Concrete Paving Field Inspection
Inspector's Workshop

National Concrete Pavement Technology Center

Tech Center

IOWA STATE UNIVERSITY

Institute for Transportation

www.cptechcenter.org

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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

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  - **Proportions**
  - **Added Water**
  - **Aggregate Moisture**
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Concrete Proportions

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

Job	SD OL
Ticket No.	1041
Date	3/26/2011
Time	15:30
Batch Size (yd^3)	8
Formula #	2

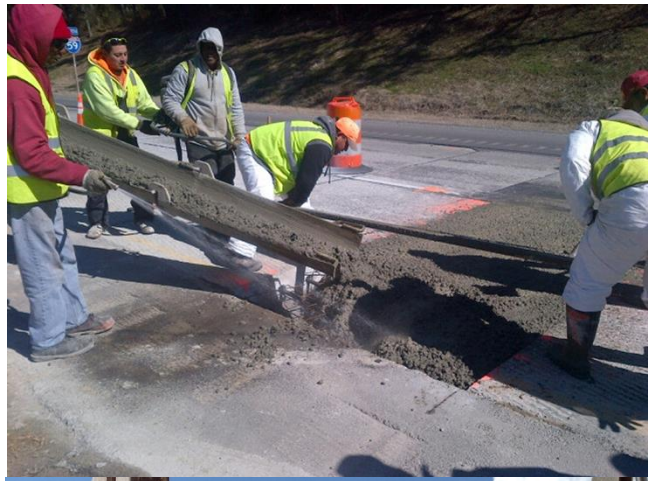
	Target	Actual	MC
Portland Cement	3680	3670	
Fly Ash (lb)	920	920	
Coarse Agg (lb)	10910	10920	3.0%
Intermediate Agg (lb)	3460	3450	2.7%
Fine Agg (lb)	10460	10480	3.8%
AEA (oz)	40	40	
Water Reducer (oz)	304	305	

Mix Water (gl)	119	120
Trim Water (gl)	10	10
Water from Agg (gl)	98	98
Total Water (gl)	227	228

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

Job	SD OL
Ticket No.	1041
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Batch Size (yd^3)	8
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AEA (oz)	40	40	
Water Reducer (oz)	304	305	

Mix Water (gl)	119	120
Trim Water (gl)	10	10
Water from Agg (gl)	98	98
Total Water (gl)	227	228

Delivery Time

Check transit time periodically

Job	SD OL
Ticket No.	551
Date	3/23/2011
Time	**11:30**
Batch Size (yd^3)	8
Formula #	2

	Target	Actual	MC
Portland Cement	3680	3670	
Fly Ash (lb)	920	920	
Coarse Agg (lb)	10860	10850	2.5%
Intermediate Agg (lb)	3470	3460	2.9%
Fine Agg (lb)	10500	10510	4.2%
AEA (oz)	40	40	
Water Reducer (oz)	304	305	

Mix Water (gl)	119	120
Trim Water (gl)	10	2
Water from Agg (gl)	98	98
Total Water (gl)	227	220

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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

- 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**

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

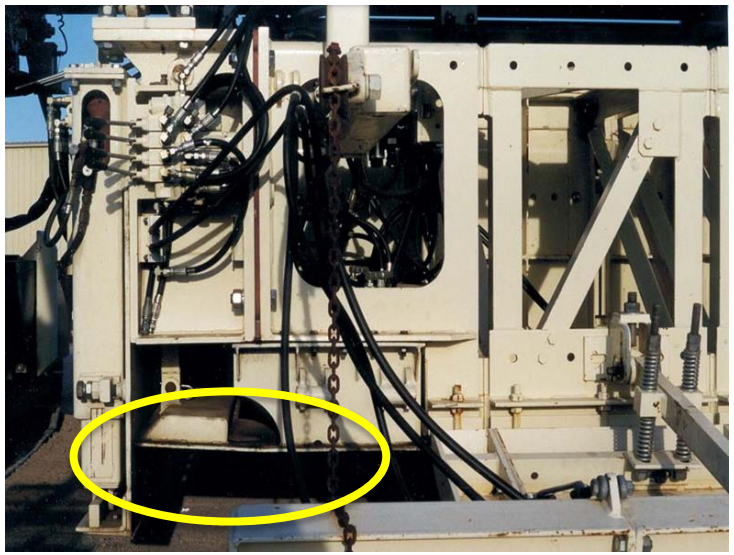
- Some surface voids in the pavement are better than slurry running off the edges
- Vibrator frequency should be adjusted for paving speed
- Vibrators should be turned off when paver is stopped
- Collect and review vibrator monitor data when used

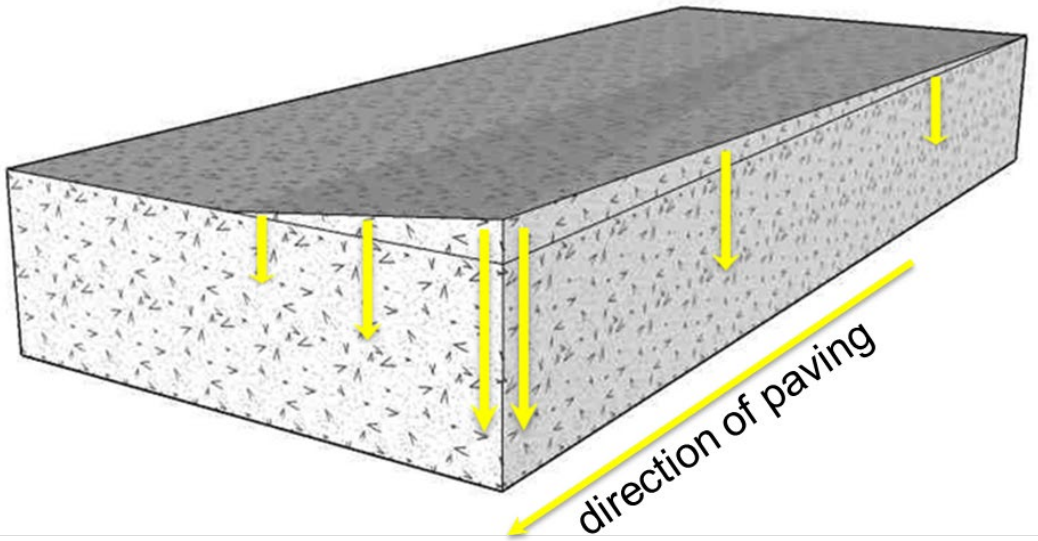
Edge Slump

- 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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Texturing

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

Curing Inspection

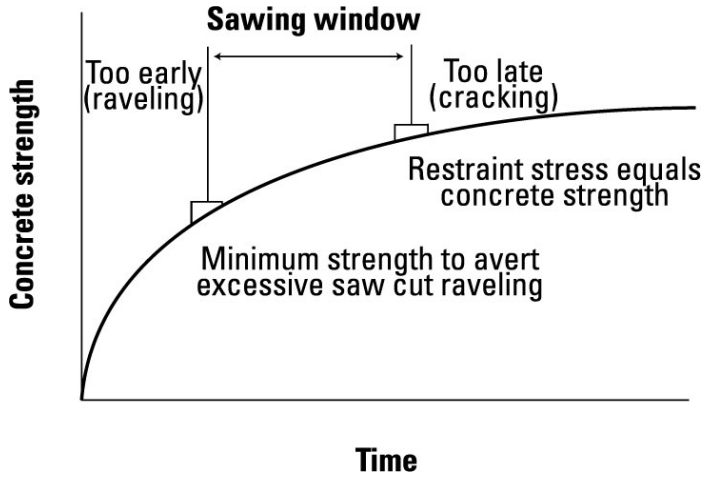
- Material meets specification
- Well agitated
- Applied as close behind the paver as possible
- Specified coverage rate allowing for texture
  - ➢ Uniform coverage (no gray streaks)
  - ➢ Like a white sheet of paper

Curing Inspection

Curing

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

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

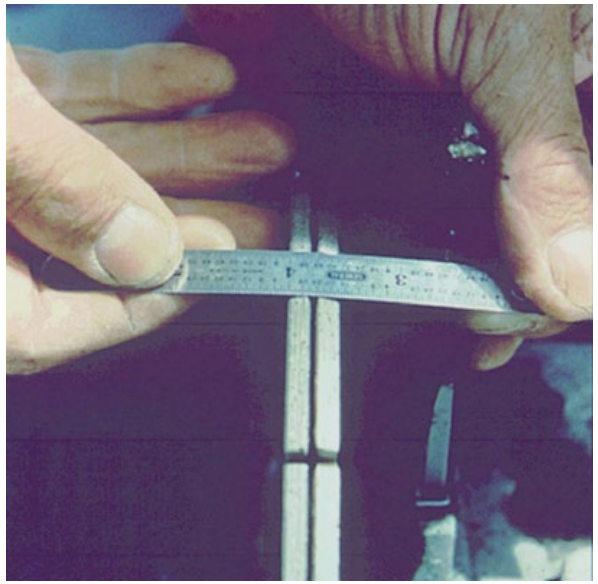
- Typically the following day
- Cure the edges

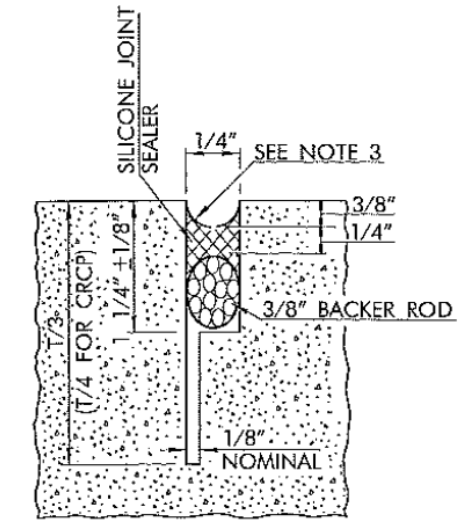
Incidental Items

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

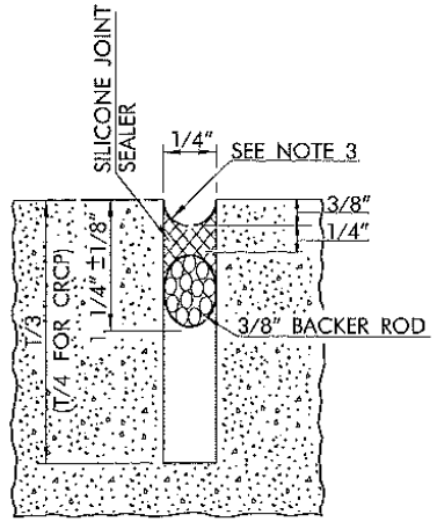
Dimension Sawing

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





SILICONE SEALANT OPTION



SILICONE SEALANT OPTION

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?

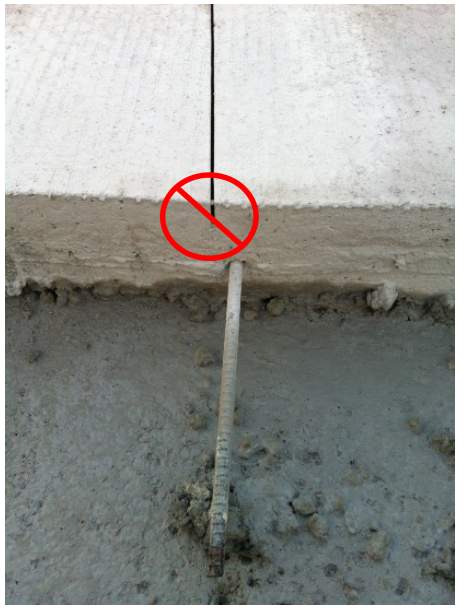
Check Previous Day's Paving

Previous Day's Paving

- Tie Bar Placement
- Dowel Bar Placement
- Thickness
- Sawcut Depth/Raveling/Alignment
- Texture
- Smoothness (profile)

Check Tie Bar Placement

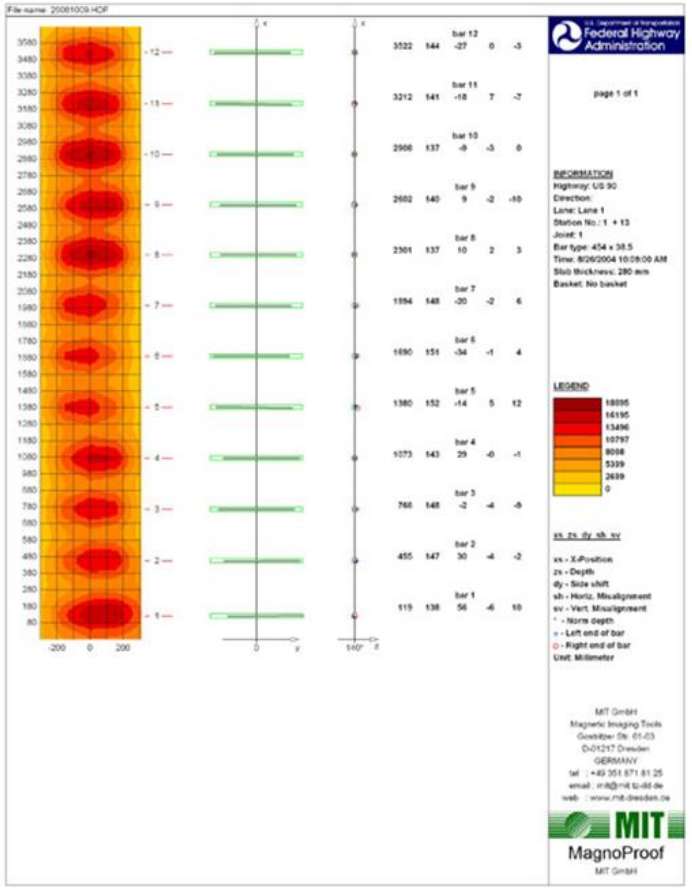
- Placement tolerance
  - Vertical – 2” cover
  - Alignment (tilt and skew) – not critical
  - **SPACING** – typically 15” from a transverse joint
- Verification
  - Visual for construction joints
  - Non-destructive methods for contraction joints (MIT SCAN T3 or GPR)



Check Dowel Bar Placement

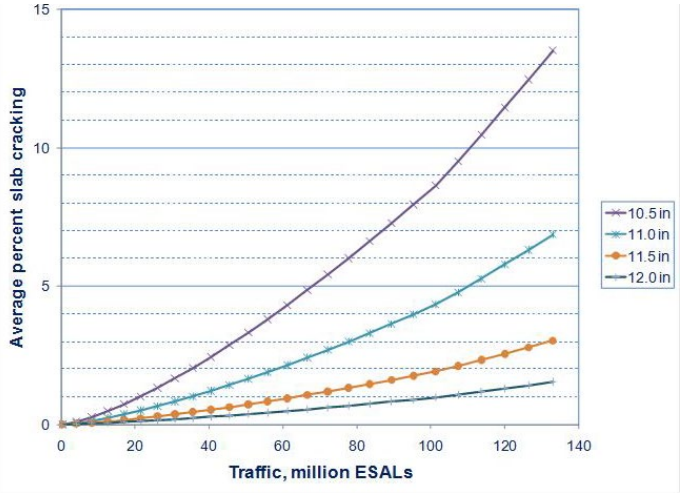
- Verification
  - Non-destructive methods (MIT Scan), must cut the shipping wire
  - Coring to verify the scan results prior to rejection

- Inspection during construction



Check Thickness

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



Check Joints

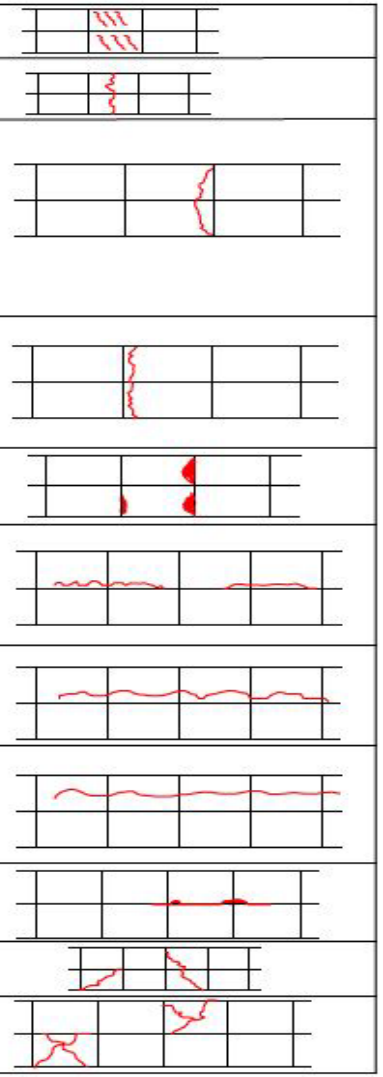
- Longitudinal & Transverse Joints
  - Contraction – check sawcut depth and bar depth
  - Construction – bar placement
- Prevent joint separation (longitudinal)

Check Joints

- Joint location relative to dowel and tie bars
- Is there excessive raveling?
- Are there any random cracks?

Sawcut Joints – Random Cracks

Defect	Orientation	Location	Description	Dowelled/Undowelled Transverse Joints	Recommended Repair
Plastic Shrinkage	Any	Anywhere	Partial-depth and more than 0.007 in. wide	Either	Do nothing
Uncontrolled Crack	Transverse	Mid-Panel	Full-Depth	Undowelled	Saw/route and seal crack
				Dowelled	Full-Depth Repair or LTR[a]
Uncontrolled Crack	Transverse	Crosses or ends at transverse joint	Full-Depth	Undowelled	Saw & seal crack; Epoxy sawed joint if uncracked
				Dowelled	Full-Depth Repair or If crack jumps from sawcut to edge of slab within 3 feet of edge of slab, stop sawcut, saw & seal crack
Uncontrolled Crack	Transverse	Parallel to & within 5 ft. of joint	Full-Depth	Undowelled	Saw and seal crack Seal joint
				Dowelled	Full-Depth repair to replace crack and joint
Spalled sawcut or uncontrolled crack	Transverse	Anywhere	Spalling; more than 3.0 in.wide	Either	Partial-Depth Repair
Uncontrolled Crack	Longitudinal	Relatively parallel to & within 1 ft. of joint; May cross or end at longitudinal joint	Full-Depth	Either	Saw/route & seal the crack or cross-stitch the crack Epoxy sawed joint if uncracked
Uncontrolled Crack	Longitudinal	Relatively parallel to & within wheel path; 1 - 5 ft. from joint	Full-Depth, hairline, or spalled	Either	Remove and replace panel or cross-stitch crack
Uncontrolled Crack	Longitudinal	Relatively parallel to & further than 5 ft. from a longitudinal joint or edge	Full-Depth	Either	Cross-stitch crack
Spalled sawcut or uncontrolled crack	Longitudinal	Anywhere	Spalled	Either	Partial-Depth Repair
Uncontrolled Crack	Diagonal	Anywhere	Full-Depth	Either	Full-Depth Repair
Uncontrolled Crack	Multiple per panel	Anywhere	Two or more full depth cracks dividing panel into 3 or more pieces	Either	Remove and replace panel



Full-Depth repair per Specification 2529
Partial-Depth repair per Specification 2530
Cross-stitch repair per Construction Manual 9.27
Repairs should be made without use of Calcium Chloride unless early opening to traffic is necessary.

a LTR = load-transfer restoration (if faulted less than 1/2"); 3 dowel bars 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

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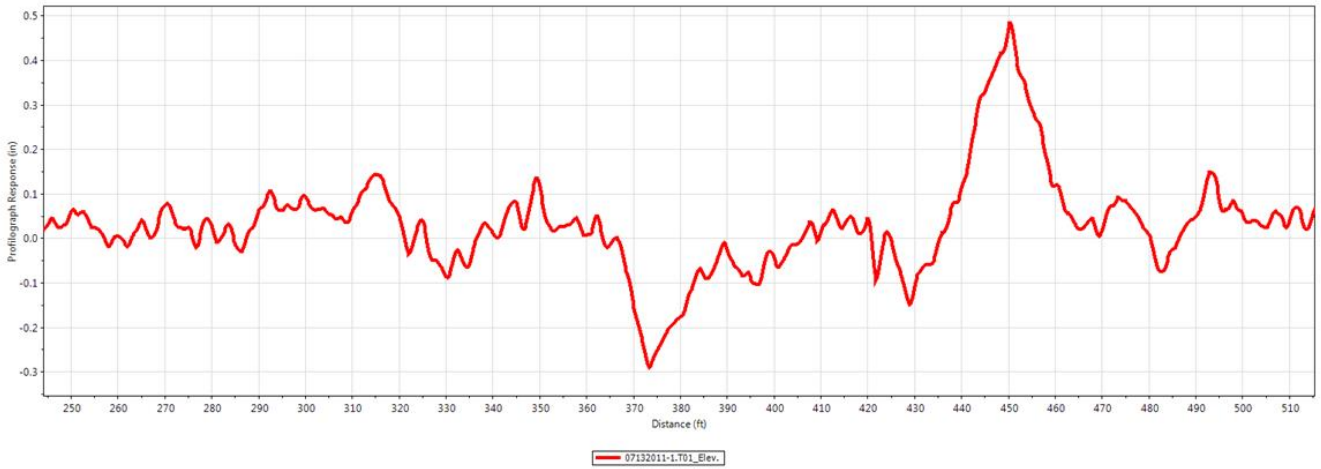
Check Texture

- 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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