PCC Paving Inspection
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IOWA STATE UNIVERSITY
Institute for Transportation

National Concrete Pavement Technology Center
Topics

- Traffic Control and Safety
- Plant
- Grade (through curing)
- Protection
- Sawing & Sealing
- Closeout
Traffic Control

• Drive the work zone in day and night
• Review skids, complaints, crashes
• Communicate deficiencies to Contractor/Inspector (ongoing)
• Be timely in repairs and adjustments
• Document
Safety

- Proper gear for visibility
- Leave yourself an out
- Be aware of backing vehicles
- Don’t assume operators see you
- Don’t walk under spreader belt
- Trip hazards (string line, dowel baskets, grade)
- Limit haul road dust
- Be aware of project and user traffic
Safety

• Safely sample
• Check in
• Be aware of flow
• Acknowledgement with operators
• Follow rules of Contractor
• Production vehicles have ROW
Plant

Aggregate Stockpiles

- Loader operator critical to consistency
- Minimize segregation
  - Avoid high cone shapes
  - Work different areas
- Uniform moisture
  - Stable drainable base
  - Draw from areas of known moisture
- Limit contamination
  - Mud on tires
  - Digging into base
  - Comingle
Plant

Mixing

• Impact
  • Uniformity
  • Air content

• Central plant
  • Minimum 60 seconds
  • Do not exceed rated capacity

• Ready mix
  • Do not exceed rated capacity
  • Certified in working order
  • 60 to 90 revolutions
Dowel Baskets

- Correct number and placement of pins
- Up to 3 tie wires may remain uncut
- Proper coating and no damage
Grade

Dowel Baskets
• Inspect level and alignment across joint
• Sight down grade
• Locate joint for sawing
• Adjust as needed to match side roads, cross-overs, etc…
• Proper alignment ensures working joint
Grade

Subgrade/base

- Wet when dry
- Pay special attention when hot, low humidity, and windy
- Do not over wet after rain
Grade

Delivery

- Proper time (minutes)
  - Dump - 30 without retarder
  - Dump - 60 with retarder
  - Ready mix - 90
- Continuous mixing
- Reasonably close to paver
- Continuous steady supply
- Ensure dumps are getting cleaned out
- Consider retarder

Iowa DOT:
2301.02, D, & 2001.21

SUDAS:
1.05 & 3.01, A
Additions

- Ready mix only
- Mix at least 30 revolutions
- Ensure total water does not exceed maximum water

C-4WR-C mix design
- 9.0 cubic yards batched

 Aggregate water
- 66.6 gals water in aggregate

 Plant Water
- 220 gals plant water

 Total Water
- 286.6 gals total water

 MAX water
- 313 gals
  - 26 gals max water allowed to be added to load
  - Or 26 gals/9 cubic yards = 2.9 gals per cubic yard
Grade

Testing - Slump

- Iowa DOT
  - Not required on slip form
  - Non slip form ½” to 4 inch
- SUDAS
  - ½” to 2 ½” machine finish
  - ½” to 4 “ hand finish
- Minimum frequencies
- Non-complying test
  - Clearly communicate results
  - If possible stop incorporating
  - Pull ready mix truck off and spin
  - Test each truck until complying

Iowa DOT:
2301.02 B, IM 204, IM 317

SUDAS:
7010 2.02 B, Table 7010.02, IM 317
Grade

Testing – Air Content

- Calibrate, correlate, and have backup air meters
- Minimum frequencies
- Iowa DOT and SUDAS
  - Acceptance is prior to consolidation
  - 8.0% +/- 2% slip form
  - 7.0% +/- 1.5% non slip form

Target
Anticipated Loss

Iowa DOT:
2301.02 B, IM 204, IM 318

SUDAS:
7010 2.02 B 2, Table 7010.02, IM 318
Grade

Testing – Air Content

• Intent is to have 6.0% after consolidation
• Loss should be checked
  • Once per day 1st 3 days
  • Once per week thereafter
  • Communicate with finishers
• Engineer may adjust loss
• Contractor should work towards target when < 7.0% or > 9.0%

Iowa DOT:
2301.02 B, CM 9.63

SUDAS:
7010 2.02 B 2
Each load is tested and evaluated for compliance

Non-complying concrete limits

Test every load in front of paver until two consecutive complying tests

Non-complying verification test

Test immediately behind paver, air is between 5% and 8%

Last verification test

Do not incorporate loads below the lower target by more than 0.5% or above the upper target by more than 1.0%
Each load is tested and evaluated for compliance.

Non-complying concrete:
- Test immediately behind the paver, air is between 5% and 8%.

When verification test is more than 0.5% above or below the target, coring may be considered.

Non-complying concrete:
- Last verification.

Test every load in front of the paver until two consecutive complying tests.

Non-complying verification test:
- Do not incorporate loads below the lower target by more than 0.5% or above the upper target by more than 1.0%.

Test immediately behind the paver, air is below 5% or above 8%.
Grade

Placement

• Close to paver
• Avoid damaging or contaminating subgrade/base
• Maintain constant supply and head for best smoothness
• Belt placer and spreader aid in providing consistent head of concrete
• Pile from a belt placer should be bell-curved
• Segregation may be occurring if the pile is skewed
Grade

Consolidation

• Avoid excessive vibration
• Frequency should match mix workability and paver speed in range of 4,000 to 8,000 VPMs
• Monitor vibration
  • Twice per day manually
  • Electronically for DOT projects over 50,000 yds^2

Iowa DOT: 2301.03, A, CM 9.64, IM 384
SUDAS: 7010 3.01, B
Grade

Finishing

- Remove some imperfections but avoid over finishing
- Do not “bless the slab” when finishing
- Check smoothness with straight edge
- Avoid over wetting burlap
- Excessive surface paste indicates
  - Too much water
  - Over vibration
  - Excessive finishing

Iowa DOT: 2301.03, A, & H, CM 9.14 & 9.41
SUDAS: 7010 3.02, H
Grade

Dimensional Checks

- Periodically check
  - Pavement width
  - Edge slump
    - ½” or less when no abutting pavement
    - ¼” or less when abutting pavement
  - Cross-slope prior to finishing
  - Thickness - observe contractor probing
- Immediately communicate issues

Iowa DOT:
2301.03, A & H, CM 9.44 & 9.53

SUDAS:
7010 3.07.D
Grade

Tie Bars

- Depth should be approximately T/2
- Reasonably level
- Perpendicular joint tying
- Approximately 18 inches from transverse joint
- Visual for construction joints
- NDT or probing during construction for contraction joints
Grade

Micro Texture

- Adequate contact area
- Burlap drag produces better texture and smoothness with lower noise levels
- Made moist not drenching constantly
- Keep clean
Grade

Macro Texture

- Longitudinal or transverse depending on application
- Shallow less noise than deep
- Adjust tine angle and length for desired depth (keep consistent)
- Minimize positive texture by keeping tines straight and clean
- Don’t stop the tine rake in down position
- Some hand work areas can be excluded
**Grade**

**SUDAS**
Microtexture: Turf or Burlap Drag
Macrotexture: (when specified)

**Iowa DOT**
Microtexture: Turf or Burlap Drag
Macrotexture when speed limit is greater than 35 mph. (Table 2301.03-1)

<table>
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<tr>
<th>Pavement/Placement Type</th>
<th>Macrotexture Orientation</th>
<th>Macrotexture Not Required</th>
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<td></td>
<td>Longitudinal</td>
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<tr>
<td>Mainline - slip-form</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Mainline - handwork</td>
<td>X</td>
<td>1</td>
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<tr>
<td>Turn lanes - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Turn lanes - handwork</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ramps - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Ramps - handwork</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Gapped sections of mainline - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Gapped sections of mainline - handwork</td>
<td>X</td>
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<tr>
<td>Radii</td>
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<tr>
<td>Crossovers</td>
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<td>Irregular Areas</td>
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<td>Bridge Approaches</td>
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</table>

1. Transverse macrotexture permitted for placements less than 600 feet in length.
2. Transverse tining required unless longitudinal grooving in concrete is specified in the contract documents.
Grade

Curing

- Material meets specification and lot number
- Well agitated
- Apply as close to paver as possible but no more than 30 minutes after finishing
- Even and complete coverage “white paper”
- Adjust for wind
- Edge covered as well
- Application rate of at least 0.067 gal per yd^2
Cold Weather Protection

Protection: SUDAS & Iowa
DOT: DOT Table 2301.03-2

Min. temp needed to start:
34°F and rising

Temp for stopping:
38°F or less and falling

Min. mix temp: 40°F

• Burlap cover can accelerate curing process or protect during cold weather
• Monitor forecast temperature to determine if protection is necessary
Hot Weather Protection

- If rate of evaporation is 0.3 psf per hour or greater, discontinue placement of concrete.
- ACPA Evaporation Rate Calculator
- HIPERPAV
Rain Damage

Cover it and leave alone

Do not finish rain water into the surface

Diamond grind to re-establish texture

SUDAS – discretion of Engineer

Iowa DOT - 3 levels of rain damage
Rain Damage – Iowa DOT

**Case 1**

Texture is absent from practically all of surface area. Surface appearance may have a “sandy” appearance or may be “pock” marked from the rain droplets. An occasional edge repair may be required due to excess edge slump or from edge rounding. Small areas along edge may have coarser particles of fine aggregate exposed. Surfaces finished in the rain or after a rain are also included in Case I. This includes any manipulation of the pavement surface including mopping of the surface to attempt to remove rainwater or retexturing while rainwater is present.

95% payment – can improve pay with grinding/grooving

**Case 2**

Texture is totally absent from the surface and cement mortar has been eroded to an extent that coarser particles of the fine aggregate fraction are generally exposed. Some slight troughs or depressions are apparent, exposing coarse aggregate particles, but this damage is confined to a limited area or randomly spread intermittently throughout damaged area. Some edge repairs may be required to restore eroded edges. Surface mortar that was removed by rain water, but later replaced or supplemented with plastic concrete is included in Case II since a cold joint or sand lens with minimal portland cement paste contact may have been inadvertently incorporated into the slab.

90% payment – can improve pay with grinding/grooving

**Case 3**

Surface mortar has been practically all removed to an extent that coarse particles of the coarse aggregate fraction are visible. Considerable erosion of edges has occurred, but not to an extent that pavement width is affected. Intermittent edge repair may be required as well as some surface patching of slight troughs or depressions that may have formed in pavement surface due to flowing water.

85% payment

Credit: John Hart, Iowa DOT
Conventional Saws

• Saw 8-12 hours after paving
• Diamond blades

a) No raveling—sawed later in the window

b) Moderate raveling—sawed early in the window

c) Unacceptable raveling—sawed too early

Figure 8-23. Close-up of different degrees of raveling caused by joint sawing (ACPA)
Early Entry Saws

- Transverse and Longitudinal Joints
- ¼” and 1/8” width
- Saw within 3 hours
- Lighter and quieter than conventional saws
- Skid plate

Residue from early entry sawing
Sawcut at Edge

- Iowa DOT Const. Manual Sec 9.21
- Prevents spalls or blow outs
- Prevents sealant from running out of slab edge
Late Sawcut

• Sawing must be continuous regardless of weather
• Sawing discontinued if crack develops ahead of saw
• Article 2301.03, N defines repair for random transverse cracks
• Appendix 9-6 Iowa DOT Construction Manual – Recommended Repairs for PCC Cracking

Late sawing crack
Sawcut Depth

- Road Standard PV-101 (Iowa DOT & SUDAS) defines all joints
- Check saw depth and width daily
- Inadequate depths may lead to cracking

Iowa DOT:
Article 2301.03, N
Road Standard PV-101
Construction Manual 9.21, Appendix 9-6

SUDAS:
7010 3.02, J
Joint Sealing

- Joint sealer spec DOT Section 4136
- Flush residue within 3 hours of wet saw
- Blow residue within 3 hours of dry saw
- Moisture and oil free compressed air

Iowa DOT:
Article 2301.03, P & Section 4136
Road Standard PV-101
Construction Manual 9.22 and 9.23

SUDAS:
7010 3.02, K
Joint Sealing

• Place when air temperature is 40 degrees F or higher
• Seal when joint surface is dry
• Iowa DOT joint worksheet – PCC Field Inspection manual
Steel

MIT T2 Scan - Tie Bars and Dowel Bars

• NDT or probing during construction for contraction joints
• Placed on longitudinal joints
• Perpendicular to centerline
• Approximately 18 inches from transverse joint
Smoothness

- 10' straightedge – mark areas ≥ ¼", repair per Iowa DOT 2316 to max 1/8"
- Profilometer or inertial profiler
- Evaluate within 48 hours after paving
- Contractor measures, Owner reviews results

Iowa DOT:
Sections 2316 & 2317
I.M. 341

SUDAS:
7010 3.08, reference 2316
Thickess

Iowa DOT

> 3500 SY MIT scan, April 2021
< 3500 SY probing, April 2021

SUDAS - Iowa DOT I.M. 346 & 347 –
Process to identify core locations and measuring thickness/thickness index

Iowa DOT:
Articles 2301.04 and 2301.05
I.M. 346, 347

SUDAS:
7010 3.08, D

Nine-point core length measuring device

MIT T2 Scan
# Pay Factors / Price Adjustments

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<td></td>
<td>≤ 3500 SY probing, April 2021</td>
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Pre-Pour Conference

- Chain of Command / Responsibilities
- Approved Mix Design & Source
- Batch Plant Operation / Certification
- Paving Schedule
  - ✓ Prime
  - ✓ Subs
- Paving Survey
- Hot/cold Weather Protection
- Water truck to wet the subgrade/subbase & haul road
- Backup Saws
- Sampling and Testing
Compliance

- If work is not in compliance with the plans and specs
- Inspector notify the Project Manager
- Iowa DOT non-compliance Form 830245
- Can result in price adjustment
- Const. Manual 2.53
Inspector Checklist

- Pre-pour
  - Pre-pour meeting
  - Grade & haul road
  - Steel
  - Stringline
  - Equipment
- Paving
  - Wetting the grade
  - Concrete Delivery
    - Delivery time
    - Water content
    - Mixing
  - Vibration
- Concrete testing
  - Air content
  - Slump
  - Strength
  - Temperature
- Pavement verification
  - Edge slump
  - Geometry
  - Steel
  - Yield
- Texture
- Station marking
- Curing
- Sawing
- Sealing
- Documentation
- Post Paving
  - Joints
  - Texture
  - Smoothness

Iowa DOT PCC Paving Field Inspection
https://iowadot.gov/training/ttcp/training_manuals/PCCField.pdf
Resources

Iowa DOT Construction Manual

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Section 7010: Portland Cement Concrete Pavement

Section 2301 Portland Cement Concrete Paving

PORTLAND CEMENT CONCRETE PAVING

FIELD INSPECTION 2020
Questions

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