

Florida Department of Transportation

MSE Wall

Course Companion Document (CCD)

2008

You will find included:

- **A complete reading of the associated Specification**
- **A full-scale version of the MSE Wall Inspector's Checklist**
- **Note pages for the course with screen-by-screen visuals**

It is recommended that you download and print the CCD, use it throughout this course, take copious notes, and keep it handy for future reference.

SECTION 548

RETAINING WALL SYSTEMS

548-1 Description.

Construct permanent and temporary retaining wall systems in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract Documents or established by the Engineer. Unless otherwise noted in the plans, provide a wall system listed on the Qualified Products List (QPL) based on the FDOT Wall Type shown in the plans. Sheet pile walls and Cast-In-Place walls are not included in this Specification. All other wall systems used to cut back existing slopes are paid for under the same pay item numbers shown in the Basis of Payment Article of this Specification. Construct all walls of a specific type (MSE (Mechanically Stabilized Earth), counterfort, etc.) using the same wall system and supplier. If different types of wall systems must be used in a manner that causes one wall to interact with or influence another wall, coordinate the detailing of these areas of interaction/influence with the assistance of the Contractor's Engineer of Record.

Obtain Precast Concrete Wall System from a manufacturing plant that is currently on the Department's list of qualified precast concrete plants. Provide written certification from the manufacturer of the Wall System that it meets the requirements of this Section.

Ensure that each Wall System Component is permanently and legibly marked by etching on the back of each panel, the panel number or type, project number (when applicable), date cast and manufacturer's name or symbol. Ensure that each shipment of products to the job site includes a list of products shipped and the required written certification statement for each product. Provide this list and certification(s) to the Engineer.

548-2 Materials.

Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:

Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.

Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:

Meet the requirements of Section 931 utilizing Grade 60 (Black) steel.

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen.

Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in

accordance with ASTM A 185. Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents.

Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable.

Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20°F and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material. Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

548-2.4 Attachment Devices:

Use soil reinforcement attachment devices as required by the wall system chosen.

548-2.5 Joint Materials and Filter Fabrics:

548-2.5.1 Horizontal Joint Filler:

Use elastomeric or polymeric pads/fillers in all horizontal joints between precast components as recommended by the wall manufacturer. Ensure that the pads are of sufficient size and hardness to limit vertical stresses on the pad and concrete surface and to prevent concrete to concrete contact at the joints.

548-2.5.2 Joint Covers:

Cover joints and other wall openings with geotextile fabric meeting the requirements of Section 985 and Type D-5 of the Design Standards, Index No. 199. Apply an adhesive approved by the Engineer to the back of the precast component for attachment of the fabric material.

548-2.5.3 Alignment Pins:

Ensure that pins used to align the precast components during construction are of the size, shape and material required for the wall system chosen.

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section. Ensure that all backfill material used in the retaining wall volume is free draining (in-place permeability not less than 1 ft/day) and meets the requirements of this Section. Have the backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement. Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus 1 foot.

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267 and by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the plasticity index as determined by FM 1-T 090 does not exceed six and the liquid limit as determined by FM 1-T 089 is less than 15. The pH, as determined by FM 5-550, shall not be lower than five and not higher than ten, unless approved otherwise by the Engineer, as follows: For walls utilizing non-metallic soil reinforcement, the Engineer may approve using a backfill with a pH value between three and ten, if no metallic structures, such as metallic pipes, are placed within the backfill. Do not use backfill with a pH lower than three or higher than ten.

Use backfill for walls using soil reinforcements that meets the following gradation limits determined in accordance with FM 1-T 027 and FM 1-T 011:

Sieve Size	Percent Passing
3 1/2 inches	100
3/4 inch	70-100
No. 4	30-100
No. 40	15-100
No. 100	5-65
No. 200	0-15

In addition, for permanent walls utilizing metallic soil reinforcement, use backfill that meets the following electro-chemical test criteria for determining corrosiveness:

Criteria	Test Method
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Resistivity: > 30 Ω -m	FM 5-551
Sulfate content: < 200 PPM	FM 5-553
Soluble chloride content < 100 PPM	FM 5-552

For walls not using soil reinforcement, use backfill that meets the following gradation limits determined in accordance with FM 1-T 027 and FM 1-T 011:

Sieve Size	Percent Passing
3 1/2 inches	100
No. 200	0-15

548-3 Concrete Component Construction.

Construct concrete components in accordance with Section 400. Precast wall components are produced using certification acceptance; therefore, assume responsibility for performance of all quality control testing and inspections required by Sections 346 and 400 for the precast component construction. Perform all Quality Control inspection and testing using CTQP qualified personnel. Perform compressive strength testing in a laboratory inspected by CCRL or CMEC. The minimum time for form removal is 12 hours. Unless otherwise indicated in the Contract Documents, apply a Class 3 finish to the concrete surface for the front face, and roughly screed the rear face to eliminate open pockets of aggregate and surface distortions in excess of 1/4 inch.

548-3.1 Curing

Cure concrete components in accordance with Section 400.

548-3.2 Tolerances:

Meet the following manufactured tolerances:

1. Precast Component Dimensions: Lateral position of soil reinforcement attachment devices-within 1 inch. All other dimensions-within 3/16 inch.
2. Precast Component Squareness: Angular distortion of the component shall not exceed 0.2 inches in 5 feet.
3. Precast Component Surface Finish: Surface defects on smooth formed surfaces measured on a length of 5 feet shall not exceed more than 0.1 inch. Surface defects on textured finished surfaces measured on a length of 5 feet. shall not exceed 5/16 inch.

548-3.3 Marking of Precast Components:

Clearly mark each precast components with the date of manufacture, the 346 concrete production LOT number and the piece-mark.

548-4 Rejection of Precast Components.

The Department will reject all precast concrete wall components not meeting the quality standard of this Section and referenced Specifications. In addition, any of the following defects will be sufficient cause for rejection by the Department:

1. Defects that indicate unsatisfactory molding.
2. Defects indicating honeycombed or open texture concrete.
3. Defects in the physical characteristics such as:
 - Signs of aggregate segregation;
 - Broken or cracked corners;
 - Soil reinforcement attachment devices improperly installed/damaged;
 - Lifting inserts not useable;
 - Exposed reinforcing steel;
 - Insufficient cover over reinforcing steel;
 - Cracks at the alignment pipe or pin;
 - Insufficient concrete compressive strength;
 - Precast Component thickness in excess of $\pm 3/16$ inch from that shown in

the Contract Documents; or

Stained front face, due to excess form oil or other reasons. If the face of the precast component is stained or discolored to the point of rejection, the stain or discoloration may be removed or a Department approved stain or a Class 5 finish may be applied to attain a uniform appearance for the entire structure, to the satisfaction of the Engineer.

548-5 Handling Storage and Shipping.

Handle, store and ship all components in a manner that prevents chipping, cracks, fractures, excessive bending stresses, mud, dirt and debris. Support precast components in storage on firm blocking located immediately adjacent to the attachment device.

548-6 Construction Requirements.

548-6.1 General:

Due to the unique nature of the structure and concept, procure from the Wall Supplier fully detailed shop drawings, technical instructions, guidance in preconstruction activities and on-site technical assistance during construction. Closely follow any instructions from the Wall Supplier, unless otherwise directed by the Engineer. Submit a copy of any instructions from the Wall Supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the Wall Supplier finalizing shop drawings. Bring any conflicts not shown in the Contract Documents to the Engineer's attention.

548-6.2 Wall Excavation:

Excavate to the limits shown in the Contract Documents and in conformance with Section 125.

548-6.3 Foundation Preparation:

Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract Documents. Prepare the foundation in conformance with Section 125. In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of 8 tons for at least five passes or as directed by the Department's District Geotechnical Engineer. Remove and replace any soft or loose foundation subsoils which, are incapable of sustaining the required compaction to the Engineer's satisfaction. For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents. Cure the leveling pad a minimum of 12 hours before placement of precast wall components.

548-6.4 Wall Erection:

Assemble, connect and support wall components as recommended by the Wall Supplier. As backfill material is placed behind the wall face, maintain the wall in the vertical position or slightly battered into the backfill to provide a final vertical alignment (by means of bracing, temporary wooden wedges placed in the joint at the junction of the two adjacent precast components on the external side of the wall or other alignment aids). Remove wooden wedges as soon as the precast component above the wedged precast component is completely erected and backfilled. External bracing is required for the initial lift of MSE systems.

548-6.4.1 Tolerances for Permanent Walls:

Ensure that vertical tolerances (plumbness) and horizontal alignment tolerances do not exceed 3/4 inch when measured with a 10 foot straight edge. The maximum allowable offset in the joint between precast components is 3/4 inch. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) shall not exceed 1/2 inch per 10 feet of wall height. Horizontal and vertical joints between precast components shall not be less than 1/2 inch or more than 1 1/4 inch. Walls which do not meet these tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

548-6.4.2 Tolerances for Temporary Walls:

Ensure that vertical tolerances (plumbness) and horizontal alignment tolerances do not exceed 3 inches when measured with a 10 foot straight edge. The final overall vertical

tolerance of the completed wall (plumbness from top to bottom) shall not exceed 1 inch per 3 feet of wall height, not to exceed a total of 6 inches. Walls which do not meet these tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

548-6.5 Backfill Placement:

Ensure that vertical tolerances (plumbness) and horizontal alignment tolerances do not exceed 3 inches when measured with a 10 foot straight edge. The final overall vertical tolerance of the completed wall (plumbness from top to bottom) shall not exceed 1 inch per 3 feet of wall height, not to exceed a total of 6 inches. Walls which do not meet these tolerances will not be accepted by the Department and must be removed and reconstructed at no cost to the Department.

Place the backfill closely following the erection of each course of precast components or soil reinforcement layers and spread by moving the machinery parallel to the wall face. Do not allow equipment heavier than 8 tons closer than 3 feet behind the wall face. Place backfill in a manner to avoid any damage or disturbance to the wall materials or misalignment of the facing materials. Remove and replace any wall materials which become damaged or disturbed during backfill placement at no cost to the Department, or correct as directed by the Engineer. Remove and reconstruct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification at no cost to the Department.

Sheepfoot, grid rollers or other types of equipment employing a foot are not allowed. Achieve compaction within 3 feet of the back of the wall face using a power operated roller or plate weighing less than 1,000 lbs. At a distance greater than 3 feet from the back of the wall, a vibratory roller may be used, provided that the frequency and amplitude combined with bulk weight of the roller has performed satisfactorily at a trial section of the same type of wall. A smooth wheel or rubber tire roller is considered adequate. Ensure that the maximum lift thickness after compaction does not exceed 6 inches. Decrease the lift thickness if necessary, to obtain specified density.

Perform backfill compaction in a way that the compactor moves in a direction parallel to the wall face and proceeds from a distance not less than 3 feet behind the wall face toward the end of the soil reinforcement element.

Ensure that the moisture content of the backfill material prior to and during compaction is uniformly distributed throughout each layer of material. Use backfill material having a placement moisture content at the dry side of the Optimum Moisture content. To achieve the required compaction moisture content, use water that meets the requirements of Section 923. Do not use saltwater. Do not transport excessively moist backfill materials to the site for any reason. The Engineer will determine the Optimum Moisture Content in accordance with FM 5-521.

At the end of each day's operation, shape the last level of backfill to permit runoff of rainwater away from the wall face or provide a positive means of controlling run off away from the wall such as temporary pipe, etc.

548-7 Acceptance Program.

548-7.1 General Requirements:

Meet the requirements of 120-10.1 except delete the requirement of 120-10.1.4.1, 120-10.1.6 and 120-10.2.

548-7.2 Maximum Density Determination:

Determine a minimum Quality Control (QC) density of 100% of the maximum density in accordance with FM 1 T-180.

548-7.3 Density Testing Requirements:

Ensure compliance with the requirements of nuclear density testing in accordance with FM 1-T 238. Determine the in-place moisture content for each density test. Use FM 1-T 238, FM 5-507 (Determination of Moisture Content by Means of a Calcium Carbide Gas Pressure Moisture Tester), or FM 5-535 (Laboratory Determination of Moisture Content of Granular Soils By Use of a Microwave Oven) for moisture determination.

Perform these tests at a minimum frequency of one set of tests per LOT. One set of tests is defined as a density test for the fill within 3 ft behind the wall face and another density test for the fill beyond 3 feet behind the wall face.

Determine test locations including stations and offsets, using the random number generator provided by the Engineer. Do not use note pads or work sheets to record data for later transfer to the density log book. Notify the Engineer upon successful completion of QC testing on each LOT.

548-7.4 Acceptance Criteria:

Obtain a minimum density of 90% of the maximum dry density as determined by FM 1 T-180 within 3 ft behind the wall face and obtain a minimum density of 95% of the maximum dry density as determined by FM 1 T-180 from beyond 3 feet behind the wall face.

548-7.5 Frequency:

Conduct sampling and testing at a minimum frequency listed in the table below. The Engineer will perform Verification sampling and tests at a minimum frequency listed in the table below.

Test Name	Quality Control	Verification
Maximum Density	One per soil type	One per soil type
Density	One set of tests per LOT per Section.	One set of tests per four LOTs for each type of QC test.

548-8 Certification.

Furnish a copy of all test reports which are necessary to document compliance with the Specifications, at least ten days prior to wall construction.

Also furnish the Engineer a Certificate of Compliance certifying that the retaining wall materials, backfill and construction practices comply with this Specification.

Acceptance of furnished material will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

548-9 Method of Measurement.

The quantity to be paid for will be the plan quantity, in square feet, completed and accepted, of the area bounded by the top of the coping, the top of the leveling pad, top of structural footings, bottom of walls which do not have footings or leveling pads, and the beginning and end wall limits as shown on the wall control drawings.

548-10 Basis of Payment.

Price and payment will be full compensation for all work specified in this Section, including the design of the wall system, excavation required specifically for wall construction below the normal roadway template, soil reinforcement, leveling pad, footings, copings, fabric material, horizontal joint materials, alignment pins, repairs, labor, equipment, and other materials necessary to complete the wall in an acceptable manner as shown on the Contract drawings. The cost of granular fill for the normal roadway template will be included in the cost of embankment or borrow excavation, as applicable.

Payment will be made under:

- Item No. 548-12- Retaining Wall System (Permanent) - per square foot.
- Item No. 548-13- Retaining Wall System (Temporary) - per square foot.

MSE WALL INSPECTOR'S CHECKLIST

The following is a general checklist that can be followed when constructing MSE Wall Inspection. CONSULT WITH PROJECT ADMINISTRATOR FOR YOUR SPECIFIC PROJECT RESPONSIBILITIES.		Yes	No	NA
1.	Has the Contractor submitted wall shop drawings? (548-6)?	1	1	1
2.	Has the Contractor submitted the required select backfill certification (548-2.6)?	2	2	2
3.	Has the Contractor supplied a Certificate of Compliance certifying that the wall materials comply with the applicable sections of the specifications? (548-1& 548-8) a.) Has the Contractor supplied a copy of all test results performed by the Contractor or supplier, which are necessary to assure compliance with the specifications? (548-8)	3	3	3
4.	Has the Contractor furnished a copy of any instructions the wall supplier may have furnished? (548-6.1)	4	4	4
5.	Have the Shop Drawings been approved?	5	5	5
6.	Did the Contractor receive the correct panels (shape, size and soil reinforcement connection layout) per the approved drawings? (548-3)	6	6	6
7.	Did the Contractor receive the correct reinforcement (proper length and size)? (548-2.3)	7	7	7
8.	Have the panels and the reinforcement been inspected? (548-2.3, 548-3)	8	8	8
9.	If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-4)	9	9	9
10.	Are the panels and reinforcement properly stored to prevent damage? (548-5)	10	10	10
11.	Has the MSE Wall area been excavated to the proper elevation? (548-6.2)	11	11	11
12.	Has the area been proof rolled per the specifications? (548-6.3)	12	12	12
13.	Has all soft or unsuitable materials been compacted or removed and replaced? (548-6.3)	13	13	13
14.	If the Contractor is using any water in the MSE Wall area, does it meet the requirements of the specification? (548-6.5)	14	14	14
15.	Has the leveling pad area been properly excavated? (548-6.3)	15	15	15
16.	Has the leveling pad been set to the proper vertical and horizontal alignment?	16	16	16
17.	Has the leveling pad cured for a minimum of 12 hours before any panels are set? (548-6.3)	17	17	17
18.	Is the first row of panels properly placed? Do they have proper spacing, bracing, tilt and where required, do they have the spacers installed? (548-6.4)	18	18	18
19.	Has the proper filter fabric and adhesive been provided? (548-2.5.2)	19	19	19
20.	Is the filter fabric being properly placed over the joints? (548-2.5.2)	20	20	20
21.	Is the adhesive being applied to the panel, then the filter fabric being placed?	21	21	21
22.	Is the filter fabric being stored properly? (548-2.3)	22	22	22
23.	Is the Contractor using the correct panels (size, shape and number of connections)for that panel's wall location and elevation?	23	23	23
24.	Is the fill being placed and compacted in 6 inch lifts? (548-6.5)	24	24	24
25.	Is the equipment being kept off the soil reinforcement until a minimum of 6 inches of fill is placed?	25	25	25
26.	Are the lifts being placed by the proper method and sequence? (548-6.5)	26	26	26
27.	Is the fill being compacted by the correct equipment and in the correct pattern? (548-6.5)	27	27	27
28.	Do the Density tests (% of Maximum Density) pass? (548-7)	28	28	28
29.	Is the fill being brought up to or slightly above the soil reinforcement elevation before the reinforcement are connected?	29	29	29
30.	Is the soil reinforcement being properly connected (connections tight and all of the slack in the soil reinforcement removed?	30	30	30
31.	Is the soil reinforcement in the proper alignment? (548-)	31	31	31
32.	Are the alignments being checked periodically and within tolerance? (548-6.4.1 & 548-6.4.2)	32	32	32
33.	Is the Contractor removing the wooden wedges as per the specifications? (548-6.4)	33	33	33
34.	At the end of each day's operation, is the Contractor providing a means of directing rainfall away from the wall? (548-6.5)	34	34	34
35.	Has the Contractor backfilled the front of the wall?	35	35	35
36.	Is the correct coping being installed?	36	36	36

Slide 1 – Introduction

MSE WALL Inspector Course Introduction \$scplnf oCurre

WELCOME TO THE MECHANICALLY STABILIZED EARTH (MSE) WALL INSPECTOR'S COURSE



Mechanically Stabilized Earth (MSE) Walls are utilized to contain earth for embankments. These structures consist of a facing element combined with horizontal soil reinforcement to retain backfilled and compacted soil. They are constructed in a manner permitting them to become an integral part of the earth they contain.

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Slide 2 - Navigation Instructions

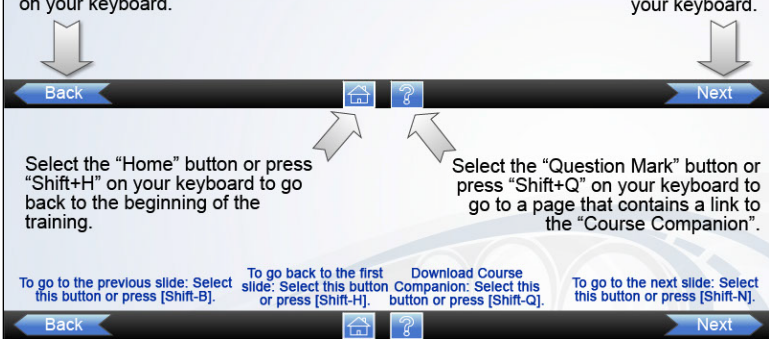
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Navigation Instructions

To navigate through this training:

To go to the previous slide, select the "Back" button or Press Shift+B on your keyboard.

To go to the next slide, select the "Next" button or Press Shift+N on your keyboard.



Select the "Home" button or press "Shift+H" on your keyboard to go back to the beginning of the training.

Select the "Question Mark" button or press "Shift+Q" on your keyboard to go to a page that contains a link to the "Course Companion".

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Slide 3 - Navigation Instructions

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Navigation Instructions

To navigate through this training:

The Table of Contents will allow you to see which chapters you have viewed and give you easy access to return to the chapter if needed for review.

You will not be able to skip ahead in this course. All questions at the end of each chapter must be answered before going to the next chapter.

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Slide 4 - Course Chapters

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Course Chapters

- Chapter 1** MSE Wall Components
- Chapter 2** Contract Documents
- Chapter 3** Installation Process
- Chapter 4** Inspectors Role & Responsibilities
- Chapter 5** Other Wall Types

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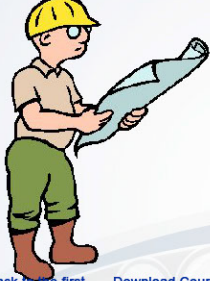
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Slide 5 - Purpose of this course...

MSE WALL Inspector Course Introduction \$Scplnf oCurre

Purpose of this course...

To prepare you to serve as a representative of the Florida Department of Transportation to ensure the work performed is in general accordance with the applicable construction documents and specifications.



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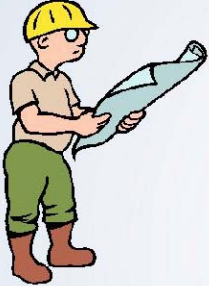
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Slide 6 - What you will learn...

MSE WALL Inspector Course Introduction \$Scplnf oCurre

What you will learn...

- Key Construction Document Elements
- Typical MSE Wall Components
- Typical MSE Wall Installation Process
- Applicable 455 Specifications
- Inspectors Role & Duties
- Other Types of Walls



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Slide 7 - Course Notes

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Important Course Notes:

1. Students are encouraged to print MSE Wall Course Companion Documents (CCD's) in order to have hard copy versions of important information and documents you will encounter throughout the Course.

Select the Help Button below to access the CCD's




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Slide 8 - CCD

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Slide 9 - Chapter 1

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Chapter 1
Mechanically Stabilized Earth (MSE)
Wall Components



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Slide 10 - Ch 1 Learning Objectives

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Chapter 1
Learning Objectives

- Identify common retaining wall components
- Describe typical backfill materials



NOTE: Throughout the lesson you will see this symbol

This indicates the FDOT Specification number relating to the lesson page topic. This is important to remember as many of the quiz questions are directly related to the FDOT Specifications governing this certification.

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Slide 11 - MSE Wall Components

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MSE Wall Components

The diagram illustrates the components of an MSE wall. On the left, the wall structure consists of horizontal layers of Wall Facing Panels held together by Wooden Wedges and Spacers. A Leveling Pad is placed at the base of the wall, above the Finished Grade. The Wall/Reinforcement Connection is shown at the top of the wall. Filter Fabric is placed between the wall and the Soil Reinforcement. The Soil Reinforcement is shown as horizontal layers of soil. The Select Backfill is the material behind the wall, and the Embankment Backfill is the material behind the soil reinforcement. The Original Ground is shown at the bottom right.

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Slide 12 - MSE Wall Materials

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MSE Wall Materials

- On the Qualified Products List (QPL)
- Construct all walls of a specific type (MSE, counterfort, etc) using the same wall system and supplier
- Obtain Precast Concrete Wall System from a manufacturing plant that is currently on the Department's list of qualified precast concrete plants
- Provide written certification from the manufacturer of the Wall System that it meets the requirements of Section 548 of the standard Specifications

548-1 Specifications on next slide...

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Slide 13 - MSE Wall Materials

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MSE Wall Materials



Construct permanent and temporary retaining wall systems in accordance with this Section and in conformance with the lines, grades, design, and dimensions shown in the Contract Documents or established by the Engineer. Unless otherwise noted in the plans, provide a wall system listed on the Qualified Products List (QPL) based on the FDOT Wall Type shown in the plans. Sheet pile walls and Cast-In-Place walls are not included in this Specification. All other wall systems used to cut back existing slopes are paid for under the same pay item numbers shown in the Basis of Payment Article of this Specification. Construct all walls of a specific type (MSE (Mechanically Stabilized Earth), counterfort, etc) using the same wall system and supplier. If different types of wall systems must be used in a manner that causes one wall to interact with or influence another wall, coordinate the detailing of these areas of interaction/influence with the assistance of the Contractor's Engineer of Record.

Obtain Precast Concrete Wall System from a manufacturing plant that is currently on the Department's list of qualified precast concrete plants. Provide written certification from the manufacturer of the Wall System that it meets the requirements of this Section.

Ensure that each Wall System Component is permanently and legibly marked by etching on the back of each panel, the panel number or type, project number (when applicable), date cast and manufacturer's name or symbol.

Ensure that each shipment of products to the job site includes a list of products shipped and the required written certification statement for each product. Provide this list and certification(s) to the Engineer.

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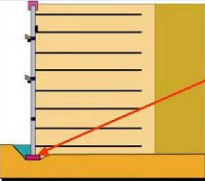
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Slide 14 - Leveling Pad

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Leveling Pad



Leveling Pad

A leveling pad is a non-reinforced concrete pad used to provide a level, consistent surface at the proper grade to place wall panels.


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Slide 15 - Leveling Pad

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Leveling Pad

548-8.3 Foundation Preparation: Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract Documents. Prepare the foundation in conformance with Section 125.

In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of 8 tons for at least five passes or as directed by the Department's District Geotechnical Engineer.

Remove and replace any soft or loose foundation subsoils which, are incapable of sustaining the required compaction to the Engineer's satisfaction.

For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents. Cure the leveling pad a minimum of 12 hours before placement of precast wall components.

548-6.4 Wall Erection: Assemble, connect and support wall components as recommended by the Wall Supplier. As backfill material is placed behind the wall face, maintain the wall in the vertical position or slightly battered into the backfill to provide a final vertical alignment (by means of bracing, temporary wooden wedges placed in the joint at the junction of the two adjacent precast components on the external side of the wall or other alignment aids).

Remove wooden wedges as soon as the precast component above the wedged precast component is completely erected and backfilled. External bracing is required for the initial lift of MSE systems.

Place soil reinforcement normal to the face of the wall, unless otherwise shown in the Contract Documents or directed by the Engineer. Prior to placement of the reinforcement, compact the backfill in accordance with 548-6.5

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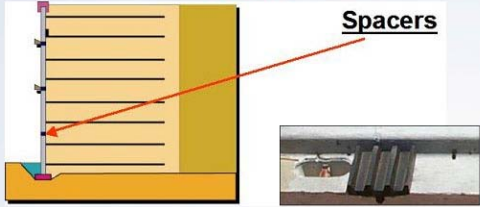
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Slide 16 – Spacers

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Spacers



Wall panel spacers are typically elastomeric or polymeric pads. They are placed in all horizontal joints between panels to limit vertical stresses on the pad and concrete surface and prevent concrete to concrete contact.

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Slide 17 – Spacers

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Spacers

548-2.5 Joint Materials and Filter Fabrics:

548-2.5.1 Horizontal Joint Filler: Use elastomeric or polymeric pads/fillers in all horizontal joints between precast components as recommended by the wall manufacturer. Ensure that the pads are of sufficient size and hardness to limit vertical stresses on the pad and concrete surface and to prevent concrete to concrete contact at the joints.

548-2.5.2 Joint Covers: Cover joints and other wall openings with geotextile fabric meeting the requirements of Section 985 and Type D-5 of the Design Standards, Index No. 199. Apply an adhesive approved by the Engineer to the back of the precast component for attachment of the fabric material.

548-2.5.3 Alignment Pins: Ensure that pins used to align the precast components during construction are of the size, shape and material required for the wall system chosen.

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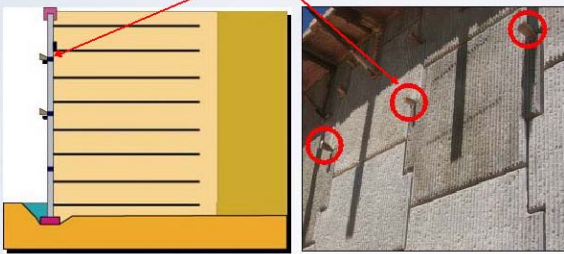
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Slide 18 - Wooden Wedges

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Wooden Wedges



The diagram on the left shows a cross-section of a wall panel being installed. A wooden wedge is shown wedged between the panel and the formwork to maintain its angle. The photograph on the right shows a real-world construction site where several wooden wedges are used to hold panels in place, with red circles highlighting the wedges.

Wooden wedges are used to help hold the panels at the correct batter during the backfill placement. The wooden wedges should be made from hard wood (such as oak, maple or ash).

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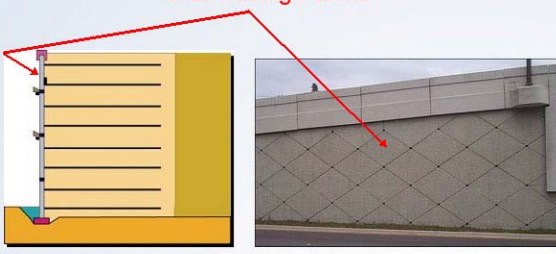
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Slide 19 - Wall Facing Panels

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Wall Facing Panels



Wall Facing panels are used to hold the backfill soil in place. The panels are typically concrete. The next few pages show other examples of Wall Facing Panels.

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Slide 20 - Wall Facing Panels

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Wall Facing Panels

548-2.1

548-2 Materials:
Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:
Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.
Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:
Meet the requirements of Section 931 utilizing Grade 60 (Black) steel

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Slide 21 - Square Panels

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Square Panels



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Slide 22 - Wall Facing Panels

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Square Panels

548-2

548-2 Materials.
Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:
Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.
Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:
Meet the requirements of Section 931 utilizing Grade 60 (Black) steel

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Slide 23 - Cruciform Panel Shape

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Cruciform Panel Shape



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Slide 24 - Wall Facing Panels

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Cruciform Panel Shape

548-2

548-2 Materials.
Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:
Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.
Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:
Meet the requirements of Section 931 utilizing Grade 60 (Black) steel

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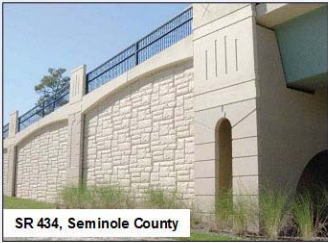
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Slide 25 - Finish Stone Panels

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Finish Stone Panels



SR 434, Seminole County

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Slide 26 - Wall Facing Panels

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Finish Stone Panels

548-2 Materials.

Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:

Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.

Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:

Meet the requirements of Section 931 utilizing Grade 60 (Black) steel

548-2

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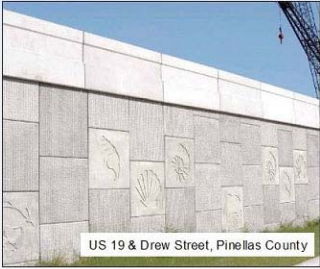
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Slide 27 - Custom Finishes

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A wide variety of custom architectural finishes are available as well.



US 19 & Drew Street, Pinellas County

548-2.1 Specifications on next slide...

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Slide 28 - Wall Facing Panels

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A wide variety of custom architectural finishes are available as well.

548-2.1

548-2 Materials:
Purchase the precast components, soil reinforcement, attachment devices, joint filler, filter fabric, and all necessary incidentals from the wall supplier chosen.

548-2.1 Concrete:
Ensure that concrete utilized for wall components is as specified in the Contract Documents and is consistent with the concrete class, environmental classification and admixture requirements for durability as stated in the Contract Documents. Produce and supply concrete for all wall components meeting the requirements of Section 346.
Produce and supply concrete for the leveling pad meeting the requirements of Section 347. Assume responsibility for performance of all testing required by Section 346. Use Department approved mix designs.

548-2.2 Reinforcing Steel:
Meet the requirements of Section 931 utilizing Grade 60 (Black) steel

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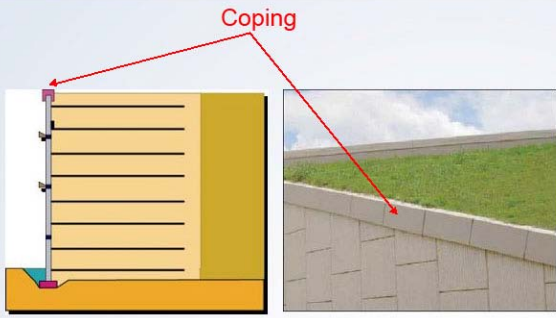
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Slide 29 – Coping

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Coping



The diagram on the left shows a cross-section of a wall with horizontal reinforcement layers. A coping is shown at the top, connecting the wall panels. The photograph on the right shows a real-world example of a coping on a concrete wall, with a red arrow pointing from the diagram to the photo.

Coping is used to tie in the top of the wall panels and to provide a smooth, pleasing finish to the wall top. It can be cast-in-place or prefabricated segments.

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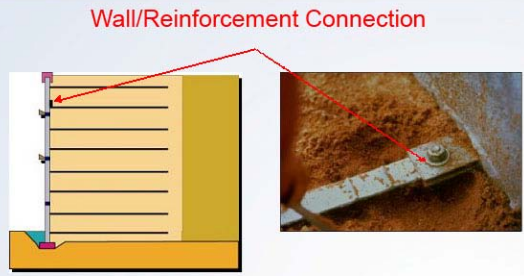
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Slide 30 - Wall/Reinforcement Connection

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Wall/Reinforcement Connection



The diagram on the left shows a cross-section of a wall with horizontal reinforcement layers. A connection is shown between the wall facing panel and the soil reinforcing. The photograph on the right shows a real-world example of a wall/reinforcement connection, with a red arrow pointing from the diagram to the photo.

The connection made between the wall facing panel and the soil reinforcing.

548-2.4 Specifications on next slide...

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Slide 31 - Wall/Reinforcement Connection

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Wall/Reinforcement Connection

548-2.4 Attachment Devices:

Use soil reinforcement attachment devices as required by the wall system chosen.

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Slide 32 - Filter Fabric

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Filter Fabric



A geotextile filter fabric is used to cover the joints between panels. It is placed on the backside of the panels. This keeps the backfill soil from being eroded through the joints and provides drainage.

548-2.3 Specifications on next slide...

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Slide 33 - Wall/Reinforcement Connection

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Filter Fabric

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen. Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in accordance with ASTM A 185.

Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents. Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable. Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20° and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material.

Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

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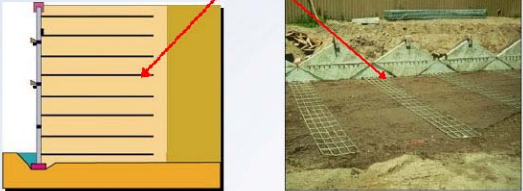
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Slide 34 - Soil Reinforcement

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Soil Reinforcement



Soil reinforcement is to provide tensile resistance to the soil and holds the wall facing panels in position. The soil reinforcement can be strips, grids, or mesh. The reinforcement can be made of steel (inextensible materials) or polymers (extensible materials). The next few pages show examples of other reinforcement options.

548-2.3 Specifications on next slide...

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Slide 35 - Wall/Reinforcement Connection

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Soil Reinforcement

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen. Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in accordance with ASTM A 185.

Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents. Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable. Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20° and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material.

Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

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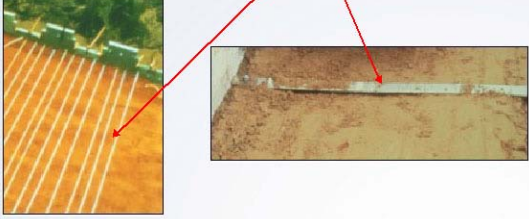
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Slide 36 - Metallic Straps

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Soil Reinforcement (metallic straps)



548-2.3

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Slide 37 - Wall/Reinforcement Connection

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Soil Reinforcement (metallic straps)

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen. Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in accordance with ASTM A 185.

Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents. Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable. Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20° and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material.

Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

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Slide 38 - Metallic Grid

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Soil Reinforcement (metallic grid)



548-2.3

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Slide 39 - Wall/Reinforcement Connection

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Soil Reinforcement (metallic grid)

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen. Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in accordance with ASTM A 185.

Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents. Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable. Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20° and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material.

Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

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Slide 40 - Non-Metallic Geogrid

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Soil Reinforcement (nonmetallic geogrid)



548-2.3

Specifications on next slide...

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Slide 41 - Wall/Reinforcement Connection

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Soil Reinforcement (*nonmetallic geogrid*)

548-2.3 Soil Reinforcement:

For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen. Use steel wire mesh and embedded loops shop fabricated from cold drawn steel wire meeting the minimum requirements of ASTM A 82, and weld into the finished mesh fabric in accordance with ASTM A 185.

Use steel strips hot rolled from bars to the required shape and dimensions with physical and mechanical properties meeting ASTM A 572 Grade 65 or as shown in the Contract Documents. Use shop-fabricated hot rolled steel tie straps meeting the minimum requirements of ASTM A 570, Grade 50, or as shown in the Contract Documents. Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable. Use structural geosynthetics made of polypropylene, select high density polyethylene or high-tenacity polyester fibers having cross-sections sufficient to permit significant mechanical interlock with the soil/backfill. Use geosynthetics having a high tensile modulus in relation to the soil/backfill. Use geosynthetics having high resistance to deformation under sustained long term design load while in service and resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

Store the geosynthetics in conditions above 20° and not greater than 140°F. Prevent mud, wet cement, epoxy, and like materials from coming into contact with and affixing to the geosynthetic material.

Rolled geosynthetic may be laid flat or stood on end for storage. Cover the geosynthetic and protect from sunlight prior to placement in the wall system. Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

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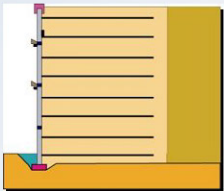
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Slide 42 - Select Backfill

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Select Backfill



- Free draining
- Tested for pH, resistivity, sulfate and chloride content
- Do not use backfill material containing more than 2.0% by weight of organic material
- Provide certification that soil meets the requirements of 548-2.6

548-2.6 Specifications on next slide...

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Slide 43 - Wall/Reinforcement Connection

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Select Backfill

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section. Ensure that all backfill material used in the retaining wall volume is free draining (in-place permeability not less than 1 ft/day) and meets the requirements of this Section. Have the backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement.

Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus 1 foot.

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267 and by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T90 and the liquid limit as determined AASHTO T90 is less than 15. The pH, as determined by FM 5-550, shall not be lower than 5.0 and not higher than 9.0. For wall systems utilizing geosynthetic backfill reinforcement, concrete panels with at least 3 inches of concrete cover over the panel reinforcement, and if no metallic structures, such as metallic pipes are placed within the backfill, the pH as determined by FM 5-550, shall not be lower than 4.5 and not higher than 9.0.

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Slide 44 - Backfill Selection Criteria

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These next few pages will delve deeper into the Backfill selection criteria.

548-2.6 Backfill Material:Use backfill for walls using soil reinforcements that meets the following gradation limits determined in accordance with FM 1-T 027 and FM 1-T 011:

Sieve Size	Percent Passing
3½ inches	100
¾"	70-100
No. 4	30-100
No. 40	15-100
No. 100	0-65
No. 200	0-12

Specifications on next slide...

To go to the previous slide: Select this button or press [Shift-B].
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Slide 45 - Wall/Reinforcement Connection

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These next few pages will delve deeper into the Backfill selection criteria.

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section. Ensure that all backfill material used in the retaining wall volume is free draining (in-place permeability not less than 1 ft/day) and meets the requirements of this Section. Have the backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement.

Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus 1 foot.

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267 and by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T90 and the liquid limit as determined AASHTO T90 is less than 15. The pH, as determined by FM 5-550, shall not be lower than 5.0 and not higher than 9.0. For wall systems utilizing geosynthetic backfill reinforcement, concrete panels with at least 3 inches of concrete cover over the panel reinforcement, and if no metallic structures, such as metallic pipes are placed within the backfill, the pH as determined by FM 5-550, shall not be lower than 4.5 and not higher than 9.0.

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Slide 46 - Backfill Selection Criteria (cont.)

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Backfill selection criteria continued...

548-2.6 Backfill Material:In addition, for permanent walls utilizing metallic soil reinforcement, use backfill that meets the following electro-chemical test criteria for determining corrosiveness:

Criteria	Test Method
Resistivity: > 30 Ω·m	FM 5-551
Sulfate content: <200 PPM	FM 5-553
Soluble chloride content: <100 PPM	FM 5-552

Specifications on next slide...

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Slide 47 - Wall/Reinforcement Connection

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Backfill selection criteria continued...

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section. Ensure that all backfill material used in the retaining wall volume is free draining (in-place permeability not less than 1 ft/day) and meets the requirements of this Section. Have the backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement.

Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus 1 foot.

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267 and by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T90 and the liquid limit as determined AASHTO T90 is less than 15. The pH, as determined by FM 5-550, shall not be lower than 5.0 and not higher than 9.0. For wall systems utilizing geosynthetic backfill reinforcement, concrete panels with at least 3 inches of concrete cover over the panel reinforcement, and if no metallic structures, such as metallic pipes are placed within the backfill, the pH as determined by FM 5-550, shall not be lower than 4.5 and not higher than 9.0.

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Slide 48 - Backfill Selection Criteria (cont.)

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Backfill selection criteria continued...

548-2.6 Backfill Material:For walls not using soil reinforcement, use backfill that meets the following gradation limits determined in accordance with FM 1-T 027 and FM 1-T 011:

Sieve Size	Percent Passing
3½ inches	100
No. 200	0-12

Specifications on next slide...

To go to the previous slide: Select this button or press [Shift-B].
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Slide 49 - Wall/Reinforcement Connection

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Backfill selection criteria continued...

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section. Ensure that all backfill material used in the retaining wall volume is free draining (in-place permeability not less than 1 ft/day) and meets the requirements of this Section. Have the backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement.

Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida. The retaining wall volume is defined to extend from the top of the leveling pad or footing, or bottom of walls which do not have footing or leveling pads, to the finish grade line and from the face of the wall to a vertical plane passing through the end of the extreme wall component (straps, counterforts, etc.) plus 1 foot.

For constructing the retaining wall volume, do not use backfill material containing more than 2.0% by weight of organic material, as determined by FM 1-T 267 and by averaging the test results for three randomly selected samples from each stratum or stockpile of a particular material. If an individual test value of the three samples exceeds 3%, the stratum or stockpile will not be suitable for constructing the retaining wall volume.

Ensure that the material is non-plastic as determined by AASHTO T90 and the liquid limit as determined AASHTO T90 is less than 15. The pH, as determined by FM 5-550, shall not be lower than 5.0 and not higher than 9.0. For wall systems utilizing geosynthetic backfill reinforcement, concrete panels with at least 3 inches of concrete cover over the panel reinforcement, and if no metallic structures, such as metallic pipes are placed within the backfill, the pH as determined by FM 5-550, shall not be lower than 4.5 and not higher than 9.0.

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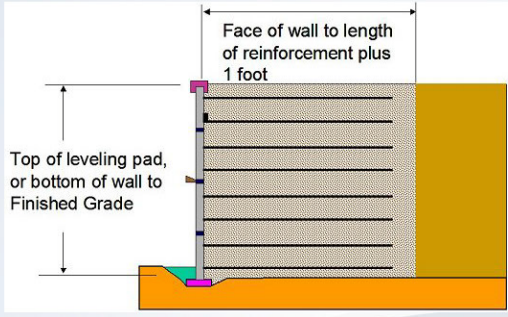
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Slide 50 - Backfill Volume

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MSE Wall Backfill Volume



The diagram illustrates the backfill volume for an MSE wall. It shows a cross-section of a wall with horizontal reinforcement layers. The backfill is shown as a yellow area extending from the face of the wall to a vertical plane that is 1 foot beyond the length of the reinforcement. The vertical extent of the backfill is from the top of the leveling pad or the bottom of the wall to the finished grade.

Face of wall to length of reinforcement plus 1 foot

Top of leveling pad, or bottom of wall to Finished Grade

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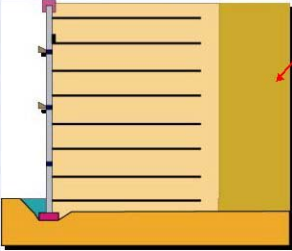
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Slide 51 - Embankment Backfill

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Embankment Backfill (non-reinforced area)



Embankment backfill is the backfill material that is permitted in normal embankment construction.

Must meet requirements of: Section 105, Contractor Quality, Control General Requirements, and Section 120, Excavation & Embankment

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Slide 52 - Chapter 1 Quiz

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This is the end of Chapter 1 of the MSE WALL Inspector Course!



Before proceeding to the next chapter, you must successfully complete the Chapter 1 quiz.

Please press the forward arrow to begin the quiz.

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Slide 78 - Chapter 2

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Chapter 2
Contract Documents



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Slide 79 - Ch. 2 Learning Objectives

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Chapter 2
Learning Objectives

- Explain the governing order of Contract Documents
- Locate Plan Sheet/Design Standards details related to MSE Walls for inspection purposes
- Identify key inspection elements of the Contract Documents

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Slide 80 - Governing Order of Documents

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Governing Order of Documents

This image depicts the governing order of Construction documents. It is important that the Inspector know and understand this order. We will review each one on the following pages.

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Slide 81 - Gov. Order of Documents (cont.)

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Governing Order of Documents

Standard Specifications - set forth the minimum directions, provisions and requirements relating to the method and manner of performing the work, or to the quantities and qualities of materials and labor to be furnished under the contract.

As shown, these are at the bottom of the governing order and superceded by all other contract documents.

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Slide 82 - Gov. Order of Documents (cont.)


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Governing Order of Documents



Supplemental Specifications - these are the additions and revisions to the Standard Specifications.

Until the next printing of the Specifications book, these are listed on-line under either January to June, or July to December Workbooks.



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Slide 83 - Gov. Order of Documents (cont.)


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Governing Order of Documents



Developmental Standards - A specification developed around a new process, procedure, or material and designated as a developmental specification.

For example, Settlement Platforms would be in this category.



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Slide 84 - Gov. Order of Documents (cont.)


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Governing Order of Documents



Design Standards - Some sheets in the Plans are "standard" sheets that are not designed specifically for this individual project but are standard designs and details used on FDOT projects.

An example of this is the Standard Index No. 6020 for Permanent MSE Wall Retaining Systems.



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Slide 85 - Gov. Order of Documents (cont.)

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Governing Order of Documents



Plans - The approved plans, including reproductions thereof, showing the location, character, dimensions and details of the work to be done. This would include any required Shop Drawings also.



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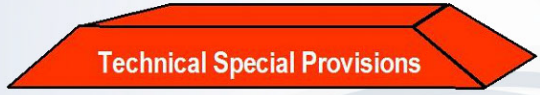
Slide 86 - Gov. Order of Documents (cont.)

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Governing Order of Documents



Technical Special Provisions - Specifications prepared, signed and sealed by an Engineer registered in the State of Florida other than the State Specifications Engineer, or his designee, which are made part of the Contract as an attachment to the Specifications Package.



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Slide 87 - Gov. Order of Documents (cont.)

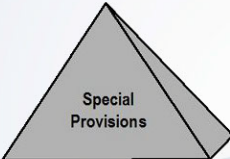
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Governing Order of Documents



Special Provisions - Specific clauses adding to or revising the Standard Specification, setting forth conditions varying from or additional to the Standard Specifications, for a specific project.

As shown, they supercede all other contract documents.



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Slide 88 – References

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References

As a MSE Wall Inspector you can perform your duties only if you know and understand the construction of MSE Walls as well as the project to be constructed.

Several of the pertinent items that a MSE Wall Inspector needs are standard specifications and documents applicable to MSE Walls on all Florida Department of Transportation projects. Other items are project specific items such as plans, special provisions, shop drawings, and contractor submittal's.

The following page gives a brief list of items that the Inspector should have in his or her possession prior to start of the work:

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Slide 89 - References (cont.)

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References

- Complete set of Project Plans
- Required Shop Drawings
- Minutes of Meetings related to MSE Walls
- Special Provisions
- Technical Special Provisions for project
- Standard Specifications for Road and Bridge Construction
- Supplemental Specifications
- Design Standards (6020 to 6201)

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Slide 90 - Quick Quiz

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Quick Quiz

Write down your answer to these two questions, then proceed to the next page to check your answer...

The Standard Specifications supercede all documents except the Plan Set.

True False

The Special Provisions for a project are only superceded by the Technical Special Provisions

True False

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Slide 91 - Quick Quiz Answer

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Quick Quiz

Write down your answer to these two questions, then proceed to the next page to check your answer...

The Standard Specifications supercede all documents except the Plan Set.

True **False**

The Special Provisions for a project are only superceded by the Technical Special Provisions

True **False**

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Slide 92 - Plan Set Review

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Plan Set Review

The project is to be constructed in accordance with the Approved Contract Documents and to be effective, the Inspector must become knowledgeable of their assigned project and the related documents.

This is accomplished by reviewing all of the project related documents.

There can be quite a few documents for each project, and it is not uncommon to overlook a certain document.

The use of a checklist, such as the one to the right, can assist the Inspector in not missing or forgetting any of the documents.

PLANS AND SPECIFICATIONS CHECKLIST

The inspector needs to be able to locate the following in the plans and Specifications and be familiar with them before the job commences. These documents should be with you at the job site and all items for reference.

YES	NO	DOCUMENTS
<input type="checkbox"/>	<input type="checkbox"/>	Sections
<input type="checkbox"/>	<input type="checkbox"/>	Key Sheets
<input type="checkbox"/>	<input type="checkbox"/>	Summary of Play Areas
<input type="checkbox"/>	<input type="checkbox"/>	Hand/Profile Sheets
<input type="checkbox"/>	<input type="checkbox"/>	Traffic Control Plans
<input type="checkbox"/>	<input type="checkbox"/>	Drainage Plans
<input type="checkbox"/>	<input type="checkbox"/>	IBBY Adjustments
<input type="checkbox"/>	<input type="checkbox"/>	General Notes
<input type="checkbox"/>	<input type="checkbox"/>	Report of Core Drains
<input type="checkbox"/>	<input type="checkbox"/>	Elevation Views
<input type="checkbox"/>	<input type="checkbox"/>	Shop Drawings
<input type="checkbox"/>	<input type="checkbox"/>	MSE Wall Drawings
<input type="checkbox"/>	<input type="checkbox"/>	Technical Special Provisions
<input type="checkbox"/>	<input type="checkbox"/>	Standard Specifications
<input type="checkbox"/>	<input type="checkbox"/>	Supplemental Specs
<input type="checkbox"/>	<input type="checkbox"/>	Other Disturbed Standards
<input type="checkbox"/>	<input type="checkbox"/>	CPM Manual
<input type="checkbox"/>	<input type="checkbox"/>	Wall Manufacturer Instructions

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Slide 93 - Key Parts of Plan

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Key Parts of Plan

In this section of the Chapter, we will review some of the Components/Sheets contained within a set of Plans, and what significance or importance they represent.

COMPONENT/SHEET	IMPORTANCE
General Notes	This sheet may contain notes that override 548 specifications. Also will have design assumptions made.
Shop Drawings	Shop Drawings submitted by Wall Supplier showing installation details.
General Plan & Elevation	Shows layout and elevation of walls & foundation (one or more sheets).

As a Certified Inspector, you should bring to the Project Administrator's attention any missing information, conflicting details, critical or possible type-o's, etc... as a result of your review of the project plans. You will need to have any issues clarified or corrected prior to the start of construction.

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Slide 94 - Key Parts of Plan (cont.)

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Key Parts of Plan

COMPONENT/SHEET	IMPORTANCE
Plan Revisions	Always check for revised sheets to determine if there are any changes that affect the MSE Wall installation.
Key Sheet	Shows what is contained in the plan set, revisions, location, Financial I.D. No., or FAP No.
Summary of Pay Items	1) Quantities 2) Pay Items
Plan and Profile	Good for project layout- shows stationing, location of MSE Walls, utilities, etc. Note that all utilities are not necessarily shown and locations may not be correct.
Wall Details	Shows the details of the wall system to be utilized.

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Slide 95 - Key Parts of Plan (cont.)

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Key Parts of Plan

In this section of the Chapter, we will review selected sheets from a typical set of plans. We will also look at some specific details of those selected sheets by enlarging them for better viewing.

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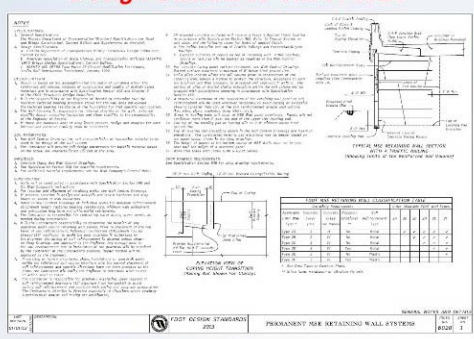
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Slide 96 - Design Standards Sheet 6020

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Design Standards Sheet 6020



This is an example of a typical Design Standards Sheet 6020

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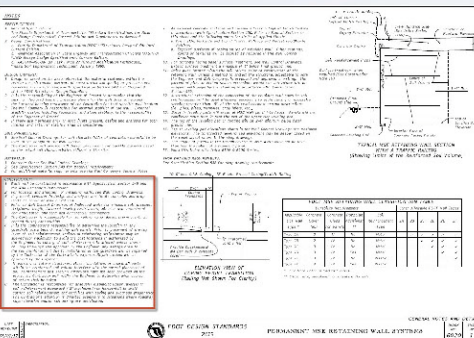
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Slide 97 - Design Standards Sheet 6020 (cont.)

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Design Standards Sheet 6020



Pay close attention to the "Notes" section of a plan. For this portion, we will focus a bit on the "Construction" portion of the notes, which is highlighted in the RED box.

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Slide 98 - Design Standards Sheet 6020 (cont.)

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Design Standards Sheet 6020

CONSTRUCTIONS

1. Walls will be constructed in accordance with Specification Section 548 and the Wall Company's Instructions.
2. For location and alignment of retaining walls, see Wall Control Drawings.
3. If present, consider in design and analysis and locate manholes and drop inlets as shown on wall elevations.
4. Refer to Wall Control Drawings of Individual walls for minimum reinforcement strip/mesh length, factored bearing resistances, minimum wall embedment and anticipated long term and differential settlements.
5. The Contractor is responsible for water retention as needed during construction.
6. It is the Contractor's responsibility to determine the location of any guardrail posts behind retaining wall panels. Prior to placement of the top layer of soil reinforcement, individual reinforcing strips/mesh may be skewed (15° maximum) to avoid the post locations if authorized by the Engineer. No cutting of soil reinforcement is allowed unless shown on Shop Drawings and approved by the Engineer. Any damage done to the soil reinforcement due to installation of the guardrail will be repaired by the Contractor at the Contractor's expense. Repair method will be approved by the

Note Item Number 1 states that the wall will be constructed in accordance with Section 548 of the Standard Specifications. Other important data such as; controlling dimensions and the Wall Manufacturers instructions can also be located in this section of the plans.

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Slide 99 - Design Standards Sheet 6020 (cont.)

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Design Standards Sheet 6020

Let's take a closer look at these two sections of the plan sheet, highlighted in the RED boxes.

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Slide 100 - Design Standards Sheet 6020 (cont.)

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Design Standards Sheet 6020

13. For Mechanically Stabilized Earth (MSE) Walls, steps in leveling pads will occur at panel interfaces. Panels will not cantilever more than 2" past the end of the leveling pad.

14. The top of the leveling pad or footing will be 2'-0" minimum below final ground line.

Note some of the controlling dimensions within this section

and

Requirements for Shop Drawings here

SHOP DRAWING REQUIREMENTS
See Specification section 548 for shop drawing requirements

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Slide 101 - Temp. Wall - Key Sheet

MSE WALL Inspector Course Chapter 2 \$scplnf oCurre

Temporary Wall - Key Sheet

CONSTRUCTION DRAWINGS
Proposed Plan

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

INTERSTATE 95 OVER S. R. 100
FLAGLER COUNTY, FLORIDA

NO.	SECTION	NO.	DETAILS
1	GENERAL NOTES	1	GENERAL NOTES
2	SECTION	2	SECTION
3	SECTION	3	SECTION
4	SECTION	4	SECTION
5	SECTION	5	SECTION
6	SECTION	6	SECTION
7	SECTION	7	SECTION
8	SECTION	8	SECTION
9	SECTION	9	SECTION
10	SECTION	10	SECTION
11	SECTION	11	SECTION
12	SECTION	12	SECTION
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14	SECTION	14	SECTION
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96	SECTION	96	SECTION
97	SECTION	97	SECTION
98	SECTION	98	SECTION
99	SECTION	99	SECTION
100	SECTION	100	SECTION

Since we're on a roll, let's review a few more specific Plan Set sheets, and items of significance to you as the Inspector. These sheets are related to the construction of a Temporary Wall.

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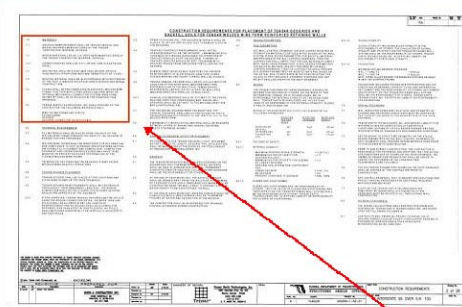
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Slide 102 - Temp. Wall - Construction Requirements

MSE WALL Inspector Course Chapter 2 \$scplnf oCurre

Temporary Wall - Construction Requirements



Let's take a closer look at this section, highlighted in the RED box, that addresses Materials.

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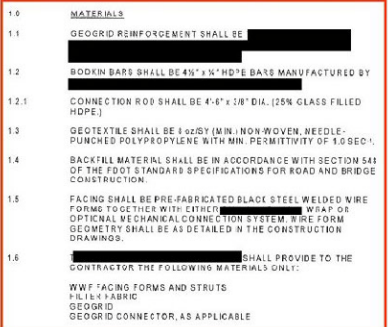
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Slide 103 - Temp. Wall - Construction Requirements

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Temporary Wall - Construction Requirements



Note that specific details on the materials are provided here. The Inspector will need to verify material compliance once materials are on site.

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Slide 104 - Temp. Wall - Construction Requirements

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Temporary Wall - Construction Requirements

3.0 **GEGRID PLACEMENT**

3.1 **GEGRID SHALL BE PLACED AT THE LOCATIONS AND ELEVATIONS SHOWN ON THE SHOP DRAWINGS.**

3.2 **GEGRID REINFORCEMENTS SHALL BE CONTINUOUS THROUGHOUT THEIR EMBEDMENT LENGTH(S). THE BODKIN CONNECTION SHALL NOT BE UTILIZED FOR SPLICING GEGRID UNLESS PRE-APPROVED BY THE ENGINEER.**

3.2.1 **IF PRE-APPROVED, UNIAxIAL GEGRIDS MAY BE SPLICED USING THE BODKIN CONNECTION DETAIL. NO MORE THAN ONE SPLICE SHALL BE ALLOWED IN ANY ONE LENGTH OF REINFORCEMENT AND NO SPLICES SHALL BE ALLOWED FOR GEGRIDS LESS THAN 6 FEET IN LENGTH (EACH). NO SPLICE SHALL BE PLACED HORIZONTALLY OR VERTICALLY ADJACENT TO ANOTHER SPLICE.**

Note that this section includes specific details on the placement of the geogrid. For example Items 3.2 & 3.2.1 cover the splicing of the geogrid material. These and others similar provide guidance to the Inspector on acceptable procedures.

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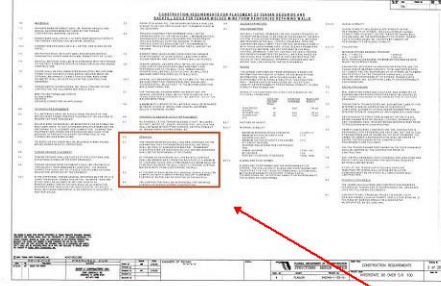
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Slide 105 - Temp. Wall - Construction Requirements

MSE WALL Inspector Course Chapter 2 \$Scplnf oCurre

Temporary Wall - Construction Requirements



Let's take a closer look at this section, highlighted in the **RED box**, that addresses Drainage.

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Notes

Slide 106 - Temp. Wall - Construction Requirements

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Temporary Wall - Construction Requirements

5.0 **DRAINAGE**

5.1 THE REINFORCED WALL HAS BEEN DESIGNED ON THE ASSUMPTION THAT THE REINFORCED BACKFILL MATERIAL SHALL BE FREE OF SUBSURFACE SEEPAGE. PERMANENT SUBSURFACE WATER (SEEPAGE) COLLECTION AND DIVERSION SHALL BE THE RESPONSIBILITY OF OTHERS.

5.2 AT THE END OF EACH WORK DAY, THE BACKFILL SURFACE SHALL BE GRADED AWAY FROM THE WALL FACE AT A MINIMUM OF 2 PERCENT SLOPE AND A TEMPORARY SOIL BERM SHALL BE CONSTRUCTED NEAR THE WALL CREST TO PREVENT SURFACE WATER RUNOFF FROM OVERTOPPING THE WALL.

5.3 AT THE END OF EACH WORK DAY, BACKFILL SURFACE SHALL BE COMPACTED WITH A SMOOTH WHEEL ROLLER TO MINIMIZE PONDING OF WATER AND SATURATION OF THE BACKFILL.

5.4 THE CONTRACTOR SHALL BE RESPONSIBLE FOR DRAINAGE CONTROL AS NEEDED DURING CONSTRUCTION.

Note that this section includes specific details related to Drainage. From the Inspector's standpoint, Items 5.2 & 5.3, related to "end of day" tasks are significant and will need to be verified.

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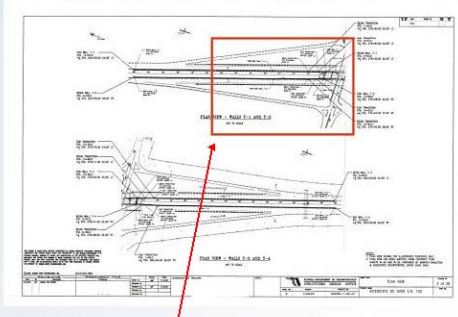
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Slide 107 - Temp. Wall - Plan Review

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Temporary Wall - Plan Review



Let's take a closer look at this section of a Temporary Wall-Plan Review.

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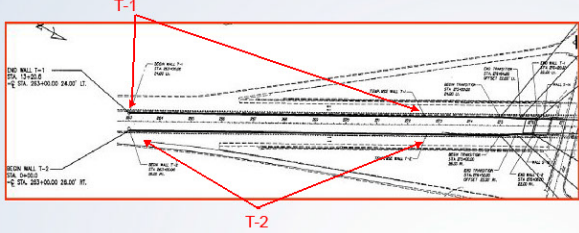
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Slide 108 - Temp. Wall - Plan Review

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Temporary Wall - Plan Review



Centerline of Construction - Stationing, as a rule, increases South to North and West to East

Note: Wall T-1 begins at Sta. 263+00 and Ends at 276+20.60, offset LT. of Centerline
Wall T-2 begins at Sta. 263+00 and Ends at 276+08.00, offset RT. of Centerline

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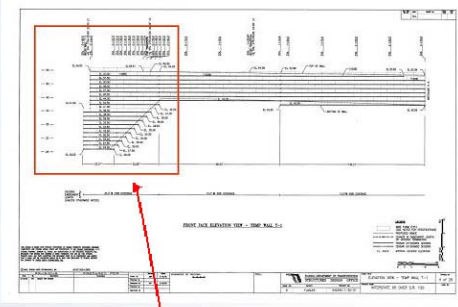
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Slide 109 - Temp. Wall - Elevation View

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Temporary Wall - Elevation View



Let's take a closer look at this section of a Temporary Wall-Evaluation View.

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Slide 110 - Temp. Wall - Elevation View

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Temporary Wall - Elevation View

This section from the Elevation View, provides the plan elevations for the wall. Increments for elevations on the wall are at 1.5' intervals, which is the height of a section of temporary wall, as shown on the Detail sheet.

Therefore, the 1st panel, begins at El. 26.00 and extends up to El. 27.50, which is the bottom elevation of the 2nd panel. The panels Start at Sta. 0+00 and go to Sta. 0+22.00, a length of 22'.

2nd panel begins

1st panel begins

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Slide 111 - Temp. Wall – Details

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Temporary Wall - Details

This section provides details for the Elevation view on the previous page.

Note the Typical 1'-6" height.

The Structural Geogrid is to extend back from the wall face (embedded) per project requirements.

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Slide 112 - Temp. Wall – Details

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Temporary Wall - Details

Now, let's take a closer look at this section of a Temporary Wall-Details

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Slide 113 - Temp. Wall – Details

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Temporary Wall - Details

This detail is related to the Wall Face.

Note the requirements related to the 6" geotextile wrap and Geogrid.

Note the Biaxial Face wrap is to extend a minimum of 4 ft. out from the wall face and that there is to be a minimum of 3" of backfill placed between the layers of Geogrid. This was also stated in the Construction Requirements.

W4.0xW4.0 WELDED WIRE FORMS
 1'-6" (TYP.)
 1'-0" (MIN.) TOP BASKET ONLY
 REINFORCED FILL
 STRUCTURAL GEGRID (CUT GEGRID SO THAT TRANSVERSE BAR IS IN CONTACT WITH GEOTEXTILE)
 3" MIN.
 GEOTEXTILE WRAP 6" MIN. TOP AND BOTTOM EMBEDMENT
 TENSAR BIAXIAL GEGRID ROLLED OUT PARALLEL TO WALL FACE
 4'-0" MIN. BIAXIAL FACE WRAP
WALL FACE DETAIL
 NOT TO SCALE

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Slide 114 - Chapter 2 Quiz

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This is the end of Chapter 2 of the MSE WALL Inspector Course!



Before proceeding to the next chapter, you must successfully complete the Chapter 2 quiz.

Please press the forward arrow to begin the quiz.

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Slide 140 - Chapter 3

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Chapter 3
Installation Process



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Slide 141 - Slide 141

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Chapter 3
Learning Objectives

Explain the site preparation and leveling pad installation process

Describe the basic wall assembly process

Explain basic backfilling requirements

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Slide 142 - 548-10 Certification

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548-10 Certification

Furnish a copy of all test reports which are necessary to document compliance with the Specifications, at least ten days prior to wall construction.

Also furnish the Engineer a Certificate of Compliance certifying that the retaining wall materials, backfill and construction practices comply with this Specification.

Acceptance of furnished material will be based on the Certificate of Compliance, accompanying test reports, and visual inspection by the Engineer.

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Slide 143 - MSE Wall Installation Process Process

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MSE Wall Installation Process

```
graph TD; A[Site Preparation] --> B[Leveling Pad Installation]; B --> C[Wall Panel Installation]; C --> D[Soil Reinforcement]; D --> E[Backfilling];
```

Site Preparation - In this phase, the site is prepared for the MSE Wall installation

Leveling Pad Installation - Installation of a non-reinforced leveling pad to place the first row of panels on is constructed

Wall Panel Installation - Starting with the first row, the wall panels are installed

Soil Reinforcement - Soil reinforcement is attached to the wall panels.

Backfilling - Backfilling is performed

This chart gives an overview of the MSE Wall installation phases, which are covered in more detail in this Chapter.

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Slide 144 - MSE Walls Foundation

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MSE Walls, like any other structure, need a good foundation to build upon.

Proper preparation of the site increases the potential for a proper performing wall. Prior to beginning fill placement, the area under the MSE wall should be prepared in accordance with the earthwork specifications including removal of any unsuitable soils.

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Slide 145 - Full Specification Text

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Full Specification Text

548-8.2 Wall Excavation: Excavate to the limits shown in the Contract Documents and in conformance with Section 125.

548-8.3 Foundation Preparation: Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract Documents. Prepare the foundation in conformance with Section 125.

In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of 8 tons for at least five passes or as directed by the Department's District Geotechnical Engineer. Remove and replace any soft or loose foundation subsoils which, are incapable of sustaining the required compaction to the Engineer's satisfaction.

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Slide 146 - 548-8.1 General

MSE WALL Inspector Course Chapter 3 \$Scplnf oCurre

548-8.1 General

Procure from the Wall Supplier fully detailed shop drawings, technical instructions, guidance in preconstruction activities and on-site technical assistance during construction.

Closely follow the Wall Supplier's instructions.

Submit a copy of any instructions from the Wall Supplier to the Engineer.

Because they are unique structures, and there is more than one MSE Wall manufacturer, it is important that the Contractor obtain and follow the instructions for the specific wall system they plan to install.

Prior to commencing construction, the Contractor is to have obtained from the Wall Supplier the applicable technical instructions, shop drawings, etc. and submitted them to the Engineer.

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Slide 147 - Wall Excavation

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Wall Excavation

548-8.2 Wall Excavation:

- Excavate to the limits shown in the Contract Documents
- In conformance with Section 125.

A good foundation is important for any type of structure to be built and MSE Walls are no different. Part of preparing the foundation is the excavation of existing materials to the planned grade.

Excavation should be to the limits shown in the plans and be in accordance with Section 125.

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Slide 148 - Wall Excavation

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Wall Excavation

548-8.3 Foundation Preparation:

Width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract Documents.

Use vibratory roller weighing a minimum of 8 tons for at least five passes.

Remove and replace any soft or loose foundation subsoils.

Following excavation of the foundation area, it should be graded level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the contract documents. Any soft or loose materials encountered are to be removed and replaced in general accordance with Section 125 of the Standard Specifications. Compaction of the graded foundation should be performed with a vibratory roller weighing a minimum of 8 tons, with a minimum of 5 passes applied. Vibratory compactors should be operated in accordance with the manufacturer's instructions for speed and amplitude.

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Slide 149 - Leveling Pad Installation

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Leveling Pad Installation

Let's take a closer look at the process from the ground-up; step- by-step. When ready, click the forward arrow to proceed...

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Slide 150 - Leveling Pad Installation

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Leveling Pad Installation

With the preparation of the original ground, an excavation for the leveling pad is performed.

Keep in mind that the leveling pad is just that – a leveling pad. A leveling pad is un-reinforced concrete with no structural value. A footing is reinforced with rebar, and by definition, has structural capacity to support load. If there are issues starting out with the leveling pad, such as unsuitable soils, wet or standing water areas, it can certainly result in additional construction issues.

Excavation for leveling pad Leveling pad Prepared surface

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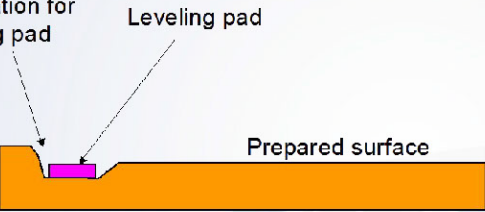
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Leveling Pad Installation

548-8.3 Foundation Preparation:

...For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents.

...Cure the leveling pad a minimum of 12 hours before placement of precast wall components.



Excavation for leveling pad

Leveling pad

Prepared surface

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Slide 152 - Leveling Pad Installation

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Leveling Pad Installation

Once the area has been properly prepared an unreinforced concrete leveling pad is poured in place. Even though the leveling pad is not "structurally" important, it is important to the construction of the wall. The leveling pad sets the horizontal and vertical alignment of the wall. It must be in the correct horizontal position, level and at correct grade. If the wall is not level, the panels will bind against each other causing spalling of the edges and corners. Experience has shown that if the wall is not started correctly, the finished product is seldom satisfactory.



Level for relatively flat terrain

Stepped to accommodate elevation changes

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Slide 153 - Leveling Pad Installation


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Leveling Pad Installation


To repeat: The leveling pad sets the horizontal and vertical alignment of the wall. It must be in the correct horizontal position, level and at correct grade. No more than 2 shims (each 3/16" thick) should be required to level the panels on the leveling pad. If the wall is not level, the panels will bind against each other causing spalling of the edges and corners.

Experience has shown that if the wall is not started correctly, the finished product is seldom satisfactory.

Too many shims; Not good



Not good way to start



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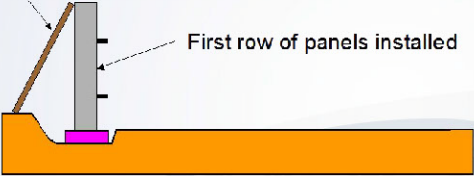
Slide 154 - Wall Panel Installation

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Wall Panel Installation

After the leveling pad is properly installed and ready to accept the first row of panels, it is necessary to brace the first row to get the wall started. Keep in mind the vertical tolerances. For example, using too many shims, is most commonly a problem that will only get worse. Walls that are started out of tolerance, usually stay that way.

Braced to maintain Vertical alignment



First row of panels installed

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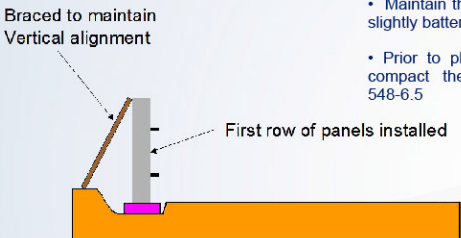
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Wall Panel Installation

548-8.4 Wall Erection:

- Assemble as recommended by the Wall Supplier
- External bracing is required for the initial lift of MSE systems
- Maintain the wall in the vertical position or slightly battered into the backfill
- Prior to placement of the reinforcement, compact the backfill in accordance with 548-6.5



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Wall Panel Installation

Full Specification Text

548-8.4 Wall Erection: Assemble, connect and support wall components as recommended by the Wall Supplier. As backfill material is placed behind the wall face, maintain the wall in the vertical position or slightly battered into the backfill to provide a final vertical alignment (by means of bracing, temporary wooden wedges placed in the joint at the junction of the two adjacent precast components on the external side of the wall or other alignment aids).

Remove wooden wedges as soon as the precast component above the wedged precast component is completely erected and backfilled. External bracing is required for the initial lift of MSE systems.

Place soil reinforcement normal to the face of the wall, unless otherwise shown in the Contract Documents or directed by the Engineer. Prior to placement of the reinforcement, compact the backfill in accordance with 548-6.5

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Wall Panel Installation

Depending on the wall height, the number of reinforcement connections on the back of the panel may vary. The panels with the most connections will be typically the lower panels of the wall. In the upper portions of the wall, the number of connections may be less. It is important that the panels are used in their proper position.



Alignment pins to maintain proper spacing

The correct placement of the first row or two of panels is very important. A spacer bar should be used to get the correct placement. They need to be on the proper alignment, grade and be level.

The correct spacing is also very important. Without the correct spacing, panel corners will crack and spall with settlement.

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Slide 158 - Wall Panel Installation

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Wall Panel Installation

- Vertical plumbness and horizontal alignment within $\frac{3}{4}$ " when measured with 10 foot straight edge.
- Overall vertical plumbness within $\frac{1}{2}$ " per 10 foot of wall height.
- Maximum panel offset at a joint is $\frac{3}{4}$ "
- Panel joints (horizontal and vertical) shall be between $\frac{1}{2}$ " and $1\frac{1}{4}$ "



Check for plumbness and alignment

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Wall Panel Installation

548-2.4 Attachment Devices: Use soil reinforcement attachment devices as required by the wall system chosen.



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Wall Panel Installation

548-2.5 Joint Materials and Filter Fabrics:

548-2.5.1 Horizontal Joint Filler:
Use elastomeric or polymeric pads/fillers in all horizontal joints between precast components as recommended by the wall manufacturer.

Ensure that the pads are of sufficient size and hardness to limit vertical stresses on the pad and concrete surface and to prevent concrete to concrete contact at the joints.



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Wall Panel Installation

548-2.5.2 Joint Covers: Cover joints and other wall openings with geotextile fabric meeting the requirements of Section 985 and Type D-5 of the Design Standards, Index No. 199. Apply an adhesive approved by the Engineer to the back of the precast component for attachment of the fabric material.



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Wall Panel Installation

Spacing blocks must be used. Wooden wedges are also used to help hold the vertical alignment of the panels. The contractor should not keep more than three levels of the wooden wedges in the wall. If more than three levels of wedges are used they may become bound in the wall making them very difficult to remove and can cause the panel to spall.

The vertical and horizontal alignments need to be checked periodically to ensure proper alignment. This will also allow problems to be spotted early and make corrections before the panels get too far out of alignment.



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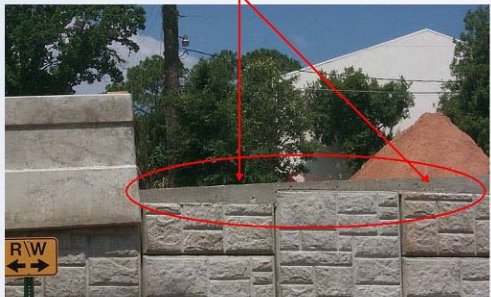
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Wall Panel Installation

A leveling course of concrete is placed prior to setting the precast units in place. This provides the vertical control needed for the barriers.



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Slide 164 - Soil Reinforcement

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Soil Reinforcement

These are examples of properly placed soil reinforcement. Improperly placed soil reinforcements will result in the safety factor of the wall design being compromised. Therefore, it is of high importance that the horizontal and vertical spacing of the soil reinforcements be maintained per the plans for the wall design.



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Soil Reinforcement

Improperly placed soil reinforcements. Special situation may dictate certain reinforcement issues. However, when they are not placed properly, the integrity of the wall is at risk. If there is any question as to the correct way to avoid utilities, piles, drainage structures, or at corners - **ASK!!!!!!**



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Slide 166 - Soil Reinforcement

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Soil Reinforcement

548-2.3 Soil Reinforcement: For walls utilizing soil reinforcement, use reinforcement consisting of steel wire mesh, metal strips or structural geosynthetics as required for the wall system chosen.

Soil reinforcements must be properly and adequately attached to the back of the wall panel. Check the Shop Drawings for additional details.



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Soil Reinforcement

Soil reinforcements must be properly and adequately attached to the back of the wall panel. The method of attachment is dependant upon the wall supplier. Check the Shop Drawings for details.



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Soil Reinforcement

Attachment of the plastic soil reinforcements is again dependent upon the wall supplier. As before, check the Shop Drawings for details.



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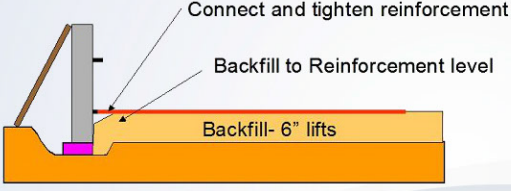
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Slide 169 - Backfilling

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Backfilling

548-8.5 Backfill Placement: Perform work in accordance with an approved Quality Control Plan (QCP) meeting the requirements of 6-8. A LOT is defined as a single lift of finished embankment not to exceed 500 feet in length. Isolated compaction operations will be considered as separate LOTs. For multiple phase construction, a LOT will not extend beyond the limits of the phase...



The diagram shows a cross-section of a retaining wall. A vertical reinforcement bar is shown extending from the wall face into the backfill. The backfill is shown in layers, with the top layer labeled 'Backfill- 6" lifts'. A horizontal line indicates the 'Backfill to Reinforcement level'. A label 'Connect and tighten reinforcement' points to the top of the reinforcement bar.

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Backfilling

548-8.5 Backfill Placement: (Key Elements)

- Place the backfill closely following the erection of each course of precast components
- Spread by moving the machinery parallel to the wall face.
- Do not allow equipment heavier than 8 tons closer than 3 feet behind the wall face.
- Place backfill in a manner to avoid any damage or disturbance to the wall materials or misalignment of the facing materials.



Specifications on next slide...

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Slide 171 - Wall/Reinforcement Connection

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Backfilling

548-8.5 Backfill Placement: (Full Text)

548-8.5.1 Compacted Select Backfill: Perform work in accordance with an approved QC Plan meeting the requirements of 105-3. A LOT is defined as a single lift of finished embankment not to exceed 500 feet in length or cumulative length of continuous interconnected walls. Backfill within 3 feet from the panels and backfill beyond 3 feet from the panels are separate LOT's. Overlapping retaining wall volumes may be considered one LOT, excluding the 3 feet width behind the panels. Strips up to 8 feet wide between 2 retaining wall volumes constructed with the same material in one operation may be considered as one LOT with the retaining wall volumes. Isolated compaction operations will be considered as separate LOT's. For multiple phase construction, a LOT will not extend beyond the limits of the phase.

Place the backfill closely following the erection of each course of precast components or soil reinforcement layers and spread by moving the machinery parallel to the wall face. Do not allow equipment heavier than 8 tons closer than 3 feet behind the wall face. Place backfill in a manner to avoid any damage or disturbance to the wall materials or misalignment of the facing materials. Remove and replace any wall materials which become damaged or disturbed during backfill placement at no cost to the Department, or correct as directed by the Engineer. Remove and reconstruct any misalignment or distortion of the wall facing due to placement of backfill outside the limits of this specification at no cost to the Department.

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Slide 172 - Backfilling

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Backfilling

548-8.5.1 Compacted Select Backfill: (Key Elements Continued)

- Sheepfoot, grid rollers or other types of equipment employing a foot are not allowed
- Achieve compaction within 3 feet of the wall face using a power operated roller or plate weighing <1,000 lbs
- Vibratory rollers may be used greater than 3 feet from the wall with a satisfactory trial section- smooth wheel or rubber tire roller is considered adequate.
- Maximum lift thickness after compaction does not exceed 6 inches.

Specifications on next slide...

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Backfilling

548-8.5.1 Compacted Select Backfill: (Full Text Continued)

548-8.5.1 Compacted Select Backfill: (Full Text Continued)
...Sheepfoot, grid rollers or other types of equipment employing a foot are not allowed. Achieve compaction within 3 feet of the back of the wall face using a power operated roller or plate weighing less than 1,000 lbs. At a distance greater than 3 feet from the back of the wall, a vibratory roller may be used, provided that the frequency and amplitude combined with bulk weight of the roller has performed satisfactorily at a trial section of the same type of wall. A smooth wheel or rubber tire roller is considered adequate. Ensure that the maximum lift thickness after compaction does not exceed 6 inches. Decrease the lift thickness if necessary, to obtain specified density.

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Slide 174 - Backfilling Placement

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Backfilling Placement



In the photo to the immediate left, steel wheeled rollers are shown. On the far left in the photo is the "large" roller that needs to stay a safe distance from the face of the wall. To the right is a small roller. Small equipment is to be used close to the wall.



In the bottom left picture, a sheepfoot roller is being used. The "feet" can damage the soil reinforcements, therefore they are NEVER permitted for using in compacting MSE wall backfill.

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Backfilling Placement

548-8.5 Backfill Placement: (Key Elements Continued)

- Perform backfill moving in a direction parallel to the wall
- Backfill from a distance not less than 3 feet from the wall face toward the end of the soil reinforcement element
- Use backfill material having a placement moisture content at the dry side of the Optimum Moisture content.
- Shape the last level of backfill to permit runoff of rainwater away from the wall face or provide a positive means of controlling run off away from the wall.
- Where flowable is used ensure that no metallic components (including soil reinforcement) are in partial contact with the flowable fill. Metallic components must be completely encapsulated by the flowable fill.

548-8.5 Specifications on next slide...

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Slide 176 - Wall/Reinforcement Connection

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Backfilling Placement

548-8.5 Backfill Placement: (Full Text Continued)

Perform backfill compaction in a way that the compactor moves in a direction parallel to the wall face and proceeds from a distance not less than 3 feet behind the wall face toward the end of the soil reinforcement element.

...p Ensure that the moisture content of the backfill material prior to and during compaction is uniformly distributed throughout each layer of material. Use backfill material having a placement moisture content at the dry side of the Optimum Moisture content.

To achieve the required compaction moisture content, use water that meets the requirements of Section 923. Do not use saltwater. Do not transport excessively moist backfill materials to the site for any reason. The Engineer will determine the Optimum Moisture Content in accordance with FM 5-521.

At the end of each day's operation, shape the last level of backfill to permit runoff of rainwater away from the wall face or provide a positive means of controlling run off away from the wall such as temporary pipe, etc.

548-8.5

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Backfilling Placement

In the proper placement of the loose soil over the soil reinforcements, it is imperative to keep the spreading machinery both away from the soil reinforcement so as to prevent damage to the reinforcement and also to keep the machinery away from the wall so as to prevent too much lateral force on the panel face.

Proper placement, keeping away from the wall



Improper placement, too close to the wall



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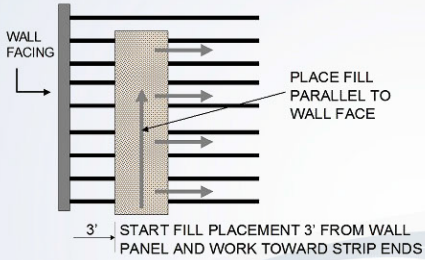
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Slide 178 - Backfilling

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Backfilling

As shown in this illustration, the fill should be placed parallel to the wall face (same direction as the wall). The placement operation should remain three feet from the wall facing (panel) to keep from inducing lateral stresses into the panel. The fill should then be worked towards the reinforcement ends (towards the middle). Care should also be taken not to damage the soil reinforcements during the placement process.



WALL FACING

PLACE FILL PARALLEL TO WALL FACE

3' START FILL PLACEMENT 3' FROM WALL PANEL AND WORK TOWARD STRIP ENDS

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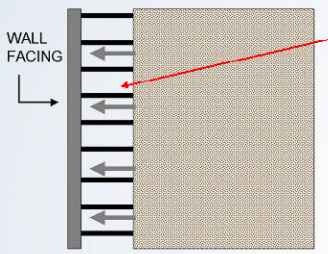
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Backfilling

FILLING FROM THE 3' POINT TO THE WALL PANELS



From the distance of three feet to the wall, the backfill should be spread using primarily manual means (physical labor and shovels).

WALL FACING

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The diagram shows a cross-section of a wall with vertical reinforcement bars. A shaded area represents the backfill. Arrows point from the backfill towards the wall, indicating the direction of spreading. A red arrow points to the 3-foot distance from the wall face where the backfilling process begins.

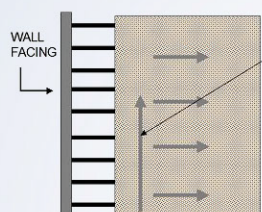
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Slide 180 - Compaction

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Compaction

Similar to placing the fill, the compaction of the fill should be accomplished in the same manner. Beginning three feet from the wall face, compact using the larger roller parallel to the wall (direction of the wall). Then compact towards the end of the soil reinforcements (towards the middle).



ROLL THE COMPACTOR PARALLEL TO THE WALL FACE

WALL FACING

START COMPACTING 3' FROM THE WALL PANEL AND WORK TOWARD THE REINFORCEMENT ENDS.

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The diagram shows a cross-section of a wall with vertical reinforcement bars. A shaded area represents the backfill. Arrows point from the backfill towards the wall, indicating the direction of compaction. A red arrow points to the 3-foot distance from the wall face where the compaction process begins.

Notes

Slide 181 – Compaction


MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Compaction

This Photo illustrates the compaction discussed on the previous page.

Larger roller to the left; a safe distance from the wall

Smaller roller to the right; closer to the wall face



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Notes

Slide 182 – Compaction

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Compaction

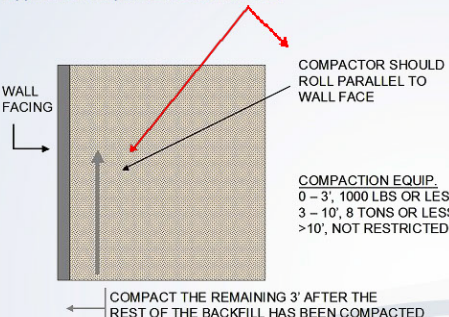
The illustration shows the location of the various sizes of compaction equipment that can be used to compact wall backfill. Note that the direction of rolling is always supposed to be parallel to the wall face.

WALL FACING

COMPACTOR SHOULD ROLL PARALLEL TO WALL FACE

COMPACTOR EQUIP.
0 – 3', 1000 LBS OR LESS
3 – 10', 8 TONS OR LESS
>10', NOT RESTRICTED

COMPACT THE REMAINING 3' AFTER THE REST OF THE BACKFILL HAS BEEN COMPACTED



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Notes

Slide 183 – Compaction

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Compaction

Examples of two smaller compactors for use in compacting the fill within three feet of the wall.



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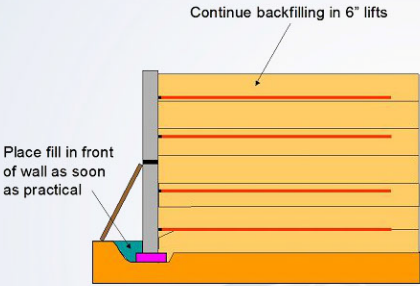
Notes

Slide 184 - Backfilling & Compaction

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Backfilling & Compaction

Two things are illustrated in this picture. One is the continuing construction of the wall. The other is the filling in of the area in front of the wall. FDOT plans call for there to be a level space in front of the wall. [this is also a good thing to look for on the plans, and is an important detail often overlooked.]



Continue backfilling in 6" lifts

Place fill in front of wall as soon as practical

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Notes

Slide 185 - Backfilling & Compaction

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Backfilling & Compaction

Keep the water from running to the panels and down the slope otherwise you will wash out the fill around the reinforcement. Slope the fill so that water does not run along and down the back side of the panels. When this is not done, erosion exposes the reinforcement and creates repair problems for the contractor. It sometimes necessitates the contractor to disassemble the wall and rebuild it. The picture on the right shows what water can do if it is not controlled.



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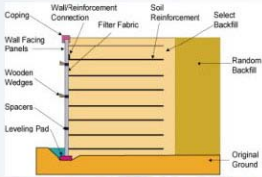
Notes

Slide 186 - Review of Chapter Objectives

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

Review of Chapter Objectives

- Explain the site preparation and leveling pad installation process
- Describe the basic wall assembly process
- Explain basic backfilling requirements



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Slide 187 - Chapter 3 Quiz

MSE WALL Inspector Course Chapter 3 \$scplnf oCurre

This is the end of Chapter 3 of the MSE WALL Inspector Course!



Before proceeding to the next chapter, you must successfully complete the Chapter 3 quiz.

Please press the forward arrow to begin the quiz.

To go to the previous slide: Select this button or press [Shift-B]. To go back to the first slide: Select this button or press [Shift-H]. Download Course Companion: Select this button or press [Shift-Q]. To go to the next slide: Select this button or press [Shift-N].


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Slide 213 - Chapter 4

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Chapter 4
Inspector's Roles and Responsibilities



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Slide 214 - Ch 4 Learning Objectives

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Chapter 4

Learning Objectives

- Describe the functions of the Inspector
- Describe the recording & reporting responsibilities of the Inspector
- Identify & use Inspector forms & checklists
- Identify applicable 548 Specifications
- When to Call "911" and Who to call

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Slide 215 - Purpose


MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Purpose

The Inspector is to serve as the State's representative and ensure that the project is constructed in general accordance with the construction documents, plans and specifications.

It is the responsibility of the Inspector to:

- Know the Plans & Specifications, both 548 & Job Specific
- Ensure that when the Shop Drawings are more stringent than the wall control drawings, that the more stringent of the two is implemented.)
- Record and document activity relative to the Plans & Specifications
- Raise a "red flag" for work performed non-compliant with the Plans & Specifications
- Contact the Project Administrator if judgment is needed



The purpose of an MSE Wall Inspector is to ensure the MSE all is constructed as specified.

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Slide 216 - Your Role

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Your Role

- Serve as the Department's Representative
- Be a "Recorder"
- Be a "Reporter"
- Keep the Engineer Informed



The purpose for a MSE Wall Inspector is to serve as a representative of the State to assure that the State gets what it is paying for. Every job is constructed with a set of guidelines called the Project Plans & Specifications. In addition, walls will have an additional set of shop drawings. Part of the inspector's duty is to monitor the job according to the Plans & Specifications. If any part of the work is done outside of these documents, then it becomes imperative that it be "fixed" as quickly, inexpensively, and as safely as possible. Therefore, the Inspector serves as the eyes and ears of the Engineer, and the reporter for the job.

Engineer, based upon 548 Specifications, Definitions, is the Director, Office of Construction acting directly or through their authorized representatives.

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Slide 217 - Your Role

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Your Role



The designer knows this project by heart, they have lived it for probably a few years.

The Contractor knows each detail of constructing the MSE Walls. They went through the plans and specs with a fine tooth comb during the bidding process.

The Inspector is generally brought in almost at the last moment so it is imperative that you become familiar with the details of the project as quickly as possible.

The Inspector should receive, in advance of the project starting, the approved plans. Review these documents for items that effect you.

The Inspector's whole purpose of being on-site is to verify that the project was built in accordance with the plans and specifications. These documents, in reality, outline your responsibilities. You must know the governing specifications.



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Slide 218 - Inspector's Tool Kit

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Inspector's Tool Kit

Approved Job Information <ul style="list-style-type: none"><input type="checkbox"/> Project Plans & Specifications w/ Revisions<input type="checkbox"/> Special Provisions & Technical Special Provisions<input type="checkbox"/> Wall Manuf. Documents	Forms <ul style="list-style-type: none"><input type="checkbox"/> MSE Wall Form (Can Make?)<input type="checkbox"/> Report of Daily Construction<input type="checkbox"/> Personal Diary
Daily Essentials <ul style="list-style-type: none"><input type="checkbox"/> Hard Hat, Boots, Reflective jacket<input type="checkbox"/> Ear, Eye Protection<input type="checkbox"/> Scale, Pen / Pencil<input type="checkbox"/> Calculator, Camera, Stop Watch<input type="checkbox"/> 20' & 150' Tape<input type="checkbox"/> Builders Square, Level	References <ul style="list-style-type: none"><input type="checkbox"/> 455 Specifications<input type="checkbox"/> Inspector's Qualification Program Manual



Above is a table of basic "tools" of the Inspector. The list is not intended to include all things that an Inspector may need for specific project or items that might be individual and/or company required.

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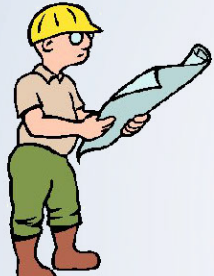
Slide 219 – Recorder

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Recorder

The Inspector should make accurate, unbiased observations of all important MSE Wall construction events.

- Daily Report of Construction
- Personal Field



This is very important if construction proceeds other than anticipated. If this is the case, the Inspector should not assume faulty operation on the part of the Contractor; the cause may be unanticipated site conditions, errors or omissions on the part of the designer, or equipment malfunction.

The record kept by the Inspector is the only form of tangible data to make an engineering judgment whenever installation problems arise. Elimination of potential causes can best be made on the basis of accurate and complete data observations.

The Inspector should always be aware that prompt performance of these duties is required so that follow-up work can be performed expeditiously.

Job progress photographs should be made.

Hence the saying, "Document, Document, Document" and be consistent with your documentation.

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Slide 220 – Reporter

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Reporter

Keep the Project Administrator Informed

It is too late to close the gate after the horses are out. Well, the same is true in performing inspection on construction projects.

- Notify the Project Administrator soon enough to make a difference
- Reduces the impact to the project schedule, cost or quality


If you observe that something is going to be performed outside of the approved plans and specifications, notify the Contractor and immediately notify the Engineer.

If you observed that the soil reinforcing construction or the reinforcement placement and compaction methods do not appear to be in accordance with the approved plans & specifications, don't wait until it is installed to say something.

Hence - DOCUMENT AND REPORT AS SOON AS POSSIBLE.

REMEMBER THE PHRASE

"SOON ENOUGH TO MAKE A DIFFERENCE"



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Slide 221 – Forms

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Forms

- Daily Report of Construction
- Project Diary
- Individualized



Complete the Daily Report of Construction along with any other forms that are required. Prior to beginning construction, obtain agreement with the PA as to what forms are to be completed. For example, the measurement that document compliance with horizontal and vertical alignment need to be kept somewhere.

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Slide 222 - Quick Quiz!

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Quick Quiz!


Write down your answer to these two questions, then proceed to the next page to check your answer...

What type of observations should the Inspector make?

- A. None
- B. Problems only
- C. Accurate & Unbiased
- D. Pump counts only

Which of the following is a function of the Inspector?

- A. Serve as a Recorder
- B. Serve as a Reporter
- C. Keep the Engineer informed
- D. All of the above



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Slide 223 - Quick Quiz! Answers

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre


Quick Quiz!

What type of observations should the Inspector make?

- A. None
- B. Problems only
- C. Accurate & Unbiased
- D. Pump counts only

Which of the following is a function of the Inspector?

- A. Serve as a Recorder
- B. Serve as a Reporter
- C. Keep the Engineer informed
- D. All of the above



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Slide 224 - Field Inspection


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Field Inspection


In the following series of slides, we will be examining the Inspector's duties in the field.



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To go to the next slide: Select this button or press [Shift-N].



Notes

Slide 225 - Road Map

MSE WALL Inspector Course
Chapter 4
\$\$\$plnf
oCurre

Road Map

MSE WALL INSPECTOR'S CHECKLIST	
The following is a copy of a checklist that can be used to help you inspect MSE walls. It is intended to be used as a guide only. It is not intended to be used as a substitute for the Inspector's professional judgment. It is not intended to be used as a substitute for the Inspector's professional judgment. It is not intended to be used as a substitute for the Inspector's professional judgment.	[X] [Y] [Z]
1. Has the Contractor submitted and approved the final plans (including the final submittal) for the wall? (See 1.01)	[X] [Y] [Z]
2. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
3. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
4. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
5. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
6. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
7. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
8. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
9. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
10. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
11. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
12. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
13. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
14. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
15. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
16. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
17. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
18. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
19. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
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21. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
22. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
23. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
24. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
25. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
26. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
27. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
28. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
29. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
30. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
31. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
32. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
33. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
34. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
35. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
36. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
37. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
38. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
39. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
40. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
41. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
42. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
43. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
44. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
45. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
46. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
47. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
48. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
49. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]
50. Has the Contractor submitted and approved the final submittal for the wall? (See 1.01)	[X] [Y] [Z]


This Checklist was developed as a training tool, and for the MSE Wall Inspector's use and as a Road Map for the Inspector.

Use of the checklist should minimize the, "I forgot", that can often occur.


Notice that it is setup (more or less) in the order that the work occurs. The form is set up in question and answer format. An answer other than "Yes" or "N/A" is reason to ask a question of the Contractor.

A full-size version of this checklist is included in the Course Companion Documents (CCD's)


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To go to the next slide: Select this button or press [Shift-N].



Notes

Slide 226 - Road Map

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Road Map

The form is set up in question and answer format. An answer other than "Yes" or "N/A" is reason to **ask a question** of the Contractor. Now, let's take a more detailed look at the questions.

MSE WALL INSPECTOR'S CHECKLIST	
The following is a general checklist that can be followed when constructing MSE Wall Inspection. CONSULT WITH PROJECT ADMINISTRATOR FOR YOUR SPECIFIC PROJECT RESPONSIBILITIES.	
1. Has the Contractor submitted wall shop drawings? (548-6)?	Yes No NA
2. Has the Contractor submitted the required select backfill certification (548-2.6)?	
3. Has the Contractor supplied a Certificate of Compliance certifying that the wall materials comply with the applicable sections of the specifications? (548-18, 548-9) a.) Has the Contractor supplied a copy of all test results performed by the Contractor or supplier, which are necessary to assure compliance with the specifications? (548-8)	
4. Has the Contractor furnished a copy of any instructions the wall supplier may have furnished? (548-6.1)	
5. Have the Shop Drawings been approved?	
6. Did the Contractor receive the correct panels (shape, size and soil reinforcement connection layout) per the approved drawings? (548-3)	
7. Did the Contractor receive the correct reinforcement (proper length and size)? (548-2.3) Have the panels and the reinforcement been inspected? (548-2.3, 548-3) If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-4)	
10. Are the panels and reinforcement properly stored to prevent damage? (548-5)	

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Slide 227 - Checklist Question

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Checklist Question 1

Has the Contractor submitted wall shop drawings? (548-8)?

548-8.1 General:

- Procure from the Wall Supplier fully detailed shop drawings, technical instructions, guidance
- Submit a copy of any instructions from the Wall Supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the Wall Supplier finalizing shop drawings.

Example on next page...

548-8 Construction Requirements.

548-8.1 General: Due to the unique nature of the structure and concept, procure from the Wall Supplier fully detailed shop drawings, technical instructions, guidance in preconstruction activities and on-site technical assistance during construction. Closely follow any instructions from the Wall Supplier, unless otherwise directed by the Engineer. Submit a copy of any instructions from the Wall Supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the Wall Supplier finalizing shop drawings. Bring any conflicts not shown in the Contract Documents to the Engineer's attention.

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Slide 228 - Checklist Question

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Checklist Question 1
Has the Contractor submitted wall shop drawings? (548-8)?

EXAMPLE

CONSTRUCTION DRAWINGS
Prepared For
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

INTERSTATE 95 OVER S. R. 100
FLAGLER COUNTY, FLORIDA

NO.	DESCRIPTION	DATE	REVISION
1	PRELIMINARY	11/11/11	
2	REVISED TO SHOW REVISIONS	11/11/11	
3	REVISED TO SHOW REVISIONS	11/11/11	
4	REVISED TO SHOW REVISIONS	11/11/11	
5	REVISED TO SHOW REVISIONS	11/11/11	
6	REVISED TO SHOW REVISIONS	11/11/11	
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Slide 229 - Checklist Question 2

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Checklist Question 2
Has the Contractor submitted the required select backfill certification (548-2.6)?

548-2.6 Backfill Material:

Meet the requirements of Sections 105, and 120 except as noted within this Section.

Backfill material tested for every soil type for pH, resistivity, sulfate and chloride content by a Department approved independent testing laboratory prior to placement.

Provide certification to the Engineer, that the results have met the requirements of this Section and are signed and sealed by a Professional Engineer, registered in the State of Florida.

Example on next page...

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Checklist Question 2

Has the Contractor submitted the required select backfill certification (548-2.6)?

Test results such as these should be provided for the backfill materials. They need to meet the requirements of the specifications and the requirements of the shop drawings. Keep in mind that if there should be a difference between what is required by the standard specifications and the shop drawings, you should be able to see this before materials are delivered to the site and be able to involve the PA to resolve the problem. Test results such as these should be provided for the backfill materials. They need to meet the requirements of the specifications and the requirements of the shop drawings. Keep in mind that if there should be a difference between what is required by the standard specifications and the shop drawings, you should be able to see this before materials are delivered to the site and be able to involve the PA to resolve the problem.

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Slide 231 - Checklist Question 3

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Checklist Question 3

Has the Contractor supplied a Certificate of Compliance certifying that the wall materials comply with the applicable sections of the specifications? (548-1& 548-10)

Sample of
Contractors
certification for
MSE Wall panels

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Slide 232 - Checklist Question 4

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Checklist Question 4

Has the Contractor furnished a copy of any instructions the wall supplier may have furnished? (548-8.1)

It is a good idea to compare the notes on the "Wall Control Drawings" from the Plans and the "shop Drawings" from the wall supplier.

The wall supplier will generally have their "Notes" on the second or third sheets of their Shop Drawing submittal. It is a good idea to verify that the wall supplier has taken the information from the "Wall Control Drawings" and correctly interpreted and implemented them.

One area of concern is that the wall supplier has adequately considered the amount of predicted settlement for the wall.

If in reading and comparing these two sets of documents, you have any questions, contact the PA for clarification. **It is much easier to solve a potential problem than it is to solve a real problem.**

548-8.1 General:
Submit a copy of any instructions from the Wall Supplier to the Engineer. Verify all pertinent retaining wall information (soil parameters, wall alignment, utility locations, conflicting structures) prior to the Wall Supplier finalizing shop drawings.

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Slide 233 - Checklist Question 5

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Checklist Question 5

Have the Shop Drawings been approved?



You should have the approved shop drawings.

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Slide 234 - Checklist Question 6

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Checklist Question 6

Did the Contractor receive the correct panels (shape, size and soil reinforcement connection layout) per the approved drawings?



Verify the panel size, shape, soil reinforcement condition and layout, storage, and finish.

Below is an example of Improper storage! Document and Inform the PA Immediately.



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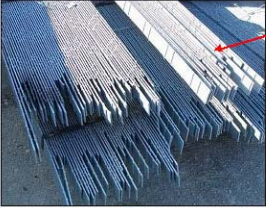
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Slide 235 - Checklist Question 7


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Checklist Question 7

Did the Contractor receive the correct reinforcement (proper length and size)?



This applies to metal (left) or plastic reinforcements. In addition, for the plastic reinforcements, protection from the sun is also required



In the case of the geotextile reinforcements, are they being protected from the sun prior to placement, is there any evidence of damage during shipment?

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Slide 236 - Checklist Question 8

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Checklist Question 8

Have the panels and the reinforcement been inspected for damage? (548-2.3)



548-2.3 Soil Reinforcement:

...Ensure that steel reinforcing strips, tie strips, reinforcing mesh and connectors used in permanent walls are galvanized in accordance with ASTM A 123 or ASTM A 153, as applicable.

...Carefully inspect all reinforcement, steel and geosynthetics to ensure they are the proper size and free from defects that may impair their strength and durability.

Note damage to connection tabs! Document and report.

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Checklist Question 8-con't

Have the panels and the reinforcement been inspected for damage? (548-2.3)



Point out the damage to the concrete panels. Is this an acceptable level of damage? As always, photos (preferably with an appropriate scaling device) and report to the PA.

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Slide 238 - Checklist Question 9

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Checklist Question 9

If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-6)

548-6 Rejection of Precast Components.

The Department will reject all precast concrete wall components not meeting the quality standard of this Section and referenced Specifications. In addition, any of the following defects will be sufficient cause for rejection by the Department:

- 1. Defects that indicate unsatisfactory molding.
- 2. Defects indicating honeycombed or open texture concrete.
- 3. Defects in the physical characteristics such as:

Signs of aggregate segregation; Broken or cracked corners; Soil reinforcement attachment devices improperly installed/damaged; Lifting inserts not usable; Exposed reinforcing steel; Insufficient cover over reinforcing steel; Cracks at the alignment pipe or pin; Insufficient concrete compressive strength; Precast Component thickness in excess of $\pm 3/16$ inch from that shown in the Contract Documents; or Stained front face, due to excess form oil or other reasons. If the face of the precast component is stained or discolored to the point of rejection, the stain or discoloration may be removed or a Department approved stain or a Class 5 finish may be applied to attain a uniform appearance for the entire structure, to the satisfaction of the Engineer.

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Slide 239 - Checklist Question 9

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Checklist Question 9-cont.

If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-6)

548-6 Rejection of Precast Components.

3. Defects in the physical characteristics such as:

- Signs of aggregate segregation
- Broken or cracked corners
- Soil reinforcement attachment devices improperly installed/damaged
- Lifting inserts not usable
- Exposed reinforcing steel
- Insufficient cover over reinforcing steel
- Cracks at the alignment pipe or pin
- Insufficient concrete compressive strength

Remember, it is not the Inspectors role to "reject" but rather to provide adequate documentation to the PA.

When the panels arrive, check for evidence of aggregate segregation, damage to the panel, exposed reinforcing steel, alignment pin issues, or other visually evident signs that a panel is not acceptable.

For the last thing in the group, how would you know about the compressive strength of the concrete? (You would have to have the results of the CQC tests).

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Slide 240 - Checklist Question 9

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Checklist Question 9-cont.

If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-6)

548-6 Rejection of Precast Components.

- Precast Component thickness in excess of $\pm 3/16$ inch
- Stained front face
- Stain or discoloration may be removed or a Department approved stain or a Class 5 finish may be applied to attain a uniform appearance for the entire structure, to the satisfaction of the Engineer.

Take measurements of the panels.

Observe the front face of the panels. Is there any discoloration? If so, report to the PA. As always, pictures are a good way to document. **A side note here** – with discoloration, pictures with a digital camera with subsequent movement from computer to another likely will result in changes to what appears as a color on a computer screen. A good idea is to have a standard color chart in photos where color will be an issue.

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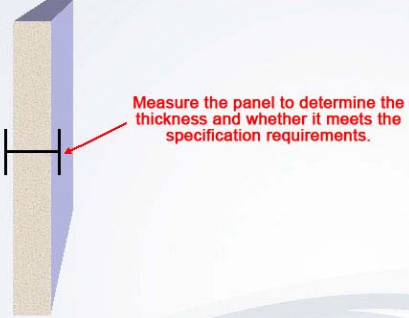
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Checklist Question 9-cont.

If any panels or soil reinforcement were found damaged, has this been reported to the PA and the items rejected or repaired per the specifications? (548-6)



Measure the panel to determine the thickness and whether it meets the specification requirements.

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Slide 242 - Checklist Question 10

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Checklist Question 10

Are the panels and reinforcement properly stored to prevent damage? (548-7)



548-7 Handling Storage and Shipping

- Handle, store and ship all components in a manner that prevents chipping, cracks, fractures, excessive bending stresses, mud, dirt and debris
- Support precast components in storage on firm blocking located immediately adjacent to the attachment device.

Check to see if the ground that the panels are stored on is relatively flat and stable. Verify that the dunnage is placed such that it does not affect the reinforcement attachment tabs or other appurtenances on the panel.

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Slide 243 - Checklist Question 11

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Checklist Question 11

Has the MSE Wall area been excavated to the proper elevation? (548-8.2)



548-8.2 Wall Excavation:

Excavate to the limits shown in the Contract Documents and in conformance with Section 125.

The area for the beginning of wall construction has been excavated and prepared for the first level of backfill.

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Slide 244 - Checklist Question 12

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Checklist Question 12


Has the area been proof rolled per the specifications? (548-8.3)

548-8.3 Foundation Preparation:

- For a width equal to or exceeding the limits of the retaining wall volume.
- Prepare the foundation in conformance with Section 125.
- Additionally, compact with appropriate vibratory roller weighing a minimum of 8 tons for at least five passes.
- Or as directed by the Department's District Geotechnical Engineer.

548-8.3 Foundation Preparation: Grade the foundation for the structure level for a width equal to or exceeding the limits of the retaining wall volume or as shown in the Contract Documents. Prepare the foundation in conformance with Section 125.

In addition to the compaction requirements of Section 125, compact the graded area with an appropriate vibratory roller weighing a minimum of 8 tons for at least five passes or as directed by the Department's District Geotechnical Engineer. Remove and replace any soft or loose foundation subsoils which, are incapable of sustaining the required compaction to the Engineer's satisfaction...



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Slide 245 - Checklist Question 13


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Checklist Question 13

Has all soft or unsuitable materials been compacted or removed and replaced?

548-8.3 Foundation Preparation:

- Remove and replace any soft or loose foundation subsoils
- To the Engineer's satisfaction.



...remove and replace any soft or loose foundation subsoils which, are incapable of sustaining the required compaction to the Engineer's satisfaction.

Excavating any unsuitable soils. Either as shown in the plans or as discovered in the field and directed by the Engineer. Should the Inspector discover what appears to be soft or yielding soils during the proof rolling operations as outlined in 548-6.3 and the Plans do not show "removal of unsuitable soils", the PA should be contacted for

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Slide 246 - Checklist Question 14

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Checklist Question 14

If the Contractor is using any water in the MSE Wall area, does it meet the requirements of the specification? (548-8.5)

548-8.5 Backfill Placement:

- Use water that meets the requirements of Section 923
- Do not use saltwater

... To achieve the required compaction moisture content, use water that meets the requirements of Section 923. Do not use saltwater. Do not transport excessively moist backfill materials to the site for any reason. The Engineer will determine the Optimum Moisture Content in accordance with FM 5-521



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Slide 247 - Checklist Question 15

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Checklist Question 15

Has the leveling pad area been properly excavated? (548-8.3)

548-8.3 Foundation Preparation:

- For permanent MSE wall systems, provide an unreinforced concrete leveling pad
- As shown in the Contract Documents.

... For permanent MSE wall systems, provide an unreinforced concrete leveling pad as shown in the Contract Documents. Cure the leveling pad a minimum of 12 hours before placement of precast wall components.



Once leveling pad area is excavated. Note the condition of the area. Look for issues such as standing water, soft conditions, etc. If these conditions are present, contact the PA.

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Slide 248 - Checklist Question 16

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Checklist Question 16

Has the leveling pad been set to the proper vertical and horizontal alignment?



Check the vertical and horizontal alignment. In particular, check for steps in the leveling pad. Placing the steps at the wrong stationing will lead to problems with the placement of the wall panels.

In this instance, there is standing water in the pad. What are the issues related to attempting to place concrete in standing water?

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Slide 249 - Checklist Question 17

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Checklist Question 17

Has the leveling pad cured for a minimum of 12 hours before any panels are set? (548-8.3)



Leveling pad is in. When was it poured? Must be at least 12 hours before panels can be set in place.

Once the leveling pad is cured for 12 hours, panel placement can commence.

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Slide 250 - Checklist Question 18

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Checklist Question 18

Is the first row of panels properly placed? Do they have proper spacing, bracing, tilt and where required, do they have the spacers installed? (548-8.4)



Check placement, spacing, bracing, tilt, and spacers.

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Checklist Question 19

Has the proper filter fabric and adhesive been provided? (548-2.5.2)

Placing adhesive on the filter fabric. Placement of the filter fabric is not always something that is uppermost in many Inspectors and many Contractors minds. However, when the fabric is not placed properly, then the backfill can erode away.



Fabric in place on back side of the panel. Failure to properly install the fabric may lead to loss of backfill from behind the wall. Loss of this backfill affects the integrity of the wall. In extreme events, it can lead to failure of the wall.

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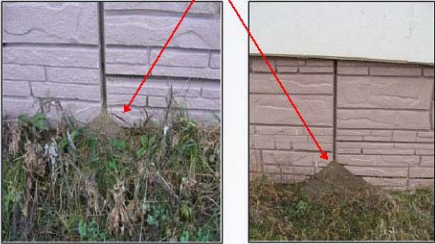
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Checklist Question 20

Is the filter fabric being properly placed over the joints? (548-2.5.2)

Failure to place the filter fabric over the joints can lead to loss of backfill material through the joint, and long term problems with the wall.



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Slide 253 - Checklist Question 21

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Checklist Question 21

Is the adhesive being applied to the panel, then the filter fabric being placed?

The standard specifications call for the adhesive to be placed on the panel first and the fabric is then attached to the panel back. Care needs to be exercised to be sure that the adhesive (glue) remains pliable (sticky) when the fabric is attached.



Note that the adhesive (glue) is placed on the wall panel as indicated in the Standard Specifications. However, do you think that there is enough to be sure that the fabric is properly adhered to the panel?

The opinion here is that there is not enough adhesive to properly hold the fabric to the panel.

Also, something that can not be shown photographically, is the condition of the adhesive. The adhesive material has a limited usable life span. If the fabric is not attached to the panel before the adhesive "hardens" again you will get a poor quality attachment.

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Slide 254 - Checklist Question 22

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Checklist Question 22

Is the filter fabric being stored properly? (548-2.3)



Prolonged exposure to sunlight damages the geotextile. This applies to both the fabric material used to keep the joint from leaking soil and the geogrid style reinforcements used on some wall types.

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Slide 255 - Checklist Question 23

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Checklist Question 23

Is the Contractor using the correct panels (size, shape and number of connections) for that panel's wall location and elevation?



Check that the panel supplied is the one(s) dimensioned on the Shop Drawings. Wall Suppliers provide several shapes and finishes. Common shapes are "cross", "square", "rectangular", and "octagonal". **Important considerations are:**

- On the front of the panel, is the proper texture supplied?
- On the back side of the panel, are the proper number of attachments supplied and are they at the correct levels for the vertical reinforcement spacing?

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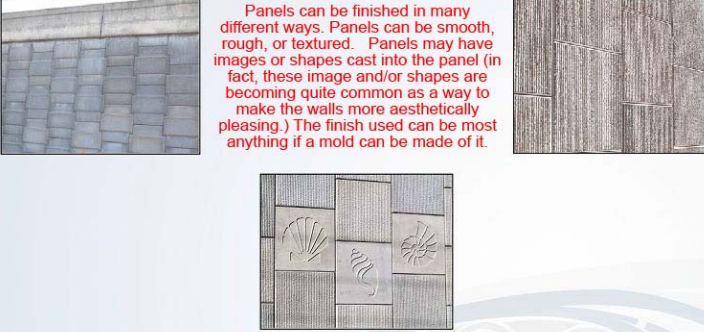
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Checklist Question 23-cont.

Is the Contractor using the correct panels (size, shape and number of connections) for that panel's wall location and elevation?

Panels can be finished in many different ways. Panels can be smooth, rough, or textured. Panels may have images or shapes cast into the panel (in fact, these image and/or shapes are becoming quite common as a way to make the walls more aesthetically pleasing.) The finish used can be most anything if a mold can be made of it.



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Slide 257 - Checklist Question 24

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Checklist Question 24

Is the fill being placed and compacted in 6 inch lifts? (548-8.5)

The fill needs to be spread parallel to the wall face and then away from the wall face to maintain the tension in the reinforcements. A good way to check the lift thickness is to mark the wall panels in six inch increments as they pretty well as "grade stakes"



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Checklist Question 24-cont.


Is the fill being placed and compacted in 6 inch lifts? (548-8.5)

Keep in mind that there are two zones of compaction.

One zone is the wall face to three feet behind the wall that is compacted with small equipment.

The second zone is the area from three feet behind the wall to the end of the reinforcements.

Both must be compacted, tested, and meet the requirements of the specification.



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Slide 259 - Checklist Question 25

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Checklist Question 25

Is the equipment being kept off the soil reinforcement until a minimum of 6 inches of fill is placed?

The Inspector should be observing the backfill placement top to ensure that the spreading equipment (in this case a dozer in the background of the photo) does not get too close to the reinforcement and damage it.



Another example of keeping equipment off of the soil reinforcements.

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Slide 260 - Checklist Question 26

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Checklist Question 26

Are the lifts being placed by the proper method and sequence? (548-8.5)

Place the fill as illustrated.

WALL FACING

PLACE FILL PARALLEL TO WALL FACE

3' START FILL PLACEMENT 3' FROM WALL PANEL AND WORK TOWARD STRIP ENDS

FILLING FROM THE 3' POINT TO THE WALL PANELS

WALL FACING

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Checklist Question 26-cont.

Are the lifts being placed by the proper method and sequence? (548-8.5)

Compact the fill as illustrated.

WALL FACING

ROLL THE COMPACTOR PARALLEL TO THE WALL FACE

START COMPACTING 3' FROM THE WALL PANEL AND WORK TOWARD THE REINFORCEMENT ENDS.

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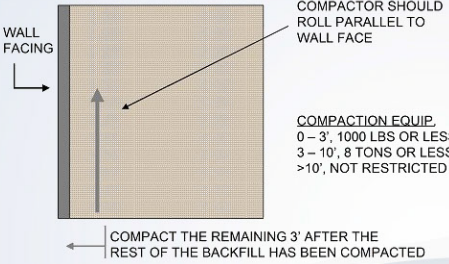
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MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Checklist Question 26-cont.

Are the lifts being placed by the proper method and sequence? (548-8.5)

Compact the fill as illustrated.



COMPACTOR SHOULD ROLL PARALLEL TO WALL FACE

COMPACTION EQUIP.
0 - 3', 1000 LBS OR LESS
3 - 10', 8 TONS OR LESS
>10', NOT RESTRICTED

COMPACT THE REMAINING 3' AFTER THE REST OF THE BACKFILL HAS BEEN COMPACTED

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Slide 263 - Checklist Question 27

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Checklist Question 27

Is the fill being compacted by the correct equipment and in the correct pattern? (548-8.5)



QUICK QUIZ!

Is the roller to the left okay for use?

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Slide 264 - Checklist Question 27

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Checklist Question 27-cont.

Is the fill being compacted by the correct equipment and in the correct pattern? (548-8.5)



No!
Sheepsfoot rollers are not allowed.

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Slide 265 - Checklist Question 28

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Checklist Question 28

Do the Density tests (% of Maximum Density) pass? (548-9)



QUICK QUIZ!
What is the criteria?

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Slide 266 - Checklist Question 29

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Checklist Question 29

Is the fill being brought up to or slightly above the soil reinforcement elevation before the reinforcement are connected?



If the soil is not up to the level of the soil reinforcement, then it increase the chance that as the soil is placed, it will either loosen the connection or strain the connection.

These are metal reinforcements.

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Slide 267 - Checklist Question 29

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Checklist Question 29-cont.

Is the fill being brought up to or slightly above the soil reinforcement elevation before the reinforcement are connected?



The picture above shows that metal straps are not in contact with the backfill.



The picture above illustrates poor placement at the wall. Note that the fill is not up to the level of the connection at the wall face.

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Slide 268 - Checklist Question 30

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Checklist Question 30

Is the soil reinforcement being properly connected (connections tight and all of the slack in the soil reinforcement removed)?

When metal soil reinforcements are used, it is somewhat simpler to tell when the "slack" is removed from the element. And when it is removed, it usually does not "creep" back.

However, more care is generally needed when using the flexible soil reinforcements shown here. They need to be "stretched" and once extended, they can have a tendency to "creep" back.

So it is imperative that the soil backfill operation begin quickly. This (the possible slackness) is also considered as one of the possible reasons that it is more difficult to keep the wall panels aligned.



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Slide 269 - Checklist Question 31

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Checklist Question 31

Is the soil reinforcement in the proper alignment? (548-8.4)



This photo shows an example of a **good alignment**.

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Slide 270 - Checklist Question 31

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Checklist Question 31-cont.

Is the soil reinforcement in the proper alignment? (548-8.4)



Geotextile type soil reinforcement with soil being placed over top. It is important to note that the reinforcement is being "tensioned" while the backfill is being placed and that the backfill is being placed correctly as previously discussed.

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Slide 271 - Checklist Question 32

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Checklist Question 32

Are the alignments being checked periodically and within tolerance? (548-8.4.1 & 548-8.4.2)



Horizontal Alignment $\frac{3}{4}$ "

Joint offset $\frac{3}{4}$ "



Vertical tolerance $\frac{1}{2}$ " per 10 feet of wall height

Horizontal and Vertical Joints $>\frac{1}{2}$ " to $<1\frac{1}{4}$ "

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Slide 272 - Checklist Question 33

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Checklist Question 33

Is the Contractor removing the wooden wedges as per the specifications? (548-8.4)



Contractor is removing the wooden wedges as the wall is constructed.

Note wooden wedges are still in down three down panels.

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Slide 273 - Checklist Question 34

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Checklist Question 34

At the end of each day's operation, is the Contractor providing a means of directing rainfall away from the wall? (548-8.5)



The Contractor in this case probably could have intentionally directed more run-off to the wall face, but he would have had to have tried very hard!

This is a very good example of how not to do it!

Note the heavy washout due to rain!

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Slide 274 - Checklist Question 35

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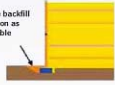
Checklist Question 35

Has the Contractor backfilled the front of the wall?


Backfill the space in front of the wall where the leveling pad was excavated as soon possible. When the area is not backfilled, the global stability is reduced.

Backfill in front of wall being placed slightly behind the wall panels. Good example of the backfill keeping pace.

Place backfill as soon as possible



Note the leveling pad in the foreground.



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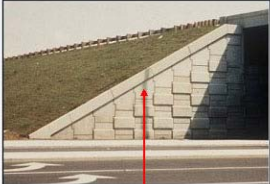

Slide 275 - Checklist Question 36

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

Checklist Question 36

Is the correct coping being installed?

What kind of coping is called for in the Wall Control Drawings and in the Shop Drawings (they should match)? The kind of coping needed will depend on its purpose. If it is the barrier wall for vehicles, then it is designed to handle those loads. If it is simply a "top" to complete the wall, then a completely different detail is used.



Type of coping where no barrier wall is needed, nor is there any pedestrian concerns, so no railing needed.

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Slide 276 - Typical problems

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Typical problems that can occur!



Note the leveling pad in standing water. This wall is starting out poorly with no good drainage. Placing fill will not be performed well in this environment.

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Slide 277 - Typical problems

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Typical problems that can occur!



More standing water at the beginning of wall construction. Good drainage is a must! If the water is from the actual groundwater, the issue is even worse.

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Slide 278 - Typical problems

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Typical problems that can occur!



The permanent wall is to the left with a temporary wall to the right. However, note the outward lean of the temporary wall.

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Slide 279 - Typical problems

MSE WALL Inspector Course Chapter 4 \$Scplnf oCurre

Typical problems that can occur!

Finished wall is visually out of vertical plumbness. Note the slip joint in the photo, which may indicate that larger amount of settlements were expected, but is this an acceptable wall according to the standard specifications for vertical plumbness. NO.



However, what can be done now to "fix" this. Also, is the "External Stability" of the wall compromised by the lack of plumbness? Very possibly, it is not, so the wall may be stable, but it will never be aesthetically pleasing.

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Slide 280 - Typical problems

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Typical problems that can occur!



Very severe washout. The flow of water along side the wall is the main issue. From the Inspection, it is imperative to provide for roadway drainage away from the wall. It also may be something of a design issue as well, something that the Inspector may not always be able to or expected to prevent, but perhaps to recognize if there are shallow embedments and too many steps in the wall.

Note where the original "ground" was on the panels.

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Slide 281 - Chapter 4 quiz

MSE WALL Inspector Course Chapter 4 \$scplnf oCurre

This is the end of Chapter 4 of the MSE WALL Inspector Course!



Before proceeding to the next chapter, you must successfully complete the Chapter 4 quiz.

Please press the forward arrow to begin the quiz.

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Slide 307 - Chapter 5

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Chapter 5
Other Wall Types



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Slide 308 - Other Wall Types

MSE WALL Inspector Course Chapter 5 \$scplnf oCurre

Other Wall Types

Temporary tied back sheet pile walls are also fairly common, but not as common as the cantilevered type. The Contractor will typically use the tied back system when the height of the wall, movement limits, size of the sheet needed, or the exterior loads are too high to be carried by the cantilevered system.



Steel Sheets

Tie Backs

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Slide 309 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$Scplnf oCurre

Other Wall Types

Cantilevered steel sheet piles are very common as temporary structures as illustrated here. They are used in a variety of circumstances from cofferdams to as shown above to allow construction adjacent to existing structures and roadway embankment. Typically, there will be some limit as to the amount of movement at the top of the sheet, but the limits are usually generous as long as there is no damage to existing structures.



Cantilevered Steel Sheet Piles

Since most of these structures are temporary, they will be "designed" by the Contractor. As such you should have shop drawings that depict the size and type of the sheet and most importantly, the tip elevation (or embedment depth) of the sheets.

If the sheets do not reach these tips (or depths), the wall may not function as designed – time to call the PA.

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Slide 310 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$Scplnf oCurre

Other Wall Types

"T" Walls are relatively uncommon in Florida. One issue with them is that they are not very settlement tolerant. Because of the construction materials used (concrete) they are corrosion resistant, however and will work well in saltwater or brackish water conditions.



If plans for your project include "T" Walls, you will need to ask additional questions about the construction inspection.

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Slide 311 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$Scplnf oCurre

Other Wall Types

Techwall is a counterfort style wall. They consist of a footing with a "key" constructed in the bottom of the footing and a wall with "ribs" that are thinner at the top and thicker at the bottom. Backfill is placed on the backside of the wall (the side with the ribs).

In this photo, you can see the wall stem, the footing that the panel is constructed on, and the keyway that is constructed below the footing. These elements are typically constructed in place.



Wall Stem
Footing
Keyway

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Slide 312 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$Scplnf oCurre

Other Wall Types

Counterfort walls are very corrosion resistant. However, they are relatively settlement sensitive and can not tolerate very much total or differential movements. Construction can also be an issue. Because of Florida's relatively high groundwater, it is common to have the footing excavation into the groundwater. Complicating the excavation issue is the keyway in the bottom of the footing. In high groundwater conditions (especially in sandy soils), it can be very difficult to construct the keyway.



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Slide 313 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$Scplnf oCurre

Other Wall Types

Here is another view of a counterfort wall.

Note the fill placement and the "ribs" inside the enclosure at this end bent.



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Slide 314 - Other Wall Types (cont.)

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Other Wall Types

Beginning a **Temporary MSE** wall is much like the permanent MSE wall, except that there (typically) is no leveling pad and the wall face is a combination of wire and geotextile fabric (frequently referred to as basket or wire face walls). In the two photos below, the beginning of a temporary MSE wall is shown.



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Slide 315 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$scplnf oCurre

Other Wall Types

These two walls show the **Temporary MSE** wall facing. The placement of the backfill behind the wall has no different requirements than the those of the permanent wall. The main difference is that the MSE wall face is not permanent. The wall may be taken down or may be "buried" as fill is placed from a subsequent phase. The Inspector would be provided with wall heights and soil reinforcement lengths (just like a permanent wall), and that forms the basis for the inspection.



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Slide 316 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$scplnf oCurre

Other Wall Types

Some MSE walls are started with the temporary wall facing with the permanent concrete wall panels placed some time later. These **"Two-Phase"** type walls are commonly used where there is a larger amount of settlement expected and the wall designer/supplier decided to use the temporary facing until the majority of the settlement has occurred. After that point, the permanent panels are attached. In these type designs, it is also common to see the "slip joints" used as additional insurance that the finished wall is aesthetically pleasing.

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Slide 317 - Other Wall Types (cont.)

MSE WALL Inspector Course Chapter 5 \$cplnf oCurre

Other Wall Types

Walls Approved for use by FDOT

- Mechanically Stabilized Earth (MSE) Walls
- Wire Faced Walls
- Geogrid Soil Reinforcement for Retaining Walls
- Two-Phase Wall Combination
- Hybrid - Gravity/MSE

The list above provides those wall types that are most commonly used throughout the state. The decision as to which wall type will be used is dependant upon a number of things including, but not limited to how well it will work for that location, cost, availability, aesthetics along with other factors.

There are other wall types that could be seen, however this usually covers the majority of the walls that will be seen in Florida. Should you get plans that detail a different wall type, get with your PA as soon as possible.

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Slide 318 - Chapter 5 Quiz

MSE WALL Inspector Course Chapter 3 \$cplnf oCurre

This is the end of Chapter 5 of the MSE WALL Inspector Course!



- If you are ready to take the Final Exam, simply click the Forward Arrow.
- If you wish to review any Chapter, just click on the Chapter number to the left.
- Thank you for your time and effort, and best of luck in your career as a MSE Wall Inspector!

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