



WHRP

Wisconsin Department of Transportation
Wisconsin Highway Research Program

Request for Proposal

Mechanically Stabilized Earth (MSE) Wall Backfill Water Infiltration

Questions submitted to research@dot.wi.gov regarding the content of this RFP are due no later than 4:30 PM (CST) on December 12, 2016

Responses to questions will be posted to the WisDOT Research and Library website <http://wisdotresearch.wi.gov/rfps-and-proposals> by 4:30 PM (CST) on December 19, 2016

Proposers must submit a PDF version of their proposal by 4:30 PM (CST) on January 20, 2017 to: research@dot.wi.gov

Proposers will be notified by May 1, 2017

For more information regarding this RFP contact the WisDOT Research Program at: research@dot.wi.gov. This RFP is posted to the Internet at: <http://wisdotresearch.wi.gov/rfps-and-proposals>

**Wisconsin Highway Research Program
Request for Proposals
Geotech Technical Oversight Committee**

Mechanically Stabilized Earth (MSE) Wall Backfill Water Infiltration

I. Background and Problem Statement

For Mechanically Stabilized Earth (MSE) retaining walls located along rivers and streams, AASHTO specifications require a differential hydrostatic pressure equal to 3.0 feet of water be applied to the wall system (see AASHTO section 11.10.10.3). The following is provided in the comment section of the AASHTO specifications:

‘Situations where the wall is influenced by tide or river fluctuations may require that the wall be designed for rapid drawdown conditions, which could result in differential hydrostatic pressures considerably greater than 3.0 feet, or alternatively rapidly draining backfill material such as shot rock or open graded gravel can be used as backfill. Backfill material meeting the gradation requirements in AASHTO LRFD Bridge Construction Specifications for MSE structure backfill is not considered to be rapid draining’

Since AASHTO considers the MSE structure backfill to not be rapid draining they would also consider them to not be rapid infiltrating.

Therefore, the goal of the research would be to evaluate how water infiltrates into MSE structure backfill and develop a model to document this condition. For example, in a situation where the hydraulic design for a 10 foot high MSE wall structure indicates that the water level will consistently rise for one hour to a height of 5 feet below the top of the wall, then remain there for 4 hours, then will consistently fall for one hour to a level below the bottom of the wall, what will the line between saturated and partially saturated soils (wetting front) within the MSE structure backfill look like and what will the corresponding internal and external lateral forces be on the MSE wall.

II. Goal and Objectives

The intended outcome of this study is to meet the following objectives:

- Conduct a literature search to determine what research has been performed to evaluate infiltration into MSE structure backfill.
- Develop a laboratory testing program to evaluate the infiltration into MSE structure backfill.
- Based on the laboratory testing program, develop a model that can predict the line between saturated and partially saturated soils (wetting front) and internal and external lateral earth pressures.

III. Scope of Work

Task 1: Literature Review and Summary of Current Practice

Conduct a literature review and assessment of current practices at various other state DOTs. There will be some lessons learned that will help the researcher organize the Work Plan. Lessons learned from other states will be used to help the researcher and Project Oversight Committee (POC) monitor and make modifications to the work plan. For example, researchers will be expected to provide information and recommendations on the following questions:

- How are other states handling the language under AASHTO section 11.10.10.3, concerning rapid drawdown and infiltration?
- What do other states use for wall backfill?
- Have other states made modifications to the design of wall drainage systems that would directly affect the terms of AASHTO section 11.10.10.3?

Task 2: Laboratory Testing Program

The researcher will need to perform comprehensive testing and analysis for infiltration of MSE structure backfill.

- A. Construct and instrument multiple scale MSE walls with precast concrete panels using WisDOT specifications for wall backfill.
- B. Perform laboratory tests on the backfill including grain size distribution tests, standard proctor, moisture content, dry density and hydraulic conductivity tests.
- C. Perform multiple simulations with varying hydraulic conditions to evaluate the infiltration into the wall backfill and internal and external lateral earth pressures.

Task 3: Data Analysis and Model

Based on the data collected in Task 2 conduct a detailed analysis of infiltration and internal and external lateral earth pressures and develop a model to predict infiltration and internal and external lateral earth pressures for various states that would be expected in the field. This model will be used by the researcher to analyze the infiltration and drawdown properties of wall backfill. After completion of the research the model should also be able to be used by WisDOT for design and analysis during design of MSE walls to evaluate rapid drawdown and infiltration scenarios.

Task 4: Final Report

Report the results of the study to the POC and Technical Oversight Committee (TOC) in a written final report and an in-person presentation.

IV. WisDOT/TOC Contribution

- A. Expected level by staff/POC/TOC members: Maximum of 20 hours over the duration of the project. POC members will consult with research team in selection of project sites.
- B. This project will require travel for a meeting to finalize the work plan with the POC, and travel to Madison is required to report the results of the study to the Geotech TOC in Task 5. Other interim reporting is also expected.
- C. If field work on or around in-service facilities is anticipated by the research, the proposal will need to discuss the nature and extent of needed traffic control and support assistance that will be requested from WisDOT. The researcher will need to closely coordinate with WisDOT regional personnel and possibly the county personnel where project fieldwork is being conducted. For WisDOT planning purposes, the Principal Investigator shall specify in his or her proposal, as practical, what specific traffic control will be required for this project, such as traffic flagging, signage, barricades, etc., as well as the duration needed (hours/day/location). It should not be assumed that WisDOT would fund the traffic control apart from the research project budget.

V. Required Travel

This project may require travel to Madison, WI for a meeting to finalize the work plan with the POC as well as interim reporting during the project. It is expected the PI will deliver the final presentation in person in Madison, WI.

VI. Deliverables

- A. Submittal and reporting of progress as required by WHRP and WisDOT.
- B. Reporting Requirements. Six (6) hard copies and an electronic copy of the final report delivered to WisDOT by contract end date.
- C. Presentation Requirements. All projects require the Principal Investigator to give a closeout presentation after submittal of the draft final report. An electronic copy of the slide presentation will be shared. The closeout presentation should include suggested implementation strategies and recommendations.

VII. Schedule and Budget

- A. Project Duration
 - i. The total duration of the project is **24 months** with an anticipated start date around **June 1, 2017**.
 - Deadline for submittal of draft final report is three months prior to contract end date to allow for report review activities.
 - Deadline for research close out presentation is 4-6 weeks prior to contract end date.
 - Deadline for submittal of the Final Report is the contract end date.

- ii. The researcher is expected to submit the draft report with quality technical writing and proper grammar. It is acceptable to include a technical editor on the research team to ensure these requirements are met.
- iii. Contract is considered closed upon satisfactory completion of the project scope, including submission of electronic and hard copies of the final report.

B. Project Budget

- i. The project budget shall not exceed **\$150,000** and shall include any costs associated with performing tests, analyzing data, and preparing the draft and final reports.
- ii. Matching funds will not be considered in the proposal evaluation process.

VIII. Implementation

The results of this study will be used to evaluate infiltration into MSE wall backfill for determining internal and external design requirements.

Such changes may consist of the following:

- Propose revisions to the WisDOT Bridge Manual based on the results of the research.
- Assessing if shot rock or open graded gravel in areas with intermittent high water are necessary.
- Develop design guidance regarding drainage behind MSE walls.