



Balanced Mix Design Workshop

September 26, 2019, Salt Lake City, Utah

Tom Clayton attended the one-day regional workshop which was presented by NCAT with support from NAPA and the FHWA. The workshop was designed for local and state highway agency materials engineers who are typically decision makers on mix design and acceptance specifications, asphalt industry managers responsible for asphalt mix designs and quality control testing, and other stakeholders interested in gaining an understanding of balanced mix design.

Overview: Balanced mix design (BMD) is an enhanced approach to designing asphalt paving mixtures to achieve a satisfactory balance between rutting resistance and cracking resistance. Unlike the Superpave design approach, BMD focuses on optimizing mixture performance using simple mixture performance tests. BMD is expected to open the door to utilizing innovative materials and technologies to design asphalt pavements while providing agencies with a more reliable way to accept mixtures.

The recently completed NCHRP Project 20-07/Task 406 developed a framework to address alternate approaches for implementation of BMD procedures that incorporate performance testing and criteria. Major outcomes of the project included state highway agencies and asphalt contractors detailing their expectations for BMD, a literature review of current practices for mix design and performance testing, knowledge gaps and research problem statements, as well as a preliminary draft AASHTO standard practice and specification for BMD in final review. To advance toward implementation, follow up is needed to promote the BMD framework and provide agencies and contractors with information and guidance on how best to proceed.

Topics Covered

- Superpave mix design limitations and refinements
- Balanced mix design definition and approaches
- Current mix design practices and modifications to improve performance
- Asphalt mixture performance tests
- Draft AASHTO standard practice and specification for balanced mix design
- Knowledge gaps and research needs
- Implementation and partnerships between agencies and industry
- Case studies and ongoing research
- Quality control and acceptance testing using performance tests

The Process: Today, asphalt mixes are primarily designed under the Superpave system, where proportioning of the aggregates and the asphalt binder relies primarily on empirical aggregate quality characteristics and mix volumetric properties such as air voids, voids in the mineral aggregate (VMA) and voids filled with asphalt (VFA).

Mixes designed with too much asphalt may be susceptible to rutting, while those with too little asphalt may be prone to cracking, raveling or other durability related pavement distresses. Concerns about the accuracy of aggregate specific gravity determinations increase with the incorporation of reclaimed asphalt pavement (RAP) and recycled asphalt shingles (RAS).

BMD used testing and design techniques to optimize the available materials to provide the best mixture utilizing the available materials. The evaluation and design processes are required to evaluate mixes for Air Voids (Va), Voids in Mineral Asphalt (VMA) for cracking potential and to Tensile Strength Retained (TSR). The process of completing a BMD is total end result and takes the control of the mixture away from the Local or State DOT and shifts the performance back to the designers.

Observations from attending: The BMD is the process is the way all APM pavements should be designed. This method addresses the issues being put forth by State and Local agencies about cracking, dry mixes and longevity. The BMD method provides a preconstruction method for doing analysis on the mixture in the lab and during production using plant produced mixtures with very prescribed and specific testing methods. This will require the performance testing limits be set and be reasonable.

What mix design variables can be changed to improve?

- Rutting resistance
- Cracking resistance
- Moisture susceptibility

BMD may allow for an increase in the use of RAP. This would occur if during the initial design and subsequent performance testing the mixtures met the BMD criteria. The use of materials will totally be up to the contractor and the designer provided they meet the individual materials requirements.

The issues implementing BMD: The approving agencies will have to be willing to release control of how the engineers are designing the mixtures. The designs will be required to meet specific criteria and the designer **MUST** create a mixture that fits into the specified criteria. The implementation of BMD will require a total shift in thought process by Local and State DOT's for mixture design approval as it currently stands where the approving agency now wants to adjust this or that because they feel they know more than the designer. They will need to be understanding and willing to accept mixes with different air voids (generally lower), VMA, and binder contents (typically slightly higher) than are being produced currently.

Engineering firms or others who are designing APM designs may be required to have some financial outlay for new or different equipment to perform some of the required tests for the cracking performance tests which will be required.