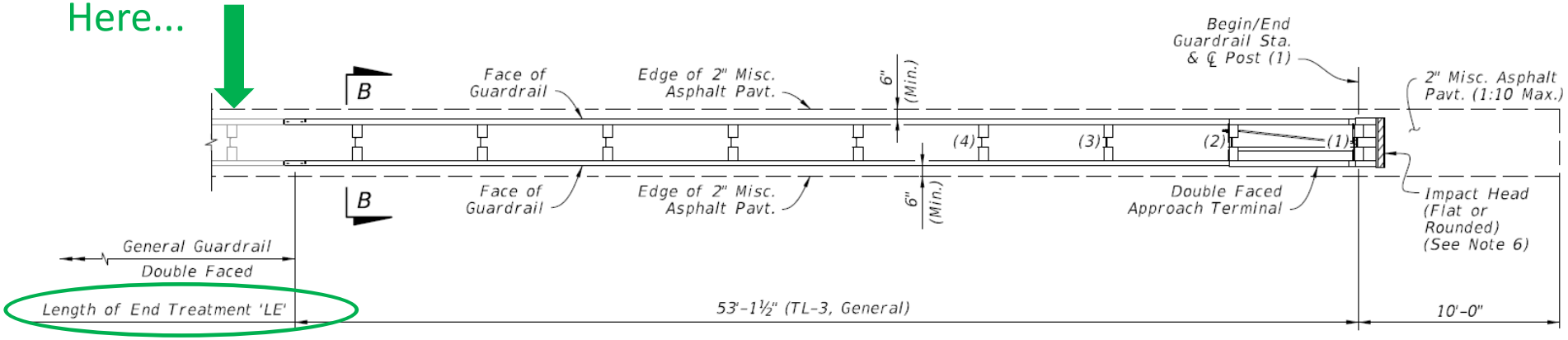
DESIGN TOOL PART D, APPROACH TERMINAL

How to find variable L_{P2}:

From Index 400,

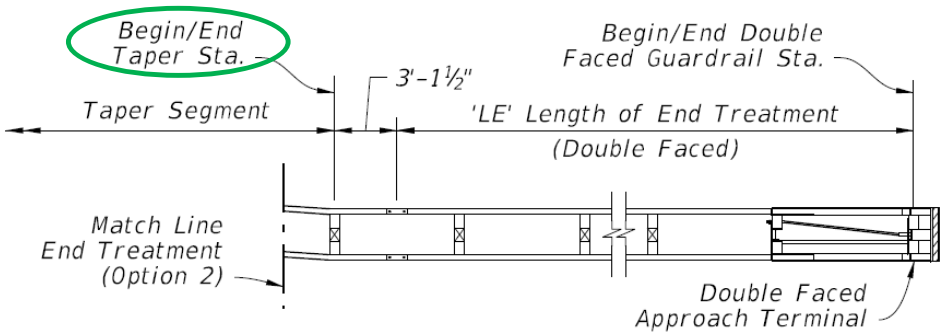
Sheet 8…

Taper Begins Here…



APPROACH TERMINAL ASSEMBLY
'DOUBLE FACED' SEGMENT - PLAN VIEW

Sheet 17…



'LE' = 53'-1½"

L_{P2} = 'LE' + ½ Span =

L_{P2} = (53'-1½") + (3'-1½") =

L_{P2} = 56'-3"