

DENSE GRADED COLD MIXES

GENERAL INFORMATION AND RESOURCES

SCOPE

Advances in asphalt emulsion technology make it possible for emulsion mixes to be used in a wide variety of pavement construction, rehabilitation, and maintenance applications. These mixes can be used as base and surface courses, stockpile mixes, upgrades for gravel roads, and as a means to reduce the total pavement thickness. One such mix is known as a dense graded cold mix, consisting of a virgin graded aggregate and an asphalt emulsion. These mixes can be produced in a central plant, a travel plant, or through the use of a pugmill.

DEFINITIONS

DENSE GRADED COLD MIX

A dense graded mix is a virgin graded aggregate mix similar in appearance to a conventional hot mix. These mixes can be used as a base or surface course. They include a wide variety of aggregate types and gradations and can be used for all types of pavement applications. These mixes typically require a thin surfacing layer (such as a chip seal or slurry seal) to protect the finished surface.

MATERIALS

ASPHALT EMULSIONS

Several factors have to be taken into account when choosing the emulsion to be used in a dense graded cold mix. The type and grade of emulsion required is affected by the aggregate type and grade, coating ability, material compatibility, mixing methods, environmental conditions, and laying and compaction processes. The most widely used grades of asphalt emulsion used in dense graded mixes are SS-1, CSS-1, MS-2, and CMS-2. In recent years, proprietary emulsions have also been developed for use in dense graded mixes.

COLD MIX AGGREGATE

The aggregate used in dense graded cold mixes can be processed or semi-processed crusher, pit, or bank run aggregates. Typically, cold mix aggregates have a very low clay content and are graded with a maximum size of 25 mm and with very little material passing through the 75 µm sieve.

DESIGN CRITERIA

When designing a dense graded mix, a number of factors have to be examined and assessed to ensure a high quality pavement surface: aggregate type and shape, mix workability, coating ability, and residual asphalt content.

AGGREGATE TYPE AND SHAPE

The overall shape of the aggregate and the amount of asphalt emulsion used can influence the quantity of aggregate required for a dense graded cold mix. Additionally, the more graded the aggregate is, the more emulsion is required for an effective mix. The compatibility of the emulsion and the aggregate is also a critical factor dictating the quality of the mix.

MIX WORKABILITY

The emulsion used in a dense graded mix should give the finished mix enough workability to be laid evenly and homogeneously and should be designed for the intended method of processing, be it immediate placement or inventory in a stockpile.



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COATING ABILITY

The asphalt emulsion should have the ability to coat the fine (passing the 4.75 mm sieve) aggregate without the fine aggregate balling up. With some emulsions, the use of mixing water aids in coating the fines.

ASPHALT RESIDUAL IN THE EMULSION

The quantity of asphalt residue in the emulsion affects the quantity of emulsion needed to coat the aggregate. Less asphalt emulsion is needed when the emulsion residue is higher.

During the design process, two key characteristics to strive for are a well-coated mix and adequate surface strength and stability, enabling the surface to handle the expected traffic load and volume. A dense graded cold mix requires an emulsion content of 5.5 to 7.0%, a minimum stability of 2500 N at 25°C, and air voids between 7 and 11%.

RECOMMENDED PERFORMANCE GUIDELINES

In order to construct a well-designed, high-quality dense graded cold mix, the following guidelines should be followed:

- Ensure that the existing pavement structure or base material is adequate for supporting the expected type and volume of traffic.
- Determine the mixing process to be used.
- Determine if the emulsion type and grade to be used is well designed for the chosen mixing process.
- Design a dense graded mix using the same aggregate that will be used on the job.
- Use a clay-free, hard-crushed aggregate with a well-graded appearance.
- Ensure that the asphalt emulsion and aggregate are compatible.
- Ensure that an adequate amount of emulsion is used.
- Ensure that the aggregate is moist but not saturated.
- Ensure that the mix is workable and the fines are well coated.
- Calibrate and inspect all equipment.
- Use a sufficient number of properly weighted pneumatic and steel rollers in static mode.
- Correctly execute all required construction techniques.
- Use traffic control to protect the mix.
- Work only in weather suitable for the type and grade of emulsion being used.
- Once the mix is cured, it should be covered with a thin wearing surface such as a chip seal or slurry seal.

RESOURCES AND REFERENCES

1. "Basic Asphalt Emulsion Manual", Fourth Edition, Asphalt Institute and Asphalt Emulsion Manufacturers Association, 2008
2. "Recommended Performance Guidelines", Second Edition, Asphalt Emulsion Manufacturers Association, Annapolis Maryland, 2006
3. "Asphalt Cold Mix Manual" MS-14, Asphalt Institute, Lexington Kentucky



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