

Asphalt Mixture Design and Performance Properties by Using a Gyrotory Compactor (RES2016-02)

Research Background

The Superpave mix design was developed in early 1990s during the Strategic Highway Research Program (SHRP) (1987-1992) to replace the Hveem and Marshall mix design methods. It is one of the primary outcomes from the SHRP study. Superpave is a comprehensive asphalt mix design and analysis system, including a Performance Grade (PG) asphalt binder specification, a series of aggregate tests and specifications, a hot mix asphalt (HMA) design and analysis system, and computer software to integrate the system components. The Superpave mix design procedure involves careful material selection and volumetric proportioning as a first approach in producing a mix that will perform successfully. The four basic steps of Superpave asphalt mix design are materials selection, selection of the design aggregate structure, selection of the design asphalt binder content, and evaluation of the mixture for moisture sensitivity.

Over the past two decades, Superpave mix design has been refined and most state DOTs have fully or partially adopted it. Unlike other state DOTs, Tennessee Department of Transportation (TDOT) is currently still using the Marshall mix design method for designing its fine graded asphalt mixtures. TDOT has also refined this method over the years by specifying certain criteria to be met. This method has served TDOT well in the past and continues to be effective. However, the Marshall method currently does not allow for design of larger stone mixes due to the size limitations in the design method. It also hinders the technical information exchange and communication of TDOT engineers, staff, and administrators with their counterparts from other state DOTs which adopted Superpave mix design.

Purpose of the project

The research project aims to compare Marshall and Superpave mix design methods using typical TDOT asphalt mixtures and recommend an improved mix design method for TDOT. This proposed method should be able to keep the good aspects of both mix design methods, while enabling TDOT take advantage of technical advancement and making it easier for technical communication and information exchange. Purposes of the project are: 1) to compare different asphalt mixture design methods using TDOT typical asphalt mixtures, including TDOT refined Marshall method, currently specified Superpave System (AASHTO M323/R35/T312), the modified version of the Superpave system (NCHRP 573); 2) to recommend a modified mix design method combining the benefits of both Marshall and Superpave methods; 3) to recommend a mix design method for larger stone mixtures that TDOT does not currently have.

Scope and significance of the project

The scope of the research work includes:

- (1). To complete a synthesis of literature review on different asphalt mixture design methods in the US;
- (2). To compare different asphalt mixture design methods using typical TDOT well-performing mixtures as well as good mixtures for the neighboring states;

- (3). To conduct a statistical analysis on critical mix design parameters (such as volumetrics, compaction efforts, aggregate gradation) to determine the design requirements or criteria;
- (4). To conduct a series of laboratory tests on typical well-performing TDOT mixtures;

Expecting outcomes

This research project is expected to provide the following outcomes and benefits upon its completion:

- Improved mix design method for TDOT asphalt mixtures;
- Recommendations on TDOT specification regarding aggregate requirements, mix design requirements, etc;
- Longer lasting pavements, saving money and reducing annual resurfacing costs;
- Better performing pavements, providing a safer driving environment and a comfortable and smooth transportation.

Time periods and status of the project

The research project started on January 1, 2016 and is scheduled to completion by September 30, 2017 (the start date on the agreement is October 1, 2015, but was delayed due to contracting approval). The project is now progressing as planned.

Contact information

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