ATTACHMENT K

SUBMITTAL REQUIREMENTS FOR APPROVAL OF MECHANICALLY STABILIZED EARTH (MSE) WALL SYSTEMS

Revised
April 11, 2018
Submittal Requirements for Approval of
Mechanically Stabilized Earth (MSE) Wall Systems

The wall system submittal should include the following sections, with section contents explained on the next pages in addition to the requirements addressed in Section 4.0 of the Prefabricated Retaining Wall System Approval Process document. Please note that some items addressed under Section 1.0 (SYSTEM) are repetitive to information requested in the Letter of Intent.

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1.0 SYSTEM

1.1 Description of System and Components

- Summarize what the system consists of and what is not included, but necessary, to construct the wall.
- Summarize external materials and variables which will influence the design, construction and performance of the system.
- List each component of the system.
- List material requirements for each component.

1.2 History, Performance, and Maintenance

- Summarize the history of development and application of the system.
- Summarize refinements made to the system, since inception.
- Summarize performance (with photos, where available) of completed structures, including:
  - Oldest
  - Tallest
  - Projects experiencing maximum measured settlement (total and differential)
  - Measurements of lateral movement / tilt
  - Demonstrated aesthetics
  - Project photos
  - Maintenance and performance history, including improvements that have been made based on the experience with the system
- Summarize any incidents where approval was revoked by a government agency for the system or any component of the system during the past five years. List these incidents if any, and describe the relationship between the rejected or revoked product component and the system being evaluated in this report. Where applicable, include a description of any predecessor product component or system.

1.3 Ohio or other State Applications

- Summarize the history of application of the system.
- Summarize the history of application of the system on Ohio projects.
- Summarize design issues specific to Ohio applications.
- Summarize construction issues specific to Ohio applications.
- Provide a list of non-ODOT users, including a contact person for each user with their telephone number, email address and a summary of all projects where the system has been used.

1.4 System Warranties

Provide a copy of all system warranties

1.5 Designated Responsible Parties

Summarize responsibilities for:
• System performance
• Material performance
• Project-specific design and construction details

1.6 Insurance Coverage for Responsible Party
List insurance coverage types (e.g., professional liability, product liability, performance), limits, and basis (i.e., per occurrence, claims made) provided by each responsible party.

2.0 DESIGN

2.1 Summary of Design Parameters and Design Approach
Provide a summary of the following, and note applicable standard and/or test method used to quantify value:
• Nominal strength of soil reinforcement element(s)
• Long-term factored strength of soil reinforcement element(s)
• Direct shear interaction coefficient
• Normalized pullout resistance factors, F* and α
• Galvanization or other protective coating requirements and thickness

2.2 Design Responsibility
• State designated responsible party for project-specific design.
• List professional liability insurance coverage limits and basis (i.e., per occurrence, claims made) provided by the design responsible party.
• Detail the system designer's Quality Control / Quality Assurance programs for project designs.
• List those items of a project design that you understand, or assume, are the responsibility of ODOT.

2.3 Summary of Design Procedures
• Summarize all deviations from the most current ODOT design specifications or requirements and the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications, along with theoretical or empirical information which support such deviations.
• Summarize when and how external stability (global stability, bearing resistance, sliding resistance, and limiting eccentricity) is assessed.
• Summarize when and how internal stability is assessed.
• Summarize seismic design considerations.
• Detail design modification for tiered structures.
• Detail design modification for acute corners.
• Detail design to overcome obstructions (e.g., drainage structures, deep foundations, etc.) in reinforced zones.

2.4 Summary of Example Calculations
• Provide detailed calculations for the external stability of the wall.
• Provide detailed calculations for the long-term factored tensile strength of the soil reinforcement and at the connection of the soil reinforcement to the facing units. Note any deviation from the most current AASHTO LRFD Bridge Design Specifications.
• Provide detailed calculations for soil reinforcement pullout resistance.
• Provide detailed calculations for reinforcing steel in facing units, as applicable.

2.5 Limitations
List all design limitations, including seismic loading; environmental restraints; wall height; external loading; foundation bearing resistance; settlement; differential settlement; and others.

3.0 MATERIALS
Provide material specifications describing the material type, quality, certifications, lab and field testing, and acceptance and rejection criteria, along with support information (and where noted, a sample of the material) for each of the following material items. Include representative test results (lab and field) clearly referencing the date, source, and method of test, and where required, the method and detailed explanation of interpretation and extrapolation. Note the source of the supplied information, include a listing of facilities normally used for testing (e.g., in-house and independent). Clearly identify the materials listed below that do not apply to the product being submitted.

3.1 Facing Unit
This section should include the following:
For wet-cast concrete steel-reinforced panels or unreinforced block masonry units:
• Standard dimensions and tolerances
• Reinforcing steel details, if applicable
• Joint sizes and details
• Concrete strength (minimum)
• Concrete % air (range)
• Freeze thaw durability
• Bearing pads (joints)
• Spacers (pins, etc.)
• Joint filter requirements: geotextile or graded granular
• Aesthetic choices (texture, relief, color, graffiti treatment)
• Other facing materials
(Dry-cast concrete masonry units will not be allowed)

3.2 Soil Reinforcement
For Metallic soil reinforcement:
• Manufacturing sizes, tolerances and lengths
• Ultimate and yield strength of steel
• Minimum galvanization thickness for 100 year design life
• Sacrificial steel thicknesses for 100 year design life
• Pullout interaction coefficients for range of backfill

For Geosynthetic Soil Reinforcement:

• Polymer resin and grade
• High Density Polyethylene (HDPE): resin type, class, grade, and category
• Polypropylene (PP): resin type, class, grade, and category
• Polyester (PET): minimum intrinsic viscosity correlated to number average molecular weight and maximum carboxyl end groups
• Mass per unit area
• Post-consumer recycled material, if any
• Nominal strength minimum average roll value and coefficient of variation for nominal strength
• QC strength (e.g., single rib, grab or strip) minimum average roll value
• Creep reduction factors for 100 year design life, including effect of temperature (20°C to 40°C)
• Durability reduction factor (chemical, hydrolysis, oxidative) for 100 year design life
• Additional durability reduction factor for high biologically active environments
• Installation damage reduction factor for range of backfill (e.g., sand, sandy gravel, gravel, coarse gravel) for allowable gradation criteria
• Junction strength (geogrids) for quality control
• Pullout interaction coefficients/pullout resistance factors for range of backfills
• Scale effect correction factor
• Coatings (type and amount)
• UV inhibitors, coatings, etc.
• UV resistance

3.3 Facing Connection Components

• Mode (e.g., structural, frictional, or combined)
• Connection strength as a % of reinforcement strength at various confining pressures for each reinforcement product and connection type submitted
• Composition of devices, dimensions, tolerances
• Full scale connection test method / results

3.4 Reinforced Wall Fill

• Soil classification
• Gradation range
• Unit weight (design and representative measured)
• Friction angle (design and representative measured)

3.5 Leveling Pad

• Size requirements
• Concrete strength, minimum
3.6 Drainage Elements
- Weep holes
- Drainage fill classification and gradation range
- Surface drainage components
- Subsurface drainage components

3.7 Coping
- Precast concrete coping
- Cast-in-place coping
- Precast and cast-in-place combination
- Installation/attachment method and details

3.8 Traffic Railing / Barrier

3.9 Precast Connections to Appurtenances

3.10 Other Materials
- Corner elements
- Slip-joint elements

3.11 Quality Control & Quality Assurance Systems
- Material suppliers
  - Metallic soil reinforcement
  - Geosynthetic soil reinforcement
  - Concrete products
  - Foundation or leveling pad
  - Connectors between facing units
  - Reinforced Wall fill
- Fabricator(s)
- Test facilities (internal and external)

4.0 DETAILS

4.1 Standard Details
Provide detailed drawings of the following standard details (electronic copy in pdf and Microstation v8i format, SS3 or later version):
- Leveling pad
- Facing unit reinforcing steel and connection inserts
- Erection details of facing units including temporary bracing, batter, joint spacing, etc.
- Connection
- Top of wall coping
- Top of wall traffic barrier
- Bottom of wall traffic barrier
- Construction of cast-in-place traffic barriers
• Joint drainage details
• Weep holes
• Subsurface drainage
• Subsurface drain outlets
• Slip joint detail
• End of wall
• Connection to appurtenances (e.g., box inlets and large obstructions)
• Fill placement procedures at soil reinforcement elevation
• Architectural face finish options

4.2 Example Details

Provide detailed drawings illustrating typical examples of the following details:

• Stepping of leveling pad with existing and final grades
• Stepping of top of wall with final grade
• Placement of soil reinforcement around steel piles
• Placement of soil reinforcement around drop inlet structures
• Placement of soil reinforcement around pipe penetrations

5.0 SPECIFICATIONS, CONSTRUCTION, AND MAINTENANCE

Provide the following information related to construction of the system:

5.1 Fabrication of Facing Units

• Curing times
• Form removal
• Concrete surface finish requirements

5.2 Field Construction Manual

Provide a documented field construction manual describing in detail, with illustrations as necessary, the step-by-step construction sequence, including requirements for:

• Foundation preparation
• Special tools required
• Leveling pad
• Facing erection
• Facing batter for alignment
• Steps to maintain horizontal and vertical alignment
• Reinforced wall fill and backfill placement / compaction
• Erosion mitigation
• All equipment requirements

5.3 Construction Specifications

Include sample construction specifications that address:

• Materials requirements
• Field sampling, testing, and acceptance / rejection requirements
- Installation requirements
- Maintenance requirements
- Aesthetics compliance, including texture, color, graffiti treatment, and durability of aesthetic features

5.4 Contractor or Subcontractor Prequalification Requirements
List any contractor or subcontractor prequalification requirements

5.5 Quality Control / Quality Assurance of Construction
Detail the quality control and quality assurance measurements required during construction to assure consistency in meeting performance requirements, and responsible parties for each.

5.6 Construction / In-Service Structure Problems
Provide case histories of structures where problems have been encountered, including an explanation of the problems and methods of repair.

5.7 Maintenance
Provide a listing of maintenance requirements to maintain performance and repair damage. If available, provide a maintenance manual