



Florida Department of Transportation

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SECRETARY

TEMPORARY DESIGN BULLETIN C08-02 ESTIMATE BULLETIN 08-07

DATE: July 9, 2008

TO: District Directors of Production, District Design Engineers, District Structures Design Engineers, District Estimates Coordinators, District Specification Engineers

FROM: Robert Robertson, State Structures Design Engineer *RJR*
Phillip Greg Davis, State Estimates Engineer *Phillip G Davis*

COPIES: Lora Hollingsworth, Timothy Lattner, David O'Hagan, David Sadler, Andre Pavlov, Jeffrey Ger (FHWA)

SUBJECT: Implementation of Perimeter Wall Design Standards -
Structures Design Manual and Basis of Estimates Handbook Updates

REQUIREMENTS

Update the January 2008 Structures Manual (Topic No. 625-020-018) as follows:

1. Volume 2 (Detailing Manual) - Replace Section 15 with Attachment A.
2. Volume 3 (Instructions for Design Standards) - Add Attachment B.
3. Volume 6 (QPL Acceptance Criteria) - Replace Chapter 2 with Attachment C.

COMMENTARY

The attached documents are required for the complete implementation of the new Interim Index No. 5250 Precast Perimeter Wall. This Index should only be used on projects with concurrence from the District Design Engineer.

Criteria justifying the use of Perimeter Walls have not been adopted by the Department at this time. The decision to use Perimeters Walls should be evaluated on a project-by-project basis and resolved by the District Office based on project constraints and demands.

BACKGROUND

Interim Index No. 5250 was developed at the request of the Structures Technical Advisory Group. This type of wall structure is intended to visually screen the roadway from adjacent properties when there are no noise abatement requirements for the wall location.

Perimeter Walls are very similar to Sound Barriers as shown within the Design Standards for both design and construction, but are generally much shorter in height (6 to 12 feet). Therefore, Perimeter Walls have been incorporated into the relevant sections of the Structures Manual that pertain to Sound Barriers (Volume 2 – Section 15 and Volume 6 - Chapter 2), with a new Instruction for Design Standards (Index No. 5250) added to the Structures Manual (Volume 3).

A new Pay Item for Perimeter Walls has been issued and a Special Provision for Section 534 of the construction specifications is currently in the review process.

IMPLEMENTATION

Design Standards Interim Index No. 5250 will be released with the Design Standards Modifications in July 2008, and is effective for project lettings beginning January 2009. The corresponding Special Provision for Section 534 will not be published until the July 2009 Workbook, so for project lettings prior to July 2009, please request this Special Provision from your District Specifications Office.

Pay Item 534- 73- Perimeter Walls, SF is effective with the January 2009 letting.

CONTACT

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RR/GD/sjn
Attachment

Attachment A

Structures Manual – Volume 2 Detailing Manual – Section 15

15 – Fences, **Perimeter Walls** and Sound Barriers

15.1 Fences **(07/05)**

15.1.1 General

- A. Show the limits of fencing in the plans if they are not from begin of approach slab at Begin Bridge to end of approach slab at End Bridge.
- B. Show estimated quantities for bridge fencing with estimated quantities for Traffic Railing and/or concrete parapets in the superstructure details sheets.
- C. Determine if bridge fencing requires grounding. If required, provide details in the superstructure sheets.

15.1.2 Chain Link Fabric and Tension Wire Types

- A. Specify the type of chain link fabric and tension wire required for bridge fencing in the General Notes. See Design Standards Index Nos. 810 through 812, Bridge Fencing for options.
- B. When PVC coated chain link fabric is specified, provide the following information in the General Notes:
 - 1.) A note specifying the color of the PVC coating for chain link fabric.
 - 2.) A note to paint the fence framework to match the color of the PVC chain link fabric.
 - 3.) A note for preparation of galvanized steel for painting.
 - 4.) A note to coat tension wire and fence fittings to match the color of the PVC chain link fabric.

15.1.3 Expansion Rails and Assemblies

Evaluate the expansion joints movements of the bridge. Expansion rails are required for concrete parapet installations at expansion joints where the total movement exceeds 1-inch. If the total movement at an individual expansion joint is 6-inches or less, the bridge fence will span the joint without using an expansion assembly. If the total movement at an individual expansion joint exceeds 6-inches, an Expansion Assembly must be installed at that location. Provide locations for expansion joints requiring expansion rails or expansion assemblies in the superstructure layout sheets. See Design Standards Index Nos. 810 through 812, Bridge Fencing for details.

15.2 Traffic Railing / Sound Barriers

15.2.1 General

For Bridge Decks up to a maximum thickness of 9-inches, the two Bars 5S1 (See Design Standard 5210) placed in the Bridge Deck may substitute for the longitudinal deck steel located within the limits of Bars 5V, provided that the total area of longitudinal deck steel beneath the barrier, as required by calculation, is not reduced. Show these bars on the Superstructure Sheets with the deck steel.

15.2.2 Form Liners

- A. Form liners providing a textured finish are permitted on the outside face of Traffic Railing /Sound Barrier with the following provisions:
 - 1.) The maximum amplitude of the form liner on the lower 32-inches section shall be limited to 1-inch depth
 - 2.) Any form liner used above 32-inches, must provide a thickened concrete section to maintain 2-inch cover.
 - 3.) Provide full details of this thickened section and the form liner in the plans.
- B. Form liners on the inside face of Traffic Railing /Sound Barrier are not recommended.

15.2.3 End Treatment Options

- A. Use one of the following options:
 - 1.) When the Sound Barrier terminates on the bridge, the End Taper shall be located at an open joint. When the Sound Barrier terminates on the Approach Slab, the End Taper shall terminate at Begin or End Approach Slab in the Design Standard Index No. 5210.

- 2.) Apply 8'-0" Traffic Railing / Sound Barrier End Taper (see Index No. 5210) adjacent to 12-inch Traffic Railing / Sound Barrier End Taper. Attach guardrail as shown on Index No. 5210. Use trench footing for 14'-0" Traffic Railing/Sound Barrier (see Index No. 5215) as the foundation for the 8'-0" Traffic Railing/Sound Barrier End Taper.
 - 3.) Apply 8'-0" Traffic Railing/Sound Barrier End Taper (see Index No. 5210) adjacent to full height 14'-0" Traffic Railing/Sound Barrier. Attach guardrail as shown on Index No. 5210. Use trench footing for 14'-0" Traffic Railing/Sound Barrier (see Index No. 5215) as the foundation for the 8'-0" Traffic Railing/Sound Barrier End Taper.
 - 4.) Taper 14'-0" Traffic Railing/Sound Barrier back until it is outside the clear zone. Taper rate varies based on both design speed and highway application (i.e., Interstate, urban or rural installations). See Design Standards and Plans Preparation Manual for applicable taper rates. 14'-0" Traffic Railing/Sound Barrier may be full height or tapered.
 - 5.) Apply a wide crash cushion at the end of the 14'-0" Traffic Railing/Sound Barrier. 14'-0" Traffic Railing/Sound Barrier may be full height or tapered. Ensure the traffic face of the crash cushion is offset at least 24-inches from vertical face of Sound Barrier. See Design Standards for crash cushion options.
- B. Show details of selected End Treatment in the Plan Sheets.

15.3 Precast Sound Barriers and Perimeter Walls **(07/08)**

15.3.1 General

- A. The precast Sound Barriers **Design Standards** Index Nos. 5200 through 5206 depict 5 pile/post connection options, based on either 10'-0", or 20'-0" post spacing and are applicable for sites with soil SPT N values between 10 and 40.
- B. The precast Perimeter Wall **Design Standards** Index No. 5250 depicts 3 pile/post connection options and 2 post/spread footing connection options, based on either 10'-0", or 20'-0" post spacing and are applicable for sites with soil SPT N values between 10 and 40.
- B. Specify **aesthetic requirements** on the **Data Tables** and flush panels (Index No. 5203) or recessed panels (Index No. 5204), as required for Sound Barriers. Perimeter Walls only utilize recessed panels.
- C. For Sound Barriers allow all pile/post connection options shown in, Index No. 5205, except for Option D (Sheet No. 5 of 7), which may be excluded when project aesthetics requirements dictate. For Perimeter Walls allow all pile/post and post/spread footing connection options unless underground/overhead utilities conflict with installation of the auger cast pile foundation options.
- D. **Data Table** cells are available on the **Structures Sitemenu** for the summary of project aesthetic requirements, wall quantities, limits of anti-graffiti coating, and applicable proprietary panel/system options.

15.3.2 Soil Conditions

- A. For project sites where soil N values are less than 10, specific designs are required.
- B. If muck/organic soils are encountered, removal or soil improvement methods may be necessary. The limits of muck/organic soils should be shown in the plans with specified removal/improvement methods and method of payment.
- C. For project sites where rock/very strong soils are encountered at shallow depths (N values greater than 40), specific designs are **permitted**.

15.3.3 Soil Survey

- A. Maximum preferred boring spacing is 200 ft. and minimum boring depth is the lesser of 2.0 times the design wall height for that location or 30'-0".
- B. Consider soil borings as structural borings that include SPT performed at a maximum of 36-inch intervals along the depth of the borings.

15.3.4 Utilities

- A. Consider spread footings at locations where auger cast piles are not practical due to overhead/underground utilities.
- B. Provide project specific foundation designs as necessary.

15.3.5 Wall Layout

During design, field stake wall alignment at 20'-0" spacing to locate potential conflicts.

15.3.6 Drainage Holes

- A. Locate wall drain holes based on site requirements.
- B. Show drain holes locations and types in the Wall Control Drawings.

15.3.7 Fire Access Holes

Locate fire access holes at hydrants and at other locations based on project requirements.

15.3.8 Anti-Graffiti Coating

- A. Contact the FDOT Project Manager to determine where anti-graffiti coating is required.
- B. For wall areas not receiving anti-graffiti coating specify a Class 5 Applied Finish applied in accordance with Specification Section 400. Specify Class 5 Finish color to match the anti-graffiti coating system unless otherwise directed by FDOT.
- C. Tabulate limits of the anti-graffiti coating in the Wall Control Drawings.
- D. Specify sacrificial or non-sacrificial coating systems as directed by FDOT District Maintenance. (See Pay Items)

15.3.9 Wall Textures

- A. For recessed panels, textures may be specified for either the back or front face of wall. For flush panels, specify textures for the front face only. Specify a broom finish for the back face.
- B. All textures shown on Index No. 5201, except Type "H", may be used for either the back face or front face of the wall. Type "H" Texture is limited to front face only.
- C. Textures on the front face are formed while textures on the back face **may be** rolled, pressed **or formed (vertical cast panels only)**; therefore random pattern types are more suitable on the back face.

15.3.10 Graphics

- A. When formed wall graphics are required, show the locations in the Wall Control Drawings.
- B. See the **Structures Sitemenu** for graphics options.
- C. Create other graphics as project requirements dictate. General considerations in creating graphics are as follows:
 - 1.) Detail wall graphics in the plans.
 - 2.) Keep wall graphics simple.
 - 3.) Wall graphics should be as large as possible (approximately 7 ft. in height).
 - 4.) Consider input from local communities when determining graphics.

15.3.11 Vehicle Impact Loads

- A. The wall systems shown on Index **No. 5200 and 5250 have** been designed for wind loads only, with no provisions for vehicle impact loads. See Plans Preparation Manual - Volume I (current version).
- B. Locate walls outside clear recovery zone or set back 5'-0" from front face of crash-tested barrier.
- C. Guardrails and delineators may be required at the back-face of walls along local streets.

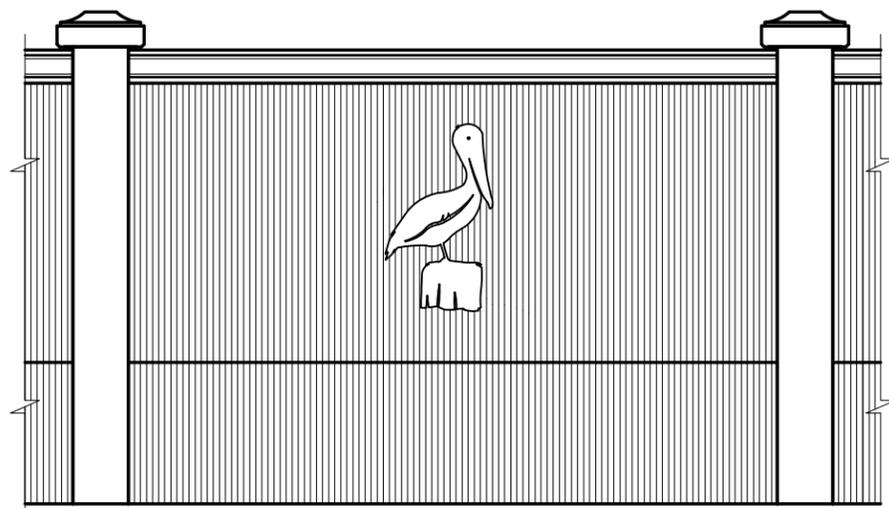
15.3.12 Proprietary Options

- A. Any of the approved proprietary **Perimeter Wall or Sound Barrier** panels or proprietary systems (panels and foundations) listed on the Qualified Products List may be allowed as alternates to the Precast Standards, provided the proprietary panel/system option meets the project's aesthetic requirements as shown in the Wall Control Drawings.
- B. List all applicable proprietary panel/systems in the Wall Control Drawings based on project requirements.

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Estimates Bulletin 08-07
Implementation of Perimeter Walls Design Standards.
Page 4.

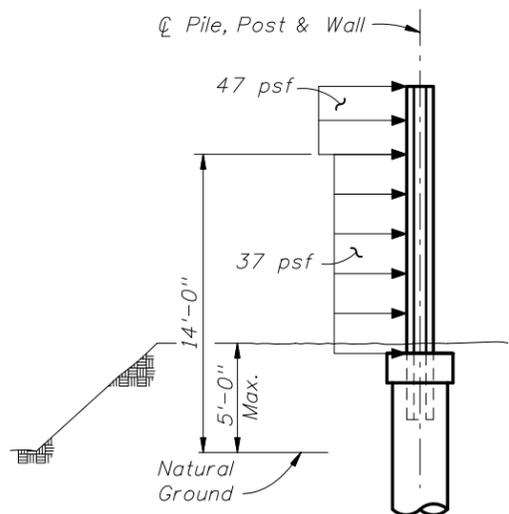
Attachment B

Structures Manual – Volume 3 Instruction for Design Standards Index No. 5250



PRECAST CONCRETE PERIMETER WALLS

NOTE: The Pelican graphic indicated above is for demonstration purposes only. The actual graphics shall be detailed in the Plans and shown on the Wall Control Drawings.



Assumed Wind Load Pressures

DESIGN INFORMATION

Design Criteria: The auger cast pile foundations herein have been designed in accordance with the current AASHTO Guide Specification for Structural Design of Sound Barriers. The design of the panels, posts and piles assumes the following wind pressures:

Posts, Panels, & Piles: 37 psf - Height Up to 14 ft.
47 psf - Height Over 14 ft. to 29 ft.

These Standards allow for the wall to be constructed on berm or fill section up to 5'-0" high. See sketch. For projects where walls are constructed on fill sections in excess of 5'-0", project specific designs are required.

In addition to meeting strength requirements, the auger cast pile lengths have been sized to limit top of wall deflections to Wall Height/50, or 5 inches whichever is smaller. Also the head of pile deflection (at ground level) has been limited to 1 inch.

Index No. 5250 (Precast Perimeter Walls) depicts 4 Post/Foundation Options, based on either 10'-0", or 20'-0" post spacing and are applicable for sites with soil SPT N values between 10 and 40. Include in the plans the completed Perimeter Wall Data Tables contained in the companion CADD cell to Index No. 5250 on the FDOT Structures Sitemenu.

Qualified Products List: Manufacturers seeking approval of proprietary perimeter wall panels, posts and foundations or systems for inclusion on the Qualified Products List as pre-approved suppliers must submit a QPL Product Evaluation Application along with design documentation, vendor drawings and other information as required in the QPL Acceptance Criteria showing the proprietary product is designed to meet all specified requirements. Project specific Shop Drawings are required for perimeter wall projects in accordance with Specification Section 534.

Proprietary Options: Any of the approved proprietary perimeter wall panels, posts and foundations, or proprietary systems (panels and foundations) listed on the Qualified Products List may be allowed as alternates to the Precast Standard, provided the proprietary panel/system option meets the project's aesthetic requirements as depicted on the "PROJECT AESTHETIC REQUIREMENTS" data table in the contract plans. The Designer should list all applicable proprietary panel/post & foundations/systems in Notes 1 and 2 in the companion CADD cell to Index No. 5250 based on project requirements. Refer to the following internet address for the Qualified Product List:

www.dot.state.fl.us/specificationoffice/qplindex.htm

For project sites where soil N values are less than 10, specific designs are required. If muck/organic soils are encountered, removal or soil improvement methods may be necessary. The limits of muck/organic soils should be shown in the plans with specified removal/improvement methods and method of payment.

For project sites where rock/very strong soils are encountered at shallow depths (N values greater than 40), spread footings or specific designs are required.



Design Instructions & Information For FDOT Design Standards

PRECAST PERIMETER WALL INSTRUCTIONS

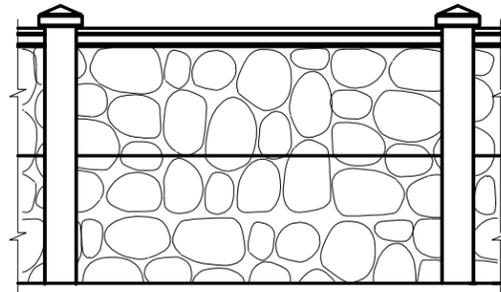
Last Revision
07/01/08

Sheet No.
1 of 2

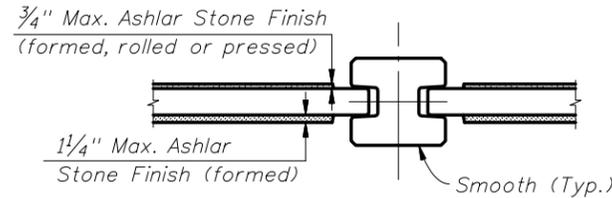
Index No.(s)
5250

PROJECT EXAMPLE

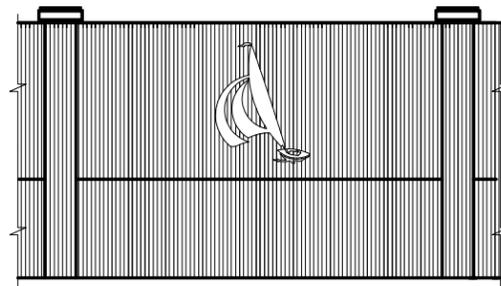
WALL NO.1:



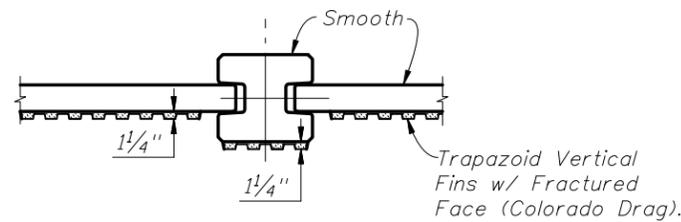
The texture of the front face of the panels to be Ashlar Stone (formed). The texture of the back face of the panel shall also be Ashlar Stone (formed, rolled or pressed). The post face is to be Smooth. The wall will not have any graphics. The post cap and panel cap shall be Type "C". The color of the wall panels to be Sandalwood Brown. The color of the post, post cap, and panel cap is to be Leather Brown.



WALL NO.2:



The texture of the front faces of the panel and post are to have Trapezoid Vertical Fins with Fractured Face (Colorado Drag). The wall has graphics. The color of the wall panels to be Sea Blue. The color of the post and post cap is to be Sand. The post cap shall be Type "A". There is no texture on the back face of the wall, and there are no panel caps.



INSTRUCTIONAL NOTES

Soil Survey: Maximum preferred boring spacing is 200 ft. and minimum boring depth is 2.0 times the intended wall height for that location or 30'-0" whichever is less. Soil borings shall be considered as structural borings which include SPT performed at a maximum of 3 ft. intervals along the depth of the borings.

Utilities: In some instances, auger cast piles may not be practical due to overhead/underground utilities. At these locations, Post/Foundation Option D (Spread Footing) should be considered. If a custom foundation is necessary, the Designer should provide project specific foundation designs as required.

Wall Layout: Wall alignment should be field staked at 20'-0" spacing during the design process in order to locate potential conflicts.

Drainage Holes: The Designer is responsible for locating wall drain holes based on site requirements. Drain holes should be clearly shown in the Control Drawings (including Type). See Index No. 5250 (Sheet 4) for details.

Fire Access Holes: The Designer is responsible for locating fire access holes based on project requirements. At a minimum, Fire Access Holes should be located at all existing hydrant locations. See Index No. 5250 (Sheet 4) for details.

Anti-Graffiti Coating: Consideration should be given to coat all portions of the wall accessible to the public with anti-graffiti coating. Wall areas not receiving anti-graffiti coating, shall be coated with a Class 5 Applied Finish in accordance with Section 400. Color of Class 5 Finish should match the anti-graffiti coating system unless specified otherwise in the plans. Tabulate limits of anti-graffiti shown on the "LIMITS OF ANTI-GRAFFITI COATING" Data Table. Either sacrificial or non-sacrificial coating systems may be specified based on District Maintenance recommendations (See Pay Items).

Wall Textures: Textures may be specified for either the back or front face of wall.

All textures depicted in Index No. 5201 except Type "H" may be used for either the back face or front face of the wall. The Type "H" Texture is limited to front face only.

Textures on the front face shall be formed. Textures on the back face may be formed, rolled or pressed, therefore the random pattern types may be more suitable on the back face.

Graphics: Wall graphics may be formed into the wall panels. When required, graphic locations shall be shown in the Control Drawings. Possible graphic options are depicted in the FDOT Structures Sitemenu as Sound Barrier Graphics CADD cells. The Designer may create other graphics as project requirements dictate. General considerations in creating graphics are as follows:

Wall graphics should be fully detailed in the plans and shall be simple. Wall graphics should be as large as possible (approximately 7 ft. in height). Input from local communities should be considered when determining graphic types.

Vehicle Impact Loads: The wall system has been designed for wind loads only, with no provisions for vehicle impact loads. See Plans Preparation Manual - Volume I, Section 32.6 (current version). Walls should be placed outside clear recovery zone or set back 5'-0" from front face of crash-tested barrier.

Guardrails and delineators may be required at the back face of wall along local streets.

PROJECT AESTHETIC REQUIREMENTS

Table Date 7-01-08

WALL NOS:	REQUIRED: (YES/NO)		REQUIRED TYPE:		REQUIRED TEXTURES (3):			
	GRAPHICS (1)	COLORED COATINGS (2)	PRECAST POST CAP (4)	PRECAST PANEL CAP (5)	PANELS:		POSTS:	
					FRONT FACE	BACK FACE	FRONT FACE	BACK FACE
1	NO	YES	Type "C"	Type "C"	Type "B"	Type "B"	Type "A"	Type "A"
2	YES	YES	Type "A"	NO	Type "H"	Type "A"	Type "H"	Type "A"

- (1) See Control Drawings.
- (2) Coat all exposed faces of wall panels with (sacrificial/non-sacrificial) anti-graffiti coating or Class 5 Applied Finish Coating.
 - For Wall No. 1, The color of wall panels shall be per Federal Color Chart, Federal Standard No. 595B, Table IV, Color 33446. The color of posts, post caps, and panel caps shall be per Federal Color Chart, Federal Standard No. 595B, Table I, Color 30051.
 - For Wall No. 2, The color of wall panels shall be per Federal Color Chart, Federal Standard No. 595B, Table V, Color 34058. The color of posts and post caps shall be per Federal Color Chart, Federal Standard No. 595B, Table IV, Color 33717.
- (3) See Index 5201 (Precast Sound Barriers - Texture Options).
- (4) See Index 5250, (Sheet 5) Coat Post Caps with the same color as post, with a Class 5 Applied Finish Coating.
- (5) See Index 5250, (Sheet 6) Coat Panel Caps with the same color as panels, with a Class 5 Applied Finish Coating.



Design Instructions & Information For FDOT Design Standards

PRECAST PERIMETER WALL INSTRUCTIONS

Last Revision: 07/01/08
 Sheet No.: 2 of 2
 Index No.(s): 5250

Attachment C

Structures Manual – Volume 6 QPL Acceptance Criteria – Chapter 2

Chapter 2 Sound Barriers and Perimeter Walls (07/08)

2.1 General (01/05)

These acceptance criteria cover four different types of QPL approvals:

- A. Sound Barrier or Perimeter Wall panels (see definitions) used with FDOT Standard Post and Foundations.
- B. Sound Barrier or Perimeter Wall posts and foundations used with FDOT Standard Precast Concrete Sound Panels or their approved alternates.
- C. Complete Sound Barrier systems (see definitions), including foundations.
- D. Crash Tested Sound Barrier Systems (see definitions).

Commentary:

The purpose of these acceptance criteria is to allow vendors to substitute their products either in part or entirely for FDOT's Standard Precast Sound Barrier System. Alternate products must utilize the same design criteria and assumptions, which are outlined in these criteria, as FDOT's Standard Precast Sound Barrier System.

2.2 Definitions

The following definitions are provided for commonly used terms in these criteria (for additional definitions, see ASTM C 634 and Section 1 of the FDOT Standard Specifications for Road and Bridge Construction):

Crash Tested Perimeter Wall Systems - Walls within the clear zone that meet NCHRP 350 Test Level 4 (TL-4) crash level criteria.

Crash Tested Sound Barrier Systems - Barriers within the clear zone that meet NCHRP 350 Test Level 4 (TL-4) crash level criteria.

Design Life – The period of time with no discernable change in the barrier insertion loss or appearance.
Maintenance Free Life – A period during which maintenance activities will not be required.

NCHRP - National Cooperative Highway Research Program

Noise Reduction Coefficient (NRC) - The Noise Reduction Coefficient is the arithmetic average (to the nearest 0.01) of the Sound Absorption Coefficients of a material in the one-third octave bands centered at 250 Hz, 500 Hz, 1000 Hz, and 2000 Hz.

Perimeter Wall – A continuous ground mounted wall structure, generally not greater than 12 feet high, with the primary function of visually screening the roadway from the adjacent properties.

Perimeter Wall Panel – The component of a perimeter wall that spans between posts. Depending on the material and the design, numerous panels may be required to fill the space between posts.

Perimeter Wall System - All of the components of a perimeter wall, including the foundation.

Post - Posts are generally considered to be the vertical supports for the panels and shall be able to provide structural support of the sound barrier system under various loads.

Sound Absorption Coefficient (SAC) - The sound-absorbing ability of the barrier surface is given in terms of an absorption coefficient. The coefficient is defined as the ratio of the energy absorbed by the surface to the energy incident upon the surface. The Sound Absorption Coefficients shall be normalized so the highest value is no greater than 1.

Sound Barrier – A continuous structure, generally not greater than 22 feet high, with the primary function of traffic noise abatement to adjacent properties. Described as a Noise Barrier in the [Project Development and Environmental Manual](#).

Sound Barrier Panel – The component of a sound barrier that spans between posts. Depending on the material and the design, numerous panels may be required to fill the space between posts.

Sound Barrier System - All of the components of a sound barrier, including the foundation.

Sound Transmission Class (STC) - Sound Transmission Class is a single number rating of the transmission loss properties of a barrier panel. Measured transmission loss data is plotted versus frequency and compared with standard contours according to rules outlined in ASTM E 90 and ASTM E 413.

2.3 Referenced Standards

2.3.1 ASTM Standards

- A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
- B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus
- C 90 - Standard Specification for Load-Bearing Concrete Masonry Units
- C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
- C 634 - Standard Terminology Relating to Environmental Acoustics
- C 652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
- C 1329 - Standard Specification for Mortar Cement
- D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- D 660 - Standard Test Method for Evaluating Degree of Checking of Exterior Paints
- D 661 - Standard Test Method for Evaluating Degree of Cracking of Exterior Paints
- D 714 - Standard Test Method for Evaluating Degree of Blistering of Paints
- D 968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
- D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
- D 1141 - Standard Test Method for the Preparation of Substitute Ocean Water
- D 1242 - Standard Test Method for Resistance of Plastic Materials to Abrasion
- D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics
- D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
- D 2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- D 2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
- D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D 3359 - Standard Test Methods for Measuring Adhesion by Tape Test
- D 3719 - Standard Test Method for Quantifying Dirt Collection on Coated Exterior Panels

- D 3801 - Standard Test Method for Measuring the Comparative Burning Characteristics of Solid Plastics in a Vertical Position
- D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
- D 4812 - Standard Test Method for Unnotched Cantilever Beam Impact Resistance of Plastics
- E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
- E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials
- E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
- E 313 - Standard Test Method for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates
- E 413 - Standard Classification for Rating Sound Insulation
- E 695 - Standard Method of Measuring Relative Resistance of Wall, Floor and Roof Construction to Impact Loading
- G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- G 155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials

2.3.2 Other Standards

- AASHTO Guide Specifications for Structural Design of Sound Barriers
- AASHTO Standard Specifications for Highway Bridges
- American National Standards Institute (ANSI) Standard Z97.1 – Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test
- American Welding Society Code D 1.1
- Federal Standard 595B Color Code
- Florida Building Code
- Florida Department of Transportation (FDOT) Plans Preparation Manual
- Florida Department of Transportation Standard Specifications for Road and Bridge Construction (FDOT Standard Specifications)
- Highway Innovative Technology Evaluation Center (HITEC) Guidelines for Evaluating the Performance of Highway Sound Barriers, October 1996
- National Cooperative Highway Research Program (NCHRP) Report 350 - Recommended Procedures for the Safety Performance Evaluation of Highway Features
- Specifications for Aluminum Structures

2.4 Sound Barrier and Perimeter Wall Requirements

2.4.1 General

2.4.1.1 Design

The structural components of the sound barriers and perimeter walls shall be designed in accordance with the latest edition of the AASHTO Guide Specifications for Structural Design of Sound Barriers (load factor design), FDOT Plans Preparation Manual, FDOT Structures Design Guidelines and these criteria. Sound barrier and perimeter wall components shall be analyzed and designed using established engineering principles.

2.4.1.2 Sound Barrier and Perimeter Wall Panels used with FDOT Standard Posts and Foundation

Submit a detailed package for the sound barrier or perimeter wall panels. For this approval, panel design calculations are required (see Section 2.15D for details). In addition to the requirements in this section, panels shall meet all requirements set forth in these criteria as applicable.

Assumed wind load pressure for panel design is 47 psf. The maximum deflection of panels due to wind load shall not exceed the lesser of 1/180 of the post spacing or 1½ inch (deflection measured relative to posts).

Panels constructed of materials other than concrete or steel shall be tested to their design strength in accordance with ASTM E 72.

Submissions for panels must be compatible with FDOT's standard posts and foundation. FDOT standard posts are either reinforced concrete or steel H post and standard foundations are auger cast piles. Sound barrier panels shall demonstrate that they can be securely connected to the standard post. The Vendor shall provide details showing how movement between the panel and post will be limited.

All panels, except those made entirely of concrete or steel materials, shall be integrated into a sound barrier **or perimeter wall** system where the bottom panel is a concrete panel. The bottom concrete panel shall be a minimum of 6 feet high for non-crash tested sound barrier **or perimeter wall** systems, unless emergency access is required as specified in Section 2.11. For systems requiring emergency access, the height of the bottom concrete panel is required to be a minimum of 8 feet high. These bottom panel height requirements do not apply to crash tested sound barrier **or perimeter wall** systems. Acoustically seal sound panel joint between the bottom concrete panel and adjacent sound panel so that the acoustical efficiency of the sound barrier is not degraded. It is not necessary to submit details for the bottom concrete panel if FDOT's standard precast concrete sound barrier **or perimeter wall** panel will be used. Submit details of the bottom concrete panel if an alternate to FDOT's standard precast concrete panels will be used. Details for an acoustic sound barrier seal between panels shall be required in all cases **for Sound Barrier Panels**.

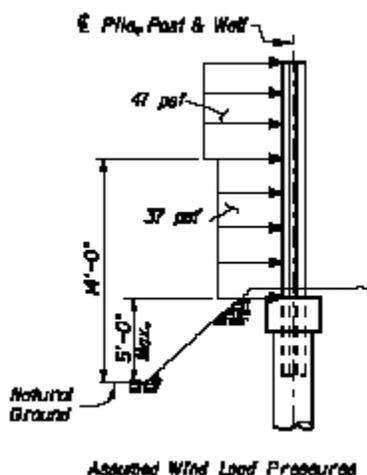
Commentary:

Due to safety concerns about horizontal flame spread along highway sound barriers/perimeter walls and maintenance issues (i.e., roadside debris, mowers scraping panels), the decision was made to limit the bottom panel in all systems to concrete or steel. Both materials resist flame spread in all directions and have a proven history of providing the required 50 year design life for sound barriers. The minimum bottom panel height of 6'-0" was chosen to clear required fire hose access holes. The minimum bottom panel height of 8'-0" for sound barriers requiring emergency access was chosen to allow forming and installation of 6'-0" high doors. Flame spread and design life requirements are discussed in further detail later in these criteria.

2.4.1.3 Sound Barrier and Perimeter Wall Posts and Foundations used with FDOT Standard Concrete Panels or Their Approved Alternates (07/06)

Submit a detailed package for the posts and foundations, including a step by step field construction manual, as appropriate (i.e., installation method) is not covered by FDOT Standard Specifications). For this approval, post and foundation design calculations are required (see Section 2.15D for details). In addition to the requirements in this section, posts and foundations shall meet all requirements set forth in these criteria as applicable.

Sound **Barrier and Perimeter Wall** posts and foundations shall be designed assuming that the wall is placed 5 feet above the surrounding ground. Assumed wind load pressures are defined below:



Wind Loads for Posts and Piles (if present):
37 psf - Height Up to 14 ft.
47 psf - Height Over 14 ft. to 29 ft.

For posts or top of barrier, the maximum deflection due to service wind load shall not exceed the lesser of 1/50 of the wall height or 5 inches (deflection measured relative to the point of fixity in the soil). Also, the lateral displacement of the pile at the base of the wall shall not exceed 1 inch.

Foundations shall be designed assuming the following soil conditions:

1. Standard Penetration Test (SPT) N Values ranging between 10 and 40.
2. Soil Unit Weight = 40 pcf (saturated).
3. Internal Friction Angle = 30
4. Soil Subgrade Modulus = 25 pci.

Foundation materials subject to corrosion shall utilize a corrosion protection system. Proposed corrosion protection systems shall be included in the submittal and approved by FDOT's State Materials Office for use.

Steel foundations may utilize a sacrificial thickness as the corrosion protection system. Use the following corrosion rates to determine required sacrificial thickness vs. environmental classification:

Environmental Classification	Corrosion Rate
Slightly Aggressive	0.001 inches per year
Moderately Aggressive	0.002 inches per year
Extremely Aggressive	0.003 inches per year

Commentary:

Design wind pressure and soil conditions assume *the most likely* scenario of a hurricane event (110 mph wind velocity in ~~per~~-saturated soil). Steel corrosion rates were provided by FDOT's State Materials Office. For environmental classification definitions, see SDG Section 1.3.

Additionally, posts shall be completely compatible with FDOT's precast concrete panels to allow easy substitution of alternate QPL approved **Sound Barrier or Perimeter Wall** panels. Posts and foundations shall demonstrate how they can meet placement tolerances outlined in FDOT Specifications Section 534.

Spread Footing Foundations: In addition to meeting bearing, overturning, and sliding requirements per **AASHTO Guide Specifications for Structural Design of Sound Barriers**, all **Sound Barrier and Perimeter Wall** spread footing designs shall meet the following:

The resultant of the ground pressure distribution shall fall within the middle-half of the footing.

Commentary: The middle-half rule addresses concerns associated with cyclic wind loads, effects of soil softening (saturated) under edges of rigid footing, potential pumping, etc.

2.4.1.4 Complete Sound Barrier and Perimeter Wall Systems

Submit a detailed package for the entire sound barrier system, including the foundation, posts and panels. For this approval, sound barrier panel, post and foundation design calculations are required (see Section 2.15D for details). Design wind load pressures, assumed soil conditions and deflection criteria for the system are the same as outlined in Section 2.4.1.2 for panels and 2.4.1.3 for posts and foundations.

In addition to the requirements in this section, Sound Barrier and Perimeter Wall systems shall meet all requirements set forth in these criteria as applicable.

2.4.1.5 Crash Tested Sound Barrier and Perimeter Wall Systems (Within Clear Zone Only)

Submit a detailed package for the entire Sound Barrier or Perimeter Wall system, including the foundation, posts, panels and crash test information. For this approval, panel, post and foundation design calculations are required (see Section 2.15D for details). Design wind load pressures, assumed soil conditions and deflection criteria for the system are the same as outlined in Section 2.4.1.2 for panels and 2.4.1.3 for posts and foundations. In addition to the requirements in this section, crash tested sound barrier systems shall meet all requirements set forth in these criteria as applicable.

Crash tested Sound Barrier and Perimeter Wall systems shall be tested in accordance with (NCHRP) Report 350 to TL-4 crash criteria at a minimum. Panels shall not dislodge from posts during crash testing or employ a mechanism to prevent panels from falling in the event that they do dislodge. Present testing and/or other supporting documentation for any such mechanism utilized in a crash tested system.

Additionally, Sound Barrier and Perimeter Wall systems shall not compromise the protection of persons and properties on roadways and other areas underneath a structure.

2.4.1.6 Panel to Post Connections

All connectors shall be fabricated of nonferrous materials, stainless steel, or be hot dip galvanized after fabrication according to the requirement of ASTM A 123 or A 153. All exposed steel shall be primed and painted with an approved 3 coat inorganic zinc painting system in accordance with FDOT Specification Section 560.

Field welds (where allowed) shall conform to the American Welding Society Code D 1.1.

2.4.2 Materials

2.4.2.1 General

The use of wood for the construction of panels and/or systems is not permitted.

All materials used in the Sound Barrier and Perimeter Wall systems shall have a minimum design life of 50 years for the site environmental conditions, except sound absorptive panels shall have a minimum design life of 25 years for the site environmental conditions. All sound barriers components shall have a maintenance free life of 25 years. All sound barrier and perimeter wall materials shall be tested by an independent laboratory qualified to perform the relevant standardized tests (as listed in Section 2.3). If performed in-house, testing shall be witnessed and certified by a qualified, independent observer trained to perform the relevant standardized tests.

All components shall be consistent in appearance, dimensions, and quality.

All components shall be resistant to corrosion. All materials subject to corrosion shall receive a protective coating or coating system meeting the requirements of Section 2.13 of these criteria or approved by the FDOT State Materials Office.

Commentary:

Due to the wide variety of coatings and coating systems commercially available, additional information for some coatings and coating systems not specifically outlined in these criteria will likely be required.

Section 2.13 of these criteria primarily covers requirements for a paint coating. The majority of coating systems will require the approval of the FDOT State Materials Office.

All materials shall have low flame spread and smoke development classifications in accordance with ASTM E 84. The maximum acceptable flame spread index and smoke developed index are 50 and 180, respectively for panels. The maximum acceptable flame spread index and smoke developed index are 25 and 180, respectively for sound barrier posts. Concrete components are exempt from this test. For composite panels, the flame spread index shall be for the panel as a whole, rather than the individual materials that make up the panel. Materials with standard weathering coatings other than paint shall be tested with coated specimens. Sound **Barrier and Perimeter Walls** components composed of materials with a flame spread index greater than 25 and/or that burn to consumption shall not be used within 100 feet of buildings (i.e., residential dwellings, schools, hospitals, motels, etc.) with an occupancy or use classification other than low hazard storage, except animal shelters which are also classified as low hazard storage.

Commentary:

*Smoke development index of 180 is based on HITEC's recommendation. Flame spread index (FSI) of 50 is based on flame spread classifications from the Florida Building Code. In the Florida Building Code, materials are classified for flame spread as either Class A (FSI = 0-25), Class B (FSI = 26-75) or Class C (FSI = 76-200). Class C materials are considered highly volatile and Class B materials will catch fire easily and help to spread a fire. Panel materials classified as Class C or in the upper half of Class B are not allowed due to the close proximity of sound barriers **and perimeter walls** to occupied buildings. Post materials must be Class A so as not to propagate flame spread horizontally. The requirement to be at least 100 ft. from occupied buildings was made to keep heat generated from burning panels from damaging surrounding buildings. Definitions of occupancy classifications can be found in the Florida Building Code.*

All materials shall be non-toxic to the environment and pose no known health hazards. Submit a Material Safety Data Sheet as required under the Occupational Safety and Health Act Enforcement (OSHA) Communication Standard to identify hazardous chemicals, health and physical hazards, exposure limits and precautions as appropriate. National Fire Protection Association (NFPA) Hazard Rating for Health category shall be 0 (zero).

All materials shall withstand prolonged periods of exposure to moisture. Where absorptive materials are used in a sound barrier panel, all edges shall be sealed to preclude moisture from entering the interior. Absorptive materials in panels shall require submission of water absorption testing. Water absorption percentage shall not exceed 2% by volume when tested in accordance with the appropriate ASTM Standard or an alternate standardized testing procedure.

Support components of absorptive sound barriers shall not degrade potential sound attenuation.

Sound **Barrier and Perimeter Wall** systems or panels using polymeric materials shall be resistant to fungus in accordance with ASTM G 21.

2.4.2.2 Concrete

All concrete **Sound Barrier and Perimeter Wall** components shall be Class IV as defined in FDOT Standard Specifications Section 346. The concrete cover on all reinforced and prestressed concrete designs shall be a minimum of 2 inches **for Sound Barriers and 1.5 inches for Perimeter Walls**. All exposed concrete surfaces shall receive a Class 5 Applied Finish Coating in accordance with FDOT Specifications Section 400 at a minimum.

2.4.2.3 Steel

All steel **Sound Barrier and Perimeter Wall** components, except bolts, shall be fabricated from stainless steel or be hot-dip galvanized after fabrication in accordance with ASTM A 123. Bolts shall be galvanized in accordance with ASTM A 153.

Steel panels shall be a minimum of 20 gauge (0.0359 inch) thickness. All steel sheeting, except stainless steel shall receive a protective coating meeting the requirements of Section 2.13 of these criteria or as approved by the FDOT State Materials Office. All pop rivets shall be either aluminum with an aluminum mandrel or stainless steel with a stainless steel mandrel.

Bolts shall meet the requirements of ASTM A 325 or A 307.

2.4.2.4 Masonry

Masonry **Sound Barrier and Perimeter Wall** panels shall be made of concrete or clay.

Concrete masonry panel units shall be hollow and load bearing, and conform to ASTM C 90. Burned clay panel units shall be hollow and load bearing, and conform to ASTM C 652. The mortar used shall conform to ASTM C 1329. A panel cap or flashing shall be used to protect the top row and posts of masonry barriers. Masonry panel units shall be placed on a concrete spread footing or leveling pad.

2.4.2.5 Aluminum

Aluminum **Sound Barrier and Perimeter Wall** components shall conform to the thickness tolerances of the Aluminum Association, Inc., as found in the latest edition of Aluminum Standards and Data.

All aluminum panels shall have a minimum nominal thickness of 0.063 inch. Any shearing, cutting, or punching of the panels shall be done prior to the application of any coatings.

2.4.2.6 Plastics

2.4.2.6.1 General

Sound Barrier and Perimeter Wall components made of plastic or fiberglass are to be tested for resistance to ultraviolet-light exposure in accordance with ASTM G 155. Subject the specimen(s) to 8000 hours minimum of exposure at a temperature of 145 F (63 C). Perform the test at 20 minute cycles, consisting of 17 minutes of light and three minutes of water spray plus light. The lamp filter shall be Daylight. The lamp's irradiance level shall be 0.35 W/m²/nm and the wavelength shall be 340 nm. Plastic or fiberglass component shall also be tested for resistance to salt spray (fog) exposure in accordance with ASTM B 117. Use salt spray in accordance with ASTM D 1141. Adjust the pH of solution to 4.7 with dilute H₂SO₄. There shall be no delamination, fading, discoloration, or embrittlement after exposure. All glazing material shall comply with the requirements of ANSI standard Z97.1.

2.4.2.6.2 Material Testing

Plastic and fiberglass components shall meet material requirements outlined in the following table:

Property	ASTM	Weathering/Exposure	Requirement
Salt Spray (Fog) Resistance	B 117	* Before and After 8000 hours	No signs of deterioration
Burn Rate and Extent of Burning	D 635	None Required	Burn Rate < 2.5 inches/min.
Resistance to Abrasion	D 1242 Method A	None Required	No signs of deterioration
Ignition Temperature	D 1929	None Required	≥ 650° F (343° C)
Color Change***	D 2244	** Before and After 8000 hours	Color change shall not exceed 3 National Bureau of Standards Units
Smoke Density	D 2843	None Required	Smoke Density Rating < 50%
Burn Characteristics in a Vertical Position	D 3801	None Required	Afterflame plus Afterglow time of ≤ 3 sec. and dripped material does not ignite cotton

Brittleness	D 4812	** Before and After 8000 hours	Panel retains 75% of its' impact resistance after accelerated weathering when tested at 74° F (23° C) and 0° F (-18° C)
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* Weathering shall be in accordance with ASTM B 117 as outlined in Section 2.4.2.6.1.

** Weathering shall be in accordance with ASTM G 155 as outlined in Section 2.4.2.6.1.

*** This test is not required for transparent plastic panels.

2.4.2.7 Other Materials

All other materials shall be resistant to ultraviolet rays for the expected service life of the components without loss of structural capability delamination, fading, or embrittlement. Perform testing for resistance to weathering and sunlight in accordance with ASTM G 155 as outlined in Section 2.4.2.6.1, as applicable. Perform testing for resistance to salt spray (fog) in accordance with ASTM B 117 as outlined in Section 2.4.2.6.1, as applicable. Material samples may be required for evaluation and approval by FDOT's State Materials Office.

2.4.2.8 Transparent Panel Materials

Transparent panel materials must meet the following additional requirements for optical properties:

Property	ASTM	Weathering*	Requirement
Luminous Transmittance	D 1003	After 8000 hours	≥ 90%
Percent Haze	D 1003	After 8000 hours	≤ 10%
Yellowness Index	E 313	After 8000 hours	≤ 5

* Weathering shall be in accordance with ASTM G 155 as outlined in Section 2.4.2.6.1.

2.5. Impact

It shall be demonstrated that **Sound Barrier and Perimeter Walls** can withstand the impact of windborne debris during hurricane events. All panels shall be shatterproof. Impact testing shall be performed in accordance with Florida Building Code Testing Application Standard (TAS) 201-94. **Sound Barrier and Perimeter Wall** elements shall be subjected to both the large and small missile impact test outlined in (TAS) 201-94, but not cyclic wind pressure loading. When more than one material comprises the shell of a composite panel, both sides shall be tested for impact resistance. Solid concrete panels at least 2 inches thick and concrete masonry panels at least 8" thick are exempt from this requirement. Passing requirements for impact tests are outlined in the table below:

Impact Test	Requirement
Large Missile	Breakage or damage is allowed, but with no penetration of the panel or excessive deflection which would allow the panel to dislodge from posts
Small Missile	No breakage or damage allowed to the pane

It shall also be demonstrated that **Sound Barrier and Perimeter Walls** can withstand the impact of projectiles that are thrown by or from passing vehicles and impacts from maintenance equipment such as mowers and weed trimmers. Impact load testing shall be performed in accordance with ASTM E 695.

Sound Barrier and Perimeter Wall elements shall be subjected to the impact test outlined in the following table:

Impact Test	Height	Weight	Requirement
Roadside Debris	3'-0"	10 lbs (4.5 kg)	No breakage or damage allowed to the panel

Panels that are not damaged during the (TAS) 201-94 large missile test are exempt from this requirement.

Commentary:

The Florida Building Code Testing Application Standard (TAS) 201-94 Large Missile test simulates an object being struck by a 2 x 4 at approximately 35 mph. The concrete and masonry panel exclusions are based on recommendations from the Florida Building Code.

2.6 Location

On roadways with flush shoulders, **Sound Barrier and Perimeter Walls** shall be located outside the clear zone unless shielded, and as close as practical to the right of way line. On roadways with curb or gutter, **Sound Barrier and Perimeter Walls** shall be a minimum of 4 feet back of the face of curb. However, additional setbacks may be required to meet minimum sidewalk requirements.

Unless it meets the NCHRP 350 TL-4 criteria for crash testing, **Sound Barriers** on bridges shall be placed a minimum of 5 feet beyond the gutter line of the bridge traffic railing barrier.

Sound Barrier and Perimeter Walls may be combined with **traffic railings** on a common foundation if the combination meets the crash test requirements of NCHRP 350 TL-4 criteria.

2.7 Acoustics

2.7.1 Sound Transmission Class (STC)

The random incidence sound transmission losses of the **Sound Barrier** panel material when tested in accordance with ASTM E 90, shall have a STC rating of Delta "T" equal to or greater than 20.

Testing of **Sound Barrier** panels using concrete for structural integrity shall submit STC verification based on Mass Law as noted in the Noise Control Reference Handbook.

For all other materials, test verification under ASTM E 90 is required unless the following conditions are met:

- A. The mass of the non-corrugated, flattened-out panel material is not less than 4 pounds per square foot.
- B. The STC of the panel material is demonstrated to be 32 or greater.

2.7.2 Noise Reduction Coefficient (NRC)

Sound absorptive panels shall be tested to determine the NRC in accordance with ASTM C 423. Testing shall be completed by an independent National Voluntary Laboratory Accreditation Program (NVLAP) certified facility. Any **Sound Barrier** panel or system shall achieve an NRC rating equal to or greater than 0.80 to be classified as sound absorptive. All other NRC ratings will be classified as sound reflective.

2.8 Expansion Joints

When the **Sound Barrier or Perimeter Wall** alignment traverses structure expansion joints, the panels or system shall be capable of accommodating thermal movement of the **Sound Barrier or Perimeter Wall** and structure within stress levels in accordance with the AASHTO Standard Specifications for Highway Bridges and without reducing acoustical attenuation for **Sound Barriers**.

2.9 Height

Ground mounted **Sound Barrier System** designs shall provide details of methods and materials to be used to accommodate heights to 22 feet above the top of the foundation. The height of a sound barrier located on a bridge structure or retaining wall system normally will be limited to 8 feet unless offset or crash tested in accordance NCHRP 350 TL-4 criteria. **Ground mounted Perimeter Wall System designs shall provide details of methods and materials to be used to accommodate heights to 12 feet above the top of the foundation.**

2.10 Drainage/Utilities

Drainage and/or utility openings shall not degrade the acoustical efficiency of a Sound Barrier by more than 0.5 dBA at 20 feet from the opening. Openings shall prevent access to pets and small children through the openings and be vandal resistant.

2.11 Access

To accommodate emergency access through the Sound Barrier or Perimeter Wall, it shall be demonstrated that access through the panel or system can be provided when and where needed without compromising structural integrity. This entryway shall be at least 3 feet wide by 6 feet high. It shall be demonstrated that the acoustical efficiency of a Sound Barrier is not degraded by more than 0.5 dBA at 20 feet from the entryway.

The Sound Barrier or Perimeter Wall panel or system design shall demonstrate how fire hose access openings and associated identification can be accommodated.

2.12 Aesthetics

Since the appearance of the Sound Barrier or Perimeter Wall may be a significant element in community acceptance, it shall be demonstrated that the standard Sound Barrier and Perimeter Wall panel or system may be altered to enhance the appearance of the wall. Each supplier of Sound Barrier and Perimeter Wall panels or systems shall be able to demonstrate the degree to which their products are capable of accommodating the following FDOT aesthetic criterion:

- A. For concrete panels, accept form liners and/or graphics on one or both sides to create an appearance of a fractured fin finish, an ashlar stone finish, or a similar relief appearance as shown in FDOT Sound Barrier and Perimeter Wall Design Standards. The minimum 2 inch concrete cover shall be maintained. For panels used with FDOT standard post and foundations, the maximum depth of form liners shall be 1.25 inches.
- B. For all panels composed of materials other than concrete, accept a textured surface other than those specified in FDOT Sound Barrier Design Standards.
- C. Accept color ranging from white to sandalwood brown or a mixture of other earth tones within the Federal Standard 595B Color Code.
- D. Mount front face of panels flush with the standard FDOT post system.
- E. Be capable of being angled or tied back into structure approach fills and berms or be stepped to fit existing terrain conditions.

All wall concepts shall demonstrate that they are capable of retaining their basic shape and remain in position without excessive vertical deflection or sagging. The sound barrier panel or system shall avoid including areas that might attract birds or permit the accumulation of dirt and debris.

2.13 Coatings and Coating Systems

Coating materials shall be characterized as non-hazardous as defined by Resource Conservation and Recovery Act (RCRA) Subarticle C rules, Table 1 of 40 of the Code of Federal Regulations (CFR) 261.24, "Toxicity Characteristic".

Upon curing, all coatings and coating systems shall produce an adherent coating that is visually uniform and capable of performing according to its designated purpose for the design life of the sound barrier component.

The coating and or coating system shall be tested in a weatherometer in accordance with the standard practices outlined in ASTM G 155. Weathering shall be in accordance with ASTM G 155 as outlined in Section 2.4.2.6.1. The coating system shall be evaluated for the following weathering effects when rated in accordance with the appropriate ASTM standard:

Weathering Effect	ASTM Standard
Checking	D 660
Cracking	D 661
Blistering	D 714
Color Change	D 2244
Adhesion	D 3359
Chalking	D 4214

There shall be no checking, cracking, blistering, or loss of adhesion. The chalking rating shall be no less than #7. The color change shall not exceed 3 National Bureau of Standards units.

The coating or coating system shall be evaluated for the following salt fog exposure effects (ASTM B 117) when rated in accordance with the appropriate ASTM standard:

Salt Spray (Fog) Exposure Effect	ASTM Standard
Checking	D 660
Blistering	D 714
Adhesion	D 3359

Salt spray (fog) exposure shall be in accordance with ASTM B 117 as outlined in Section 2.4.2.6.1.

There shall be no checking, blistering, loss of adhesion, or corrosion along the sample edges.

The coating or coating system shall be tested for impact resistance in accordance with ASTM D 2794.

Perform test with a 30 in/lb impact.

The coating or coating system shall be tested for its resistance to abrasion in accordance with ASTM D 968. Perform the test using 3000 liters of sand. There shall be no loss of the coating thickness.

Additionally, finish coatings shall be tested for fungal resistance in accordance with ASTM D 3273 and dirt pick-up in accordance with ASTM D 3719. The fungal and dirt pick-up rating shall not exceed 10.

All exposed **Sound Barrier and Perimeter Wall** surfaces or weather coatings shall be able to accept an FDOT approved water based anti-graffiti coating. Anti-graffiti coating for concrete components shall meet the requirements of FDOT Specification Section 563.

2.14 Repairability

The manufacturer shall demonstrate the repairability of the panel or system submitted for approval. The manufacturer shall include a written procedure for the removal and replacement of posts, panels, or other parts. The manufacturer's data shall specify repair methods acceptable for their product, such as: patching, retexturing, repainting, replacing, saw cutting and replacing, or by using special coatings. For plastic, fiberglass and transparent panels, include repair methods for scratches caused by knives or

similar cutting items. It shall also specify conditions under which the manufacturer recommends repair or replacement. The texture and color of the repair shall match the remainder of the **Sound Barrier or Perimeter Wall**. The data shall also include specific retexturing methods recommended for their product.

The **Sound Barrier or Perimeter Wall** system shall resist graffiti and facilitate its removal. Removal may include non-caustic chemical agents, sandblasting, pressure washing, or other methods. Include graffiti removal method(s) in the QPL submittal. The manufacturer's data shall specify if the product requires reapplication of an anti-graffiti coating after removal of graffiti. The texture and color after graffiti removal shall match the remainder of the **Sound Barrier or Perimeter Wall**.

Replacement parts shall be readily available. A list of distributors for replacement parts shall be provided. The submission shall include the latest information available on the cost of replacement parts.

The procedure shall discuss right-of-way needs behind the barrier **or wall** to allow equipment access and facilitate replacement.

2.15 Approval

Panels, posts and foundations or systems will be approved only if the design and materials are determined to conform to these criteria. The Department reserves the right to request additional information and/or testing not specifically outlined in these criteria to assist in the evaluation of any **Sound Barrier or Perimeter Wall** component.

Commentary:

Due to the unknown nature of QPL submittals and the variety of panel products available, additional information for some materials not specifically outlined in these criteria will likely be required. The testing of these materials shall be in accordance with the latest industry standards. Include all standard test methods other than ASTM Standard Test Methods in the QPL submittal with the accompanying test results.

In order for a **Sound Barrier or Perimeter Wall** panel, post and foundation or complete system (including crash tested) to be considered for approval, the manufacturer shall complete the "Sound Barrier QPL Submittal Information Form", available at the following internet address:

www.dot.state.fl.us/structures/StructuresManual/CurrentRelease/SoundBarrierElectronic.dot

Note: This form works only with IE Explorer. Other browsers may not work.

Submit it to the FDOT Product Evaluation Administrator along with additional information as applicable.

Additional information must be submitted to the FDOT Product Evaluation Administrator in the order outlined in the Submittal Form. Additional information includes the following:

- A. Results of tests, as outlined in this criteria, performed by an independent test laboratory.
- B. Detailed material specifications.
- C. Material Safety Data Sheet(s) in either OSHA or ANSI format.
- D. Structural design calculations for panels, posts and foundations or systems for heights up to 22 feet **for Sound Barriers and heights up to 12 feet for Perimeter Walls**. Calculations shall include, but not be limited to, the following:
 1. **Panels**- Calculations shall include panel/post connection for 10 foot and/or 20 foot post spacing consistent with FDOT's Standard Posts and Foundation.
 2. **Posts and foundations** - Calculations shall include panel/post connection for 10 foot and/or 20 foot post spacing consistent with FDOT's Standard Precast Panels and post/foundation connection. Foundation calculations shall also be included.
 3. **Sound Barrier or Perimeter Wall** systems – Calculations shall include panel/post and post/foundation connections. Foundation calculations shall also be included.

Calculations shall be signed, dated and sealed by a Professional Engineer licensed in the State of Florida.

- E. Foundation design calculations shall allow for barrier **or wall** heights up to a minimum of 22 feet assuming the poor soil conditions outlined in Section 2.4.1.3. Calculations shall be signed, dated and sealed by a Professional Engineer licensed in the State of Florida.

F. Crash Test Information.

G. Detailed structural drawings showing the **Sound Barrier or Perimeter Wall** panel or system. All Structural Drawings shall be in either Microstation (preferred), Autocad or PDF format and signed, dated and sealed by a Professional Engineer licensed in the State of Florida. Details shall include, but not be limited to the following:

1. **Sound Barrier or Perimeter Wall** Systems

- a. General Notes. General Notes shall outline design criteria, material requirements, fabrication and erection tolerances consistent with the requirements outlined herein and FDOT Standard Specifications Section 534. The list of distributors where replacement parts may be obtained shall also be included in the General Notes, as required.
- b. Wall Dimensions and Details. Details shall include panel bearing details, connections to post and foundation system, accommodation of steps in wall and variations in wall height and alignment, method of acoustically sealing panel joints, fire access and drainage holes.
- c. Foundation Dimension and Details. Details shall include complete foundation details.

2. **Sound Barrier or Perimeter Wall** Panel

- a. General Notes. General Notes shall outline design criteria, material requirements, fabrication and erection tolerances consistent with the requirements outlined herein, FDOT's Standard Post and Foundation and FDOT Standard Specifications Section 534. The list of distributors where replacement parts may be obtained shall also be included in the General Notes, as required.
- b. Panel Dimensions and Details. Details shall include panel bearing details, connectivity to FDOT's Standard Post, accommodation of steps in the wall, variations in wall heights and alignment, and method of acoustically sealing panel joints. Provide details for fire hose access and drainage holes for bottom concrete panels that are not FDOT's standard concrete panel.

3. **Sound Barrier or Perimeter Wall** Post and Foundation

- a. General Notes. General Notes shall outline design criteria, material requirements, fabrication and erection tolerances consistent with the requirements outlined herein and FDOT Standard Specifications Section 534. The list of distributors where replacement parts may be obtained shall also be included in the General Notes, as required.
- b. Post Dimensions and Details. Details shall include panel/post and post/foundation connection and accommodation of steps in wall and variations in wall height and alignment.
- c. Foundation Dimension and Details. Details shall include complete foundation details.

H. Other information and/or testing pertinent to the design and performance of the **Sound Barrier or Perimeter Wall** panel, post and foundation or system as applicable, including coatings and coating systems.

I. A statement relative to construction requirements to install the **Sound Barrier or Perimeter Wall** panel, post and foundation or system. Information may include contractor means and methods, tolerances, minimum distance required from adjacent property to build the wall system and the adaptability of system to avoid underground and overhead utility conflicts.

J. General maintenance requirements for **Sound Barrier or Perimeter Wall** panel or system, applicability to coating systems, and reparability methods.