ALDOT 402-00
PROCEDURE FOR APPROVAL OF MECHANICALLY STABILIZED EARTH WALLS

1. SCOPE

1.1 This procedure establishes the guidelines by which the manufacturer of a mechanically stabilized earth wall system (MSEW) shall submit a product to the Alabama Department of Transportation (ALDOT) for:

- Approval of a wall system.
- Inclusion of that system on the ALDOT list of approved MSEW systems.

A proprietor whose name and/or product does not appear on the current list of approved MSEW systems may not use a project currently being advertised for bids as the basis for obtaining MSEW system approval and inclusion on the list of approved wall suppliers.

1.2 The current approved MSEW system list is contained in the current listing of the Department’s “Materials, Sources, and Devices with Special Acceptance Requirements” manual, List II-22 and is available upon request.

2. APPLICABLE DOCUMENTS

2.1 AASHTO Standard Specifications for Highway Bridges with interims

2.2 FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes-Volume I and II.

3. SYSTEM APPROVAL PROCESS

3.1 Proprietors interested in having their MSEW system approved shall submit a written request to the Product Evaluation Board (PEB) of ALDOT for an application and requirement procedure.

3.2 Upon receipt of the submittal the PEB will contact the Bureau of Materials and Tests and Bridge Bureau for review of the application and submittal package.

3.3 After a review of the submittal ALDOT Geotechnical Division (located in the Bureau of Materials and Tests) will submit recommendations to ALDOT PEB. These recommendations will follow the guidelines referenced in 5.3.1, 5.3.2, and Appendix A of ALDOT-402 (see below)
3.4 After receiving recommendations from the Geotechnical Division and the Bridge Bureau, the PEB will vote on approval of the MSEW system. ALDOT PEB will notify the proprietor in writing ALDOT’s decision.

3.5 ALDOT reserves the right to remove a supplier and/or wall system from the MSDSAR, List II-22. This includes but not limited to ALDOT’s judgement of product performance, design, and/or construction procedures or other reasons ALDOT deems a justifiable cause.

4.0 MSEW SYSTEM DESIGN CRITERIA

4.1 All components of the MSEW system shall meet the current requirements of AASHTO Standard Specifications for Highway Bridges with interims and publication number FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume II.

5.0 SUBMITTAL REQUIREMENTS

5.1 The MSEW system proprietor shall furnish one of three options (see below) to the ALDOT PEB and the ALDOT Geotechnical Division for review.

5.2 System supplier must provide concrete facing elements from a certified precast producer per ALDOT’s “Materials Sources and Devices with Special Acceptance Requirements” manual, List I-8.

5.3 Submittal of the requirements for review does not release the proprietor from further submittals as deemed necessary by ALDOT.

5.3.1 Option I:
A system evaluation final report prepared by the Highway Innovative Technology Evaluation Center (HITEC). For information regarding the HITEC process contact Muhammad Amer at mamer@asce.org. Submittal of a HITEC Report does not release the proprietor from further submittals as deemed necessary by ALDOT.

5.3.2 Option II:
Submit an evaluation report performed by an approved third-party source (Contact the Assistant Materials and Tests Bureau Chief – State Geotechnical Engineer at (334) 206-2270 for approved sources). See Appendix A for a checklist of items that will provide guidance on what is required to be submitted to the reviewer. The third-party reviewer may require additional information not contained in the check list.
5.3.3 Option III:
Submittal of all documentation of approvals and reviews from two other State DOT offices which have equivalent approval procedures as Option I or II described above.
Appendix A

Option #2 Submittal Checklist to Approved Source:

INSTRUCTIONS

The applicant shall furnish the following information along with any additional required information to a third-party reviewer that is approved by the Assistant Materials and Tests Bureau Chief – State Geotechnical Engineer. Once the third-party review has been completed and a report produced, the report shall be submitted along with the PEB application to the Research and Development Bureau. The Research and Development Bureau will then distribute the application packet to the Geotechnical Division of the Bureau of Materials and Tests and the Bridge Bureau. The Geotechnical Division and Bridge Bureau shall have a period of at least 60 days to complete a thorough review of submitted materials. Upon completion of ALDOT’s review and if approved by ALDOT, the product will be placed on the MSDSAR Manual, List II-22 under probationary status and will be added to List II-22 as a conditionally approved item. The ALDOT State Geotechnical Engineer reserves the right to determine the conditions of the approval and the duration of the probation period. Once on the list, the wall system will be limited to one total ALDOT project with a height of less than 15 feet and a maximum wall face area of 3000 square feet. The wall system will be prohibited at abutments during the probation period. Personnel from the ALDOT Geotechnical Engineer’s office will thoroughly review the construction of the MSE wall on the first awarded ALDOT project. This will include observing and having access to the wall installation and review by the company’s installer. After successful completion of the project (pay item accepted and paid), the wall system will be subject to a performance evaluation for a period of 180 days. During the evaluation period, the wall system will be periodically inspected by ALDOT personnel. The wall system will be prohibited on any other ALDOT project during the evaluation period. Upon completion of the performance period and if the wall performance is to the satisfaction of ALDOT, the probation status will be removed.

Part One: Materials and Material Properties

Provide a sample of the reinforcement material and material specifications describing the material type, quality, certifications, lab and field testing, acceptance and rejection criteria along with support information for each of the following material items. Include representative test results (lab and/or field) clearly referencing the date, source and method of test, and, where required, the method of interpretation and/or extrapolation. Along with the source of the supplied information, include a listing of facilities normally used for testing (i.e., in-house and independent).
1.1 Facing Unit

Yes No N/A

☐ ☐ ☐ standard dimensions, tolerances and weights
☐ ☐ ☐ joint sizes and details
☐ ☐ ☐ concrete strength (minimum)
☐ ☐ ☐ wet cast concrete % air (range)
☐ ☐ ☐ dry cast concrete density (minimum or range)
☐ ☐ ☐ moisture absorption (percent and by weight)
☐ ☐ ☐ salt scaling
☐ ☐ ☐ freeze/thaw durability factor
☐ ☐ ☐ facing unit to facing unit shear resistance
☐ ☐ ☐ bearing pads (joints)
☐ ☐ ☐ spacers (pins, etc.)
☐ ☐ ☐ joint filter requirements: geotextile or graded granular
☐ ☐ ☐ aesthetic choices (texture, relief, color, graffiti treatment)
☐ ☐ ☐ other facing materials

1.2 Earth Reinforcement

1.2.1 Metallic

Yes No N/A

☐ ☐ ☐ ultimate and yield strength of steel
☐ ☐ ☐ minimum galvanization thickness for 75-year design life
☐ ☐ ☐ sacrificial steel thickness for 75 and 100-year design life
☐ ☐ ☐ corrosion resistance test data
☐ ☐ ☐ pullout interaction coefficients for range of backfill
### 1.2.2 Geosynthetics

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- HDPE: resin type, class, grade and category
- PP: resin type, class, grade and category
- PET: minimum intrinsic viscosity correlated to number average molecular weight and maximum carboxyl end groups
- post-consumer recycled material, if any
- weight per unit area
- minimum average roll value for ultimate strength: coefficient of variation for ultimate strength (include mill certified test reports)
- creep reduction factor for 75 and 100-year design life, including effect of temperature (20C to 40C) (include test results)
- durability reduction factor (chemical, hydrolysis, oxidative) for 75 and 100-year design life
- additional durability reduction factor for high biologically active environments
- installation damage reduction factor for range of backfill (i.e. sand, sandy gravel, gravel, coarse gravel) (include test results)
- splicing details and associated seam strength (in the direction of loading)
- pullout interaction coefficients for range of backfills
- embedment scale factor
- coatings (type and amount)
- UV inhibitors, coatings, etc.
- UV resistance
1.3 Facing Connections

Yes No N/A

☐ ☐ ☐ mode (i.e., 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

1.4 Range of Backfill

Yes No N/A

☐ ☐ ☐ Reinforced: soil classification, gradation, unit weight, friction angle

☐ ☐ ☐ Facing: Soil classification, gradation, unit weight, friction angle

1.5 Leveling Pad

Yes No N/A

☐ ☐ ☐ cast-in-place

☐ ☐ ☐ precast

☐ ☐ ☐ granular

1.6 Drainage Elements

Yes No N/A

☐ ☐ ☐ weep holes

☐ ☐ ☐ base

☐ ☐ ☐ backfill

☐ ☐ ☐ surface
1.7 Coping
Yes No N/A
☐ ☐ ☐ precast
☐ ☐ ☐ precast attachment method/details
☐ ☐ ☐ cast-in-place

1.8 Traffic Railing/Barrier
Yes No N/A
☐ ☐ ☐ precast
☐ ☐ ☐ cast-in-place

1.9 Connections to Appurtenances
Yes No N/A
☐ ☐ ☐ cast-in-place
☐ ☐ ☐ other

1.10 Other Materials
Yes No N/A
☐ ☐ ☐ corner elements
☐ ☐ ☐ slip-joint elements

1.11 Quality Control/Quality Assurance Systems
Yes No N/A
☐ ☐ ☐ Material supplier(s) for metallic reinforcement
☐ ☐ ☐ Material supplier(s) for polymeric reinforcement
☐ ☐ ☐ Material supplier(s) for concrete products
☐ ☐ ☐ Material supplier(s) for backfill
Part Two: Design

Provide design assumptions and procedures with specific references (e.g., design code section) for each of the following items. Clearly show any deviations from the AASHTO 2002 Interim provisions, along with theoretical or empirical information which support such deviations.

2.1 External Stability

Yes No N/A

☐ ☐ ☐ sliding
☐ ☐ ☐ overturning (including traffic impact)
☐ ☐ ☐ bearing capacity (overall and local)
☐ ☐ ☐ seismic
☐ ☐ ☐ settlement (total and differential)
☐ ☐ ☐ recommended wall embedment

2.2 Internal Stability

Yes No N/A

☐ ☐ ☐ assumed failure surface
☐ ☐ ☐ distribution of horizontal stress
☐ ☐ ☐ concentrated dead load surcharge
☐ ☐ ☐ sloped surcharge
☐ ☐ ☐ broken-back surcharge
☐ ☐ ☐ live load surcharge
Yes No N/A

- traffic surcharge
- lateral loads from piles, drilled shafts within reinforced backfill
- allowable tensile strength of the reinforcement
- pullout
- facing connections
- facing design: connections
- facing design: concrete strength requirements
- effective face batter
- compound/global stability
- seismic considerations
- design modification for tiered structures, acute corners
- full design details to overcome obstructions in reinforced zones (e.g., drainage structures, deep foundations, etc.)

2.3 Performance Criteria

Yes No N/A

- ultimate strength of reinforcement
- service limit for steel, Fy
- service limit for polymeric, strength at 10% strain
- long-term allowable design strength
- material properties, requirements and test standards
- horizontal/vertical deflection limits
2.4 Plan Sheets

*Provide representative plan sheets showing all standard details along with any alternate details, including the following:*

Yes No N/A

- ☐ ☐ ☐ details for wall elements
- ☐ ☐ ☐ connection details
- ☐ ☐ ☐ appurtenance connection details
- ☐ ☐ ☐ obstruction detail (utilities, parapet/sidewalk connection, deep foundations, light standard and box)
- ☐ ☐ ☐ corrosion /durability protection details
- ☐ ☐ ☐ construction details
- ☐ ☐ ☐ optional details

2.5 Specifications

*Provide sample specifications for:*

Yes No N/A

- ☐ ☐ ☐ materials
- ☐ ☐ ☐ installation
- ☐ ☐ ☐ construction manual
- ☐ ☐ ☐ maintenance

2.6 Aesthetic Compliance

*Detail the provisions in material specifications for aesthetic compliance, including:*

Yes No N/A

- ☐ ☐ ☐ texture
2.7 Limitations

List all design limitations, including:

Yes No N/A
☐ ☐ ☐ seismic loading
☐ ☐ ☐ environmental restraints
☐ ☐ ☐ wall height, external loading
☐ ☐ ☐ other - utilities, foundation scour, pH range

2.8 Example Calculations

Provide detailed (long-hand) design calculations for the four problems shown in Figure 1 in conformance with your practice or the AASHTO 2002 Interims. The calculations should address the technical review items listed above. List deviations from the AASHTO 2002 Interims.

Yes No N/A
☐ ☐ ☐ Problems 1, 2, and 3 (See Appendix B)
☐ ☐ ☐ Problems 4 (See Appendix B)

2.9 Computer Support

If a computer program is used for design or distributed to customers, provide representative computer printouts of design calculations for the above typical applications demonstrating the reasonableness of computer results.

Yes No N/A
☐ ☐ ☐
2.10 Quality Control/Quality Assurance Systems

*Include the system designer’s Quality Assurance program for evaluation of conformance to the quality control program.*

Yes No N/A

Part Three: Construction

*Provide the following information related to the construction of the system:*

3.1 Fabrication of Facing Units

Yes No N/A

- □ □ □ curing times
- □ □ □ form removal
- □ □ □ concrete surface finish requirements

3.2 Field Construction Manual

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

Yes No N/A

- □ □ □ foundation preparation
- □ □ □ special tools required
- □ □ □ leveling pad
- □ □ □ facing erection
- □ □ □ facing batter for alignment
- □ □ □ steps to maintain horizontal and vertical alignment
- □ □ □ retained fill and reinforced fill placement/compaction
Yes No N/A
☐ ☐ ☐ erosion mitigation
☐ ☐ ☐ all equipment requirements

3.3 Construction Specifications

Include sample construction specifications, showing field sampling, testing, and acceptance/rejection requirements:

Yes No N/A
☐ ☐ ☐

3.4 Construction Case Histories

Provide construction case histories and photos/videotapes from projects illustrating the construction process:

Yes No N/A
☐ ☐ ☐

3.5 Contractor or Subcontractor Prequalification Requirements

List any contractor or subcontractor prequalifications

Yes No N/A
☐ ☐ ☐

3.6 List of Contractors and Subcontractors

Provide a list of installation contractors who have constructed this system, including contact persons, addresses and telephone numbers. Provide a list of precasters.

Yes No N/A
☐ ☐ ☐
3.7 Quality Control / Quality Assurance of Construction

Describe the quality control and quality assurance measurements required during construction to assure consistency in meeting performance requirements.

Yes No N/A

□ □ □

Part Four: Performance

Provide the following information related to the performance of the system:

4.1 Warranties

Provide a copy of any system warranties.

Yes No N/A

□ □ □

4.2 Designated Responsible Party

Yes No N/A

□ □ □ system performance

□ □ □ material performance

□ □ □ project-specific design (in-house, consultant)

4.3 Insurance Coverage for Responsible Party

List insurance coverage types (e.g., professional liability, product liability, performance) limits, basis (i.e., per occurrence, claims made) provided by each responsible party

Yes No N/A

□ □ □
4.4 Project Performance History

Provide a well-documented history of performance (with photos, where available), including:

Yes No N/A

☐ ☐ ☐ oldest

☐ ☐ ☐ highest

☐ ☐ ☐ projects experiencing maximum measured settlement (total and differential)

☐ ☐ ☐ measurements of lateral movement/tilt

Yes No N/A

☐ ☐ ☐ demonstrated aesthetics

☐ ☐ ☐ project photos

☐ ☐ ☐ maintenance history

4.5 Numerical Model Studies

Provide case histories of numerical model studies.

Yes No N/A

☐ ☐ ☐

4.6 Instrumented Structures

Provide case histories of instrumented structures.

Yes No N/A

☐ ☐ ☐

4.7 Field Tests

Yes No N/A

☐ ☐ ☐ construction testing
4.8 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.

Yes No N/A
☐ ☐ ☐ pullout testing
☐ ☐ ☐ crash-barrier testing
☐ ☐ ☐ seismic load test

4.9 Unit Costs

Provide typical unit costs in $/ft² of vertical face, supported by data from projects.

Yes No N/A
☐ ☐ ☐

4.10 Maintenance

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

Yes No N/A
☐ ☐ ☐

4.11 Quality Control History

Provide the history for the system and material quality along with improvements that have been made based on the experience with the system.

Yes No N/A
☐ ☐ ☐
4.12 List of Users

Provide a list of users, including contact persons, addresses and telephone numbers (ensure correct and current project information)

Yes No N/A
☐ ☐ ☐

Part Five: Letters of References and Approvals

Provide information listing all current contracts and letters of approvals:

Yes No N/A
☐ ☐ ☐
Appendix B

PROBLEM 1:
Roadway Surface
\[ q = 10 \text{ kN/m} \]
\[ \phi = 34^\circ \]
\[ \gamma = 20 \text{ kN/m}^3 \]
\[ \phi_i = 30^\circ \]
Reinforced Soil Mass
Design Life 75 yrs.

PROBLEM 2:
Roadway Surface
\[ q = 10 \text{ kN/m} \]
\[ \phi = 34^\circ \]
\[ \gamma = 20 \text{ kN/m}^3 \]
\[ \phi_i = 30^\circ \]
Design Life 75 yrs.

PROBLEM 3:
Roadway Surface
\[ q = 10 \text{ kN/m} \]
\[ \phi = 34^\circ \]
\[ \gamma = 20 \text{ kN/m}^3 \]
Design Life 75 yrs.

PROBLEM 4:
Roadway Surface
\[ q = 10 \text{ kN/m} \]
\[ \phi = 34^\circ \]
\[ \gamma = 20 \text{ kN/m}^3 \]
Design Life 75 yrs.

\[ P_y = 45 \text{ kN/m (Dead)} \]
\[ +50 \text{ kN/m (Live)} \]
\[ P_H = 2.25 \text{ kN/m} \]

Figure 1
Example Design Problems