Superpave Section 39 and Local Agencies - What’s next?

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APWA Northern California Chapter
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Presentation Summary

• Superpave - what is it and why change?
• Overview of new Section 39
• What does the change mean to you?
• Moving forward with the new specification
Superpave - What is it and Why Change?

• Superpave is a specification/process
• Development started in late 1980s with SHRP
• Consists of 2 parts:
  – Asphalt binder
  – Mix design
Superpave What is it and Why Change?

- Caltrans already using binder spec (PG system)
- Caltrans “officially” transitioned out of Hveem mix design procedure September 2015 with 2015 spec
- Caltrans adopted Superpave with deviations from national procedure
Superpave Mix Design

- Process originally had three levels of mix design depending upon traffic levels
- Only one level was adopted for highway agencies nationwide
- Lack of guidance for low volume roads (local agency projects)
Why Change to Superpave?

- Hveem mix design equipment minimally supported by testing industry
  - Originally developed ~ Mostly in 1930s to 1960s
  - Much of equipment is very old
  - Repairs problematic, new parts difficult to obtain
  - Lack of manufacturers and expertise for equipment
- Become consistent with rest of country (last to adopt)
- Utilize newer specimen preparation techniques and production test equipment
Why Change to Superpave?

• That said...
  – Many agencies and laboratories, particularly small agencies are sticking with Hveem process and older Caltrans Specifications
  – Superpave equipment is costly and agencies may not want to learn or have capacity to adopt
  – However, state and sometimes federal funding can be lost if agency does not utilize Superpave
Hveem Mix Design Process

- Specialized mixing bowl
- Kneading compactor
- Load press to establish final specimen height
- Stabilometer to determine binder content for optimum “stability and durability”

Francis Hveem

Photo C. L. Monismith
Hveem: Three-Head HMA Mixer

Photo courtesy UCPRC
Hveem: Kneading Compactor

Photos courtesy UCPRC and C. L. Monismith
Hveem: Load Press for Specimen Height
Mix Stability, Durability

Stability Curve

Maximum Stability

Maximum Durability

Durability Curve

Optimum AC for Highest Stability

Design Asphalt Content

Optimum AC for Highest Durability without Instability

Minimum allowable Stability for given traffic loading

Asphalt Content, percent

From C. L. Monismith
Superpave Mix Equipment

• “Off the shelf” mixer
• Superpave Gyratory Compactor (SGC) & Mold
Superpave Gyratory Compactor

Photos FHWA and Pavement Interactive

$25K to $40K
Superpave Gyratory Compactor

Photos courtesy UCPRC
Superpave Gyratory Compactor

Superpave  Hveem

Photo FHWA and Pavement Interactive
Moisture Sensitivity Testing

- T 283 Modified Lottman
- T 324 Hamburg Wheel Tracker ($40K-$60K)

Labs have this already

Photos Pavement Interactive and UCPRC
New Section 39 (From 2015 Specifications)

• Developed by expert panel from Caltrans and Industry
• Simplified and Reorganized “Plain Language”
• 39-1x  General – *not used*
• 39-2  HMA – *most content here*
  – 2.01 General – *not used*
  – 2.02 Type A Hot Mix Asphalt
  – 2.03 Rubberized Hot Mix Asphalt- Gap Graded
  – 2.04 Open Graded Friction Courses
  – 2.05 Bonded Wearing Courses
What’s New in Section 39 (key points)

• Gradually changing over past few years
• Test methods now AASHTO/ASTM – Very Few CTMs
• HMA Acceptance In Place and Mix Design Methods changed to reflect Superpave processes
  – Air void content based upon SGC gyrations
  – Hamburg Wheel Tracker Tests added
• Major change is to how binder content selected
  – Aggregate gradation bands consistent
### Specification Changes – Mix Design - Selected Items  HMA Type A

#### ~2010

<table>
<thead>
<tr>
<th>Quality characteristic</th>
<th>Test method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air void content (%)</td>
<td>California</td>
<td>4.0</td>
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<tr>
<td>Voids in mineral aggregate (%)</td>
<td>California</td>
<td>17.0</td>
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<td>No. 4 grading</td>
<td>Test 367</td>
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<tr>
<td>3/8” grading</td>
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<tr>
<td>1/2” grading</td>
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<tr>
<td>3/4” grading</td>
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<tr>
<td>Voids filled with asphalt (%)</td>
<td>California</td>
<td>76.0 – 80.0</td>
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<tr>
<td>No. 4 grading</td>
<td>Test 367</td>
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<tr>
<td>3/8” grading</td>
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<td>1/2” grading</td>
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<td>3/4” grading</td>
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<tr>
<td>Dust proportion</td>
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<td>No. 4 and 3/8” gradings</td>
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<tr>
<td>1/2” and 3/4” gradings</td>
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<td>No. 4 and 3/8” gradings</td>
<td>Test 366</td>
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<td>1/2” and 3/4” gradings</td>
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#### 2015

<table>
<thead>
<tr>
<th>Quality characteristic</th>
<th>Test method</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>Air void content (%)</td>
<td>AASHTO T 269*</td>
<td>N_{0.05} &gt; 4.0 N_{0.05} = 5.0 for 1-inch aggregate</td>
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<td>Gyrations compaction</td>
<td>AASHTO T 312</td>
<td>N_{0.05} = 8 N_{0.05} = 85.0 N_{0.05} = 130</td>
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<td>Voids in mineral aggregate (min. %)</td>
<td>SP-2</td>
<td>Asphalt Mixture Volumetrics</td>
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<tr>
<td>Gradation:</td>
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<tr>
<td>No. 4</td>
<td></td>
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</tr>
<tr>
<td>3/8”-inch</td>
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<tr>
<td>1/2”-inch</td>
<td></td>
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<tr>
<td>3/4”-inch</td>
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<tr>
<td>1-inch</td>
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<td>with NMAS = 1-inch</td>
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<tr>
<td>with NMAS = 3/4-inch</td>
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</tr>
<tr>
<td>Dust proportion</td>
<td>SP-2</td>
<td>Asphalt Mixture Volumetrics</td>
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<tr>
<td>Hamburg wheel track (min number of passes at 0.5-inch rut depth)</td>
<td>AASHTO T 324 (Modified)</td>
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<tr>
<td>Binder grade:</td>
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<tr>
<td>PG 58</td>
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<td>10,000</td>
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<tr>
<td>PG 64</td>
<td></td>
<td>10,000</td>
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<tr>
<td>PG 70</td>
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<td>15,000</td>
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<tr>
<td>PG 70 or higher</td>
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<td>20,000</td>
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<td>Hamburg wheel track (min number of passes at the inflection point)</td>
<td>AASHTO T 324 (Modified)</td>
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<tr>
<td>Binder grade:</td>
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<td>PG 58</td>
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<tr>
<td>PG 64</td>
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<td>10,000</td>
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<tr>
<td>PG 70</td>
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<tr>
<td>PG 70 or higher</td>
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<td>15,000</td>
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<td>Moisture susceptibility (min. psi)</td>
<td>AASHTO T 283*</td>
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<td>Moisture susceptibility, wet strength (min. psi)</td>
<td>AASHTO T 283*</td>
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* Separate Table for RHMA-G
## Specification Changes – Acceptance - Selected Items  HMA Type A

~2010

<table>
<thead>
<tr>
<th>Quality characteristic</th>
<th>Test method</th>
<th>HMA type</th>
<th>HMA type</th>
<th>RHMA-G</th>
<th>OGFC</th>
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<tbody>
<tr>
<td>Aggregate gradation *</td>
<td>California Test 202</td>
<td>JMF ± tolerance b</td>
<td>JMF ± tolerance a</td>
<td>JMF ± tolerance c</td>
<td>JMF ± tolerance a</td>
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<tr>
<td>Sand equivalent (min) a</td>
<td>California Test 217</td>
<td>47</td>
<td>42</td>
<td>47</td>
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<tr>
<td>Asphalt binder content (%)</td>
<td>California Test 217</td>
<td>JMF ± 0.45</td>
<td>JMF ± 0.45</td>
<td>JMF ± 0.50</td>
<td>JMF ± 0.50</td>
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<td>HMA moisture content (%, max)</td>
<td>California Test 379 or 382</td>
<td>1.0</td>
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<td>1.0</td>
<td>1.0</td>
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<td>Stabilometer value (min) a</td>
<td>California Test 226 or 370</td>
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<td>30</td>
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<td>Percent of crushed particles</td>
<td>California Test 205</td>
<td>90</td>
<td>25</td>
<td>--</td>
<td>90</td>
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<td>Coarse aggregate (% min)</td>
<td>California Test 205</td>
<td>75</td>
<td>--</td>
<td>75</td>
<td>75</td>
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<td>Fine aggregate (% min) b</td>
<td>California Test 366</td>
<td>70</td>
<td>20</td>
<td>70</td>
<td>90</td>
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<tr>
<td>Fine aggregate (min) b</td>
<td>California Test 211</td>
<td>12</td>
<td>--</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Los Angeles Rattler (% max)</td>
<td>California Test 211</td>
<td>45</td>
<td>50</td>
<td>40</td>
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<td>Air void content (%) a</td>
<td>California Test 217</td>
<td>4 ± 2</td>
<td>4 ± 2</td>
<td>TV ± 2</td>
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<tr>
<td>Flat and elongated particles (% max by weight @ 5:1)</td>
<td>California Test 234</td>
<td>45</td>
<td>45</td>
<td>45</td>
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<tr>
<td>Voids filled with asphalt (%) a</td>
<td>California Test 235</td>
<td>76.0–80.0</td>
<td>76.0–80.0</td>
<td>Report only</td>
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<tr>
<td>Voids in mineral aggregate (% min) a</td>
<td>California Test 235</td>
<td>17.0</td>
<td>17.0</td>
<td>--</td>
<td>--</td>
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<tr>
<td>Dust proportion b</td>
<td>California Test 367</td>
<td>0.9–2.0</td>
<td>0.9–2.0</td>
<td>18.0–23.0 g</td>
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</tr>
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<tbody>
<tr>
<td>Asphalt binder content (%)</td>
<td>AASHTO T 308 Method A</td>
<td>JMF ±0.30, ±0.50</td>
</tr>
<tr>
<td>HMA moisture content (max, %) a</td>
<td>AASHTO T 329 Method A</td>
<td>1.0</td>
</tr>
<tr>
<td>Air void content at Nmax (%) b</td>
<td>AASHTO T 269</td>
<td>4.0 ± 1.5 (5.0 ± 1.5 for 1-inch aggregate)</td>
</tr>
<tr>
<td>Density of core (% of max theoretical density) a</td>
<td>California Test 375</td>
<td>91.0–97.0</td>
</tr>
<tr>
<td>Hamburger track (min number of passes at 0.5-inch rut depth)</td>
<td>AASHTO T 324 Method A</td>
<td>Polyester grade: PG 58 10,000 PG 70 20,000</td>
</tr>
<tr>
<td>Hamburger track (min number of passes at inflection point)</td>
<td>AASHTO T 324 Method A</td>
<td>Polyester grade: PG 58 10,000 PG 70 20,000</td>
</tr>
<tr>
<td>Moisture susceptibility (min, psi)</td>
<td>AASHTO T 233</td>
<td>100</td>
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<tr>
<td>Moisture susceptibility (min, wt. %)</td>
<td>AASHTO T 233</td>
<td>70</td>
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</tbody>
</table>

Separate Table for RHMA-G

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What Does the Change Mean to Local Agencies?

• From owner standpoint – will vary by agency
  – Depends what you decide to do
  – Regardless, crucial to be familiar with new methods if want to move forward with majority of field

• Generally, local (Bay Area) producers and testing labs have equipment and learned new processes

• Material being placed based upon new spec will not vary dramatically from what you are used to seeing

• Biggest change is how industry must operate
  – New equipment, processes, learning curve...
Moving Forward with the New Specification

• Many options available to local agencies
  1) Adopt specification completely as written
  2) Stick with older Caltrans specifications (< 2010)
  3) Write local specifications to supersede portions of Section 39 where desired (“Hybrid”)
  4) Write/use a modified Section 39 that better reflects local practices (Superpave “Lite” or “Low Volume” or “SP-L”)
  5) Use “GREENBOOK”
1) Adopt Specification Completely as Written

**Pros**

- Document developed by Caltrans/industry experts
- Contractors and suppliers will know document
- If sole specification—simplifies process

**Cons**

- Must learn new spec and related processes (ex. submittal review of new mix designs)
- May not be as suitable to local conditions as you may want—“Highway Mixes”
- Extra unneeded components
- If sole spec then lose local control
2) Stick with Older Caltrans Specifications (≤2010)

Pros
• Minimal change necessary to your current processes

Cons
• Major producers and contractors moving towards Superpave
  – Possible difficulties finding suppliers
  – Price issues?
• May not be as suitable to local conditions as you may want
  – “Highway Mixes”
  – Extra unneeded components
3) Write Local Specifications to Supersede Portions of Section 39 Where Desired ("Hybrid")

Pros

• Gives benefit of local control in specialized areas
• Can take advantage of strong points of Section 39

Cons

• Generally requires two specifications to handle
• Can be cumbersome and confusing to contractor (and maybe you)
• Must be careful to avoid conflicting requirements
4) Write / Use Modified Section 39 to Reflect Local Practices (Superpave “Lite” or “Low Volume”)

**Pros**
- Allows for use of completely locally tailored specification
- One document to deal with during construction
- Development started by Caltrans and Industry
- More appropriate mixes and processes

**Cons**
- Effort and expense required to produce and learn (short term)
- Spec will not be fully supported and updated by Caltrans (you do it)
  — Does that matter?
5) Use the “GREENBOOK”

Pros
• Document developed by agency/industry experts
• Very popular in Southern California

Cons
• Very popular in Southern California
• Northern contractors not as familiar
• Relearn specifications and be different from other agencies
• Major producers and contractors moving towards Superpave
Some Ideas on Adapting the New Specification and/or Improving Your Own (*taken from SP-LV*)

- Vary mix design requirements by Traffic Index (I, II, III)
  - Aggregate requirements (crushed %, size, durability...)
  - Binder content
Some Ideas on Adapting the New Specification and/or Improving Your Own *(taken from SP-LV)*

- Go with nuclear gauges instead of cores for density after gauges calibrated
- Eliminate Profilometer/IRI requirements
- Add WMA temperature placement requirements
Some Ideas on Enhancing the New Specification and/or Improving Your Own

- Longitudinal joint density measurement
  - More difficult to produce adequate densities at joints than mat
  - If densities are measured, more likely achieved
  - Set reasonable standard - can’t be unrealistic
  - Practicality and risk concerns

- Emphasize smooth and uniform surface
  - Example: excessive raking
  - Improve appearance/density
  - Your spec can dictate methods

- Incentives/Disincentives
Ways to Improve Your Pavements and Minimize Specification and Construction Problems

• Pre-con meeting to discuss construction details and enforcement

• Continual communication essential between Contractor and Agency

• Put bid packages together as early in year as possible
  – Minimize late season paving problems and work with contractor under less strained conditions (workload, weather...)
  – Maximize chance at lower bid prices and material availability

• Field QC/QA
  – Specifications as good as inspection and ability to verify contractor is performing to them
  – Inspector versus watcher – training and enforcement
Conclusions

• Caltrans “Superpave” specification evolving over past several years and now official

• Major suppliers/labs adapted to specification though still learning curve throughout state

• Strive to understand basics of Superpave and enhance your specifications to improve your pavements
  – Get outside help if necessary
  – CalAPA offers detailed 4 hour class on new Section 39

• Ultimately agencies must decide how to use and adapt to new specification
Questions ?!

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