Rapid Asphalt Production/Construction Controls Feedback – PCF
Part 3 - e-Circular

May 1, 2017
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Adam Hand – UNR
Jim Musselman – Oldcastle Materials
Gerry Huber – HRG
Kevin Hall – UAR
Lee Gallivan – GC, Inc
Dave Newcomb – TTI/TAMU
Production/Construction Feedback

- PCF – controls and devices designed to provide rapid feedback to the user to improve the density and hence the performance of asphalt pavements.
Production/Construction Feedback

● Areas of concern:
  – Design
  – Materials
  – Specifications
  – Construction
  – Aggregate moisture
  – Asphalt Sampling
  – Compaction
PCF

Area of concern:
- Pavement Dsn
- Thickness
- Mix design
  - BMD
  - Conventional
- Aggregate Structure
PCF

Area of concern:
Does the mix design take into account:
- Pavement Thickness
- Aggregate Structure
  - A. NMAS
  - B. Fine
  - C. Coarse
  - D. Gap Graded Mixes
    - i. SMA
    - ii. OGFC/Porous

- Assumption: density measured by Gmb
PCF

Area of concern: Does the (project) density specification take into account:

- Pavement Thickness
- Subgrade
  - drainage
  - soft spots
  - repairs
- If an overlay
  - drainage
  - pavement condition
  - soft spots/cracks
  - repairs
PCF

Area of concern: Does the (project) density specifications account for:

- Best practices
- Impediments to implementation
Area of concern:

- Is the density data being interpreted correctly?
- In a timely fashion?
PCF – e-circular 1st Draft

- Executive Summary-
- Introduction-
  - Why compaction is so important
- Mix Designs-
  - Balanced Mix Designs as a start
  - Use of RAP, RAS, RMA
  - Understanding Volumetrics the good/bad/or ugly
Next steps

- Review of Utah Density Specification
- Review of FHWA Density Initiative projects
- Outline of Compaction Improvement
- E-circular
  - Executive summary
  - Review of topics
  - Prepare e-circular over the next 12 months.
Compaction Improvement

Pre-Construction
- Site Investigation
- Underlying Support Surface Conditions
- Pavement Design
  - Mix Type Selection
  - Lift Thickness
- Mix Design
  - Gradation
  - Binder
  - Compactability

Construction
- Balanced Production
  - Plant Production
  - Truck Scheduling
- Environmental Monitoring
  - Wind Speed
  - Air Temp
  - Base Temp/Moist
- Paving Practices
  - Segregation
  - Stop-Start
  - Truck Bump
  - Temp.
- Paving Monitoring
  - Temp.
  - In-Place Density
  - QC/QA
  - Real-Time Feedback
- Compaction
  - Rolling Pattern
  - Roller Position
  - Roller Coverage
- Adjustments
  - Evaluate Feedback
- Real-Time Feedback
- Evaluate Feedback
- Adjustments
Utah DOT HMA In-place Density Specification

Howard Anderson
Utah DOT Asphalt Engineer

FHWA Asphalt Mixture & Construction ETG
Iowa State University, Ames, Iowa

May 2, 2017
UDOT Specifications

- January 2017

Utah Department of Transportation

2017 Standard Specifications
For Road and Bridge Construction

January 1, 2017
Definitions

- **Longitudinal Joint** – Any new asphalt lift abutting an existing paving lift, exceeding 200 feet in length and excluding intersections. This includes joints created by echelon paving and new asphalt placed against a milled asphalt edge.

- **Overband** – an 8 inch protective asphalt coating sealing the longitudinal joint of final riding surface, as proposed by the contractor and approved by the Engineer.
Definitions

- Thin Overlay Pavement – An overlay where the sum of the thickness of the HMA lifts is less than two inches
- Production Day – A 24 hour period in which HMA is being placed
- Lot – The number of tons of HMA placed in a Production Day
Specification Highlights

- Both Mat and Long Joint Density
- Thin Lifts Treated Separately
- Density based on Cores and $G_{mm}$
- Joint Layout Plan 10 days Prior to Paving
- Lot = One day’s paving, minimum 4 samples
- Targets & Limits (Table 2)
- PWL / Pay Factor
  - $/ton Incentive or Disincentive
  - Payment is Step Function (Table 1)
    » Incentive/Disincentive = $0.00/ton for PWL 88-91%
**In-place Density**

- **Mat**
  - Cores taken with 2 contract days of paving
  - Move 1ft from edge
  - $G_{mm}$ of Lot

- **Long Joint**
  - May remove joint edges (3” confined, 6” unconfined) with payment
  - Cores taken with 2 contract days of paving
  - $G_{mm}$ of mat averages
Specification Limits

- **Mat**
  - Target = 93.5%
  - LL = 91.5%
  - UL = 97.5%

- **Long Joint**
  - Target = 91.5%
  - LL = 89.5%
  - UL = 97.5%

### Table 2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>UL and LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ inch sieve for 1 inch HMA</td>
<td>Target Value ± 6.0%</td>
</tr>
<tr>
<td>½ inch sieve for ¾ inch HMA</td>
<td>Target Value ± 5.0%</td>
</tr>
<tr>
<td>⅜ inch sieve for ½ inch HMA</td>
<td>Target Value ± 3.0%</td>
</tr>
<tr>
<td>No. 8 sieve for ⅜ inch HMA</td>
<td>Target Value ± 2.0%</td>
</tr>
<tr>
<td>No. 50 sieve</td>
<td>Target Value ± 0.35%</td>
</tr>
<tr>
<td>No. 200 sieve</td>
<td></td>
</tr>
<tr>
<td>Asphalt Binder Content</td>
<td></td>
</tr>
<tr>
<td>Mat Density</td>
<td>Lower Limit</td>
</tr>
<tr>
<td></td>
<td>Target Value - 2.0%</td>
</tr>
<tr>
<td></td>
<td>Upper Limit</td>
</tr>
<tr>
<td></td>
<td>Target Value + 4.0%</td>
</tr>
<tr>
<td>Longitudinal Joint Density</td>
<td>Lower Limit</td>
</tr>
<tr>
<td></td>
<td>Target Value - 2.0%</td>
</tr>
<tr>
<td></td>
<td>Upper Limit</td>
</tr>
<tr>
<td></td>
<td>Target Value + 6.0%</td>
</tr>
</tbody>
</table>
Incentive/Disincentive

- If mat density PWL \(\leq 88\%\), No %AC & gradation Incentive
- $/ton
- R&R
- Accept in-place option, 35% penalty bid price.

### Table 1

**Incentive/Disincentive for Asphalt Binder Content, and Mat Density**

<table>
<thead>
<tr>
<th>PT Based on Min. Four Samples</th>
<th>Incentive/Disincentive (Dollars/Ton)</th>
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<tbody>
<tr>
<td>&gt;99</td>
<td>2.00</td>
</tr>
<tr>
<td>96-99</td>
<td>1.50</td>
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<tr>
<td>92-95</td>
<td>1.00</td>
</tr>
<tr>
<td>88-91</td>
<td>0.00</td>
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<tr>
<td>84-87</td>
<td>-0.26</td>
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<tr>
<td>80-83</td>
<td>-0.60</td>
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<tr>
<td>76-79</td>
<td>-0.93</td>
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<tr>
<td>72-75</td>
<td>-1.27</td>
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<tr>
<td>68-71</td>
<td>-1.50</td>
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<tr>
<td>64-67</td>
<td>-1.93</td>
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<tr>
<td>60-63</td>
<td>-2.27</td>
</tr>
<tr>
<td>&lt;60</td>
<td>Reject</td>
</tr>
</tbody>
</table>

**Incentive/Disincentive for Gradation**

<table>
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<td>52-55</td>
<td>-10.00</td>
</tr>
<tr>
<td>&lt;52</td>
<td>Reject</td>
</tr>
</tbody>
</table>

**Incentive/Disincentive for Longitudinal Joint Density**

<table>
<thead>
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<th>PT Based on Min Four Samples</th>
<th>Incentive/Disincentive (Dollars/Ton)</th>
</tr>
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<tbody>
<tr>
<td>&gt;99</td>
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*The $5 penalty and Overband Longitudinal Joint if Final Surface Lift*
Old Contractor Perspective

• Easily understood specification

• Forces paving planning (Joint Layout 10 days prior)

• Includes dispute resolution

• Industry heard in specification development/revisions
Dispute Resolution

- 02741 HMA
- 02744 SMA

SECTION 01456
MATERIALS DISPUTE RESOLUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for disputing acceptance or verification test results for the following materials on Department projects:
   1. Section 02056 – Embankment, Borrow, and Backfill
   2. Section 02721 – Untreated Base Course
   3. Section 02735 – Microsurfacing
   4. Section 02741 – Hot Mix Asphalt
   5. Section 02743 – Hot Mix Asphalt – Bike and Pedestrian Paths
   6. Section 02744 – Stone Matrix Asphalt
   7. Section 02745 – Asphalt Material
   8. Section 02752 – Portland Cement Concrete Pavement
   9. Section 02785 – Chip Seal Coat
   10. Section 02786 – Open-Graded Surface Course
   11. Section 02787 – Bonded Wearing Course
   12. Section 03055 – Portland Cement Concrete
   13. Section 03310 – Structural Concrete

B. Procedures for requesting that rejected, non-conforming material be allowed to remain in place.
Dispute Resolution

- Dispute Acceptance or Verification Test Results

- Submit Dispute within:
  - 1 Week of receiving test results
  - 24 Hours before performing work

- Include engineering analysis, statistical analysis, QC test results, ...

- If Merit Found by UDOT 3 potential avenues
  - Test and Calculation Procedure Review
  - Validation Testing As Appropriate
  - Third Party Testing As Appropriate
If Merit Found

- Test and Calculation Procedure Review
  - No Significant Errors: Evaluate Lot with Original Test Results
  - If Significant Errors: Go to Validation or 3\textsuperscript{rd} Party Testing

- Validation Testing As Appropriate
- Third Party Testing As Appropriate
Validation Testing

- Performed by UDOT
  - In UDOT Central or Region Materials Lab
- Use Material Remaining from Original UDOT Test
  - All sublots re-tested
- Retest Results Validate or Invalidate Original UDOT Test Results
  - Validated if Within $2 \times \sigma$ of Original Results
- Validation Tests May NOT be Used for Acceptance
- If Validated, Use Original Acceptance Test Results
- If Not Validated, Eliminate Invalidated Test Results and tRe
Dispute Resolution

- Request to Allow Rejected Material to Remain In-place
- Submit Request within:
  - 1 Week of receiving test results
  - 24 Hours before performing work
- Include engineering analysis – Expected Service Life vs. Design Life
Thank You & Feedback

- Questions
- Suggestions
- Thoughts
Compaction Improvement

Pre-Construction

- Site Investigation
- Underlying Support
- Surface Conditions
- Pavement Design
- Mix Type Sel.
- Lift Thick
- Mix Design
  - Gradation
  - Binder
  - Compactability

Construction

- Balanced Production
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- Adjustments
  - Evaluate
  - Feedback
  - Compaction Improvement
IICCTG 2017 Conference

Sept. 26-28, 2017
Minneapolis, MN USA

- Integrated Intelligent Construction solutions
- Intelligent Compaction
- Paver-Mounted Thermal Profiling
- Continuous Asphalt Density Measurement
- 3D Modeling and Automated Machine Guidance