

# Geotech Tools

## Geoconstruction Information and Technology Selection Guidance for Geotechnical, Structural, and Pavement Engineers

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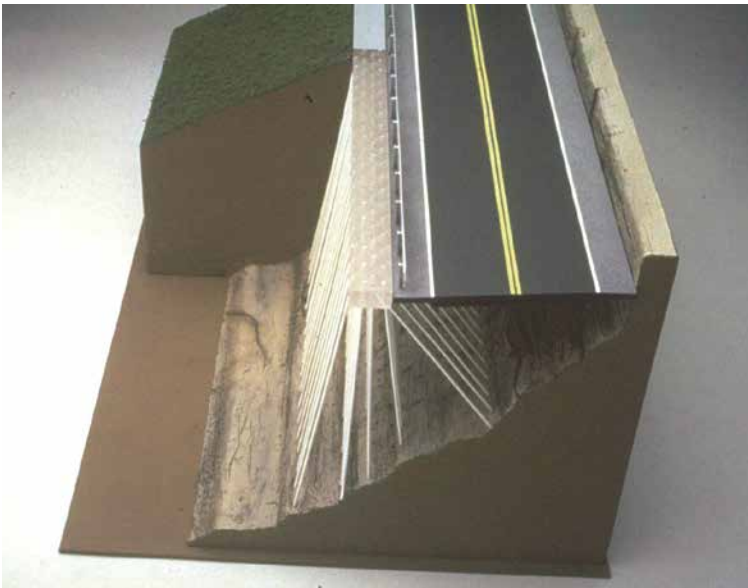
**G**eotechnical solutions are geoconstruction technologies or ground-improvement systems that alter poor soil and ground conditions to meet project requirements. Selecting an appropriate geoconstruction technology to use in transportation systems is a complex undertaking that depends on integration of available knowledge and a number of factors specific to both the problem and the site. Although geoconstruction technologies have existed for several decades, various obstacles prevent their widespread application in transportation infrastructure projects. To address the barriers and promote more widespread use of geoconstruction technologies, SHRP 2 Renewal Project R02: Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform investigated the state of practice and created the web-based tool Geotech Tools: Geo-Construction and Technology Selection Guidance for Geotechnical, Structural, and Pavement Engineers, which is available at [www.geotechtools.org](http://www.geotechtools.org), to disseminate the research results. The project also produced two reports—*Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform* (the final report); and *Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform: Development Report* (which summarized the development of the website). This brief provides an overview of the Geotech Tools website, the development report, and the final report.

### Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform (Final Report)

Transportation engineers, planners, and officials have expressed the need for a comprehensive system of access to critical information about geoconstruction technologies and for a tool to assist in deciding which technologies are potentially applicable to their projects. SHRP 2 Project R02 investigated current practices in transportation project engineering and geotechnical engineering to identify and assess methods to advance the use of these technologies. The final report describes the work, results, and products of this project.

SHRP 2 Project R02 examined a broad spectrum of materials, processes, and technologies within geotechnical engineering—ranging from structural foundations to grouting to vibro-concrete columns. In all cases, the project investigated the applicability of geoconstruction technologies to the following three project elements:

1. New embankment and roadway construction over unstable soils
2. Roadway and embankment widening
3. Stabilization of pavement working platforms



Micropile walls used for slope stability

To address the many technical and nontechnical impediments to widespread, effective use of geotechnical technologies in transportation, this project cataloged geotechnical technologies; developed design, construction, and quality control/quality assurance (QC/QA) guidance procedures; built cost-estimating tools; and crafted sample guide specifications.

**Product Availability:** Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform is available at <http://www.trb.org/Main/Blurbs/168148.aspx>.

## Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform: Development Report

The development report describes how the Geotech Tools website was developed. It includes information about the project background and a literature review, as well as the development, programming, and testing of the website. This report also includes recommendations for future enhancements to Geotech Tools.

The website platform was developed using Adobe ColdFusion, and the programs were written in ColdFusion Markup Language. This particular programming language offered the versatility to complete dynamic websites that query databases. The JavaScript programming language provided interactive site content and allowed for

live page updates based on user actions. The knowledge to complete both dynamically developed web pages and the interactive selection system was contained in a Microsoft Access database.

Geotech Tools was designed to use two approaches for technology selection. The first approach is that the system conservatively eliminates technologies during the process based on technical feasibility and project constraints. The second approach identifies a common theme throughout the selection procedure that helps users make the final selection of an appropriate technology. The tool leads the user to multiple technologies and provides the means for technology introduction, design, and cost estimating.

Geotech Tools is designed to assist, not replace, the technical specialist (geotechnical, structural and pavement). The engineer's experience and judgment should be the basis for the final selection process, taking into consideration the following factors: construction cost, maintenance cost, design and quality control issues, performance and safety (e.g., pavement smoothness, hazards caused by maintenance operations, and potential failures and poor performance), inconvenience (a tangible factor, especially for heavily traveled roadways or long detours), environmental aspects, and aesthetic aspects (appearance of completed work with respect to its surroundings).

**Product Availability:** Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform: Development Report is available at <http://www.trb.org/Main/Blurbs/168246.aspx>.

## Geotech Tools

The Geotech Tools website provides access to critical information on geoconstruction technologies. It can be used to help geotechnical, structural, and pavement engineers decide which technologies are potentially applicable to site-specific conditions. Geotech Tools includes 46 ground-improvement and geoconstruction technologies and processes applicable to the three project elements; a complete list is available in Table 1. It has a technology catalog and a technology selection assistance tool, as well as sections on design philosophy and a glossary. It also includes eight tools for each of the technologies in the catalog: technology fact sheets, photographs, case histories, design procedures, quality control/quality assurance procedures, cost estimating tools, specification guidance, and a bibliography. The primary value of this web-based information and guidance system is that it collects, synthesizes, integrates, and organizes a vast amount of important information about geo-

**Table 1. Technologies in Geotech Tools Website**

Aggregate Columns
Beneficial Reuse of Waste Materials
Biotreatment for Subgrade Stabilization
Blasting Densification
Bulk-Infill Grouting
Chemical Grouting/Injection Systems
Chemical Stabilization of Subgrades and Bases
Column-Supported Embankments
Combined Soil Stabilization with Vertical Columns (CSV)
Compaction Grouting
Continuous Flight Auger Piles
Deep Dynamic Compaction
Deep Mixing Methods
Drilled/Grouted and Hollow Bar Soil Nailing
Electro-Osmosis
Excavation and Replacement
Fiber Reinforcement in Pavement Systems
Geocell Confinement in Pavement Systems
Geosynthetic Reinforced Construction Platforms
Geosynthetic Reinforced Embankments
Geosynthetic Reinforcement in Pavement Systems
Geosynthetic Separation in Pavement Systems
Geosynthetics in Pavement Drainage
Geotextile-Encased Columns
High-Energy Impact Rollers
Hydraulic Fill + Vacuum Consolidation + Geocomposite Drains
Injected Lightweight Foam Fill
Intelligent Compaction / Roller Integrated Compaction Monitoring
Jet Grouting
Lightweight Fill, EPS Geofoam, Low-Density Cementitious Fill
Mechanical Stabilization of Subgrades and Bases
Mechanically Stabilized Earth Wall Systems (MSEW)
Micropiles
Onsite Use of Recycled Pavement Materials
Partial Encapsulation
Prefabricated Vertical Drains and Fill Preloading
Rapid Impact Compaction
Reinforced Soil Slopes
Sand Compaction Piles
Screw-in Soil Nailing
Shoot-in Soil Nailing
Shored Mechanically Stabilized Earth Wall System
Traditional Compaction
Vacuum Preloading with and without PVDs
Vibrocompaction
Vibro-Concrete Columns

technical solutions in a system that makes the information readily accessible to personnel at transportation agencies, contractors, and the consultant communities.

Geotech Tools was designed to achieve the following objectives:

1. Provide an information system that has a comprehensive technology catalog.
2. Provide technology selection assistance to help users develop a select list of applicable technologies based on key project and site characteristics.
3. Provide information and guidance for engineers to select a technology and develop a project-specific design based on project performance requirements and constraints.
4. Provide an interactive, fully functional, and populated knowledge resource to house the information system and guide users through the selection process.
5. Provide a glossary of the abbreviations and terms used throughout the information and guidance system.



Deep soil mixing



Roadway widening at abutment constrained by limited headroom and existing piles

The website, Geotech Tools, and the downloadable tools can be used by both technical and lay audiences to learn about the technologies. The website can be used to investigate potential solutions for general and for project-specific site conditions by browsing the technologies catalog, by using the technology category classifications, or by using the selection system. It can help users find procedures for design and QC/QA, and develop cost estimates and specifications. The interactive nature of the website allows users to test various project solutions efficiently. Lay users may find the technology fact sheets, photographs, and case histories valuable for quickly developing a basic understanding of a geoconstruction technology. The case histories provide examples where the technology has been used and they include transportation agency technical contacts, when available.

**Product Availability:** Geotech Tools is available at [www.geotechtools.org](http://www.geotechtools.org). Those new to the website need to click on the “Not registered?” link to create a username and password before they can login.

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[www.TRB.org/SHRP2/Renewal](http://www.TRB.org/SHRP2/Renewal)