Concrete Paving Field Inspection Inspector’s Workshop

National Concrete Pavement Technology Center

IOWA STATE UNIVERSITY Institute for Transportation

www.cpotechcenter.org
Instructor

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PCC Paving Field Inspection

- Why are we here?
- How do we achieve quality for PCC paving?
- Got a project….Now what?
- What is concrete?
- What kinds of equipment are used?
- What happens before you start paving?
- **What happens when you’re finally paving?**
- What is the inspector’s role?
- What about all of the other road building stuff?
- What paperwork?
WHAT HAPPENS WHEN YOU ARE FINALLY PAVING?
Daily Items During Paving

• Subgrade/Subbase Moisture
• Date Stamp and Sta. Marks
• Mixture Homogeneity and Uniformity
• Slab Geometry
  • Batch Tickets
    ➢ Proportions
    ➢ Added Water
    ➢ Aggregate Moisture
    ➢ Delivery Time
    ➢ Yield
• vibrator frequency and consolidation
• Edge Slump
• Dowel Placement
• Hand Finishing
• Texturing
• Curing
• Sawing
Subgrade/Subbase Moisture

- Moisten base ahead of the paver
- Prevent excessive water loss into the base
  - Workability
  - Cracking
Date Stamp and Station Marks

- Imprints in the fresh concrete
- Invaluable when troubleshooting problems
Mixture Uniformity

- Homogeneous - thoroughly mixed
- Thoroughly mixed - belt placer segregation – separation of aggregate and mortar
- Uniform – consistent, not wet/dry/wet/dry …
Slab Geometry

• Check width - morning
• Check thickness - hourly
• Check cross-slope - morning and through transitions
Daily Items During Paving

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  - Aggregate Moisture
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Concrete Proportions

• Target weights and actual weights
• Compare proportions to the approved mix design – three times per day
Added Water

Water:Cementitious (w/cm) ratio is critical

• Transit mixed concrete
  ➢ Monitor water added on site
  ➢ Reject the load if the max. w/cm is exceeded

• Central mixed concrete
  ➢ Assure that trim water is thoroughly mixed and included on the batch tickets
Aggregate Moisture

- Aggregates weights batched **include water**
- Moisture contents should be adjusted as needed
- Check batch tickets to see if it ever changes

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<tr>
<th></th>
<th>Target</th>
<th>Actual</th>
<th>MC</th>
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<tr>
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<td>Fly Ash (lb)</td>
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<td>Coarse Agg (lb)</td>
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<td>305</td>
<td></td>
</tr>
<tr>
<td>Mix Water (gl)</td>
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<tr>
<td>Trim Water (gl)</td>
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<td>Total Water (gl)</td>
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Delivery Time

Check transit time periodically

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<td>Batch Size (yd³)</td>
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<td>Fly Ash (lb)</td>
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<td>10860</td>
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<td>2.5%</td>
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<td>2.9%</td>
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<td>Fine Agg (lb)</td>
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<td>10510</td>
<td>4.2%</td>
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<td>AEA (oz)</td>
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<tr>
<td>Water Reducer (oz)</td>
<td>304</td>
<td>305</td>
<td></td>
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<tr>
<td>Mix Water (gl)</td>
<td>119</td>
<td>120</td>
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<tr>
<td>Trim Water (gl)</td>
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<td>2</td>
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<tr>
<td>Water from Agg (gl)</td>
<td>98</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>Total Water (gl)</td>
<td>227</td>
<td>220</td>
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</tbody>
</table>
Grade Yield

- Concrete used / concrete required (expressed as %)
  - Example: 256 cy/240 cy = 107%

- Almost always greater than 100%

- If less than 100%
  - Deficient thickness (thin slab)?
  - Incorrect concrete proportions?
Daily Items During Paving

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  - Aggregate Moisture
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- Edge Slump
- Dowel Placement
- Hand Finishing
- Texturing
- Curing
- Sawing
Vibrator Frequency and Consolidation

• Monitor pavement edge for sharp, clean edges
• Check pavement to assure a closed smooth surface
• Collect and review vibrator monitor data when used
Vibrator Frequency and Consolidation

- Some surface voids in the pavement are better than slurry running off the edges
- Vibrator frequency should be adjusted for paving speed
- Vibrators should be turned off when paver is stopped
- Collect and review vibrator monitor data when used
Edge Slump

• Concrete is *extruded* through a slipform paver
• Batter and overbuild allows for some edge slump
• Check periodically with a straightedge
• Halt paving if the edge keeps falling
Edge Overbuild

• Thickened edge formed by the paver to allow for relaxation of the edge
Edge Overbuild

• Sensitive to mixture and equipment adjustments
Dowel Placement

CD baskets
- Bars in basket assembly are placed ahead of paver
- Secure baskets to base
- Control head of concrete to avoid excessive force
- Positive marking for the saw crew
Dowel Placement

Dowel bar inserter (DBI)
• Bars inserted in plastic concrete
• Positive marking for the saw crew
Dowel Placement

Baskets or DBI
Manually verify bar location (min. 2x per day)
Hand Finishing

- Close voids in the surface
- Correct bumps and dips
- No added water
- Do not over finish
Texturing

- Maintain straight tines
- Clean mortar buildup from the burlap drags and tines
- Avoid positive texture (noise generator)
Curing Inspection

- Material meets specification
- Well agitated
- Applied as close behind the paver as possible
- Specified coverage rate allowing for texture
  - Uniform coverage (no gray streaks)
  - Like a white sheet of paper
Curing Inspection

Curing
• Start early
• Keep it wet and warm
• Does it affect strength? Yes
• When it dries, it dies

Poor

Good
Sawing

- Timing
  - Raveling
  - Cracking
- Sawcut depth
- Joint location relative to marks left by the paving crew
- Alignment

- Stick around and keep them on their toes
Fixed Form Paving

• Setting Forms
• Embedded Steel
• Spreading/Puddling
• Hand Vibration
• Strike-Off
• Hand Finishing
• Texturing
• Curing
• Stripping Forms
Setting Forms

- Set to line and grade
- Fine graded
- Shim forms when necessary
- Securely pinned
Embedded Steel

- Dowel baskets
- Tie bars
  - Chaired in contraction joints
  - Placed in forms or drilled and epoxied in construction joints
Spreading/Puddling

- Even distribution from the truck chute
- Shoveled ahead of the strikeoff
  - Stinger vibrators are not shovels
  - Rakes are not shovels
Hand Vibration

• Insert and remove stinger vibrator vertically
• Repeat at a pattern that provides adequate consolidation
• Do not vibrate embedded steel
Strikeoff

- Hand method (wet screed)
- Vibrating screed
- Roller screed
- Bridge deck paver
Hand Finishing

- Correct bumps and dips
- Close surface voids
- Do not over-finish
Texturing

• Burlap/Turf drag
• Hand tining
Curing

- Small sprayer
- Apply before any evaporation occurs
  - Full coverage
  - Uniformly white
Stripping Forms

• Typically the following day
• Cure the edges
Incidental Items

- Dimension Sawing
- Joint Sealing
- Granular or Earthen Backfill (shouldering)
Dimension Sawing

- Only necessary for sealants that require a specific joint shape (width:depth)
- Flush the slurry from the widened joint
Joint Sealing

• Clean and dry joint faces
  ➢ Sandblast
  ➢ Dry compressed air
• Backer rod installation
• Sealant installation
Backfill

• Hauling equipment is typically allowed on the pavement after opening strength has been met

• It’s important to protect pavement edges from damage (stay away):
  - loaded trucks
  - motor graders
  - rollers
Q: WHAT TO DO DURING PAVING?
Check Previous Day’s Paving

Previous Day’s Paving
- Tie Bar Placement
- Dowel Bar Placement
- Thickness
- Sawcut Depth/Raveling/Alignment
- Texture
- Smoothness (profile)
Check Tie Bar Placement

• Placement tolerance
  ➢ Vertical – 2” cover
  ➢ Alignment (tilt and skew) – not critical
  ➢ **SPACING** – typically 15” from a transverse joint

• Verification
  ➢ Visual for construction joints
  ➢ Non-destructive methods for contraction joints (MIT SCAN T3 or GPR)
Check Dowel Bar Placement

• Verification
  ➢ Non-destructive methods (MIT Scan), must cut the shipping wire
  ➢ Coring to verify the scan results prior to rejection

• Inspection during construction
Check Thickness

- Performance is sensitive to thickness
- Spot check edges
- Coring
- MIT T3
Check Joints

• Longitudinal & Transverse Joints
  ➢ Contraction – check sawcut depth and bar depth
  ➢ Construction – bar placement

• Prevent joint separation (longitudinal)
Check Joints

- Joint location relative to dowel and tie bars
- Is there excessive raveling?
- Are there any random cracks?
<table>
<thead>
<tr>
<th>Defect</th>
<th>Orientation</th>
<th>Location</th>
<th>Description</th>
<th>Dowelled/Undowelled Transverse Joints</th>
<th>Recommended Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Shrinkage</td>
<td>Any</td>
<td>Anywhere</td>
<td>Partial-depth and more than 0.007 in. wide</td>
<td>Either</td>
<td>Do nothing</td>
</tr>
<tr>
<td>Uncontrolled Crack</td>
<td>Transverse</td>
<td>Mid-Panel</td>
<td>Full-Depth</td>
<td>Undowelled</td>
<td>Sawcut and seal crack</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td></td>
<td></td>
<td>Dowelled</td>
<td>Full-Depth Repair or LTR^</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td></td>
<td></td>
<td>Undowelled</td>
<td>Saw &amp; seal crack; Epoxy sawed joint if uncracked</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td></td>
<td></td>
<td>Dowelled</td>
<td>Full-Depth Repair or If crack jumps from sawcut to edge of slab within 2 feet of edge of slab, step sawcut, saw &amp; seal crack</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td></td>
<td></td>
<td>Undowelled</td>
<td>Saw and seal crack; Seal joint</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td></td>
<td></td>
<td>Dowelled</td>
<td>Full-Depth repair to replace crack and joint</td>
</tr>
<tr>
<td>Spalled sawcut</td>
<td>Transverse</td>
<td>Anywhere</td>
<td>Spalling; more than 3.0 in. wide</td>
<td>Either</td>
<td>Partial-Depth Repair</td>
</tr>
<tr>
<td>or uncontrolled crack</td>
<td>Longitudinal</td>
<td>Relatively parallel to &amp; within 1 ft. of joint; May cease or at longitudinal joint</td>
<td>Full-Depth</td>
<td>Either</td>
<td>Sawout &amp; seal the crack or cross-stitch the crack; Epoxy sawed joint if uncracked</td>
</tr>
<tr>
<td>Uncontrolled Crack</td>
<td>Longitudinal</td>
<td>Relatively parallel to &amp; within wheel path; 1 - 5 ft. from joint</td>
<td>Full-Depth, hairline, or spalled</td>
<td>Either</td>
<td>Remove and replace panel or cross-stitch crack</td>
</tr>
<tr>
<td>Uncontrolled Crack</td>
<td>Longitudinal</td>
<td>Relatively parallel to &amp; further than 5 ft. from a longitudinal joint or edge</td>
<td>Full-Depth</td>
<td>Either</td>
<td>Cross-stitch crack</td>
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<tr>
<td>Spalled sawcut</td>
<td>Longitudinal</td>
<td>Anywhere</td>
<td>Spalled</td>
<td>Either</td>
<td>Partial-Depth Repair</td>
</tr>
<tr>
<td>or uncontrolled crack</td>
<td>Diagonal</td>
<td>Anywhere</td>
<td>Full-Depth</td>
<td>Either</td>
<td>Full-Depth Repair</td>
</tr>
<tr>
<td>Uncontrolled Crack</td>
<td>Multiple per panel</td>
<td>Anywhere</td>
<td>Two or more full depth cracks driving panel into 3 or more places</td>
<td>Either</td>
<td>Remove and replace panel</td>
</tr>
</tbody>
</table>

Full-Depth repair per Specification 2525. LTR = load-transfer restoration (if faulted less than 1/2”), 3 dowels per wheel path grouted into slots sawed across the crack. Slots must be parallel to each other and the longitudinal joint. Backfill with non-shrink, cement-based grout. Diamond grind if faulting is severe.

Appendix 9-6
Iowa DOT Construction Manual
Check Texture

• Macro-texture (tining) affects tire-pavement noise

• Micro-texture (burlap drag) affects skid resistance

• No standard measurement technique

• Visually inspect for uniformity and texture depth
Check Smoothness

• Daily contractor quality control testing

• Request a summary report and profile data
IN CONCLUSION:

YOU’RE ALMOST READY FOR THE PCC PAVING EXPERIENCE

Thank You

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