Introduction

- Concrete paving operation:
  - Delivery
  - Placement
  - Finishing
  - Texturing
  - Curing
  - Sawcutting

- Inspection – What is it and Why?
  - Provide a level of oversight
  - Assure conformity with plans and specs
  - Opportunity for timely remedial action to problems
  - What it is Not- Running Contractors Operation

Safety

What operations cause safety risks?
- Trucks backing
- Spreader belt
- Finishing
- Noise
- Batch tickets
- Traffic control
- Trip hazards (stringline, windrows, dowel baskets, etc)
**Safety**

What can be done to improve safety?
- **E-Ticketing**
- Safety meetings / training
- High visibility gear
- Never assume operators see you
- Parking off site
- Dust control
- Communication
- Checklists

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**Traffic Control**

- Review the work zone day and night
- Communicate deficiencies to Contractor/Inspector
- Be timely in repairs and adjustments
- Document

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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

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**Role of the Inspector – Paving Day**

- Check the grade
- Wetting the grade
- Concrete Delivery
  - Delivery time
  - Adding water
  - Mixing
  - Clean boxes
- Concrete placement
- Concrete testing
  - Air content
  - Slump
  - Temperature
- Concrete pavement testing
  - Edge slump
  - Pavement width
  - Cross slope
  - Depth/Thickness
  - Yield
- Vibration
- Steel placement
- Finish
- Texture
- Curing
- Sawing
- Station Markers
- Strength beams maturity
- Date stamp
- Haul road
- Documentation
- Non-compliance

Iowa DOT PCC Paving Field Inspection
https://iowadot.gov/training/ttcp/training_manuals/PCCField.pdf
**Check Grade & String line**

- Check grade using stringline and level for inconsistencies
- Look for debris, bar positioning & grade conditions
- View paver stringline for misalignment, sags or rises
- Periodically walk ahead of paver
- Check grade profile with stringline

**Steel Placement**

- Insure proper placement, fastening & alignment (if not, integrity is compromised)
- CD basket provides load transfer

**Steel Placement**

- Walk the grade, look for bar placement and alignment
- Check joint locations with adjoining joints particularly in multiple pass construction
- Review at intersections, crossovers, intakes or anywhere where joint has to match another feature
- Typically 8 stakes per lane width

**Producing Concrete**

- Central/ Portable mixed batch plant
  - Mixed prior to discharge
  - Increased production
  - Direct control
  - Check in

- Stationary dry-batch plant (Ready Mix)
  - Batched directly into truck
  - Truck does the mixing
**Safety at the Plant**
- Safety sample
- Check in
- Be aware of flow
- Acknowledgement with operators
- Follow rules of Contractor
- Production vehicles have ROW

**Minimize Segregation**
- Avoid high cone shape piles
- Pile should be no higher than end loaders dump
- Build pile outward
- Limited space use 4ft. tall lifts

**Plant**

**Adequate Mixing Time**
- Uniformity
- Air entrainment
- Strength
- Workability

**Wetting the Grade**
- Very important step (especially if hot, dry windy)
- Dry subgrade draws water from the concrete
- Can lead to cracking
- Do not over water

Grade must be moist ahead of the paver
Concrete Delivery

Dump truck – 30 minute time limit
May be extended 30 min with approved retarder

Iowa DOT: Articles 2001.02, D, & 2001.21

SUDAS: 1.05 & 3.01.A (References Iowa DOT)

Ready mix truck – 90 minute time limit

Concrete Delivery

Adding Water

- Specs prohibit adding water to slab by spray, wand, brush or other methods
- Wet burlap drag is allowed
- Decrease moisture if slurry or small bubbles develop on trailing edge of burlap

Wet burlap drag

Adding Water (Ready Mix)

- Watch the amount of added water!
- Added water not to exceed max w/c (check batch tickets)
- If water added, mix for additional 30 revolutions

Adding 1 gallon / cu. yd:
- Increases workability ~1"
- Lowers strength ~200 psi
- Increases drying shrinkage ~10%
- Increases permeability ~50%

Air Testing

- Calibrate the air meter & backup air meter
- Iowa DOT & SUDAS
  - 8.0% ± 2% (slip form)
  - 7.0% ± 1.5% (non slip form)

Air Content:
Iowa DOT: Article 2301.02, B
I.M. 318,327,204,204,530
SUDAS: 7010, 3.08 B

Location & frequency of Tests
Iowa DOT: I.M. 327, 204
Construction Manual 9.61
SUDAS: 7010, 3.08 A
**Air Testing – Aggregate Correction Factor**

<table>
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<th>Source #</th>
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<tr>
<td>A2004</td>
<td>Conkin</td>
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<td>A8002</td>
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<tr>
<td>A9002</td>
<td>Westchester</td>
<td>14.16</td>
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</tbody>
</table>

Iowa DOT I.M. 318

Example: For slip form PCC paving utilizing ready mixed concrete, specified air is 8.0% plus or minus 2.0%. For an aggregate correction factor of 1.0%, the target would be 9.0% (8.0% equals the specified target of 8.0% plus the aggregate correction factor of 1.0%) plus or minus 2.0%.

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**Air Testing – Behind the Paver**

- Slipform pavers can have air loss of 2% or greater
- Specs allow for checking behind the paver
- Allow check once in morning & if mix changes, once again

Air content should be checked behind the paver once each day for the first three days of paving. After that, air should be checked once per week behind the paver to verify the amount of air loss through the paver is consistent. Iowa DOT Construction Manual 9.63

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**Slump Test**

- Used to check consistency between loads
- Used to approximate workability and measure consistency
- Iowa DOT not required for slip form paving
- SUDAS ½" – 2 ½" (machine finish) ½" – 4" (hand finish)

**Strength Testing**

- Concrete strength determined by beam breaks (unless using Maturity Method)
- Min of two beams per day
- Cured like pavement and stored on site
- Strength and time required to determine pavement opening
- Smaller beams / cylinders (and rods) now (depending on coarse aggr. Size)

Iowa DOT: Article 2301.03, U I.M. 316, 328, 383

SUDAS: 7010 3.08, A
**Maturity Testing**

- I.M. 383
- Time-Temperature Factor wires
- Inspector monitors periodically

Maturity probe location with hand held thermometer

[FHWA Image: Form E114 - Maturity Strength Curve]

[FHWA Image: Form E141 - Maturity Record]

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**Check Cross Slope and Edge**

- Check periodically & before finishing operation
- Increase in mix water may cause edge slump
- \( \frac{1}{2} \)" edge slump permissible if no abutting pavement.
- \( \frac{1}{4} \)" edge slump permissible if abutting pavement

[Iowa DOT: Article 2301.03, A, IM 346]

[SUDAS: 7010 3.07.D]

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**Check Thickness**

- Check periodically
- Notify contractor of thickness discrepancies
- Document in inspector daily diary

[Iowa DOT: MIT T2 Scan]

[SUDAS: 7010 3.07.D]

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**Check Thickness**

MIT T2 Scan

[Iowa DOT DS 15064 - PCC Paving Non-Destructive Thickness Determination]

Keep discs a minimum of 3’ away from steel

[Images: FHWA]
**Yield Calculation**

- During the paving operation, the inspector should run yield checks throughout the day.
- Compared delivered with placement. Calculate cubic yards per station.
- Cubic yards delivered will be obtained from the concrete tickets.
- A yield of 103% to 106% is normal.

**Vibration Monitoring**

- Vibration gives proper consolidation
- Over-vibration can segregate aggregates & lower air content
- Check twice per day for allowable (<50,000 sq. yds.)

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- Vibration gives proper consolidation
- Over-vibration can segregate aggregates & lower air content
- Check twice per day for allowable (<50,000 sq. yds.)

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**Tie-Bar Insertion**

- L – bars are placed manually or mechanically
- Timing device used to obtain spacing

**Sawcut = T/3**

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**Tie-Bar Insertion**

- Mechanical tie bar inserter (loaded manually)
- L – bars are placed manually or mechanically
- Timing device used to obtain spacing

**Sawcut = T/3**
**Finishing**

- Remove small imperfections
- Tight surface with few holes
- Extensive finishing can damage integrity of slab
- Do not add free water

Iowa DOT:
Article 2301.03, A, & H
Chapter 9.14, 9.41

SUDAS:
7010 3.02, H

**Texturing (Micro)**

- Micro texture placed using burlap or artificial turf
- Adequate contact turf
- Keep moist (not soaking)
- Keep clean

Iowa DOT:
Article 2301.03, H
Construction Manual 9.42

SUDAS:
7010 3.02, H, 5

**Texturing (Macro)**

**Macro Texture**
- Longitudinal tining produces less noise
- Shallow produces less noise than deep
- Adjust tine angle and length for desired depth (consistency)
- 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

**Texture**

<table>
<thead>
<tr>
<th>Pavement/Placement Type</th>
<th>Macrotexture Orientation</th>
<th>Macrotexture Not Required</th>
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<tbody>
<tr>
<td></td>
<td>Longitudinal</td>
<td>Transverse</td>
</tr>
<tr>
<td>Machine - slip-form</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Machine - handmade</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Turn lanes - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Turn lanes - handmade</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ramps - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Ramps - handmade</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gapped sections of machine - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Gapped sections of machine - handmade</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Iowa DOT
Microtexture:
Turf or Burlap Drag
Macrotexture when speed limit is greater than 35 mph.

(Side 2301.03-1)

<table>
<thead>
<tr>
<th>Roadway</th>
<th>Crossovers</th>
<th>Paved/Medians</th>
<th>Shoulders</th>
<th>Intersection Areas</th>
<th>Bridge Approaches</th>
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<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Transverse macrotexture permitted for placements less than 500 feet in length
2. Transverse tining required unless longitudinal grooving in concrete is specified in the contract documents.
Make Curing Uniform

- Surface should be uniform white on surface and vertical edges
- Windy days require additional effort
- Application rate = 0.067 gal per SY
- Apply within 30 min.
- Should not track after 12 hours

Curing

- Agitate before and during application
- Check lot number with approved list from Iowa DOT Office of Materials

Iowa DOT:
Article 2301.03, K, & Section 4105

SUDAS:
7010 3.02, 1

Cold Weather Protection

Min. temp needed to pave: 34°F and rising
Temp for stopping: 38°F or less and falling
Min. mix temp: 40°F

- Burlap cover can be used to accelerate curing process or protect during cold weather
- Monitor forecast temperature to determine if protection is necessary

Conventional Saws

- Saw 8-12 hours after paving
- Diamond blades used
- Can be dry or wet sawing
**Early Entry Saws**

- Used on Transverse and Longitudinal Joints
- Saw within 3 hours
- Minimal dust
- Quieter than conventional saws

**Sawcut at Edge**

- Pull up of sawcut before edge of slab
- Blowout at edge of slab
- 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

**Compliance**

- Inspector encounters work that is outside of the specifications, it is considered to be non-complying
- Inspector should notify the Project Manager
- Project Manager will then issue a Non-Compliance Notice
- Iowa DOT has a non-compliance Form 830245
- Can result in price adjustment
- Const. Manual 2.53

Communicate with the contractor when questionable activities are observed.
### 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.

**SUDAS:**
- 7010 3.02, J.

### Joint Sealing

- Joint sealer must meet Section 4136.
- Flush residue within 3 hours of wet saw.
- Blow residue within 3 hours of dry saw.

**Iowa DOT:**
- Article 2301.03, P & Section 4136.
- Road Standard PV-101.

**SUDAS:**
- 7010 3.02, K.

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### Joint Sealing

- Air blast of joint prior to sealing.

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### Joint Sealing

- Place when air temperature is 40 degrees F or higher.
- Seal when joint surface appear dry.
- Iowa DOT joint worksheet.

### Steel

#### Dowel Baskets

- Correct alignment of bars.
- Correct placement of transverse saw cut.
- MIT Dowel Scan.
Steel

**Tie Bar**
- Placed on longitudinal joints
- Perpendicular to centerline
- Approximately 18 inches from transverse joint
- MIT T2 Scan
  - NDT or probing during construction for contraction joints

Pay Factors

<table>
<thead>
<tr>
<th>Pay Factors</th>
<th>SUDAS</th>
<th>Iowa DOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Content</td>
<td>7010.04</td>
<td>Smoothness tables 2316.05 Smoothness</td>
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<tr>
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<td>7010.05</td>
<td>Thickness tables 2301.05-1 Thickness</td>
</tr>
<tr>
<td>Thickness</td>
<td>7010.06</td>
<td>Smoothness</td>
</tr>
</tbody>
</table>

Smoothness

- California profilograph
- Inertial profiler
  - Check with 10' straightedge should not deviate more than 1/8"
  - Profilometer or inertial profiler
  - Evaluate within 48 hours after paving

thickness

- Iowa DOT I.M. 346 – Process to identify core locations
- Iowa DOT I.M. 347 – Process to measure thickness & determine thickness index

- Nine-point core length measuring device
- MIT T2 Scan
- Iowa DOT: Articles 2301.04 and 2301.05
- I.M. 346, 347
- SUDAS: 7010 3.08, D
Questions

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