An Update of Superpave (HMA)

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Background of Superpave

- AASHTO and FHWA have dropped the term “Superpave” and is using HMA for everything
- CALTRANS has moved to PG Binders
- 1/2 country using volumetric as part of acceptance program. Recommended characteristics include Binder, Air Voids in the Mixture, VMA, and Density.
Polymer Shortages - 2008

- Reasons include but not limited to:
  - Asia (China & India) buying all the polymer’s they can
  - Refiners switching to lighter crude's which are fine for gasoline but are not conducive for production of asphalt binders. Causes higher prices
  - Short-term problems at a Shell Chemical cat cracker. Resulting in a shortage of base stock for C4 to make butidene for SBS.
  - Regional Effects: SEMGroup, Marathon, BP, Mobil-Exxon, Chevron will all have some shortages
  - Over-all binder supply does not appear to be affected
Polymer Shortages - 2008

- What can we do to keep our asphalt pavement program going:
  - Don’t just arbitrarily reduce the binder grades
  - Reduce binder grades for projects based on traffic requirements
  - Increase N-Design one level (to increase stiffness)
  - Eliminate SBS modifiers in mixes > 4 inches
  - Substitute/replace with stronger mixes
  - Allow alternative modifiers (Acid, SBR- Latex, etc.)
  - If you can, delay new projects. Shortages through the end of the year- 2008
  - Don’t just arbitrarily reduce the binder grades
Mixture Issues
Superpave Gyratory Compactor Calibration
Making Superpave Mixtures Consistent
AASHTO Designation: T 312-03
Preparing ... Specimens by ... SGC

4.1

_Superpave Gyratory Compactor_ – ... an average internal angle of $1.16^\circ \pm 0.02^\circ$

.....

(only internal angle with simulated mix measurement)
Internal Angle Measurement with Hot Mix Asphalt

DAV on Top to measure $\alpha_T$

DAV on Bottom to measure $\alpha_B$
HMS & RAM
(Mixless)
Asphalt Mix Performance Tester

The test can evaluate the rutting and fatigue response of the mix.

The equipment is relatively inexpensive and easy to use.

Provides input data for MEPDG

Can be used for Construction acceptance.
Asphalt Mix Performance Tester

- Develop new pooled fund for purchase of the equipment.
- Establishment of a technician training school for operation of the equipment.
- Develop precision and bias for test procedure.
- Last step in the original “Superpave” Development rollout
N-DESIGN

EFFECT OF DESIGN COMPACTION
on MIX PROPERTIES
Effect on VMA

Aggregate Blend Constant

19 MM MIXTURES

Change in VMA vs. Change In Gyrations

Effect on VMA

-2.0% -1.0% 0.0% 1.0% 2.0%

-60 -40 -20 0 20 40 60
Effect on Stiffness

Volumetric Properties Constant

$G^*(0.1\text{Hz}), \text{kPa}$

Change from Design Gyrations

15
What Should Design Gyrations Be?

- 20-30 gyrations changes
  - VMA by 1%
    - 0.4% asphalt content
  - Mixture stiffness by 25 to 30%
    - about one PG high temp grade difference
  - SO . . . . . . .reducing gyrations reduces stiffness
In Superpave (Marshall too)

- Air voids and VMA specified
  - Controls asphalt content

- Gradation does not control asphalt content
  - Therefore . . . . to change (increase) asphalt content, change VMA requirement
CONCLUSIONS for N-Design

• Density at end of service life not appropriate to define N-design
• N-design does not influence asphalt content
• N-design in Superpave is “in the ball park”
• Performance testing as final criteria
Recycling
Key Points of FHWA Recycling Policy

• Recycled materials should get first consideration in overall materials selection.
• Recycling can offer engineering, economic and environmental benefits.
• Engineering and environmental properties are important.
• Life Cycle Cost benefits assessment is warranted.
• Restrictions prohibiting recycled material that are without technical basis should be removed.
FHWA Plan on Current Status of Pavement Recycling

- What work being done
  - A RAP Technical Working Group has been established.
  - This group includes government, industry and academia.
  - They will be used to guide the many activities to be accomplished.
FHWA Plan on Current Status of Pavement Recycling

• Do an analysis of the current market and practices to determine appropriate level
• FHWA activities in pavement recycling.
  – Where are the issues?
    • Up to What Percent 30-40-50????
  – Construction processing, workability, durability
• NCHRP Report No. 598 on Recycled Materials.
Issues for Superpave (HMA) Mixtures

- Longitudinal Segregation
  - Kansas Centerline Specification
  - Colorado’s Pavers Segregation Kits
- Density (Nuclear vs Cores)
- Lay Down Thickness (3-4 times NMAS)
- Sampling Location (Behind the Paver)
- Moisture in Mixtures and Permeability
- Premature Failures (density, T&L joints)
- Milling for Quality
Quality Assurance Program

FHWA Requirements

• **State Acceptance Program**
  – State’s Testing and acceptance
  – Certified Materials
  – Using contractor test results with State Verification

• **Dispute resolution**

• **Qualified Technicians**

• **Accredited / Qualified Labs**

• **Independent Assurance Program**

• **Contractor Quality Control Processes**
Where We Are Now …

- 22 State Reviews completed to date
  - RI, ID, IN next
- Not enough State Verification Testing w/ CAT
- Not enough State personnel
- Reluctance to spend money on construction engineering - not even for consultants
- Ineffective validation procedures
- Increasing volume of projects/workload
Resources

• FHWA-RD-02-095
  “Optimal Procedures for Quality Assurance Specifications”

• FHWA-HRT-04-046
  “Evaluation of Procedures for Quality Assurance Specifications”

(Burati, Weed, Hughes, Hill)
Resources

- NHI Course 134042: Materials Control and Acceptance Quality Assurance (2 or 4 day versions)
- NHI Course 134064: Transportation Construction Quality Assurance (2 or 3 day versions)
- FHWA Basic PWL Workshop (25 States)
- FHWA Basic Warranty Workshop (2 States)
- SPECRI SK software and training (Fall 2008)
- NHI Course 134059: Quality Assurance Specification Development and Validation Course (Winter 2008)
- FHWA QA Summary Report 2003-2008
  - www.fhwa.dot.gov/pavement/materials/stewardrevie w2006.cfm
New and Developing Technologies

- Intelligent Compaction
- Automated Plant Controls for QC & QA
- Warm Mix
- Better Binder Testing, MSCR Testing (addresses modifiers)
- Pavement Performance Warranties
Intelligent Compaction

---- Definition ----

What is “Intelligence?”

- Oxford Dictionary: “…able to vary behavior in response to varying situations and requirements”

- Ability to:
  - Collect information
  - Analyze information
  - Make an appropriate decision
  - Execute the decision

3000-4000 TIMES A MINUTE
Intelligent Compaction

GPS antenna

GPS reference station
GPS / positioning with reference station
At the mix plant are there other processes that can be part of a QA program?
In line viscometer for verification of binder
No more dials and knobs in the modern plant.
WARM MIX ASPHALT TECHNOLOGY

44th Annual Idaho Asphalt Conference
Evolution...

QA Specs

Performance Specs

Design Build
Warrant Maintain
QA of the Future

• The QA will all be tied to Internet.
  – Direct download of info to the owner.
  – Posting of data immediately to all parties.
  – Faster review and resolution of discrepancies.
Where We Are Going ... Long Term

- Domestic Scan of other industries
- Move toward Quality Management Systems by all contractors and suppliers
  - Beyond ISO 9000 - sector specific requirement
    - Aerospace - AS9100
    - Automotive - ISO/TS16949
- Quality Based Selection and Procurement
- Design Build Warrant Maintain
Design Build Warrant Maintain - The Final QA?

• Long Term Warranty
  – Performance based contract
  – Guarantees product integrity
  – Contractor responsible for repair of defects or replacement

• Warranty Period
  – Pre specified for repair defects

• Warranty workshops available for states
... and beyond!

- Cannot continue on same path of regulate and enforce
- Cannot continue to police contractors trying to catch them in the act
  - System needed to mate contractor’s priorities in-line with agency’s
  - Quality and long term performance
Thank You

Questions