BASE STABILIZATION

GENERAL INFORMATION AND RESOURCES

SCOPE

Base stabilization is a process wherein the existing underlying materials (base, sub-base, and/or sub-grade) is pulverized and mixed into a homogeneous base material without the presence of heat. The treatment can be mechanical, chemical, or bituminous.

The base stabilization process improves the

- material's shear strength due to traffic loading
- modulus (stiffness) of the material in order to minimize permanent deformation caused by traffic loading
- resistance to moisture damage, maintaining the material's shear strength and modulus
- stability of the material when exposed to traffic loading and moisture
- durability of the material, extending its service life

DEFINITIONS

BASE STABILIZATION

Base stabilization is a treatment wherein the existing underlying material is pulverized, mixed, and blended into a homogeneous base material. This blended material can be further stabilized in three different ways and, if needed, combinations of all three types of stabilization can be performed in order to increase the material's performance.

MECHANICAL

Mechanical stabilization is achieved by adding virgin aggregate or recycled materials such as recycled asphalt pavement (RAP) or recycled concrete.

CHEMICAL

Chemical stabilization is done by adding lime, Portland cement, fly ash, lime, cement kiln dust, or various proprietary chemical products.

BITUMINOUS

Bituminous stabilization is achieved by adding liquid asphalt, asphalt emulsion, or expanded (foamed) asphalt.

MATERIALS

ASPHALT EMULSION

A number of different types and grades of asphalt emulsions can be used in base stabilization. The type and grade of emulsion required is based on a number of factors: environmental conditions (temperature and humidity), time of year, and existing road conditions. The most common emulsions used are CSS-1 and CMS-2, including their polymer-modified formulations. Proprietary products are also commonly used for the base stabilization process. Compatibility between the emulsion and the reclaimed material is critical to ensuring optimal performance.

EXPANDED (FOAM) ASPHALT

PG 58-28 is the asphalt cement typically used in base stabilization. Softer grades can be used if the specifications for tensile strength can still be met. To create the foam, 2 to 3% water is injected into the hot (150 to 170°C) asphalt.

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BLENDED MATERIAL

Blended material is created by pulverizing a pavement surface's underlying granular materials into a homogeneous mixture. Virgin aggregate, RAP material, or crushed concrete can be added to improve the material's overall strength. The maximum particle size is typically 37 mm. The pulverizing machine can control the gradation of the material through speed, milling head direction, and the addition of granular materials.

MODIFIERS

There are different modifiers that can be used in the full-depth reclamation process. Besides asphalt emulsion or expanded (foam) asphalt, virgin aggregate may be added to improve gradation, stability, or cross slope. Portland cement or lime in dry or slurry form as well as Type C fly ash can be used to improve early strength, cohesion, and resistance to moisture damage.

AGGREGATE

The aggregates used to improve the gradation or give extra strength can be virgin crusher run, recycled crushed concrete, or recycled asphalt pavement (RAP). The virgin aggregate can also be coarse aggregate if the gradation needs to be corrected due to the fine nature of the pulverized material.

DESIGN CRITERIA

In order to design a mix that satisfies the objectives of the project, the existing material must be investigated for structural adequacy, thickness, slope, cross-fall, and visual appearance. In most instances, the accepted method of design is the procedure developed by Wirtgen GmbH and laid out in the "Wirtgen Cold Recycling Technology Manual." The design procedure is performed as follows:

- Obtain representative samples of the base, sub-base, and sub-grade materials from the field.
- Determine the gradation and physical properties of the various granular materials.
- Select the type and amount of additional aggregate, if required.
- Select the type and grade of recycling additive, if required.
- Estimate the amount of recycling and additive required.
- Determine the pre-mix moisture content for coating.
- Test the trial mixtures, initial curing properties, final curing properties, and moisture sensitivity of the material.
- Establish a job mix formula.
- Make the required adjustments in the field.

RECOMMENDED PERFORMANCE GUIDELINES

In order to construct a well-designed, high-performance base stabilized mix, the following guidelines should be followed:

- Ensure the existing structure is adequate for supporting the expected traffic type and volume.
- Evaluate the existing structure for distresses and make sure any necessary repairs are completed prior to construction.
- Ensure that the base stabilization process is the best process for the job's specific requirements.
- Determine if a corrective aggregate or other modifiers such as cement are needed.
- Ensure a proper mix design is created. Use this design only as a guide.
- Field adjustments may have to be made to the water content or recycling additive in order to achieve good coating and workability properties.
- Proper equipment is required: reclaimer, grader, water truck, and compactors.

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- The use of a vibratory footpad, pneumatic vibratory rollers, and static steel rollers is required.
- If a modifier is used, the compaction process must begin as soon as the mix is placed.
- Breakdown rolling followed by shaping and final compaction is required.
- Rolling patterns should be established at the job's outset with the use of a nuclear gauge.
- Curing of the finished mat is required before placing the wearing surface.
- Curing time may vary depending on environmental conditions and the type of additive used. Typically, 2 to 4 days for foam and 10 to 14 days for emulsions are needed for the curing process to be complete.
- A light fog seal may be needed to prevent surface ravelling.
- Typically, an HMA wearing surface is placed over the stabilized base but, for lower traffic roads, other surfacing options are available. The structural requirements of the pavement will determine the appropriate type of HMA or surfacing.

RESOURCES AND REFERENCES

1. "Basic Asphalt Emulsion Manual", Fourth Edition, Asphalt Institute and Asphalt Emulsion Manufacturers Association, 2008
2. "Basic Asphalt Recycling Manual", Asphalt Recycling and Reclaiming Association, Annapolis, Maryland, 2001
3. "Wirtgen Cold Recycling Technology", 2012 Edition, Wirtgen GmbH, 2012
4. "Report on Cold Recycling of Asphalt Pavements", Task Force 38, AASHTO/AGC/ARTBA, March 1998