

PCC Paving Inspection

March 5, 2021

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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

Iowa DOT:
2001.21

SUDAS:
7010 3.01

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



Grade

Iowa DOT
2301.03, E, PV-101

SUDAS
Sect. 7010 3.02, E

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

Iowa DOT
2109.03

SUDAS
7010 3.02 B

Subgrade/base

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



Grade

Iowa DOT:
2301.02, D, & 2001.21

SUDAS:
1.05 & 3.01, A

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



Grade


Iowa DOT:
Articles 2301.02 C

SUDAS:
7010 3.01 A

Additions

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

PLANT COPY

IDEAL **IDEAL READY MIX COMPANY, INC.** Call Charley  The Ideal Man!

P.O. BOX 410
WEST BURLINGTON, IOWA 52655
PH. 319-754-4747

Buyer agrees to pay a SERVICE CHARGE on such amounts past due computed by periodic rate of 1 1/2% per month (minimum \$.50) which is AN ANNUAL PERCENTAGE RATE of 18% applied to the past-due balance after deducting current payments or credits.
Claims for shortage will not be allowed unless made at time this material was delivered.
Not responsible for damage caused by vehicle driving in on private property when ordered to by customer.
Not responsible for imperfections or blemishes caused from deleterious material in the concrete.
FLUID CONCRETE CAN BE HAZARDOUS TO YOUR HEALTH. DIRECT OR INDIRECT CONTACT OF FLUID CONCRETE WITH SKIN MAY CAUSE BURNS, WASH AND FLUSH AFFECTED SKIN AREA PROMPTLY ON CONTACT. IF A RASH OR BURNS OCCUR CONSULT A PHYSICIAN IMMEDIATELY.
MATERIAL SAFETY DATA SHEETS (MSDS) ARE AVAILABLE ON REQUEST FOR ALL PRODUCTS. ☐ Sign Lien Form on Reverse

1154540

DELIVERY CODE	PROPOSAL	CUSTOMER CODE	TIME	DATE	TICKET NO.
	1956	05034	14:11	08/23/11	1154639
INVOICE TO:	CHARGE	CASH	CUST. JOB NO.	TERMS	ACCELERATOR
HERBERGER CONSTRUCTION	N				1%
INDIANOLA IA	WATER AT JOB	FINISH TIME	DRIVER	ADAM	PLANT NO. 19
DELIVER TO:	HOLD-UP TIME	PRY MILES	WINTER SVC. CHG.	PRICE PER YD.	AMOUNT
BRS-CQ20 (65) -- 60-20					
agg=66.6g1 / plant=220.0g	QUANTITY	DESCRIPTION	PRICE	AMOUNT	
total=286.6g1 / max=313.0g1	9.00	C-4WR-C			
	QUANTITY ORDERED	QUANTITY DELIVERED	NO. OF LOADS		
	18.00	9.00	1		
SHIP VIA	MIX PRODUCT NUMBER	TAX	RESALE	COPIES	
759	17627	22			

QUANTITY	CODE	DESCRIPTION
9.00	15386	CERT. PLT. INSP.
9.00	L6190	LARRY BIBBS SE 258
9.00	04303	HAUL CHRG

Material	Required	Batched
ROCK	12921 lb	12880 lb
SAND	14042 lb	13980 lb
CEMENT	4266 lb	4270 lb
FLYASH	1071 lb	1070 lb
WATER	220.3 g1	229.9 g1
PROCESTE	140.11 oz	140.00 oz
AIR	36.00 oz	36.00 oz

TOTAL
TAX
AMOUNT

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

Iowa DOT:
2301.02 B, IM 204, IM 317

SUDAS:
7010 2.02 B, Table 7010.02, IM 317

Testing - Slump

- Iowa DOT
 - Not required on slip form
 - Non slip form $\frac{1}{2}$ " to 4 inch
- SUDAS
 - $\frac{1}{2}$ " to 2 $\frac{1}{2}$ " machine finish
 - $\frac{1}{2}$ " 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



Grade

Iowa DOT:
2301.02 B, IM 204, IM 318

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

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



Grade

Iowa DOT:
2301.02 B, CM 9.63

SUDAS:
7010 2.02 B 2

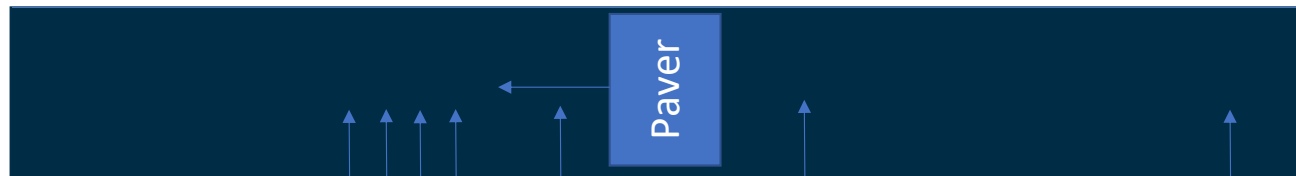
Testing – Air Content

- 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 $> 9.0\%$



Each load is tested and evaluated for compliance

Non-complying concrete limits



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

Do not incorporate loads below the lower target by more than 0.5% or above the upper target by more than 1.0%

Non-complying verification test

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

Last verification test

Each load is tested and evaluated for compliance

Non-complying concrete

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

Non-complying concrete

Paver

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

Do not incorporate loads below the lower target by more than 0.5% or above the upper target by more than 1.0%

Non-complying verification test

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

Last verification

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

Iowa DOT:
2301.03, A, CM 9.64, IM 384

SUDAS:
7010 3.01, B

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 yds²



Grade

Iowa DOT:
2301.03, A, & H, CM 9.14 & 9.41

SUDAS:
7010 3.02, H

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
 - To much water
 - Over vibration
 - Excessive finishing



Grade

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

SUDAS:
7010 3.07.D

Dimensional Checks

- Periodically check
 - Pavement width
 - Edge slump
 - $\frac{1}{2}$ " or less when no abutting pavement
 - $\frac{1}{4}$ " or less when abutting pavement
 - Cross-slope prior to finishing
 - Thickness - observe contractor probing
- Immediately communicate issues



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

Iowa DOT:
2301.03 H, CM 9.42

SUDAS:
7010 3.02, H 5

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)

Pavement/Placement Type	Macrotexture Orientation		Macrotexture Not Required
	Longitudinal	Transverse	
Mainline - slip-form	X		
Mainline - handwork		X	
Turn lanes - slip-form	X	1	
Turn lanes - handwork		X	
Ramps - slip-form	X	1	
Ramps - handwork		X	
Gapped sections of mainline - slip-form	X	1	
Gapped sections of mainline - handwork		X	
Radii			X
Crossovers			X
Paved Medians			X
Shoulders			X
Irregular Areas			X
Bridge Approaches		2	
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

Iowa DOT:
2301.03 K, 4105

SUDAS:
7010 3.02 I

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 yd²



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

/// EVAPORATION RATE CALCULATOR ///

CONCRETE TEMPERATURE AND AMBIENT CONDITION

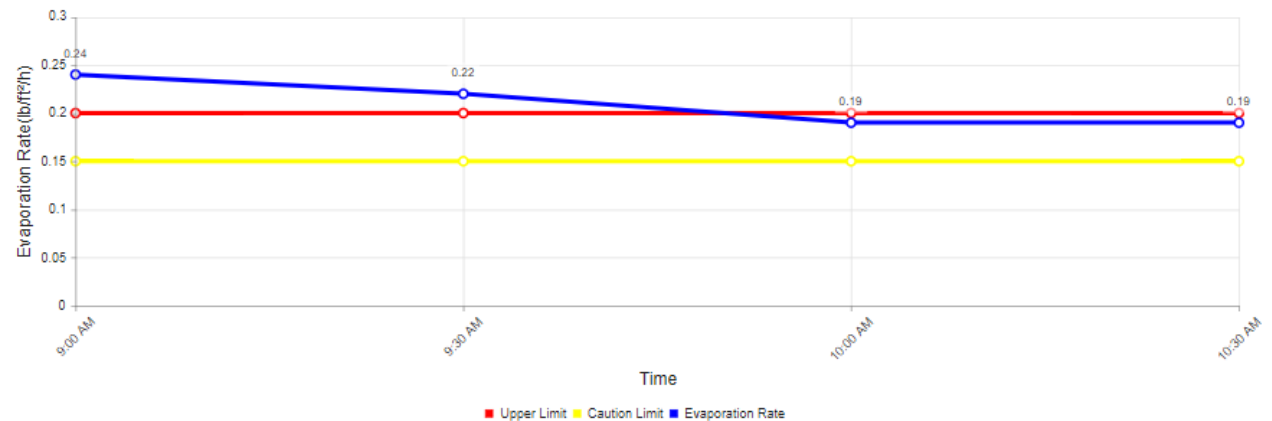
English / Metric

Time	Concrete Temp (°F)	Air Temp (°F)	Relative Humidity (%)	Wind Velocity (mph)	Evaporation Rate (lb/ft ² /h)
9:00 AM	70.0	100.0	25.0 %	35.0	0.24
9:30 AM	70.0	102.0	25.0 %	34.0	0.22
10:00 AM	70.0	103.0	25.0 %	32.0	0.19
10:30 AM	70.0	104.0	25.0 %	32.0	0.19

Calculate

Save Inputs

EVAPORATION RATE RESULT



- 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

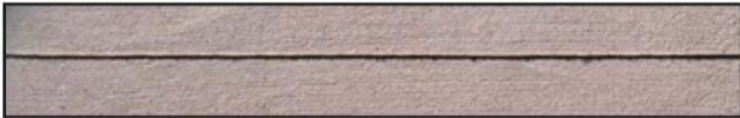
Surface mortar has been practically all removed to an extent that coarse particles of the coarse aggregate fraction are visible. Considerable erosion of edges has occurred, but not to an extent that pavement width is affected. Intermittent edge repair may be required as well as some surface patching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

85% payment

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)



Conventional saw on longitudinal joint

Early Entry Saws



- Transverse and Longitudinal Joints
- 1/4" and 1/8" width
- Saw within 3 hours
- Lighter and quieter than conventional saws
- Skid plate



Residue from early entry sawing

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

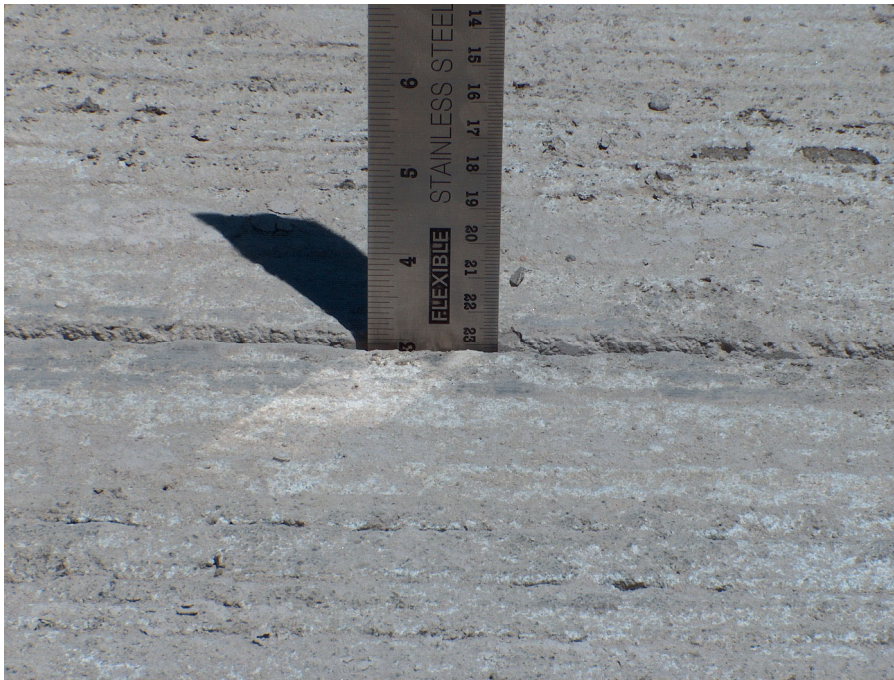
Late Sawcut

- 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**



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



Air blast of joint prior to 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



Installing hot pour sealant

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

[illegible]

Joint Check Worksheet

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



California profilograph



Inertial profiler

- 10' straightedge – mark areas $\geq \frac{1}{4}$ ", repair per Iowa DOT 2316 to max $\frac{1}{8}$ "
- 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

Thickness

Iowa DOT

- > 3500 SY MIT scan, April 2021
- ≤ 3500 SY probing, April 2021



MIT T2 Scan



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

Pay Factors / Price Adjustments

SUDAS

Air Content
Smoothness
Thickness

Tables	7010.03
	7010.04
	7010.05

Iowa DOT

Air Content
Water / Cement
Vibrator Frequency
Certified Plant Inspection

Late Curing
Smoothness

2317.05 Primary/Interstate
2316 All others

Thickness

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

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



Communicate with the contractor when questionable quality/work is observed

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



Section 7010:
Portland Cement Concrete
Pavement



Section 2301
Portland Cement Concrete
Pavement

PORTLAND CEMENT CONCRETE PAVING



FIELD INSPECTION 2020



Iowa DOT Construction Manual

Construction Manual

Chapters	Descriptions
Foreword	
Chapter 1	General Information
Chapter 2	Contract Administration
Chapter 3	General Inspection
Chapter 4	Construction Survey
Chapter 5	Safety
Chapter 6	Grading
Chapter 7	Erosion Control
Chapter 8	Hot Mix Asphalt (HMA) Pavement, Bases and Subbases
Chapter 9	Portland Cement Concrete (PCC) Pavement
Chapter 10	Environmental
Chapter 11	Structures
Chapter 12	Incidental Construction

Questions



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