Florida Department of Transportation

JEB BUSH
GOVERNOR

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Tallahassee, FL 32399-0450

DENVER J. STUTLER, JR.
SECRETARY

September 9, 2005

MEMORANDUM

TO: District Directors of Operations, District Directors of Production, District Design Engineers, District Structures and Facilities Engineers, District Geotechnical Engineers, District Maintenance Engineers, District Construction Engineers, District Structures Design Engineers

FROM: William Nickas, P.E., State Structures Design Engineer

COPIES: Bob Greer, Jeffrey Ger (FHWA), Brian Blanchard, John Harris, David Sadler, Duane Brautigam, Sharon Holmes, Larry Sessions, Robert Robertson, Marcus Ansley, David O'Hagan, Steve Plotkin, Elwin Broome.

SUBJECT: Temporary Design Bulletin C05-16
Permanent and Temporary Retaining Walls: Structures Design Guidelines, QPL Acceptance Criteria, Plans Preparation Manual, and Design Standards

REQUIREMENTS (3)

1. For projects let after July 1, 2006:
    a. Replace Section 3.13, Retaining Wall Design, of the July 2005 Structures Design Guidelines with Attachment A.
    b. Modify Table 1.2 Concrete Cover, of the July 2005 Structure Design Guidelines, as follows:
        i. under Substructure, after Retaining Walls, add: (excluding MSE Walls)
        ii. under the table, add: for cover requirements in MSE walls see Section 3.13
    c. Modify Table 1.3 Concrete Class, of the July 2005 Structure Design Guidelines, as follows:
        i. under Substructure, after Retaining Walls, add: (excluding MSE Walls)
        ii. under Table 1.3, add: for concrete requirements in MSE walls, see Section 3.13
    d. Replace Sections 30.2.3 and 30.2.4, of the January 1, 2005 Plans Preparation Manual -Volume 1, with Attachment C.
    e. Delete Exhibit 30-A of the January 1, 2005 Plans Preparation Manual, Volume 1.
2. Add Attachment B to the July 2005 Structures Manual - Volume 6, QPL Acceptance Criteria, Chapter 3 - Proprietary Retaining Wall Systems.
3. Add the Table of FDOT Wall Types in Attachment D to Index 5300 of the 2006 Design Standards.

COMMENTARY

See attachments.

BACKGROUND

Future retaining wall systems (permanent and temporary) built for the Department will be designed in accordance with the AASHTO LRFD Bridge Design Specifications. In order to fully comply with the LRFD and current Department policies, new design provisions are necessary in the Structures Design Guidelines, Proprietary Retaining Wall Systems QPL Acceptance Criteria, and Plans Preparation Manual.

Retaining wall details common to all manufactures are included in the 2006 Design Standards. General proprietary retaining wall details and LRFD calculations (see Structures Design Guidelines and Attachment A) will be submitted for approval by each manufacturer as part of the QPL process (see Attachment B). Approved systems will be listed on the QPL along with the FDOT Wall Type, proprietary drawings and LRFD calculations. Designers will list the appropriate FDOT Wall Type (see Attachment D) in the plans for use at each wall location (see PPM Chapter 30 and Attachment C). Since MSE Walls are constructed using select structural fill, new concrete class and cover requirements are established based on air borne contaminants (see Attachment A).

IMPLEMENTATION

For projects let before July 1, 2006, use the current 2004 Design Standards (LFD) with interims and July 2005 Structures Design Guidelines Section 3.13. Select applicable retaining walls for the project from the approved wall systems found in the 2004 Design Standards, including Interims, and comply with January 2005 Plan Preparation Manual including Chapter 32.

For projects let July 1, 2006 and after, use the 2006 Design Standards with Table of FDOT Wall Types (Attachment D), the LRFD Retaining Wall Structures Design Guidelines (Attachment A) and revised Plan Preparation Manual Sections 30.2.3 and 30.2.4 (Attachment C, see the flow chart for plan requirements). Wall companies will submit their proprietary wall designs using QPL Acceptance Criteria for Proprietary Retaining Wall Systems (Attachment B).

<u>Critical Dates</u>

July 1, 2005

- 2006 Design Standards for LRFD Retaining Wall Systems (Index 5300) were published. The Design Standards are for use on all projects let July 1, 2006 and after. Projects let prior to July 1, 2006 will continue to use the current 2004 Design Standards with interims (LFD).

September 9, 2005

- LRFD Retaining Wall Structures Design Guidelines, QPL Acceptance Criteria Design, revised Plan Preparation Manual instructions, and Table of FDOT Wall Types are published in a Design Bulletin.

- Qualified Products List (QPL) submittals begin to be accepted and approved in accordance with Retaining Wall design section of the Structures Design Guidelines (Attachment A), Proprietary Retaining Wall Systems QPL Acceptance Criteria (Attachment B), Plan Preparation Manual (Attachment C), and Table of FDOT Wall Types (Attachment D).
- The Department no longer accepts LFD Retaining Wall submittals for inclusion in the 2004 Design Standards.

July 1, 2006

- Lettings begin using 2006 Design Standards and QPL approved Retaining Wall companies.
- Structures Design Guidelines (SDG) Section 3.13 referencing LFD Retaining Wall Design is removed.
- Revised 548 Construction Specification is implemented stating the contract must choose FDOT Wall Types from the QPL unless otherwise noted in the plans.

CONTACT

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WNN/DOH

Attachment A
Structures Manual - Volume 1
Structures Design Guidelines - Section 3.13
For Projects Let July 1, 2006 and After

3.13 Retaining Wall Design (For Projects let July 1, 2006 and after)

3.13.1 General

A. Use Chapter 30, ***Plans Preparation Manual*** *for* retaining wall plans preparation and administrative requirements in conjunction with the design requirements of this Section. Refer to ***SDG*** Chapter 1 for the retaining wall concrete class (excluding MSE Walls) and reinforcing steel cover requirements.

B. Rankine earth pressure may be used in lieu of lateral earth loads on walls developed from Coulomb earth pressure. If Rankine earth pressure is used, the resultant lateral earth load can be assumed to be located at the centroid of the earth pressure diagram.

C. During the design process, review wall locations for conflicts with existing or proposed utilities located beneath proposed reinforced fill wall volume. Analyze for settlement effects, maintenance repair access, etc.

D. Do not place utilities in the soil-reinforced zone behind Mechanically Stabilized Earth (MSE) or tie-back walls.

Commentary:
Utilities placed below the wall or in the reinforced zone cannot be maintained because excavation in this zone will compromise the structural integrity of these wall types. Leaking pipes could wash out and destroy the structural integrity of the wall.

3.13.2 Mechanically Stabilized Earth Walls

Commentary:
FHWA Publication No. FHWA-NHI-00-043, "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design & Construction Guidelines", contains background information on the initial development of MSE wall design and is referenced by ***LRFD*** *Article 11.10.1 as the design guidelines for geometrically complex MSE walls.*

A. For MSE Walls, use the following Table for concrete class and cover requirements:

Distance (D) from wall to a body of water with high chloride content (greater than 2,000 ppm) or any coal burning industrial facility, pulpwood plant, fertilizer plant or similar industry.	Concrete	Cover
D > 2,500 feet (low air contaminants)	Class II	2 inches
2,500 feet >= D >= 300 feet (moderate air contaminants)	Class IV	2 inches
D < 300 feet (extreme air contaminants)*	Class IV	3 inches

* include calcium nitrite when D <= 50 feet (splash zone)

B. Minimum Service Life [11.5.1]

1.) Design permanent walls for a service life of 75 years, except those supporting abutments on spread footings. Design walls supporting abutments on spread footings for a service life of 100 years.
2.) Design temporary walls for the length of contract or a service life of three years, whichever is greater.

B. Concrete Leveling Course

1.) All permanent walls will have a non-structural concrete leveling course as a minimum.
2.) The entire bottom of the wall panel will have bearing on the concrete leveling course.

C. Bin Walls [11.10.1]

1.) When two walls intersect forming an internal angle of less than 70 degrees, design the nose section as a bin wall. Submit calculations for this special design with the plans for review and approval.
2.) Design structural connections between wall facings within the nose section to create an

at-rest bin effect without eliminating flexibility of the wall facings to allow tolerance for differential settlements.

3.) For wall facings without continuous vertical open joints, such as square or rectangular panels, design the nose section to settle differentially from the remainder of the structure with a slip joint. Facing panel overlap, interlock or rigid connection across vertical joints is not permitted.

4.) Design soil reinforcements to restrain the nose section by connecting directly to each of the facing elements in the nose section. Run soil reinforcement into the backfill of the main reinforced soil volume to a plane at least 3 feet beyond the Coulomb (or Rankine) failure surface (See Figure 3-1).

5.) Design of facing connections, pullout and strength of reinforcing elements and obstructions must conform to the general requirements of the wall design.

D. Minimum Length of Soil Reinforcement [11.10.2.1]

In lieu of the requirements for minimum soil reinforcement lengths in ***LRFD*** Article [C11.10.2.1] and substitute the following:

The minimum soil reinforcement length, "L", measured from the back of the facing element, must be the maximum of the following:

Walls in Front of Abutments on Piling

$L \geq 8$ feet and

$L \geq 0.7H1$

Walls Supporting Abutments on Spread Footings

$L \geq 22$ feet and

$L \geq 0.6 (H1 + d) + 6.5$ feet, (d = fill height above wall) and

$L \geq 0.7\ H1$

Where:

$H1$ = mechanical height of wall, in feet, and measured to the point where the potential failure plane (line of maximum tension) intersects the ground surface.

L = length in feet, required for external stability design

Commentary:
As a rule of thumb, an MSE Wall with reinforcement lengths equal to 70% of mechanical height, the anticipated factored bearing pressure ($q_{uniform}$) can be estimated to be about 200% of the overburden weight of soil and surcharge. It may be necessary to increase the reinforcement length for external stability to assure that the factored bearing pressure does not exceeds the factored bearing resistance (q_r) of the foundation soil at this location.

E. Minimum Front Face Wall Embedment [11.10.2.2]

1.) Consider scour and bearing capacity when determining front face embedment depth.

2.) Consult the District Drainage and Geotechnical Engineers to determine the elevation of the top of leveling pad.

3.) In addition to the requirements for minimum front face embedment in ***LRFD*** Article [11.10.2.2], the minimum front face embedment for permanent walls must comply with both a minimum of 24 inches to the top of the leveling pad and Figure 3-2. Also, consider normal construction practices.

F. Facing [11.10.2.3]

1.) The typical panel size must be square and not exceed 30 square feet in area (5 feet by 5 feet, nominal).

2.) The typical non-square (i.e., diamond shaped, not rectangular) panel size must not exceed 40 square feet in area.

3.) Special panels (top out, etc.) must not exceed 50 square feet in area.

4.) Full-height facing panels must not exceed 8 feet in height.

5.) SDO will consider use of larger panels on a case-by-case basis. The reinforcing steel concrete cover must comply with Table in 3.13.2.A.

G. External Stability [11.10.5]

1.) The reinforced backfill soil parameters for analysis are:

a. Sand Backfill (Statewide except Miami-Dade and Monroe Counties)
b. Moist Unit Weight: 105 lbs per cubic foot
c. Friction Angle: 30 degrees

2.) Limerock Backfill (Dade and Monroe Counties only)
a. Moist Unit Weight: 115 lbs per cubic foot
b. Friction Angle: 34 degrees.

3.) In addition to the horizontal back slope with traffic surcharge figure in ***LRFD***, Figure 3-3 illustrates a broken back slope condition with a traffic surcharge. If a traffic surcharge is present and located within $0.5H1$ of the back of the reinforced soil volume, then it must be included in the analysis.

4.) The Geotechnical Engineer of Record for the project is responsible for designing the reinforcement lengths for the external conditions shown in Figure 3-4 and any other conditions that are appropriate for the site.

H. Apparent Coefficient of Friction [11.10.6.3.2] The pullout friction factor (F^*) need not be reduced for properly placed and compacted, saturated backfill.

I. Soil Reinforcement Strength [11.10.6.4]

1.) In lieu of the corrosion rates specified in ***LRFD*** Article [11.10.6.4.2a], substitute the following requirements:

The following corrosion rates for metallic reinforcement apply to non-corrosive environments only (low and moderate air contaminants in Table 3.13.2.A):

a.) Zinc (first 2 years)	0.59 mils/year
b.) Zinc (subsequent years to depletion)	0.16 mils/year
c.) Carbon Steel (after depletion of zinc)	0.48 mils/year
d.) Carbon Steel (75 to 100 years)	0.28 mils/year

2.) Use a minimum corrosion rate of 6 mils/year for Temporary MSE Walls with:
a.) metallic reinforcement below the 100 year flood elevation.
b.) wire facing and connections exposed to extreme air contaminants (Table 3.13.2.A).

3.) Do not use metal soil reinforcement if the wall is located within the 100 year flood plain and the nearby water chloride content is greater than 2,000 ppm.

4.) Epoxy coated reinforcement mentioned in ***LRFD*** Commentary [C11.10.6.4.2a] is not permitted. Passive metal soil reinforcement (i.e., stainless steel, aluminum alloys, etc.), is permitted only with written SDO approval.

5.) Geosynthetic reinforcements (***LRFD*** 11.10.6.4.2b) must comply with Chapter 31 of the ***Plans Preparation Manual, Volume I.*** Use the same reinforcement properties as those for geosynthetic reinforced soil slopes shown on Design Standards Index No. 501 with a maximum 2% strain for permanent walls and 5% strain for temporary walls.

6.) For geosynthetic reinforcement, supplement ***LRFD*** Table 11.10.6.4.3b-1 with the following default value:

Application	Total Reduction Factor, RF
Critical temporary wall applications with non-aggressive soils and polymers meeting the requirements listed in Table 11.10.6.4.2b-1.	7.0

7.) For permanent wall systems using welded wire soil reinforcement, the minimum wire size in both the longitudinal and transverse directions shall be W10 for walls with a 75 year service life and W11 for walls with a 100 year service life.

8.) Do not design soil reinforcement to be skewed more than 15 degrees from a position normal to the wall panel unless necessary and clearly detailed for acute corners. In these instances, follow the pre-approved bin wall details shown in the QPL Vendor Drawings.

Commentary:

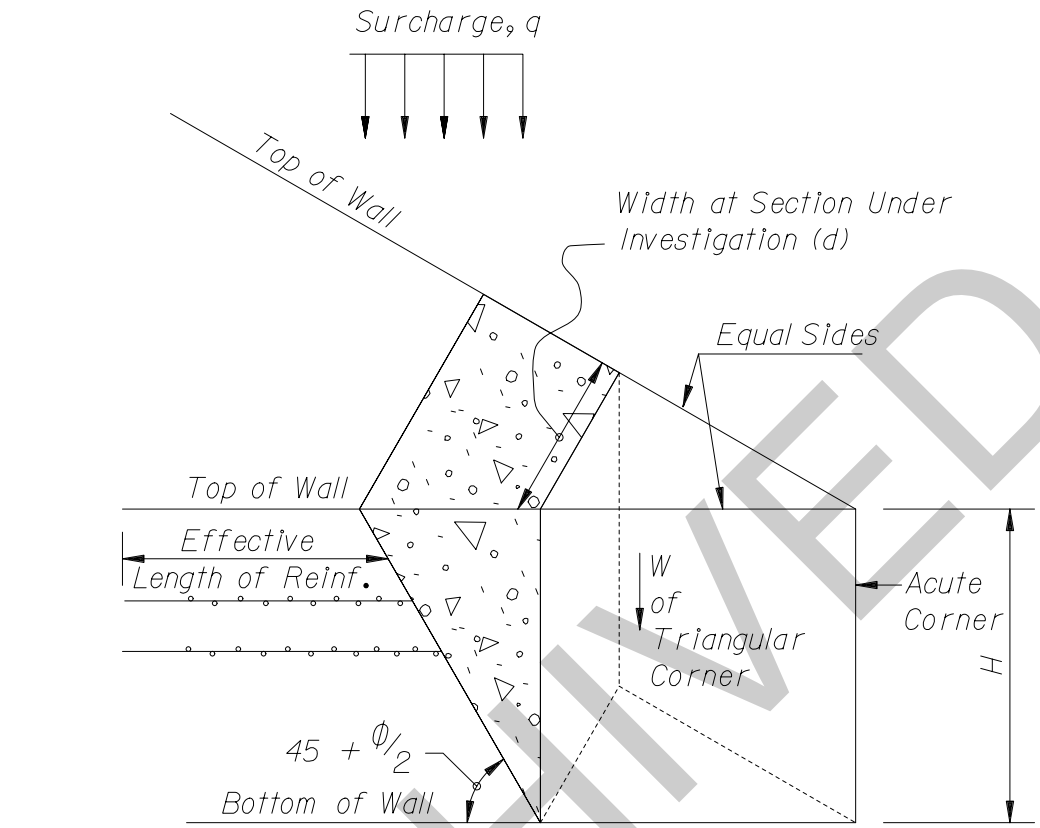
There are times when the 15 degree criteria cannot be met due to vertical obstructions such as piling, drainage structures or bridge obstructions with angles. In these cases, clearly detail the soil reinforcement skew details in the Shop Drawings.

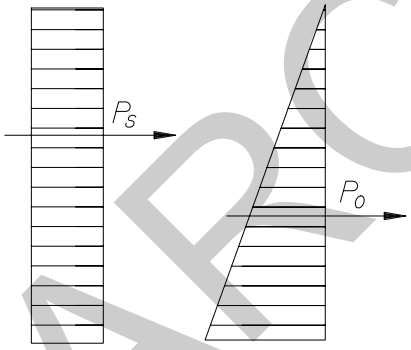
9.) Do not design soil reinforcement to be skewed more than 15 degrees from a horizontal position in elevation view to clear horizontal obstructions.
10.) Soil reinforcement must not be attached to piling, and abutment piles must not be attached to any retaining wall system.

J. Reinforcement/Facing Connection [11.10.6.4.4]
Design the soil reinforcement to facing panel connection to assure full contact of the connection elements. The connection must be able to be inspected visibly during construction.
Commentary:
Normally mesh and bar mats are connected to the facing panel by a pin passing through loops at the end of the reinforcement and loops inserted into the panels. If these loops are not aligned, then some reinforcement will not be in contact with the pins causing the remaining reinforcement to be unevenly stressed and/or over stressed. If the quality of this connection cannot be assured through pullout testing and quality control during installation, then the strength of the soil reinforcement and its connections should be reduced accordingly.

K. End Bents on Piling behind MSE Walls
1.) All end bent piles must be plumb when MSE Wall is not parallel to the end bent centerline.
2.) The minimum clear distance shall be 2'-0" for both of the following:
a.) Between the front face of the end bent cap or footing and the back face of wall panel.
b.) Between the face of piling and leveling pad. (The 2'-0" dimension is based on the use of 18-inch piles. Whenever possible for larger piles, increase the clear distance between the wall and pile such that no soil reinforcement is skewed more than 15 degrees).
3.) Soil reinforcement to resist the overturning produced by the earth load, friction, and temperature must be attached to end bents, unless the long-term settlement exceeds 4 inches. In this case, the reinforcement must not be attached to the end bent and a special wall behind the backwall must be designed to accommodate the earth load.

L. End Bents on Spread Footings behind MSE Walls:
1.) The spread footing must be sized so that the factored bearing pressure does not exceed 6000 psf.
2.) The edge of the footing must be a minimum of 1'-0" behind the back of the wall panel.
3.) The minimum distance between the centerline of bearing on the end bent and the back of the wall panel must be 4'-0".





$P_o = \frac{1}{2} \gamma H^2 K_o$ [Width at Section Under Investigation]

$P_s = q H K_o$ [Width at Section Under Investigation]

Note : Analyze the acute corner at each Column of Panel Joints until no reinforcement beyond the failure surface is required (i.e. until the factored sliding resistance is greater than the factored horizontal earth loads).

DESIGN CRITERIA FOR ACUTE CORNERS

Figure 3-1

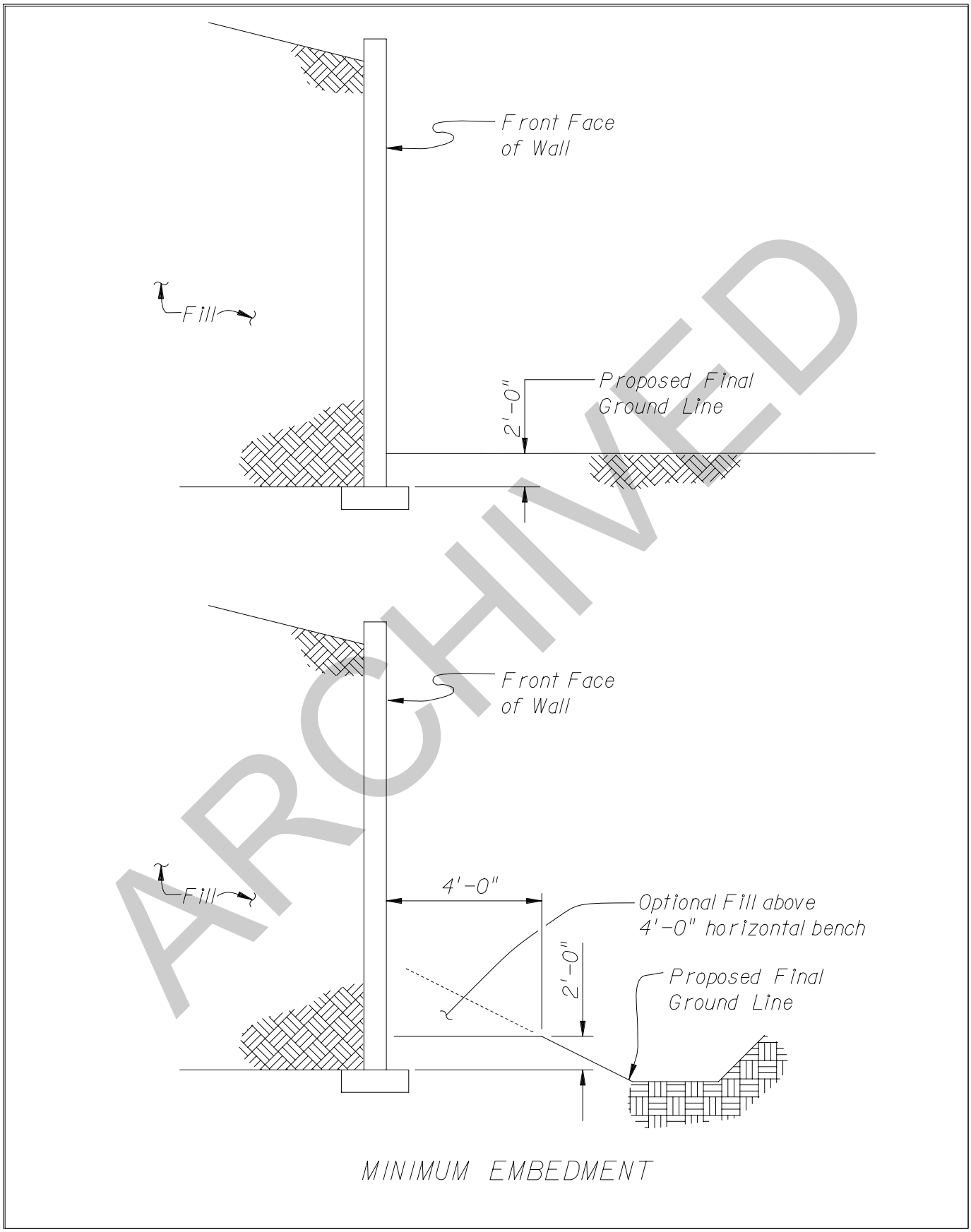
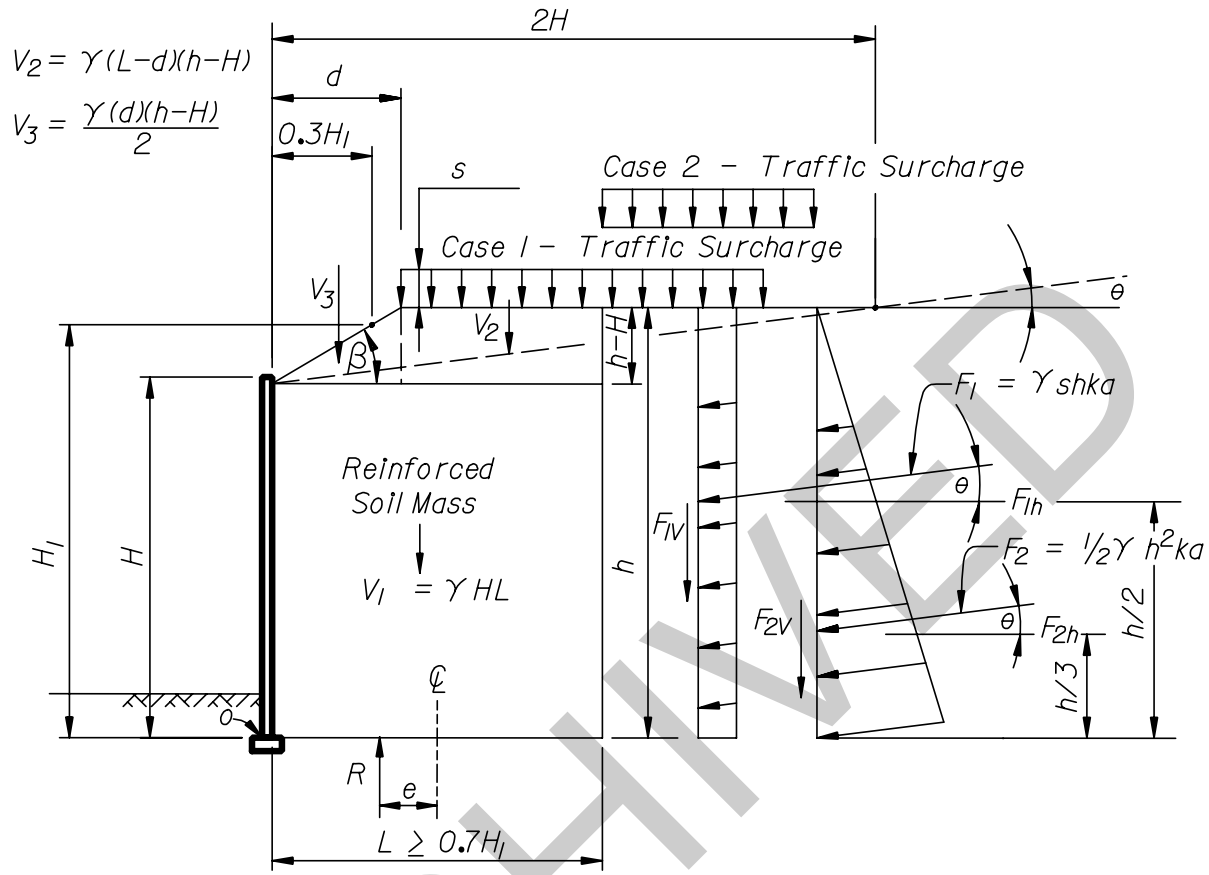


Figure 3-2



Case I used for bearing resistance, reinforcement tensile resistance and overall stability calculations.

Case 2 used for sliding, eccentricity, and reinforcement pullout resistance calculations.

$F_{1h} = (F_1)\cos(\theta)$
$F_{1V} = (F_1)\sin(\theta)$
$F_{2h} = (F_2)\cos(\theta)$
$F_{2V} = (F_2)\sin(\theta)$

$$H_1 = H + \frac{(\tan\beta)(0.3H)}{(1-0.3\tan\beta)} \quad \text{(Mechanical Height)}$$

$$K_a \text{ For Random Fill: } K_a = \cos(\theta)\left[\frac{\cos(\theta)-\sqrt{\cos^2(\theta)-\cos^2\phi}}{\cos(\theta)+\sqrt{\cos^2(\theta)-\cos^2\phi}}\right]$$

Loads shown are unfactored. Use appropriate load and resistance factors in analysis.

ϕ = friction angle of back fill or foundation, whichever is lowest.

$$e = \frac{L}{2} - \frac{Mr-Mo}{R} \leq \frac{L}{4} \qquad \sigma_V = \frac{R}{L-2e}$$

Where: e = Eccentricity
R = Resultant of Vertical forces
= $(V_1 + V_2 + V_3 + F_{1V} + F_{2V})$

BROKEN BACK BACK FILL CASE WITH TRAFFIC SURCHARGE

Figure 3-3

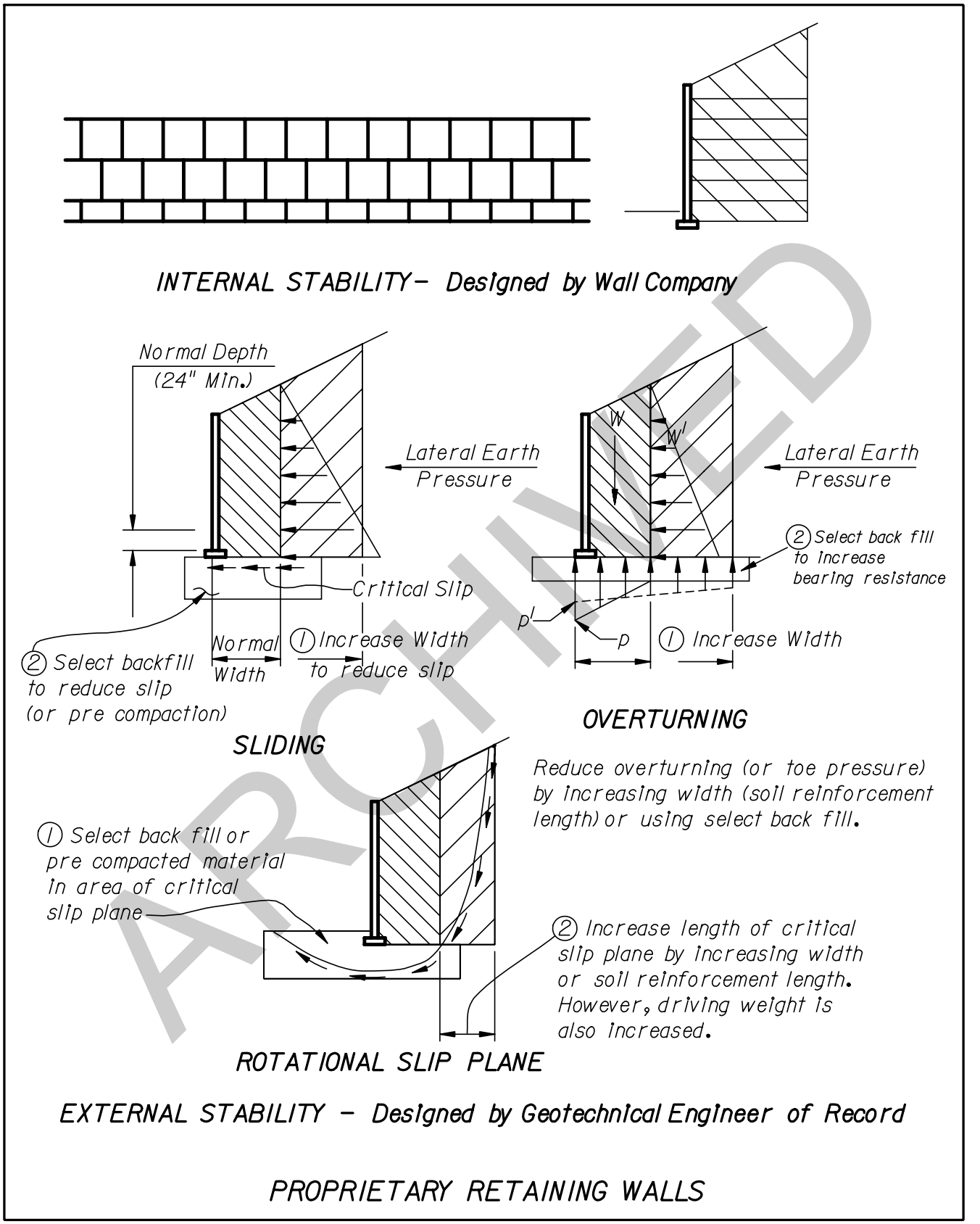


Figure 3-4

Attachment B
Structures Manual - Volume 6
QPL Acceptance Criteria
Chapter 3 - Proprietary Retaining Wall Systems

Chapter 3 Proprietary Retaining Wall Systems

3.1 General

A. These acceptance criteria cover two different types of QPL approvals:

1.) Permanent proprietary retaining wall systems used as structural retaining walls.

2.) Temporary proprietary retaining wall systems used as structural retaining walls.

B. These criteria do not apply to modular block walls.

3.2 Definitions

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

Leveling Course (Pad) – a non-reinforced concrete pad used to provide a level and consistent surface at the proper grade on which to place the wall panels.

Soil Reinforcement – component that holds the wall facing panels in position and provides reinforcement for the soil. Soil reinforcement can be strips, grids, or mesh and made of either steel or approved geosynthetics.

Structural Retaining Wall – retaining walls greater than five feet high or any wall that supports highway loads, regardless of height.

Wall Facing – component used to hold the soil in position at the face of the wall. Materials for wall facing panels are reinforced concrete for permanent wall systems and wire mesh or approved geosynthetics for temporary wall systems.

Wall/Reinforcement Connection – area where the connection is made between the wall facing and the soil reinforcement.

Wall System – All components of a retaining wall system.

3.3 Referenced Standards

American Association of State Highway and Transportation Officials (AASHTO) "LRFD Bridge Design Specifications"

The Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction"

Florida Department of Transportation "Structures Design Guidelines" (SDG)

Florida Department of Transportation “Design Standards”

3.4 Design

A. Design wall systems in accordance with the FDOT ***Structures Design Guidelines*** and applicable Specifications listed in ***SDG*** Section I.6.

B. All Design Calculations and Design Details must be signed, dated, and sealed by a Professional Engineer licensed in the State of Florida.

3.5 Approval Process

The Department and/or Department Consultants will review wall system designs.

Highway Innovative Technology Evaluation Center (HITEC) evaluation is desirable.

Make all submittals to the FDOT Product Evaluation Administrator in the Specifications Office.

3.5.1 Tentative Approval

A. Tentative Approval will be granted only if the wall system design and submittal procedure conform to these acceptance criteria.

B. Due to the nature of QPL submittals and the variety of retaining wall systems, additional information not specifically outlined in these criteria as well as a formal presentation to Department personnel may also be required to gain tentative approval.

C. The company will be notified in writing of the Department's decision to either reject, request additional information, or grant tentative approval.

3.5.2 Final Approval

A. After granting tentative approval, the Department will select a course of action for the final approval process. Final approval for wall systems with an established history in Florida may be granted based on past performance.

B. For wall systems new to Florida, the Department may elect the following course of action:

1.) The State Structures Design Office will select a suitable project for evaluation of the wall system and notify the company. The wall system is considered an experimental feature and will not be subject to competitive bidding.

2.) The Department will provide the company with control plans prepared either in-house or by the Consultant Engineer of Record.

3.) In compliance with the scheduling requirements of the project, the company will submit complete design plans to the Structures Design Office.

4.) In order to evaluate the performance and constructability of the wall system, a field and/or laboratory instrumentation-monitoring program, developed by the State Geotechnical Engineer's Office, may be required. These monitoring programs will be part of the contract bid package. The nature and extent of the monitoring program will likely differ significantly for various wall systems. Either Department personnel or a designee of the Department will monitor the wall system's performance and constructability, at the Department's discretion.

5,) After the project and monitoring programs are completed, the State Structures Design Office in conjunction with the State Geotechnical Engineer's Office will provide a written report summarizing the monitoring program results. This report will include recommendations for acceptance, rejection, or the need for an additional experimental project. The company will be notified in writing of the Department's decision regarding approval for the wall system.

6.) The course of action outlined above is only one alternative for granting final approval for a wall system. The Department may elect another course of action it deems appropriate to grant final approval. Final approval will be granted only if the Department determines the design and performance of the wall system to be satisfactory.

C. The company will be notified in writing of the Department's decision to either reject or grant final approval for the wall system. This notification will contain any limitations and/or restrictions (i.e., where the wall system may be used) for using the wall system deemed necessary by the Department.

D. Detailed structural drawings and Field Construction Manual (Item 3.6.1K below) will be posted on the Department's QPL website after final approval is granted.

3.6 Submittals

A. Submit a completed Product Evaluation Application

B. Submit the following documentation (in 8.5" x 11" format unless stated otherwise) and in the order listed:

1.) Trade Name of Product.

2.) Company's name, address, telephone number and plant locations.

3.) Applicable FDOT Wall Type as outlined in the *PPM* Chapter 30.

4.) Product Characteristics

5.) Wall System design model including laboratory and field experimentation that support all wall system theories.

6.) Practical applications with descriptions and photographs.

7.) Limitations and disadvantages of the system including:

a.) Estimated design life.

b.) Durability and corrosion data for the proposed soil reinforcement system.

d.) Long term vertical settlement the wall system can tolerate without exceeding normal stress range of the soil reinforcement and wall facing

c.) Differential settlement the wall system can tolerate without exceeding normal stress range of the soil reinforcement and wall facing, or the construction tolerances in FDOT Standard Specifications Section 548.

d.) The effects of scour and water flow.

C. Submit signed, dated, and sealed design calculation including:

1.) Date of the ***Structures Design Guidelines*** used in the design

2.) Internal stability calculations for soil reinforcement length vs. wall height in 2 ft. increments from 10 ft. up to a height of 40 ft.

3.) Two sets of calculations; one for sand backfill and one for limerock backfill. See SDG Section 3.13.2.G for Backfill Soil Parameters.

4.) Design calculations, either by hand or by a wall company program, with hand calculations verifying the program output. Hand calculations for a 20 ft. height for each soil condition are required.

D. If a proprietary wall system design program is used, provide the program with instructions at no cost to the Department for use in reviewing the design.

E. Corrosion/durability design procedures for soil reinforcement elements.

F. Submit signed, dated, and sealed design details in 11" x 17" MicroStation (preferred), AutoCAD or PDF format Structural drawings. Show all details specific to the wall system. These details supplement the retaining wall system Design Standards. Include to the following:

1.) Notes specific to the wall system.

2.) Panel sizes and reinforcing.

3.) Soil reinforcement connection to wall facings.

4.) Wall panel abutment interfacing.

5.) Slip joints.

6.) Steps in leveling pad.

7.) Soil reinforcing details around vertical obstructions (e.g. piling, inlets, etc).

8.) Filter fabric placement at panel joints and around obstructions (e.g. inlets, utilities, piling, etc.).

9.) Details for skewing soil reinforcement (15 degrees maximum) without cutting when grid reinforcement is used.

10.) Corner panels (required at all corners 70 degrees or greater).

11.) Bin wall details for acute corners (required at all corners less than 70 degrees).

12.) Details showing how to accommodate long term (post construction) wall settlement in excess of 4 inches without attaching soil reinforcement to the abutment (i.e. special wall design referred to in the SDG), thereby isolating the loads in the wall.

13.) If the proposed system is subject to corrosion due to stray electrical currents, details of how to ground the wall system.

G. Any common procedures for field and laboratory evaluation to be included in the project bid documents, including instrumentation and special requirements.

H. Pull-out test data for the proposed wall/reinforcement connection and size and type of soil reinforcement for wall system. Testing must be submitted for all sizes and/or soil reinforcement to be utilized on Department projects. For soil reinforcement grids, this includes all various configurations and combinations of longitudinal and transverse wires. Testing shall be done by an independent soil testing laboratory or testing agency certified by the Department.

I. Detailed material specifications showing material type, quality, certifications, field-testing, acceptance and rejection criteria and placement procedures.

J. Other information pertinent to the design and performance of the wall system as necessary.

K. A comprehensive field construction manual describing in detail, with illustrations, construction requirements and the step-by-step construction sequence for the wall system. Submit manual in 8.5” x 11” format in either pdf (preferred) or MS Word format.

L. General maintenance requirements for the wall system.

M. Listing of locations where the wall system is installed (locations within or close to Florida). Include the owner’s name, address and telephone number.

N. Typical unit costs (i.e. per square foot of wall surface fabricated, transported, and installed) supported by data from projects no more than five years old.

Attachment C
Plans Preparation Manual – Volume 1
Sections 30.2.3, 30.2.4 and Flowchart
For Projects Let July 1, 2006 and After

30.2.3 Retaining Walls (Proprietary Design - Control Plans only; Full Design not Required in Contract Plans)

Use the following procedure in preparing plans for wall projects.

1. BDR/30% Plans

Discuss and justify the use of proprietary retaining walls and FDOT Wall Types (see Index 5300) in the BDR. Provide documentation of all the site-specific geotechnical information and wall system considerations in the Retaining Wall Justification portion of the BDR. Include the Preliminary Control Plans and the information previously shown in this Section.

2. 90% Plans

Include the Control Plans into the 90% Plans submittal

General notes, common details, and the Table of FDOT Wall Types are shown in the ***2006 Design Standards***. Approved proprietary retaining wall system drawings and details are listed, with FDOT Wall Type, on the State Specifications Office QPL website.

The site-specific wall design details are submitted as shop drawings for each project.

30.2.4 Wall System Selection

Using the site-specific geotechnical information, the Engineer of Record (EOR), in cooperation with the geotechnical engineer, will determine all wall system requirements. Design considerations include short term and/or long term settlement, differential settlement (both longitudinal and from front of wall to end of concrete stems or soil reinforcement (rotation)), and global stability. Use the Flow Chart for Permanent Retaining Wall Design to determine:

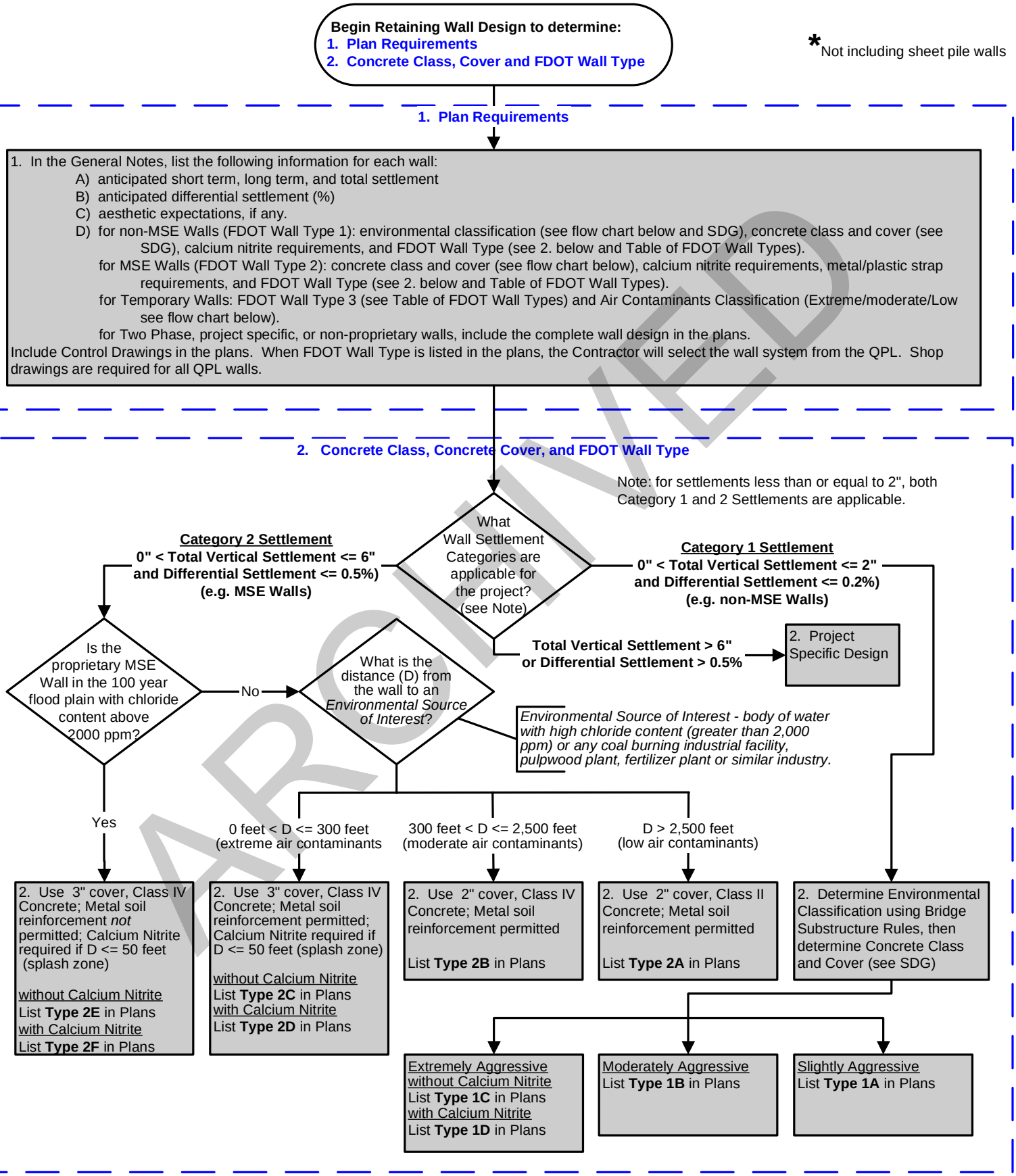
1. Plan requirements
2. Concrete Class, Concrete Cover, and FDOT Wall Type

For all walls, place notes on the General Notes sheet of the Control Plans in accordance with the Plan Requirements listed in the Flow Chart.

During construction on projects with a FDOT Wall Type listed in the plans, the contractor will submit, for approval by the engineer, a QPL approved wall system allowed in accordance with FDOT Wall Type Table. The July 2006 FDOT Standard Specifications Section 548, Retaining Wall Systems will state: Unless otherwise detailed and/or shown in the plans, choose a wall system from the Qualified Products List (QPL) in accordance with the FDOT Wall Type listed in the plans.

On projects with non-QPL Walls (non-proprietary walls, complex walls, two phase walls, total settlement > 6 inches, differential settlement > 0.5%, etc), the complete wall design and details are included in the plans.

Flowchart for Retaining Wall Design*



Attachment D
Addition of Table of FDOT Wall Types to Index 5300 of the 2006 Design Standards

Table of FDOT Wall Types

Wall Type[1]	Proprietary QPL Item	Settlement Category	Design Settlement Limitations				Durability Category	Durability Factors				Other Allowable Wall Types[7]									
			Total Settlement[2]		Differential Settlement[3]	Typical Wall Construction		Concrete Cover	Concrete Class	Calcium Nitrate	Soil Strap Type	1A	1B	1C	1D	2A	2B	2C	2D	2E	2F
Type 1	No						Project Specific					Project Specific									
Type 1A	Yes	1	<= 2”	and	<= 0.2%	Cantilever, Gravity, and Counterfort Walls	A	2"	II	No	n/a	X	X	X	X	X	X	X	X	X	X
Type 1B							B	2"	IV	No			X	X	X	X	X	X	X	X	X
Type 1C							C	3"	IV	No				X	X	X	X	X	X	X	X
Type 1D [4]							D	3"	IV	Yes					X	X	X	X	X	X	X
Type 2	No						Project Specific					Project Specific									
Type 2A	Yes	2	<= 6”	and	<= 0.5%	MSE Walls	A	2"	II [5]	No	metal					X	X	X	X	X	X
Type 2B							B	2"	IV [5]	No							X	X	X	X	X
Type 2C							C	3"	IV [5]	No								X	X	X	X
Type 2D							D	3"	IV [6]	Yes									X		X
Type 2E							E	3"	IV [6]	No	plastic									X	X
Type 2F [4]							F	3"	IV [6]	Yes											X
Type 3	Yes	3	n/a		<= 2.0%	Temporary Walls	n/a				metal/plastic	n/a									

1 - Listed in the Plans; Wall Type combines both Settlement Limitations and Durability Factors

2 - Amount of wall settlements that the will occur in its design life and includes both short and long term settlements. Short term settlements occur during wall construction and may contain elastic deformation and densification settlement. Long term settlements continue after the completion of the wall and may include consolidation and secondary consolidation/creep settlements.

3 - Settlements along the alignment of and perpendicular to the wall face; usually are not uniform. Expansion joints for the cast-in-place walls and slip joints for MSE walls are provided to control wall and wall panel cracks, respectively.

4 - Includes all underground walls and walls submerged in water

5 - For concrete requirements, see Specification Section 346 using slightly aggressive environment

6 - For concrete requirements, see Specification Section 346 using extremely aggressive environment

7 - "Other Allowable Wall Types" listed with an "X", have Settlement Limitations and Durability Factors greater than those required by the "Wall Type" (Column 1)