



Minnesota Department of Transportation

IDEA Retaining Wall Evaluation Supplemental Requirements

1. Purpose

The purpose of this document is to provide retaining wall system suppliers with a list of information that the Minnesota Department of Transportation (MnDOT) requires, in addition to an IDEA report, to evaluate placing a system on a MnDOT approved products list (APL).

Links to MnDOT submittal requirements are listed under Section 4.2 of this document. Additional submittal requirements, to those contained in an IDEA report, are listed under Sections 5 through 9, of this document. It is recommended that wall system suppliers contact MnDOT prior to preparation of a submittal for current requirements and additional general information.

2. National Based Retaining Wall Programs¹

The Highway Innovative Technology Evaluation Center (HITEC) was established in 1994 as a collaborative effort by the Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB) to accelerate the process by which technological advances are introduced for use in highway infrastructure (HITEC, 1998). The HITEC Program has been administered through the Civil Engineering Research Foundation (CERF) of The American Society of Civil Engineers (ASCE). The structure of HITEC was designed to facilitate comprehensive consensus-based nationally accepted performance evaluations of new or innovative technologies for the highway community.

Over a period of about 20 years, 18 complete earth retention systems (ERS) were evaluated and each documented with a final report. These evaluations compelled critical thinking by both transportation officials and manufacturers on challenging earth retention issues. Now, many of those issues have been resolved and MSE retention has become a commonly accepted component of transportation infrastructure. To advance innovation in ERSs and help disseminate new technologies into practice with public transportation agencies FHWA has prepared a protocol for Innovations, Developments, Enhancements, Advancements (IDEA) for ERSs.

The Highway IDEA program has three objectives:

- Update and improve the existing HITEC Technical Evaluation Protocol for new and modified earth retention systems and ERS components to provide a timely, transparent and cost-effective evaluation process.

¹ Johnson, K.A. and Valentine, R.J. (2016). Highway Innovations, Developments, Enhancements and Advancements (IDEA) – Protocol for Technical Evaluation of Earth Retention Systems, FHWA-16-006, 83p.

- Develop guidance for use of Technical Evaluations by project owners and/or transportation agencies.
- Develop guidance for administration and maintenance of Technical Evaluations, including periodic system reviews.

3. IDEA Listed Wall System Types

The IDEA program currently has review checklists established for seven wall system types. Wall types included are mechanically stabilized earth (MSE) and gravity. The type of wall and components of these seven types are listed in Table 1. The types are numbered, for later referral to.

Table 1. Current IDEA Wall System Types

Wall		Components	
#	Type	Facing	Soil Reinforcement
1	MSE	Concrete Modular Block	Extensible Soil Reinforcement
2	MSE	Concrete Modular Block	Inextensible Soil Reinforcement
3	MSE	Precast Concrete Panel	Extensible Soil Reinforcement
4	MSE	Precast Concrete Panel	Inextensible Soil Reinforcement
5	MSE	Steel Facing	Extensible Soil Reinforcement
6	MSE	Steel Facing	Inextensible Soil Reinforcement
7	Gravity	Precast Concrete Modular	n/a

4. MnDOT Wall Usage

4.1. Wall Systems Used

MnDOT uses several wall system types, on a regular basis. These include (for fill walls): cast-in-place (CIP) concrete cantilever; CIP concrete counterfort; gravity walls constructed of wet-cast, precast modular block wall (PMBW) units; and MSE walls with a variety of facing, including dry-cast modular block wall (MBW) units, and reinforcement options. MSE wall system types include: precast panel faced; MBW faced, geosynthetic reinforced; and PMBW faced, geosynthetic reinforced. Wall system types used by MnDOT, following the IDEA listing (see Table 1), are noted in Table 2 including additional notes about usage. The respective MnDOT wall terminology is noted, where applicable.

4.2. Special Provisions and Submittal Requirements

Precast panel faced walls:

MnDOT Technical Memorandum No. 14-02-B-01 –

<http://www.dot.state.mn.us/products/walls/msewalls.html>

MnDOT APL – <http://www.dot.state.mn.us/products/walls/msewalls.html>

Standard provisions available at: <http://www.dot.state.mn.us/pre-letting/prov/index.html>

MBW faced, geosynthetic reinforced MSE walls, with MnDOT standard designs:
 Standard plans available at: <http://standardplans.dot.state.mn.us/StdPlan.aspx>

PMBW faced, gravity and geosynthetic reinforced MSE walls:
 Standard provisions available at: <http://www.dot.state.mn.us/pre-letting/prov/index.html>

Table 2. MnDOT Wall System Types and Terminology

Wall		Components		Notes
#	Type	Facing	Soil Reinforcement	
1	MSE	Concrete Modular Block	Extensible Soil Reinforcement	MnDOT has two types of systems: MnDOT terminology is (1) dry-cast modular block wall (MBW) unit face and geosynthetic soil reinforcement; and (2) wet-cast precast concrete modular wall (PMBW) unit with geosynthetic soil reinforcement. Standard plans and special provisions are used by MnDOT for MBW faced walls, in lieu of vendor designs. MnDOT has APLs for geosynthetic soil reinforcements, for MBW units, and for MBW-geosynthetic reinforcement combinations (that controls connection strength). Vendor designs are used for PMBW faced walls.
2	MSE	Concrete Modular Block	Inextensible Soil Reinforcement	Currently not used by MnDOT.
3	MSE	Precast Concrete Panel	Extensible Soil Reinforcement	MnDOT has APL of wall systems, and a standard special provision for these walls.
4	MSE	Precast Concrete Panel	Inextensible Soil Reinforcement	
5	MSE	Steel Facing	Extensible Soil Reinforcement	Either a temporary wall, where it is a contractor designed structure; or a permanent wall and a special project feature, where a special provision will be used. No APL for these types.
6	MSE	Steel Facing	Inextensible Soil Reinforcement	
7	Gravity	Precast Concrete Modular	n/a	MnDOT has two types of systems: (1) wet-cast precast concrete modular wall (PMBW) units; and (2) concrete facing with monolithic perpendicular stems. MnDOT has APL of wall systems, and a standard special provision for PMBW gravity walls. MnDOT plans to develop an APL for the second type of systems, using IDEA report and supplemental information submittal from vendors.

5. MnDOT MBW Faced MSE Walls – Additional Submittal Requirements

5.1. ERS Components

- Provide Minnesota-specific information including concrete mix and strength, aggregate sources, and manufacturer that meet MnDOT Materials Office requirements/approvals.
- Provide detailed freeze-thaw durability test report(s) documenting manufactured units meet MnDOT durability requirements for MBW units.

5.2. ERS Design

- Summary table of wall system design input parameters for use with MSEW computer program.
- Provide full laboratory connection strength test reports, with interpretation and design value recommendations.

5.3. Construction

- Any information pertinent to use in Minnesota.

5.4. Quality Control

- Any additional information pertinent to use by MnDOT, or other Minnesota government agencies.

5.5. Performance

- List of prior publicly funded projects completed within the past 5 years in Minnesota, and/or climates similar to Minnesota, including contact person, date of construction, addresses, and telephone numbers; maximum height; and any design, construction, or performance issues.

5.6. Other Information

- Any additional information pertinent to use by MnDOT, or other Minnesota government agencies.

6. MnDOT PMBW MSE Walls – Additional Submittal Requirements

6.1. ERS Components

- Provide Minnesota-specific information including precast concrete mix and strength, aggregate sources, and precast manufacturer that meet MnDOT Materials Office requirements/approvals.

6.2. ERS Design

- System or component supplier organizational structure, specifically engineering and construction support staff.
- Name and provide information on firm(s) that will be providing design for MnDOT walls. The design engineer and the checker engineer must be registered Professional Engineer in the State of Minnesota.
- State design methodology used for MSE wall design, and computer program used.

- State design methodology and computer program used for compound stability analysis.
- Summary table of wall system design input parameters for use with MSEW computer program (for MnDOT QA use).
- Provide a wall design calculations for the maximum wall height permitted for the applicable phase submitted (II or III).
- Provide design drawing detail of the leveling pad, which meets MnDOT special provisions. Include cross section and elevation.
- Provide design drawing details of reinforcement horizontal splay and vertical skew for obstruction avoidance, with maximum splay and skew noted.
- Provide typical design drawing details for structural frames to carry reinforcement around obstructions.

6.3. Construction

- Provide an erection/construction guide that is MnDOT-specific (It includes all MnDOT requirements and details; and does not contain options not allowed by MnDOT).

6.4. Quality Control

- Provide detailed description, or detailed manual, for quality control of design engineering.

6.5. Performance

- Provide insurance requirements/coverage for the design engineering firm(s).
- List of prior publicly funded projects completed within the past 5 years in Minnesota, and/or climates similar to Minnesota, including contact person, date of construction, addresses, and telephone numbers; maximum height; and any design, construction, or performance issues.

6.6. Other Information

- Previously have submitted Phase 1, Gravity Walls and gained approval, or submit concurrently with MSE submittal.
- Organize submittals into up to maximum 8-foot exposed height; Phase 2, MSE Walls up to maximum 10-foot exposed height (12-foot total height); and Phase 3, MSE Walls up to maximum 18-foot exposed height (20-foot total height).
- Any additional information pertinent to use in Minnesota.

7. MnDOT Concrete Panel Faced MSE Walls – Additional Submittal Requirements

7.1. ERS Components

- In addition to bearing pad description, provide detailed specifications for the bearing pads and submit results of laboratory tests in the form of vertical load-vertical strain and vertical load-lateral strain curves for the specific bearing pads proposed. The vertical load-vertical strain curve should extend beyond the first yield point.

7.2. ERS Design

- System or component supplier organizational structure, specifically engineering and construction support staff.
- Name and provide information on firm(s) that will be providing design for MnDOT walls.
- State design methodology used for MSE wall design, and computer program used.
- State design methodology and computer program used for compound stability analysis.
- Summary table of wall system design input parameters for use with MSEW computer program (for MnDOT QA use).
- Provide example calculation for maximum, practical wall height.
- Provide design drawing detail of the leveling pad, which meets MnDOT special provisions. Include cross section and elevation.
- Provide design drawing details of reinforcement horizontal splay and vertical skew for obstruction avoidance, with maximum splay and skew noted.
- Provide typical design drawing details for structural frames to carry reinforcement around obstructions.
- Provide typical detail(s) of top of wall with traffic barrier.
- Provide detail of geomembrane connection to top facing panels (steel soil reinforcements only).

7.3. Construction

- Provide an erection/construction guide that is MnDOT-specific (It includes all MnDOT requirements and details; and does not contain options not allowed by MnDOT).

7.4. Quality Control

- Provide detailed description, or detailed manual, for quality control of design engineering.
- Provide detailed description, or detailed manual, for quality control of panel bearing pads.

7.5. Performance

- Provide insurance requirements/coverage for the design engineering firm(s).
- List of prior publicly funded projects completed within the past 5 years in Minnesota, and/or climates similar to Minnesota, including contact person, date of construction, addresses, and telephone numbers; maximum height; and any design, construction, or performance issues.

7.6. Other Information

- Any additional information pertinent to use in Minnesota.

8. MnDOT PMBW Modular Gravity Walls – Additional Submittal Requirements

8.1. ERS Components

- Provide Minnesota-specific information including precast concrete mix and strength, aggregate sources, and precast manufacturer that meet MnDOT Materials Office requirements/approvals.

8.2. ERS Design

- System or component supplier organizational structure, specifically engineering and construction support staff.
- Name and provide information on firm(s) that will be providing design for MnDOT walls.
- Summary table of wall system design input parameters (for MnDOT QA use).
- Provide design drawing detail of the leveling pad, which meets MnDOT special provisions. Include cross section and elevation.

8.3. Construction

- Provide an erection/construction guide that is MnDOT-specific (It includes all MnDOT requirements and details; and does not contain options not allowed by MnDOT).

8.4. Quality Control

- Provide detailed description, or detailed manual, for quality control of design engineering.

8.5. Performance

- Provide insurance requirements/coverage for the design engineering firm(s).
- List of prior publicly funded projects completed within the past 5 years in Minnesota, and/or climates similar to Minnesota, including contact person, date of construction, addresses, and telephone numbers; maximum height; and any design, construction, or performance issues.

8.6. Other Information

- Submittal is for Phase 1, Gravity Walls up to maximum 8-foot exposed height (10-foot total height).
- Any additional information pertinent to use in Minnesota.

9. MnDOT Precast Modular Gravity Walls with Perpendicular Concrete Stems – Additional Submittal Requirements

9.1. ERS Components

- In addition to bearing pad description, provide detailed specifications for the bearing pads and submit results of laboratory tests in the form of vertical load-vertical strain and vertical load-lateral strain curves for the specific bearing pads proposed. The vertical load-vertical strain curve should extend beyond the first yield point.

- Details should include a leveling pad detail, with the bottom of the leveling pad embedded a minimum of 4 feet below finished grade in front of the wall (similar to other vendor supplied wall systems).

9.2. ERS Design

- System or component supplier organizational structure, specifically engineering and construction support staff.
- Name and provide information on firm(s) that will be providing design for MnDOT walls.
- State design methodology used for wall design, and computer program used. Specifically note any exceptions to AASHTO LRFD Bridge Designs specifications.
- Summary table of wall system design input parameters (for MnDOT QA use).
- Provide example calculation for maximum, practical wall height.
- Provide design drawing detail of the leveling pad. Include cross section and elevation.
- Provide typical detail(s) of top of wall with traffic barrier.

9.3. Construction

- Provide an erection/construction guide that is MnDOT-specific (It includes all MnDOT requirements and details; and does not contain options not allowed by MnDOT).

9.4. Quality Control

- Provide detailed description, or detailed manual, for quality control of design engineering.
- Provide detailed description, or detailed manual, for quality control of panel bearing pads.

9.5. Performance

- Provide insurance requirements/coverage for the design engineering firm(s).
- List of prior publicly funded projects completed within the past 5 years in Minnesota, and/or climates similar to Minnesota, including contact person, date of construction, addresses, and telephone numbers; maximum height; and any design, construction, or performance issues.

9.6. Other Information

- Any additional information pertinent to use in Minnesota.