Balanced Mix Design

Howie Moseley
State Bituminous Materials Engineer
What is a Balanced Mix Design?

- Asphalt mix design using performance tests on appropriately conditioned specimens that address multiple modes of distress taking into consideration mix aging, traffic, climate and location within the pavement structure.

— Asphalt Mix ETG definition
Balanced Mix Design Illustration

Cracking Resistance

Rutting Resistance

AC Content
Balanced Mix Design Illustration

Minimum Cracking Resistance

Cracking Resistance

Rutting Resistance

AC Content

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Balanced Mix Design Illustration

Cracking Resistance

Minimum Rutting Resistance

Rutting Resistance

AC Content

Florida Department of Transportation
Balanced Mix Design Illustration

Cracking Performance versus AC Content

Cracking Resistance

Rutting Resistance

AC Content
Balanced Mix Design Illustration

Cracking Resistance

Minimum AC Content

Rutting Resistance

AC Content

Minimum AC Content
Balanced Mix Design Illustration

Rutting Performance versus AC Content

Cracking Resistance

Rutting Resistance

AC Content
Balanced Mix Design Illustration

Cracking Resistance vs. Rutting Resistance

Maximum AC Content vs. AC Content

- Maximum AC Content
- AC Content

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Three Balanced Mix Design Approaches

- **Volumetric Design and Performance Verification**
  - What we do today plus a rutting and cracking test

- **Performance-Modified Volumetric Mix Design**
  - What we do today, but the mix design can be tweaked based on the rutting and cracking test data

- **Performance Design**
  - Volumetrics not required, the designer optimizes the mix design to achieve the desired minimum performance criteria
What about Florida’s Performance?

Improved Training Courses

CQC

PWL Specs

Warranty Specs

Fine graded mixes

PMA Binders

Reduced resurfacing program

Superpave

Binders

Reduced resurfacing program

Fine graded mixes

PMA Binders

Improved Training Courses

CQC

PWL Specs

Warranty Specs

% of SHS Deficient

PCS Year


0% 2% 4% 6% 8% 10% 12% 14% 16% 18% 20% 22% 24%
Are Florida Mix Designs Balanced?

PAVEMENT CONDITION SURVEY HISTORY
Crack, Rut and Ride Ratings & Single-Combined Rating

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Deficient Lane Miles

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FDOT
Should Florida Mix Designs be Balanced?

• Yes and No
• Rutting is a safety hazard and usually occurs early in the pavement life
• Top down cracking (Florida’s primary distress) usually occurs later in the pavement’s life and is relatively inexpensive to address compared to rutting or bottom up cracking
Should Florida Pursue Balanced Mix Designs?

- Yes – There is room for improvement
- Given the current level of performance in Florida, mixtures may be a little dry
- A small increase in AC content could improve durability and hopefully result in an increase in density
- Increased density would further improve durability
- Concerns with rutting would be addressed with a rutting performance test
What’s the Hold Up?

- There are numerous cracking tests, but no consensus on which one is the most effective.
- Many of the available rutting and cracking performance tests are expensive and complex.
Some of the more recent performance tests are less expensive and less complex.

- IDEAL-CT (cracking)
- Hot IDT or IDEAL-RT (rutting)
- Cantabro (durability)

However, these tests are relatively new and still being researched

- NCAT test track cracking study
- ACAF IDEAL-CT working group
- FHWA performance test rodeo
What about Production?

- Lab mix and plant mix are similar, but not the same.
- Materials change over time
- Balanced Production
  - In my opinion, performance testing needs to happen at the plant if you are doing any level of balanced mix design past performance verification.
  - Plant testing needs to be relatively quick, but relate to performance
What are Other States Doing?

- Some states have implemented performance testing at mix design
- Most states are interested in balanced mix design
- Some states are looking to pilot performance testing at the plant
  - Alabama and Texas
  - More complex testing at mix design
  - Simpler testing during production
What is Florida’s Plan?

- Continue to monitor and research, especially the cracking tests
- Watch and learn from other states
- Continue to partner with Florida’s asphalt industry
Thank You

Questions?

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State of Florida
Department of Transportation

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