Transportation Association of Canada

TAC Publication Primer

Evaluating Soil and Material Stabilization Products

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Introduction

The stabilization of poor soils is a common practice during road construction in Canada. There are numerous stabilization products already on the market, and agencies can struggle to obtain important information about the installation and long-term performance of new products. Most new stabilization products are proprietary in nature, and can pose significant issues with ultimate responsibility for any problems or failures. Product evaluation in a field setting is expensive and time consuming, and many agencies face challenges in assessing products and their potential application in local conditions.

TAC's *Guide to Evaluating Soil and Material Stabilization Products* will help agencies evaluate new soil and material stabilization products for potential use in roadway infrastructure. Its objectives are:

- To identify typical soil stabilization processes in Canada, available soil stabilization products, and procedures used by Canadian agencies to evaluate and select those products for road construction
- To summarize Canadian experience with various soil stabilization products, including long-term performance
- To develop a procedure for evaluating soil stabilization products that will help Canadian agencies standardize laboratory testing, field trials and sharing of results

Stabilization products

Soil and material stabilization products are typically used to modify the properties of in-situ materials, or to bind them together:

- *Stabilization* generally refers to an improvement of engineering properties over the longer term through the use of mechanical processes or chemical products to improve the material shear strength, stiffness and durability of a specific layer in the pavement structure.
- *Modification* generally refers to chemical products (additives) or mechanical processes that provide short-term improvements during or shortly after stabilization; it improves the engineering properties of a material to assist or expedite the construction process. Modification can include a change in gradation through the addition of soil or granular materials, or the application of chemical additives to dry the material, alter the plasticity index, or facilitate compaction.

This guide considers 30 different stabilization products and processes for use in roadway infrastructure. They are grouped into four main categories: mechanical stabilization, cementitious stabilization, asphalt stabilization, and other chemical stabilization. A survey of Canadian agencies and practitioners found that 24 of these 30 stabilization products and processes are in regular use in roadway projects.

Mechanical stabilization processes

Mechanical stabilization techniques are used to enhance soil-particle interlock through a variety of methods. Mechanical stabilization includes compacting, various forms of blending in-situ soil and granular materials, and a wide array of geosynthetics (geogrids or geotextiles).

Mechanical stabilization is predominantly used in subgrade layers to improve the compaction of existing layers or modify the material properties (blending); however, compaction and blending can be used on existing granular base/subbase material that is substandard. In addition, there are many geosynthetic products that can be used in almost every layer in the pavement structure to address construction, durability and maintenance issues.

Thirteen mechanical stabilization techniques were reviewed, and a survey of Canadian stakeholders found that many of them are used by municipal, provincial and territorial agencies. Compaction and geosynthetics (including geogrids and geocells) were identified as standard techniques, while blending, aggregate piers and grouting techniques are commonly used by provincial agencies but not by municipalities.

Cementitious stabilization processes

Cementitious stabilization techniques are used to modify existing subgrades and granular base/subbase materials. When these products are used at higher application rates than those used for modification, they stabilize the material through the creation of a variety of different cementitious products.

Cementitious stabilization techniques can be used throughout the pavement structure. They can be used within the subgrade layers to improve the compaction of existing layers or modify the material properties as well as increase the strength of subgrade materials. They can be used to improve the engineering properties of existing granular base/subbase material and subgrade materials. They can also be used, either alone or in combination with asphalt stabilizers, to enhance the material properties and durability of blended asphalt and granular base/subbase materials.

Six cementitious stabilization techniques were reviewed, and a survey of Canadian stakeholders found that many of them are used by municipal, provincial and territorial agencies. Cement and lime are used by most agencies, while supplementary cementitious materials, fly ash and blast furnace slag are commonly used by provincial agencies but not by municipalities.

Asphalt stabilization processes

Asphalt stabilization techniques are used to improve the engineering properties of relatively coarse-grained materials (i.e., with low fines content and low plasticity) by enhancing material resilience and moisture resistance. They are typically used on upper pavement layers, but can also be used on subgrades.

Three asphalt stabilization techniques were reviewed. A survey of Canadian stakeholders found that asphalt emulsions and foamed asphalt are common across the country, while cutback asphalts are not being used due to their negative environmental effects.

Other chemical stabilization processes

Numerous non-traditional stabilizers have entered the market over the last two decades that address performance issues in subgrade and granular base/subbase materials. A key concern with these products is the lack of detailed information on their properties and their long-term performance in Canadian climates.

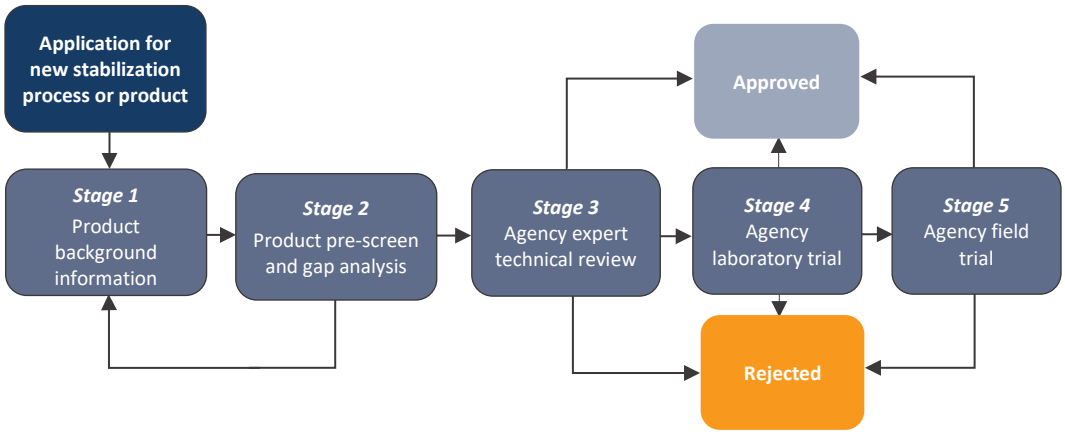
Eight chemical stabilization techniques were reviewed. A survey of Canadian stakeholders found that five are used to some degree, with chlorides being the only chemical stabilization method in regular use.

Framework for evaluating new stabilization products

It is a challenge for agencies to evaluate new stabilization or modification products and processes due to the volume of requests, resource requirements, and uncertain performance. Furthermore, the results of expensive and time-consuming laboratory and field-testing programs may only be applicable to a relatively narrow set of conditions. Appropriate field trial sites are also limited, which makes it difficult for an agency to select which products to include in a trial. These constraints exist in the context of external pressure to get products approved/fast-tracked in the hope that they can maximize the effectiveness of limited budgets.

This guide describes a recommended five-stage framework for agencies to evaluate new materials (see Figure 1). It includes a standard *Supplier/Contractor Application Form* to gather key information that can help agencies conduct an initial assessment of a product, and assess the benefits of a more detailed evaluation. Subsequent stages of the evaluation framework include a gap analysis, an expert technical review, and a laboratory trial (if warranted, including recommended performance tests and a laboratory testing program) and field trial (if warranted, including recommended performance tests and monitoring programs).

Figure 1: Framework for evaluating new stabilization products



For more information

The *Guide to Evaluating Soil and Material Stabilization Products* is available for purchase from TAC's online Bookstore. The publication's catalogue page also includes the guide's table of contents and a fillable PDF version of the *Supplier/Contractor Application Form*.

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401 - 1111 Prince of Wales Drive, Ottawa, ON K2C 3T2

Tel: 613-736-1350 | Email: secretariat@tac-atc.ca

www.tac-atc.ca