Increasing Asphalt Cement Content in Superpave Mixes

A Report on Roundtable Discussion between MTO and Industry

Pamela Marks
Head, Bituminous Section

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Outline

- Internal MTO Survey
- MTO and Industry Roundtable Discussion
- Challenges
- Improvements Being Considered

Internal MTO Survey

- Survey sent to internal Ministry of Transportation, Ontario (MTO) staff
- Asked what improvements can we make to the:
  - design,
  - materials, and
  - construction

  of our hot mix asphalt (HMA) pavements?
- Approximately 100 ideas generated!
- Many ideas aimed at increasing the asphalt cement (AC) content in our Superpave mixes

MTO and Industry Roundtable Discussion

- Before going ahead with any ideas, MTO wanted to meet with Industry to discuss ideas and challenges identified
- Roundtable discussion held October 16, 2015
- All agreed there is not a single simple solution to a more durable mix
- Discussed in detail, 13 specific possible solutions under the following groupings:
  - Increasing Asphalt Cement
  - Pavement Permeability
  - Use of Recycled Materials
  - Mixing and Compaction Temperatures

Increasing Asphalt Cement

1. Fixed AC Bid Values

- ✓ MTO has implemented AC_{BID}
  - ✓ Payment adjustment based on job mix formula (JMF)
  - ❑ Will be moving to payment based on actual AC content results in conjunction with MTO's new web based contract management system (WBCMS)
  - No advantage to reduce AC content in design or production
  - Has not increased AC content significantly on it's own
  - What is the actual cost of increasing AC content?

Increasing Asphalt Cement

2. Higher Maximum $N_{initial}$ Requirements

- ✓ MTO allows higher $N_{initial}$ gyration requirements of ≤ 89.5
  - Implemented for 2015 contracts as Contractor option
  - Only allows more AC in certain mixes
  - No feedback yet on how this is working

Nini » Density for Stability Under Rollers

Increasing Asphalt Cement

3. Use Fine Graded Mixes

- ✓ MTO has implemented designer option to use fine graded surface course mixes
  - May not be fully utilizing fine graded mixes everywhere they are appropriate
  - Fine graded mixes have been beneficial when produced within this band
  - Consider implementing on all surface courses
  - Challenge – everyone may not be able to supply suitable fine aggregate
- ❑ Consider using more Superpave 9.5 mm mixes

Increasing Asphalt Cement

4. Call for Minimum AC Content

- MTO has not implemented
  - May have unintended consequences
  - Mix with minimum AC content not necessarily more durable

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5. Reduce the Allowable Acceptance for Air Voids and/or AC Content

- MTO has not implemented
  - Cannot tighten tolerances more than test variability
- Consider shifting tolerance range so more tolerance for higher AC content and less for lower AC content

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6. Lower the Design Air Voids

- MTO will consider
  - Lowering design air voids to 3.5% in conjunction with:
    - reducing design gyrations,
    - raising VMA (voids in mineral aggregate) requirements, and/or
    - adding film thickness requirements
  - Category D and E designed with same aggregate so only way to get same voids at higher gyrations is to take out AC
- Challenges
  - May have limited success at increasing AC content since aggregate proportioning can be manipulated to maintain low AC content since no incentive to add more AC

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7. Reduce or Cap the Design Gyration Levels

Ndes» Density for Short Term Performance

- MTO will consider
  - Changing design gyration levels in conjunction with:
    - lowering design air voids,
    - raising VMA requirements, and/or
    - adding film thickness
  - Some US states have cap on levels
  - Others specify gyration level depending on binder type
  - A lot of testing is required to be confident mixes with these changes will perform
- Challenges
  - Dropping gyrations alone will not guarantee more AC

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8. Raise VMA Requirements

- MTO will consider
  - Cannot implement alone. Again, would need to be done in conjunction with:
    - lowering design air voids,
    - reducing design gyrations, and/or
    - adding film thickness
  - Requires extensive laboratory testing to determine effects
- Challenges
  - Getting clean enough aggregates
  - Consider incentive for Industry to justify use of classifiers

Increasing Asphalt Cement

9. Specify Gyration Level Depending on Binder Type

- MTO may consider
  - Change from specifying gyration level by ESALs (equivalent single axle load) to based on binder type
  - Consider as part of reducing or capping design gyration levels
  - Oklahoma DOT has implemented this
- Challenges
  - Cannot implement alone to ensure more AC

Design ESALs (millions)	MTO Category
<0.3	A
0.3 – 3	B
3 – 10	C
10 – 30	D
>30	E

Pavement Permeability

10. Add a Minimum Density at $N_{initial}$ Gyrations

- MTO has no current plans to implement
  - Oklahoma DOT had previously implemented this to combat permeability issues
  - Done because field mixes showing permeability often had densities at $N_{initial}$ gyrations of 81-83%

Pavement Permeability

11. Add a Minimum Laboratory Permeability Requirement

- MTO already considering
  - ✓ MTO has been investigating permeability in specific applications
  - More AC results in better permeability results
  - Lower permeability mixes can be more durable
  - Awaiting results of study

Use of Recycled Material

12. Reduce or Ban the Use of RAP

- MTO has not implemented
  - Use of reclaimed asphalt pavement (RAP) is a good environmental practice MTO wants to continue
  - MTO allows up to 20% RAP in surface mixes (was based on unfractionated materials)
  - MTO's ERS system makes irresponsible use of RAP difficult

- Consider implementing Binder Replacement Ratio method once available
  - Need to know how much AC comes from RAP, the grade of the AC in RAP and in the mix

Mixing and Compaction Temperatures

13. Develop a New Methodology for Mixing and Compaction Temperatures

- MTO will consider
  - Currently most non-standard polymer modified ACs have the same recommended mixing and compaction temperatures
  - OHMPA Technical Committee has recently discussed this issue and it was discussed at roundtable as well
  - Consider revising wording in specifications to make clear mixing and compaction temperatures for field vs. laboratory
  - Could result in more durable and longer lasting mixes

Challenges

- No simple solution
- Cannot change one property without looking at possible unintended consequences on other properties
  - How do we change a combination of air voids, VMA, and gyration requirements to not limit the maximum AC content?
- Production of fine aggregate for mixes
- How to pay for a more durable mix? For more AC?
- Is an incentive required?

Improvements Being Considered

- Specify more fine graded mixes
- Shift tolerance ranges without reducing range
- Implement binder replacement ratio method
- A combination of lower air voids, higher VMA, and lower/capped design gyrations
- Implement a film thickness requirement
- Implement a permeability requirement
- Develop a new methodology to establish mixing and compaction temperatures

Closing

- Roundtable discussion was successful
- Good discussion and MTO gained valuable insight into the challenges faced by Industry
- Goal is to have more durable asphalt pavements
- MTO plans to move forward with some of the ideas generated while keeping in mind the challenges identified at the roundtable discussion
- MTO appreciates Industry's input and willingness to discuss issues facing our industry and looks forward to further input in the future

Questions

Pamela Marks
Head, Bituminous Section
145 Sir William Hearst Avenue, Room 238
Downsview, Ontario
M3M 0B6
Pamela.marks@ontario.ca