

Balanced Mix Design (BMD) Task Force Update

FHWA Mixture and Construction ETG

Ames, Iowa

Spring 2017



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Discussion Items

- Research Problem Statement (RPS) Submitted to AASHTO
- Balanced Mix Design Tech Brief
- NCHRP 20-07 Task 406 Project Development of a Framework for Balanced Asphalt Mixture Design and Gap Analysis
- Other BMD Activities of Interest
- Future

Balanced Mix Design Technical Brief

- Tech Brief document w/ FHWA, but yet to be published.
- Submitted October 2016



TechBrief

The Asphalt Pavement Technology Program is an integrated, national effort to improve the long-term performance and cost effectiveness of asphalt pavements. Managed by the Federal Highway Administration through partnerships with state highway agencies, industry and academia the program's primary goals are to reduce congestion, improve safety, and foster technology innovation. The program was established to

Balanced Mixture Design Approaches for Asphalt Pavement Construction

This *Technical Brief* provides an overview of balanced mixture design (BMD) approaches used by states in asphalt pavement construction. These approaches are still under development and this document will attempt to show its current status and some of the issues that will need to be addressed in the future.

Balanced Mix Design NCHRP Research Problem Statement (RPS)

- RPS prepared by the BMD TF in June 2016
- Submitted to AASHTO SOM
- BMD statement was the only RPS in the area of asphalt mixtures or binder.
- Ranked very high, BUT...not advanced forward
 - Time / Funding too great provided as reasons

VI. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Recommended Funding: Phase I - \$1,000,000
Phase II - \$700,000 (2020, 2021)

Research Period: Phase I: 36 months
Phase II: 24 months



BMD RPS

NCHRP Problem Statement

I. PROBLEM NUMBER

To be assigned by NCHRP staff.



II. PROBLEM TITLE

Development of a Recommended Practice for Balanced Asphalt Mixture Design

III. RESEARCH PROBLEM STATEMENT

Background

In September 2015, the FHWA Expert Task Group on Asphalt Mixture and Construction formed a Task Force on Balanced Mixture Design (BMD) to move forward changes in the way asphalt mixtures are formulated. The task group has defined BMD as “*Asphalt mixture design using performance tests on appropriately conditioned specimens that address multiple modes of distress taking into consideration mixture aging, traffic, climate and location within the pavement structure.*” The objective of BMD is to design asphalt mixtures for performance using a rational approach instead of relying on strictly volumetric guidelines. The Task Force has identified three types of approaches used for a Balanced Mixture Design: A) Performance Testing, B) Superpave with Adjustments Based on Performance Testing and C) Superpave with Adjustments Based on Volumetrics and Performance Testing.

NCHRP 20-07 Task 406 Project Development of a Framework for Balanced Asphalt Mixture Design and Gap Analysis

- Project was submitted after the larger NCHRP project was not advanced forward by the SOM
- **Time/Funding:** 1 yr. / \$100K
- **Objective:** Develop a framework that addresses alternate approaches to devise and implement balanced mix design procedures incorporating performance testing and criteria. The framework shall be presented in the format of an AASHTO recommended practice and shall encompass a wide variety of testing procedures and criteria.
- **Status:** Three proposals were received on the project with all proposals being very high quality. A research contractor has been selected with the contract documents currently being finalized.

NCHRP Project 20-07/Task 406, FY 2017

Development of a Framework for Balanced Asphalt Mixture Design

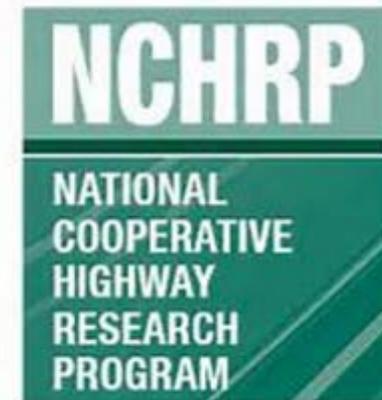
Funds Available: \$100,000

Contract Time: 12 months (includes 3 months for NCHRP review and for contractor revision of the final report)

Staff Responsibility: Edward [Harrigan](mailto:eharriga@nas.edu), 540-454-2149 (email: eharriga@nas.edu)

Authorization to Begin Work: 04/01/2017 (estimated)

Proposal Due Date: 01/26/2017



Other BMD Related Activities of Interest

- High level of interest from state DOTs/industry regarding BMD.
 - MSB: Presentations in Colorado, Florida, Michigan, Montana, Oregon, South Carolina, and Vermont to give an overview of BMD and highlight the Task Force efforts.
- Regional Pooled Fund Study (Mid Atlantic/Northeast states) on Performance Related Specifications. Tom Bennert and Frank Fee are leading this effort.
- Initial Balanced Mix Design training course was conducted by NCAT with others scheduled throughout 2017.
- NAPA will be holding a “*Paving for Performance – Designed to Perform*” conference in Atlanta on October 11 – 13. Include sessions on balanced mix design and performance specifications.
- **Performance / Balanced Mixture Design: Implementation Efforts and Success Stories** TRB workshop session (AFK30/AFK50) proposed (awaiting decision).
- Significant state funded research on BMD related activities.

BMD Research In Progress - California



Title:	PPRC14 SPE 3.33: Simplified Performance Based Specifications for AC Long Life Projects
Accession Number:	01620518
Record Type:	Project
Abstract:	The objective of this project is to complete the development of simplified asphalt mix design procedures and specification preparation for Asphalt Concrete (AC) long life projects that are easier for contractors and districts to understand and communicate on, but do not increase the risk of poor performance to California Department of Transportation (Caltrans). Evaluate revised specifications and procedures on new AC long life projects. Support Caltrans on implementation and training.
Language:	English
Sponsor Organizations:	California Department of Transportation Sacramento, CA 95819 United States
Project Managers:	Yang, John Phone: (916) 654-8220
Performing Organizations:	Regents of the University of California, Berkeley Berkeley, CA United States
Principal Investigators:	Harvey, John Phone: (530) 754-6409 Email: jtharvey@ucdavis.edu
Project Status:	Active

BMD Research In Progress - Idaho



Title:	Development and Evaluation of Performance Measures to Augment Asphalt Mix Design in Idaho
Accession Number:	01604825
Record Type:	Project
Abstract:	This project will evaluate and adopt performance tests to evaluate fatigue cracking (fatigue and thermal), rutting and moisture damage. The specification limits that are developed for the performance tests will be included in the asphalt mix design in Idaho. The performance threshold limits will be implemented and thus lead to consistently high-performance asphalt pavement.
Contract Numbers:	RP 261
Language:	English
Sponsor Organizations:	Idaho Transportation Department P.O. Box 7129, 3311 West State Street Boise, ID 83707-1129 United States
Project Managers:	Santi, Michael J Idaho Transportation Department Phone: (208) 334-8450 Fax: (208) 334-4411 Email: mike.santi@itd.idaho.gov
Project Status:	Programmed
Funding:	\$170,000.00
Start Date:	20161001

BMD Research In Progress - Indiana



Title:	SPR-4114: Performance Balanced Mix Design for Indiana's Asphalt Pavements
Accession Number:	01620664
Record Type:	Project
Abstract:	Several performance-balanced mix design (BMD) methods are available. This project will validate them with Indiana mixture and pavement conditions. A primary project deliverable is a draft ITM of BMD.
Supplemental Notes:	Contract to a Performing Organization has not yet been awarded.
Contract Numbers:	SPR-4114
Language:	English
Sponsor Organizations:	Purdue University/Indiana Department of Transportation JHRP Purdue University 1284 Civil Engineering Building, Room 4154 West Lafayette, IN 47907-1284 United States
Principal Investigators:	Lee, Jusang Indiana Department of Transportation Haddock, John E Purdue University Email: jhaddock@purdue.edu
Project Status:	Active

BMD Research In Progress - Minnesota



Title:	Balanced Design of Asphalt Mixtures
Accession Number:	01610304
Record Type:	Project
Abstract:	<p>Volumetric parameters form the basis for current state of practice in asphalt mixture design. Many state department of transportation (DOTs), including Minnesota Department of Transportation (MnDOT), utilize a design process that bases optimum binder content on volumetric principles. However, many DOTs across the nation are working towards implementation of balanced mix design procedures for hot-mix asphalt. Texas Department of Transportation (TxDOT) is one example of a state that is at an advanced stage of implementation. With volumetric design, assurance of good field performance requires confidence and engineering judgment, primarily based on experience. This project will be comprised of eight tasks focused on the development of a balanced mix design (BMD) approach for MnDOT. It is anticipated that the BMD will be developed primarily for use in designing surface course mixtures on medium to high volume roads. The research approach will consider climate, substrate and mix type in the design procedure. The project will begin with a review of technology and practice to define the activities other agencies will conduct in developing a balanced mix design procedure. Tests for low-temperature cracking, rutting and moisture sensitivity will be selected for the experimental portion of the study.</p>
Contract Numbers:	99007 WO#6
Language:	English
Sponsor Organizations:	Minnesota Department of Transportation 395 John Ireland Boulevard St Paul, MN 55155 United States
Performing Organizations:	Texas A&M Transportation Institute Texas A&M University System 3135 TAMU College Station, TX 77843-3135 United States
Principal Investigators:	Newcomb, David E Texas A&M Transportation Institute

BMD Research In Progress - Texas



Title:

Develop Guidelines and Design Program for Hot-Mix Asphalts Containing RAP, RAS, and Other Additives through a Balanced Mix-Design Process

Accession Number:

01618957

Record Type:

Project

Record URL:

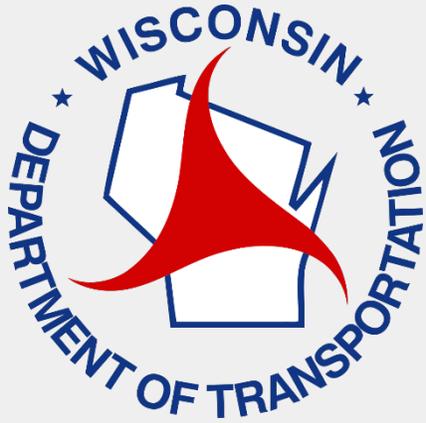
<http://library.ctr.utexas...BILWlyODctYzljMzQ3ZmVmOWFI> 

Abstract:

University of Texas at El Paso (UTEP) will provide TxDOT with an Asphalt Concrete (AC) mix design program and guidelines to determine the optimum recycled asphalt pavement (RAP), recycled asphalt shingles (RAS), and additives content for designing balanced mixes without compromising the quality and performance of the final product. During this project, the university will:

1. Evaluate current mix designs, design processes and guidelines for use of RAP, RAS, and additives on AC mixes in Texas and worldwide to identify weaknesses and strengths of current practices for balanced mix designs involving RAP, RAS, and other additives.
2. Gather laboratory and field performance of sections studied under Research Project 0-6679. These sections are identified as historical and in-service sections (sections to be determined by Texas Department of Transportation (TxDOT)) constructed with and without RAP, RAS, and additives.
3. Determine correlation of laboratory results to pavement sections studied under Research Project 0-6679 (chosen by TxDOT) using performance indicators from tests such as the overlay tester (OT) and Hamburg wheel tracking device (HWTD) and strength parameters like the Indirect Tensile strength from past research projects to implement a protocol for a balanced cracking and rutting resistant mix containing RAP, RAS, and other additives.
4. Evaluate at least 15 mixes used by TxDOT through a factorial experiment to assess the influence of RAP, RAS, and additives on the performance of balanced Hot Mix Asphalt (HMA) mixes.
5. Evaluate the feasibility of an AC mix design process that not only consider the raw and recycled materials but also incorporates the structural design of the pavement section to reliably characterize the performance of the designed AC mix.
6. Develop a design program for TxDOT pavement designers and engineers to determine the optimum RAP, RAS, and additive contents on AC mixes with varying aggregate type, asphalt content and grade and (if feasible) structural design of the pavement.

BMD Research In Progress - Wisconsin



Title:	Analysis and Feasibility of Asphalt Pavement Performance-Based Testing Specifications for the Wisconsin Department of Transportation
Accession Number:	01580508
Record Type:	Project
Record URL:	http://wisdotresearch.wi.gov/project?id=853
Abstract:	<p>Efforts to improve the sustainability and performance of asphaltic mixtures have led to innovations within the pavement industry for new materials and production methods. Specific examples include use of binder modifiers including polymers, extender oils and WMA (Warm Mix Asphalt) additives, use of higher recycled materials content involving both recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) and plant modifications (i.e. foaming). Research at the federal level has introduced new test methods and a design methodology that are more closely related to in-service performance through enhanced material characterization by considering loading time, temperature, and aging. In addition, the concepts of visualization and force measurement during compaction have been recently upgraded by providing direct measurements of mixture aggregate structure and shear stability versus estimation based on density. In contrast to these technological improvements, methods used to accept mixtures during production and placement (i.e. volumetric properties and density) remain unchanged and may not be indicative of performance. Given the maturity of recently developed test methods, there is a need to define a performance-based mixture acceptance framework that applies to the mix design, production, and placement phases of constructing asphaltic mixtures. The framework will include both tests that measure mixture properties directly and methods to estimate mixture performance that are suitable for use as quality control and acceptance tests. The aim of this research is to develop a performance-based acceptance framework that applies to both mixture design and quality control/acceptance during production and further to assess the feasibility of implementing this framework into Wisconsin Department of Transportation's</p>

Future BMD Task Force Activities

- Effective Communication
 - Highlight the benefit of BMD concepts
 - Monitor research in progress / disseminate information
- Field Acceptance
 - Better understanding of acceptance protocols within a BMD approach
- Other thoughts...?

Thank You!

