IDOT Update
Looking Forward

2012 Illinois Bituminous Paving Conference
December 12, 2012

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Illinois Department of Transportation

Looking Back
PG Liquid Binder Usage

PG Binder Used (in thousand tons)

* Partial year
Liquid AC Sampling at HMA Plants

Sample at closest point to the mix - at Injection Line

Sample Port Location per Specification
### 2012 District PG INV Field Samples

**As of 11/21/12**

<table>
<thead>
<tr>
<th>District</th>
<th>Sample Total</th>
<th>Off Test</th>
<th>% Off Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>345</td>
<td>8</td>
<td>2.3</td>
</tr>
<tr>
<td>2</td>
<td>81</td>
<td>3</td>
<td>3.7</td>
</tr>
<tr>
<td>3</td>
<td>89</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>4</td>
<td>88</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>5</td>
<td>123</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>136</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>166</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>8</td>
<td>250</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>9</td>
<td>96</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1374</strong></td>
<td><strong>18</strong></td>
<td><strong>1.3 %</strong></td>
</tr>
</tbody>
</table>

### District PG Investigative Field Samples

**As of 11/21/12**

<table>
<thead>
<tr>
<th>District</th>
<th>Sample Total</th>
<th>Off Test</th>
<th>% Off Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>345 (357) (654)</td>
<td>8 (11) (12)</td>
<td>2.3 (3.1) (1.8)</td>
</tr>
<tr>
<td>2</td>
<td>81 (122) (215)</td>
<td>3 (3) (4)</td>
<td>3.7 (2.5) (1.9)</td>
</tr>
<tr>
<td>3</td>
<td>89 (57) (121)</td>
<td>3 (0) (1)</td>
<td>3.4 (0) (0.8)</td>
</tr>
<tr>
<td>4</td>
<td>88 (112) (223)</td>
<td>1 (0) (0)</td>
<td>1.1 (0) (0)</td>
</tr>
<tr>
<td>5</td>
<td>123 (95) (176)</td>
<td>0 (0) (0)</td>
<td>0 (0) (0)</td>
</tr>
<tr>
<td>6</td>
<td>136 (189) (227)</td>
<td>0 (2) (2)</td>
<td>0 (1.1) (0.9)</td>
</tr>
<tr>
<td>7</td>
<td>166 (179) (209)</td>
<td>1 (0) (1)</td>
<td>0.6 (0) (0.5)</td>
</tr>
<tr>
<td>8</td>
<td>242 (260) (249)</td>
<td>2 (0) (7)</td>
<td>0.8 (0) (2.9)</td>
</tr>
<tr>
<td>9</td>
<td>81 (99) (122)</td>
<td>0 (1) (2)</td>
<td>0 (1.0) (1.6)</td>
</tr>
</tbody>
</table>
PAY FOR PERFORMANCE

PFP Implementation Schedule

- **2010**
  - Min. One PFP project / District
  - ≥ 8,000 tons individual mix

- **2011**
  - Min. 50% of all Interstate or Supplemental Expressway
  - ≥ 8,000 tons / mix

- **2012**
  - All Interstate & Supplemental Expressway
    - ≥ 8,000 tons / mix
PFPP/QCP Implementation Schedule Revised

- 2013 & 2014 & Beyond
  - PFP will be expanded to include:
    - Interstate & Non-Interstate projects ≥ 4,000 tons
      - 50% in 2013
      - 100% in 2014
  - PFP full implementation (above 8,000 tons)
  - QCP for projects < 8,000 tons
    - 2 Projects/District in 2012
    - 50% in 2013
    - 100% in 2014 – start rollout for LR&S jobs

2012 PFP Projects

<table>
<thead>
<tr>
<th>District</th>
<th>Projects</th>
<th>Tons</th>
<th>% Jobsite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>87398</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>8,516</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>99,227</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>57,807</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>97,522</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>2*</td>
<td>76,000**</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>6(7*)</td>
<td>141,757</td>
<td>100</td>
</tr>
<tr>
<td>8</td>
<td>1 (3*)</td>
<td>8,000 (44,000)</td>
<td>100</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25 (30*)</td>
<td>476,851 (612,227)</td>
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</tbody>
</table>
2012 PFP Projects

<table>
<thead>
<tr>
<th>District</th>
<th>Projects</th>
<th>Surface</th>
<th>Binder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>2*</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>6(7*)</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>1 (3*)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25 (30*)</td>
<td>19</td>
<td>11</td>
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</table>

*With carryover

2012 PFP Project Disputes

<table>
<thead>
<tr>
<th>District</th>
<th>Projects</th>
<th>Disputes</th>
<th>Mix</th>
<th>Cores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td></td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td></td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>2*</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>6(7*)</td>
<td></td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>1 (3*)</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25 (30*)</td>
<td></td>
<td>25</td>
<td>35</td>
</tr>
</tbody>
</table>

*Carryover
Average Pay

- Binder = 99.7
- Surface = 100.0
- Overall = 99.9

PFP Spec Revisions for 2013

- Increase timeframe for submittal of QC results to 48 hrs (allows aging to match IDOT)
- Exclude outer one foot of unconfined edge from random core calculations
  - Institute random 1 test/half mile/unconfined edge core density with pay adjustment table similar to Dust/AC
## Unconfined Edge Density Pay Adjustment Table

<table>
<thead>
<tr>
<th>Density</th>
<th>Deduct / half mile / unconfined edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 90%</td>
<td>$0</td>
</tr>
<tr>
<td>89.0% to 89.9%</td>
<td>$1000</td>
</tr>
<tr>
<td>88.0% to 88.9%</td>
<td>$3000</td>
</tr>
<tr>
<td>&lt; 88.0%</td>
<td>Outer 1.0 foot will require remedial action acceptable to the Engineer</td>
</tr>
</tbody>
</table>

### QUALITY CONTROL FOR PERFORMANCE
2012 QCP Projects

<table>
<thead>
<tr>
<th>District</th>
<th>Contract #</th>
<th>Mix Application</th>
<th>Tons</th>
<th>Pay</th>
<th># of Mix Sublots tested by District</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>64529</td>
<td>N70 F Surf</td>
<td>5400</td>
<td>100%</td>
<td>2/6 = 33%</td>
</tr>
<tr>
<td>3</td>
<td>66A75</td>
<td>Surface</td>
<td>9,840</td>
<td>93.8%</td>
<td>10/10 = 100%</td>
</tr>
<tr>
<td>3</td>
<td>66A75</td>
<td>4.75 mm L.B.</td>
<td>4,920</td>
<td>99.5%</td>
<td>5/5 = 100%</td>
</tr>
<tr>
<td>3</td>
<td>66644</td>
<td>Surface</td>
<td>5,124</td>
<td>100.0%</td>
<td>5/5 = 100%</td>
</tr>
<tr>
<td>3</td>
<td>66644</td>
<td>4.75mm L.B.</td>
<td>2,509</td>
<td>100.0%</td>
<td>1/3 = 33%</td>
</tr>
<tr>
<td>8</td>
<td>76E52</td>
<td>Binder</td>
<td>1967</td>
<td>100.0%</td>
<td>2/2 = 100%</td>
</tr>
<tr>
<td>8</td>
<td>76E52</td>
<td>Surface</td>
<td>4103</td>
<td>100.0%</td>
<td>4/4 = 100%</td>
</tr>
<tr>
<td>9</td>
<td>78271</td>
<td>4.75 leveling Binder</td>
<td>6251.2</td>
<td>99.4%</td>
<td>2/7 = 29%</td>
</tr>
<tr>
<td>9</td>
<td>78271</td>
<td>C Surface</td>
<td>12929.6</td>
<td>97.9%</td>
<td>4/13 = 31%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>53,044</td>
<td>99.0%</td>
<td>70%</td>
</tr>
</tbody>
</table>

QCP Spec Revisions for 2013

1. Cap each Pay Parameter Prior to Calculating the Combined Pay Factor
2. Adjust Ranges for 103% Pay
3. Adjust Density for 95% Pay
4. Clarify Additional Dept. Testing/Results May be Included in Pay Calcs
5. Change Acceptable Limits density range for IL-4.75 from 92.0-98.0% to 90.0-98.0%
6. Increase timeframe for submittal of QC results to 48 hrs (allows aging to match IDOT)
Startup and Mix Issues

Startup/Test Strip Issues

- Adopt the same Acceptable Limits as PFP & QCP for Test Strips
- In addition to meeting JMF, the Voids must be within 2.0% - 6.0% for Dept to pay for Test Strip
Mix Changes

- Eliminate:
  - N105 Surface & Binder Mixes
  - IL-12.5mm Surface Mixes
- For 9.5mm mixes move to 32% passing #8
- Significant Figures & Rounding Issues
  - IDOT will Form Committee to Address
- Considering Min VMA of 15.0% instead of 15% (14.5%) for 9.5 mm mixes – will be delayed at least until 2014

Streamlining Mix Design Verification

- Option in Verification Procedure to allow Districts to paper verify w/ mix testing performed only on TSR & Hamburg Wheel
Walking on the Edge Issues

- Mix designs that barely meet criteria – send for verification on a wing and prayer
  - Just barely passed – a good thing right?
  - Cheap source but highly variable gradation may be costly in the end
- Bad Sampling methods
Min VMA = 15%
14.5 accepted

Mix Design Submitted and Verified at 14.6%

Min Accepted 14.5%

Normal Distribution

Mix Design Submitted and Verified at 14.6%

Min Accepted 14.5%
Normal Distribution

Mix Design Submitted and Verified at 14.6%

Min Accepted 14.5%

VMA

Normal Distribution

Mix Design Submitted and Verified at 15.1%

Min Accepted 14.5%

VMA
Normal Distribution

Min Accepted 14.5%

Design Robustness

Mix Design Submitted and Verified at 15.1%

Sampling
Another Source of Variability
Avoid the Cliff!

- Don’t carry bad QC/QA habits to PFP or QCP
  - Seek “robust” designs that allow a margin of variability
  - Recognize lab to plant issues i.e. VMA collapse
- Make sure sampling is representative
  - If sample is questionable – combine all material, re-blend and re-split while being witnessed
- Poor sampling, marginal mix design, ignoring lab to plant issues (dust/VMA collapse) and variable aggregate supply
  - Bad combinations!
  - Adds up to Remove and Replace $$$

Fine GRADED Asphalt MIX
Fine Mix HMA
- Less large stone on large stone
- Relies on crushed fine on fine fractions
- Larger stone floats in matrix
- Why?
  - Improved compactability – Higher Joint Density
  - Less permeable
  - Longer life
  - Less Segregation

Update
- Slow rollout – more trials in 2013
- ICT Fine Graded Research:
  - Lab Testing Complete – Favorable Results
  - ATLAS Testing In-Progress
- Districts 3, 5, 7 and 8 now using fine graded binder
- District 9 will be using soon
Sustainability:

Is the capacity to endure. For humans, sustainability is the long-term maintenance of responsibility, which has environmental, economic, and social dimensions, and encompasses the concept of stewardship, the responsible management of resource use. (Wikipedia)
Elected officials can’t help themselves for voting “green”
Very popular report especially after elections

Recycled and Reclaimed Materials Utilized in Highway Construction 2010

- Air-Cooled Blast Furnace Slag
- By-Product Lime
- Crumb Rubber
- Fly Ash
- Glass Beads
- Glass Cullet
- Ground Granulated Blast Furnace Slag
- Microsilica
- Reclaimed Asphalt Pavement
- Reclaimed Asphalt Shingles
- Recycled Concrete Material
- Steel Reinforcement
- Steel Slag
- Wet-Bottom Boiler Slag

2010 Recycling

- 1.7M Tons
  - 73,913 semi truck loads
  - Line of Trucks 700 miles long
  - Downtown Chicago to Mississippi River on I-57 (both directions)
- Value $53M
Past few years have completed several studies to address recycling issues
- Quality of materials
- Engineering of end product
- Health and safety issues

Illinois Center for Transportation
- [http://www.dot.il.gov/materials/research/ict.html](http://www.dot.il.gov/materials/research/ict.html)

Bureau of Materials and Physical Research
- [http://www.dot.il.gov/materials/research/reports.html](http://www.dot.il.gov/materials/research/reports.html)

FHWA – RAP Expert Task Group (ETG)
- [http://www.morerap.us/index.html](http://www.morerap.us/index.html)

Need for “Greener” & Low Cost Options Going Forward
PAVEMENT PRESERVATION

HOT In-place Recycling
COLD In-place Recycling
Shingles

RAS – Type I vs. Type II

Type I – New material (Pre-Consumer)

Type II – Roof Tear-Off’s (Post-Consumer)

Type I – Manufacture Waste

Type II – Post-Consumer Waste
Two Sources

- Manufacture “waste” – Type I
  - Not technically “waste” but IL EPA monitors usage
    - Apply for Beneficial Use Determination (BUD)

- Tear-offs – Type II
  - Headed for landfill as waste
  - To reclaim/divert from landfill
    - Must follow regulatory processes of ILEPA
      - No hazard to environment
      - Beneficial use of material
      - Apply for Beneficial Use Determination (BUD)
    - BUD’s granted by ILEPA before use in IDOT project

Construction and Demo Debris Recycling - MBL
Landfill $$: IN Only
C & D Site $$: IN = OUT

INCOMING
- New Building Waste
  - Lumber, pallets and plywood
  - Metal
  - Drywall scrap
  - Contractor waste bags/containers
  - Scrap roofing/siding/flooring
  - Waste containers
  - Carpet
  - Brick/block/stone/concrete/tile
- Mixed Demo Waste
- Tear-off Roofs/shingles

OUTGOING
- Wood Scrap
  - Mulch
  - Fuel for power generation
- Aluminum scrap
- Copper scrap
- Steel/iron scrap
- Plastic/vinyl scrap
- Recycled Aggregate (brick, stone, tile & concrete)
- Shingles (sorted)
- Fiber
- True waste – landfill
Sort and Grind

- Final sort
- Grind
- Screen
- Ready for HMA

Engineering
Asphalt Binder Replacement (ABR)
Goldilocks HMA Mix

Not too hard
Not too soft
“Just right”

Too Hard
Too Soft

- Stripping – TSR
- PG Grade selection (Polymer)
- Hamburg

Too Hard
- Limits on Replacement Asphalt (RAP/RAS %)
- Grade bumps down with higher replacement %
- Max Tensile Strength
- Fracture toughness requirement (under research)
Controls

- Too Soft
  - Stripping – TSR
  - PG Grade selection (Polymer)
  - Hamburg
- Too Hard
  - Limits on Replacement Asphalt (RAP/RAS %)
  - Grade bumps down with higher replacement %
  - Max Tensile Strength
  - Fracture toughness requirement (under research)

Grade Bumping is Critical

- Low amounts of AC replacement can be tolerated with little or no impact
- Around 20% replacement mix properties are impacted
  - Grade bumping policy
    - Above 20% - bump down
    - PG64-22 to PG 58-28 to… (PG46-34 for 40%+)?
  - If not followed – shorter pavement life due to cracking
Hamburg Wheel

Specimen Prep
Hamburg Wheel
50 Passes/Minute

158 Lbs

50 °C
Implementation Schedule

• 2011
  – High Replacement RAP and RAS
  – Permissive use Warm Mix
• 2012 - 2013
  – Other New mixes (fine graded) and Renewals
• 2014 on
  – Full Implementation
Total Recycle Asphalt (TRA)

- **Sustainability Features**
  - Over 97% recycled material – no mined material
    - Concrete Aggregate
    - RAP
    - RAS
    - Slag
  - 57% Asphalt Binder Replacement (ABR)

- **Engineering Features**
  - N50 Mix “D” Surface
  - PG52-28
  - TSR = 109.5/120.4 = 0.91
  - Hamburg - 5.3mm Ave @ 20,000 Passes
  - 20% reduced cost of mix
Mix Details

Aggregate Design
+2.8% PG 52-28

- Crushed Concrete
- Course FRAP
- Fine RAP
- Steel Slag
- Shingle - RAS

Total Recycle Asphalt

CONCRETE
SLAG
RAP
TRA Future

- Testing of plant produced material
  - District
  - BMPR
  - ICT @ UIUC
- Demo projects 2013 construction
- Special Provision for use as soon as 2014

Questions