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P76
2007

PROFILOGRAPH INSTRUCTION MANUAL 2007 – 2008

Iowa Department of Transportation
Iowa Transportation Center Materials
7.6 METER CALIFORNIA PROFILOGRAPH

Revised Report
Changed Lab. No. _____

For Information Only Preliminary Intermediate Final

Lab. No. _____ Route No. _____ Project No. _____
Date Reported _____ Date Placed _____ County _____
Tested At 1/2 Front Wheel Track Contractor _____
Tested By _____ Date _____

Fracture Related To:

<input type="checkbox"/> Primary Schedule A	<input type="checkbox"/> PCC Strip Finish	<input type="checkbox"/> ACC Paving
<input type="checkbox"/> Primary Schedule B	<input type="checkbox"/> PCC Finish Form	<input type="checkbox"/> ACC Resurfacing
<input type="checkbox"/> Secondary	<input type="checkbox"/> PCC Random Darning	<input type="checkbox"/> ACC Patches
<input type="checkbox"/> Municipal	<input type="checkbox"/> PCC Unbonded Overlay	
<input type="checkbox"/> Other	<input type="checkbox"/> PCC Patches	

Roadway Type: 2 Lane 4 Lane Ramp Other _____

Northbound Eastbound Direction _____ Shoulder Wheelbound
 Inside Lane (If Lane Only) Outside Lane

Length (m, 30ft)	Measured Roughness (mm, 1/8in)	Profile Index (mm, 1/8in) (1000mm, 39.37in)	Location (Station)	Length (m, 30ft)	Measured Roughness (mm, 1/8in)	Profile Index (mm, 1/8in) (1000mm, 39.37in)
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← 12 Feet (3.7) Bump Locations or 12.0mm (1/2) Dip Locations → Station _____

Iowa Transportation Center Materials Engineer



Technical Training & Certification Program

General Info

- DOT employees use Func. Code 141
- Restrooms
- Break room/vending machines
- Smoking areas
- Cell phones-please turn off now-MUST be turned off during test

Course Objectives

- Certification
- Profilograph machine types
- Calibration
- Terminology
- Specifications/IM 341 governing smoothness testing
- Proper reporting
- Test

Contacts

- **Overall questions-Kevin Jones** Central Materials Testing Engineer 515-239-1237
- **Jeff Brinkman-paving in District 1**
Cell phone 515-290-1375
office 515-239-1286
- **Rex Kinkade-bridges in District 1**
cell phone 515-290-6975
Office 515-239-1326

Certification

- Attend this class
- Open book test-80% required
- Good for 5 years

Certification (cont.)

- Testing and reporting needs to be done by certified people
- DOT Materials will do verification test minimum of 10% of the project
- Contracting authority will review all reports for incentive/penalty

IM 213- Appendix B

■ **False Statements Concerning Highway Projects**

"Whoever, being an officer, agent, or employee of the United States"... "knowingly makes any false statement, false representation, or false report"... about "plans, maps, specifications, contracts, or costs of construction on any highway or related project"... or with "respect to the character, quality, quantity, or cost of any work"... "pursuant to provisions of the Federal-aid Roads Act approved July, 1, 1916, as amended and supplemented; **SHALL BE FINED NOT MORE THAN \$10,000 OR IMPRISONED NOT MORE THAN 5 YEARS OR BOTH**."

Smoothness Specs/IMs (as of Oct 2007)

- IM 341--smoothness in general
- SS 01050— 0.0" BB for paving
- GS 2316— 0.2" BB for paving
- SS-01054—bridges/approaches

IM 341

- Machine types
- Calibration
- Terminology
- Test procedure
- Reduction
- Reporting

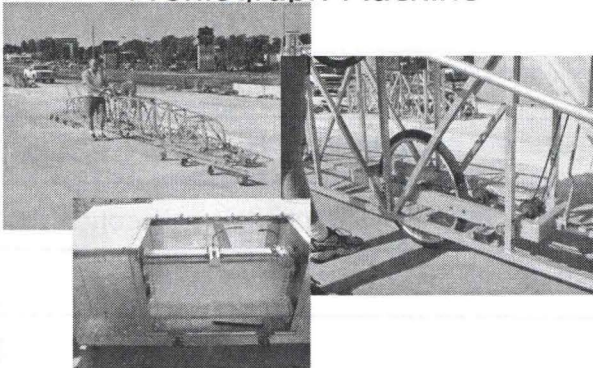
Profilograph Machine

- Manual style/Computer style
- LISA
- Hi-speed

Profilograph Machine

- Usually a 3-piece truss (aluminum)
- 32 feet overall length
- Recording box and bicycle wheel are interconnected by cables and/or rods, which measure vertical distances along a roadway
- Computer, printer, and power source for computerized units
- ¼ point marker is MANDATORY on mainline paving

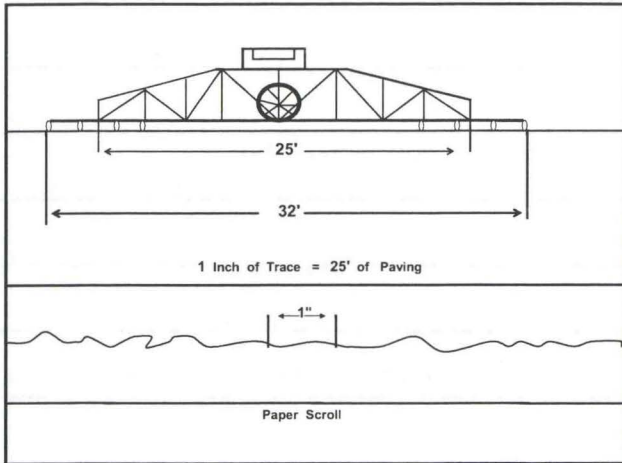
Profilograph Machine

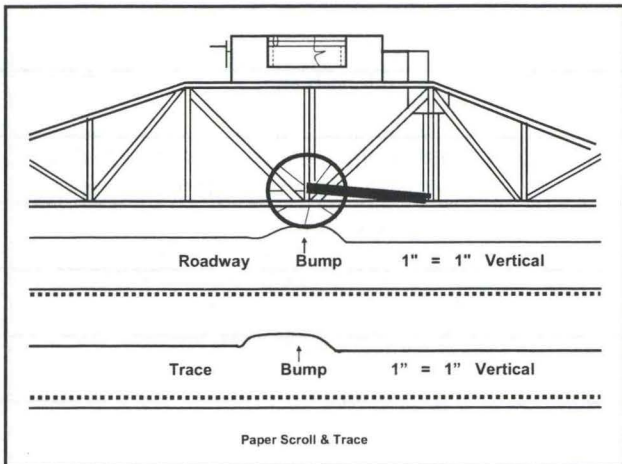


Profilograph Machine

IMPORTANT

- Longitudinal Calibration – 1" = 25'
1" of trace represents 300" of road (300:1)
- Vertical Calibration – 1" = 1" or 1:1





Calibration

- Each machine must be calibrated annually in Ames (Central Materials)
- Profilers calibrated on test strip annually
- Longitudinal distance will be calibrated to within 1.2 ft in 500 ft
- Vertical measurement will be checked by using an object of known height

Calibration

- Note the settings used on computer profilograph calibrations
- Compare to table in IM 341, Section E (Page 3)

Profilograph/Profiler Settings (computer)

Blanking Band	0.2 inches (or 0.001")
Scallop Rounding	0.01 inches
Min. Scallop Height	0.03 inches
Min. Scallop Width	0.08 inches
Filter Type, length	Butterworth, 2.0 feet
Bump/Dip height	0.50 inches
Bump/Dip Width	25 feet actual distance

Calibration

- Profilograph calibration should be checked regularly (500'-1000')
- If the machine misses the longitudinal distance by more than 2.4 ft. in 1000 ft., corrective action is required.

Calibration

CORRECTIVE ACTION

- Items to check first
 1. Proper tire pressure
 2. Recording drum slipping on gears
 3. Paper not feeding properly
 4. Make sure all gears are engaged prior to starting
 5. Problem in gear box (i.e. bird's nest)

- If these items do not solve the problem, you need to recalibrate!

Calibration

- Problems encountered when machine is not measuring the correct longitudinal distance
 1. 1/2" bump locations will be off causing the contractor to correct in wrong areas
 2. Entire profile index will be affected as index is based on length of project from profilograph

- Get the machine fixed if any doubt exists!

Terminology

- Segment
- Section
- Profile Index (PI)
- Defects (bumps, dips)
- Testing
- Evaluating

Segment

- 1/10 mile or 528 feet
- "short" segment is 250 but not 528 feet—stands alone for penalty and incentive
- "super" segment is shorter than 250 so it is added to the previous full segment

Section

- The total of all segments in a day's run
- Each lane is tested and evaluated separately
- Definition: a minimum of 0.1 mi segment of pav't placed in a day. If less than 0.1 mi segment is paved will be grouped w/ next day—if last day will be grouped w/ previous day

Profile Index

- Number used for incentive/penalty purposes and correlation with DOT
- Profile index=measured roughness (inches) divided by length (miles)
- $PI = \text{in/mi}$

Testing

- Checking for bumps and dips and maybe profile index

Evaluating

- Profile index is figured
- If an area is "evaluated" the Profile index is figured and bumps and dips are recorded
- An area that is "tested" is not necessarily "evaluated" for PI

Test Procedures

- 48 hour notification
- Testing direction
- Speed
- Note stationing on trace
- Label/mark/identify and label some more
- Unit/ lane positioning

48 HOUR NOTIFICATION!!!!

IM 341, Part F, #1, page 4

The contractor (or subcontractor) responsible for smoothness testing and evaluation shall give the Project Engineer AND THE DME 48 HOURS NOTICE PRIOR TO TESTING so the Office of Materials may provide a certified technician for correlation purposes with the contractor.

Unit Positioning

Wheel track positioning for:

- bridge decks
- bridge deck overlays
- bridge approaches
- 0.0" blanking band projects (interstates, primary road-- SS-01050)

Wheel tracks are located 3 and 9 feet from centerline (IM 341, Part F, no. 11a)

Unit Positioning

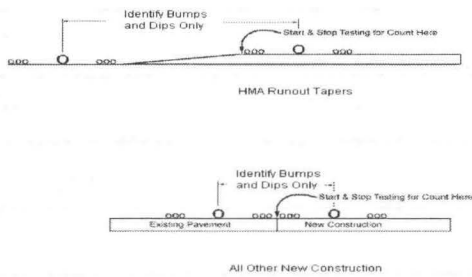
Quarter point positioning for:

- county, city, special primary projects
- GS 01013 (replacing 2316)
- Quarter point located 6 feet from center line

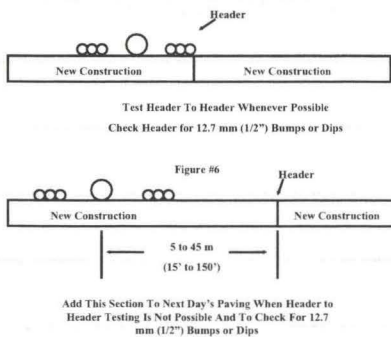
Unit Positioning

- Start with test wheel 16 feet on old paving
- End with test wheel 16 feet on old paving
- Ramps, loops-test as close to center as possible (offset 2ft to RIGHT if needed)
- Tapers-start at 4ft width
- Bridge Approaches

Unit Positioning-old/new headers

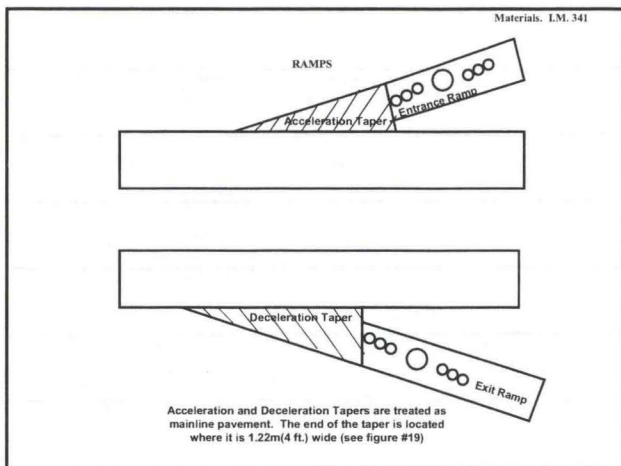


Unit Positioning-new headers



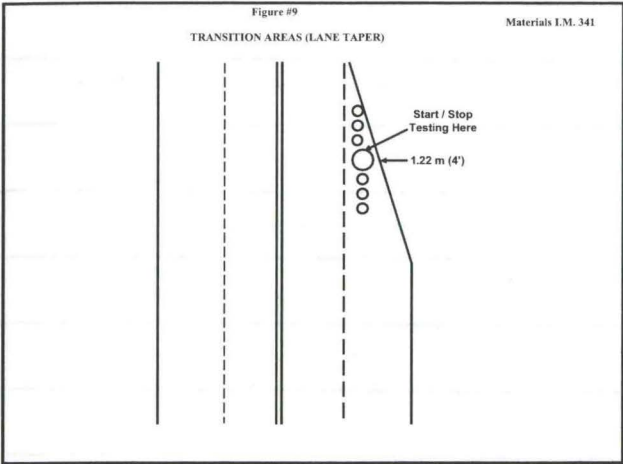
Ramps and Acceleration / Deceleration Tapers

- Start at the first indication of full lane width and stop when taper width is 4'
- See IM 341, Figure 9 (Pg. 16)



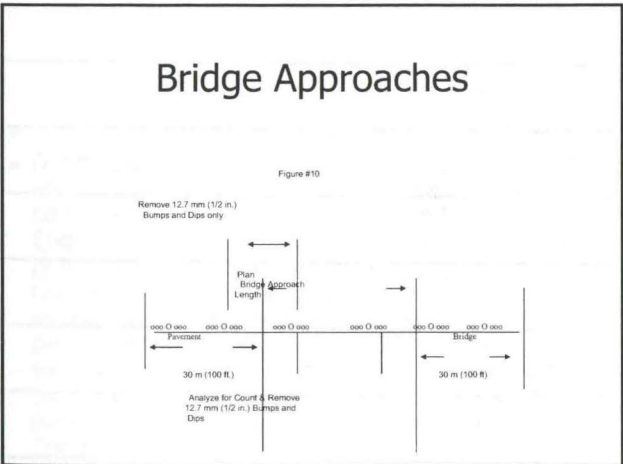
Transition Area

- Adding or subtracting lanes
- Start and stop trace wheel when pavement width is 4'



Bridge Approaches

- Shall be tested and/or evaluated w/ profilograph if 100' or more
- Each lane is an individual segment
- Shall be tested at wheel tracks
- No incentive
- Found in SS-01054



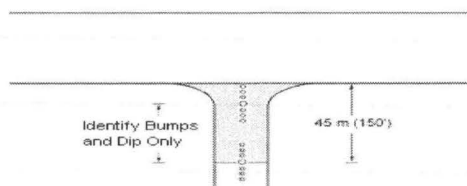
Exclusions from TESTING

- Detour pavement, crossovers, shoulders, sections less than 50' (2316.01, B)
- The 16' at a mainline/side road connection

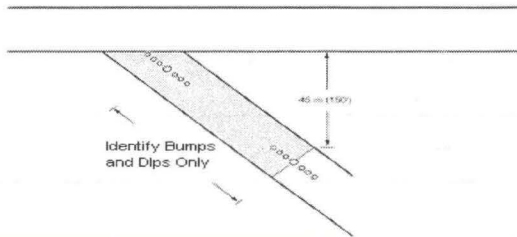
Exclusions from EVALUATING

- Side road connections IF under 600' (otherwise the first 150' is not evaluated)
- Old/new Headers
- Run out tapers
- Single lift pav't 2" or less unless corrected
- Storage and turn lanes
- Pavement less than 8.5' wide

Sideroad exclusions over 600'



Sideroad –more than 600'



Reporting

- Timeframe for submittal
- Preliminary
- Final
- Corrected
- Certification statement
- Distribution

Timeframe for submittal

- From SS-01050, part C, "evaluation":(also 2316.03)
- During the first 3 days of the paving operation, and after long shut-down periods, the pavement shall be tested and the test report furnished to the Engineer and District Materials Engineer by the end of the next day worked following the placement. On HMA pavement, the testing shall be performed as soon as the pavement has cooled sufficiently to permit testing. The Engineer and the Contractor will use the results of the initial testing to evaluate the paving methods and equipment. If the initial paving operation produces acceptable results, the Contractor may continue paving.

Types of Reports

- Preliminary reports are to get information to inspectors ASAP. A final report must follow
- Final reports must be neat, orderly, easy to understand and have all required information
- Corrected reports indicate either an error on the original or that corrective work has been accomplished and retested

Corrected Reports

- Contractor test reports shall have one of the following at the bottom of the report:
 - **No Corrective Work Required.**
 - **Corrective Work Required.**
 - **Corrective Work Completed.**

Rounding on Reports

- **English**
 - Length to 3 decimal places, miles
 - Roughness to 2 decimal places, inches (0.01 for computers, 0.05 for manual)
 - Profile index to 2 decimal places, Inches/mile
- **Metric**
 - Length to 3 decimal places, kilometers
 - Roughness to 1 decimal place, millimeters (0.1 for computers, 1.3 for manual)
 - Profile index to 1 decimal place, millimeters/kilometer

Rounding on Reports

11.5651 → 11.57

11.5649 → 11.56

11.565 → 11.56

11.555 → 11.56

Rounding for Specification Compliance

11.55 → 11.6

11.65 → 11.6

10.05 → 10.0

9.95 → 10.0

Test Reporting



Revised Report
Changes Lab. No.

25 - FOOT CALIFORNIA PROFILOGRAPH

For Information Only Preliminary Intermediate Final

Lab No. 5SG6-051A Route No. Old Hwy 34 Project No. TJ-34-9(173)--2M-29
 Date Reported 11-3-06 Date Paved 9-25-06 County Des Moines
 Tested At: 1/4 Point Wheel Track Contractor Cessford Constr. Co.
 Tested By S. Gettings Date 10-31-06
 Trace Reduced By Laser Date 11-3-06

Primary Schedule A PCC Slip Form ACC Paving
 Primary Schedule B PCC Fixed Form ACC Resurfacing
 Secondary PCC Bonded Overlay ACC Patches
 Municipal PCC Unbonded Overlay
 Other PCC Patches

Roadway Type: 2-Lane 4-Lane Ramp Other

Northbound Eastbound Southbound Westbound
 Inside Lane Outside Lane

Length Miles (km)	Measured Roughness Inches (mm)	Profile Index Inches/Miles (mm/km)	Location (Station)	Length Miles (km)	Measured Roughness Inches (mm)	Profile Index Inches/Miles (mm/km)
			382+59	0.1	0.12	1.20
				0.1	0.07	0.70
				0.1	0.00	0.0
				0.1	0.00	0.0
				0.1	0.10	1.00
				0.1	0.10	1.00
				0.1	0.07	0.70
				0.1	0.03	0.30
				0.1	0.24	2.40
				0.95	0.00	0.0
			240+03	2.73	1.80	0.66

Contr. Lab No. Contr. Results DOT Results Difference Tolerance
 Des-29 0.81 in/mi 0.66 in/mi 0.15 in/mi 1 in/mi

Note: Tied Des Moines Co. projects TJ-034-9(171-174)--2M-29
 #24134 thru 24137

Station \geq 1/2" (12.7 mm) Bump Locations Station
 or
 1/2" (12.7 mm) Dip Locations

Test results correlate per I.M. 216

Copies J. Omundson
 J. Webb
 J. Johnson
 Cessford Constr. S. Gettings

Jim Webb
 District Materials Engineer



DISTRICT TEST REPORT
 MATERIALS DISTRICT # 4
 7.6 Meter California Profilometer

REVISION TO
 CORRECTION TO

Cedar Valley Corp.

O. Box 1740, Waterloo, IA 507C

INFORMATION ONLY PRELIMINARY INTERMEDIATE FINAL

LAB NO	<u>06004-3NB</u>	ROUTE NO	<u>Hwy-2</u>	S PROJECT #	<u>STP-002-1(43)&(64)-2C-36</u>
REPORT DATE	<u>07/25/06</u>	PAVE DATE	<u>07/20/06</u>	N PROJECT #	
TESTED AT	1/4 Poin <input type="checkbox"/> Wheeltrack <input checked="" type="checkbox"/>	COUNTY	<u>Fremont</u>	PRIME	<u>Cedar Valley Corp.</u>
TESTED BY:	<u>Andrew Phillips CI338</u>				
REDUCED BY:	<u>Andrew Phillips CI338</u>				

SCHEDULE A Multi-lane Primary Non PCC SLIP FORM ACC PAVING
 SCHEDULE B New Resurfaced PCC FIXED FORM ACC RESURFACING
 SECONDARY PCC BONDED OVERLAY ACC PATCHES
 MUNICIPAL PCC UNBONDED OVERLAY
 BUMPS/DIPS PCC PATCHES
 ROADWAY TYPE: 2 LANE 4 LANE RAMP OTHER _____

N.B. E.B. DIRECTION \longleftrightarrow S.B. W.B.
 INSIDE LANE 4-LANE ONLY \longleftrightarrow OUTSIDE LANE

ISWT			Location	OSWT			Aver Index	Incentive
LENGTH (kilometers)	MEASURED ROUGHNESS (millimeters)	PROFILE INDEX (mm/km)		LENGTH (kilometers)	MEASURED ROUGHNESS (millimeters)	PROFILE INDEX (mm/km)		
0.161	47.50	295.0	ISWT	0.161	42.10	261.5	278.3	850
0.161	42.10	261.5	26+70	0.161	41.30	256.5	259.0	850
0.161	51.30	318.5	to	0.161	45.80	284.5	301.6	850
0.161	59.60	370.2	36+69	0.161	62.30	387.0	378.6	450
0.161	63.90	396.9		0.161	61.20	380.1	368.5	
0.194	57.80	297.9	OSWT	0.194	63.10	325.3	311.6	850
			26+70					
			to					
			36+69					
0.999	322.200	322.52		0.999	315.800	316.12		

TOTAL INCENTIVE THIS LAB **\$3,850**

CORRECTIVE
 WORK
 REQUIRED

This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.

Name: Andrew Phillip
 Andrew Phillips - Cert Tech CI338

34+38	BUMPS	DIPS	34+38	BUMPS	DIPS
EXCLUDED BUMPS		EXCLUDED DIPS		EXCLUDED DIPS	

R = Reran A = Grinding was done

CMT.

1717 NE 58th Ave
Des Moines, Iowa 50313
Phone: 515-263-0794

Fax: 515-263-0851

25 FOOT CALIFORNIA PROFILOMETER

District 2 Materials

Revised Report
Changes Lab. No. HAR-1

For Information Only Preliminary Intermediate Final

Lab No. HAR-1C Route No. US 65 Project No. STP-65-6(47)-2C-42
 Date Reported _____ Date Paved 6/12/06 County HARDIN
 Tested At 1/4 Point Wheel Track 0.2" Blanking Band Contractor HEARTLAND ASPHALT
 Tested By RALPH DITTMER, MIKE LEEPER Date 6/12/2006
 Traced Reduced By COMPUTER Date 6/12/2006

Primary Schedule A PCC Slip Form ACC Paving
 Primary Schedule B PCC Fixed Form ACC Resurfacing
 Other PCC Patches ACC Patches

Roadway Type: 2-Lane 4-Lane Ramp Other

Northbound Eastbound Southbound Westbound
 Inside Lane Inside Wheel Track Outside Lane Outside Wheel Track

Length (feet)	Measured Roughness (Inches)	Profile Index (in/Mi)	Average Profile Index (Inches/miles)	Length (Miles)	Measured Roughness (Inches)	Profile Index (in/Mi)
INSIDE WHEEL TRACK			OUTSIDE WHEEL TRACK			
0.1	2.89	28.90	30.85	0.1	3.28	32.80
0.1	2.41	24.10	28.10	0.1	3.21	32.10
0.1	2.41	24.10	22.00	0.1	1.99	19.90
0.1	2.32	23.20	24.70	0.1	2.62	26.20
0.1	1.92	19.20	18.60	0.1	1.80	18.00
0.1	1.59	15.90	17.35	0.1	1.88	18.80
0.1	1.95	19.50	19.50	0.1	1.95	19.50
0.1	1.79	17.90	19.40	0.1	2.09	20.90
0.1	1.89	18.90	19.70	0.1	2.05	20.50
0.1	1.67	16.70	18.05	0.1	1.94	19.40
0.1	1.59	15.90	17.45	0.1	1.90	19.00
J.1	2.20	22.00	22.10	0.1	2.22	22.20
0.1	1.67	16.70	17.05	0.1	1.74	17.40
0.1	2.04	20.40	20.40	0.1	2.04	20.40
0.1	1.39	13.90	14.35	0.1	D 1.48	14.80
0.1	1.94	19.40	20.20	0.1	2.10	21.00
0.1	1.67	16.70	16.20	0.1	1.57	15.70
0.1	1.78	17.80	17.70	0.1	1.76	17.60
0.1	1.67	16.70	15.05	0.1	D 1.34	13.40
0.1	1.54	15.40	15.65	0.1	1.59	15.90

Location (Station)
(BEGIN FULL DEPTH)
1588+94
TO
1417+16
(END FULL DEPTH)

Note: A = \$750.00 Incentive Pay
B = \$500.00 Incentive Pay
C = \$350.00 Incentive Pay
D = \$200.00 Incentive Pay

*Note: 1/2" bump in outside wheel track at Station 1466+94 corrected by contractor.

PAGE 1 OF 2

Station NONE

(1/2") Bump Locations
or
(1/2") Dip Locations

Station NONE

[Signature]
This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.

District _____ Materials
25 FOOT CALIFORNIA PROFILEMETER

Revised Report
Changes Lab. No. _____

For information Only Preliminary Intermediate Final

Lab. No. _____ Route No. _____ Project No. _____
 Date Reported _____ Date Paved _____ County _____
 Tested at: $\frac{1}{4}$ Wheel Track Contractor _____
 Tested By _____ Date _____
 Trace Reduced By _____ Date _____

Primary Schedule A PCC Slip Form ACC Paving
 Primary Schedule B PCC Fixed Form ACC Resurfacing
 Secondary PCC Bonded Overlay ACC Patches
 Municipal PCC Unbonded Overlay
 Other PCC Patches

Roadway Type: 2-Lane 4-Lane Ramp Other _____

N.B. Inside Lane Centerline
 E.B. Direction (4-Lane Only)
 S.B. Outside Lane
 W.B. $\frac{1}{4}$ Point

BEGINNING STATION	ENDING STATION	DISTANCE MEASURED (FEET)	DISTANCE TRAVELED (FEET)	PROFILE INDEX (IN/MI)
651+86	657+14	528	528	2.8
657+14	662+42	528	528	3
662+42	667+70	528	528	0.8
667+70	672+98	528	528	1.7
672+98	678+26	528	528	2.3
678+26	683+54	528	528	3.5
683+54	688+07	146	453	2.1
688+07	690+50	0	243	Bridge
690+50	695+78	235	528	1.5
695+78	701+06	528	528	2.5
701+06	706+34	528	528	2.4
706+34	711+62	528	528	0.7
711+62	716+90	528	528	1.9
716+90	722+18	528	528	0.7
722+18	727+46	528	528	4.6
727+46	732+74	528	528	2.6
732+74	738+02	528	528	3.2
738+02	743+30	528	528	7.3
743+30	748+58	528	528	2.5
748+58	753+86	528	528	4.6
753+86	759+14	528	528	6.2
759+14	764+42	528	528	4.6
764+42	769+70	528	528	0.6
Bumps or Dips	None			

SS 01050-Zero BB paving

- Required on Interstate and Primary main line paving except when specifically excluded or modified by contract documents
- Exclusions are detour pavement, shoulders, crossovers, and individual sections of pavement less than 50' in length (probably won't even TEST)

SS-01050

- PCCP and HMA have different incentive schedules-no tiered incentive
- Must be tested and evaluated by trained and certified people
- Must use computer reduction
- Wheel path testing (3' and 9' from CL)

Corrective Actions

- SS-01050.04, D: Corrective work shall be at the Contractor's expense except for the 16' beyond the headers when the contractor is not responsible for the adjoining surface.
- Grinding needs to be completed before coring for pav't thickness can be done
- 2532.04, .5: The engineer may test for smoothness and bumps near the center line and other spot locations where compliance is questioned. Additional grinding may be required

2316

- For counties, cities
- Special primary projects
- 0.2" blanking band
- Quarter point testing (middle of the traffic lane)

2316

- Pavement divided into segments of continuous placement of 0.1 mi
- Terminates at day's work joint, bridge, similar interruption or when crosses to a section with a different smoothness designation
- Segment of 249' or less-added to previous segment
- Segment of 250' to 527'-stands alone
- Each lane is tested and evaluated separately

SS-01054

- Replaces 2317 for bridges
- Wheel path testing of bridges, approaches
- All approaches fall under this specification

SS-01054-exclusions from EVALUATION

- Bridge decks/overlays less than 100'
- Approaches under 100'
- Slab bridges
- 16' at the ends of a section
- 16' each side of expansion joints

SS-01054-limits

- New bridge deck-less than 22.1 in/mi
- Bridge deck overlay-less than 15.1 in/mi
- Any approaches-less than 22.1 in/mi
- No 1/2" bumps or dips allowed

Practical Exercises

Problem 1 (1PR2-019)

0.100 mi	0.40 in	_____ in/mi
0.100 mi	0.15 in	_____ in/mi
0.100 mi	0.30 in	_____ in/mi
0.100 mi	0.05 in	_____ in/mi
0.100 mi	0.20 in	_____ in/mi
0.100 mi	0.05 in	_____ in/mi
0.100 mi	0.05 in	_____ in/mi
0.100 mi	0.45 in	_____ in/mi
0.087 mi	0.80 in	_____ in/mi
0.887 mi	2.45 in	_____ in/mi

Problem 1 (1PR2-019) answers

0.100 mi	0.40 in	<u>4.0</u> in/mi
0.100 mi	0.15 in	<u>1.5</u> in/mi
0.100 mi	0.30 in	<u>3.0</u> in/mi
0.100 mi	0.05 in	<u>0.5</u> in/mi
0.100 mi	0.20 in	<u>2.0</u> in/mi
0.100 mi	0.05 in	<u>0.5</u> in/mi
0.100 mi	0.05 in	<u>0.5</u> in/mi
0.100 mi	0.45 in	<u>4.5</u> in/mi
0.087 mi	0.80 in	<u>9.20</u> in/mi
0.887 mi	2.45 in	<u>2.76</u> in/mi

Problem 2 (1pr2-039)

0.100 mi	0.10 in	_____ in/mi
0.100 mi	0.10 in	_____ in/mi
0.100 mi	0.00 in	_____ in/mi
0.142 mi	0.45 in	_____ in/mi
0.442 mi	0.65 in	_____ in/mi

Problem 2 (1pr2-039) answers

0.100 mi	0.10 in	<u>1.00</u>	in/mi
0.100 mi	0.10 in	<u>1.00</u>	in/mi
0.100 mi	0.00 in	<u>0.00</u>	in/mi
0.142 mi	0.45 in	<u>3.17</u>	in/mi
0.442 mi	0.65 in	<u>1.47</u>	in/mi

Problem 3

Length	IWT	PI	length	OWT	PI	Ave.
0.1 mi	0.3 in	_____	0.1 mi	0.2 in	_____	_____
0.1 mi	0.15in	_____	0.1 mi	0.65 in	_____	_____
0.078 mi	0.2 in	_____	0.077 mi	0.4 in	_____	_____
_____	_____	_____	_____	_____	_____	_____

Problem 3

Length	IWT	PI	length	OWT	PI	Ave.
0.1 mi	0.3 in	<u>3.0in/mi</u>	0.1 mi	0.2 in	<u>2.0in/mi</u>	<u>2.5in/mi</u>
0.1 mi	0.15in	<u>1.5in/mi</u>	0.1 mi	0.65 in	<u>6.5in/mi</u>	<u>4.0in/mi</u>
0.078 mi	0.2in	<u>2.56in/mi</u>	0.077mi	0.4 in	<u>5.19in/mi</u>	<u>3.88in/mi</u>
<u>0.278mi</u>	<u>0.65in</u>	<u>2.34in/mi</u>	<u>0.277mi</u>	<u>1.25in</u>	<u>4.51in/mi</u>	<u>3.42in/mi</u>



TECHNICAL TRAINING & CERTIFICATION PROGRAM

GENERAL

The purpose of the Technical Training & Certification Program is to ensure Quality Control (QC)/Quality Assurance (QA) and Acceptance of Aggregates, Hot Mix Asphalt (HMA), Portland Cement Concrete (PCC), Grade Inspection, Precast and Prestressed Concrete, and Pavement Profiles and to ensure proper documentation of quality control/quality assurance and acceptance procedures and test results by industry and Contracting Authority personnel.

This Instructional Memorandum (IM) explains the requirements to become certified and to remain certified to perform inspection and testing in the State of Iowa. This IM also describes the duties, responsibilities and the authority of persons assigned the position of Certified Technician in any of the above areas for construction or maintenance projects. Appendix C of this IM lists what tests and procedures the technician is qualified to perform for each level of certification they obtain.

Through a cooperative program of training, study, and examination, personnel of the construction industry, State DOT, and other Contracting Authorities will be able to provide quality management and certified inspection. Quality control/quality assurance and acceptance sampling, testing and inspection will be performed by certified personnel and documented in accordance with the IMs.

A technician who is qualified and holds a valid certification(s) shall perform quality control/quality assurance and acceptance at a production site, proportioning plant, or project site. Responsibilities cannot be delegated to non-certified technicians. The duties of a Certified Technician may be assigned to one or more additional Certified Technicians.

The Technical Training & Certification Program will be carried out in accordance with general policy guidelines established or approved by the Highway Division Director. A Board of Certification composed of the following members will advise the Director:

- Director – Office of Materials
- Director – Office of Construction
- Representative of District Materials Engineers**
- Representative of District Construction Engineers**
- Representative of Associated General Contractors (AGC of Iowa)
- Representative of Iowa Concrete Paving Association (ICPA)
- Representative of Asphalt Paving Association of Iowa (APAI)
- Representative of Iowa Ready Mixed Concrete Association (IRMCA)
- Representative of Iowa Limestone Producers Association (ILPA)
- Representative of County Engineers
- Coordinator of Technical Training & Certification Program**

** Appointed by Program Director

The Director of the Office of Materials will be the Program Director. Coordinators will be appointed by the Program Director to assist in administration of the program and to handle such planning, administration, and coordinating functions as may be needed.

TRAINING

The Iowa DOT will provide the training necessary to become certified or an agency approved by the Program Director. Producers/Contractors are encouraged to conduct their own pretraining program. A complete listing of training opportunities is available in the Technical Training & Certification Program's Information and Registration Booklet or at the Technical Training & Certification Program website, www.iowa.gov/dot/materials/training.htm. This book is available at any of the Iowa DOT Materials Offices. They may also be obtained from the ICPA, IRMCA, ILPA, and APAI.

CERTIFICATION REQUIREMENTS

1. A candidate must attend instruction and pass the examination(s) for all levels of certification prepared and presented by the Program Director or someone designated by the Program Director. If the new candidate fails the examination, they will have one opportunity to retake the examination. The retake must be completed within six months of the original exam. If they fail the retake of the examination, they will need to attend the training again before taking the examination the third time. If an individual is recertifying they will have only one opportunity to take the examination. If they fail the examination they must take the applicable training before retaking the examination.
2. All prerequisites shall be met before the applicant may attend the next level of training for the certification desired. A listing of certification levels and prerequisites is located in Appendix A.
3. Once the candidate has met all the criteria and has received certification, it is recommended the Certified Technician work under the supervision of an experienced technician until they become efficient in the inspection and testing methods they will be performing.

An individual requesting to become certified as a Precast/Prestress Concrete Technician is required to obtain forty hours of experience assisting in quality control inspection at an approved plant before certification will be issued. The experience must be documented and shall be approved by the District Materials Engineer. This experience must be completed within two years from the date the individual attended the training.

4. Registered Professional Engineers, engineering graduates, and geology graduates from accredited institutions will be exempt from the training requirement in the areas they have had instruction. In order to obtain certification for any technical level, these persons must pass all applicable tests for the level of certification they wish to obtain. All certificates issued in accordance with these requirements will be subject to the same regulations concerning expiration, recertification, etc., as applies to certificates obtained via training and examinations.

Out-of-state technicians will be issued certifications when the following criteria are met:

1. The applicant must be certified in another state or shall have received equivalent training, if the state does not have a certification program, in each level of certification they are requesting.
2. The applicant must pass an examination for each level of certification desired, which will be administered by the Iowa Department of Transportation. Failure of the examination shall require the applicant to take the applicable schooling before they can retake the exam.
3. The applicant must follow the prerequisite requirements of the Technical Training & Certification Program.

Out-of-state applications should be submitted to the District Materials Office closest to the home location of the applicant. Copies of all the applicant's certifications must accompany the application.

CERTIFICATION

Upon successfully completing the requirements for certification, the Program Director will issue a certificate and a pocket certification card. This certification is not transferable. A certification shall be valid for five years.

CERTIFICATION IDENTIFICATION

The certificate will contain letters that identify the District of record, the certificate holder, certification number, the level of certification, and the expiration date of each level.

The assigned certification number may change if the certificate holder changes their residence.

RENEWAL OF CERTIFICATION

A certification shall be valid through December 31st of the fifth year. A 90-day grace period will be allowed. If the individual has not renewed their certification within the 90-day grace period, they are automatically decertified. The individual may obtain certification by taking the examination for the level of certification they are requesting. If the individual does not take the examination within one year after their certification(s) expire, i.e., 12/31/expiration year, they must retake all applicable schooling and pass the examinations. If an applicant becomes decertified in any level of certification and that certification is a prerequisite for other levels of certification the applicant will also be decertified in those related levels of certification.

All certified technicians will be required to pass an examination in each level of certification they hold before recertification will be issued. Failure of any level shall require the applicant to retake the applicable schooling and pass the test.

The certificate holder shall be responsible for applying for certification renewal and for maintaining a current address on file with the appropriate District Materials Office.

Technicians certified as Level I HMA and/or Level II PCC shall attend a minimum of two update classes each in the five-year period between certification and each recertification. The Iowa DOT or an agency or organization approved by the TTCP will hold these classes. These update classes will be listed in the Technical Training & Certification Program Booklet and on the program website, or the certified technician may contact the Iowa DOT for information. If an individual does not attend the two update classes required before their certification expires, they must take the entire schooling and pass the examination for the certification required.

The certified technician will not receive credit for the following:

1. More than one update per training season in each level of certification.
2. An update taken during the same training season in which the individual recertified.

UNSATISFACTORY PERFORMANCE NOTICE

A certified technician failing to perform the required specified duties or inadequately performing these duties, will receive an Unsatisfactory Notice (Office of Materials IM 213, Appendix B). The notice will be from the District Materials Engineer in the District where the failure occurred. This notice and all supporting documentation will be placed in the technician's permanent file with the District Materials Office in which the technician resides. The notice will also be placed on the statewide computer file.

SUSPENSION & DECERTIFICATION

A three-month suspension will be given upon receipt of two Unsatisfactory Performance Notices. Technicians that are suspended shall not perform any duties of the applicable certification, including any duties for which the affected certification is a prerequisite.

Technicians are eligible to be reinstated after the three-month suspension and successful completion of the applicable recertification test(s).

Technicians are subject to decertification when they receive a third Unsatisfactory Performance Notice.

Certified Technicians will be decertified for any of the following reasons:

The certificate will become invalid for the following reasons:

1. Failure of the certificate holder to renew the certificate prior to regular expiration as described above.
2. Use of false or fraudulent information to secure or renew the certificate.
3. Use of false or fraudulent actions or documentation by the certificate holder.
4. Not performing tests and technician duties properly and in accordance to specifications.

Action will be effective on the date the Program Director issues the suspension or decertification notice.

Technicians that are decertified shall not perform any duties requiring certification. Technicians may request reinstatement after one year.

Appeals and reinstatement requests shall be submitted in writing to the Program Director. Appeals and reinstatement requests will be considered by the Certification Board.

If reinstatement is authorized, the applicant must attend and successfully complete the applicable certification courses.

FUNCTIONS & RESPONSIBILITIES

A certificate holder at each production site, project site, proportioning plant, or laboratory will perform duties. The certified technician shall perform quality control testing in accordance with specified frequencies and submit designated reports and records.

The specification requirement for materials testing by a certified technician does not change the supplier's responsibilities to furnish materials compliant with the specification requirements.

The District Materials Engineer and/or Project Engineer will be responsible for monitoring the sampling, testing, production inspection activities and quality control performed by the contractor. A monitor shall have satisfactorily completed the training and be certified for the level of technician they are monitoring.

The District Materials Engineer and/or Project Engineer will have authority and responsibility to question and where necessary, require changes in operations and quality control to ensure specification requirements are met.

QUALITY CONTROL, TESTING, & DOCUMENTATION

The QC Technician shall be present whenever construction work related to production activity, such as stockpiling or other preparatory work, requires record development and/or documentation is in progress. The QC Technician's presence is normally required on a continuing basis beginning one or more days before plant operation begins and ending after plant shut down at the completion of the project. The work shall be performed in a timely manner and at the established frequencies.

The QC Technician's presence is not normally required during temporary plant shut downs caused by conditions, such as material shortages, equipment failures, or inclement weather.

All quality control activities and records shall be available and open for observation and review by representatives of the contracting authority.

Reports, records, and diaries developed during progress of construction activities will be filed as directed by the Contracting Authority and will become the property of the Contracting Authority.

Quality control activities, testing, and records will be monitored regularly by Contracting Authority representatives. The Project Engineer or District Materials Engineer will assign personnel for this function.

Monitor activities will be reported and filed at prescribed intervals with the Project Engineer, District Materials Engineer, producer, contractor, and the contractor's designated producer.

At no time will the monitor inspector issue directions to the contractor, or to the QC Technician. However, the monitor inspector will have the authority and responsibility to question, and where necessary, reject any operation or completed product, which is not in compliance with contract requirements.

ACCEPTANCE

Completed work will be accepted on the basis of specification compliance documented by acceptance test records, and monitor inspection records. Specification noncompliance will require corrective action by the producer, contractor, or by the contractor's designated producer, and review of events and results associated with noncompliance by the Project Engineer.

CERTIFICATION LEVELS

<u>CERTIFICATION LEVEL</u>	<u>TITLE</u>	<u>PRE-REQUISITES</u>
<u>AGGREGATE</u>		
Level I Aggregate	Certified Sampling Technician	None
Level II Aggregate	Certified Aggregate Technician	Level I Aggregate
<u>PORTLAND CEMENT CONCRETE</u>		
Level I PCC**	PCC Testing Technician	None
Level II PCC	PCC Plant Technician	Level II Aggregate & Level I PCC
Level III PCC	PCC Mix Design Technician	Level II PCC
**American Concrete Institute (ACI) Grade I certification will be acceptable as a portion of the Level I PCC training.		
<u>HOT MIX ASPHALT</u>		
HMA Sampler	HMA Sampler	None
Level I HMA	HMA Technician	Level II Aggregate
Level II HMA	HMA Mix Design Technician	Level I HMA
<u>PROFILOGRAPH</u>		
Profilograph	Profilograph Technician	None
<u>PRESTRESS</u>		
Prestress	Prestress Technician	Level I PCC or ACI Grade I <i>If the technician will be performing gradations, they will need to be Aggregate Level II- certified.</i>

UNSATISFACTORY PERFORMANCE NOTICE

Issued To: _____

Date: _____

This notice is to inform you that your performance as a Certified Inspector/Technician was unsatisfactory for the reason(s) listed below.

This notice will be placed in your permanent file with the District Materials Office in which you reside. It will also be placed on the statewide computer file.

The goal of the Technical Training and Certification Program (TTCP) is to work with contractors, producers, cities, and counties to continually improve the quality of Iowa's construction projects. We hope you will work with us to achieve this goal.

Unsatisfactory Performance:

District Materials Engineer

cc: Program Director – Materials Engineer, Ames
TTCP Coordinator
Resident Construction Engineer

FEDERAL CODE 1020 and IOWA CODE 714.8

I.M. 213 discusses the Unsatisfactory Notice that Certified Technicians are given when they are not performing their job duties satisfactorily. This can be given for a number of reasons including, improper sampling and/or testing, not performing their duties and reporting in the time frame required, reporting incorrect information, etc. The technician is given one written notice, the second notice is three-month certification suspension, and the third notice is decertification. According to I.M. 213 the Certified Technician can automatically be decertified for false statements without going through the Unsatisfactory Notice procedure. The Certified Technician also needs to be aware of the false statement clause that is applicable to all federal-aid projects and the fraudulent practice clause that applies to all non-federal aid projects. **Certified Technicians need to read and be aware of U.S.C. 1020 and Iowa Code 714.8 since these do apply to them.** They read as follows:

FEDERAL AID PROJECTS

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, the following notice shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS

18 U.S.C. 1020 reads as follows:

“Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined not more than \$10,000 or imprisoned not more than 5 years or both”

NON-FEDERAL AID PROJECTS

Iowa Code 714.8, subsection 3, defines fraudulent practices. “A person who does any of the following acts is guilty of a fraudulent practice. Subsection 3, Knowingly executes or tenders a false certification under penalty of perjury, false affidavit, or false certificate, if the certification, affidavit, or certificate is required by law or given in support of a claim for compensation, indemnification, restitution, or other payment.” Depending on the amount of money claimed for payment, this could be a Class C or Class D felony, with potential fines and/or prison.

The above codes refer to the individual making the false statement. **Standard Specification Article 1102.03, paragraph C, section 5 refers to the Contractor.**

Article 1102.03, paragraph C, section 5 states, “A contractor may be disqualified from bidder qualification if or when: The contractor has falsified documents or certifications, or has knowingly provided false information to the Department or the Contracting Authority.”

CERTIFIED TECHNICIANS QUALIFICATIONS

Tests and Procedures the Certified Technician is qualified to perform for each level of certification.

LEVEL I AGGREGATE

- IM 204 - Inspection of Construction Project Sampling & Testing (when material is incorporated)
- IM 209, App. C - Aggregate Specification Limits & Sampling & Testing Guide (when material is produced)
- IM 301 - Aggregate Sampling Methods

LEVEL II AGGREGATE

- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 302 - Sieve Analysis of Aggregates
- IM 306 - Determining the Amount of Material Finer Than #200 (75µm) Sieve in Aggregate
- IM 307 - Determining Specific Gravity of Aggregate
- IM 308 - Determining Free Moisture & Absorption of Aggregate
- IM 336 - Methods of Reducing Aggregate Field Samples to Test Samples
- IM 344 - Determining the Amount of Shale in Fine Aggregate
- IM 345 - Determining the Amount of Shale in Coarse Aggregate

LEVEL I PCC

- IM 204 - Inspection of Construction Project Sampling & Testing
- IM 208 - Materials Laboratory Qualification Program
- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 315 - Method of Protecting, Curing, Making & Testing Concrete Cylinders
- IM 316 - Flexural Strength of Concrete
- IM 317 - Slump of Hydraulic Cement Concrete
- IM 318 - Air Content of Freshly-Mixed Concrete by Pressure
- IM 327 - Sampling Freshly-Mixed Concrete
- IM 328 - Making, Protecting, and Curing Concrete Flexural Specimens
- IM 340 - Weight Per Cubic Foot, Yield, & Air Content (Gravimetric) of Concrete
- IM 383 - Testing the Strength of PCC Using the Maturity Method
- IM 385 - Temperature of Freshly-Mixed Concrete
- IM 525 - Designing Flowable Mortar
- Iowa 410-B - Method of Test for Flow of Grout Mixtures
- AASHTO T97 - Third Point Loading

LEVEL II PCC

- IM 527 - Paving Plant Inspection
- IM 528 - Structural Concrete Plant Inspection
- IM 529 - PC Concrete Proportions

LEVEL III PCC

- IM 530 - Quality Management & Acceptance of PC Concrete Pavement
- IM 531 - Test Method for Combining Aggregate Gradations
- IM 532 - Aggregate Proportioning Guide for Portland Cement Concrete Pavement

HMA SAMPLER

- IM 322 - Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 - Method of Sampling Asphaltic Materials

LEVEL I HMA

- IM 204 - Inspection of Construction Project Sampling & Testing
- IM 208 - Materials Laboratory Qualification Program
- IM 216 - Guidelines for Verifying Certified Testing Results
- IM 320 - Method of Sampling Compacted Asphalt Mixtures
- IM 321 - Method of Test for Compacted Density of Hot Mix Asphalt (HMA) (Displacement)
- IM 322 - Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 - Method of Sampling Asphaltic Materials
- IM 325 - Compacting Asphalt Concrete by the Marshall Method
- IM 325G - Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyrotory Compactor (SGC)
- IM 337 - Determining Thickness of Completed Courses of Base, Subbase, & Hot Mix Asphalt
- IM 350 - Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
- IM 357 - Preparation of Hot Mix Asphalt (HMA) Mix Samples for Test Specimens
- IM 501 - Asphaltic Terminology, Equations & Example Calculations
- IM 508 - Hot Mix Asphalt (HMA) Plant Inspection
- IM 509 - Tank Measurement & Asphalt Cement Content Determination
- IM 511 - Control of Hot Mix Asphalt (HMA) Mixtures
- IM 514 - Correlation of Field Density for Hot Mix Asphalt (HMA) Paving

LEVEL II HMA

- IM 380 - Vacuum-Saturated Specific Gravity & Absorption of Combined or Individual Aggregate Sources
- IM 510 - Method of Design of Hot Mix Asphalt (HMA) Mixes
- AASHTO T176 - Plastic Fines in Graded Aggregate & Soils by use of Sand Equivalent Test
- AASHTO T304 - Uncompacted Void Content of Fine Aggregate
- ASTM D 4791 - Flat Particles, Elongated Particles, or Flat & Elongated Particles in Coarse Aggregate

PROFILOGRAPH

- IM 341 - Determining Pavement & Bridge Ride Quality

PRESTRESS

- IM 570 - Precast & Prestressed Concrete Bridge Units

PROFILOGRAPH TECHNICIAN DUTIES

Duties of the Profilograph Technician are detailed in IM 341 and consist of, but are not limited to the following:

- A. Test pavement for smoothness criteria.
- B. Evaluate and certify test results.
 - 1. Certified person that reduces trace must sign certified test report.
 - 2. Profilograms become part of permanent project record.
- C. Documentation
 - 1. Certified Profilograph Test report must include following statement:

This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.



GUIDELINES FOR VALIDATING TEST RESULTS

GENERAL

Agency laboratory and field personnel validate testing by Contractor and producer personnel on a regular basis. Tolerances given herein are for use as guides to flag test result variations that indicate a possible discrepancy.

TOLERANCES

The tolerances shown in the following listing apply to the difference between Contractor and producer test results and verification test results. When the tolerances are exceeded, an immediate investigation must be made to determine possible cause so that any necessary corrections can be made.

<u>TEST NAME</u>	<u>TEST METHOD</u>	<u>TOLERANCE</u>
Slump of PC Concrete	IM 317	1/4 in. (6 mm)
Air Content of PC Concrete	IM 318	0.4%
Length of Concrete Cores	IM 347	0.10 in. (2 mm)
Free Moisture in Aggregate, by Pycnometer	IM 308	0.2%
Specific Gravity of Aggregate, by Pycnometer	IM 307	0.02
Moisture in Aggregate, by Hot Plate		0.3%
Wet Density by Nuclear Gauge, Soils & Bases (kg/m ³)	IM 334	2.0 lb./ft. ³ (32)
G _{mm} Maximum Specific Gravity	IM 350	0.010
G _{mb} Density of HMA Concrete, by Displacement	IM 321	0.020
G*/Sin Delta	T315	10% of mean
% Binder, Ignition Oven	IM 338	0.3%
G _{sa} Apparent Specific Gravity	IM 380	0.010
G _{sb} Bulk Specific Gravity	IM 380	0.028
Percent Absorption	IM 380	0.37%
Fine Aggregate Angularity	T304	2
Sand Equivalency	T176	10 % of mean

Pavement Profile Index (0.2" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
6.0 (95) or less	1.0 in./mi. (16 mm/km)
6.1 to 20.0 (96 to 315)	2.0 in./mi. (32 mm/km)
20.1 to 40.0 (316 to 630)	3.0 in./mi. (47 mm/km)
More than 40.0 (630)	5.0 in./mi. (79 mm/km)

Pavement Profile Index (0.0" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
25.0 (395) or less	3.0 in./mi. (47 mm/km)
25.1 to 40.0 (396 to 630)	4.0 in./mi. (63 mm/km)
More than 40.0 (630)	5.0 in./mi. (79 mm/km)

Bridge Profile Index (0.2" blanking band)	IM 341
Verification Profile Index Test Result	
Inches/mile (mm/km)	
6.0 (95) or less	2.0 in./mi. (32 mm/km)
6.1 to 20.0 (96 to 315)	3.0 in./mi. (47 mm/km)
20.1 to 40.0 (316 to 630)	4.0 in./mi. (63 mm/km)
More than 40.0 (630)	6.0 in./mi. (95 mm/km)

TOLERANCES FOR AGGREGATE GRADATIONS

Determining the precision of an aggregate sieve analysis presents a special problem because the result obtained with a sieve is affected by the quantity of material retained on the sieve and by results obtained on sieves coarser than the sieve in question. Tolerances are, therefore, given for different ranges of percentage of aggregate passing one sieve and retained on the next finer sieve used.

Comparisons of test results are made on each fraction of the sample, expressed in percent that occurs between consecutive sieves.

NOTE: Tolerances for aggregate gradations are only valid if the two tests were made on a split sample. Experience has shown that improper sample reduction, as well as differences in test procedures can contribute to results being out of tolerance. When a comparison exceeds the tolerance limits, a review of the test procedures and equipment will be performed. Where practical, additional comparisons will be done with similar equipment and methods.



DETERMINING PAVEMENT & BRIDGE RIDE QUALITY

SCOPE

This IM describes procedures used to perform smoothness testing on new pavements and bridge deck surfaces. A certified person is required to perform the testing and the reduction and reporting.

PROCEDURE

A. Apparatus

1. California or Ames Engineering type, 25-foot profilograph See Figure 1, 2, and 3 or an approved inertial profiler. See Figure 4.
2. Plain recording chart paper for the manual units. The Iowa DOT units use Honeywell 5701 paper.
3. Blanking band, a plastic scale 1.70 in. wide and 21.12 in. long. The center of the scale has an opaque band 0.2 in. wide extending the entire length and scribed lines 0.1 in. apart, parallel to the opaque band. See Figure 5.
4. Bump template, a plastic template with a line 1 inch long scribed on one face with a small hole or scribed mark at both ends, and a parallel slot (or edge) 0.5 inches away. See Figure 5.
5. Scale graduated in tenths of an inch.
6. Medium-point ballpoint pen in red ink or other contrasting color to the profile trace.
7. Calculator.
8. Reporting Form #821301 or a modified form with the same format.

B. Profiler Approval

All profilers must first be evaluated by the Iowa DOT Materials Laboratory to be considered for use under Articles 2316, 2317, and 2529.10 of the Standard Specifications. The manufacturer or contractor shall arrange for testing on an HMA pavement and a longitudinally tined PCC pavement with a profile index of less than 3.0 inches per mile and shall contact the Special Investigations Engineer to arrange for side-by-side testing with the Iowa DOT test equipment. The units shall be within 0.5 inches per mile on the 0.2-inch blanking band and within 10% on the 0.0-inch blanking band. Re-evaluation may be required if the unit fails to correlate with the Iowa DOT monitor testing.

C. Traffic Control

1. Follow Traffic Control Layouts in the Iowa DOT Standard Road Plan sheets TC-231 and TC-431 when performing smoothness testing on pavements or bridges under traffic. The link is http://www.dot.state.ia.us/design/stdplne_tc.htm.
2. Remember that these are minimum traffic control layouts and that additional signing or more elaborate traffic control layouts (such as a complete lane closure) may be required. Two-way radios may also be required.
3. Safety first! No test result is worth a crash, personal injury or fatality.

D. Calibration

A vertical and a horizontal calibration are required for the profilograph or profiler to work properly. Prior to use, the Iowa DOT shall calibrate profilographs and profilers. The calibration is good for a maximum of one year. The entire profilograph must be assembled for inspection of condition. Contractor-owned ProScan units must also be calibrated annually in the Central Materials Laboratory.

1. The horizontal calibration is done on a 528-ft. test section. The profilograph trace (profilogram) shall be identical to the reference trace when viewed on a light box. A rotating calibration wheel may also be used. The scale is 1:300. The unit shall be adjusted according to the manufacturer's instructions to within a tolerance of 0.25% (0.05 inches on the profilogram, 1.3 feet on the test section).
2. The vertical calibration or verification is done with the unit stopped. Calibration blocks (machined to within 0.01 inches.) are slid under the recording wheel or sensor. For manual units, measure the vertical trace line from the base line to the peak and return. (**NOTE:** The trace line must return to the base line.) For computerized units follow the manufacturer's procedure. The tolerance shall be ± 0.01 inch.

A rotating calibration wheel shall also be used with the same vertical calibration test tolerance as above. The Profile Index computed by the profilograph shall be within 10% of the established 0.0-inch blanking band index for the calibration wheel. Those profilographs not meeting the tolerance and those profilographs and profilers not calibrated on the wheel may be required to demonstrate compliance on a pavement section. Compliance would be determined comparing the computed index to a calibrated profilograph or profiler run at the same time. The units shall be within 0.5 inches per mile on the 0.2-inch blanking band and within 10% on the 0.0-inch blanking band.

E. Computer Settings

Below are the settings that shall be used for testing in Iowa.

PROFILOGRAPH/ PROFILER CALIBRATION FACTORS

MANUFACTURER	MANUAL	COMPUTER	FILTER SETTINGS		TIRE PRESSURE
			LOW PASS/ DATA	170kPa (25 PSI)	OTHER
AMES	X	---	---	---	As Calibrated
AMES	---	X	2.0	X	---
AMES LISA (1)	---	X	2.0	---	10 PSI
COX	X	---	---	X	---
MCCRACKEN	X	---	---	X	---
MCCRACKEN	---	X	2.0	X	---
MACBETH	X	---	---	---	As Calibrated
LAB-BUILT	X	---	---	X	---
PROSCAN	---	DOS VER.	11	---	---
PROSCAN	X	WINDOWS VER.	1.50	---	---
SSI	---	X	2.0	X	---
SSI HIGH SPEED (2)	---	X	2.0	---	As Calibrated

(1) The TriODS triple laser is approved for both HMA and tined PCC. The single laser is approved for HMA only.

(2) Approved for HMA only.

PROFILOGRAPH/ PROFILER REDUCTION SETTINGS

Blanking Band	0.20 inches (5.1 mm) or
Scallop Rounding	0.01 inches (0.1 mm)
Minimum Scallop Height	0.03 inches (0.8 mm)
Minimum Scallop Width	0.08 inches (2.0 mm) on trace (2.0 ft. actual distance)
Filter Type	Butterworth (moving average for ProScan)
Bump/Dip Height	0.50 inches (12.7 mm)
Bump/Dip Width	25 feet actual distance (7.6 m)

The current versions of the McCracken profilograph software and the Ames LISA software have a filter called a blanking band filter factor or high pass filter. The filter should be set to "0" (off) for the majority of profilograph testing. The filter setting is displayed with the other information at the end of the profilogram. It is intended to be used only on short radius horizontal curves to compensate for the effect of the superelevation. The result of using the filter is a reduction in the longer wavelength features of the profilogram and a possible reduction in the profile index.

F. Test Procedure

1. The contractor (or sub-contractor) responsible for smoothness testing shall give the Project Engineer and the District Materials Engineer 48 hours notice prior to testing so the District Materials Office may provide a certified technician for correlation testing.
2. Dirt and debris may affect profilograph index readings. Excessive mud or caked mud must be removed prior to testing. A grader blade or power broom will knock concrete crumbs off longitudinal or transverse grooving. This will produce fewer spikes and a better profile trace to accurately reduce.
3. Since the profilograph is symmetrical, testing may be performed in either direction of traffic. It is desirable to test in the direction of traffic and reduce traces in the direction of traffic wherever possible. While this is easy to do with manual profilograph machines and reduction methods, it is recognized that some computer profilographs may have problems meeting these criteria. It is not the intention to penalize for the use of computer profilographs.
4. Pointer bar use is mandatory except on bridge decks.
5. More than one person may be required to hold the back end of the profilograph exactly at 1/4 point on superelevated or sharp horizontal curves.
6. The profilograph is pushed at walking speed. Do not push or pull with a truck or car.
7. For manual units, lift the test wheel and rotate it to take slackness out of the chain, and lower it to the pavement surface at the starting point prior to testing. Lifting the test wheel at the beginning and end of each trace clearly define termini. This may also be accomplished by pulling the recording cable.
8. Note stationing on the profilogram at least every 1000 ft. (300 m) and preferably every 500 ft. (100 m). Closer station references are highly desirable where possible. This station referencing on the trace is used to accurately locate 1/2 in. (12.7 mm) bumps (or dips). Use landmarks, roadway signs, maintenance markers, or mileposts on Hot Mix Asphalt (HMA) resurfacing projects. Spray paint can be used on the pavement for computer profilographs to mark the location of 1/2 in. (12.7 mm) bumps (or dips).
9. Completely label both ends of the profilograph roll and note the stationing and roll number at each end of the roll. Add the test report laboratory number to each end after reduction.
10. When a segment is corrected by grinding to improve the profile index, the entire segment must be retested and a new profile index calculated to determined specification compliance. The profilograph roll from the corrected area shall be labeled at both ends with the information from the original profilograph roll and a note indicating that the area was corrected by grinding.

11. Test unit positioning

- a. The center wheel shall be at 1/4 point (6 feet from the centerline or lane line) on new pavements and in the wheel tracks (3 feet and 9 feet from the centerline or lane line) on new bridge decks and bridge deck overlays. See Figure 6.
 - b. Where possible, the profilograph should start with the front wheel at beginning of the new construction for which the contractor is responsible. See Figure 7.
 - c. Test to header whenever possible stopping the front wheel at the header, and starting at that same location for the next section. The header must be included in the count and checked for 1/2 in. (12.7 mm) bumps or dips and count.
 - d. The 16 ft. to 150 ft. (5 m to 45 m) odd length at the end of a day's run due to barrier fences, machinery, paving not placed yet, etc., should be included in the next day's run.
 - e. The first 150 ft. (45.7 m) on side roads which are 600 feet or longer will be omitted from the profile index. This 150 ft. (45.7 m) distance will be measured perpendicular to mainline paving and from edge of pavement to edge of pavement. This area will be checked for bumps and dips only. See Figure 8.
 - f. Acceleration and deceleration tapers to ramps and loops are tested as mainline pavement. The end of the entrance and exit ramp tapers is located at the point where the ramp is full lane width.
 - g. Testing starts on transitions and tapers to lanes and ramps when the pavement reaches a width of 4 feet (1.2 m). See Figure 9.
 - h. Test the wider pavement width on ramps to represent ramp smoothness if the ramp width is placed in more than one pass (such as on HMA resurfacing projects). Testing should be performed as closely to the center of the ramp driving lane as possible. If the pavement joint falls exactly at the center of the driving lane of the ramp, then offset 2 ft. (0.6 m) to the right with traffic to test with the profilograph.
 - i. When testing bridge approaches, push the profilograph 100 ft. (30 m) on the pavement and 100 ft. (30 m) on the bridge to get enough trace to correctly position the blanking band through the bridge approach area. Only the actual bridge approach length is analyzed as shown in Figure 10. The header at the bridge and at the approach and adjacent pavement are checked for bumps and dips.
10. When testing over 4 in. (100 mm) expansion joints, fill the space with wood, cover the space with metal (or some other material) so that the small profilograph wheels can roll over the joint.

G. Manual Trace Reduction & Bump Locating Procedure

1. A red (or other contrasting color) outlining procedure is mandatory on all manually reduced profilograms from PCC pavement sections involving price adjustments or incentive payments. No outlining shall be done on HMA, bridge decks, or when using ProScan or other computerized units. On bridge decks, the deck should be swept and the profilograph should be pushed slowly enough so that no or little spiking occurs.
 - a. Outlining is not intended to correct or compensate for an incorrectly run profilogram. Continuous spiking and chatter indicates that the profilograph was operated too fast or the pavement was not cleaned prior to testing. Profilograms with continuous spiking or chatter are not acceptable and should be rerun.
 - b. The outlining procedure removes spikes and minor deviations caused by rocks, texturing, or dirt. See Figure 11. To outline a trace, care should be taken to average only normal spiking. Scallops must **not** be smoothed or averaged during the outlining.
 - c. Start at one end of the trace. Carefully draw a line along the trace profile. Draw along scallops, even those less than 0.08 inches wide.
2. Use a 1/2 in. (12.7 mm) bump template to locate bumps or dips for removal. At each prominent bump or dip on the profile trace, place the template so that the small holes or scribe marks at each end of the scribed line intersect the profile trace to form a chord across the base of the dip or indicated bump. The line on the template need not be horizontal. With a sharp pencil draw a line using the narrow slot in the template (or edge) as a guide. Any portion of the trace extending above or below this line will indicate the approximate length and height of the bump or dip in excess of the specification.
3. There may be instances where the distance between easily recognizable low points is less than 1 in. (25 ft.) [25.4 mm (7.6 m)]. In such cases a shorter chord length shall be used in making the scribed line on the template tangent to the trace at the low points. It is the intent, however, of this requirement that the baseline for measuring the height of bumps or dips will be as nearly 25 feet (1 inch) [7.6 m (25.4 mm)] as possible, but in no case to exceed this value. When the distance between prominent low points is greater than 25 feet (1 inch) [7.6 m (25.4 mm)] make the ends of the scribed line intersect the profile trace when the template is in a nearly horizontal position. A few examples of the procedure are shown in Figure 12.
4. Place the blanking band over the profile to remove or "blank out" as much of the profile as possible. When this is done, scallops above and below the blanking band usually will be approximately balanced. The blanking band must not move when counting scallops in a segment. See Figure 13.

The profile trace may move from a generally horizontal position when going over the transition to small radius superelevated curves. When such conditions occur, contact the District Materials Engineer. The District Materials Engineer may allow the profile at that segment to be broken into short sections and the blanking band repositioned on each section while counting scallops.

5. Measure and total the height of all the scallops appearing both above and below the blanking band, measuring each scallop to the nearest 0.05 in. (1.3 mm). Round down as well as up. Do not count a scallop as 0.05 in. (1.3 mm) just because you see the profile line or there is space under the line.

Short sections of the profile line may be visible outside the blanking band, but unless they project 0.03 in. (0.8 mm) or more and extend longitudinally for 2.0 feet (0.61 m) [0.08 in. (2 mm) on the profilogram] or more, they are not included in the count. See Figure 11 for illustration of these special conditions. Spikes are not counted. Double-peaked scallops are only counted once as the highest peak.

Write the total count in inches (millimeters) on the profilogram above the profile line (toward the center of the segment) and circle it. Outline the position of the blanking band when reducing the trace for later repositioning to check trace reduction procedure. Do not rotate the blanking band about the last end position when moving forward with trace reduction. Blank out as much of the profile as possible for each segment.

When a scallop occurs at the end of the blanking band, count the scallop only once. Place the scallop in the 0.1-mile (161 m) segment where the peak is highest.

Always use the measured trace length in computations. This length will not agree exactly with distance by subtracting stationing. Always use \pm after the ending station on the report.

6. The last segment counted is generally not an even 0.1-mile (161 m). If not, its length should be scaled to determine its length in miles (kilometers). For the example shown below, the odd length segment measures 7.60 in. (193 mm) in length.

$$\frac{193 \text{ mm} \times 0.3 \text{ m/mm}}{1,000 \text{ m/km}} = 0.058 \text{ km} \quad \frac{7.60 \text{ in.} \times 25 \text{ ft./in.}}{5,280 \text{ ft./mi.}} = 0.036 \text{ mi.}$$

If the odd length segment is 0.047 miles (250 feet) [0.076 km (76.2 m)] or less, it is added to and included in the evaluation of the adjacent segment in that section. If the odd length segment is more than 0.047 miles (0.076 km) it is evaluated on its own.

The profile index is determined as inches per mile (millimeters per kilometer) in excess of the blanking band. For 0.1-mile segments, the profile index can be determined from the inches of roughness by moving the decimal place one position to the right. For odd length segments and metric, the profile index is determined by dividing the inches (millimeters) by the segment length in miles (kilometers). The weighted average for a day's run is determined by dividing the total inches (millimeters) of roughness for the day's run by the total length in miles (kilometers) of the day's run.

H. Testing of Patches

1. Testing of pavement patches is covered in Article 2529.10 of the Standard Specifications. Patches between 50 feet and 250 feet are evaluated using the Average Base Index (ABI).
2. Figure 14 shows the areas to be tested and analyzed.

I. Reporting

1. The test report is required for project acceptance. Contractors should put their company name at the top of Iowa DOT Form #821301 and produce a new form. Remove "District Materials Engineer" at bottom of form. Contractors may develop their own form but it shall follow the same layout and style as Form #821301.
 2. There are several types of reports:
 - a. **Information Only.** Used by the DOT inspector when the test report is not for validation.
 - b. **Preliminary.** Used by the contractor to submit the report in the time period required in the specifications. A final report must follow.
 - c. **Final.** Used to indicate that the report is being submitted for acceptance.
 - d. **Corrected.** Used to indicate that there was either an error in the original test report or that the section was corrected by grinding and retested.
 3. Test report laboratory numbers must be continuous and increasing numerically as each succeeding test is performed. Laboratory numbers shall have a letter added to the end of the original laboratory number for corrected reports (i.e., original report number 01-218L-05, corrected report number 01-218L-05-A). Put the Laboratory Number on the trace roll.
 4. Contractor test reports shall have one of the following at the bottom of the report:
 - e. **No Corrective Work Required.**
 - f. **Corrective Work Required.**
 - g. **Corrective Work Completed.**
 5. The corrected test report shall include all the information and data from the original test report and also show the retested profile index for each corrected segment. Identified bumps and dips shall be noted as corrected.
 6. Rounding for reporting shall be as follows:

English
Length to 3 decimal places, miles
Roughness to 2 decimal places, inches (0.01 for computers, 0.05 for manual)
Profile index to 2 decimal places, Inches/mile

Metric
Length to 3 decimal places, kilometers
Roughness to 1 decimal place, millimeters (0.1 for computers, 1.3 for manual)
Profile index to 1 decimal place, millimeters/kilometer
 7. An example of a completed report form is shown in Figure 15. Always start with a full 0.10-mile (161 m) segment and align both directions or lanes on the form.
 8. The reverse side of Form #821301 is for bridge decks. An example of a completed bridge
-

deck monitor report is shown in Figure 16.

9. Each certified profilograph test report must also include the following certification statement:

“This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.”

10. Certified profilograph reports shall have the following distribution:

RCE, County or City Engineer
District Materials Engineer
Special Investigations Engineer (will make Ames distribution)
Contractor (For Iowa DOT Personnel)
Subcontractor (For Iowa DOT Personnel)

J. Certification

1. Contractors must furnish and certify profilograph test reports. A trained, certified person shall do the testing and evaluation and the evaluation shall be certified.
2. Profile traces (profilograms) become part of the RCE (County or City Engineer) permanent project records.
3. Basis of certification is in Materials IM 213. Applications should be sent to the Technical Training & Certification Program Coordinator.
4. The certified profilograph person who reduced the trace must sign each certified profilograph test report.

K. Metrication

1. Some projects are metric. Use either a “soft or hard” conversion. Either reduce the traces using the English System or set the computer for metric values. You need not report both the English System and the Metric System on the same report form. Circle either mm/km or inches/mile under the Profile Index Column.
2. Conversion factors are as follows:

in./mi. to mm/km, multiply by 15.786
inch to mm, multiply by 25.4
mile to kilometer, multiply by 1.609347
feet to meter, multiply by 0.3048006

DISPUTE RESOLUTION SYSTEM

Normally the District Materials Office will perform verification testing within 1 month from receiving finals test reports and notification from the Contractor that the bridge or pavement is available for testing. The validation tolerances are in IM 216. When the Contractor test results cannot be validated, the District Materials Office will promptly notify the Contractor and begin the dispute resolution process. Testing disputes arising between the Contracting Agency and the Contractor shall be resolved in a reliable, unbiased manner or an evaluation performed by the Iowa DOT Central Materials Laboratory. Resolution decisions by the Iowa DOT Central Materials Laboratory will be final.

The District Materials Engineer will select some or all of the following steps for the dispute resolution:

1. Check all numbers and calculations.
2. Review testing procedures.
3. Compare profilograms and dates of testing.
4. Check equipment operation, calibrations and tolerances.
5. Perform side-by-side tests.
6. Involve the Central Materials Laboratory.

If the discrepancy cannot be resolved using the steps listed above, or if it is determined that the Contractor's testing is in error, then the Agency test results will be used for the acceptance decision for the project.

Figure 1. 25-Foot California Type Profilograph

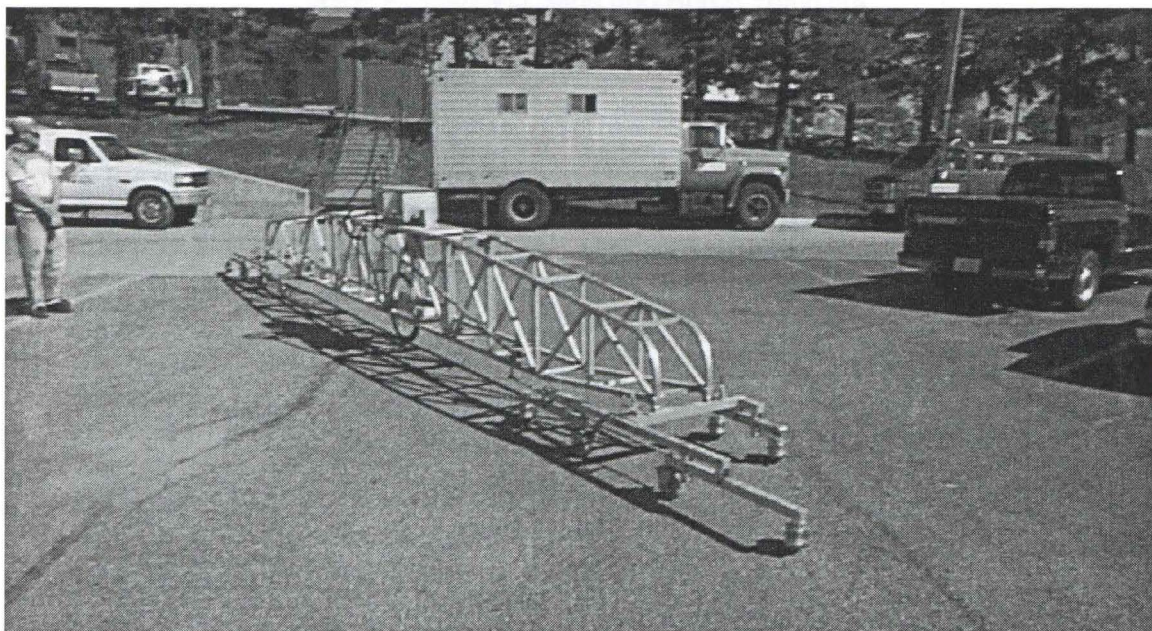


Figure 2. Manual Profilograph Recording Unit

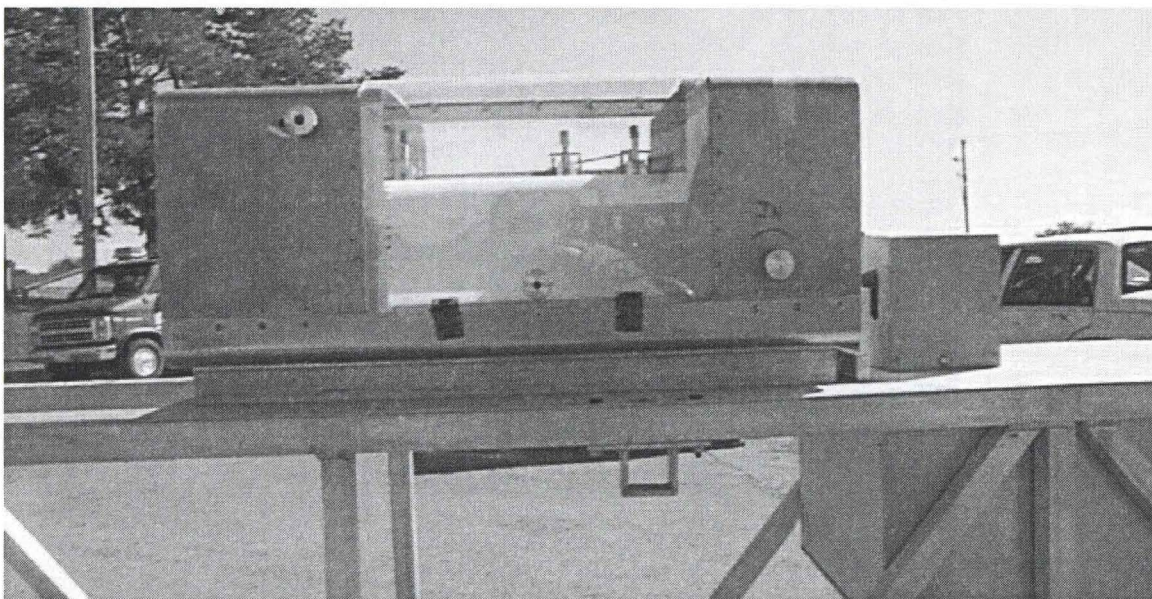


Figure 3. Computerized Profilograph

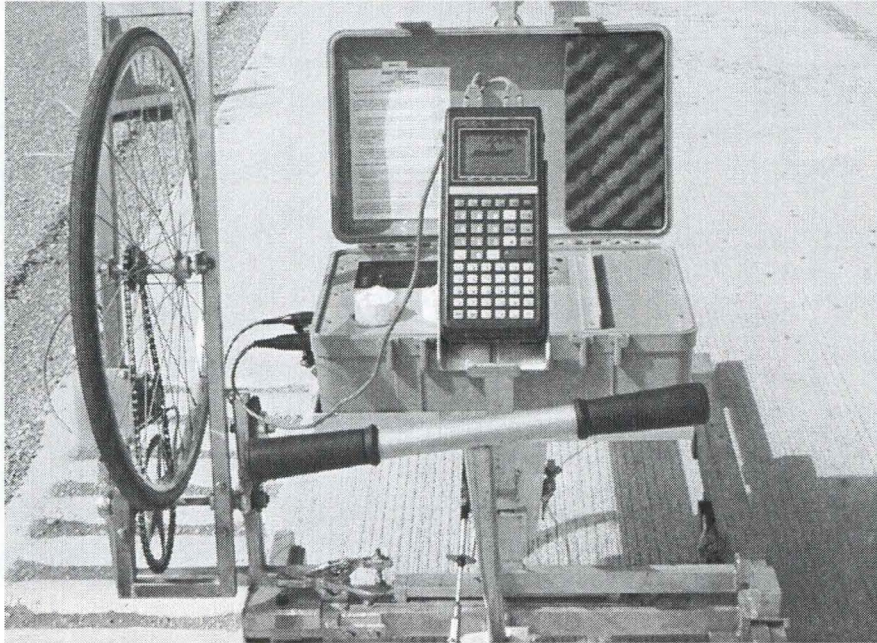


Figure 4. Light Weight Inertial Profiler



Figure 5. Blanking Band and Bump Template

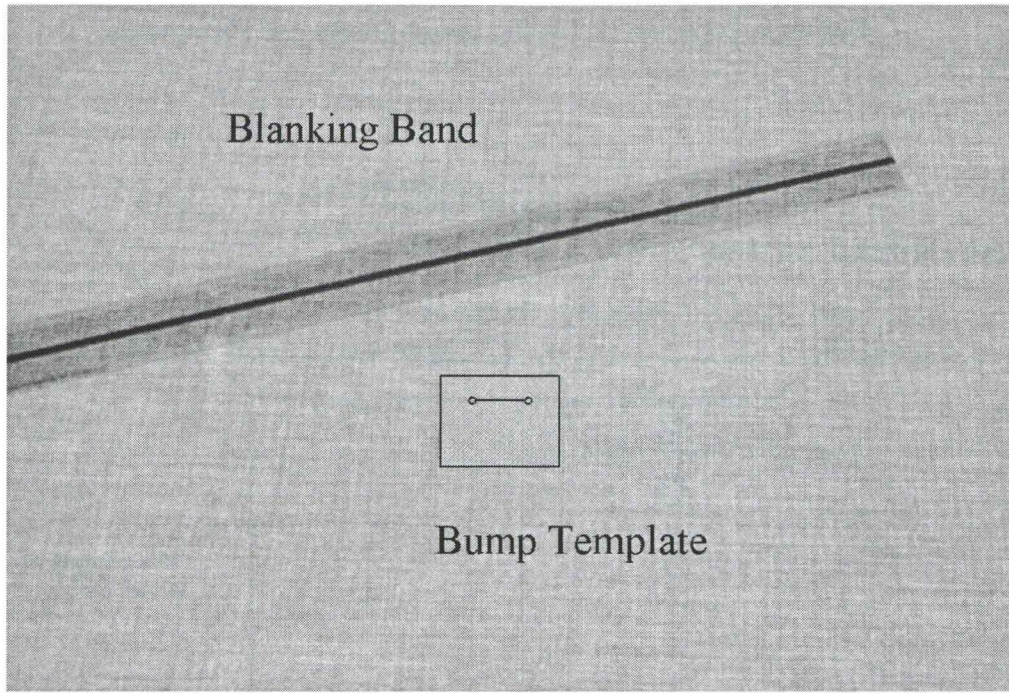


Figure 6. Location for Testing Bridge Decks and Pavements

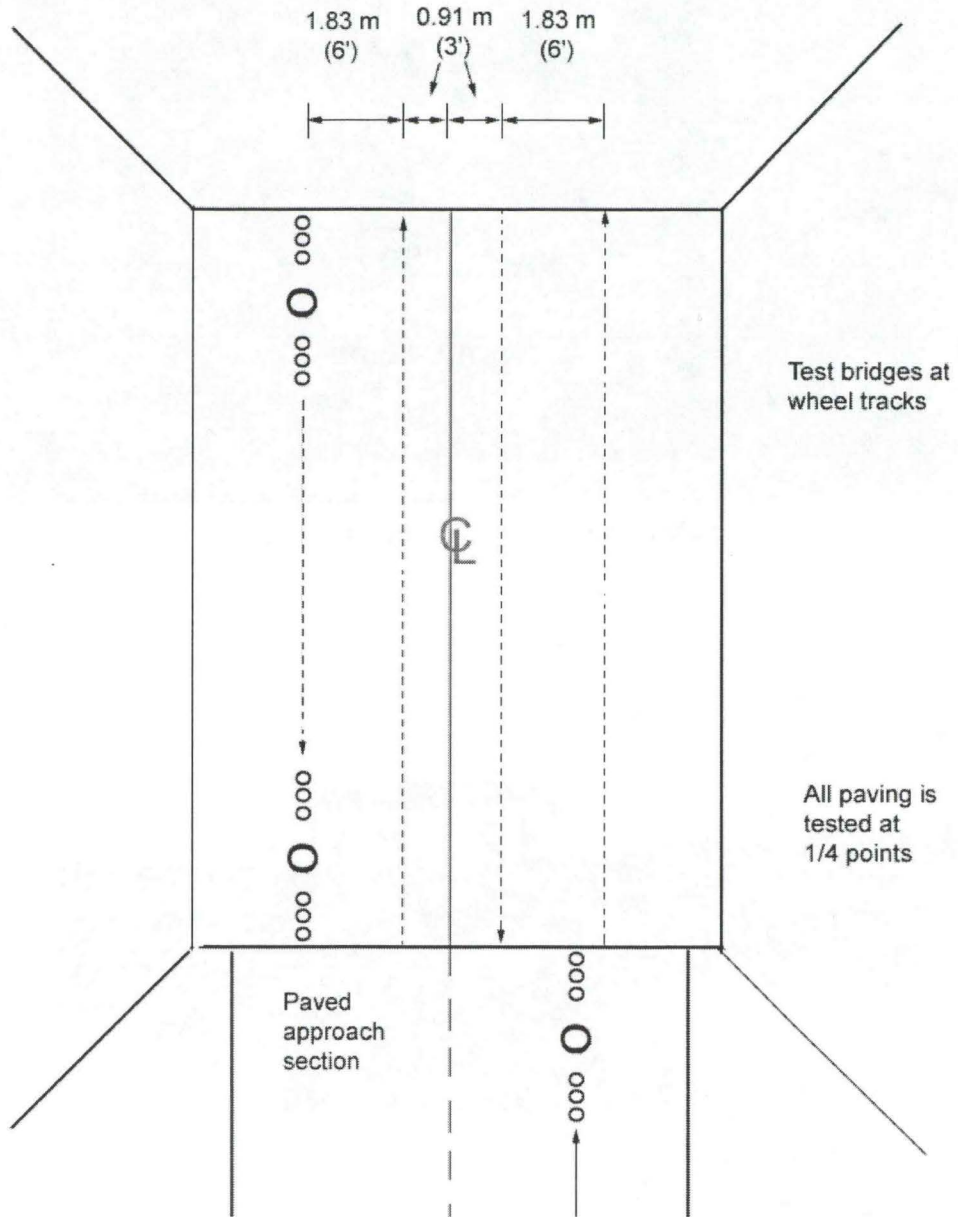
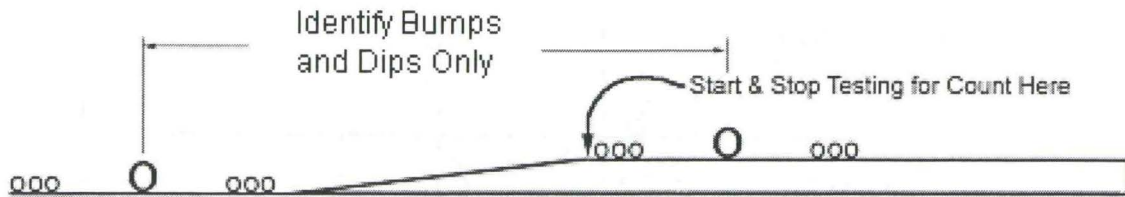
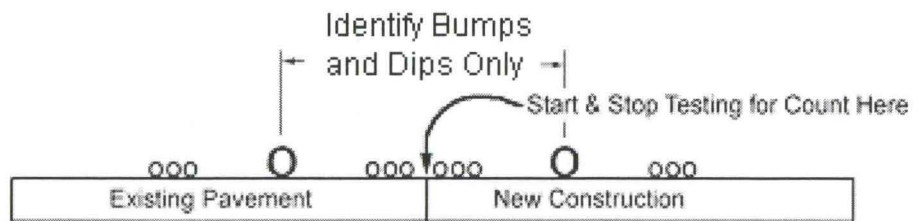


Figure 7. Testing at Headers



HMA Runout Tapers



All Other New Construction

MEMORANDUMS

SPECIFICATIONS

Figure 8. Excluded Area from Profile Index for Side Roads over 600 Feet

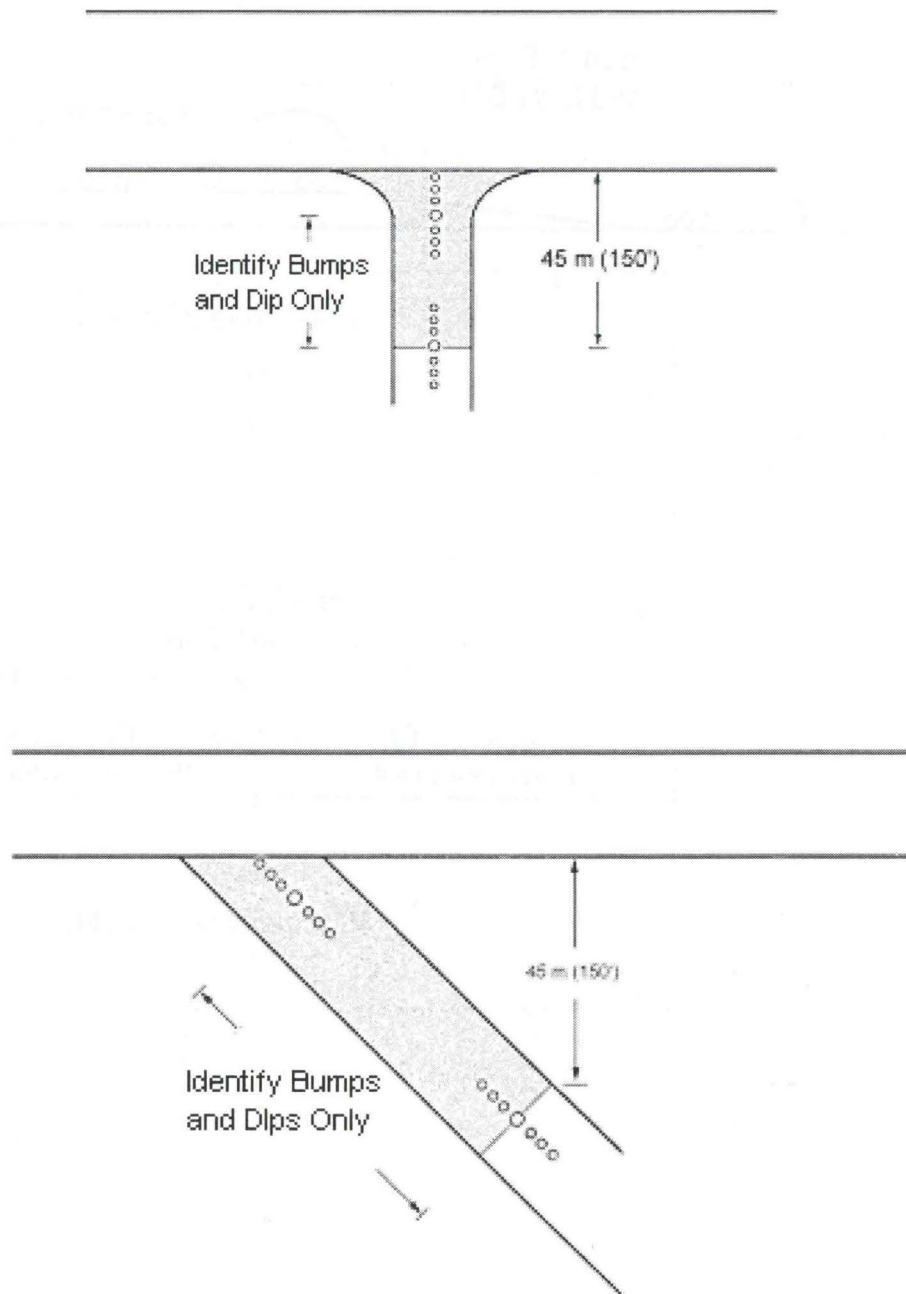


Figure 9. Starting and Stopping Location for Tapers

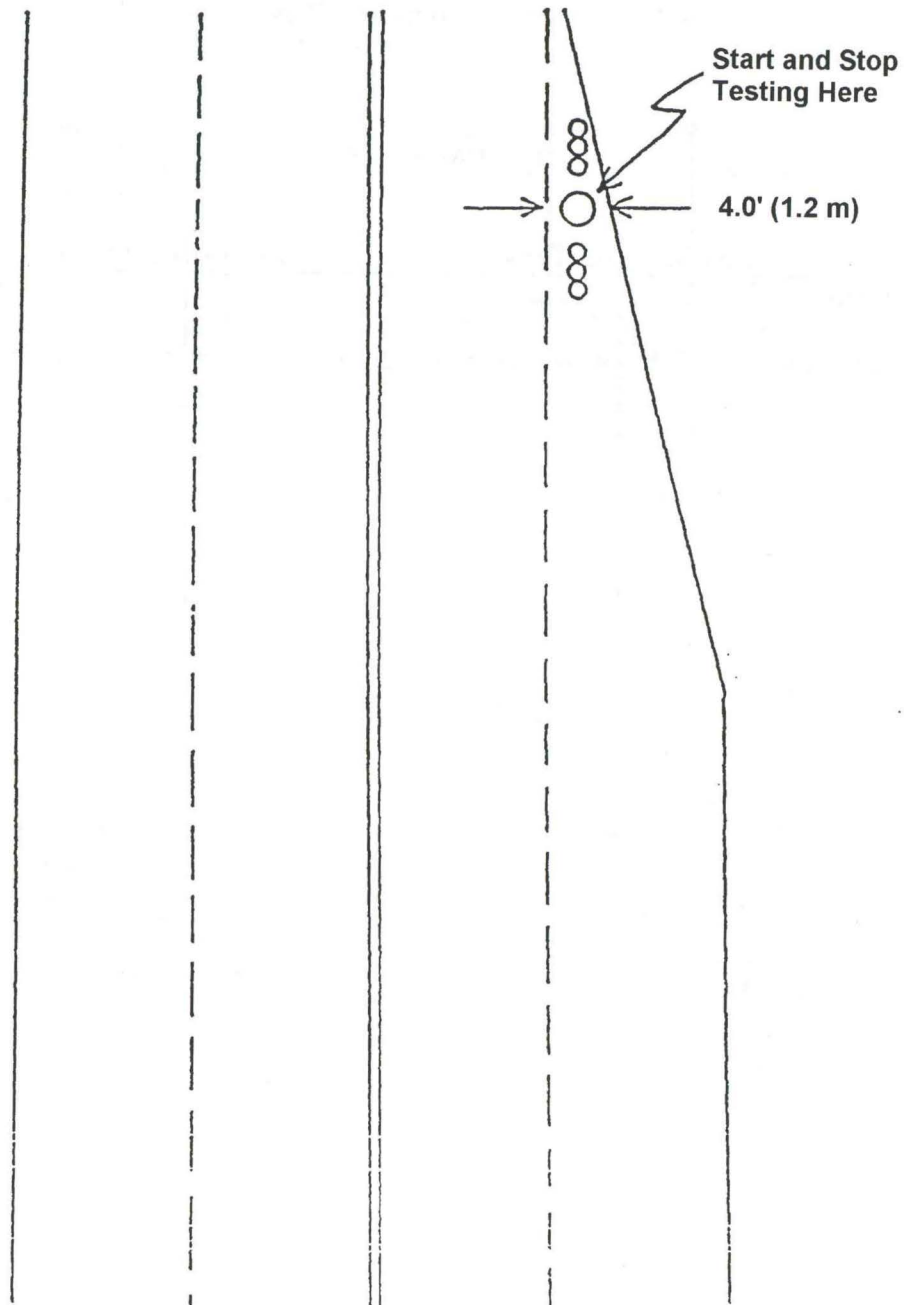


Figure 10. Testing of Bridge Approach Sections

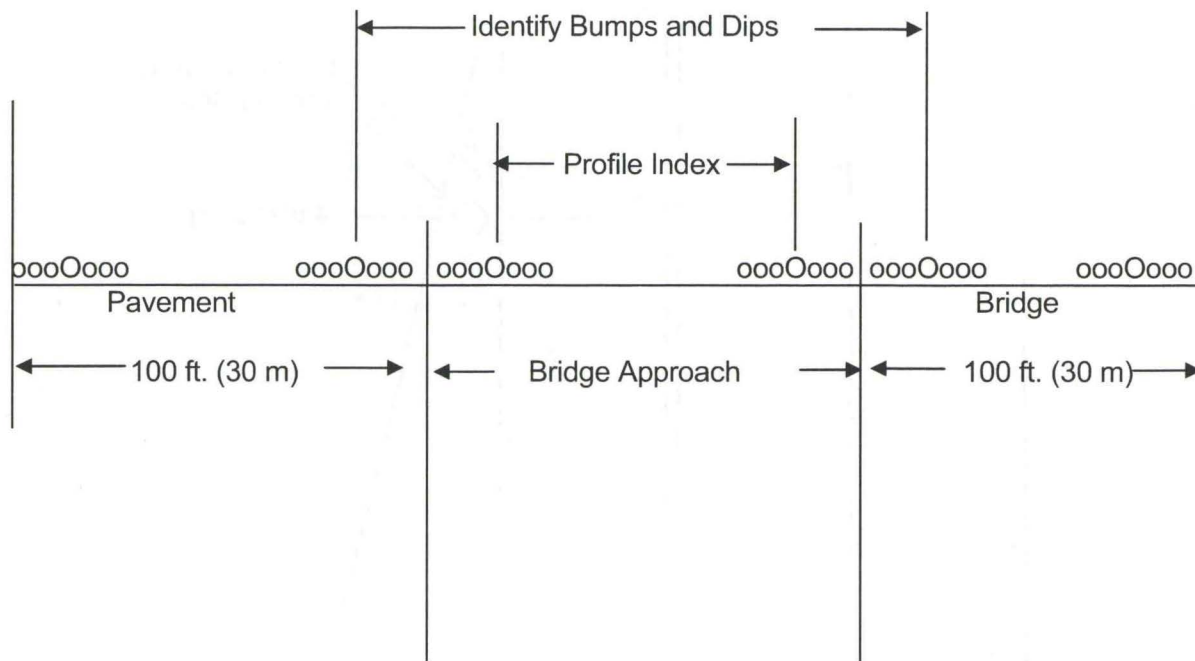
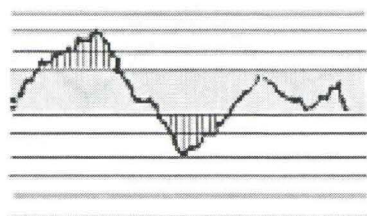


Figure 11. Manual Trace Reduction Conditions

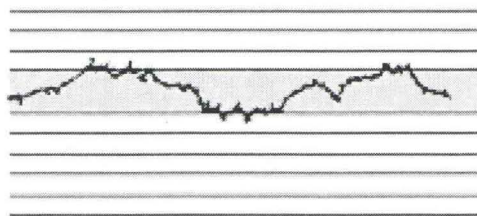
TYPICAL CONDITIONS

Scallops are areas enclosed by profile line and blanking band. (Shown crosshatched in this sketch)



A

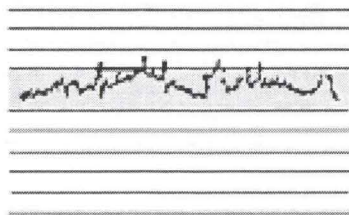
Small projections which are not included in the count



B

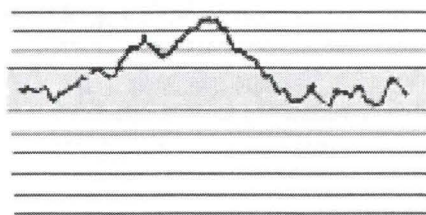
SPECIAL CONDITIONS

Rock or dirt on the pavement (not counted).



C

Double peaked scallop (Only the highest part counted).



D

Figure 12. Examples Using the Bump Template *

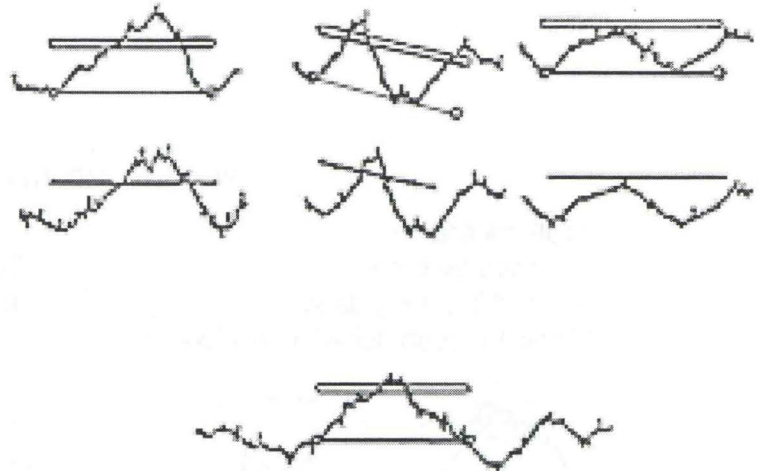
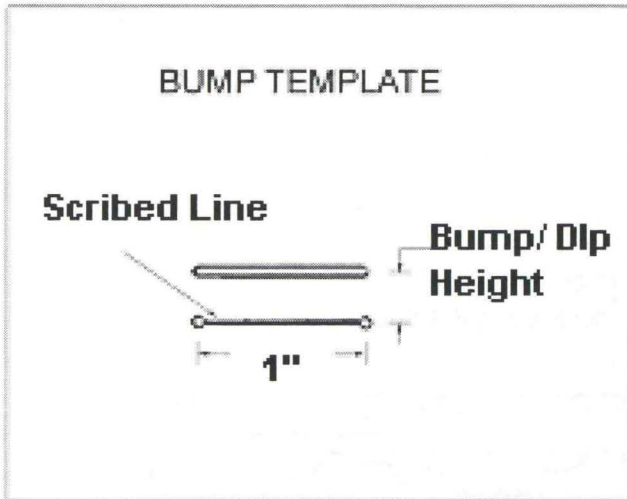


Figure 13. Example of Blanking Band Placement

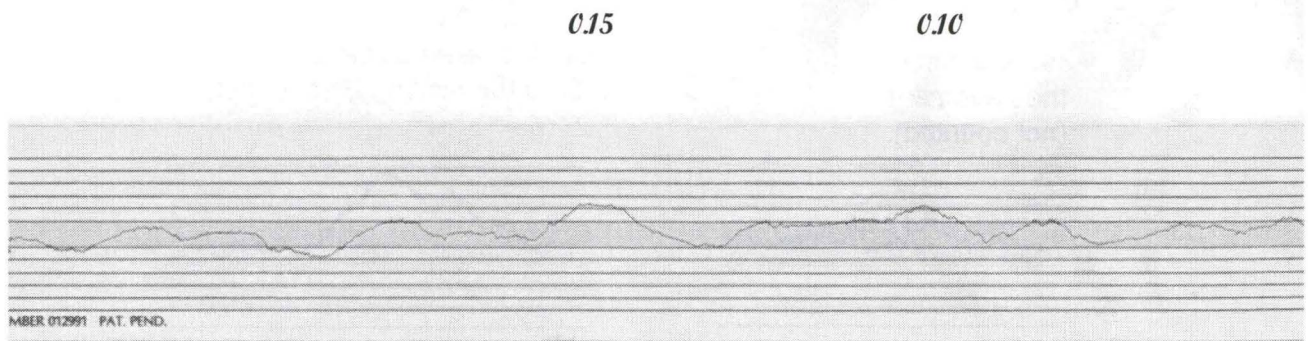
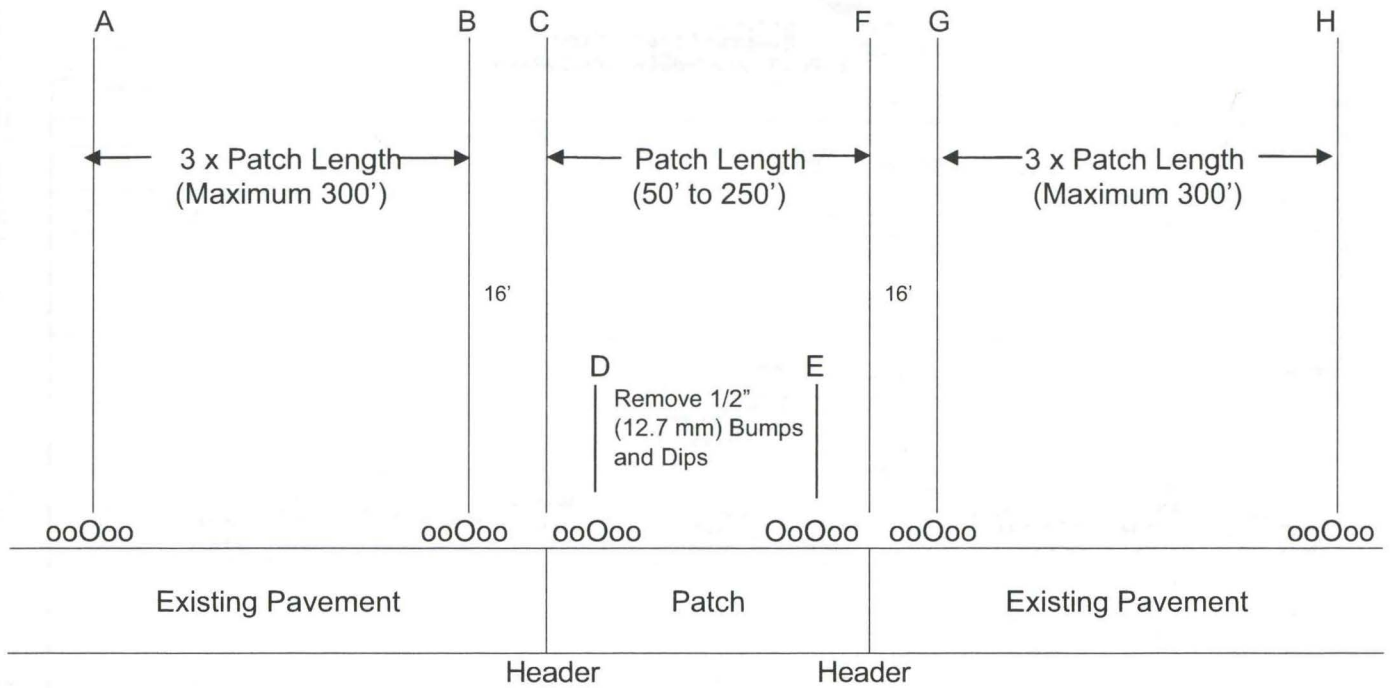


Figure 14. Area to be Tested for Pavement Patches



Patch Testing Procedure Specification 2529.10

Compare the index of Line AH to the index of the ABI

$$ABI = \frac{AB + GH}{2}$$

Correct Smoothness between line

Figure 16. Sample Bridge Test Report

Report: Standard

**PAVEMENT TEST REPORT
25-FOOT CALIFORNIA PROFILOGRAPH**

New Bridge

Results: Final

Lab No. JS04-18-1 Route No. US 18 Project No. NHSX-18-7(49)--2R-19
 Date Reported 9/9/2004 Date Paved 8/8/2004 County Chickasaw
 Tested By John Smith Contractor ABC Construction Date 09/08/04
 Trace Reduced By John Smith Date 09/08/04

Other _____ Tested at: Wheel Track Design: English

New Bridge _____ Blanking Band: 0.2-Inch

Roadway Type: 2-Lane Lane: _____

Length (Miles)	Eastbound		Location (Station)	Direction (4-Lane Only)		Westbound		Index Avg. (in./mi.)	Incent./ Deduct
	Wheel Track Measured Roughness (Inches)	Inside Profile Index (Inches/Mile)		Wheel Track Measured Roughness (Inches)	Outside Profile Index (Inches/Mile)				
0.057	0.20	3.51	77+12	0.057	0.30	5.26	4.39		
			80+12 +/-						

0.057 0.20 3.51 0.057 0.30 5.26

AVG = AVG =

Incentive Levels Other _____

From Station 1/2" Bump Locations To Station

**NO
CORRECTIVE
WORK
REQUIRED**

Copies: Special Investigations, Ames
 District Materials Engineer
 Resident Construction Engineer

This is to certify that all testing and trace reduction herein described has been performed according to applicable contract specifications and requirements.



Iowa Department of Transportation

SUPPLEMENTAL SPECIFICATIONS FOR PRIMARY AND INTERSTATE PAVEMENT SMOOTHNESS

Effective Date
October 16, 2007

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SUPPLEMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

Replace all of Section 2316 with the following, except as noted:

Section 2316. Pavement Smoothness

01050.01 GENERAL.

Pavement smoothness shall be evaluated for all Interstate and Primary main line pavement surfaces, and all other road surfaces included on Primary projects, except when specifically excluded or modified by the contract documents. ~~Pavement smoothness shall not be evaluated for all other roads unless specified in the contract documents.~~ Main line pavement is defined as all permanent pavement for through lanes, traffic lanes, including tapers to parallel lanes or through lanes at intersections, tapers to climbing lanes, and tapers to ramps and loops. Pavement smoothness shall also be evaluated for all interchange ramps and loops, side roads, auxiliary lanes, and bridge approaches. Exclusions from profilograph testing are detour pavement, shoulders, crossovers, and individual sections of pavement less than 50 feet (15 m) in length.

~~If this specification is required by contract documents on non-Primary projects let by the Department, it will be added in its entirety without modification.~~

The Engineer may determine the pavement smoothness according to Materials I.M. 341 using a 10 foot (3 m) straightedge or rolling straightedge on surfaces excluded from profilograph testing. The variation of the surface from the testing edge of the straightedge shall not exceed 1/8 inch (3 mm) between any two contacts, longitudinal or transverse. The Contractor shall correct all irregularities exceeding the specified tolerance using equipment and methods approved by the Engineer. After the Contractor has corrected an irregularity, the Engineer may perform monitor testing of the area to verify compliance with the specified tolerance.

01050.02 EQUIPMENT.

The Contractor shall provide and operate an Ames type or California type profilograph to produce a profilogram (profile trace) of the surface tested ~~determine the pavement profile~~ in accordance with Materials I.M. 341. Other types of profilographs or profilers that produce compatible results and meet the

requirements of Materials I.M. 341 may be used. The Contractor's operator shall be trained and certified to operate the profilograph as required by the Contracting Authority.

If the Contractor's profilograph has a mechanical recorder, the Contractor shall provide automated trace reduction equipment in accordance with Materials I.M. 341. If the Contractor's profilograph has a computerized recorder, the trace produced will be evaluated without further reduction.

1050.03 SURFACE TOLERANCES, TESTING, AND EVALUATION.

A pavement section segment is defined as a continuous area of finished pavement 0.1 mile (161 m) in length and one lane (10 to 12 foot (3.0 to 3.7 m) nominal) in width. A partial section segment resulting from an interruption of the continuous pavement surface (i.e. bridge approaches, side road tie-ins, the cessation of the daily paving operations, etc.) is subject to the same evaluation as a whole section segment.

A. Tolerances.

The Contractor shall produce pavement with an average profile index per 0.1 mile (161 m) section segment as shown in the Table 01050.03 below.

TABLE 01050.03: TOLERANCE FOR AVERAGE PROFILE INDEX PER 0.1 MILE (161m) (0 inch blanking band)

Surface Type	Profile Index For greater than 45 mph	Profile Index For 45 mph or less and ramps
	Inches per mile (mm/km)	Inches per mile (mm/km)
PCC Pavement	45.0 or less (710 or less)	65.0 or less (1025 or less)
HMA Pavement	40.0 or less (630 or less)	45.0 or less (710 or less)
	40.0 or less (630 or less)	
	35.0 or less (550 or less)	

B. Testing.

The Contractor shall determine the pavement profiles for each lane according to the procedures for one lane, as shown in Materials I.M. 341 except for main line traffic lanes and through lanes which will be tested in the wheel paths. Round the trace scallops to the nearest 0.01 inch (0.1 mm). The wheel paths are defined as the 3 feet (0.9 m) and 9 feet (2.7 m) from the center line or lane line. Average the two wheel path profile indexes for each section segment. Additional profiles may be taken only to define the limits of an out-of-tolerance surface variation. The Engineer may use a 10 foot (3 m) straightedge (or other means) to detect irregularities outside the required trace paths. The Engineer may also use the straightedge to delineate the areas that require corrective action.

Bridge approaches shall be tested according to Section 2317 of the Standard Specifications.

C. Evaluation.

The Contractor shall determine a profile index based on the 0 inch (0 mm) blanking band following the same procedures shown in Materials I.M. 341 for each section segment of finished pavement surface except for:

1. Primary side roads connections less than 600 feet (180 m) in length.
2. Non-primary side road connections, which shall be evaluated according to Section 2316 of the Standard Specifications.
3. Bridge approaches, less than 50 feet (15 m) which shall be evaluated according to Section 2317.
4. Storage lanes, turn lanes, and other auxiliary lanes less than 600 feet (180 m).
5. Pavement less than 8.5 feet (2.6 m) in width.

56. The 16 feet (5 m) before and the 16 feet (5 m) beyond the ends of the section when the Contractor is not responsible for the adjoining surface.

67. On HMA single lift pavement overlays pavements with no milling. Single lift pavement overlays 2 inches (50 mm) or less in thickness, unless the existing surface has been corrected by milling or scarification.

78. Runout tapers on HMA overlays at existing pavement, bridges, or bridge approach sections where the thickness is less than the design thickness.

~~The Contractor shall determine, for information only, a profile index based on the 0.2 inch (5.1 mm) blanking band.~~

For the following situations, the profile index will be evaluated. If the average profile index exceeds the tolerances listed in Article 01050.03, A, the Contractor may elect to eliminate that area from the profile index for the day's paving operation and evaluate the area using a 10 foot (3 m) straightedge as outlined in Article 01050.01.

1. Horizontal curves with a centerline radius of less than 1000 feet (300 m) and the pavement within the superelevation transition of such curves.
2. Crest and sag vertical curves with an $L/A < 100$ where L is the length of curve in feet and A is the grade change in percent ($L/A < 30.5$ where L is the length in meters and A is the grade change in percent).

The Contractor shall determine a daily average profile index for each day's paving operation. A day's paving operation is defined as a minimum of 0.1 mile (161 m) ~~section segment~~ of pavement placed in a day. If less than 0.1 mile (161 m) ~~section segment~~ is paved, the day's production will be grouped with the next day's production. If the production of the last day of project paving is less than 0.1 mile (161 m) ~~section segment~~, it will be grouped with the previous day's production.

During the first 3 days of the paving operation, and after long shut-down periods, the pavement shall be tested and the test report furnished to the Engineer and District Materials Engineer by the end of the next day worked following the placement. On HMA pavement, the testing shall be performed as soon as the pavement has cooled sufficiently to permit testing. The Engineer and the Contractor will use the results of the initial testing to evaluate the paving methods and equipment. If the initial paving operation produces acceptable results, the Contractor may continue paving.

If the day's average profile index exceeds the values in Table 01050.03 ~~45.0 inches per mile (710 mm/km) (65.0 inches per mile (1025 mm/km) on roadways with posted speeds of 45 mph or less)~~, the paving operation will be suspended until corrective action is taken by the Contractor. When the paving is resumed, the paving operations will be evaluated with the start-up testing procedures in the preceding paragraph.

The Contractor shall make the profilogram and evaluation available to the Engineer and District Materials Engineer during the project and furnish both at the end of the project. The evaluation of the trace shall be performed according to Materials I.M. 341. The test report shall be furnished to the Engineer within 2 working days after placement of the pavement and again within 2 working days after any corrections are made.

01050.04 CORRECTIVE ACTIONS.

The pavement will be evaluated in 0.1 mile (161 m) ~~sections segments~~ using the profilograph, to determine pavement ~~sections segments~~ where corrective work or pay adjustments will be necessary. Each individual profilograph trace will be evaluated (not the average of multiple traces) to determine the areas where corrective action on 0.5 inches (12.7 mm) bumps and dips is needed.

Within each 0.1 mile (161 m) ~~section segment~~, all areas representing high points (bumps) or low points (dips) with deviations in excess of 0.5 inches (12.7 mm) in a length of 25 feet (7.6 m) or less shall be corrected by the Contractor regardless of the profile index value. Pavement ~~sections segments~~ excluded

from profile index evaluation in Article 01050.03 shall be evaluated for high points and low points with deviations in excess of 0.5 inches (12.7 mm) in a length of 25 feet (7.6 m) or less and shall be corrected by the Contractor.

Bumps and dips equal to or exceeding 0.5 inches (12.7 mm) in a length of 25 feet (7.6 m) or less shall be identified separately.

A. Roadways with a posted speed greater than 45 mph.

Any 0.1 mile (161 m) section segment, including bumps, having an initial average profile index of greater than those tolerances shown in Article 01050.03, A, shall be corrected to reduce the average profile index to those shown in the Table 01050.04 below, or replaced at the Contractor's option. On sections segments where corrections are made, the Contractor shall test the pavement to verify that corrections have met the average profile index as shown in the Table 01050.04 below.

B. Roadways with a posted speed of 45 mph, or less, and ramps.

Any 0.1 mile (161 m) section segment, including bumps, having an initial average profile index of greater than those tolerances shown in Article 01050.03, A, shall be corrected to reduce the average profile index to those shown in the Table 01050.04 below, or replaced at the Contractor's option. On sections segments where corrections are made, the Contractor shall test the pavement to verify that corrections have met the average profile index as shown in the Table 01050.04 below.

TABLE 01050.04: AVERAGE PROFILE INDEX PER 0.1 MILE (161 m) AFTER CORRECTIONS (0 inch blanking band)

Surface Type	Profile Index For greater than 45 mph	Profile Index For 45 mph or less and ramps
	Inches per mile (mm/km)	Inches per mile (mm/km)
PCC Pavement	40.0 or less (630 or less)	65.0 or less (1025 or less)
HMA Pavement	40.0 or less (630 or less)	45.0 or less (710 or less) 50.0 or less (790 or less)

C. Bridge approach sections shall be corrected according to Section 2317 of the Standard Specifications. having an initial average profile index of 65.1 inches per mile (1026 mm/km) or greater shall be corrected to reduce the profile index to 65.0 inches per mile (1025 mm/km) or less on each trace, or replaced at the Contractor's option. On sections where corrections are made, the pavement will be tested by the Contractor to verify that corrections have produced a profile index of 65.0 inches per mile (1025 mm/km) or less for each trace.

D. Corrective work shall be at the Contractor's expense except for the 16 feet (5 m) before and the 16 feet (5 m) beyond the end of the section when the Contractor is not responsible for the adjoining surface. Corrective work shall be completed prior to determining pavement thickness.

Bush hammers or other impact devices will not be permitted.

1. PCC Pavement.

On PCC pavement, corrections shall be made using an approved profiling device or by removing and replacing the pavement. The corrective methods used by the Contractor shall be applied to the full lane width. When completed, the corrected area (full lane width) shall have uniform texture and appearance, with the beginning and ending of the corrected area squared normal to centerline of the paved surface. Where surface corrections are made, transverse grooving will not be required.

2. HMA Pavement.

On HMA pavement, corrections shall be made by diamond grinding, by overlaying the area, by replacing the area, or by inlaying the area. If the surface is corrected by diamond grinding, the work and equipment shall be the same as specified for PCC pavement except that the ground surface shall be covered with a seal coat in accordance with Section 2307 of the Standard Specifications with the following modifications:

The binder bitumen may be the emulsion or cutback asphalt used for tack coat, applied at a rate of 0.10 gallon per square yard (0.7 L/m²). Hand methods may be used for spraying.

The cover aggregate shall be sand, applied at a rate of 10 pounds per square yard (5 kg/m²). Hand methods may be used may be used for spreading. The sand shall be slightly damp, but with no free moisture, as determined by visual inspection. Embedment shall be by at least one complete pneumatic roller coverage.

This seal coat is intended to be placed immediately after the diamond grinding is completed in the travel lane. The Engineer may approve this construction when road surface temperatures are below 60°F (16°C).

Labor, equipment, and materials used for this seal coat will not be paid for, but shall be considered incidental to other items.

If the surface is corrected by overlay, replacement, or inlay, the surface correction shall begin and end with a transverse saw cut normal to the pavement lane lines or edge lines within any one area. The profile of the surface must be smooth with no bumps or dips at the beginning or end of correction.

Overlay correction must be for the entire pavement width. Pavement cross slope must be maintained through the corrected areas.

E. The Engineer may perform profilograph testing on the surface for monitoring and comparison purposes. The procedure for monitoring and comparing results is in Materials I.M. 216. The Engineer will perform verification testing to validate the Contractor's certified quality control testing. If the Engineer's verification test results validate the Contractor's test results, the Contractor's results will be used for acceptance. Disputes between the Contractor's and Engineer's test results will be resolved in accordance with Materials I.M. 341. The Engineer may test the entire project length if it is determined that the Contractor certified test results are inaccurate, and the Contractor will be charged for this work at a rate of \$400.00 per mile (\$250.00 per kilometer), per profile track, with a minimum charge of \$800.00. Furnishing inaccurate tests may result in decertification of the Contractor's certified operator.

On lanes over 8.5 feet (2.6 m) in width, for through traffic which requires matching the surface of the new pavement to the surface of an existing pavement, an Average Base Index (ABI) will be determined according to Section 2316 of the Standard Specifications, calculated as shown in Materials I.M. 341; this will be the smoothness base in inches per mile (millimeters per kilometer) for payment for the new pavement unless otherwise specified. The schedule for adjusted payment for the ABI is in Article 2316.05. Should the surface of the existing pavement be specified for correction, smoothness testing for ABI calculation shall be done after correction. Surface correction is required for smoothness exceeding ABI +50 for any section for posted speeds greater than 45 mph or exceeding ABI +85 for any section for posted speeds of 45 mph or less and ramps.

01050.05 PAY ADJUSTMENTS.

Pay adjustments will be based on the initial average profile index determined for the sections segments prior to performing any corrective work. Areas excluded from the profilograph testing and bridges approaches will not be subject to price adjustments.

If the Contractor elects to remove and replace the sections segments, the Contractor will be paid the price adjustment that corresponds to the initial average profile index obtained on the pavement sections segments after replacement.

When the plans dictate that an area of pavement is to be hand finished, the area will not be subject to reduced payment. However, the area is to be profiled and corrected as necessary to meet these specifications.

A. PCC Pavement.

The payment will be adjusted as shown in the Table 01050.05A below according to the posted or proposed speed.

TABLE 01050.05A: SCHEDULE FOR ADJUSTMENT PAYMENT FOR PCC PAVEMENTS (0 inch blanking band)

Profile Index For greater than 45 mph Inches per mile (mm/km)	Profile Index For 45 mph or less and ramps Inches per mile (mm/km)	Dollars per 0.1 mi. section segment per lane	
		Interstate & Multi-Lane Divided Segments	Other Primary Segments
22.0 or less (345 or less)	25.0 or less (395 or less)	+950.00	+850.00
22.1 to 23.5 (346 to 370)		+800.00	+650.00
23.6 to 26.0 (371 to 410)	25.1 to 30.0 (396 to 475)	+600.00	+450.00
26.1 to 45.0 40.0 (411 to 710 630)	30.1 to 65.0 (476 to 1025)	0.00	0.00
40.1 to 45.0 (631 to 710)	65.1 to 70.0 (1025 to 1105)	-600.00	-450.00
45.1 or more (711 or more)	65.1 70.1 or more (1026 1105 or more)	0.00*	0.00*

* These sections segments must be corrected to the levels shown in the Table 01050.04 in Article 2316.04.

B. HMA Pavement.

The payment will be adjusted as shown in the Table 01050.05B below according to the posted or proposed speed.

TABLE 01050.05B: SCHEDULE FOR ADJUSTMENT PAYMENT FOR HMA PAVEMENTS (0 inch blanking band)

Profile Index For greater than 45 mph Inches per mile (mm/km)	Profile Index For 45 mph or less and ramps Inches per mile (mm/km)	Dollars per 0.1 mi. section segment per lane	
		Interstate & Multi-Lane Divided Segments	Other Primary Segments
10.0 or less (160 or less)		+850.00	+750.00
10.1 to 11.5 (161 to 180)	15.0 or less (235 or less)	+650.00	+500.00
11.6 to 13.5 (181 to 215)		+500.00	+350.00
13.6 to 15.5 (216 to 245)	15.1 to 20.0 (236 to 315)	+350.00	+200.00
15.6 to 40.0 35.0 (246 to 630 550)	20.1 to 45.0 (316 to 710)	0.00	0.00
35.1 to 40.0 (551 to 630)	45.1 to 50.0 (711 to 790)	-350.00	-200.00
40.1 or more (631 or more)	45.1 50.1 or more (791 or more)	0.00*	0.00*

* These sections segments must be corrected to the levels shown in the Table 01050.04 in Article 2316.04.

C. Pavements using ABI.

**SCHEDULE FOR ADJUSTMENT PAYMENT
FOR PAVEMENTS USING ABI (0 inch blanking band)**

Profile Index For greater than 45 mph	Profile Index 45 mph or less and ramps	Contract Price Adjustment
Inches per mile (mm/km)	inches per mile (mm/km)	Dollars per section*
0 to ABI	0 to ABI	0.00
ABI +.1 (1) to ABI +30.0 (470)	ABI +0.1 (1) to ABI +45.0 (710)	-300.00
ABI +30.1 (471) to ABI +40.0 (630)	ABI +45.1 (711) to ABI +65.0 (1025)	-500.00
ABI +40.1 (631) to ABI +50.0 (790)	ABI +65.1 (1026) to ABI +85.0 (1340)	-800.00

* Payment will be based on results after correction.

Section 2316. Pavement Smoothness.

2316.01 GENERAL.

Pavement smoothness shall be evaluated for all ~~Interstate and Primary~~ main line pavement surfaces, and all other road surfaces included on ~~Primary projects, except when specifically excluded by the contract documents.~~ ~~non-Primary roadways~~ unless specified in the contract documents. Main line pavement is defined as all permanent pavement for traffic lanes, including tapers to parallel lanes or through lanes at intersections, tapers to climbing lanes, and tapers to ramps and loops. Pavement smoothness shall also be evaluated for all interchange ramps and loops.

If this specification is required by contract documents on non-Primary projects let by the Department, it will be added in its entirety. Selected portions of the specification will not be deleted.

Bridge approach sections which are a part of the paving contract will be tested for smoothness according to Section 2317.

A. Smoothness Requirements.

The following shall apply to all ~~Interstate and Primary~~ projects, and to ~~non-Primary~~ projects when specified. Smoothness requirements in inches per mile (millimeters per kilometer) are listed in Schedules A and B. On lanes over 8.5 feet (2.6 m) in width, for through traffic which requires matching the surface of the new pavement to the surface of an existing old pavement, an Average Base Index (ABI) will be calculated as shown below; this will be the smoothness base in inches per mile (millimeters per kilometer) for payment for the new pavement unless otherwise specified. The requirements are shown in Schedule C.

Schedule for Identification of Pavements And Bridge Approach Sections		
<u>Pavement</u>	Schedule By Posted Speed (mph) (Existing or Proposed)	
	45 or less	Over 45
Mainline, curbed (one or both sides of roadway)	B	A
Mainline, not curbed	A	A
Ramps and Collector Distributor Roads	A ⁽³⁾	A ⁽³⁾
Loops	B	B
Side Roads	B	A
Grade Separations ⁽¹⁾	B	A
Pavement adjacent to existing pavement (added lane)	C ⁽²⁾	C ⁽²⁾

(1) Including municipal and Secondary Roads therein.

(2) $ABI = \frac{PI + X}{2}$

2

Where,

PI = the profile index of the edge line of the abutting lane. If the computed ABI is less than X, use an ABI equal to X.

X = 7 inches/mile (110 mm/km) if Schedule A, or 22 inches/mile (350 mm/km) if Schedule B.

(3) When a ramp or collector distributor road terminates at an intersection with a traffic signal or stop sign, the 700 feet (215 m) nearest the intersection will be evaluated under Schedule B.

B. Exclusions.

Areas excluded from smoothness testing are detour pavement, crossovers, shoulders, and sections less than 50 feet (15 m) long.

All excluded areas will be checked with a surface checker by the Engineer and shall not exceed 1/8 inch in 10 feet (3 mm in 3 m).

2316.02 MEASUREMENT.

The Contractor shall provide and operate an Ames or California type profilograph to determine the pavement profile produce a profilogram (profile trace) of the surface tested in accordance with Materials I.M. 341. Other types of profilographs or profilers that produce compatible results and meet the requirements of Materials I.M. 341 may be used.

When a pavement, for which smoothness is to be tested is adjacent to an existing old pavement, smoothness must also be tested on the old pavement 3 feet (1 m) from the adjacent edge for ABI calculation. Should the surface of the old pavement be specified for correction, smoothness testing for ABI calculation shall be done after correction.

All objects and foreign material on the pavement surface, including protective covers, if used, shall be removed by the Contractor prior to testing, and if appropriate, protective covers shall be properly replaced by the Contractor after testing.

A profilogram shall be made for each segment of 50 feet (15 m) or more. The profilogram shall include the 16 feet (5 m) beyond the ends of the section.

A. Pavements.

The pavement surface will be divided into sections that represent continuous placement. A section will terminate at a day's work joint (header), a bridge, similar interruption, or when continuous placement crosses to a section with a different smoothness designation. Sections longer than 778 feet or 0.147 miles (240 m) placed without interruption will be separated into segments of 0.1 mile (160 m). The terminating segment may be shorter than 0.1 mile (160 m) and greater than 250 feet (80 m) and is still considered a segment. A segment is to be in only one traffic lane. Each traffic lane will be tested and evaluated separately. Gaps in otherwise continuous sections, for temporary crossings, or similar construction sequencing, will be tested, when placed, and included in the adjacent section evaluation.

B. Bridge Approach Sections.

Bridge approach sections shall be tested with the profilograph. Each lane of each approach shall be an individual segment and shall not be considered a part of a pavement segment, section, or project. Testing shall be at the center of each traffic lane of travel.

2316.03 PROFILOGRAPH TESTING.

The Contractor shall perform testing and furnish the profilogram results to the Engineer. The testing and evaluation shall be done by a trained and certified person, and the evaluation shall be certified in accordance with Materials I.M. 341.

A. Pavements.

Each segment shall be tested and evaluated. The profile trace and index for each segment of paving shall

be furnished to the Engineer by noon of the next day worked following the placement until there has been 3 consecutive days of paving where the index for all segments would result in 100% payment or better. After 3 consecutive days of paving that qualify for at least 100% payment, the profile trace and index must be furnished to the Engineer within 48 hours after each day's run. Should any following day be evaluated to receive less than 100% payment, a trace and index shall be furnished to the Engineer by noon the following day worked for each day until there has been 3 consecutive days of 100% payment or better.

For each day's run, an evaluation shall be submitted to the Engineer within 5 working days. This evaluation submittal shall include identification of segments that may qualify for less than 100% payment, segments that may qualify for incentive payment, segments to be corrected, and the section weighted average in inches per mile (millimeter per kilometer) certified smoothness testing.

The Engineer will perform verification testing to validate the contractor's certified quality control testing. If the Engineer's verification test results validate the Contractor's test results, the Contractor's results will be used for acceptance. Disputes between the Contractor's and Engineer's test results will be resolved in accordance with Materials I.M. 341. The Engineer may test the entire project length if it is determined that the Contractor certified test results are inaccurate, and the Contractor will be charged for this work at a rate of \$400.00 per mile (\$250.00 per kilometer), per profile track, with a minimum charge of \$800.00. Furnishing inaccurate tests may result in decertification of the Contractor's certified operator.

~~The Engineer may also subject the surface to monitor testing. Any portion of the project may be tested if the Engineer determines that the Contractor certified test results are inaccurate. If they are inaccurate, the Contractor will be charged for this work at a rate of \$250 per lane per mile (\$150 per lane per kilometer), with a minimum charge of \$500. In addition, furnishing inaccurate test results could result in decertification.~~

~~B. Bridge Approach Sections.~~

~~Bridge approach sections shall be tested and evaluated.~~

2316.04 PROFILE INDEX.

A. Pavement.

A profile index shall be calculated for each segment from the profilogram in accordance with Materials I.M. 341 except for:

1. Side road connections less than 600 feet (180 m) in length.
2. Single lift pavement overlays 2 inches (50 mm) or less in thickness unless the existing surface has been corrected by milling or scarification.
3. Storage lanes and turn lanes.
4. Pavement less than 8.5 feet (2.6 m) in width.
5. The 16 feet (5 m) at the ends of the section when the Contractor is not responsible for the adjoining surface.
6. Runout tapers on HMS overlays at existing pavement, bridges, or bridge approach sections when the thickness is less than the design thickness.

If there is a segment of 250 feet or 0.047 mile (80 m) or less in length at the end of a section, the profilograph measurements for that segment shall be added to and included in the evaluation of the adjacent segment in that section.

Bumps and dips shall be separately identified on all profilograms. These appear as high or low points on the profilogram and correspond to high points (bumps) or low points (dips) on the pavement surface. They are identified by locating vertical deviations exceeding 0.5 inches for a 25 foot (13 mm for a 7.6 m) span for both bumps and dips as indicated on the profilogram.

~~B. Bridge Approach Sections.~~

~~A profile index shall be calculated for each bridge approach section in accordance with Materials I.M. 341 except for plan lengths less than 50 feet (15 m) which will be checked for bumps and dips only.~~

2316.05 SURFACE CORRECTION.

Surface correction for pavement smoothness may be required which includes bumps or dips. The correction shall be completed before the determination of pavement thickness.

Bump, dip, and smoothness correction work shall be for the full lane width of the paved surface.

All correction work shall be subject to the approval by the Engineer. After all required correction work is completed, the final profile index shall be determined.

A. Pavements.

1A. Portland Cement Concrete Pavement.

PCC pavement surface correction shall be accomplished by grinding the pavement using a diamond grinder, by PCC resurfacing, or by replacement. Grinding and texturing equipment shall meet the requirements of Section 2532, except the cutting head shall have a minimum width of 24 inches (600 mm). Surface correction shall be performed parallel to lane lines or edge lines as directed by the Engineer and each pass shall be parallel to the previous passes. The ground surface shall be of uniform texture.

Adjacent passes shall not overlap more than 1 inch (25 mm) and they shall not have a vertical difference of more than 1/8 inch (3 mm) as measured from bottom of groove to bottom of groove. Smoothness correction shall begin and end at lines normal to the pavement lane lines or edge lines within any one corrected area. The grinding shall proceed from the center line or lane line toward the pavement edge to maintain pavement cross slope.

2B. Hot Mix Asphalt Pavements.

For asphalt pavements, the surface correction shall be accomplished by diamond grinding, by overlaying the area, by replacing the area, or by inlaying the area.

If the surface is corrected by diamond grinding, the work and equipment shall be the same as specified for PCC pavement except that the ground surface shall be covered with a seal coat as described in Article 2303.03, B, 2, for a runout in accordance with Section 2307 with the following modifications.

The binder bitumen may be the same material used for tack coat, applied at a rate of 0.10 gallon per square yard (0.45 L/m²). Hand methods may be used for spraying.

The cover aggregate shall be sand, applied at a rate of 10 pounds per square yard (5 kg/m²). Hand methods may be used for spreading. The sand shall be slightly damp, but with no free moisture, as determined by visual inspection. Embedment shall be by at least one complete pneumatic roller coverage.

This seal coat is intended to be placed immediately after the diamond grinding is completed in the travel lane. This work shall be completed when the road surface temperature is above 60°F (16°C).

Labor, equipment, and materials used for this seal coat will not be paid for separately, but shall be considered incidental to the items for which correction is required.

If the surface is corrected by overlay, replacement or inlay, the surface correction shall begin and end with a transverse saw cut normal to the pavement lane lines or edge lines within any one area. Profile of surface must be smooth with no bumps or dips at beginning or end of correction. Overlay correction must be for the entire pavement width. Pavement cross slope must be maintained through the corrected areas.

B. Bridge Approach Sections.

~~Surface correction of bridge approach sections shall be accomplished by grinding or other approved methods. This work shall be as identified in Section 2532.~~

~~The area requiring correction shall be ground full lane width.~~

2316.06 BUMPS AND DIPS.

Bumps and dips, including those at headers, on all pavements for which pavement smoothness is designated shall be evaluated. Correction work will be required in accordance with the following criteria and in areas excluded from profilograph testing, for deviations exceeding 1/8 inch in 10 feet (3 mm in 3 m).

A. Bumps.

For all pavements evaluated under Schedule A, all bumps exceeding 0.5 inch (12.7

mm) within a 25 foot (7.6 m) span, as indicated on the profilogram, shall be assessed a price adjustment or be corrected at the discretion of the engineer except as stated in Article 2316.06, C. ~~On all pavements evaluated under Schedule B the bumps shall be corrected except when otherwise allowed by the Engineer and as stated in Article 2316.06, C.~~

Corrected bumps will be considered satisfactory when measurement by the profilograph shows that the bumps are 0.3 inch (8 mm) or less in a 25 foot (7.6 m) span. ~~For all bumps under Schedule B not corrected, the Contractor will be assessed a price adjustment for each bump over 0.5 inch (13 mm) except as stated in Article 2316.06, C.~~

When a lane over 8.5 feet (2.6 m) in width, for through traffic, is constructed adjacent to an existing old pavement, bump correction or price adjustment to the Contractor for a bump will not apply if a bump exists at that location in the adjacent existing old pavement.

B. Dips.

On all pavements, dips of 0.5 inch to 1.0 inch (~~43~~ 12.7 mm to 25 mm) in a 25 foot (7.6 m) span, as indicated on the profilogram, shall be assessed a price adjustment or be corrected at the discretion of the Engineer except as stated in Article 2316.06, C. ~~corrected when required by the Engineer. The Contractor will be assessed a price adjustment for dips of 0.5 inch to 1.0 inch (13 mm to 25 mm) that are not corrected except as stated in Article 2316.06, C.~~ The Contractor will be required to replace the pavement in areas with dips over 1.0 inch (25 mm). Corrected dips will be considered satisfactory when the profilogram shows the dips are less than 0.3 inch (8 mm) in a 25 foot (7.6 m) span.

When a lane over 8.5 feet (2.6 m) in width is constructed adjacent to an existing old pavement, correction of a dip or price adjustment to the Contractor for a dip will not be required if a dip exists at that location in the adjacent existing old pavement.

C. Exceptions.

When the Contractor is not responsible for the adjoining pavement, bumps and dips exceeding 0.5 inches (43 12.7 mm) located within 16 feet (5 m) either side of the end of a section will be evaluated by the Engineer. The Contractor will not be price adjusted for bumps and dips in this area. When instructed by the Engineer to repair these bumps and dips, the Contractor will be paid in accordance with Article 1109.03, B.

2316.07 SMOOTHNESS.

The smoothness of pavements will be compensated by the addition (incentive) or the subtraction (price reduction) of a determined amount for each segment of pavement to the price bid for pavement. These amounts are identified in the appropriate schedule of Article 2316.08.

A. Pavement Where Schedule A Smoothness is Required.

For the appropriate categories of highway, as shown in Schedule A, incentives for pavement smoothness will be paid for each segment of pavement with an initial index per mile (kilometer) per segment of 3.0 inches (48 mm) or less.

~~A second incentive will also be paid for each segment in a section if all segments in the section qualify for 100% payment with no grinding.~~

~~If all segments in a project qualify for 100% payment with no grinding, a third incentive will be added to the amount paid per segment.~~

For segments with an initial index of 7.1 to 10.0 inches per mile (~~140.4~~ 111mm/km to 160 mm/km), the Contractor ~~shall~~ may grind the surface to a final index of 7.0 inches per mile (110 mm/km) per segment or receive a price reduction.

For segments with an index of 10.1 inches per mile (~~160.4~~ 161mm/km) and greater, the Contractor shall grind the surface to a final index of 7.0 inches per mile (110 mm/km) or less.

B. Pavement Where Schedule B Smoothness is Required.

For all highways, incentives for pavement smoothness will be paid for each segment of pavement with an initial index of 12 inches per mile (190 mm/km) per segment or less.

For all segments with an initial index of 22.1 to 30.0 inches per mile (350 346 mm/km to 470 475 mm/km), the Contractor may grind the surface to a final index of 22.0 inches per mile (350 mm/km) per segment or receive a price reduction.

For segments with an index of 30.1 inches per mile (470.4 476mm/km) and greater, the Contractor shall grind the surface to a final index of 22.0 inches per mile (350 345mm/km) or less.

C. Pavement Adjacent to Existing Pavement.

For each segment of new pavement 8.5 feet (2.6 m) or more in width, and over 600 feet (180 m) in length, which is to be matched to the surface of an existing pavement, smoothness will be evaluated by the Average Base Index (ABI) as defined in Article 2316.01, A or B.

Surface correction is required for smoothness exceeding ABI + 12 (190) when Schedule A is required and exceeding ABI + 30 (470 475) when Schedule B is required. Payment will be based on results after correction in accordance with Schedule C.

Areas not included in the profilograph test shall be checked longitudinally with a 10 feet (3 m) straight edge and the surface shall not deviate from a straight line by more than 1/8 inch in 10 feet (3 mm in 3 m). If correction is necessary, it shall meet requirements of Article 2316.05.

D. Bridge Approach Sections.

Where Schedule A or Schedule B smoothness is required, bridge approach sections shall be constructed to an index of not greater than 22.0 inches per mile (350 mm/km). If the original surface does not meet this criteria, the surface shall be ground to an index of 22.0 inches per mile (350 mm/km) or better.

Smoothness of bridge approach sections will not be used in the calculations for incentive or price reduction of pavement segments, sections, or the project.

2316.08 SCHEDULE OF PAYMENT.

For each traffic lane of main line pavement and each traffic lane of interchange ramps and loops evaluated for smoothness, as defined in Article 2316.01, the Engineer will determine the length of each segment in miles (kilometers).

For roadways, the Contractor may receive an incentive payment or be assessed a price reduction based on the number of qualifying segments and the initial profile index.

Pavement segments excluding repair work that are subject to profilograph testing, as defined in Article 2316.04, will be considered for additional payment as a smoothness incentive or price reduction. For a segment to be qualified for incentive, there must be no grinding within that segment.

Surface correction (grinding) of bridge approach sections, and as stated in Article 2316.06, C, will not count as surface correction on adjacent pavement segments and will not detract from possible incentive payments on those segments.

Single lift pavement resurfacing 2 inches (50 mm) or more in thickness that have milling or scarification of the original pavement, shall be rated using the multi-lift schedules.

A \$900 price adjustment shall be assessed for each dip not corrected in each pavement lane under Schedule A and B except as stated in Article 2316.06, C. In addition, a \$900 price adjustment will be assessed for each bump not corrected under Schedule A and B except as stated in Article 2316.06, C. Bumps and dips not corrected will also be included in the evaluation for the segment smoothness.

The cost of certified smoothness and associated traffic control shall be incidental to the cost of the pavement.

These payments or assessments will be based on the following schedules:

A. Schedule A Smoothness Requirements.

Pavement segments which are designated for Schedule A smoothness will be evaluated for incentive or price reduction assessments as follows:

INCENTIVES FOR PAVEMENT SMOOTHNESS						
INITIAL PROFILE INDEX	SINGLE LIFT PAVEMENTS (5)			MULTI-LIFT PAVEMENTS (8)		
Inches Per Mile (mm/km) Per Segment (1)	Interstate & Multi-Lane Divided Primary (2)	All-Other Primary (3)	Non-Primary (4)	Interstate & Multi-Lane Divided Primary (6)	All-Other Primary (6)	Non-Primary (7)
	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment
0-1.0	650	550700	200300	300	200250	75125
1.1-2.0	550	450600	150250	250	150200	50 100
2.1-3.0	450	350450	100200	200	100150	2550
3.1-7.0	Unit Price	Unit Price	Unit Price	Unit Price	Unit Price	Unit Price
(0-16)	650	550700	200300	300	200250	75125
(17 6.1 -32)	550	450600	150250	250	150200	50100
(332.1 -48)	450	350450	100200	200	100150	2550
(498.1 -110)	Unit Price	Unit Price	Unit Price	Unit Price	Unit Price	Unit Price

(1) For each segment of pavement that has an initial index, within the limits listed, with no grinding, the Contractor will receive an incentive payment as shown in the tabulation for the appropriate category.

(2) If all segments in a section of pavement in this category qualify for 100% payment with no grinding, the qualifying incentive payment will be increased by \$100 per segment for each.

(3) If all segments in a section of pavement in this category qualify for 100% payment with no grinding, the qualifying incentive payment will be increased by \$75 per segment for each segment in the section.

(4) If all segments in a section of pavement in this category qualify for 100% payment with no grinding, the qualifying incentive payment will be increased by \$50 per segment for each segment in the section.

(5) If all segments in a project qualify for 100% payment with no grinding, the qualifying incentive payment as indicated in notes (2), (3), and (4) will be increased by \$50 per segment for each segment in the project.

(6) If all segments in a section of pavement in this category qualify for 100% payment with no grinding, the qualifying incentive payment will be increased by \$25 per segment for each segment in the section.

(7) If all segments in a section of pavement in this category qualify for 100% payment with no grinding, the qualifying incentive payment will be increased by \$10 per segment for each segment in the section.

(8) If all segments in a project qualify for 100% payment with no grinding, the qualifying incentive payment as indicated in notes (6) and (7) will be increased by \$25 per segment for each segment in the project.

PRICE REDUCTION FOR PAVEMENT SMOOTHNESS						
Initial Profile Index	Single Lift Pavements			Multi-Lift Pavements		
Inches Per Mile (mm/km) Per Segment	Interstate & Multi-Lane Divided	All Other Primary	Non-Primary	Interstate & Multi-Lane Divided	All Other Primary	Non-Primary
	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment	Dollars Per Segment
3.1-7.0 7.1-10.0 ⁽¹⁾ 10.1 & Over ⁽²¹⁾	Unit Price Grind or 300 Grind Only	Unit Price Grind or 200 Grind Only	Unit Price Grind or 100 Grind Only	Unit Price Grind or 150 Grind Only	Unit Price Grind or 100 Grind Only	Unit Price Grind or 50 Grind Only
(48.1 - 110) (1110 - 160) ⁽¹⁾ (160.1 & Over) ⁽²¹⁾	Unit Price Grind or 300 Grind Only	Unit Price Grind or 200 Grind Only	Unit Price Grind or 100 Grind Only	Unit Price Grind or 150 Grind Only	Unit Price Grind or 100 Grind Only	Unit Price Grind or 50 Grind Only

(1) For segments with an initial index of 7.1 to 10.0 (110.1 to 160), the Contractor may grind the surface to a final index of 7.0 (110) or better or accept a price reduction for each segment of pavement in non-compliance equal to the amount shown for the appropriate category.

(21) For segments with an initial index of 10.1 (160.1 161) and over, the Contractor shall grind the surface to a final index of 7.0 (110) or better. In lieu of grinding the surface to a final index of 7.0 (110) or better, the Contractor may elect to replace part or all of the segment.

B. Schedule B Smoothness Requirements.

Pavement segments for which Schedule B smoothness is designated and which is indexed in segments greater than 50 feet (15 m), will be evaluated for incentive or price reduction as follows.

For individual segments shorter than 50 feet (15 m), properly corrected if required, no price reduction assessment will be made.

INCENTIVES FOR PAVEMENT SMOOTHNESS		
Initial Profile Index	New Pavements	Resurfaced Pavements
Inches Per Mile (mm/km) Per Segment ⁽¹⁾	Dollars Per Segment	Dollars Per Segment
0 - 4.0 (0 - 650)	600	300
4.1 - 8.0 (65.4 - 130)	500	250
8.1 - 12.0 (130.1 - 190)	400	200
12.1 - 22.0 (190.1 - 3450)	Unit Price	Unit Price

(1) For each segment of pavement that has an initial index, within the limits listed, with no grinding, the Contractor will receive an incentive payment as shown in the tabulation for the appropriate category.

PRICE REDUCTION FOR PAVEMENT SMOOTHNESS

Per Segment Index	New Pavements	Resurfaced Pavements
Inches Per Mile (mm/km) Per Segment	Dollars Per Segment	Dollars Per Segment
12.1 - 22.0 (190.1 - 3450) 22.1 - 30.0 ⁽¹⁾ (34650.1 - 4750) 30.1 & over ⁽²⁾ (4760.1 & over)	Unit Price Grind or 500 Grind Only	Unit Price Grind or 250 Grind Only

(1) For segments with an initial index of 22.1 to 30.0 (350.1 to 470), the Contractor may grind the surface to a final index of 22.0 (350) or better or accept a price reduction for each segment of pavement in non-compliance equal to the amount shown for the appropriate category.

(2) For segments with an initial index of 30.1 (470.1) and over, the Contractor shall grind the surface to a finish index of 22.0 (350) or better. In lieu of accepting a price reduction and grinding the surface to a final index of 22.0 (350) or better the Contractor may elect to replace part or all of the segment.

C. Pavement Adjacent To Existing Pavement.

For new pavement which has been matched to an existing old pavement for which an Average Base Index (ABI) was calculated, the pavement will be evaluated for a price reduction for each segment based on Schedule A or Schedule B payment.

SCHEDULE C		
INITIAL PROFILE INDEX or PROFILE INDEX AFTER CORRECTION		
(Schedule A) Inches Per Mile (mm/km) Per Segment	(Schedule B) Inches Per Mile (mm/km) Per Segment	Dollars Per Segment
0 to ABI	0 to ABI	0
ABI + 0.1 (0.1) to ABI +4 (65) incl.	ABI + 0.1 (0.1) to ABI + 10 (160) incl.	300
ABI + 4.1 (665.1) to ABI +8.0 (130) incl.	ABI + 10.1 (160.1) to ABI + 20 (315) incl.	500
ABI + 8.1 (130.1) to ABI +12 (190) incl.	ABI + 20.1 (3165.1) to ABI + 30 (4750) incl.	800
Greater than ABI + 12 (190)	Greater than ABI + 30 (470)	Grind Only

D. Bridge Approach Sections.

Bridge approach sections shall be corrected for smoothness as specified in Article 2316.07, in lieu of a price reduction Section 2317.



Iowa Department of Transportation

SUPPLEMENTAL SPECIFICATIONS FOR SMOOTHNESS OF BRIDGE DECKS AND BRIDGE DECK OVERLAYS

Effective Date
December 18, 2007

THE STANDARD SPECIFICATIONS, SERIES 2001, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SUPPLEMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

Replace Section 2317 of the Standard Specifications with the following:

01054.01 GENERAL.

Smoothness shall be evaluated for all Interstate and Primary bridge decks, new approaches and bridge deck overlays, and overlaid approaches except when specifically excluded by the contract documents. Smoothness shall also be evaluated for all non-Primary bridge decks, new approaches and bridge deck overlays, and overlaid approaches for projects where the Department is the Contracting Authority, except when specifically excluded by the contract documents.

If this specification is required by contract documents on non-Primary projects let by the Department, it will be added in its entirety. Selected portions of the specification will not be deleted.

01054.02 EQUIPMENT.

The Contractor shall provide and operate an Ames type or California type profilograph to produce a profilogram (profile trace) of the surface tested in accordance with Materials I.M. 341. Other types of profilographs or profilers that produce compatible results and meet the requirements of Materials I.M. 341 may be used.

01054.03 PROFILOGRAPH TESTING.

The Contractor shall remove all objects and foreign material from the deck surface, including protective covers, if used, prior to testing by the Engineer. If appropriate, properly replace protective covers after testing.

A profilogram will be made by a test in each wheel path of each traffic lane. The profilogram will include a minimum of 16 feet (5 m) beyond the bridge section when there is adjoining pavement. Bridge decks and bridge deck overlays will be treated as one section. The profilogram will include a minimum of 100 feet (30 m) beyond the approach section when there is adjoining pavement.

For bridge lengths of 778 feet (240 m) or less, each traffic lane shall be a segment. For bridges longer than 778 feet (240 m), a segment shall be 0.1 miles (160 m) of the traffic lane. If the remaining segment is 250 feet (80 m) or less in length, it shall be included in the adjacent bridge segment. If the remaining

segment is more than 250 feet (80 m) in length, it shall be evaluated on its own. When bridge deck overlay expansion joints are not new or replaced, segments shall begin and end at the expansion joints.

Each bridge approach lane shall be a separate segment.

The Contractor shall perform quality control testing and furnish the profilogram results to the Engineer. The testing and evaluation shall be done by a trained and certified person, and the evaluation shall be certified in accordance with Materials I.M. 341.

01054.04 PROFILE INDEX.

An average profile index shall be calculated for each segment from the two wheel path profilograms in accordance with Materials I.M. 341 except for:

1. Bridge decks or bridge deck overlays less than 100 feet (30 m) in length.
2. New bridge approach sections or bridge approach overlays less than 100 feet (30 m) in length.
3. Bridge decks for new concrete slab bridges.
4. The 16 feet (5 m) at the ends of the section.
5. The 16 feet (5 m) on each side of the expansion joints that are not new or replaced.

Limits for average profile index per 0.1 mile (160 m) segment shall be as follows:

New Bridge Deck	less than 22.1 inches/mile (351 mm/km)
Bridge Deck Overlay	less than 15.1 inches/mile (241 mm/km)
Bridge Approach (New or Overlaid)	less than 22.1 inches/mile (351 mm/km)

The Engineer will perform verification testing to validate the Contractor's certified quality control testing. If the Engineer's verification test results validate the Contractor's test results, the Contractor's results will be used for acceptance. Disputes between the Contractor's and Engineer's test results will be resolved in accordance with Materials I.M. 341. The Engineer may test the entire project length if it is determined that the Contractor's certified test results are inaccurate, and the Contractor will be charged for this work at a rate of \$500 per bridge deck. In addition, providing inaccurate test results may result in decertification.

If the placements are less than 100 feet (30 m), each lane shall be tested and evaluated. The Contractor shall provide the Engineer with the final trace and index and the final evaluation within 14 calendar days of the completion of the deck.

On deck placements of 100 feet (30 m) and greater, the Contractor shall provide the Engineer with the initial profile trace and index for each lane by noon of the fifth working day following each of the first two placements. On subsequent placements, the Contractor shall provide the Engineer with the trace and index following every third placement until completion of the deck. On single-pour bridges, the Contractor shall provide the Engineer with the final profile trace and index and the final evaluation within 2 weeks of the completion of the deck.

01054.05 SURFACE CORRECTION.

Surface correction work shall be for the full segment width of the paved surface.

All correction work shall be subject to the approval by the Engineer. After all required correction work is completed, the final profile index shall be determined.

Surface correction shall be accomplished by grinding or by other methods approved by the Engineer. This work shall be as identified in Section 2532 of the Standard Specifications, except the cutting head shall have a minimum width of 24 inches (600 mm). Surface correction shall be performed parallel to lane lines or edge lines as directed by the Engineer and each pass shall be parallel to the previous passes. The ground surface shall be of uniform texture.

Adjacent passes shall not overlap more than 1 inch (25 mm) and they shall not have a vertical difference of more than 1/8 inch (3 mm) as measured from bottom of groove to bottom of groove. Smoothness correction shall begin and end at lines normal to the lane lines or edge lines within any one corrected area. The grinding shall proceed from the center line or lane line toward the edge to maintain cross slope.

Cross slope must be maintained throughout the corrected area.

Corrective grinding shall be done before longitudinal grooving.

01054.06 BUMPS AND DIPS.

Bumps and dips, including those at headers, on all surfaces for which smoothness is designated will be evaluated. Correction work will be required in accordance with the following criteria. Areas excluded from profilograph testing shall be corrected for deviations exceeding 1/8 inch in 10 feet (3 mm in 3 m).

A. Bumps.

All bumps exceeding 0.5 inch (12.7 mm) within a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected except as stated in Article 01054.06, C.

Corrected bumps will be considered satisfactory when measurement by the profilograph shows that the bumps are 0.3 inch (8 mm) or less in a 25 foot (7.6 m) span.

B. Dips.

All dips exceeding 0.5 inch (12.7 mm) in a 25 foot (7.6 m) span, as indicated on the profilogram, shall be corrected only when required by the Engineer except as stated in Article 01054.06, C. The Contractor will be assessed a price adjustment of \$900 for each dip exceeding 0.5 inch (12.7 mm) that is not corrected except as stated in Article 01054.06, C. A dip in both wheel paths at a lane location will be considered a single dip when assessing a price adjustment. Corrected dips will be considered satisfactory when the profilogram shows the dips are less than 0.3 inch (8 mm) in a 25 foot (7.6 m) span.

C. Exceptions.

When the Contractor is not responsible for the adjoining surface, bumps and dips exceeding 0.5 inches (12.7 mm) located within 16 feet (5 m) either side of the end of a section will be evaluated by the Engineer. The Contractor will not receive a price adjustment for bumps and dips in this area. When instructed by the Engineer, the Contractor will be paid to repair these bumps and dips in accordance with Article 1109.03, B.

01054.07 SCHEDULE OF PAYMENT.

The cost of certified profilograph testing and associated traffic control shall be incidental to the contract unit price for the item for which the testing is required.

A. Incentives.

New bridge decks or bridge deck overlays which are designated for smoothness shall be evaluated for incentives using the initial profile index and the number of segments on the bridge.

For each segment of a bridge to be qualified for an incentive payment, the profilogram for that segment before correction must meet the specification requirement so there is no price reduction.

For each segment of the bridge deck or bridge deck overlay, the incentive index is 12.0 inches per mile (190 mm/km) for new bridge decks, and 4.0 inches per mile (65 mm/km) for bridge deck overlays. The incentive payment will be in accordance with the following schedule:

INCENTIVES

NEW BRIDGE DECKS		BRIDGE DECK OVERLAYS	
Initial Profile Index Inches Per Mile (mm/km) Per Segment	Dollars Per Segment	Initial Profile Index Inches Per Mile (mm/km) Per Segment	Dollars Per Segment
0- 6.0 (0-95)	6000	0- 2.0 (0-32)	2000
6.1-12.0 (96-190)	3000	2.1-4.0 (33-65)	1000
12.1-22.0 (191-350)	Unit Price	4.1-15.0 (66-240)	Unit Price

B. Price Reduction.

New bridge decks or bridge overlays which are designated for smoothness shall be evaluated for price reduction assessment using the final profile index and the number of segments.

The Contractor may grind the surface of the bridge deck to a final index of 22.0 inches per mile (350 mm/km) or less, or the surface of a bridge deck overlay to a final index of 15.0 inches per mile (240 mm/km) in lieu of a price reduction.

For each segment of bridge deck with a final index of 22.1 inches per mile (351 mm/km) or greater or bridge deck overlay with a final index of 15.1 inches per mile (241 mm/km) or greater, the contractor shall accept a price reduction in accordance with the following schedule:

PRICE REDUCTION

NEW BRIDGE DECKS		BRIDGE DECK OVERLAYS	
Initial Profile Index Inches Per Mile (mm/km) Per Segment	Dollars Per Segment	Initial Profile Index Inches Per Mile (mm/km) Per Segment	Dollars Per Segment
22.1-30.0 (351-470)	2000	15.1-20.0 (241-315)	1000
30.1-35.0 (471-550)	4000	20.1-25.0 (316-390)	2000
35.1-40.0 (551-630)	6000	25.1-30.0 (391-470)	3000
over 40.0 (over 630)	*	over 30.0 (over 470)	*
* Correction shall be required to an index of 15.0 inches per mile (240 mm/km) for overlays and to an index of 22.0 inches per mile (350 mm/km) for new decks.			

C. Bridge Approach Sections and Overlay of Bridge Approach Sections.

Bridge approach sections and overlay of bridge approach sections shall be corrected for smoothness as specified in Article 01054.05 in lieu of a price reduction.

**IOWA DEPARTMENT OF TRANSPORTATION
DISTRICT 1 MATERIALS
7.6 METER CALIFORNIA PROFILOGRAPH**

Revised Report
Changes Lab No.: _____

For Information Only: Preliminary: Intermediate: Final:

Lab No.: 1PR2-019 Route No.: HWY 316 Project No.:

Date Reported: 8/7/02 Date Paved: 7/22/02 County: POLK

Test at: 1/4 Point Wheel Track Contractor:

Tested By: BRINKMAN Date: 7/26/02

Trace Reduced By: PROSCAN Date: 7/29/02

- | | | |
|--|---|---|
| <input checked="" type="checkbox"/> Primary Schedule A | <input type="checkbox"/> PCC Slip Form | <input type="checkbox"/> ACC Paving |
| <input type="checkbox"/> Primary Schedule B | <input type="checkbox"/> PCC Fixed Form | <input checked="" type="checkbox"/> ACC Resurfacing |
| <input type="checkbox"/> Secondary | <input type="checkbox"/> PCC Bonded Overlay | <input type="checkbox"/> ACC Patches |
| <input type="checkbox"/> Municipal | <input type="checkbox"/> PCC Unbonded Overlay | |
| <input type="checkbox"/> Other | <input type="checkbox"/> PCC Patches | |

Roadway Type: 2-lane 4-lane Ramp Other

Northbound Eastbound Southbound Westbound
 Inside Lane Outside Lane
 ← Direction → (4-Lane Only)

Length km (Miles)	Measured Roughness mm (Inches)	Profile Index Mm/km (Inches/Miles)	Location (Station)	Length km (Miles)	Measured Roughness mm (Inches)	Profile Index mm/km (Inches/Mile)
			360+66	0.1mi	0.4 in	
				0.1	0.15	
				0.1	0.3	
				0.1	0.05	
			to	0.1	0.20	
				0.1	0.05	
				0.1	0.05	
				0.1	0.45	
			314+50	0.087	0.8	
				0.887 miles	2.45 inches	

Contractor Lab #	Contractor Results	DOT Results	Difference	I.M. 216 Tolerance
				±

Station ← 12.7 mm (1/2") Bump Locations → Station
 or
 12.7 mm (1/2") Dip Locations

Copies: DISTRICT 1 Materials (Project File-original)
Central Materials

John H. Vu

**IOWA DEPARTMENT OF TRANSPORTATION
DISTRICT 1 MATERIALS
7.6 METER CALIFORNIA PROFILOGRAPH**

Revised Report
Changes Lab No.: _____

For Information Only: Preliminary: Intermediate: Final:

Lab No.: 1PR2-039 Route No.: HWY 30 Project No.:

Date Reported: 12/5/02 Date Paved: 9/03/02 County:

Test at: 1/4 Point Wheel Track Contractor: Cedar Valley Corp.

Tested By: Brinkman/ Burr Date:

Trace Reduced By: Proscan Date: 12/05/02

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Primary Schedule A | <input checked="" type="checkbox"/> PCC Slip Form | <input type="checkbox"/> ACC Paving |
| <input type="checkbox"/> Primary Schedule B | <input type="checkbox"/> PCC Fixed Form | <input type="checkbox"/> ACC Resurfacing |
| <input type="checkbox"/> Secondary | <input type="checkbox"/> PCC Bonded Overlay | <input type="checkbox"/> ACC Patches |
| <input type="checkbox"/> Municipal | <input type="checkbox"/> PCC Unbonded Overlay | |
| <input type="checkbox"/> Other | <input type="checkbox"/> PCC Patches | |

Roadway Type: 2-lane 4-lane Ramp Other

Northbound Eastbound Southbound Westbound
 Inside Lane Outside Lane

← Direction →
(4-Lane Only)

Length km (Miles)	Measured Roughness mm (Inches)	Profile Index Mm/km (Inches/Miles)	Location (Station)	Length km (Miles)	Measured Roughness mm (Inches)	Profile Index mm/km (Inches/Mile)
			4127+14	0.100 mi	0.10 in	
			to	0.100 mi	0.10 in	
			4134+31	0.100 mi	0.00 in	
				0.142 mi	0.45 in	
				<u>0.442 mi</u>	<u>0.65 in</u>	

Contractor Lab #	Contractor Results	DOT Results	Difference	I.M. 216 Tolerance
				±

Station none ← 12.7 mm (1/2") Bump Locations → Station none
 or
 12.7 mm (1/2") Dip Locations

Copies: DISTRICT 1 Materials (Project File-original)
 Central Materials
 Jeff Brinkman (2)

 John Hart
 District 1 Materials Engineer

**PAVEMENT TEST REPORT
 25-FOOT CALIFORNIA PROFILOGRAPH**

For Information Only
 Preliminary
 Intermediate
 Final

Lab No. _____ Route No. _____ Project No. _____
 Date Reported _____ Date Paved _____ County _____
 Contractor _____
 Tested By _____ Date _____
 Trace Reduced By _____ Date _____

Primary Schedule A Tested at
 bridge deck overlay Blanking Bar

Roadway Type:
 2-Lane
 4-Lane
 Ramp
 Other _____

Inside Lane
 Direction (4-Lane Only)
 Outside Lane

Wheel Track Inside Measured				Direction (4-Lane Only)			Wheel Track Outside Measured		Index Averag Incent./ (In./Mi.) Deduct
Length (Miles)	Roughness (Inches)	Profile Index (Inches/Mile)	Location (Station)	Length (Miles)	Roughness (Inches)	Profile Index (Inches/Mile)			
0.100	0.30	_____	0+00	0.100	0.20	_____	_____		
0.100	0.15	_____		0.100	0.65	_____	_____		
0.078	0.20	_____		0.077	0.40	_____	_____		

AVG = _____

Station 1/2" Bump Locations Station

Copies:
 Special Investigations, Ames
 District Materials Engineer
 Resident Construction Engineer

**Iowa Department of Transportation
Technical Training and Certification Program**

COURSE EVALUATION SHEET

In an effort to improve the Iowa DOT Technical Training and Certification Program, we ask that you fill out this evaluation form after you have taken the exam. Thank you for your cooperation.

Course: _____

Location: _____

Instructor: _____

1. What type of agency are you employed by?

2. Please rate the following portion of the course on a scale of 1-5. 1 = Poor, 5 = Excellent

Facility: _____

Material: _____

Instructors: _____

Course Activities: _____
(lectures, videos, demonstrations, etc.)

3. Are there any changes you would like to see made in the course?

REMARKS:

STATE LIBRARY OF IOWA



3 1723 02092 7760