

Earth Retaining Structures and Systems Submittal Checklist

Part One: Materials and Material Properties

Provide a sample of the reinforcement material and material specifications describing the material type, quality, certifications, laboratory and field testing, acceptance and rejection criteria along with support information for each of the following material items. Include representative test results clearly referencing the date, source and method of test. Along with the source of the supplied information, include a listing of facilities normally used for testing.

1.1 Facing Unit

- standard dimensions and tolerances
- 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

- manufacturing sizes, tolerances and lengths
- ultimate and yield strength of steel
- corrosion protection - minimum sacrificial steel thickness and galvanization thickness for 75 and 100 year design life
- pullout interaction coefficients for range of acceptable backfill

1.2.2 Geosynthetics

- polymer type and grade
 - 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
- minimum average roll value for Quality Control strength
- creep reduction factor for 75 and 100 year design life
- durability reduction factor for 75 and 100 year design life
- additional durability reduction factor for high biologically active environments
- installation damage reduction factor for range of acceptable backfill
- junction strength for quality control
- strength of spliced connection as a percentage of the reinforcement ultimate strength
- pullout interaction coefficients for range of acceptable backfill
- embedment scale factor
- reinforcement coatings (type and amount)
- UV inhibitors, coatings, etc.
- UV resistance

1.3 Facing Connection(s)

- mode (i.e., structural/mechanical, frictional or combined)
- connection strength as a percentage 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 Backfill

- classification, gradation, unit weight, friction angle

1.5 Leveling Pad

- cast-in-place
- precast
- granular

1.6 Drainage Elements

- backfill properties
- collector and outlet pipe material, size, and spacing

1.7 Coping

- precast
- precast attachment method/details
- cast-in-place (forming details)

1.8 Traffic Railing/Barrier

- precast
- cast-in-place (forming details)

1.9 Connections to Appurtenances

- precast

1.10 Other Materials

- corner elements
- slip-joint elements

1.11 Quality Control/Quality Assurance Systems

- material suppliers
 - geosynthetic reinforcement
 - concrete products
 - backfill (reinforced and unreinforced)
- fabricator(s)
- test facilities (internal and external)

Part Two: Design

Provide design assumptions and procedures with specific references (e.g., design code section) for each of the following items clearly showing compliance with current AASHTO specifications. Design shall account for all live and dead loads; traffic surcharge, loads from sloped embankments above the wall, traffic impact, and vertical and lateral loads from shallow and deep foundations within the reinforced backfill.

2.1 External Stability

- sliding
- eccentricity (including traffic impact)
- bearing capacity (overall and local)
- global stability
- settlement (total and differential in both the transverse and longitudinal directions)
- recommended wall embedment below finished grade

2.2 Internal Stability

- assumed failure surface
- distribution of horizontal stress both from top to bottom of wall and from the front to back of the reinforcement
- traffic impact
- allowable tensile strength of the reinforcement
- maximum vertical and horizontal spacing of reinforcement
- facing design
 - connections
 - concrete strength requirements
- design modification for tiered structures and acute corners
- full design details to overcome obstructions in reinforced zones

2.3 Performance Criteria

- nominal strength of reinforcement
- service limit states
 - for steel, F_y
 - for geosynthetics, nominal strength at % strain
- long-term factored nominal strength
- horizontal/vertical deflection limits

2.4 Plan Sheets. Provide representative plan sheets showing all standard details along with any alternate details, including the following:

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

2.5 Specifications. Provide sample specifications for:

- materials
- construction
- maintenance

2.6 Aesthetic Compliance. Detail the provisions in material specifications for aesthetics compliance, including:

- texture
- color
- graffiti treatment for facing panels
- durability of aesthetic features

2.7 Limitations. List any and all design limitations, including:

- environmental restraints
- wall height, external loading

2.8 Example Calculations. Provide detailed (hand) design calculations to include standard proprietary items (connections, standard panels, traffic barriers, etc.).

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.

2.10 Quality Control/Quality Assurance Systems. Include the system designer's Quality Assurance program for evaluation of conformance to the quality control program.

Part Three: Construction

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

3.1 Fabrication of Facing Units

- 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:

- foundation preparation
- special tools required
- leveling pad
- facing erection
- facing batter for alignment
- steps to maintain horizontal and vertical alignment
- steps to maintain required horizontal and vertical joint spacing
- retained and backfill placement/compaction
- erosion mitigation
- all equipment requirements

3.3 Construction Specifications. Include sample construction specifications, showing field sampling, testing, and acceptance/rejection requirements.

3.4 Construction Case Histories. Provide construction case histories and photos/video from projects illustrating the construction process.

3.5 Contractor or Subcontractor Prequalification Requirements. List any contractor or subcontractor prequalifications.

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.

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.

Part Four: Performance

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

4.1 Project Performance History. Provide a well-documented history of performance (with photos, where available), including:

- oldest
- highest
- projects experiencing maximum measured settlement (total and differential)

- measurements of lateral movement/tilt
- demonstrated aesthetics
- project photos
- maintenance history

4.2 Instrumented Structures. Provide case histories of instrumented structures.

4.3 Field Tests

- construction testing
- pullout testing
- crash-barrier testing

4.4 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.

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

4.6 List of Users. Provide a list of at least three users, including contact persons, addresses and telephone numbers (ensure correct and current project information).