

# RESEARCH SPOTLIGHT

## Project Information

**REPORT NAME:** Establish Policies and Procedures for Use of Subgrade Stabilization in Michigan

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**RESEARCH REPORT NUMBER:** SPR-1733

**PROJECT COST:** \$188,000

**COST SHARING:** 20% MDOT, 80% FHWA through the SPR, Part II, Program

## MDOT Project Manager



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## Best practices and specifications for stabilizing pavement subgrades

Stabilizing the subgrade under pavement can facilitate the construction process and support sustainable pavement performance. Determining when and where stabilization may be needed and best practices for constructing a stabilized subgrade, however, depends on many factors. New guidance and construction specifications will support the Michigan Department of Transportation (MDOT) in identifying projects that would most benefit from a stabilized subgrade. Unified construction specifications will ensure consistent practices across the agency.

### PROBLEM

Soft and wet subgrade soil may need to be removed and replaced during road construction to stabilize the subgrade and provide long-term pavement performance. Alternative measures can be used to stabilize the subgrade that avoid the lengthy removal and replacement process, including allowing the soil to dry and then compacting it, adding geosynthetic barriers, or mixing granular materials such as cement or lime with the soil.

Choosing when to use stabilization methods depends on site-specific criteria such as soil type, drainage and traffic levels. MDOT has used subgrade stabilization in eight road projects since 2005, each with different specifications for materials and mix design, equipment and construction.

Unified guidelines and procedures for project selection and best practices for



Stabilizing the subgrade under pavement layers can accelerate construction and provide longer-term pavement sustainability.

mix design and construction could support MDOT engineers in future projects and lead to more widespread use of subgrade stabilization in pavement construction.

### RESEARCH

A review of previous research projects and other resources provided information about materials, methods and mix designs for

*“These results provide much-needed subgrade stabilization standards and guidance to know when we should be using these techniques to enhance pavement performance across Michigan.”*

**Michael Eacker, P.E.**  
Project Manager

subgrade stabilization. An online survey of state departments of transportation (DOTs) and select federal agencies gathered additional information about road construction projects and experience with subgrade stabilization. Agencies provided details about project selection, materials used, mix design and construction specifications, and pavement design inputs.

Collaborating with MDOT engineers and the Research Advisory Panel, researchers evaluated the agency’s existing subgrade stabilization specifications for project selection, materials and mix design, as well as laboratory testing, drainage, and field quality control and assurance. Further agency input was obtained through interviews with MDOT staff and an online survey of staff involved in subgrade stabilization projects.

## RESULTS

Using information gathered from previous MDOT subgrade stabilization projects, other state DOT specifications and extensive consultations with MDOT staff and experts, researchers developed comprehensive guidance for project selection, mix design and construction of stabilized subgrades for road projects.

Representatives from 28 state transportation agencies responded to the survey. Of these agencies, some use subgrade stabilization extensively and have developed guid-

ance documents and specifications. Other agencies have researched this practice, and about one-third of responding state DOTs don’t include the practice in standard specifications. Materials commonly used are cement and lime, but other stabilizers like fly ash have been successful in some states.

Researchers developed a new construction specification for MDOT that addresses requirements for materials and equipment, construction, and quality control and assurance. The specification covers mixture designs using lime, lime-fly ash, cement, or lime-cement – products that MDOT has used in previous stabilization projects. The timeline of subgrade strength development is also addressed based on testing conducted during two subgrade stabilization projects.

Guidance documents developed with ongoing review and input from MDOT engineering and construction staff include:

***Technical Guide for Selection of Pavement Projects for Chemical Stabilization of Subgrade Soils.*** Guidelines help determine if stabilization is needed for long-term pavement performance or short-term support to facilitate construction based on subgrade conditions found during scoping and geotechnical exploration and testing.

***Guidelines for Mix Design of Chemically Stabilized Soils in Pavement Structures.*** Guidance can assist MDOT engineers in reviewing and responding to contractor-developed mix designs, which will depend on subgrade soil type. Soil sampling, material testing, additive selection, and mix design recommendations are included. High-organic or high-sulfate soils may not be conducive to a subgrade stabilization process.

***Guidelines for Construction of Chemically Stabilized Soils in Pavement Structures.*** Detailed information on subgrade stabilization construction, including preconstruction, inspection and testing, and measurement and payment, will support the review of contractor construction documents and quality assurance.

Finally, researchers established recommended inputs for stabilized subgrades in

AASHTO pavement design methods after a limited sensitivity analysis of the geotechnical inputs using six final MDOT pavement designs.

## IMPLEMENTATION

MDOT’s regional engineers, designers and project managers can begin to use the subgrade stabilization guidance immediately. After implementing the procedures and specifications for a limited number of projects to identify any needed refinements, MDOT will incorporate the specifications and guidance into official agency construction and geotechnical manuals.

## Research Administration

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**The final report is available online at**

[MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1733](http://MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1733).

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