



Florida Department of Transportation

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SECRETARY

ROADWAY DESIGN BULLETIN 15-12
STRUCTURES DESIGN BULLETIN 15-07
(FHWA Approved: August 18, 2015)

DATE: August 27, 2015

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Consultant Project Management Engineers, District Construction Engineers, District Maintenance Engineers, District Geotechnical Engineers, District Structures Design Engineers, District Roadway Design Engineers, District Traffic Operations Engineers, Program Management Engineers, District Drainage Design Engineers

FROM: Michael Shepard, P. E., State Roadway Design Engineer
Robert V. Robertson, P.E., State Structures Design Engineer

Handwritten signatures in blue ink. The first signature reads "Michael Shepard" and the second reads "Robert V. Robertson".

COPIES: Brian Blanchard, Tom Byron, David Sadler, Tim Lattner, Trey Tillander, Mark Wilson, Bruce Dana, John Krause, Larry Jones, Larry Ritchie, Bob Crim, Rudy Powell, Greg Schiess, Nicholas Finch (FHWA), Jeffrey Ger (FHWA), Chad Thompson (FHWA), Phillip Bello (FHWA)

SUBJECT: Pipes within Walled Embankment Sections

REQUIREMENTS

- 1) Replace Structures Design Guidelines Section 3.13.1.D and F with the following:
D. Design all drainage conveyances and structures within or adjacent to retaining walls and embankments confined by retaining walls in accordance with the requirements of the Drainage Manual.
F. During the design process, review wall locations for conflicts with existing or proposed utilities beneath or adjacent to the proposed wall and/or reinforced soil volume. Coordinate wall and utility locations and designs with the District Utilities Engineer. The use of requirements established for drainage conveyances and structures as listed in the Drainage Manual is preferred. See **Utilities Accommodation Manual** for more information.
- 2) Delete Structures Design Guidelines Table 3.13.1-1 and Figures 3.13.1-1 through 3.13.1-7.
- 3) Revise Drainage Manual, Chapter 3, Section 3.11.1 to read as follows:

3.11.1 Pipes within or Adjacent to Retained Earth (Walled) Embankment Sections

The design requirements of this section pertain to all pipes that are to be constructed within or adjacent to embankments confined by retaining walls. Avoid the placement of drainage pipes through retaining walls and similar structures when possible. If pipes must be placed within or adjacent to retaining walls, coordinate the design of the drainage system with the geotechnical and structural engineers.

The drawings in Appendix F detail three categories of pipes within retained earth (walled) embankments. Pipes proposed for installation within these wall zones are defined as Wall Zone Pipes.

The Optional Pipe Summary Sheet must note those pipes that are deemed Wall Zone Pipes. When steel pipes are listed as an option for Wall Zone Pipes, the minimum pipe wall thickness, meeting the requirements of Appendix F, shall also be shown on the Optional Pipe Summary Sheet.

Pipes used as vertical drains passing under or through retaining walls, must satisfy the structural requirements of AASHTO LRFD Bridge Design Specifications, Chapter 12.

When existing pipes are to be incorporated within or adjacent to retained earth embankments sections, assess the condition of the pipe – both water tightness and structural adequacy under the proposed loading – and confer with the geotechnical and structural engineers.

4) Change Drainage Manual Table 6-1 and Table 6-1 Notes to read as follows:

TABLE 6-1 CULVERT MATERIAL APPLICATIONS AND DESIGN SERVICE LIFE

Application		Storm Drain		Cross Drain		Side Drain ⁴	Gutter Drain	Vertical Drain ¹⁰	Wall Zone Pipe ¹¹	French Drain		
Highway Facility (see notes)		Minor	Major	Minor	Major	All	All	All	All	Replacement will Impact the Roadway ⁵		Other
Design Service Life →		50	100	50	100	25	25 ⁶	100	100	Minor	Major	All
Culvert Material		An * indicates suitable for further evaluation An (*) indicates scheduled for immediate testing. Once the tested pipes are found sufficient, the Table will be updated.										
A N P I P E	Corrugated Aluminum Pipe CAP	*	*	*	*	*	*			*	*	*
	Corrugated Steel Pipe CSP	*	*	*	*	*	*			*	*	*
	Corrugated Aluminized Steel Pipe CASP	*	*	*	*	*	*			*	*	*
	Spiral Rib Aluminum Pipe SRAP	*	*	*	*	*				*	*	*
	Spiral Rib Steel Pipe SRSP	*	*	*	*	*				*	*	*
	Spiral Rib Aluminized Steel Pipe SRASP	*	*	*	*	*				*	*	*
	Steel Reinforced Concrete Pipe RCP	*	*	*	*	*				*	*	*
	Non-reinforced Concrete Pipe NRCP	*	*	*	*	*				*	*	*
	Polyethylene Pipe – Class I HDPE-I	*		*		*				*		*
	Polyethylene Pipe – Class II ⁸ HDPE-II	*	*	*	*	*				*		*
	Polypropylene Pipe PP	*	*	*	*	*			(*)	*	*	*
	Steel Reinforced Polyethylene Pipe SRPE	*	*	*	*	*			(*)			
	Polyvinyl-Chloride Pipe ⁷ PVC	*	F949	*	F949	*		F949	(*)	*	F949	*
Fiberglass Pipe								*				
Steel pipe (per Spec 556.2.1)								*	*			
S T R U C T U R A L P L A T E	Structural Plate Aluminum Pipe SPAP	*	*	*	*	*						
	Structural Plate Alum. Pipe-Arc SPAPA	*	*	*	*	*						
	Structural Plate Steel Pipe SPSP	*	*	*	*	*						
	Structural Plate Steel Pipe-Arch SPSPA	*	*	*	*	*						
B O X	Aluminum Box Culvert	*	*	*	*	*						
	Concrete Box Culvert CBC	*	*	*	*	*						
	Steel Box Culvert	*	*	*	*	*						

Notes for Table 6-1

1. A minor facility is permanent construction such as minor collectors, local streets and highways, and driveways, provided culvert cover is less than 10 feet. Additionally, this category may be called for at the discretion of the District Drainage Engineer where pipe replacement is expected within 50 years or where future replacement of the pipe is not expected to impact traffic or require extraordinary measures such as sheet piling.
2. A major facility is any permanent construction of urban and suburban typical sections and limited access facilities. Urban facilities include any typical section with a fixed roadside traffic barrier such as curb or barrier wall. Additionally, rural typical sections with greater than 1600 AADT are also included in this category.
3. Temporary construction normally requires a much shorter design service life than permanent does. However, temporary measures that will be incorporated as permanent facilities should be treated as permanent construction with regard to design service life determination.
4. Although culverts under intersecting streets (crossroads) function as side drains for the project under consideration, these culverts shall be designed using applicable cross drain service life criteria, not the shorter sidedrain service life criteria. Index 273 shall be used for end treatment.
5. Replacing this pipe would require removal and replacement of the project's pavement or curb.
6. Gutter drains under retaining or through walls should use a 100 year DSL.
7. F949 PVC service life is 100 years. Other PVC pipe has a 50 year service life. PVC pipe should not be used in direct sunlight unless it meets the requirements of **Specification 948-1.1**.
8. Class II HDPE pipe may not be used in the Florida Keys.
9. Any pipes under or adjacent to permanent structures such as retaining walls, MSE walls, buildings, etc. shall use a 100 year DSL.
10. Resilient connectors required for all vertical pipes.
11. Due to the expected high cost of Steel Pipe, only list Steel Pipe as an option if no other pipe material is allowed.

5) Add the following to the Drainage Manual as Appendix F:

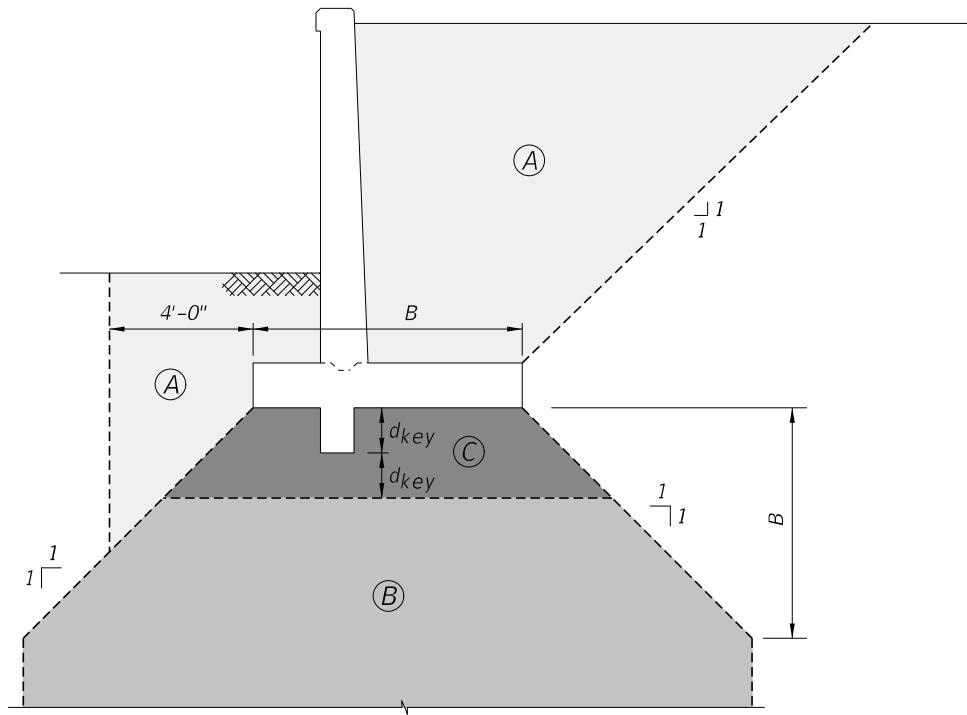
Wall Zone Criteria

Wall Zone	Requirements ¹	Comments
A	Wall Zone Pipe (see Drainage Manual Table 6-1)	Not likely to leak and used when probable first indicator of leak is topside settlement or soil loss
B	Wall Zone Pipe. No longitudinal conveyances ² allowed. Transverse conveyances must meet AASHTO LRFD criteria ³	First indicator of leak is wall damage: pipe must endure unique loading with no chance of leakage
C	No pipes allowed	First indicator of leak is bridge damage.

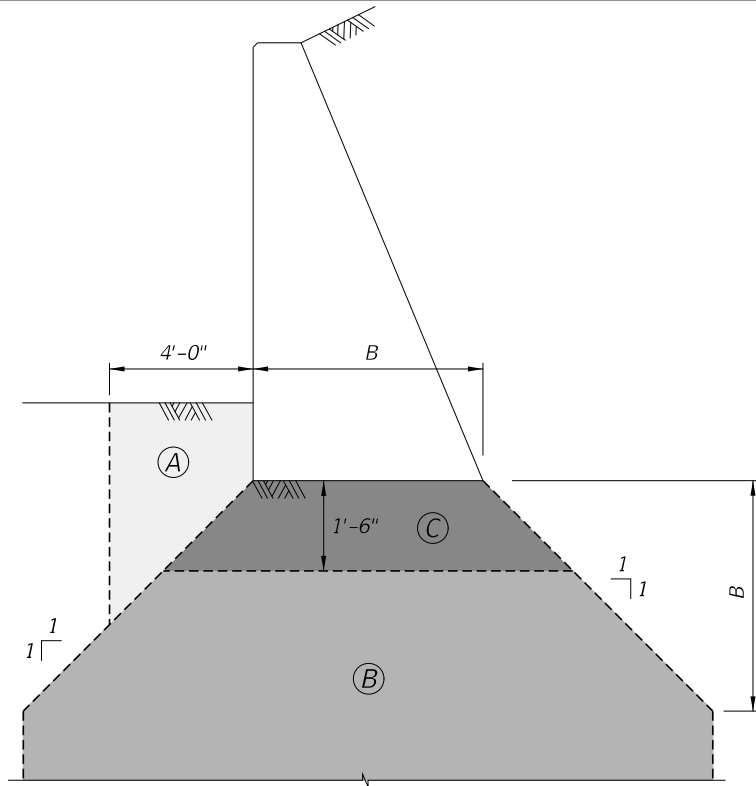
Notes

1. Requirements apply to all retaining walls including those shown in the following sketches. Wall types not shown or project specific wall designs shall incorporate the same restrictions.
2. For the purposes of this table and these figures, a longitudinal conveyance is defined as a pipe run that is aligned with the wall stationing and deviating no more than 45 degrees from the wall alignment. For skewed walls and in the cases where the criteria for longitudinal and transverse directions overlap, e.g., at wall corners, the more stringent criteria must apply.
3. The structural analysis of the pipe must satisfy AASHTO LRFD Bridge Design Specifications, Chapter 12. Pipes in Zone B must be designed to provide adequate structural integrity after the expected section loss due to corrosion over the design service life of the pipe. LRFD assumptions are listed below:
 - a. 120 lb/cubic ft Soil Density (moist)
 - b. Pipe trench excavation per Subarticle 124-4.4 of the **FDOT Specifications**
 - c. Pipe trench backfill allowable soils, bedding and compaction per Article 125-8 of the **FDOT Specifications**
4. Special design constraints may be imposed when a pressurized pipe is placed within, through, under, or immediately adjacent to a retaining wall. This is to assure the design of structural elements takes into consideration support limitations that may be created by the presence of utilities and potential damage or failure of the structure if a pressurized pipe leaks.

5. French Drains are not permitted within any retained earth (walled) embankment sections or wall zones.
6. Hydraulically size drainage pipes to allow for future internal lining.
7. Two-phased MSE walls, per SDG 3.12.1.D, are used when significant settlement is expected. For two-phased MSE walls, transverse piping must be installed after as much of the settlement as practical has occurred. Coordinate this effort with the Geotechnical Engineer.



SECTION THRU CAST IN PLACE CANTILEVER RETAINING WALL (INDEX 6010)



SECTION THRU CAST IN PLACE GRAVITY WALL (INDEX 6011)

Figure F-1

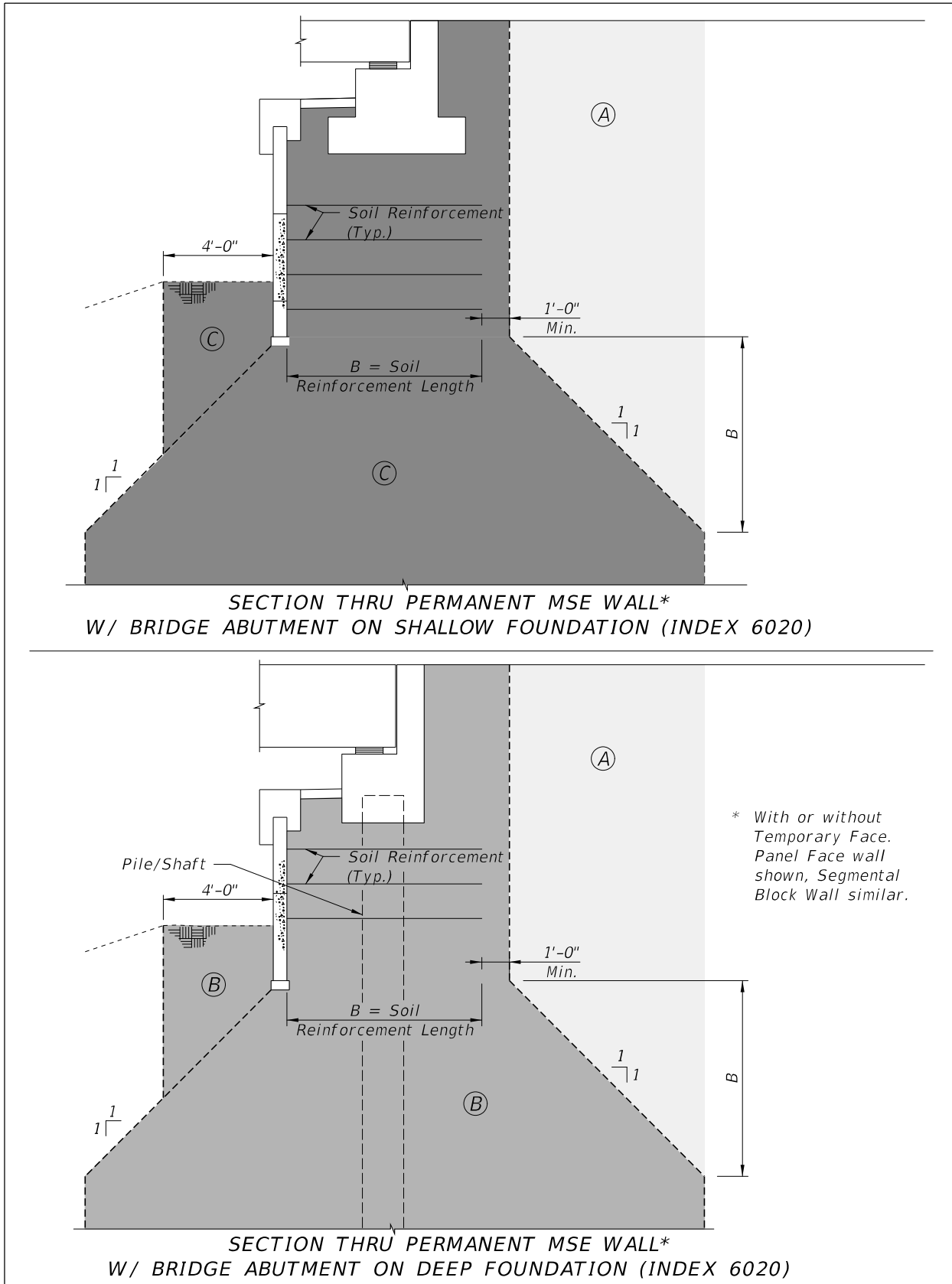


Figure F-2

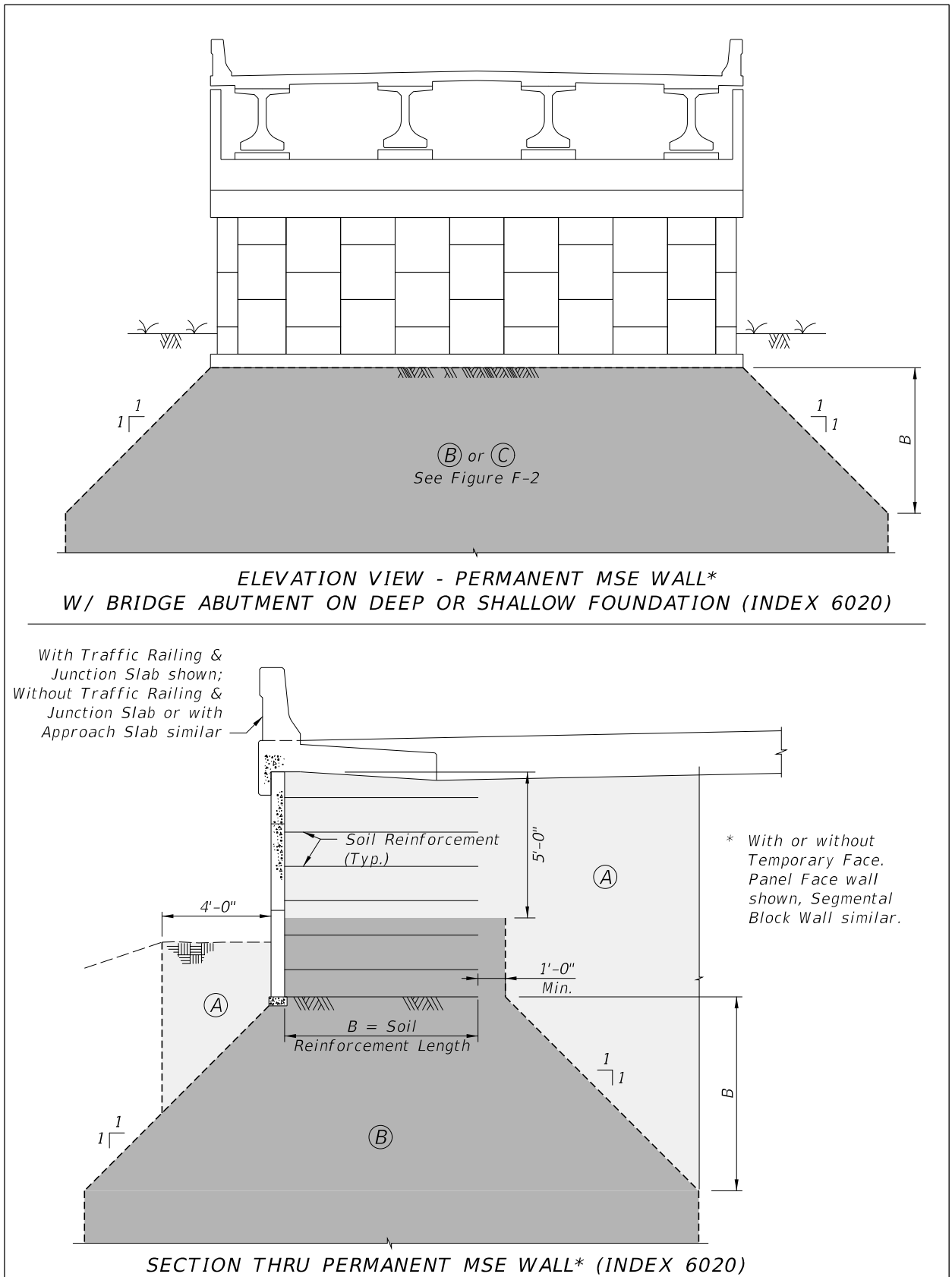


Figure F-3

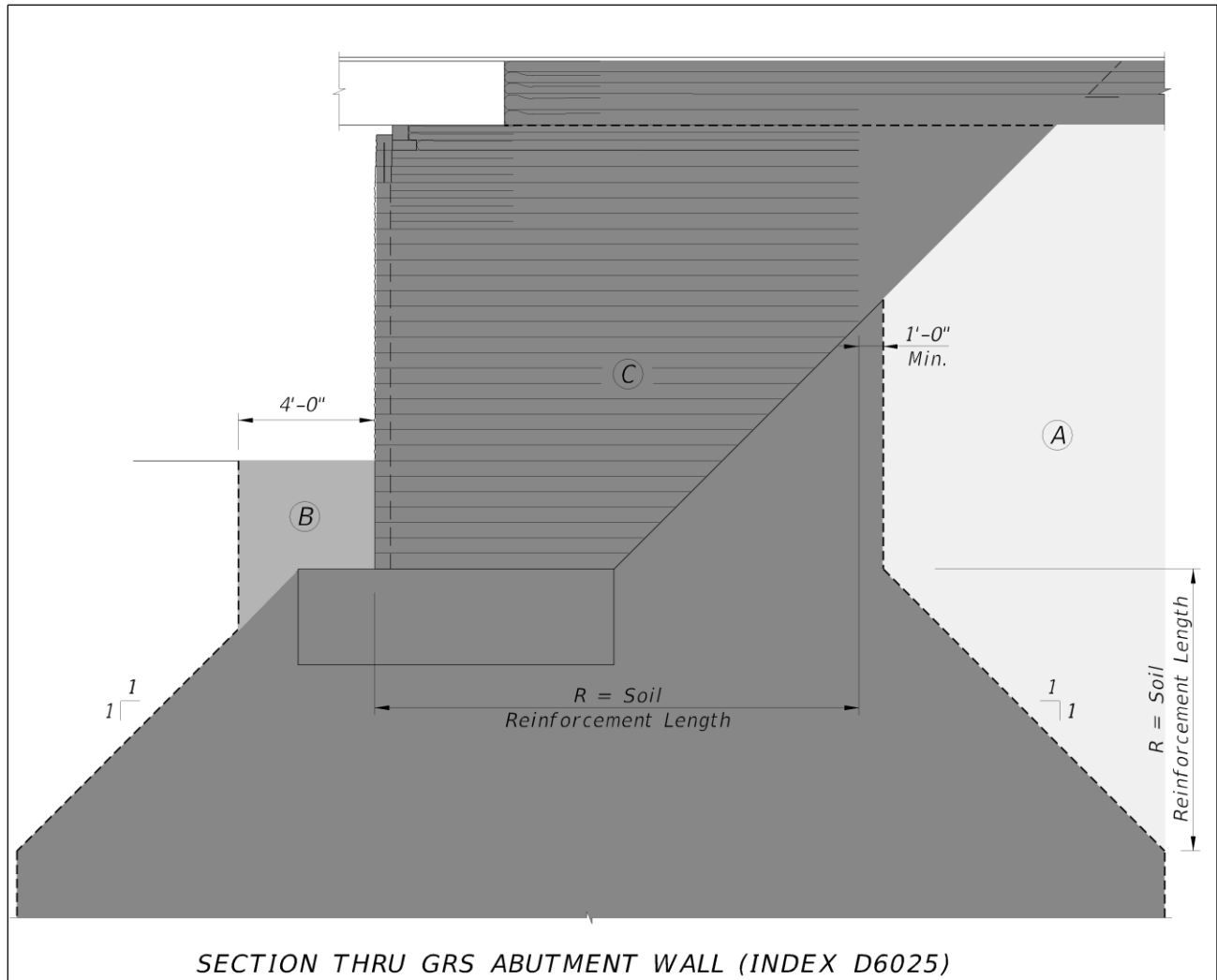


Figure F-4

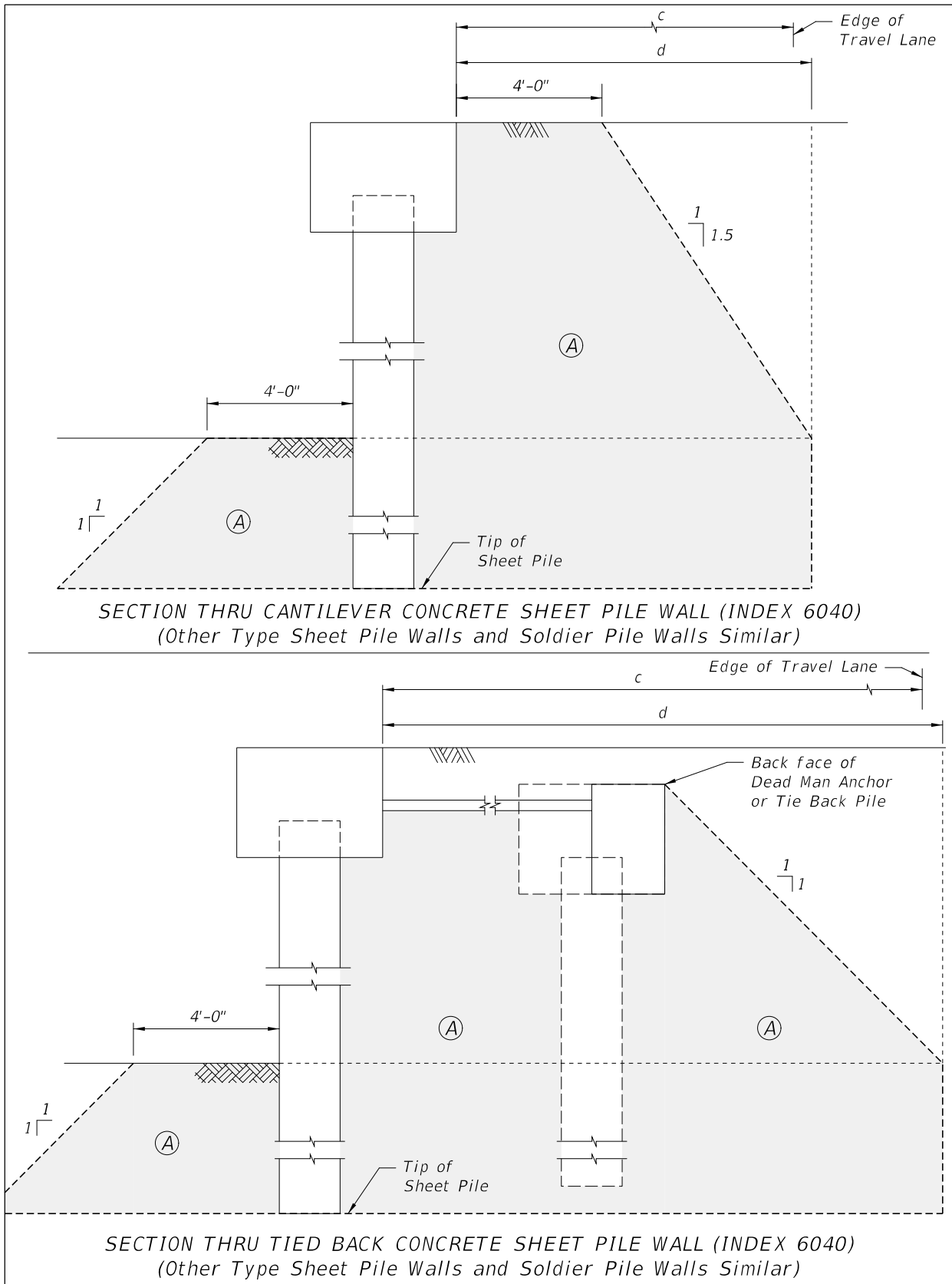


Figure F-5

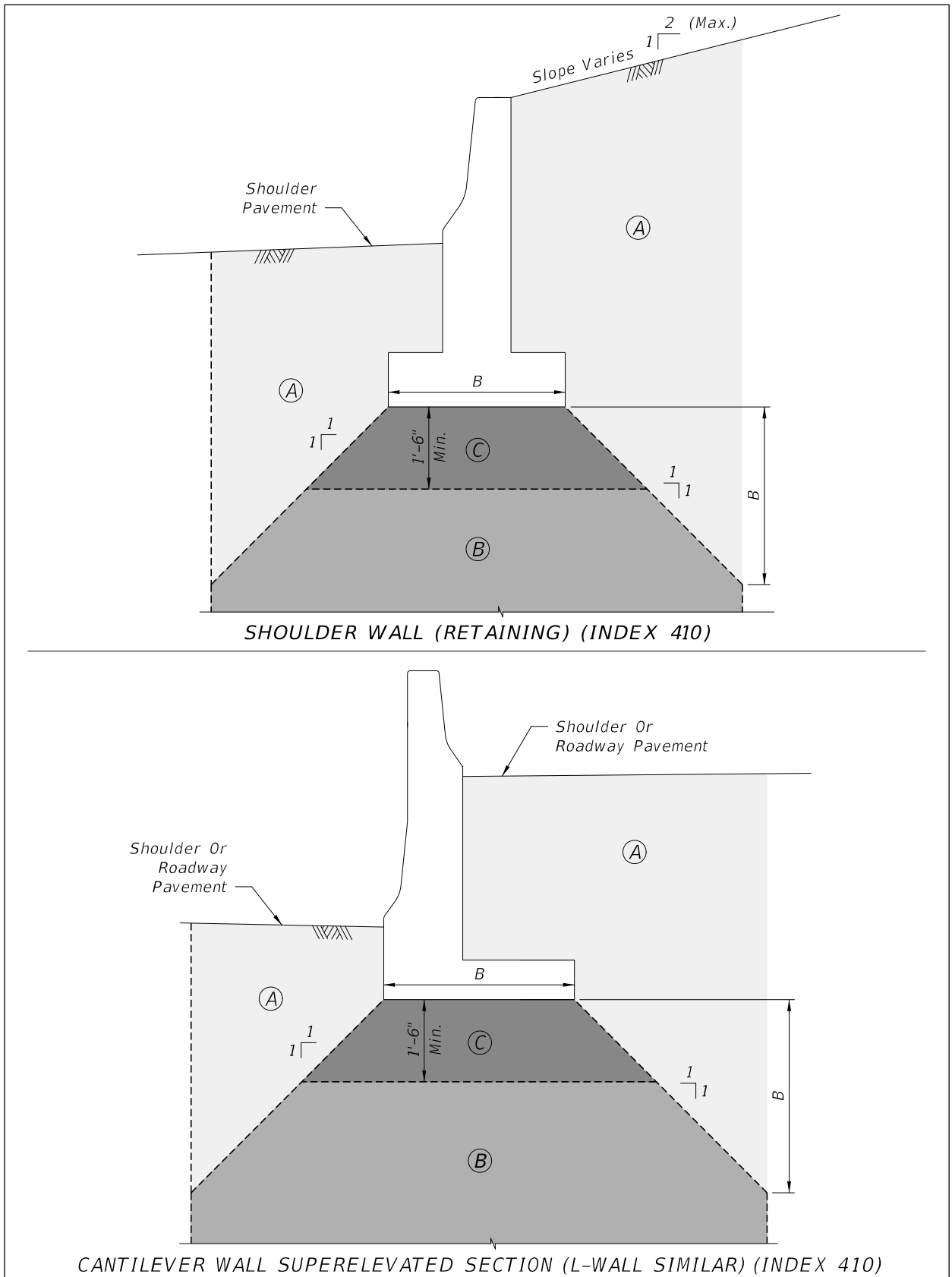


Figure F-6

COMMENTARY

Pipes near retaining walls may be subjected to greater settlement and eccentric loadings than pipes located in roadway sections without walls. Leakage from drainage systems near retaining walls may compromise the performance of the wall, resulting in costly repairs. These changes are intended to mitigate the risk to retaining walls by using pipes less likely to leak due to settlement and, in some cases, require pipes with welded joints that will not leak.

Section 430 of the *FDOT Specifications* is being updated for the January 2016 eBook. Some revisions to *Section 430* include:

- 1) Subarticle 430-2.1 on pipe materials will include Steel Pipe and reference Subarticle 556-2.1.
- 2) The following text will be added to Subarticle 430-4.1
 - When laying pipes that pass through retaining walls, connect the portion of the pipe within the wall to the external portion of the pipe run only after the full height of the wall supported embankment is in place.
 - Use resilient connectors on pipes entering and leaving drainage structures with Wall Zone Pipes.
 - Provide a 2 to 4 inch pipe overhang beyond the drainage structure internal walls with Wall Zone Pipes.
 - Pipe joints must be watertight to 10.8 psi when pulled out 2 inches from the fully home joint alignment with Wall Zone Pipes without welded joints.
 - Joint gaps between sections of pipe not to exceed 5/8 inch from fully home joint alignment for all pipe diameters with Wall Zone Pipes without welded joints.

BACKGROUND

The guidance in this bulletin was developed by a multidisciplinary team consisting of Structures Design, Construction, Maintenance, and Drainage Design. The team reviewed all available forensic evidence from wall damage associated with water, identifying occurrences associated with pipe leakage both at pipe joints and at pipe to structure connections. Additional discussions between Central Office Drainage and Geotechnical staff finalized these details.

These requirements were presented to the Pipe Industry at the July 30, 2015 Pipe Advisory Group meeting. The PAG was provided a two week written comment period.

IMPLEMENTATION

The Requirements of this bulletin are effective immediately on all design-bid-build projects in Phase I or Phase II design development. These requirements may be implemented immediately on all design-bid-build projects either in Phase III or Phase IV at the discretion of the District.

This bulletin is effective immediately on all design-build projects for which the final RFP has not been released. Design build projects for which the final RFP has been released are exempt from these requirements unless otherwise directed by the District via addenda.

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