

PORTLAND CEMENT CONCRETE LEVEL II INSTRUCTION MANUAL

2025-2026









TECHNICAL TRAINING AND CERTIFICATION PROGRAM

TABLE OF CONTENTS

1. Glossary	1-1
References	1-3
Rounding and Decimals	1-5
2. Introduction	2-1
3. Certification Program	
Requirements	3-1
Certifications	3-1
Performance Requirements	3-2
Responsibilities	3-2
Unsatisfactory Performance Notice	3-3
Federal Code 1020	3-4
Certified Plant Inspection	3-6
4. Materials	
Cement	4-1
Fly Ash	4-2
GGBFS	4-3
Aggregates	4-4
Water	4-5
Chemical Admixtures	4-5
Concrete Mixes	4-7
MAPLE User's Guide	4-1
	7.
5. Proportions	
Proportions	5-1
Mineral Admixture Substitution	5-9
6. Moistures	
Moisture Corrections	6-1
Water/Cement Ratio	6-7
7. Sampling & Testing	
Aggregates	7-1
Test Frequency	7-3
Aggregate Gradation Table	7-7

Safety Equipment . Material Checklist	Inspection ant Inspection	8-1 8-1 8-2 8-5 8-7 8-9
Transit Mixe Ready Mix T Yield	r Condition	9-2 9-3 9-5 9-12 9-19
10. Solutions		CH 10
11. IM 213	Technical Training & Certification Program	
12. IM 401	Inspection and Acceptance of Portland Cemen	t
13. IM 403	Inspection and Acceptance of Admixtures	
14. IM 491.14	Inspection and Acceptance of Slag for Use in F	CC
15. IM 491.17	Inspection and Acceptance of Fly Ash	
16. IM 527	Paving Plant Inspection	
17. IM 528	Structural Concrete Plant Inspection	
18. IM 529	Portland Cement Concrete Proportions	
19. IM 535	PCC Plant Monitor	
20. IM T-203	General Aggregate Source Information	

TECHNICAL TRAINING AND CERTIFICATION PROGRAM CONTACT INFORMATION

CONTACT PERSON Brian Squier - TTCP Coordinator	ADDRESS Technical Training & Certification	PHONE # 515-233-7915
brian.squier@iowadot.us	Program and District 1 Materials Construction and Materials Bureau	313-233-7913
Hope Arthur - TTCP Coordinator hope.arthur@iowadot.us	800 Lincoln Way Ames, Iowa 50010	515-509-8302
Jon Kleven jon.kleven@iowadot.us	District 2 Materials 428 43rd Street SW Mason City, Iowa 50401	641-422-9428
Alex Crosgrove alex.crosgrove@iowadot.us	District 3 Materials 6409 Gordon Drive Sioux City, Iowa 51106	712-239-4713
Mike Magers michael.magers@iowadot.us	District 4 Materials 2310 E. Seventh St. Atlantic, Iowa 50022	712-243-7649
Helen Bailey helen.bailey@iowadot.us	District 5 Materials 205 E. 227th St. Fairfield, Iowa 52556	319-759-5408
Tammy Siebert tammy.siebert@iowadot.us	District 6 Materials 5455 Kirkwood Blvd. SW Cedar Rapids, Iowa 52404	319-730-1501

Des Moines Area Community College (DMACC)

Boone Campus 1125 Hancock Drive Boone, Iowa 50036

Dawn Walker 515-433-5232 dmwalker2@dmacc.edu

or

Gregg Durbin 515-433-5058 gsdurbin@dmacc.edu

DOT CONTACT INFORMATION

Wesley Musgrove	Construction & Materials Bureau Director	515-239-1843
John Hart	Bituminous Materials Engineer	515-239-1547
Brian Johnson	Bituminous Field Engineer	515-290-3256
Bob Dawson	Chief Geologist	515-239-1339
Kevin Merryman	Contract Administration Engineer	515-239-1848
Melissa Serio	Earthwork Engineer	515-239-1280
Cedric Wilkinson	E-Construction Program Administrator	563-391-2750
Jennifer Strunk	FieldManager/FieldBook/Doc Express	641-344-0044
Desiree McClain	Foundations Field Engineer	515-233-7906
Jeff DeVries	Materials Testing Engineer	515-239-1237
Chris Brakke	Pavement Design Engineer	515-239-1882
Todd Hanson	PCC Materials Engineer	515-239-1226
Elijah Gansen	PCC Field Engineer	515-233-7865
Mahbub Khoda	Prestressed & Precast Concrete Engineer	515-239-1649
Kyle Frame	Structures Group Engineer	515-239-1619
Curtis Carter	Senior Structures Field Engineer	515-239-1185
Jesse Peterson	Structures Field Engineer	515-239-1159
Brian Worrel	Traffic Safety Engineer	515-239-1471
Mike Lauritsen	District 1 Materials Engineer	515-357-4350
Barry Thede	District 2 Materials Engineer	641-423-8516
Mark Sadler	District 3 Materials Engineer	712-251-0808
Timothy Hensley	District 4 Materials Engineer	712-243-7629
Allen Karimpour	District 5 Materials Engineer	515-815-1405
Shane Neuhaus	District 6 Materials Engineer	319-366-0446

ORGANIZATIONS CONTACT INFORMATION

Asphalt Paving Association of Iowa 1606 Golden Aspen Drive Suite 102 Ames, IA 50010 Mike Kvach 515-450-8166 www.apai.net

Iowa Concrete Paving Association 360 SE Delaware Ave. Ankeny, IA 50021 Greg Mulder 515-963-0606 www.concretestate.org Iowa Limestone Producers Association 4438 114th St Urbandale, IA 50322 Randy Olson 515-262-8668 www.limestone.org

Iowa Ready Mix Concrete Association 380 SE Delaware Ave. Ankeny, IA 50021 Greg Mulder 515-963-0606 www.iowareadymix.org

Iowa Prestress Association Dennis Drews 402-291-0733

Chapter 1 GLOSSARY

LEVEL II PCC GLOSSARY

Absolute Volume - Space occupied by materials in a cubic yard of concrete.

Absorption – The condition of an aggregate when all of the aggregate's pores are not full so it can absorb water.

Accelerator – A chemical admixture used to speed up the set of cement in a concrete mixture.

Aggregate – Sand, rock, or gravel used as a portion of a concrete mixture.

Air – A chemical admixture used in concrete to produce air voids.

Batch – One cubic yard of concrete. When on a project you may hear someone reference a batch of concrete as the total cubic yards of concrete being mixed at one time but for this training a batch of concrete is considered one cubic yard.

BATCH WEIGHTS

SSD (Dry) Batch Weights – The weights of the aggregate, cementitous materials, and water calculated from the absolute volumes and specific gravities before the aggregate weights are adjusted for moisture content.

Adjusted (Wet) Batch Weights – The weights of the ingredients of a batch of concrete after the aggregate weights have been adjusted for moisture.

Cement – The fine gray powder that holds aggregates together in a concrete mixture.

Chemical Admixture – A chemical (air, water reducer, etc.) that is added to concrete to produce varying results on the concrete.

Concrete – A mass of sand and rock bound together by cementitous materials.

Fly Ash – A common mineral admixture used in concrete mixtures. Fly ash is a byproduct of the burning of finely ground coal in electricity generating power plants. The two types of fly ash are Type C (cementitous) or Type F (non-cementitous).

Free Moisture – The excess water on an aggregate after the aggregate is completely saturated.

Ground Granulated Blast Furnace Slag (GGBFS) – A mineral admixture that is a byproduct of steel production. GGBFS is made from slag floating on top of an iron blast furnace.

Instructional Memorandum (IM) – Four volumes of manuals issued by the lowa DOT Materials Department containing specifications on material's inspection and testing.

Load – The total amount of concrete being batched out.

Lot System – The system used in the decision of when to sample materials i.e., in a paving plant a lot is one day's run.

Pozzolan – A finely divided, siliceous or aluminosiliceous material that reacts with water and calcium hydroxide released by Portland cement hydration to form cementing compounds.

Retarder – A chemical admixture used to delay the set of cement in a concrete mixture.

Saturated Surface Dry (SSD) – The condition of an aggregate when it contains all the water it can hold but has no moisture on the surface.

Specific Gravity – The ratio of the density of water to the density of a material.

Water to Cement Ratio (W/C) – The ratio of the amount of water in a batch of concrete to the amount of cement. Maximum W/C is the highest ratio of water and cement that can be used in concrete and still be within specification.

Water Reducer – A chemical admixture used in concrete to reduce the amount of water required to produce slump which allows the lowering of the amount of cement required.

References

Instructional Memorandums

- Volume II
- Volume IV

Specifications

- Article 2301 Portland Cement Concrete Pavement
- Article 2403 Structural Concrete
- Article 4100 General Provisions
- Article 2001 General Equipment Requirements

General Supplemental Specifications

• GS-23005 -October 2025

Supplemental Specification (SS) or Special Provisions (SP)

Applied to specific projects, QMC

Construction Manual

- 3.07 Monitoring Program
- 9.00 Portland Cement Concrete Pavement
- 11.50 Concrete

Contract Documents

Proposals

ROUNDING & DECIMALS

Rounding is uniform throughout the certification training. You would look at the place to the right of the number you are rounding to and if it is 5 or above round up or 4 and below it remains the same.

Examples:

Rounding to whole numbers-

Rounding to tenths-

Rounding to hundredths-

Rounding to thousandths-

There are many equations used in Level II PCC to obtain percentages, weights, ratios, etc. The answers to these equations are expressed with the decimals in different locations.

The following is a listing of how many places to round each answer.

Specific Gravity – hundredths – 2.62 2.77

Moisture – tenths – 2.7 0.6

Air – tenths – 6.5 5.8

Slump - $\frac{1}{4}$ inch - $\frac{3}{2}$ 2 $\frac{3}{4}$

Beam size - hundredths - 5.95 6.00 6.05

Absolute Volumes – thousandths - .082 .334

Water Cement Ratio (W/C) – thousandths - .480 .468

Cement Yield – tenths – 99.7 100.3

Pounds (lbs) – whole - 1450 385

Gallon (gal) – whole - 28 34

Cement Tons - hundredths - 117.0 54.50

Cubic Yards – hundredths – 117.00 54.50

(Concrete is batched in ¼ cubic yard increments)

There will be given numbers that are used in calculations that may be rounded differently than shown above. When given a number for use in a calculation, use the number in the form required. For example: 8.33 lbs./gal; 62.4 lbs. = unit weight of water, etc.

Caution: Consult the applicable specifications for required air content and slump before using this chart.

	Type of		Slump (in.)		•	% Air Content	Ħ	Specification	
Paving	Concrete	Min.	Target	Мах.	Min.	Target	Max	Reference	
Slip form	A, C, QMC				9	8	10	2301.02 B, 2122	122
Non-slip form	A, C, QMC	0.5		5	5.5	7	8.5	2301.02 B	
Concrete Base (Non-slip form)	A, C	0.5		2	5.5	7	8.5	2301.02 & 2201 & 2122	201 & 2122
Curb and gutter (slip form)	C				9	8	10	2512.02 & 2301.02	301.02
Curb and gutter (Non-slip form)	Э	0.5		5	5.5	7	8.5	2512.02 & 2301.02	301.02
Sidewalk	Э			5	5.5	7	8.5	2511.02 & 2301.02	301.02
Intakes and manholes	Э			5	5.5	6.5	8.5	2403.02	
Repair									
Patches with or without CaCl ₂	Σ	1	33	4	2	6.5	8.5	2530.02 B & 2529.02 B	2529.02 B
		Н	4	2					
		(w)	(when WR is used)	d)					
Underseal and grouting, flowing mortar		ш	By Flow Cone					2539.02 B & 2506	2506
Overlays									
Unbonded, white topping Bonded	C, QMC	same as	same as specified concrete	ncrete				2310.02	
Lighting &									
Highway Signing									

2403.02 A & B

8.5

Foundation

Caution: Consult the applicable specifications for required air content and slump before using this chart.

	Type of		Slump (in.)			8	% Air Content		Ś	Specification
Structures	Concrete	Min.	Target	Max.	2	Min.	Target	Max	Ž	Reference
Seal Coat	×	0		8					77	2405.02 D
Stricture & Supply	J				в,	5.5	6.5	8.5	,۲	0 % V CO COVC
Sub-structure & super-structure) Jan	1	4	2	<u> </u>	5.5	7.5	9.5	, ,	2403.02 A & D
(Decks - Tetalael Tegallea)) L				(whe	n placed	(when placed by pumping/belting)	g/belting)	77	412.02
Slope Protection	C	1		3	3	5.5	6.5	8.5	0	On the Plan Sheet
Piling encased & Pipe Pile Filling	U	П	4	5		5.5	6.5	8.5	57	2403 - 2501.03 E & F
	0	0	0.75	1			L	L	77	2413.02 D.1
Bridge Deck Overlay	HPC	1	4	5	'	ი.c —	ი.ი	х. С.	77	2413.02 D.2
Bridge Deck - Class B Repair	C	1		3	ш)	5.5	6.5	8.5	27	2403.02 B, 2412 (2413.03 D)
										2513.03 A
Barrier Rail - Cast in place	U	Н	4	2		9	7	8.5	57	2403
Barrier Rail - Slipform (fibers)	BR	-	-	-		9	7	8.5	5	2414.02
Drilled Shafts (retarder required)	Q	6.5	8	9.5	Sar	ne as stı	Same as structural concrete.	oncrete.	2,7	2433.02 2403
Guardrail										
End anchors	O	1	4	5		4		7	22	2403.02 & 2505.03 B

|--|

Caution: Consult the applicable specifications for required air content and slump before using this chart.

	Type of		Slump (in.)			% Air Content	¥	Specification
Paving	Concrete	Min.	Target	Max.	Min.	Target	Max	Reference
Slip form	A, C, QMC				9	8	10	2301.02 B, 2122
Non-slip form	A, C, QMC	0.5		2	5.5	7	8.5	2301.02 B
Concrete Base (Non-slip form)	A, C	0.5		2	5.5	7	8.5	2301.02 & 2201 & 2122
Curb and gutter (slip form)	Э				9	8	10	2512.02 & 2301.02
Curb and gutter (Non-slip form)	Э	0.5		2	5.5	7	8.5	2512.02 & 2301.02
Sidewalk	J			2	5.5	7	8.5	2511.02 & 2301.02
Intakes and manholes	Э			2	5.5	6.5	8.5	2403.02
Repair								
Patches with or without CaCl ₂	Σ	1	3	4	5	6.5	8.5	2530.02 B & 2529.02 B
		П	4	2				
		w)	(when WR is used)	(p;				
Underseal and grouting, flowing mortar			By Flow Cone	a				2539.02 B & 2506
Overlays								
Unbonded, white topping Bonded	C, QMC	same a	same as specified concrete	oncrete				2310.02
Lighting & Highway Signing								
Foundation	O	1	4	2	5.5	6.5	8.5	2403.02 A & B

Caution: Consult the applicable specifications for required air content and slump before using this chart.

	Type of		Slump (in.)	•		% Air Content	Ħ	Spe	Specification
Structures	Concrete	Min.	. Target	Max.	Min.	Target	Max	Ref	Reference
Seal Coat	×	0		8				240	2405.02 D
Caritoriata acciri3 9 Caritoriata dira	Ĺ				5.5	6.5	8.5	077	0.0 0.00
Sub-Structure & Super-Structure	۔ د	1	4	2	5.5	7.5	9.5	240 747	2403.02 A & B
(Decks - Letataet Tequilea)))				(when plo	(when placed by pumping/belting)	ing/belting)	747	7412.02
Slope Protection	Э	1		3	5.5	6.5	8.5	00	On the Plan Sheet
Piling encased & Pipe Pile Filling	Ú	1	4	2	5.5	6.5	8.5	240	2403 - 2501.03 E & F
Victory 7000 cabing	0	0	0.75	1	u	ט	0	241	2413.02 D.1
	HPC	1	4	5	<u>.</u>	<u>.</u>))	241	2413.02 D.2
Bridge Deck - Class B Repair	U	1		3	5.5	6.5	8.5	240 (24:	2403.02 B, 2412 (2413.03 D)
								251	2513.03 A
Barrier Rail - Cast in place	U	Н	4	2	9	7	8.5	2403)3
Barrier Rail - Slipform (fibers)	BR	1	1	•	9	7	8.5	241	2414.02
Drilled Shafts (retarder required)	Q	6.5	8	9.5	Same a	Same as structural concrete.	concrete.	2433. 2403	2433.02 2403
Guardrail									

7
4
5
4
1
C
d anchors

Proportion Table 1 Concrete Mixes

Using <u>Article 4110</u> and <u>4115</u> Aggregates Basic Absolute Volumes of Materials Per Unit Volume of Concrete

A BAIVEO	Daa!a/a -	- 0 474	Mass / 0 F00
AWIXES	Basic w/c =	= 0.4/4	Max $w/c = 0.532$

A MIXES	8 Basic w/c = 0.4	74 Max w/c	= 0.532		
Mix No.	Cement	Water	Air	Fine	Coarse
A-2	0.101	0.150	0.060	0.276	0.413
A-3	0.104	0.155	0.060	0.306	0.375
A-4	0.108	0.161	0.060	0.335	0.336
A-5	0.111	0.165	0.060	0.365	0.299
A-6	0.115	0.171	0.060	0.392	0.262
BR MIXE	ES Basic w/c =	= 0.400 Max	w/c = 0.450		
Mix No.	Cement	Water	Air	Fine	Coarse
BR	0.114	0.143	0.060	*	*
C MIXES	Basic w/c = 0.4	30 Max w/c	= 0.488		
Mix No.	Cement	Water	Air	Fine	Coarse
C-2	0.110	0.149	0.060	0.272	0.409
C-3	0.114	0.154	0.060	0.302	0.370
C-4	0.118	0.159	0.060	0.331	0.332
C-5	0.123	0.166	0.060	0.358	0.293
C-6	0.128	0.173	0.060	0.383	0.256
C-WR M	IXES Basic w/c =	= 0.430 Max	w/c = 0.450		
Mix No.	Cement	Water	Air	Fine	Coarse
C-3WR	0.108	0.146	0.060	0.309	0.377
C-4WR	0.112	0.151	0.060	0.338	0.339
C-5WR	0.117	0.158	0.060	0.366	0.299
C-6WR	0.121	0.163	0.060	0.394	0.262
D MIXES	Basic w/c = 0.4	23 Max w/c	= 0.450		
Mix No.	Cement	Water	Air	Fine	Coarse
D-57	0.134	0.178	0.060	0.314	0.314
D-57-6	0.134	0.178	0.060	0.377	0.251
	S Basic w/c = 0.3		= 0.400		
Mix No.	Cement	Water	Air	Fine	Coarse
M-3	0.149	0.153	0.060	0.287	0.351
M-4	0.156	0.161	0.060	0.311	0.312
M-5	0.160	0.165	0.060	0.338	0.277
	Basic w/c = 0.3			T	,
Mix No.	Cement	Water	Air	Fine	Coarse
O-4WR	0.156	0.160	0.060	0.312	0.312
HPC-O MIX	1		w/c =0.420	Γ	
Mix No.	Cement	Water	Air	Fine	Coarse
HPC-O	0.134	0.164	0.060	0.321	0.321
	MIXES Basic w/c		w/c =0.450	Τ	
Mix No.	Cement	Water	Air	Fine	Coarse
HPC-S	0.118	0.156	0.060	0.333	0.333

STANDARD MEASUREMENTS

Weight of Water per Cubic Foot = 62.4 lbs./cu. ft.

Weight of Water per Gallon = 8.33 lbs/gallon

Cubic Feet per Cubic Yard = 27 cu. ft.

TO DETERMINE WEIGHT PER UNIT VOLUME

Absolute Volume X Specific Gravity X Unit Weight of Water X Cubic Feet per Cubic Yard

TO DETERMINE ABSOLUTE VOLUME

Batch Weight ÷ Specific Gravity ÷ Unit Weight of Water ÷ Cubic Feet per Cubic Yard

TO DETERMINE ADJUSTED (WET) BATCH WEIGHTS

Adjusted (Wet) Batch Weight = SSD (Dry) Batch Weight X 100 (100 - % Moisture)

TO DETERMINE ADJUSTED WATER

Adjusted Water = Adjusted (Wet) Batch Weight - SSD (Dry) Batch Weight

TO DETERMINE WATER/CEMENT RATIO

Water/Cement Ratio = <u>Total Weight of All Water</u> Total Weight of All Cementitious

TO DETERMINE MAXIMUM WATER

Maximum Water Cement Ratio of Mix X Total Weight of All Cementitious

TO DETERMINE CEMENT YIELD

Cement Yield = (Total Cement Batched + Left in Scale This Check - Left in Scale Last Check) X 100
Total Cement Billed

Chapter 2 INTRODUCTION

PCC Level II Introduction

I. Introduction

This course is intended for the training of Certified Concrete Plant Technicians. The training manual that accompanies this course has been prepared to provide assistance not only for classroom use, but also as a self-training manual and a reference to be used in the field.

At the beginning of each section, references are given to:

- Iowa Department of Transportation Standard Specifications with the Specification Article listed
- Materials Instructional Memorandums (IM)

These references will enable the Certified Plant Technician to refer to those documents for more detailed information.

NOTE: IMs and Specifications are updated each spring and fall and the technician should always make sure they are looking at the most current IMs and specifications.



Remember to check for IM and Specification changes each spring and fall.

Chapter 3 CERTIFICATION PROGRAM

Certification Program for Certified Plant Technicians

IM 213

A. Requirements

The requirements for obtaining a Certified Portland Cement Concrete Plant Technician Level II certification are:

- Certification in Aggregate Technician
- Certification in Level I PCC Concrete Testing
- A score of at least 80% on the Level II PCC exam

In addition to the above requirements, recommended experience includes:

- Performing Gradation Tests
- Performing Moisture Tests
- · Calculating Batch Weights
- Performing Specific Gravity Tests
- · Checking Slump, Air and Flexural Strength
- · Maturity Meter Testing
- · Checking Tolerances and Sensitivity of Scales
- Complete Plant Inspection: Stockpiling, Admixture Dispensers, Scales, etc.
- Completing Reports
- Keeping Proper Records and Plant Diaries

The Technician should have experience performing the above duties under a certified technician before performing plant inspection duties on their own.

B. Certifications

Certifications are issued for a five-year period. Level II PCC updates are no longer required for recertification.



C. Performance Requirements

Suspension of Certification

A Certified Technician will be suspended for unsatisfactory and/or inadequate performance. (See Unsatisfactory Performance form on the following page)

- After 2 such notices, a technician will receive a three-month suspension.
- A third notice will result in Decertification.

Technician Decertification

- A Technician's Certificate will become invalid for any one of the following:
 - · Failure to renew the Certificate prior to regular expiration
 - Use of false or fraudulent information to secure or renew
 - False or fraudulent actions or documentation
 - Not performing tests and duties properly in accordance with specifications

Federal Code 1020, Iowa Code 714.8

Certified Technicians need to be aware of the consequence of issuing a false statement (refer to codes on pages 3-4 and 3-5)

D. Responsibilities

IM 213

The Certified Plant Technician shall:

- Sample
- Test
- · Perform prescribed inspections, all at the specified frequencies
- · Be responsible for Quality Control

The Project Engineer will:

- · Be responsible for monitoring inspections
- · Be responsible for verification

UNSATISFACTORY PERFORMANCE NOTICE
Date:
is to inform you that your performance as a Certified Inspector/Technician was ry for the reason(s) listed below.
and all supporting documentation will be placed in your record with the Iowa of Transportation's Technical Training & Certification Program (TTCP).
the Technical Training and Certification Program (TTCP) is to work with contractors, cities, counties, and consultants to continually improve the quality of Iowa's projects. We hope you will work with us to achieve this goal.
ry Performance:
District Materials Engineer
Director –Construction and Materials Engineer, Ames cordinator t Construction Engineer

FEDERAL CODE 1020 and IOWA CODE 714.8

IM 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 IM 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."

Section 2521. Certified Plant Inspection

2521.01 DESCRIPTION.

Certified plant inspection will be required for Interstate, Primary, state park, and institutional projects. It will apply to other projects only when designated. When this specification applies, furnish or oversee certified plant inspection for the work, as specified herein.

2521.02 REQUIREMENTS.

- **A.** For certified plant inspection, comply with <u>Materials I.M. 213</u>, using personnel certified for the type of inspection to be accomplished and using prescribed test equipment the Contractor furnishes. Ensure the equipment is also available for use by the Engineer for monitoring purposes.
- **B.** When a field laboratory or office is furnished, as provided in <u>Section 2520</u>, exclusive use by the Engineer for inspection purposes is intended. Additional field laboratory space and equipment and/or office space for use by the Contractor to fulfill the requirements of Certified Plant Inspection are incidental to the contract unit price for the item for which this inspection is required.
- **C.** Delivery of samples to the District Materials Laboratory may also be required. Comply with the provisions in Section 2534.

2521.03 APPLICATION.

This specification applies to all HMA, HMA patching material, PCC, structural concrete, and flowable mortar, except where excluded by a note in the contract documents.

2521.04 METHOD OF MEASUREMENT.

Certified plant inspection will not be measured.

2521.05 BASIS OF PAYMENT.

Certified plant inspection will not be paid for separately and is to be included in the contract unit price for the item for which this inspection is required.

Chapter 4 MATERIALS

PCC Level II Materia

III. CONCRETE MATERIALS

Concrete consists of three basic components-aggregates (both sand and rock), cement, and water. When mixed together and the chemical reaction is allowed to proceed, they form concrete. This material is one of the most versatile construction materials and has tremendous compressive strength. It is widely used for both pavements and structures.

- **Cement** is the fine gray powder that holds the aggregates together.
- Concrete is a mass of sand and rock bound together by cement.



Portland cement is the most important and the most expensive component in a concrete mixture. It is the glue that holds the aggregates together and is the primary ingredient that will determine the strength of the concrete. The strength is developed through a process called hydration described as follows:

- Water contacts cement grain
- Exothermic reaction occurs
- Small needle-like crystals form on the surface of the cement particle
- Crystals interlock and form a gel-like mass.

Types

ASTM C150 / AASHTO M85

- I -Normal
- II -Moderate Sulfate Resistance
- III -High Early Strength
- IV -Low Heat of Hydration
- V -High Sulfate Resistance





Blended Cements

ASTM C595 / AASHTO M240

- IP Up to 25% Pozzolan
- IS Up to 35% GGBFS
- IL 5% to 15% Limestone
- IT Ternary blend of slag S(%) and Limestone L(%)

Type I or Type II cement may be used for pavements, structures, and other applications. Type III cement may be used in precast and prestressed concrete only. Type IP, Type IS, or Type IL cement may be furnished at the Contractor's option when Type I or Type II cement is specified. Use the same unit volume of Type IP, Type IS, or Type IL cement in the concrete that is specified for Type I or Type II cement.

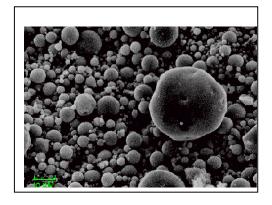
Storage and Handling

- Stored in weatherproof enclosures
- If lumps develop
 - Less than 1% okay
 - 1 to 5% requires batch weight adjustments
 - Rejected if exceeds 5% maximum on 840 μm (No. 20) sieve

2. Fly Ash - Article 4108, IM 491.17

Fly ash is a common mineral admixture used in most concrete paving mixtures. It is by-product of the burning of finely ground coal in electricity generating power plants.

This fine, powdery material, which is almost totally spherical in shape, is known as a pozzolan. Pozzolans are finely divided, siliceous or aluminosiliceous materials that react with water and calcium hydroxide released by Portland cement hydration to form cementing compounds.



Types - ASTM C618 / Article 4108

- Class C Fly Ash
 - Cementing
 - High Lime (CaO)
- Class F Fly Ash
 - Non-cementing
 - Low Lime (CaO)

Approved sources of each are listed in IM 491.17.

Some of the benefits that can often be achieved by using fly ash in the concrete include:

- Economical mix
- Increased long term strength
- Increased workability
- Reduced heat of hydration
- Reduce permeability



Ground granulated blast furnace slag (GGBFS) is a mineral admixture is a by-product of steel production. GGBFS is made from slag floating on top of an iron blast furnace. The slag is tapped off and quenched in water to produce a glassy sand-like material. This material is ground to a fine powder.





The powder has slight cementing properties and minerals similar to those found in cement such as

- Silica
- Calcium
- Magnesim
- Aluminum

Advantage to using GGBFS

- Increased workability
- Increased strength
- Reduced permeability
- Increased sulfate resistance
- Decreased alkali aggregate reactivity

GGBFS is commonly blended or inter-ground with cement to form a IS blended cement.



4. Aggregates - Articles 4109, 4110, 4111, 4112, 4115, 4117 and IM T-203

The aggregates in the concrete mixture make up the largest portion of the volume of the concrete, often about two thirds.

- Standard Iowa DOT mixes
 - o Fine aggregate sand
 - Coarse aggregate gravel or crushed stone
- QMC mixes
 - o Well graded
 - o Intermediate aggregate
 - o Increases workability



a. Gradation

Gradation table

b. Durability

• IM T-203

5. Water - Article 4102

The water used in batching concrete can come from almost any source. Each source must be tested and approved if it is not potable. Often lakes or streams are used because they are close to the project. This water must meet hardness, alkalinity, and acidity requirements. During the summer, warm water may increase the temperature of the concrete, which can lead to placement problems.

6. Chemical Admixtures - Article 4103, IM 403

Admixtures can be classified by function and include:

- Air-entraining admixtures
- Water-reducing admixtures
- Retarding admixtures
- Accelerators
- Superplasticizers

Accelerators and super plasticizers are not commonly used in paving. Calcium Chloride is commonly used as an accelerator in patching work.

Reasons for using admixtures are:

- To reduce the cost
- Achieve certain concrete properties effectively
- Ensure the quality of concrete in adverse weather conditions



Admixtures cannot make "bad concrete" good, nor should they be used as a substitute for good concrete practices.

a. Air Entraining

Air-entraining admixtures are used to entrain millions of microscopic air bubbles in concrete.

- Freeze Thaw Durability
- Increase Workability

Types

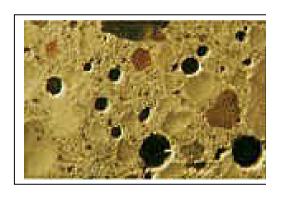
- Neutralized Salt of Pine Wood Resins (normally called Vinsol Resins)
- 2. Synthetic Detergents

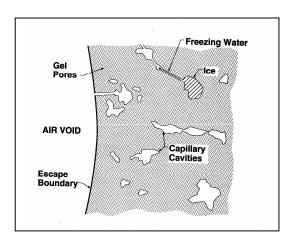
Why entrain air in concrete?

- Concrete is a porous material
- Exposed to moisture, water moves through the pores
- Below freezing, water turns to ice at 9% more volume
- Expanding ice forces water through capillaries
- Air voids act as pressure relief

Without air voids, the repeated freezing and thawing will damage the concrete. This damage is increased with deicing salts.

A listing of the many factors affecting the air entraining ability of the concrete is found at the end of this chapter.

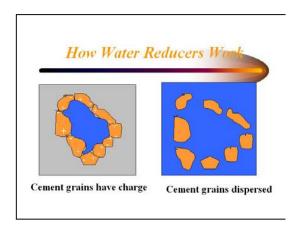




Concrete Material

b. Water Reducer

- A water reducer is a liquid used to reduce the "static cling" produced by the electrical charges on cement particles.
- Reduce the quantity of mixing water required to produce concrete of a certain slump, reduce water/cement ratio, or increase slump. Typical water reduction is 7% to 10% with low range water reducers.



c. Retarders

- Delay the set of cement
- · Act as water reducer
- Increase working time in hot weather

Concrete Mixes

Classes of Mix - IM 529 Typical Uses

•	Class A	Detour Pavement, Sidewalks, Shoulders
•	Class C	Primary Paving & Structures & Trails
•	Class D	Structural
•	Class M	Patching/ high early strength
•	Class O	Deck Overlay / Structural Repair

See IM 529 for the entire list of mixes and their uses.

Concrete Properties

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance
Cement	Alkali Content	Air content increases with increased alkali content	Dosage may be reduced up to 40% for high alkali cements
		Very low alkali cements (less than 0.3%) reduces air content	Dosage may need to be increased by 100%
			Dosage may be increased up to 100% for Type III cements
	Blended Cements	As fineness of cement increases air content decreases Air content decreases with increase in LOI	Increase dosage rates of up to 100% Increase dosage rates of up to 100% or more
	Content	Air content decreases with increased amount of cement	Increase dosage as cement content increases
	Admixture Compatibility	Rapid slump loss is observed when a cement containing anhydrite is used in conjunction with a lignosulfonate based water reducer - hard to control air content	Use a retarding type admixture. Delay addition of water reducer by 15 secs. Increase mix time

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance	
Mineral Admixtures	Fly ash (LOI)	Air content decreases with higher LOI (carbon content) Carbon adsorbs the air agent reducing effectiveness	LOI's may vary as the peak load at the power plant causing variability load to load	
		Air may be unstable with some combinations of fly ash, cement, and AEA's	Prepare trial mixes and evaluate air	
		LOI's greater than 1%	Usually increases AEA demand	
		LOI's greater than 2% may cause air to be very unstable over time	May increase AEA demand 5 times or more. May not be able to stabilize entrained air or attain required amount of air	
		Finer fly ashes decreases air content		
	GGBFS	Air content decreases as GGBFS fineness increases	May need up to 100% or more AEA with finely ground slags	
	Silica Fume	Air content decreases with increase in silica fume content	May need up to 100% increase in AEA	
Chemical Admixtures	Water Reducers	Air content increases with increase water reducer dosage rates (lignin-based water reducers)	Reduce AEA dosage by up to 50%	
	Retarders	Similar to water reducers	Reduce AEA dosage	

Concrete Properties

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance
Aggregates	Maximum Size	Air content requirements decrease as maximum size increases (up to 1.5")	Total air content required to protect concrete decreases
		Well graded aggregates aid in retention of smaller entrained air bubbles	Monitor gradations
	Sand	Air content increases with increased sand content	Decrease AEA content
	Sand Grading	Increased amounts retained on No. 30 to 50 sieves promote air entrainment	Monitor sand gradations
		Increased amount of fines passing the No. 100 sieve will decrease air content	Monitor sand gradations
		Organic contaminants may result in large fluctuations in air	Use clean sands
	Moisture Absorption	Many coarse aggregates are highly absorptive. Some will indicate moisture and still absorb water from the mix.	Manage stockpiles - moisture contents can vary load to load causing increases and decreases in slump and air content
	Minus No. 100	Increased amounts of crushed fines decreases air content Clay or silt fines in sand decrease air content	Total combined of greater than 2% passing the #100 sieve will affect ability to entrain air
		Combined totals greater than 2% may decrease air contents Combined totals greater than 2.5% will decrease air contents	May require dosage increases up to 5 times

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance
Water	Hardness	Batching air agent with hard water or wash water first will decrease air content	Increase AEA by up to 50%
	Organic Contaminants	May increase or decrease air	Test water before using if not potable
	w/c ratio	Air content increases with increase in w/c ratio	1 gallon water = 0.5 to 1" slump
	Slump	Increase in slump increases air content (Up to 6 in.) Increase in slump to greater than 6 in. decreases air content	Increase slump 1" -increase air 0.5%
		Difficult to entrain air in low slump concrete (less than 1in.)	Increase slump

Concrete Properties

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance
Production	Batching Sequence	Simultaneous batching may lower air content Batching AEA on to cement reduces AEA effectiveness	Discharge AEA into water or water line or on to sand
		Blending all materials promotes better mixing and entrained air development	
	Mixer Capacity	Air content increases as capacity is approached Overloaded mixer decreases air content	Run 80 to 85% of capacity gives best mixing action
	Mixing Time	Air content increases up to 5 min. mixing (central plant) Air content will decrease after 20 minutes of mixing (transit)	1 to 3 min. mix time optimum for central
		Mixing times less than 60 seconds may not develop proper air void system for freeze thaw protection	
	Mixing Speed	Air content increases to 20 rpm and decreases as speed increases	
	Admixture metering	Accuracy and reliability of dispensing system affects uniformity of air	Visually check bottles for accuracy
		Add all chemical admixtures separately	

Factors Affecting Control of Air in Concrete

Category	Characteristic	Effects	Guidance
Placement Procedures	Transport and delivery	Transport in non agitated equipment worse than for agitated	When using non-agitated haul units use smoothest and shortest haul routes
	Haul Time	Loss of 1 to 4 percent air depending on time Worse in hot weather	Use haul route that results in shortest time
	Mixing Drum	Air content decreases as mixer blades are worn or if concrete has hardened on or around the blades and pedestals	Perform regular maintenance
	Belt Conveyors	Reduces air content by up to 1 percent for less than 3000 ft.	
	Pumping	Pumping can lose up to 4% air	Don't allow high vertical drop Distance, slump, and line pressure all affect air content
	Vibration	Air content decreases under prolonged vibration at high frequencies (>10,000 vpm)	Closely spaced vibrators recommended 8000 vpm max. internal vibrators
	Finishing	Air content reduced in surface layer by excessive finishing	Avoid finishing with bleed water on surface DO NOT add water to surface to finish
	Temperature	Air content decreases with increasing temperature In low slump concrete (< 2 in.) at a temperature above 90 F is has been found to be more difficult to hold the slump and increase air contents. Likewise a small amount of water generates larger slump gains and a larger entrained air increase for concrete at 70F	Watering of stockpiles will help cool coarse aggregate and reduce absorption of mix water Utilize coldest water possible for Hot Weather Concreteing (well water)

User's Guide for Materials Approved List Enterprise (MAPLE)

1. Introduction

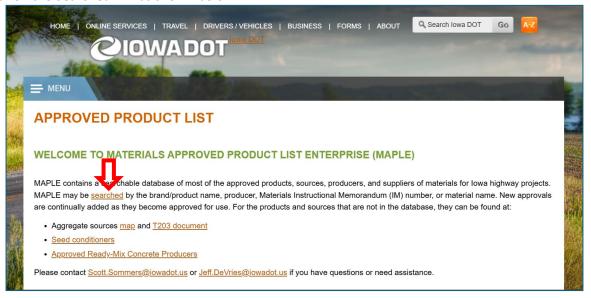
The Iowa DOT Materials Approved List Enterprise (MAPLE) has been in service for all users since July 2014. The MAPLE allows users to check all products approved in Iowa from a single data base. This document is to provide instruction on how to use the MAPLE.

2. How to get to MAPLE

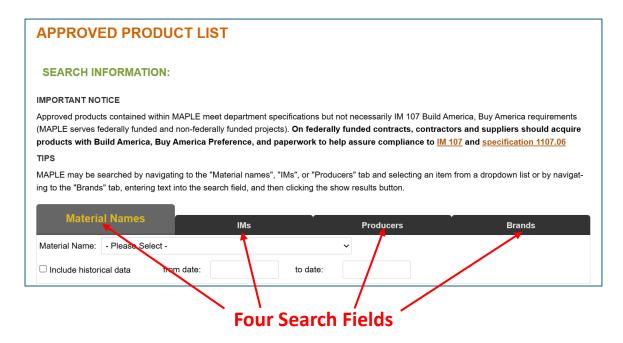
The MAPLE can be found at: https://maple.iowadot.gov/

3. Searching MAPLE

Click on the Searched link as shown below

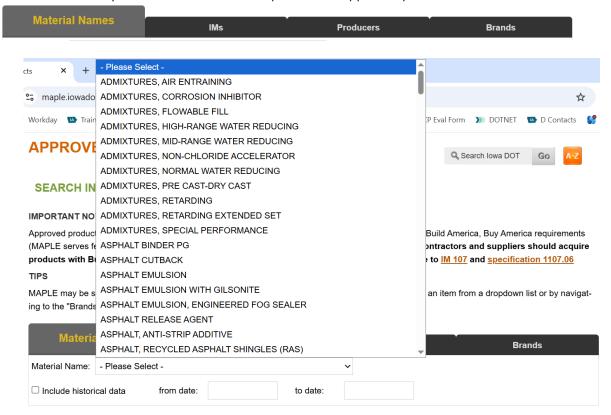


The user can search MAPLE through one of four fields listed: Material Names, IMs, Producers, and Brands.



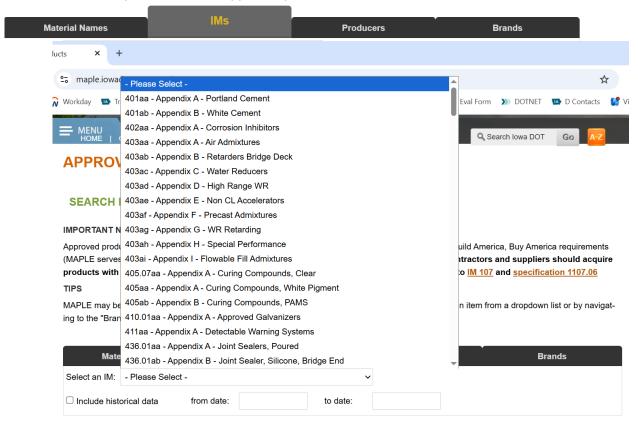
4. Search by Material Names

Click on the **Material Names** tab to search by type of material. Click on the arrow and a list will appear as shown. Click on any of the material names to produce an approved product list.



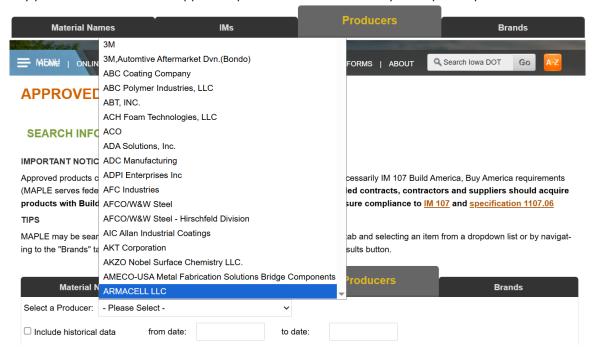
5. Searching by IMs

Click on the **IMs** tab to search by IM number. Click on the arrow | and a list will appear as shown. Click on any of the IM's listed to produce a list of approved products in that IM.



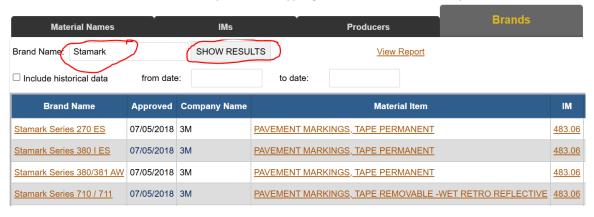
6. Searching by Producers

Click on the **Producers** tab to search by producer. Click on the arrow and a list will appear as shown. Click on any producer for a list of all approved products manufactured by that specific producer.



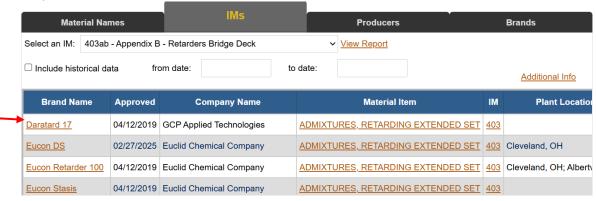
7. Searching by Brand Name

Click on the Brands tab to search by freeform typing the brand name of the product. Click SHOW RESULTS



8. Selecting a Product

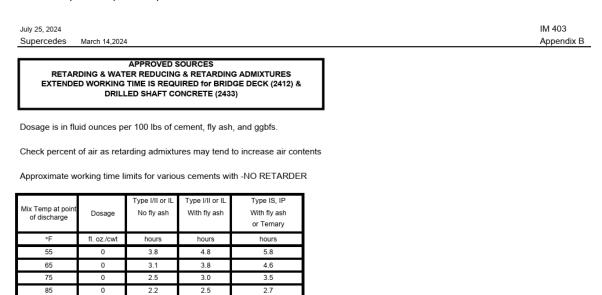
After a list of products has been displayed, click on the individual Brand Name to display more information about the product.



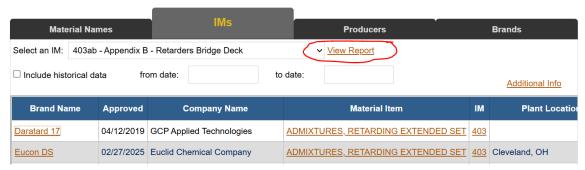
You can use the scroll bar on the right of the screen to scroll down for more information.



Some products may have a link in the **More Information** field. A pdf with the additional information will appear after clicking on see file. More information may be found on the following IM's: 403ab, 445.01ab, 451ad, 455.02aa, 455aa, 462aa, and 557ab.



Clicking on **View Report** from any of the four **Search Fields**. This will open a new window and enable the user to export the list to Excel, Word, or a PDF file.







Materials Approved Products List

403ab - Appendix B - Retarders Bridge Deck

Brand Name	Approved	Company Name	Material Item	IM	Plant Location	Marketer	Terminal/Supplier	Dosage
Daratard 17	04/12/2019	GCP Applied Technologies	ADMIXTURES, RETARDING EXTENDED SET	403		GCP Applied Technologies		Extende d Time- See File
Eucon DS	02/27/2025	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH	Euclid Chemical Company		4 fl oz./100 lbs
Eucon Retarder 100	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH; Albertville, MN; Marengo, IA	Euclid Chemical Company		Extende d Time- See File
Eucon Stasis	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403		Euclid Chemical Company		Extende d Time- See File
Eucon WR-91	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH; Albertville, MN; Marengo, IA	Euclid Chemical Company		Extende d Time- See File
Mapecrete Resolve	01/19/2024	Mapei Corporation	ADMIXTURES, RETARDING EXTENDED SET	403		Mapei Corporation		2 fl oz./100 lbs

Chapter 5 PROPORTIONS

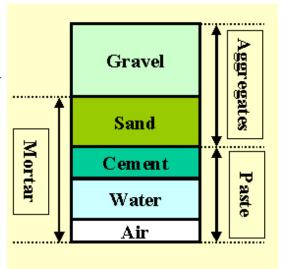
Proportions

Calculating the batch weights for Portland cement concrete is one of the duties of the certified technician. This chapter will cover calculating the batch weights in various mix types. The certified plant technician makes the batch weight calculations and the monitor will then cross check the calculations. This work is normally completed on a computer program, but it is important the Level II PCC technician knows how to perform these calculations manually. It is important that batching of the concrete does not begin until these calculations have been cross checked.

IM 529 covers proportioning of PCC. This IM includes Standard Iowa DOT mixes. This would include absolute volumes, saturated surface dry batch weights, and basic and maximum water/cement ratios.

There are a number of sources the technician will need to calculate batch weights. These sources will give the technician the specific gravities, source names, etc. Beginning October of 2014, approved sources previously printed twice per year in IM appendices will now be found in the Materials Approved Products Listing Enterprise, or MAPLE database. Maple can be accessed at https://maple.iowadot.gov

Instructions for using MAPLE can be found at the end of Chapter 4.



The batch weight calculations are based on the absolute volumes of the materials in the PCC mix. One cubic yard is the basic unit of volume. The illustration shows how a mix is proportioned with each material taking up a certain space or volume. All of the volume added together make one cubic yard. The aggregate is proportioned according to the mix number being used. The table showing the different aggregate proportions according to mix number is located in IM 529 and is partially shown here.

Mix No.	Percent Coarse	Percent Fine
2	60	40
3	55	45
4	50	50
5	45	55
6	40	60

Specific gravity is used to convert the volumes to equivalent weights. Specific gravity is the ratio of a material's density to the density of water. The specific gravities of all the materials are found in the various sources shown above. The specific gravity of the aggregates is also tested by the technician, but their results are used ONLY to check against the T-203 source for accuracy. **The specific gravity use for proportioning is taken from the T-203.**

Another important part of proportioning is to calculate the percent of moisture that is in the aggregate. Batch weights and water in the mix will need to be adjusted since the original proportioned weights are figured on material that is in saturated surface dry condition, without any excess moisture.

The proper ratio of water to cementitous material is critical to obtain strength requirements for PCC. The technician will calculate the water/cement ratio (w/c) to make sure they are running close to the basic w/c recommended and, more important, to make sure they don't exceed the maximum w/c allowed. The w/c is calculated by taking all the water in a cubic yard of concrete and dividing that by all the cementitous material in the same cubic yard. Always be sure to include all the water, which would include, in the materials, added at the plant, and water added in the grade. The same is true for the cementitous materials, which would include, cement, fly ash, and GGBFS.

The following pages will include instructions on proportioning, moisture corrections, and water/cement ratio.

Standard Measurements

Weight of water per cubic foot = 62.4 lbs./cu. ft.

Weight of water per gallon = 8.33 lbs/gallon

Cu. ft. per cu. yd. = 27 cu. ft.

To figure weight per unit volume

Absolute Volume x Specific Gravity x Unit Weight of water x cu. ft. per cu. yd.

To figure absolute volume

Batch Weight ÷ Specific Gravity ÷ Unit Weight of water ÷ cu. ft. per cu. yd.

Example 1 - C-3WR Mix Proportions - IM 529

<u>Absolute Volumes</u>					
0.108					
0.146					
0.060					
0.309					
0.377					

Assume Sp. G. of 2.65 for both coarse and fine aggregates.

Batch Weights - SSD

Cement Weight = $0.108 \times 3.14 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 571 lbs. per cubic yard

Basic Water = $0.146 \times 1.00 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 246 lbs. per cubic yard

Fine Agg. = $0.309 \times 2.65 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 1380 lbs. per cubic yard

Coarse Agg. = $0.377 \times 2.65 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 1683 lbs. per cubic yard

Calculate the Batch Weights for the Materials

M-3 Mix

Materials	Source	Absolute	Specific	Batch
		Volume	Gravity	Weight
Cement	PC3802	0.149	3.14	
Fine Aggregate	A06502	0.287	2.65	
Coarse Aggregate	A17012	0.351	2.68	
Water	City	0.153	1.00	
Air		0.060	0	

Calculate the Batch Weights for the Materials

C-4WR Mix

Materials	Source	Absolute	Specific	Batch
		Volume	Gravity	Weight
Cement	PC0108	0.112	2.97	
Fine Aggregate	A17514	0.338	2.65	
Coarse Aggregate	A21516	0.339	2.69	
Water	City	0.151	1.00	
Air		0.060	0	

Calculate the Batch Weights for the Materials

C-4WR Mix

You will need to look up the specific gravities.

Materials	Source	Absolute	Specific	Batch
		Volume	Gravity	Weight
Cement	PC3702	0.112		
Fine Aggregate	A22520	0.338		
Coarse Aggregate	A22012	0.339		
Water	City	0.151		
Air		0.060		

Calculate the Batch Weights for the Materials

C-3WR

You will need to look up the absolute volumes

Materials	Source	Absolute	Specific	Batch
		Volume	Gravity	Weight
Cement	PC0209		3.11	
Fine Aggregate	A24512		2.66	
Coarse Aggregate	A22012		2.66	
Water	City		1.0	
Air				

Mineral Admixture Substitution

The two mineral admixtures that are common in Iowa are Fly Ash (predominately Class C) and Ground Granulated Blast Furnace Slag (GGBFS). The mineral admixtures are replaced by weight, not volume on a pound for pound basis. Fly Ash is replaced at a maximum of 20% and GGBFS at a maximum of 35%. The total maximum replacement = FA replacement + GGBFS replacement. The total maximum mineral admixture substitution rate is 50% for structures and 50% for paving. For more information on when mineral admixtures may be substituted, refer to Article 2301.01 – Paving, Article 2403.03 – Structural, and Article 2412.02 – New Decks.

Batch weights are calculated using mineral admixtures by multiplying the weight of the cement by the percent of replacement for each mineral admixture. The mineral admixture(s) is then subtracted from the cement, which gives the corrected cement total. When replacing cement with mineral admixtures, the absolute volume of the cement will be different. Therefore, absolute volumes must be adjusted for the entire mix. Examples of replacement and readjusting the mix are shown in the following examples.

Example 2 - Fly ash substitution - C-3WR mix

20% fly ash substitution. Assume 2.59 Sp. G. for fly ash

571 lbs. per cubic yard \times 0.20 = 114 lbs. fly ash

571 - 114 = 457 lbs cement

Abs. Vol. cement = $457 \text{ lbs} \div 3.14 \div 62.4 \text{ lbs/ft}^3 \div 27 \text{ ft}^3/\text{yd}^3$

= 0.086

Abs. Vol. fly ash = $114 \text{ lbs} \div 2.59 \div 62.4 \text{ lbs/ft}^3 \div 27 \text{ ft}^3/\text{yd}^3$

= 0.026

Weight Water = $0.430 \times 571 \text{ lbs}$.

= 246 lbs per cubic yard

Abs. Vol. Water = $246 \div 1.00 \div 62.4 \text{ lbs/ft}^3 \div 27 \text{ ft}^3/\text{yd}^3$

= 0.146

Abs. Vol. Air = 0.060

Abs. Vol. = 0.086 + 0.026 + 0.146 + 0.060

(subtotal) = 0.318

(1-subtotal) = 1 - 0.318

= 0.682

%Coarse = 0.55 X 0.682

= 0.375

%Fine = 0.45×0.686

= 0.307

Weight Fine Agg. = $0.307 \times 2.65 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 1371 lbs per cubic yard

Weight Coarse Agg. = 0.375 X 2.65 X 62.4 lbs/ft³ X 27 ft³/yd³

= 1674 lbs per cubic yard

Check to make sure Absolute Volumes = 1.00

 Cement
 0.086

 Fly Ash
 0.026

 Water
 0.146

 Air
 0.060

 Coarse
 0.375

 Fine
 0.307

 Total
 1.00

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		<u></u>	County :	
Mix No.:		Abs Vol. Cement:	Туре:	
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17): _		Source:	Sp. Gr.:	
Slag (IM 491.14):		Source:	Sp. Gr.:	
Adju	sted lbs. Cement:			
т	otal Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement + v	wt Flv Ash +Slag) =	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement + v	· · · · · ·	
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal		
		Total	= -	1.000
9/ EA Agg :	Eina	Aggregate (1.000 - Subtotal) X % In Mix	_	
% FA Agg % In. Agg.:	Intorm	Aggregate (1.000 - Subtotal) X % In Mix		
% CA Agg.:		e Aggregate (1.000 - Subtotal) X % In Mix		
% on 199		Aggregate Total	= -	
Aggregate Weights	Fine A	ggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Intermedia	ate Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Coarse	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
_				
Summary		Cement (lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg. (lbs/cy)		
		Interm. Agg. (lbs/cy) Coarse Agg. (lbs/cy)		
		(IDS/CY)		

Distribution: ___ Materials, ___ DME, ___ Proj. Engr., ___ Contractor

Example 3 - Fly ash and GGBFS substitution - C-3WR mix

20% fly ash substitution. Assume 2.59 Sp. G. for fly ash 30% GGBFS substitution. Assume 2.88 Sp. G. for GGBFS

571 lbs. per cubic yard X 0.20 = 114 lbs. fly ash 571 lbs. per cubic yard X 0.30 = 171 lbs. GGBFS

571 – 114 – 171 = 286 lbs cement ((114 + 171) / 571) X 100 = 50% replacement for C-3WR-C20-S30

Abs. Vol. cement = 286 lbs \div 3.14 \div 62.4 lbs/ft³ \div 27 ft³/yd³

= 0.054

Abs. Vol. fly ash = $114 \text{ lbs} \div 2.59 \div 62.4 \text{ lbs/ft}^3 \div 27 \text{ ft}^3/\text{yd}^3$

= 0.026

Abs. Vol. GGBFS = 171 lbs \div 2.88 \div 62.4 lbs/ft³ \div 27 ft³/yd³

= 0.035

Weight Water = $0.430 \times 571 \text{ lbs.}$

= 246 lbs per cubic yard

Abs. Vol. Water = $246 \div 1.00 \div 62.4 \text{ lbs/ft}^3 \div 27 \text{ ft}^3/\text{yd}^3$

= 0.146

Abs. Vol. Air = 0.060

Abs. Vol. = 0.054 + 0.026 + 0.035 + 0.146 + .060

(subtotal) = 0.321

(1-subtotal) = 1 - 0.321

= 0.679

%Coarse = 0.55 X 0.679

= 0.373

%Fine = 0.45×0.683

= 0.306

Weight Fine Agg. = $0.306 \times 2.65 \times 62.4 \text{ lbs/ft}^3 \times 27 \text{ ft}^3/\text{yd}^3$

= 1366 lbs per cubic yard

Weight Coarse Agg. = 0.373 X 2.65 X 62.4 lbs/ft³ X 27 ft³/yd³

= 1665 lbs per cubic yard

Check to make sure Absolute Volumes = 1.00

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.: _			_		County :	
Mix No.:		Al	os Vol. Cement:		Туре:	
Cement (IM 401):	0/	lbs	Source:		Sp. Gr.:	
Fly Ash (IM 491.17): _	%		Source:		Sp. Gr.:	
Slag (IM 491.14):	Г		Source:		Sp. Gr.:	
Adju	sted lbs. Cement:]			
To	otal Cementitious_		Total % Re	placement =		
IM T203	Fine Aggregate	Source:			Sp. Gr.:	
IM T203	Interm. Aggrega				Sp. Gr.:	
IM T203	Coarse Agregat		•		Sp. Gr.:	
-						
Basic w/c_				/cy) = Design w/c (wt. cement		
Max w/c_			Max. Water (lbs/	(cy) = Design w/c (wt. cement	: + wt Fly Ash +Slag) =	<u>-</u>
Absolute Volumes	Cement			(lbs/cy) / (Sp. Gr. X 62.4 X 27	7) =	
	Fly Ash			(lbs/cy) / (Sp. Gr. X 62.4 X 27	7) =	
	Slag			(lbs/cy) / (Sp. Gr. X 62.4 X 27	7) =	
	Water			(lbs/cy) / (1.00 X 62.4 X 27)	=	
	Air					0.060
				Subtotal	=	
				1.000 - Subtotal	=	
				Total	=	1.000
% FA Agg.:		Fine A	ngregate (1 000 -	Subtotal) X % In Mix	=	
% In. Agg.:				- Subtotal) X % In Mix	=	-
% CA Agg.:				- Subtotal) X % In Mix	=	
55 _			33 33 4 ()	Aggregate Total	=	
Aggregate Weights		Fine Ago	ıregate (abs vol	.) X Sp. Gr. X 62.4 X 27	=	
1.99.090					_	
		intermediate	Aggregate (abs	s vol.) X Sp. Gr. X 62.4 X 27	-	
		Coarse A	ggregate (abs vo	ol.) X Sp. Gr. X 62.4 X 27	=	
Summary			Cement	(lbs/cy)		
			Fly Ash	(lbs/cy)		
			Slag	(lbs/cy)		
			Water	(lbs/cy)		
			Fine Agg.	(lbs/cy)		
			Interm. Agg.	(lbs/cy)		
			Coarse Agg.	(lbs/cy)		
Distribution	ME	0				
Distribution: Materials, D	ME, Proj. Engr.,	Contractor				

Calculate the Batch Weights for the Materials

This is a M-4-C10 mix. You can use Form 150 to calculate answers. Remember to find the absolute volume of the cement and basic water in IM 529.

Materials	Source
Cement	PC0509
Fly Ash	FA041C
Fine Aggregate	A26502
Coarse Aggregate	A26004
Water	City
Air	

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		_	County :	
Mix No.:		Abs Vol. Cement:		
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17): _	76	Source:	Sp. Gr.:	
Slag (IM 491.14): _		Source:	Sp. Gr.:	
Adjus	sted lbs. Cement:			
To	otal Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement + wi	t Flv Ash +Slag) =	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement + wt	· · · · · · · · · · · · · · · · · · ·	
_				
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal	<u> </u>	
		Total	=	1.000
% FA Agg.:	Fine A	ggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	=	
% CA Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	=	
		Aggregate Total	=	
Aggregate Weights	Fine Age	gregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Intermediate	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
		ggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
•				
Summary		Cement (lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy) Fine Agg. (lbs/cy)		
		Interm. Agg. (Ibs/cy)		
		Coarse Agg. (Ibs/cy)		
		(IDS/CY)		

Calculate the Batch Weights for the Materials

This is a C-3WR-C20 mix. You can use Form 150 to calculate answers. Remember to find the absolute volume of the cement and basic water in IM 529.

Materials	Source
Cement	PC0509
Fly Ash	FA009C
Fine Aggregate	A26502
Coarse Aggregate	A26004
Water	City
Air	

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:				County:	
Mix No.:		Abs Vol. C	ement:	Type:	
Cement (IM 401): _	0/,	lbs S	ource:	Sp. Gr.:	
Fly Ash (IM 491.17): _	76	S	ource:	Sp. Gr.:	
Slag (IM 491.14): _		s	ource:	Sp. Gr.:	
Adju	sted lbs. Cement:				
Т	otal Cementitious	Tot	al % Replacement =		
IM T203	Fine Aggregate So	urce:		Sp. Gr.:	
IM T203	Interm. Aggregate S	ourco:		Sn Gr	
IM T203	Coarse Agregate So	ource:		Sp. Gr.:	
Basic w/c		Wat	er (lbs/cy) = Design w/c (wt. ce	ment + wt Flv Ash +Slag) =	
Max w/c			er (lbs/cy) = Design w/c (wt. ce		
_				•	
Absolute Volumes	Cement		(lbs/cy) / (Sp. Gr. X 62.4	X 27) =	
	Fly Ash		(lbs/cy) / (Sp. Gr. X 62.4	X 27) =	
	Slag		(lbs/cy) / (Sp. Gr. X 62.4	X 27) =	
	Water		(lbs/cy) / (1.00 X 62.4 X	27) =	
	Air				0.060
			Subt	otal =	
			1.000 - Subt		
				otal =	1.000
% FA Agg.:		Fine Aggregate	1.000 - Subtotal) X % In Mix	=	
% In. Agg.:			(1.000 - Subtotal) X % In Mix	=	
% CA Agg.:			(1.000 - Subtotal) X % In Mix	=	
_			Aggregate Total	=	
Aggregate Weights		Fine Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Inte	ermediate Aggregat	e (abs vol.) X Sp. Gr. X 62.4 X	27 =	
		Coarse Aggregate	(abs vol.) X Sp. Gr. X 62.4 X 27	=	
Summary		c	Gement (Ibs/cy)		
y			ly Ash (lbs/cy)		
		•	Slag (lbs/cy)		
			Water (lbs/cy)		
		Fin	e Agg. (lbs/cy)		
			n. Agg. (lbs/cy)		
			e Agg. (Ibs/cy)		
					

Calculate the Batch Weights for the Materials

This is a C-3WR-C20S20 mix. You can use Form 150 to calculate answers. Remember to find the absolute volume of the cement and basic water in IM 529.

Materials	Source
Cement	PC0009
Fly Ash	FA009C
GGBFS	SL00A
Fine Aggregate	A19522
Coarse Aggregate	A22040
Water	City
Air	

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		-	County :	
Mix No.: _	Ab	Туре:		
Cement (IM 401): _	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17): _		Source:	Sp. Gr.:	
Slag (IM 491.14): _		Source:	Sp. Gr.:	
Adju	sted lbs. Cement:			
Т	otal Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement + w	t Flv Ash +Slag) =	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement + w		
_				
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal		
		Total	=	1.000
% FA Agg.:	Fine Ac	ggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	=	
% CA Agg.:	Coarse A	Aggregate (1.000 - Subtotal) X % In Mix	=	
_		Aggregate Total	=	
Aggregate Weights	Fine Agg	regate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Intermediate	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Coarse Ag	ggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
0	_			
Summary		Cement (lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg. (lbs/cy) Interm. Agg. (lbs/cy)		
		Coarse Agg (lbs/cy)		

Chapter 6 MOISTURES

Moisture Corrections

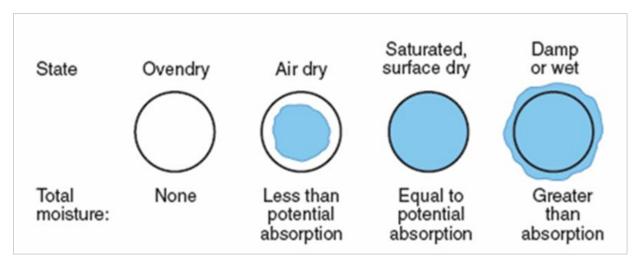
Aggregates can be in four different states. They are the following:

Oven dry – There is no moisture inside or outside of the aggregate

Air dry - The aggregate has moisture on the inside, but is not completely saturated. The aggregate could still absorb moisture.

Saturated Surface Dry – The aggregate contains all the moisture it can hold, but there is no excess moisture on the aggregate.

Damp or wet – The aggregate contains all the moisture it can hold and there is excess moisture on the surface.



Batch weights for concrete mixes are calculated using saturated surface dry (SSD) condition for the aggregates. Aggregates coming from the stockpiles are rarely in the SSD condition, so they are tested using the Moisture test taught in Aggregate Technician (IM 308). This will give the percentage of moisture for the aggregate. Aggregates can also be in the air dry state, which would allow them to absorb water, but this is not common. If the technician does have an aggregate with a negative moisture (absorption), they must adjust the mix for the absorption. The maximum permissible absorption is 0.5%. Since an absorption is rare, there will not be a lot of class time spent on this procedure. If the technician does run into an absorption in the field and needs assistance, they should contact their DOT PCC technician. Normally, aggregate will be in a damp/ wet condition and adjusting batches for that condition will be discussed. As was stated previously original batch weights are calculated with aggregates in SSD. Once the aggregate has been tested for moisture and the correct moisture content is calculated, the aggregate batch weights need to be adjusted. After adjusting the batch weights, the moisture in the aggregate will be used in determining the basic water and the maximum water. Moisture content in excess of 0.5% between succesive batches must be prevented.

Example 1 - Given SSD (dry) batch weights determine the adjusted (wet) batch weights

Coarse Agg. = 1665 lbs. Fine Agg. = 1366 lbs. Basic Water = 246 lbs

Assume: Coarse Aggregate Moisture = 0.3%

Fine Aggregate Moisture = 3.1%

Equation: Wet batch wt. = <u>Batch wt., SSD</u> x 100 (100 - % moisture)

Wet Batch wt., coarse = $\underline{1665 \text{ lbs.}}$ x 100 = 1670 lbs. (100 - 0.3)

Wet Batch wt., fine = $\underline{1366 \text{ lbs.}}$ x 100 = 1410 lbs. (100 - 3.1)

Adjusted Water

= Wet Batch Weight - Dry Batch Weight

Coarse - 1670 lbs. - 1665 lbs. = 5 lbs. water in aggregates

Fine - 1410 lbs. - 1366 lbs. = 44 lbs. water in aggregates

Basic Water 246
- Coarse Water 5
- Fine Water 44
197 lbs.

Example 2 - Given SSD (dry) batch weights determine the adjusted (wet) batch weights

Coarse Agg. = 1665 lbs. Fine Agg. = 1366 lbs. Basic Water = 246 lbs

Assume: Coarse Aggregate Moisture = 0.5%

Fine Aggregate Moisture = 3.1%

Equation: Wet batch wt. = <u>Batch wt., SSD</u> x 100 (100 - % moisture)

Wet Batch wt., coarse = $\frac{1665 \text{ lbs.}}{(100 - 0.5)}$ x 100 = 1673 lbs.

Wet Batch wt., fine = $\frac{1366 \text{ lbs.}}{(100 - 3.1)}$ x 100 = 1410 lbs.

Adjusted Water for Aggregate Moistures

= Wet Batch Weight - Dry Batch Weight

Coarse - 1673 lbs. - 1665 lbs. = 8 lbs. water in aggregates

Fine - 1410 lbs. - 1366 lbs. = 44 lbs. water in aggregates

Basic Water 246
- Coarse Water 8
- Fine Water 44
194 lbs.

Aggregate Moisture Corrections/Adjusted (Wet) Batch Weights

Calculate the adjusted (wet) batch weights for the following aggregate weights with the moistures given:

Fine Aggregate – 1418 pounds

Coarse 0.9

Coarse Aggregate – 1560 pounds Moistures – 1. 3.5 Fine Adjusted Batch Weight Fine Coarse 0.7 Coarse Adjusted Batch Weight Fine Adjusted Batch Weight ___1469___ Answer Fine 3.5 Coarse 0.7 Coarse Adjusted Batch Weight 1571 2. Fine 2.9 Fine Adjusted Batch Weight Coarse 0.6 Coarse Adjusted Batch Weight Fine 3. 2.1 Fine Adjusted Batch Weight Coarse 0.3 Coarse Adjusted Batch Weight 4. Fine 3.9 Fine Adjusted Batch Weight

Coarse Adjusted Batch Weight

Aggregate Moisture Corrections/Adjustments

Calculate the free water for each cubic yard of concrete from the previous page:

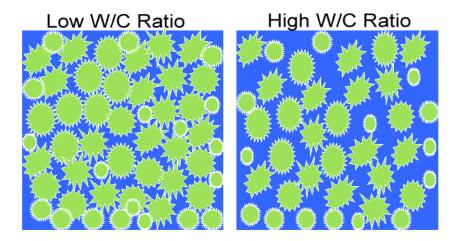
1.	Total Dry B	ted Batch Weights atch Weights in Aggregate			
	Answer	Total Adjusted I	Batch Weights	3040	
		Total Dry Batch	Weights	2978	
		Total Water in A	Aggregate	62	
2.	Total Dry B	ted Batch Weights atch Weights in Aggregate			
3.	Total Dry B	ted Batch Weights atch Weights in Aggregate			
4.	Total Dry B	ted Batch Weights atch Weights in Aggregate			

Water/Cement Ratio (W/C)

Water/cement ratio is the ratio of the amount of cementitious materials in concrete compared to the amount of water in the same cubic yard or batch.

- Effect of w/c on Strength and Permeability
- W/C ratio affects both strength and permeability
- A higher W/C ratio results in a lower strength and higher permeability
- As w/c ratio increases, the cement grains are pushed further apart and the needle like growths have less interconnections
- Permeability is directly related to durability since it controls the rate of moisture and contaminant intrusion
- Strength continues to develop as long as there is a supply of moisture (wet curing)
- Rule of Thumb: Adding 1 gallon of water per cubic yard increases slump ~1" and increases w/c ratio by ~0.015 (lowers strength ~250 psi and increases permeability)

When determining W/C, it is important that all cementitious materials and all water be included in the calculation. The cementitious materials include cement, fly ash (Type C) and GGBFS. The water includes water added at the plant, water in the materials, and water added at the grade. The total water is divided by the total cement to get the water/cement ratio. Remember, the Basic W/C and the Maximum W/C for all mixes are shown in IM 529. Maximum water/cement ratio should never be exceeded.



Water/Cement Ratio (W/C)

Example 1:

Water at the plant – 186 lbs. Water in the material – 47 lbs. Water added at the grade – none

Cement – 529 lbs. Fly Ash – 95 lbs.

	Exampl	e 1	
Cementitiou	s Material	Water	
Cement Fly Ash	529 <u>95</u> 624	Plant Material	186 <u>47</u> 233
23	33/624 = .373	3	

Example 2:

Water at the plant - 127 lbs. Water in the material - 36 lbs. Water added at the grade - 5 gal. 5 x 8.33 = 42 lbs. (all units must be the same so the gallons need to be converted to pounds)

Cement – 465 lbs. Fly Ash – 92 lbs. GGBFS – 62 lbs.

	Examp	le 2	
Cementitio	us Material	Wat	er
Cement Fly Ash GGBFS	465 92 <u>62</u> 619	Plant Material Grade	127 36 <u>42</u> 205
2	205/619 = .33	1	

Problem 10

Water/Cement Ratio (W/C)

Calculate the water/cement ratio for each of the following cubic yard batches using the batch weights given:

1.	Cement	624 lbs.	w/c	
	Total Water	274 lbs.		
2.	Cement	564 lbs.	w/c	_
	Fly Ash	76 lbs.		
	Total Water	265 lbs.		
3.	Cement	624 lbs.	w/c	
	Water at plant	167 lbs		
	Water in Materials.	31 lbs.		
	Water added grade	54 lbs.		
4.	Cement	385 lbs.	w/c	
	Fly Ash	72 lbs.		
	GGBFS	68 lbs.		
	Water at plant	135 lbs.		
	Water in materials	44 lbs.		
	Water added grade	60 lbs.		

Problem 11

Maximum Water Adjustments

What is the maximum water allowed that can be added at the grade for each mix after the water in the aggregate and the water added at the plant have been determined: (convert to gallons)

1.	C-4WR-C2	20
	205 lbs. wa	ter added at the plant
	36 lbs. wate	er in the aggregate
	594 lbs. of	cementitious material
	Maximum v	vater that can be added at the grade
	Answer	C-4WR-C20
		205 lbs. water added at the plant
		36 lbs. water in the aggregate
		594 lbs. of cementitious material
		Maximum water that can be added at the grade26 lbs
2.	M-4	
	220 lbs. wa	ter added at the plant
	47 lbs. wate	er in the aggregate
	825 lbs. ce	mentitious material
	Maximum v	vater that can be added at the grade
3.	C-3WR	
	190 lbs. wa	ter added at the plant
	43 lbs. wate	er in the aggregate
	565 lbs. ce	mentitious material
	Maximum v	vater that can be added at the grade
4.	M-3-C20	
	225 lbs. wa	ter added at the plant
		er in the aggregate
	788 lbs. ce	mentitious material
	Maximum v	vater that can be added at the grade

Chapter 7 SAMPLING & TESTING

Sampling and Testing

There are aggregate tests that need to be completed as part of the PCC production process for Quality Control, Verification, and Independent Assurance. Tests may be completed by a Level II PCC technician or an Aggregate Technician. These test methods were covered in Aggregate Technician certification class and the IM's covering the test methods may be reviewed for more detailed information.

Test Methods

IM 301 Aggregate Sampling & Sample Size

- Ensure proper samples are obtained
- Poorly obtained samples cause inaccurate test results

IM 336 Reducing Aggregate Field Samples

- Split samples
- Ensure representative samples tested

IM 302 Sieve Analysis & IM 306 Minus #200

- To determine compliance with gradation specifications with IM 209
- Gradation can affect workability, water demand, etc.
- Coarse aggregate may be tested as one sample

IM 307 Specific Gravity of Aggregates

- Ratio of materials density to water
- Used to convert volumes to equivalent weights (masses)
 - Cement 3.14 (Type I/II)
 - Water 1.00
 - Air
 - Aggregates IM T-203 determine
 - Sample splitter
 - Immerse (+ #4 sieve) in water for period of not less than 15 hours

IM 308 Free Moisture and Absorption of Aggregates

- Same as IM 307 except test sample is wet as received
- Needed to determine moisture content of aggregates
- Adjust batch weights and ensure accurate w/c ratio

QUALITY CONTROL (QC)

Quality control is those actions necessary to assess production and construction processes so as to control the level of quality being produced in the end product. This concept of quality control includes sampling and testing to monitor the process. Quality control testing is performed by the Contractor when certified plant inspection is required. The Contractor's test results for aggregate moistures and gradations are considered quality control. Quality control tests are used to ensure proper material being delivered from the source and to identify problems with handling and stockpiling. Quality control testing reduces the potential for rejected materials.

VERIFICATION (V)

Verification is the sampling, testing, and the assessment of test results to determine whether or not the quality of produced material or construction process is acceptable in terms of the specifications. Verification sampling and testing is performed by the agency.

INDEPENDENT ASSURANCE (IA)

Independent assurance is the verification by a third party not directly responsible for quality control or acceptance testing. Independent assurance testing is performed by Materials. Independent assurance insures that sampling variability (the variation in sampling technique), testing variability (the lack of repeatability of test results by operators, equipment condition, calibration, and test procedure) and the differences in these variabilities between laboratories and over time do not improperly influence testing measurements. For example, the same sample tested by different laboratories should give roughly the same result.

LOT

A lot is a defined quantity of material from a single source assumed to be produced and/ or placed essentially by the same controlled process.

TEST FREQUENCY

A. Paving Plants (IM 527)

- For continuous construction operation, a verification lot is defined as a week of paving. Lots less than three days of paving will be grouped with the previous or subsequent lot. A verification lot may include a minimum of three days up to eight days. Verification sampling and testing will be performed the first day of paving. Thereafter, verification sampling will be performed daily and tested once per lot. If production on a given day is less than 500 cubic yards, verification sampling may be grouped with the previous or subsequent full day of paving.
- Quality control sampling and testing shall be performed daily.
- Intermittent and low construction operation shall be grouped to establish a lot not to exceed one week. A minimum of one verification sample will be obtained and tested during the week. When intermittent production is longer than one week, sample once per week and test 20% of the samples obtained.

Quality Control Chart

Production	Specific Gravity	Moisture	Gradation	Report
Continuous	1/day first three days, 1 per 3 days thereafter	1/day >500 yd³ 2/day >1000 yd³	1/day > 500 yd³	1/day
Intermittent	1/week	1/day >500 yd³ 2/day >1000 yd³	1/day > 500 yd³	1/week
Low	1/week	1/week	1/week	1/week

B. Ready Mix Plants (IM 528)

- For structural concrete, a quality control lot shall consist of one week. If 50 cubic yards (40 m³) or less are produced in one calendar week, testing may be grouped with previous or subsequent lot, or 1 per two weeks. A bridge deck is considered a lot.
- For non-structural concrete items as described below, a quality control lot shall be one per month. Testing and sampling for non-structural concrete is based on that being the only concrete being produced. If structural or paving concrete is being produced, no additional gradation sampling and testing is required for non-structural concrete produced from the same plant, since the sampling and testing frequency for structural and paving concrete is greater. If multiple projects are being supplied by the plant, one representative sample for the lot covers quality control sampling and testing for all of the projects.

Miscellaneous concrete and any concrete bid item supplied at 10 cubic yards (7.6 m³) or less for a project will be accepted without gradation testing. A gradation test for flowable mortar, revetment grout, or fabric formed revetment grout is required for the mix design only. The PCC Level II certified technician shall provide, for these bid items, materials certifications, batch tickets, and plant reports.

Quality Control Sampling, Testing, and Reporting Chart

PRODUCTION	Specific Gravity	Moisture	Gradation	Report
Structural	1 the first week, monthly thereafter or 1 every two weeks thereafter for DWU sources	2/week or 1/deck	1/deck, or 1/week. If <50 yd³ produced in week 1/two weeks	1/lot or 1/deck
Non-Structural	1/month	1/two weeks	1/month	1/month
Miscellaneous	N/A	N/A	N/A	1/project

Specific Gravity

- A. It is a good idea to try to test each aggregate before the work begins.
- B. This gives the pycnometer weight for the moisture test
- C. If sample varies more that 0.02 from the T-203 Sp.Gr. or varies more that 0.02 from 1 days test to the next, contact the District Materials Lab and begin testing another sample.



Moisture

- A. Moisture shall not vary between batches by more than 0.5%
- B. Spec. 2301.02 C.1.e
 - 1. Coarse aggregate with an absorption of 0.5% or more shall be wetted and allowed to drain at least one hour before batching.
 - 2. It is recommended to soak a pile if it shows absorption.
- C. When water can be observed dripping from bins between batches, the material must not be used.
 - 1. Allow the stockpile to drain
- D. Use common sense on moisture samples. If it rains or snows, sample more often.

Gradations

- A. When certified plant inspection is required, the Contractor's test results for aggregate gradation shall be quality control. Quality control tests are used to ensure proper material being delivered from the source and to identify stockpile changes. A lot is accepted when a verification test by the agency is determined to be in compliance. The minimum frequency for quality control and verification testing shall be in accordance with IM 204.
- B. CPI -Sample and test once per day (paving) or once per week (structural).
 - If a sample result is near or exceeds the specification limits, the CPI should inform the contractor and the agency so they can increase monitor frequency.
 - 2. The District Materials Engineer may investigate sampling and testing procedures.
 - 3. The producer needs to be notified if gradations continue to fail.



- C. Agency -Sample and test first day, thereafter, sample once per day and test once per week for paving, sample and test once per lot for structures.
 - 1. In accordance with IM 205, Agency will randomly select sample location and time, witness sampling, and take immediate possession of samples.
 - 2. Contractor may provide assistance in obtaining samples.
 - 3. The agency will split the verification sample with the contractor. This allows both parties to check testing diferences; however, IM 216 correlation is not required. This is a good practice.
 - 4. A lot is accepted when a verification test by the agency is determined to be in compliance.
 - 5. Retain samples until lot is accepted.





Grad. No.	Section No.	Table 4109.02-1: Aggregate Gradation Table (Percent Passing)	12-1: Aggre 1 1/2"	gate Grada 1.00″	ation Table 3/4"	(Percent P	assing) 3/8"	#4	8#	#30	#20	#100	#200	Notes
~	4110, 4125, 4133, 4134	PCC FA, Cover Agg.					100	90- 100	70-100	10 60			- - - - -	_
2	4112	PCC Intermediate				95-100			0-10					
ю	<u>4115</u> (57, 2-8), <u>4118</u>	PCC CA & Pipe Bedding	100	95-100		25-60		0-10	0-5				-0 1 .	2, 10
4	4115 (2-8)	PCC CA	100	50-100	30-100	20-75	2-22	0-10	0-5				-0 1.5	10
5	4115 (67, 2-8)	PCC CA		100	90-100		20-55	0-10	0-5				-0 -2:	10
9	4115.05 (Repair & Overlay)	PCC CA			100	90-100	40-90	0-30					-0 1.5	10
7	4116 (Class V)	PCC FA & CA	100					80- 92	60-75	20- 40				
ω	4116.03 (Class V)	Fine Limestone					100	90-					0-30	
o	2556	Grout Aggregate				100	85-100		0-10				-0 -2:	
10	4119, 4120.02, 4120.03 (C gravel)	Granular Surface			100			50- 80	25-60					3, 11
-	4119, 4120.02, 4120.04, 4120.05, 4120.07, (A, B Cr. St.)	Granular Surface & Shoulder		100	95-100	70-90		30- 55	15-40				6-16	4, 5, 11
12a	4121 (Cr. St.)	Granular Subbase	100			40-80			5-25				9-0	6, 11
12b	4121 (Cr. Gravel)	Granular Subbase	100			50-80			10-30		- 2 2		3-7	7, 11
13a	4122.02 (Cr. St.)	Macadam St. Base												15
13b	4122.02	Macadam Choke St.	:	100					:					11
4	4123 4117 (No. 4 Cr. Gr. Cr. St. or	Modified Subbase	100		70-90			05	10-40		c			5, 7, 11
18	Nat. Sand)	Leveling Aggregate					100	93- 100	50-80		- 15		0-4	7
19	4117, 4125 (1/2" Cr. Gr. or Cr. St.)	Cover Aggregate			100	97-100	40-90	0-30	0-15				-0 1.	7
20	4125 (1/2" Scr. Gr.)	Cover Aggregate			100	95-100	40-80	0-15	2-0				0- 1.5	11
21	4117, 4125 (3/8" Cr. Gr. or Cr. St.)	Cover Aggregate				100	90-100	10- 55	0-20	0-7			1.5	11
22	4124	Fine Slurry Mixture					100	85- 100	40-95	20- 60	14- 35	10- 25	5-25	9, 11
23	4124 (Cr. St.)	Coarse Slurry Mixture					100	-02 90	40-70	19- 42			5-15	11
29	4131	Porous Backfill			100	95-100	50-100	0-20	8-0					11
30	4132.02 (Cr. St.)	Special Backfill	100						10-40				0-10	5, 1 1, 4
31	4132.03 (Gravel)	Special Backfill		100	90-100	75-100			30-55				3-7	11
32	4133 (Sand/Gr./Cr. St.)	Granular Backfill							10-100				0-10	8, 11, 16
35	4134 (Natural Sand/Gr.)	Floodable Backfill	100						20-90				0-4	11
36	4134 (Natural Sand)	Floodable Backfill						100					0-5	7
37	2320 (Quartzite/Granite/Slag)	Polymer-Modified Microsurfacing					100	90-	65-90	30- 50	30	10-	5-15	12, 13
38	2320 (limestone/Dolomite)	Polymer-Modified Microsurfacing					100	70- 90	45-70	15- 35	10- 25	5-20	5-15	12, 13
Notes: (GI	Notes: (Gradations No. 15, 16, 17, 24, 25, 26, 27, 28, 33, and 34 have been deleted)	26, 27, 28, 33, and 34 l	nave been	deleted)									 	

7-7

- For <u>Section 4110</u>, when the fine aggregate is sieved through the following numbered sieves 4, 8, 16, 30, 50, and 100 no more than 40% shall pass one sieve and be retained on the sieve with the next higher number. -:
- When used in precast and prestressed concrete bridge beams, 100% shall pass the 1.00" sieve. When used for pipe bedding (4118) the No. 200 restriction does not 'n
- When compaction of material is a specification requirement, the minimum percent passing the No. 200 sieve is 6%. က
- 4. See specifications for combination of gravel and limestone.
- Unwashed air dried samples of crushed composite material shall be tested for gradation compliance except that no gradation determination will be made for material passing the No. 200 sieve. 5
- The gradation requirement for the No. 8 sieve shall be 5% to 20% when recycled material is supplied. ဖ
- For Section 4121 gravel, one fractured face on 30% or more of the particles retained on the 3/8 inch sieve. For Section 4123 gravel, one fractured face on 75% or more of the particles retained on the 3/8 inch sieve. ۲.
- 8. Crushed stone shall have 100% passing the 11/2" sieve.
- Gradation limitations for the 30, 50, and 100 sieves shall not apply when slurry mixture is applied by hand lutes, such as for slurry leveling. <u>ග</u>
- Maximum of 2.5% passing the No. 200 sieve allowed if for crushed limestone or dolomite when documented production is 1% or less 9.
- When Producer gradation test results are used for acceptance, test results representing at least 90% of the material being produced shall be within the gradation limits discretion, be resampled using Materials I.M. 301 procedures. One hundred percent of the stockpile quality control and verification test results shall be within the and the average of all gradation results shall be within the gradations limits. Stockpiled material not meeting the criteria may, at the District Materials Engineer's gradation limits. 7
- For Quartzite/Granite/Slag: 45% to 70% passing No. 16 Sieve; for Dolomite/Limestone: 25% to 50% passing No. 16 Sieve.
- 13. Percent passing shall not go from the high end to the low end of the range for any two consecutive screens.
- 14. If the material meets the quality requirements of Article 4120.04, a maximum of 14% passing the No. 200 sieve will be allowed.
- 15. 3" nominal maximum size screened over 3/4" or 1.00" screen.
- **16.** 100% passing the 3" screen

Chapter 8 CERTIFIED PLANT INSPECTION

VII.Certified Plant Inspection

IM 527 and Article 2521

A. General

- · Certified Plant Inspection will be required for:
 - Primary projects
 - Interstate projects
 - State Park projects
 - Institutional projects
- The Contractor will furnish the Certified Plant Technician for the work specified.
- The Plant Technician will be responsible for:
 - Inspection of plant operation
 - Aggregate gradations
 - Identification of materials
 - Testing strength specimens
 - Maintenance of proper reports
 - Other duties as specified in IM 213
 - If test results indicate noncompliance, the Contractor is responsible for deciding corrective action, not the technician



Safety should be uppermost in the minds of those working in concrete plants. The technician should:

- Make certain all contractual safety requirements are met
- Encourage the elimination of hazards
- Become familiar with hazards
- Wear protective headgear when working around bins and other plant equipment
- Make sure that belt sampling locations are equipped with an On-Off switch





C. Equipment

- Bins (Article 2001.06 and IM 527)
 - The contractor shall maintain any stress carrying parts of the bin frame
 - Bins must be fully loaded for at least 12 hours before concrete proportioning and the amount of settling determined by the contractor



- If the settlement differential of footings exceeds 1/10 foot (30mm), the District Materials Engineer must be notified
- All other plant machinery shall meet current OSHA standards
- Proportioning Equipment (Article 2001.20 and IM 527)
 - General
 - Proportioning scales and meters shall be test loaded to the maximum load expected during production
 - The DME or a designated staff will witness calibrations before concrete work begins
 - Equipment must be examined at least at 3-hour intervals for correctness of the amount being batched and for damage to the equipment
 - Scale sensitivity shall be checked at least twice a day during a normal working day
 - Cement and Fly Ash Scales



- Scales must be accurate to within ±0.5% of the load and must operate (delivery tolerance) within ±1% of the required batch amount
- Cement shipment yield determinations must be made every 10,000 cubic yards (10,000 cubic meters) after the original determination made near the end of the first full day of production



Aggregate Scales

- Must operate within a delivery tolerance of ±1% of the required batch amount
- Water Measuring Device
 - Water delivered to the batch must be accurate to 2.2 pounds or ±1% of the amount shown by the indicator; whichever is greater
- Admixture Dispensing Equipment
 - Equipment for dispensing liquid admixtures must be accurate to ±3% of the quantity required
 - Operation of the dispenser must be observed for uniform delivery at least once during each 3 hours of normal operation
 - The dispensing equipment must be flushed with water at least once a day
- Mixing Equipment (Article 2001.21 and IM 527)
 - Stationary Mixers
 - Mixing time shall be a minimum of 60 seconds and a maximum of 5 minutes



- Charge time plus discharge time plus minimum mixing time of 60 seconds is the minimum batch cycle time
- Mixing time must be determined and recorded at least once per day

Truck Mixers

- Batches must be mixed from 70-90 revolutions at mixing speed
- Mixing time must be determined and recorded at least once daily
- Transit mixers must carry a current certification stating that the mixer has been examined in the last 30 days

Continuous Mixers

- Calibration performed by Contactor, witnessed by District Materials
- Once calibrated in a
 District, it is not required
 that it be recalibrated
 for subsequent projects
 within that District



- Transportation Vehicles (Article 2301.02 and IM 527)
 - Stationary Mixing
 - Concrete must be placed from non-agitating units within 30 minutes after discharge from mixer. If a retarding admixture is used, this time may be extended an additional 30 minutes
 - Concrete must be placed from agitating units within 90 minutes after the water and cement have made contact with each other



Truck Mixing

 On truck-mounted transits with agitation, concrete must be placed within 90 minutes after the water and cement have made contact with each other. If no agitation is used, the time limit is 30 minutes

D. Material

- Identification
 - Aggregates
 - The plant technician shall verify that all material incorporated in the project is properly certified.
 - Certified aggregate may be incorporated on the basis of the certified truck ticket.
 - Cementitous Material (cement, fly ash, GGBFS)
 - May be incorporated into the project on the basis of the manufacturer's certification.
 - Water
 - Municipal supply systems and potable sources may be used without testing; other sources (lakes, streams, etc.) must be approved by the Central Laboratory.
 - Admixtures (Air-Entraining, Retarding and Water-Reducing Admixtures)
 - May be incorporated with no further testing if listed in MAPLE. Dosage rates are also included in MAPLE. Any admixtures suspected of being frozen and materials older than 18 months shall not be used before being tested and approved.
 - Air entraining admixtures shall be stirred, agitated, or circulated at least weekly to ensure a uniform and homogenous mixture of solids and solution.
 - Retarding, water-reducing, and high range water-reducing admixtures shall be stirred, circulated, or agitated thorougly once a day prior to operation of the proportioning plant to maintain the solids in suspension. Each 100 gallons of solution shall be circulated a minimum of 5 minutes per day.

- Storage and Handling of Materials
 - Storage and handling of all aggregates must comply with Article 2301.02. The D.M.E. authorizes and is responsible for proper changes.
 - Fine aggregate must be drained at least 24 hours before being used.
 - For both coarse and fine aggregate, moisture content of successive batches must not vary more than 0.5%.
 - Be alert for contamination of aggregate stockpiles.
 - Cementitous materials must be stored in weatherproof enclosures. If lumps develop in cement or fly ash, it must not be used until it has been reprocessed, retested and approved. Cementitous materials, which have been in storage at the project site for more than 60 days or in the producer silo for more than one year, must also be retested and approved.





VI.Concrete Plant Inspection Checklist

I.M. 527

- 1. The proportioning equipment must be examined at least at 3-hour intervals for correctness of the amount being delivered and for damage.
- 2. The scale sensitivity shall be checked at least twice during a normal working day by placing a mass equal to 1/10 percent of the batch on the fully loaded scales and observing the movement of the indicator.
- 3. Check scale operation to determine cement delivery tolerance conformance at least once during each day of normal operation.
- 4. The Standard Specification requires that the cement shipment yield determination must be made at intervals of approximately 10,000 cubic yards (10,000 cubic meters) after the original determination made near the end of the first full day of production.
- 5. Check scale operation to determine aggregate delivery tolerance conformance at least once during a normal working day and document.
- 6. If water is measured with a scale, the delivery tolerance must be determined at least once for each day of normal operation and document.
- 7. Admixture dispensers shall be observed for uniform delivery at least once during each 3 hours of normal operation and document.
- 8. Admixture dispensers must be flushed with water at least once daily.
- 9. Determine and record the mixing speed and the mixing time at least once daily by using the sweep hand of a watch and counting the drum revolutions in one minute.
- 10. Determine and record the time between batching and placement at least once during each day of normal operation.
- 11. Specific Gravity One sample per day for both coarse and fine aggregates for the first three days of normal operation and one for each three days of normal operation for both coarse and fine thereafter, assuming the first three days results are consistent.
- 12. Moisture A minimum of one test per each half day of operation.

- 13. Gradation (QC) Obtain and test one sample per day. See Construction Department Instruction No. 3.22. Show sample number, name of sampler, and name of tester on lab work sheet.
- 14. If maturity not being used, one beam for each 2000 cu. yd. (1529 cubic meters) of concrete placed. Make flexural tests representing alternating 2000 cu. yd. (1529 cubic meters) placement units at 7 and 14 days.
- 15. At the plant, the plant inspector shall remove the specimens, clean the molds, oil and return the molds to the grade at the direction of the paving inspector. The plant inspector shall store the specimens until date of test. The storage space shall be a pit adequate for the project, and for normal projects it should be at least 4 ft. x 6 ft. x 18 in. (1.2 m x 1.8m x .46 m). The specimens shall be wet at all times. If the temperature in the sand filled pit drops below 40°F (4.4°C), remove the specimens and place them under wetted burlap in a heated enclosure or in lime saturated water. See I.M. 328. Note: Lime saturated water is prepared by mixing 1 ounce (30 ml) of hydrated lime with 1 gallon (4 L) of water.
- 16. When opening is determined by the maturity method, casting beams every 2000 cubic yards (1529 cubic meters) is not required. The plant inspector should ensure curve development is performed according to I.M. 383.

17. Other duties include:

- Close observation of stockpiling and handling of aggregates. There must be no intermingling of aggregates and no contamination.
- Frequent check on wet batch or dry batch truck cleanliness and degree of discharge.
- · Document all the above data in diary.
- Make the following report daily: Plant Reports Form #800240
- Make the following report as prescribed: Cement Yield Report Form #820912E
- At the end of the project, make a copy of the plant book for the Engineer, within 10 days.
- When required by Article 2301.07, make a copy of vibration-monitoring device records in electronic format.

Structural Plant Inspection

I.M. 528

Equipment

- Elevated, Low-Profile, and Ground Level Bins
 - Tendency for aggregates to be intermingled.
 - Intermingled or contaminated materials must not be incorporated.



Proportioning Equipment

- District Materials Engineer approves annually.
- Calibration Report will be posted.
- · Vibration and material accumulation cause adjustments to drift
- Small amounts not objectionable.
- Scales not properly sensitized require immediate action
- Plant superintendent or authorized operator representative must make scale and equipment adjustments. Plant inspector not to participate in this activity.
- Plant inspector independently determines if settings or if adjustments are correct and amounts of material in batch are correct.





- If material accumulation exceeds one percent of the material batch, it must be removed and readjusted to indicate a zero load within 0.5%.
- Scale sensitivity checked at beginning of placement if intermittent or daily if continuous. 1/10 percent of batch on fully loaded scales shall exhibit visible indicator movement.
- Strict adherence to plant inspector determine independently to maintain division of authority and to minimize erroneous operations.
- · Suitable wind protection of scales
- Air entraining required for all structural concrete, except Class X
- Retarding admixture may be required. Water reducer may be used at contractor's option.
- Intermingling of admixtures together may neutralize each other. Introduce separately.

Mixing Equipment

- Truck mounted transit mixers
- Stationary central mixers with in-transit agitation
- Stationary mixers located at site
- Concrete mobiles

Transit mixers must carry current certification signed by responsible company representative - mixer condition examined in last 30 days and free of hardened concrete. It is the responsibility of the CPI to check ready mix trucks for the monthly condition certification.



Sampling and Testing Aggregates

- Structural
 - Specific Gravity
 - 1 the first week, monthly thereafter.
 - 1 the first week, 1 every 2 weeks thereafter for DWU sources
 - Variations greater than 0.02 from T-203, inform Project Engineer and District Materials Engineer immediately.
 - Moisture
 - Two samples per week, or one per deck.
 - Gradation (QC)
 - · One sample per week.
 - If less than 50 yd³/wk group with previous or subsequent week
 - One per bridge deck.
- Non-structural and miscellaneous concrete
 - The items of work described in IM 528 are designated as nonstructural and/or miscellaneous concrete, when placed at less than 100 cubic yards per week.
 - When non-structural concrete is the only concrete produced for the project(s) from a given plant, quality control testing may be reduced to one specific gravity per month, one gradation per month, and one moisture every two weeks.
- Miscellaneous concrete
 - No testing is required for miscellaneous concrete.

Water cement ratio

- Water demand exceeds design w/c ratio and approaches maximum, notify Project Engineer and District Materials Engineer
- Check aggregate moistures, batch weights, scales, water meter, etc.
- Shall not exceed maximum w/c ratio
- May increase cement content with District Materials Engineer approval

Strength Tests - IM 316

- Required for each day's placement of a structural unit in flexure by agency.
- Abutment walls, pier footings, bridge end posts, and culvert curtain walls not considered critical structural units - strength testing not required.

















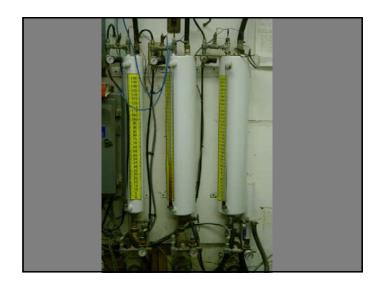


































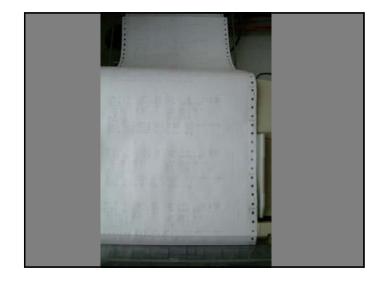


































•	•			
E	•			
	•			
8-1	26			





































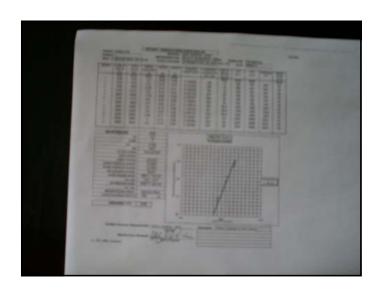












-	

































Chapter 9 REPORTS

REPORTS

Calibration Reports

• Form 820917

Transit Mixer Condition

• Form 820907

Ready Mix Tickets

• Form 830212

Portland Cement Shipment Yield

- Every 10,000 cubic yards
- Form 820912

Paving and Structural Report

- Daily or Weekly
- Form 800240E or 800240M

Plant Report

- https://iowadot.gov/Construction_Materials/pcc/eplantreport.xlsm
- Use project Info page in the excel file



TRANSIT MIXER CONDITION CERTIFICATE

In accordance with requirements of Iowa Department of Transportation Standard Specifications Section 2001.21B this certifies the herein described transit mixer was examined on the date shown and was found to be in proper working condition, the fins and blades were not damaged or worn excessively, and the drum interior was free of hardened concrete buildup.

	Unit Identification Number			
	Home Base			
	Mixer Manufacturer			
	Serial Number			
	MMB Rating (Mixing, Cu. Yd.)		Year New	
	Truck Manufacturer			
	Model			
Date		Signature		

Form	0202	17
F()[[]]	みろ い/	1/

READY MIX CONCRETE

10-12-16

		Plant
Truck No.:	Ticket No:	
Date:	Des. No.:	
Proj. No.:		
	Retarder/Water Reducer?Y	es No
Conc. This Truck:		CY
Air agent added this truck:		OZ.
Time Batched:	Discharged:	
Rev. Mixed (Plant)	Grade:	
Water (gal. or lbs. This Truck) 8	8.33 lbs./gal.	
In Aggregate:	gal	lbs.
Added (Plant):	gal	lbs.
Subtotal:	gal	lbs.
Added Grade:	gal	lbs.
TOTAL WATER:	gal	lbs.
Maximum Water Allowed:	gal	lbs.
Air:	Slump:	
Plant Inspector:		
Receiving Inspector:		

Example 1 Ready Mix Ticket

Reissued April 20, 2010 Supersedes April 20, 2004

Matls. IM 527 Appendix C

Form 830212	READY MIX CONCRETE	10-12-16
American C G	ilmore CITY	Plant
Truck No.: 5	Ticket No: 2	
Date:	Des. No.: 307	
Proj. No.: <u>F55M</u> -	015-1(7)3T-76	
Mix No.: <u>C4 - C2</u>	20 Retarder/Water Reducer? Yes	No
Conc. This Truck:	6	_ CY
Air agent added this tru	uck:	oz.
_	5 AM Discharged: 8:30 AM	
Rev. Mixed (Plant)	70 Grade: 30	
Water (gal. or lbs. This		
In Aggregate:		
	<u>/34</u> gal. <u>/,//6</u> lbs	
	/83 gal/,524 lbs	
Added Grade:		
TOTAL WATER:		i.
Maximum Water Allowe	ed: <u>219</u> gal. <u>/, 824</u> lbs	i.
Air: 6.8%	Slump: 3 "	
Plant Inspector: <u>Jo</u>	hn Doe NWOOO	,
Receiving Inspector:	DAVIO Jones NW999	

PROBLEM 12

Use the following information to fill in the Ready Mix Ticket. The ticket is from Project #STP-53-4(15)—2C-53 and from Kirk's Ready Mix.

Truck #4, Ticket#2
Batched at 8:45 AM and Discharged at 9:30 AM
Mixer Revolutions – 72 at plant, 35 at grade
Air agent added this truck – 18 ounces
Percent of air – 6.8%
Slump - 2 ¾ inches
6 c. yds. C-3WR-C15S30 batched on 8/4/14
65 lbs. water per cubic yard in the aggregates
150 lbs. water per cubic yard added at the plant
19 lbs. water per cubic yard added at the grade

The amounts given are in pounds per cubic yard. The tickets want both pounds and gallons **per truck**.

Remember: Sign the first ticket and write your certification number. Initial the rest of the tickets and write your certification number.

Form 830212

READY MIX CONCRETE

10-12-16

		Plant
Truck No.:	Ticket No:	
Date:	Des. No.:	
Proj. No.:		
	Retarder/Water Reducer?]Yes No
Conc. This Truck:		CY
Air agent added this truck:		OZ.
Time Batched:	Discharged:	
Rev. Mixed (Plant)	Grade:	· · · · · · · · · · · · · · · · · · ·
Water (gal. or lbs. This Truck)	8.33 lbs./gal.	
In Aggregate:	gal	_ lbs.
Added (Plant):	gal	_ lbs.
Subtotal:	gal	lbs.
Added Grade:	gal	lbs.
TOTAL WATER:	gal	lbs.
Maximum Water Allowed:	gal	_ lbs.
Air:	Slump:	
Plant Inspector:		
Receiving Inspector:		

PROBLEM 13

Use the following information to fill in the Ready Mix Ticket. The ticket is from Project #STP-53-4(15)—2C-53 and from Kirk's Ready Mix.

Truck #8, Ticket #4
Batched at 10:15 AM and Discharged at 11:05 AM
Mixer Revolutions – 70 at plant, 33 at grade
Air agent added this truck – 27 ounces
Percent of air - 7.2%
Slump – 3 inches
9 c. yds. C-4-C15 batched on 8/5/10
64 lbs. of water per cubic yard in the aggregates
183 lbs. water per cubic yard added at the plant
25 lbs. water per cubic yard added at the grade

The amounts given are in pounds per cubic yard. The tickets want both pounds and gallons **per truck**.

Remember: Sign the first ticket and write your certification number. Initial the rest of the tickets and write your certification number.

Form 830212	READY MIX CONCRETE	10-12-16
		Plant
Truck No.:	Ticket No:	····
Date:	Des. No.:	
Proj. No.:		
Mix No.:	Retarder/Water Reduc	er? Yes No
Conc. This Truck:		CY
Air agent added this truc	ck:	OZ.
Time Batched:	Discharged:	
Rev. Mixed (Plant)	Grade:	· · · · · · · · · · · · · · · · · · ·
Water (gal. or lbs. This	Γruck) 8.33 lbs./gal.	
In Aggregate:	gal	lbs.
Added (Plant):	gal	lbs.
Subtotal:	gal	lbs.
Added Grade:	gal	lbs.
TOTAL WATER: _	gal	lbs.
Maximum Water Allowe	d: gal	lbs.
Air:	Slump:	

Receiving Inspector:

Form 820912E 8-00

lowa Department of Transportation Office of Materials PORTLAND CEMENT SHIPMENT YIELD REPORT

Report No	
Date Submitted	

Contract ID: _ Project No.: _				CEMENT SH	IPMENT YIEL	.D REPORT		Source:			
County: _			_	Plant Lo	ocation:			Contractor			
Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре
			╂──┤┞								
			╁┈┤├								
			1								
Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)							
						Total	Billed W	/eight (Tons)			
					4				1		
					\dashv				Yield =	%	
					+						
Left in		This C	heck (+)		7						
Scale (Tons)	Pr	evious Yield						C.P.I.:			
		Veighed (Bate									

Distribution: ___ DME ____ RCE ____ Central Materials ____ Contractor ____ Inspector

Form 820912E - computer

E - Units

Example 2 Cement Yield Check

Report No.: Portland Cement Shipment Yield Report Date Submitted: 09/24/10

Contract ID: Project No.: STP388-(34)-445 County: Henry

Plant Location: Hwy. 34

Source: Ash Grove

Contractor: Benson Paving

	Invoice	Billed	
Date	Number	Tons	Туре
09/20	11456	24.30	1/11
09/20	11779	23.77	1/11
09/20	12467	24.11	1/11
09/20	12888	23.67	1/11
09/20	13664	23.98	1/11
09/20	14321	24.22	1/11
09/21	14478	24.46	1/11
09/21	14555	24.12	1/11
09/21	15522	24.43	1/11
09/21	15688	24.21	1/11
09/21	15777	23.87	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11

	Invoice	Billed				
Date	Number	Tons	Type			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			
0	0	0.00	1/11			

	Invoice	Billed	
Date	Number	Tons	Type
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	I/II
0	0	0.00	1/11
0	0	0.00	I/II
0	0	0.00	I/II
0	0	0.00	I/II
0	0	0.00	1/11
0	0	0.00	I/II
0	0	0.00	1/11
0	0	0.00	1/11
0	0	0.00	1/11

			_	
	Cement			Cement
	batched	Batched		Batched
Mix No.	lbs / yd3	yd3		Tons
C-4WR	624	788.00		245.86
M-4	825	49.00		20.21
0	0	0.00		0.00
0	0	0.00		0.00
0	0	0.00		0.00
Left In Scale		2.10		
(Tons)		1.90		
	266.27			

Yield = 100.4 %

C.P.I.: Signature

Distribution: ____ DME ____ RCE ___ Central Materials ____ Contractor ____ Inspector

Problem 14

Cement Yield Problem

Calculate the cement yield given the following

- 4096 lb. cement in scale hopper from last cement yield check.
- 4872 cubic yards at 623 lb./c. yd.
- 615 cubic yards at 604 lb./c. yd.
- 66 cubic yards at 823 lb./c. yd.
- 3000 lb. left in scale hopper

Total weight billed is 3,333,333 lb. (1666.67 Ton)

Form 820912E 8-00

lowa Department of Transportation Office of Materials PORTLAND CEMENT SHIPMENT YIELD REPORT

Report No	
Date Submitted	

Contract ID: _ Project No.: _				CEMENT SH	IPMENT YIEL	.D REPORT		Source:			
County: _			_	Plant Lo	ocation:			Contractor			
Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре
											-
											-
			╂┈┤┞								1
			╁┈┤├								
		1	1								
Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)							
						Total	Billed W	/eight (Tons)			
					4				1		
					\dashv				Yield =	%	
					+						
Left in		This C	heck (+)		7						
Scale (Tons)	Pr	evious Yield						C.P.I.:			
		Veighed (Bate									

Distribution: ___ DME ____ RCE ____ Central Materials ____ Contractor ____ Inspector

Problem 15

Cement Yield Problem

Calculate the cement yield given the following

- 2600 lb. cement left in scale hopper from last yield check
- 1480 cubic yards at 492 lb./c. yd.
- 500 cubic yards at 571 lb./c. yd.
- 3000 lb. cement left in hopper this check
- Total billed weight is 512.05 Ton
- Show your work in Tons (convert lb. to ton)

Form 820912E 8-00

lowa Department of Transportation Office of Materials PORTLAND CEMENT SHIPMENT YIELD REPORT

Report No	
Date Submitted	

Contract ID: _ Project No.: _				CEMENT SH	IPMENT YIEL	.D REPORT		Source:			
County: _			_	Plant Lo	ocation:			Contractor			
Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре
											-
											-
			╂┈┤┞								1
			╁┈┤├								
		1	1								
Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)							
						Total	Billed W	/eight (Tons)			
					4				1		
					\dashv				Yield =	%	
					+						
Left in		This C	heck (+)		7						
Scale (Tons)	Pr	evious Yield						C.P.I.:			
		Veighed (Bate									

Distribution: ___ DME ____ RCE ____ Central Materials ____ Contractor ____ Inspector

1. PLANT PAGE – FORM #240

Plant Reports are to be recorded in the computer program or on hand completed forms, both provided by the Iowa Department of Transportation. A copy of the completed PCC Plant Page shall be faxed or delivered to the District Materials Engineer on the next working day, within four hours after start-up of the plant. The CPI shall keep a copy of the PCC Plant Page and send the original to the Project Engineer. Copies of the files containing the project information are to be available to the engineer upon request until the project is final.

A separate report is to be made for each day concrete is placed. These reports are to be consecutively numbered for each project. A sample copy and the instructions on completing this report are in **Appendix A**.

When computer forms are used, the following equipment is necessary.

2. PERSONAL COMPUTER

The personal computer shall be capable of running Iowa DOT Programs. The printer shall be capable of producing quality hard copies. That is, original printed output, which is clearly readable and remains readable after being faxed and/or copied.

INSTRUCTIONS FOR COMPLETION OF PCC PAVING & STRUCTURAL REPORTS

The new reporting process does not include Mobile Mixer information. Use the following forms and reports when using a Mobile Mixer:

Form E 115 Air & Slump Record Form E 120 Mobile Mixer Data Record

Report #820180 Gradation Test

Report #821297 Nuclear Density of Plastic PC Concrete

Report #820020 Mobile Mixer Calibration

Project No.

Enter the project number listed on the plans.

Plant Name

Enter the name of the ready-mix plant and location for structural concrete. Enter the approximate location of a paving plant set up by a contractor.

Example: Croell - Waverly (Ready Mix)

2 miles NW of Waverly (Paving Plant)

Contractor/Sub

A group of people or a company must perform the work being done, either a prime or sub contractor. Enter the name of the contractor performing the work. If it is a subcontractor, list this after the contractor's name.

Weather

Enter a brief description of the actual weather conditions at the paving plant. Weather conditions are not required for structural concrete (Ready Mix).

Contract ID

Enter the nine-digit contract number listed at the top of a contract. This is <u>not</u> the five-digit accounting ID number listed with the project number.

County

Enter the county listed on the project plans.

Temperatures, Min. & Max.

An air temperature shall be recorded early in the morning for the minimum and around midafternoon for the maximum. Take the temperatures in a shaded area, otherwise they are meaningless. Temperatures are not required for structural concrete, except bridge decks.

Report No.

Start with the number 1 at the beginning of work for each project. The ending report number shall coincide with the last day each item is completed for paving and the last week for structural. Do not restart the report sequence if the project carries over to the next year.

Example: (Paving) 16 days of 10.5-inch slip form paving - report 1 through 16.

(Ready Mix) 8 weeks of concrete on Des. 1290 - report 1 through 8.

Date This Report

Enter the date the concrete is placed for each day of paving. Enter the last day of the workweek for structures (normally the Saturday date).

Date of Last Report

Self-explanatory.

Design No.

Enter the design number of the structure where the concrete is being placed on each project. Leave this space blank on paving projects.

Check Mix (Central or Ready)

Place an "X" in the appropriate box provided indicating how the concrete is being produced.

Check Usage (Paving, Structural, Incidental, Patching)

Place an "X" in the appropriate box provided to indicate the type of work where the concrete is used.

Date (Mo./Day)

This column is only used for Ready Mix concrete applications. Enter the month and the date for each day of production during the week.

Example: 5/24, 7/01, 12/03, etc.

Mix Number

Enter the mix number being used that is listed in the proportion tables of <u>IM 529</u>.

Location- Station (Beg. /End/Dir)

Enter the beginning and ending station for concrete placed daily by mix. Enter the direction (N, S, E, W) for divided sections or B for 2-lane sections. For structural concrete enter the unit placed (Example: pier, cap, footing, deck). Enter item placed for other work. (Example: sidewalk, drive) The grade inspector will provide the location or item placed to the plant inspector.

Batched

Enter the total cu. yds. batched for each mix for a paving plant. Enter the total cu. yds. batched for each unit poured for structures.

% Of Est. Used

Enter the percent of estimated concrete used. The grade inspector will provide the % of estimate used ((cubic yards used / cubic yards estimated) X100) to the plant inspector

Fine, Intermediate & Coarse Aggregate (Moisture)

Enter the percent moisture once in the morning and once in the afternoon for paving projects. Enter the percent moisture for each unit poured on structures.

Fine, Intermediate & Coarse Aggregate (T203 sp gr)

Enter the specific gravity for each aggregate listed in the T203 source tables.

Fine, Intermediate & Coarse Aggregate (Dry Wt.)

Enter the weight of each aggregate calculated by absolute volumes.

Actual Quantities Used Per cu. yds. (Pounds)

Cement
 Fly Ash
 GGBFS
 Enter the pounds of cement calculated by absolute volumes.
 Enter the pounds of GGBFS calculated by absolute volumes.

Fine Enter the actual pounds of fine aggregate adjusted by moisture content.

Inter. Enter the actual pounds of intermediate aggregate adjusted by moisture content. **Coarse** Enter the actual pounds of coarse aggregate adjusted by moisture content.

In Agg. Enter the calculated difference between the actual weights and the dry weights of all

aggregates.

Plant Enter the average pounds of water added at the plant for each cu. yd., including ice Enter the average pounds of water added on the grade (if permitted by specification).

Avg. W/C Ratio

Enter the ratio of total water, including water in the aggregates and water added on the grade, in one cu. yd. divided by the total sum of cement, fly ash, and ggbfs in one cu. yd., report to three decimal places.

CPI Gradations

This section of the report is for reporting the Certified Plant Inspector gradation test results for the coarse and fine aggregates being used in the mix.

Batched (Today or Week)

Place an "X" under the Today column if the report is being submitted daily (paving).

Place an "X" under the Week column if the report is being submitted weekly (structures).

Concrete Batched

Enter the total cu. yd. of concrete batched under the appropriate column. Paving plant totals are normally under the Today column; structural concrete totals are normally under the Week column.

To Date Total

Enter the running total for both concrete and cement.

Air Entraining (Air Ent.)

Enter the brand name or source, average rate per cu. yd., and lot number.

Water Reducer (Wat. Red.)

Enter the brand name or source, average dosage rate, and lot number.

Retarder

Enter the brand name or source, average dosage rate, and lot number.

Calcium Chloride (Cal. Chlor.)

Matls. IM 527 Appendix A

Enter the brand name or source, average dosage rate, and lot number only when added at the plant site

Superplasticizer (Superplas.)

Enter the brand name or source, average dosage rate, and lot number.

Concrete Treatment

Place an "X" directly behind Ice, Heated Water, or Heated Materials, if one or more are used. If ice is used to cool the mix, enter the pounds of ice per cu. yd. Include weight of ice with plant water.

Cement

Enter the cement type, specific gravity, and source. See IM 401 for the actual source name.

Fly Ash

Enter the type and specific gravity and source. See <u>IM 491.17</u> for the actual source name.

<u>Example:</u> Chillicothe and ISG Headwaters are <u>not</u> source names. Ottumwa is the source name.

Rock

Enter the T203 A number, and gradation number.

GGBFS

Enter the grade, specific gravity, and source. See IM 491.14 for the actual source name.

Sand

Enter the T203 A number, and gradation number.

Intermediate

Enter the T203 A number.

Remarks

Enter delays, which may take place. Enter description of noncomplying test results.

CPI

Enter the Certified Plant Inspector name and certification number.

Monitor

Enter the plant monitor name and certification number.

If using the computer spreadsheet, most of this information will be entered on the Project Information and Mix Information sheets and automatically transferred to the Report. For QMC and BR mixes, the combined gradation will be calculated from aggregate percentages entered in the Mix Information Station From and To, Totals to Date Cement and Concrete, and Remarks will be entered directly on the Report.

The next page is an example of a completed Paving Plant Report.

SEND	(Daily)	(Weekly)	(Monthly)	(Project)			Max	w/c	Ratio			Total	To Date			mber												-				_				
ne(x)							Avg	w/c	Ratio			Week				Lot Number								Source					Grad. No.							
C Leck Olle(x)	Paving	Structure	Non-structural	Miscellaneous		//C Ratio:			Grade		Batched	Today				Rate													T-203 A# Grad. No.							
(×)XIIX			Non	Misc		Max On Grade W/C Ratio:		Water	Plant				One (X)	yd3	tons	eo.								Sp. Gr.												-1
Check Mix(x)	Central	Ready	•			Max (In Agg.				Check One (X)	Concrete:	Cement:	Brand / Source								Type					Source							
					ů.		lbs/yd3		Coarse							B									Cement:	Fly Ash:	GGBFS:	_	•	Coarse:	Intermediate:		_			
							Used -		Inter.		lbs/yd3						Air Entraining:	Water Reducer (Normal):	Retarder:	Calcium Chloride:	Superplasticizer:										Inte					
	Report No.:	Date This Report:	st Report:	Des No.	tion date:	Curve #:	Actual Quantities Used		Fine		8						Air	ater Reduce		Calciun	Super															
	ž	Date Thi	Date Of Last Report:	Structures Des. No:	Curve / Validation date:		Actua		GGBFS		eatment		Water	aterials				×										CW	Zone					C.P.I. #1:	Monitor #1:	
			٥		Š				Fly Ash		Conc. Treatment	lce	Heated Water	Heated Materials														Within	Target			cifications			Ĕ	
			ĥ	ĥ					Cement																			#200				- apple spe	ade alore			
							egate	Wt. SSD	lbs		Comply	Y/N	Υ	Y	>	Comply	Υ	٨	>		Comply	Y/N	\	Υ	٨			#100				Contified RM The DCC mix contains certified materials anniound animenates and was produced in compliance with annificable specifications	dda iii a			
	Contract ID:	County:	Temp. Min:	Temp Max:	aturity Mix ID:	Ë	Coarse Aggregate	T-203	Sp. G.		#200	0-2.5				#200					#200							#20				ompliano				
	S		Te	_ 	- Maturit	1 1	ဒိ	Moi	(%)		8#					8#					#100						adation	#30				i begil				
							ggregate	Wt. SSD	sql		#					#					#20						Adjusted % Passing Calculated Combined Gradation	#16				was proc	200			
							Intermediate Aggregate	T-203	Sp. G.		3/8"					3/8"					#30						ulated Cor	8#				dafec an	gares, an			
							Intern	2	(%)		1/2"					1/2"					#16						sing Calc	#4				yed addre	in hor			
	Project No.:	Plant Name:	Contractor:	SubContractor	Weather:	Maturity Used?:	egate	Wt. SSD	sql		3/4"					3/4"				-	8#						ted % Pas	3/8"				ale appro	ale, apple			
	ſ	Δ.		Sub		Matu	Fine Aggregate	t. T-203	Sp. G.		-										#						Adjus	. 1/2"				- fied mater				
Location	n To							Mois	(%)		1 1/2"					1 1/2"					3/8"							3/4"				ains certif				
Ľ	From							od % Of Est.	Nsed							diate					1/2"							1				mix conf				
	nent							Batched	yd3		Coarse	48.0				Intermediate	12.0				Fine	40.0						1 1/2"	et			The PC		2		
	Date of Placement	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5		Mix																					Target			ertified RI	N Pollino	Nelliains		

E - Units	r.	X (Daily)	(Weekly)	ctural (Monthly)	leous (Project)		atio:		Ava Max		Ratio		.0 0.450	0			tal Waste Waste	Date To Date	0.00		Lot Number	80	2						= 1	or-it-			Grad. No.	က	-			
	Placement Type	Continous		Non-structural	Miscellaneous		Max On Grade W/C Ratio:			Water	Plant Grade		190.0 0.0	0.0	0.0	Batched	Total	To Date			Rate	'd 23	3 oz./100lbs 557882					0	annos	FC0309-Continental - Davenpo FA004C-Council Bluffs Unit #3			urce					
	Pla	Paving					Ма				In Agg.						Daily	×			ource		9						0 0000	FA004C-Cou			T-203 A # & Source	4	UTH			
	ype	Central X	Ready						ed - lbs/vd3		Inter. Coarse						Check	One (X)	Concrete: yd3	Cement: tons	Brand / Source	Daravair 1000-GCP	Eucon WR-75-Euclid					o de la	9	ں یا	1			A85006-AMES MINE	A85510-AMES SOUTH			
Ĺ		5.: 004	rt: 9/5/2025	rt: 9/4/2025	ö	:0:	:0:	تن	Actual Quantities Used		:S Fine					lbs/yd3			<u>ვ</u>	%		Air Entraining:	Normal Water Reducer:	Mid-Range Water Reducer:	High-Range Water Reducer:	Special Performance Admixturer:	Concrete Fibers:			Flv Ash:	GGBFS:	1 1	1		Intermediate: Fine:			
		Report No.:	Date This Report:	Date Of Last Report:	Structures Des. No:	Curve / Validation Date:	Curve Expiration Date:	TTE	Act		Fly Ash GGBFS					nent (X)		ier	rials	ogen Dose Cement			Normal	Mid-Range \	High-Range ∖	ial Performan	ō					cw	Zone				C P I #1.	
Ę		ı	ă	Date	Stru	Curve /	Curve	ı			Cement					Conc. Treatment	lce	Heated Water	Heated Materials	Liquid Nitrogen	CarbonCure:					Spec	-					Within	Target Z			S		:,
PCC Plant Report		975	85-Story	49 °F	71 °F				Coarse Aggregate	T-203 Wt. SSD						Comply	Υ/N				Comply					Comply	Y/N					#100 #200				ble specification		
		Contract ID: 85975		Temp. Min:	Temp. Max:	Maturity Mix ID:	Curve Strength:	Curve Type:	Coars	Moist.			0.3			#200 C	0-2.5				#200 C					#200 C						#20				with applical		
		Con	ı	Ē	Ter	Maturit	Curve S) J	aregate	Wt. SSD	sq					8#	0-5				8#					#100					ation	#30				compliance		
			- Neveda				#:		Intermediate Aggregate	t. T-203						#4	0-10				#					#20					ombined Grada	#16				s produced in		
		Project No.: STP-99(19)30-85	Plant Name: Manatt's Paving - Neveda	anatt's		Cloudy	Curve #:			/t. SSD M						1/2" 3/8"	25-60				1/2" 3/8"					#16 #30	,				Adjusted % Passing Calculated Combined Gradation	#4 #8				egates, and wa		
		ject No.: S	nt Name: N	Contractor: Manatt's	SubContractor:	Weather: C	Maturity?:		Fine Aggregate	T-203						3/4"					3/4"					8#	70-100				ed % Passin	3/8"				proved aggr		
		¥.	Pla	8	SubCo		Σ	1	Ē	Moist			3.0			-1-	95-100				.+					#	6				Adjust					materials, ap		
	Location	From To								% Of Est. Waste						1 1/2"	100				1 1/2"					1/2" 3/8"	100					1" 3/4"				Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications		
v10.1			9/5/2025	9/5/2025						Batched %			1,298.00			Coarse					Intermediate					Fine						1 1/2"				The PCC mix c		
800240 computer		Date of Placement	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5			Mix		1 C-3WR-C20	2 C-3WR-C20	8 3	2		Sample Date:				_	Sample Date:	9	-22			SampleDate:						Target			Certified RM	Remarks	

Example 3 Plant Report

4/3/2023

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Form E820150 E - Units

Project No.:	STP-99(19)30-85			County : 85-	Story	_
Mix No.:	C-3WR-C20	Ab	s Vol. Cement:	0.1080	Type:	<u>IL</u>
Cement (IM 401):	<u>566</u> %	lbs	Source:	PC0509-Continental - Daver	Sp. Gr.:	3.11
Fly Ash (IM 491.17):		113	Source:	FA004C-Council Bluffs Unit	Sp. Gr.:	2.62
Slag (IM 491.14):	% [0	Source:		Sp. Gr.:	
CarbonCure:	% 0	0	Cement Reduct	tion		
Garbonoure.						
	Adjusted Cement:	453	Ibs			
	Total Cementitious	566	Ibs	Total % Replacement =	28	=
IM T203			A85510-AMES S	OUTH	Sp. Gr.:	2.65
IM T203 IM T203	Interm. Aggrega Coarse Agrega		A85006-AMES N	IINE	Sp. Gr.: Sp. Gr.:	2.69
Basic w/c	0.430	Water	lbs/cy	= Basic w/c X (Total Cementition	ous) =	243
Max w/c		Max. Water	lbs/cy	= Max w/c X (Total Cementition	•	255
Absolute Volumes	Cement			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.086
	Fly Ash			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.026
	Slag			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	_			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.144
	All				•••••	0.060
				Subtotal	=	0.316
				1.000 - Subtotal	=	0.684
				Total	=	1.000
% FA Agg.:	45	_		Subtotal) X % In Mix	=	0.308
% In. Agg.:				- Subtotal) X % In Mix	=	
% CA Agg.:	55	Coarse A	ggregate (1.000	- Subtotal) X % In Mix	=	0.376
				Aggregate Total	=	0.684
Aggregate Weights		Fine:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1375
		Intermediate:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	0
	1	Coarse:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1704
Summary			Cement	453 lbs/cy		
-			Fly Ash	113 lbs/cy		
Plant Name & Location:	Manatt's Paving - N	eveda	Slag			
CPI:			Water	243 lbs/cy		
Cert #:			Fine Agg.	1375 lbs/cy		
••••			Interm. Agg.	0 lbs/cy		
			Coarse Agg.	1704 lbs/cy		
			oouise Agg.	1704 183769		
		A	Air Entrainment:	Daravair 1000-GCP	Rate:	5.0 oz/yd
		Normal	Water Reducer:	Eucon WR-75-Euclid	Rate:	3 oz./100lbs
		Mid-Range	Water Reducer:		Rate:	
		High-Range	Water Reducer:		Rate:	
		_ J	Retarder:		Rate:	
	Si	pecial Performa	nce Admixture:		Rate:	
	٩		Fibers:		Rate:	
			CarbonCure:			
Distribution: DME, Pro	Engr Contractor		Carboncure:		oz/cy:	
Distribution: DME, Pro	. Engr., Contractor					

E - Units Report SEND		(Weekly)	(Monthly)	(Project)				M	Avg Max				0.420 0.450				Waste		000					X	a	n	ור	ol	le	3	3	P	'la	ar	وية قورية	.I		Re	- 	0	r	t	
ш			uctural	aneons		Ratio:	J				0			0.0	0.0		leto	-				Lot Number	866	382								port-IL	2		ō								
Placement Type	Continous		Non-structural	Miscellaneous		Max On Grade W/C Ratio:			1				190.0			Batched	_	· £					5.0 oz/yd 233998	(0							annoe	PC0509-Continental - Davenport-IL	Siums Onlic										
Placeme	Đ.					Max On			746			17.	19				_	_	2	3 9	2	Rate	5.0 0	3 oz./1								9-Continen	-council E		T-203 A # & Source								
_	Paving							2	2		드		48				Naily		2426.00			Source	d.	iclid							.1				T-203 A#	ш	1	H	5				
Plant Type (x)	Central							Christal			Inter. Coarse	1711	1709				Chec	One (X)	Concrete: vd3		cement: tons	Brand / Source	Daravair 1000-GCP	Eucon WR-75-Euclid						i d	ש	IL 3.11	7.97	=		A85006.AMES MINE		A85510-AMES SOUTH	7000 C PRINTED CO.				
	004	rt: 9/5/2025	rt: 9/4/2025	ö			ü	Activity Oliver	nal Qualities O			1413	1418			lbs/yd3	•		<u>.</u>		%		Air Entraining:	Normal Water Reducer:	Mid-Range Water Reducer:	High-Range Water Reducer:	Retarder:	Special Performance Admixturer:	Concrete Fibers:		•	Cement:	rıy Asn:	960		Coareo.	Intermediate:	Fine.					
	Report No.:	Date This Report:	Date Of Last Report:	Structures Des. No:	Curve / Validation Date:	Curve Expiration Date:	ITE		¥		sh GGBFS		m			± X			u	, ,	e Cement		-	Normal	lid-Range \	gh-Range \		Performan	ŏ						_ 0				7	i,		. iż	
		Date	Date Of	Structu	Curve / Val	Curve Exp	-				_		113			Conc. Treatment	اده	Heated Water	Heated Materials		Pose Dose				Σ	Ĭ		Special						, a	17							C.P.I. #2:	
		ĺ			•	ı	ı		9		ن		1 453			Conc	_	Hea	Heate			CarbonCure:												Within	T					us			
		ý	ř	۴				90000	greyate				1704			<u>~</u>					7	Ž						Ş				7		#200						pecificatio		_	
•	3: 85975	y: 85-Story	n: 49	x: 7	ä	<u>:</u>		,	Coarse Aggr				2.69			Comply						Comply	×					Comply						1					-	plicable s			
	Contract ID:	County:	Temp. Min:	Temp. Max:	Maturity Mix ID:	Curve Strength:	Curve Type:	1	2			4.0	0.3			#200						#200						0 #200	0-1.5					#20					_	се міти ад			
					Mat	Cur		400000000000000000000000000000000000000	Aggregate		sql .					#	5.0	3				#						#100					100	#30	į				-	л сотрії			
		eveda						otonoma A ctollecomotal	Hediate A	202-1	Sp.					#	0-10	2				#						#20						# Grad	<u></u>					roducean			
	9)30-85	Plant Name: Manatt's Paving - Neveda				Curve #:	0	1042	Moiot	MOIST.	(%)					3/8"						3/8"						#30	10-60				0	#8	£					and was p			
	Project No.: STP-99(19)30-85	Manatt's I	Manatt's		Cloudy	•		4	916 744	Wt. 33D	sqi	1,375	1,375			1/2"	25.60	3				1/2"						#16					0	#Z	Į					gregates,			
	oject No.:	int Name:	Contractor: Manatt's	SubContractor:	Weather:	Maturity?:	•	Access of	T 202	502-1	Sp. G.	2.65	2.65			3/4"						3/4"						8#	70-100				à	3/8"	0/6					proved ag			
	Ā	ä	ŭ	SubC		2		Ü	L toioM	MOISI.	(%)	2.7	3.0			÷	95.100	9				; -						#4	90-100				4	Adjus	71				1	ateriais, ap			
ıtion	2								4000	waste	yd3	0.00	0.00			1 1/2"	100	3				1 1/2"						3/8"	100					3/4"	t				9.7	certified m			
Location	From								,		nsed	0.0	0.0															1/2"						ŧ	-					contains			
v10.1		9/5/2025	9/5/2025						Lo do to	Datciled	yd3	1,128.00	1,298.00			Coarse					_	Intermediate					1	Fine						1 1/0"					i i	Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications			
800240 computer	Date of Placement	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5			2	X			2 C-3WR-C20	۶ 4			Sample Date:						Sample Date:	Q)-2 ⁴	4			SampleDate:						Target					Certified KIM	Kemarks		

SEND	(Daily)	(Weekly)	(Monthly)	(Project)					Мах	w/c	Ratio	0.450						Waste	To Date				F	r	O	b	le	er	Υ) '	16	•												
Report	×								Avg	w/c	Ratio							Waste		000	0.00		er													Grad. No.	3		-					
0	sno		Non-structural	Miscellaneous		V/C Ratio:	-				Grade	26.0	0.0	0.0	0.0	0.0	700	Total	To Date	280			Lot Number	77 AA4356	ME88934C						9	3 =	r & Water											
Placement Type	Continous		Non	Misc		Max On Grade W/C Ratio:				Water	Plant	151.0					Patchote						Rate	þ	S						Source	PC3209-Holcim - ST. Gen-II	FA010C-Muscatine Power & Water			nrce								
Plac	Paving					Max					In Agg.							Daily	×	4					e							3209-Hole	010C-Mus			T-203 A # & Source								
e (x)	×								lbs/yd3		Coarse							Check	One (X)	chir	yas	tons	Brand / Source	-Sika	75-Euclid						Sp. Gr.		FA		-	T-20	SWICK		DONIA					
Plant Type (x)	Central	Ready									Inter.								0			Cement:	Bra	Sika AEA-14-Sika	Eucon WR-75-Euclid						Type	1	U		<u> </u>		A54002-KESWICK		A58504-FREDONIA					
	900	7/16/2014							Actual Quantities Used		Fine						lbe/vd3	an from		č	3 (ٽ %	2	Air Entraining:	•		Reducer:	Retarder:	nixturer:	Concrete Fibers:		Cement:	Fly Ash:	GGBFS:	1		Coarse: /	•						
	Report No.:		Report:	es. No:	n Date:	n Date:	į	Ë	Actual Qu		GGBFS						8					Cement	Kedux.	Air En	Normal Water Reducer:	Mid-Range Water Reducer:	High-Range Water Reducer:	u.	Special Performance Admixturer:	Concret								Inter						
	Repo	Date This Report:	Date Of Last Report:	Structures Des. No:	Curve / Validation Date:	Curve Expiration Date:					Fly Ash (tmont		ater	orio d	teriais		(ozicy)		Nor	Mid-Ra	High-Ra		ecial Perfo						CW	Zone					C.P.I. #1:	C.P.I. #2:	Monitor #1:	- I - I - I - I - I - I - I - I - I - I
			Da	Σ	Curve	Curv					Cement						Conc Treatment	lce lce	Heated Water	Topico Ma	Heated Materials	Liquid Nitrogen	CarbonCure:	_					ď						Within	Target					O	O	M	į
			¥.	¥					jate	Wt. SSD	sql							<u> </u>					Car												#200					ifications				
	56743	County: 54-Keokuk	89	87					Coarse Aggregate	T-203	Sp. G.						Comply	N X					Comply						Comply	Α'N					#100					icable spec				
	Contract ID:	County:	Temp. Min:	Temp. Max:	Maturity Mix ID:	Curve Strength:	, T on	curve 1ype:	Coa	Moist.	(%)	0.7					#200	0-2.5	i				#200						#200	0-1.5					#20					e with appl				
	Ŝ	ı	Į.	Te	Maturit	Curve		in o	regate	Wt. SSD	sql						8#	0-5					8#						#100					tion	#30					compliance				
									Intermediate Aggregate	T-203	Sp. G.						#	0-10					#						#20					Adjusted % Passing Calculated Combined Gradation	#16					oduced in				
	4733-54	ota	nstruction		/arm	Curve #:	1		Interm	Moist.	(%)						3/8"	5					3/8"					F	#30	10-60				ated Combi	8#					and was pr				
	Project No.: FM-6(222)14733-54	Plant Name: Shipley-Keota	Shipley Construction		Overcast/warm				ıte	Wt. SSD	sql						1/2"	25-60					1/2"						#16					ing Calcula	#					gregates,				
	oject No.:	int Name:	Contractor:	SubContractor:	Weather:		•		Fine Aggregate	T-203	Sp. G.						3/4"	5					3/4"						8#	70-100				ted % Pass	3/8					pproved ag				
	Ā	ä	ŭ	SubC		2	_		Œ	Moist.	(%)	3.8					ŧ	95-100					.1						#	90-100				Adjus	1/2"					naterials, a				
Location	To									. Waste	yd3						1 4/2"	100					1 1/2"						3/8	100					3/4"					s certified r				
Ľ	From									% Of Est.	Nsed												ē						1/2"						÷					nix contains				
		8/6/2013								Batched	yd3	1,256.00					9160	5	_				Intermediate						Fine						1 1/2"					The PCC n				
	Date of Placement	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5				Mix		C-3WR-C20						Sample Date:					_	Sample Date:	. (9-2	5			SampleDate:						Target	_			Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications	Remarks			

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		-	County :	
Mix No.: _	Ab	os Vol. Cement:	Туре:	
Cement (IM 401): _	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17): _		Source:	Sp. Gr.:	
Slag (IM 491.14): _		Source:	Sp. Gr.:	
Adju	sted lbs. Cement:			
Т	otal Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement + w	t Flv Ash +Slag) =	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement + w		
_				
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal		
		Total	=	1.000
% FA Agg.:	Fine Ac	ggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	=	
% CA Agg.:	Coarse A	Aggregate (1.000 - Subtotal) X % In Mix	=	
_		Aggregate Total	=	
Aggregate Weights	Fine Agg	regate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Intermediate	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Coarse Ag	ggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
0	_			
Summary		Cement (lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg. (lbs/cy) Interm. Agg. (lbs/cy)		
		Coarse Agg (lbs/cy)		

ort SEND	(Daily)	(Weekly)	(Monthly)	(Project)			1	Max				0.450					te Waste	To Date				F	ا ^ر) 	ol T	e	n	1	1 ⁻	<i> </i> 				No.								
Report	×		a	SI		يا		Avg	w/c	Ratio							Waste		0.00			mber									(2)			ļ	Grad. No.	3		-					
,be	Continous		Non-structural	Miscellaneous		W/C Ratio				Grade	0.0	0.0	0.0	0.0	0.0	Batched	Total	To Date				Lot Number	233998	557882						Source	nanute-IP(Unit #3											
Placement Type	Con		ž	Σ		Max On Grade W/C Ratio:			Water	Plant	175.0	190.0				Ba						Rate	5.0 oz/yd	3 oz./100lbs 557882						So	PC0108-Ash Grove - Chanute-IP(25)	FA004C-Council Bluffs Unit #3			ource								
Pla	Paving					Ma				In Agg.	0						Daily	×				0		69							C0108-Ash	A004C-Cou			T-203 A # & Source	RA					ļ		!
e(x)	×							lbs/yd3		Coarse							Check	(X) auc	yd3	tons		Brand / Source	00-GCP	75-Euclid						Sp. Gr.		F			T-2(UTH AURC		LER					
Plant Type (x)	Central	Ready								Inter.								U	Concrete:	Cement:		Bra	Daravair 1000-GCP	Eucon WR-75-Euclid						Type	1	o				A10030-SOUTH AURORA		A10516-MILLER					
	004	9/17/2014						Actual Quantities Used		Fine						lbs/yd3			Cor	ŏ	%		Air Entraining:		educer:	educer:	Retarder:	ixturer:	Fibers:		Cement:	Fly Ash:	GGBFS:	1		Coarse:							
	Report No.:		eport:	s. No:	Date:	Date:	TE	Actual Qua		GGBFS						- ×					Cement Redux.		Air Ent	Normal Water Reducer:	Mid-Range Water Reducer:	High-Range Water Reducer:	œ	Special Performance Admixturer:	Concrete Fibers:		J	_					Intern						
	Repo	Date This Report:	Date Of Last Report:	Structures Des. No:	Curve / Validation Date:	Curve Expiration Date:				Fiv Ash G						nent		ter	rials					Norn	Mid-Ran	High-Ran		ial Perforr						CW	Zone					C.P.I. #1:	C.P.I. #2:	Monitor #1:	
			Date	Str	Curve /	Curve				Cement						Conc. Treatment	lce	Heated Water	Heated Materials	iquid Nitro	Dose (oz/cy)	CarbonCure:						Spe						Within	Target					C.F	S.	Monit	
									Wt. SSD							0			I	_		Carbo												#200 v	_				ations				
	265	-Louisa	4° 69	87 °F				Coarse Aggregate	T-203 W		<u>;</u>					Comply	Y/N					Comply	X/N					Comply	Z X					#100					ce with applicable specifications				
	Contract ID: 67592	County: 58-Louisa	Temp. Min:	Temp. Max:	Mix ID:	rength:	Curve Type:	Coars	Moist.			0.3				#200	0-2.5					#200					-		0-1.5					#20					ith applica				
	Cont	O	Tem	Tem	Maturity Mix ID:	Curve Strength:	Curve	gate	SD							8#	0-5					8#						#100					u	#30					npliance w				
								Intermediate Aggregate	T-203	Sp. G.	i					#4	0-10					#4						#20					d Gradatio	#16					uced in co				
	3-58	8 &F62				Curve #:		Intermed	Moist.							3/8"						3/8"						#30	10-60				d Combine	8#					l was prod				
	Project No.: STP-64(12)28-58	Plant Name: KR - Hwy 218 &F62	nife River		Sunny				t. SSD							1/2"	25-60					1/2					-	#16					Adjusted % Passing Calculated Combined Gradation	#4					egates, and				
	et No.: S	Name: K	Contractor: Knife River	tractor:				Fine Aggregate	T-203 V		i 1					3/4"						3/4"					F	8#	20-100				1 % Passing	3/8"				\parallel	oved aggr				
	Proj	Plan	Con	SubContractor:	>	Mat		Fine	Moist.			3.0				<u>+</u>	95-100					-1-						_	90-100				Adjusted	1/2"					erials, appı				
ion	To								Waste							1 1/2"	100					1 1/2"					-		100					3/4"					rtified mat				
Location	From								% Of Est.	Used							1											1/2						<u>.</u> -					contains ce				
		8/6/2013	8/6/2013						Batched		1,256.00	1,384.00				Coarse	!				ı	Intermediate	L				_	Fine						1 1/2"					he PCC mix				
	Date of Placement	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5			Mix		C-3WR-C20						Sample Date:					ä	Sample Date:	9	-27	,			SampleDate:						Target		1		Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compilan	Remarks			J

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		_	County :	
Mix No.: _		abs Vol. Cement:	Туре:	
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17):	70	Source:	Sp. Gr.:	
Slag (IM 491.14): _		Source:	Sp. Gr.:	
Adjus	sted lbs. Cement:			
To	otal Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement + w	t Fly Ash +Slag) =	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement + w		
_		, ,, ,	, o, <u> </u>	
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	_	
		1.000 - Subtotal	<u> </u>	
		Total	<u>-</u>	1.000
			_	1.000
% FA Agg.:	-	Aggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	=_	
% CA Agg.:	Coarse	Aggregate (1.000 - Subtotal) X % In Mix	=	
		Aggregate Total	=	
Aggregate Weights	Fine Ag	gregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
	Intermediat	e Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
	Coarse A	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=	
Summary		Cement (lbs/cy)		
•		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg. (lbs/cy)		
		Interm. Agg. (lbs/cy)		
		Coarse Agg. (lbs/cy)		

Chapter 10 SOLUTIONS

Calculate the Batch Weights for the Materials

M-3 Mix

Materials	Source	Absolute Volume	Specific Gravity	Batch Weight
Cement	PC3802	0.149	3.14	788
Fine Aggregate	A06502	0.287	2.65	1281
Coarse Aggregate	A17012	0.351	2.68	1585
Water	City	0.153	1.00	258
Air		0.060	0	

Calculate the Batch Weights for the Materials

C-4WR Mix

Materials	Source	Absolute Volume	Specific Gravity	Batch Weight
Cement (IS)	PC0108	0.112	2.97	560
Fine Aggregate	A17514	0.338	2.65	1509
Coarse Aggregate	A21516	0.339	2.69	1536
Water	City	0.151	1.00	254
Air		0.060	0	

Calculate the Batch Weights for the Materials

C-4WR Mix

You will need to look up the specific gravities.

Materials	Source	Absolute Volume	Specific Gravity	Batch Weight
Cement	PC3702	0.112	3.14	593
Fine Aggregate	A22520	0.338	2.65	1509
Coarse Aggregate	A22012	0.339	2.66	1519
Water	City	0.151	1.00	254
Air		0.060		

Calculate the Batch Weights for the Materials

C-3WR

You will need to look up the absolute volumes

Materials	Source	Absolute	Specific	Batch
		Volume	Gravity	Weight
Cement	PC0209	0.108	3.11	566
Fine Aggregate	A24512	0.309	2.66	1385
Coarse Aggregate	A22012	0.377	2.66	1690
Water	City	0.146	1.0	246
Air				

4/3/2023

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Form E820150 E - Units

Project No.:			=	County : <u>91</u>	-Warren	=
Mix No.:	M-4-C10	At	os Vol. Cement:	0.1560	Type:	<u>IL</u>
Cement (IM 401):	817	lbs	Source:	PC0509-Continental - Daver	Sp. Gr.:	3.11
Fly Ash (IM 491.17):	% 10	82	Source:	FA041C-Prairie Creek Gene	Sp. Gr.:	2.80
Slag (IM 491.14):	%	0	Source:		Sp. Gr.:	
	%		_		·	
CarbonCure:	0	0	Cement Reduc	tion		
	Adjusted Cement	: 735	_lbs			
	Total Cementitiou	s 817	_lbs	Total % Replacement =	19	-
IM T203	00 0		A26502-ELDON	-FRANKLIN	Sp. Gr.:	2.67
IM T203 IM T203		-	A26004-LEWIS		Sp. Gr.: Sp. Gr.:	2.60
		_	-			
Basic w/c Max w/c		Water Max. Water	•	= Basic w/c X (Total Cementition = Max w/c X (Total Cementition		268 327
Max W/C	0.400	Wax. Water	ibs/cy	- Wax W/C A (Total Cementition	.5) –	321
Absolute Volumes	Cemer	t		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.140
	Fly As	h		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.017
	Sla	g		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Wate	r		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.159
	A	r				0.060
				Subtotal	=	0.376
				1.000 - Subtotal	=	0.624
				Total	=	1.000
% FA Agg.:				Subtotal) X % In Mix	=	0.312
% In. Agg.: % CA Agg.:				- Subtotal) X % In Mix - Subtotal) X % In Mix	=	0.312
,, o,, r,gg		_	iggiogato (illoco	Aggregate Total	=	0.624
Aggregate Weights		Fine:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1404
		Intermediate:	Abs Vol. X Sp. (Gr. X 62.4 X 27	=	0
		Coarse:	Abs Vol. X Sp. (=	1367
			7.00 CO 7. Op			
Summary			Cement	735 lbs/cy		
Plant Name & Location:			Fly Ash Slag	82 lbs/cy 0 lbs/cy		
CPI:			Water	268 lbs/cy		
Cert #:			Fine Agg.	1404 lbs/cy		
			Interm. Agg.	0 lbs/cy		
			Coarse Agg.	1367 lbs/cy		
			Ata Fatas been t	Ciles Air Ciles	B-4	0.0 ==1 ::1
			Air Entrainment:			6.0 oz/yd
				Plastocrete 161-Sika	Rate:	2 oz./100lbs
		_	Water Reducer: Water Reducer:		Rate:	
		myn-Kange	Retarder:		Rate:	
		Special Performa			Rate:	
		opeciai Feriofilia	Fibers:		Rate:	
			CarbonCure:		oz/cy:	
Distribution: DMF Pro	i Engr Contractor		Carbonoure.		ozicy.	

4/3/2023

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Form E820150 E - Units

Project No.:			=	County : <u>91</u>	-Warren	=
Mix No.:	C-3WR-C20	Ab	s Vol. Cement:	0.1080_	Type:	IL
Cement (IM 401):		lbs	Source:	PC0509-Continental - Daver	Sp. Gr.:	3.11
Fly Ash (IM 491.17):		113	Source:	FA009C-Louisa Generating	Sp. Gr.:	2.69
Slag (IM 491.14):	%	0	Source:		Sp. Gr.:	
CarbonCure:	% 0	0	Cement Reduc	tion		
		1	lbs			
	Adjusted Cement		-	Total 9/ Banka amant -	20	
	Total Cementitious		_lbs	Total % Replacement =	28	-
IM T203	00 0		A26502-ELDON	-FRANKLIN	Sp. Gr.:	2.67
IM T203		-			Sp. Gr.:	
IM T203	Coarse Agre	gate Source:	A26004-LEWIS		Sp. Gr.:	2.60
Pagio w/o	0.420	Water	lbo/ov	- Basia w/a V (Total Comentitie	ous) =	242
Basic w/c Max w/c		Water Max. Water	•	= Basic w/c X (Total Cementition = Max w/c X (Total Cementition	-	243 254
WIAX W/C	0.430	_ IVIAX. VVALEI	ibs/cy	- Max W/C X (Total Cementition	15) –	234
Absolute Volumes	Cemen	t		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.086
	Fly Asi	h		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.025
	Sla	g		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Wate	r		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.144
	Ai	r				0.060
				Subtotal	_	0.215
				Subtotal 1.000 - Subtotal	=	0.315
				Total	=	1.000
% FA Agg.:	45	Fine Ag	gregate (1.000 -	Subtotal) X % In Mix	=	0.308
% In. Agg.:		_		- Subtotal) X % In Mix	=	
% CA Agg.:	55	_		- Subtotal) X % In Mix	=	0.377
- CO		_		Aggregate Total	=	0.685
Aggregate Weights		Fine:	Abs Vol. X Sp. 0		=	1386
		Intermediate:	Abs Vol. X Sp. 0	Gr X 62 4 X 27	_	0
		Coarse:	Abs Vol. X Sp. 0		_	1651
		Coarse.	Abs Vol. A Sp. C	31. X 02.4 X 21	_	1031
Summary			Cement	453 lbs/cy		
			Fly Ash	113 lbs/cy		
Plant Name & Location:			Slag			
CPI:			Water	1bs/cy		
Cert #:			Fine Agg.	1386 lbs/cy		
			Interm. Agg.	0 lbs/cy		
			Coarse Agg.	1651 lbs/cy		
		,	Air Entrainment:	Sika Air-Sika	Rate:	6.0 oz/yd
		Normal	Water Reducer:	Plastocrete 161-Sika	Rate:	2 oz./100lbs
		Mid-Range	Water Reducer:		Rate:	
		High-Range	Water Reducer:		Rate:	
			Retarder:		Rate:	
		Special Performa	ance Admixture:		Rate:	
			Fibers:		Rate:	
			CarbonCure:		oz/cy:	
Distribution: DME. Pro	i. Engr Contractor					

4/3/2023		•	ment Of Transpo	rtation		Form E820150
			ce Of Materials	DETE		E - Units
		PORTLAND	CEMENT CONC	RETE		
Duning 4 No.				0	14/	
Project No.:			-	County : <u>91</u>	-vvarren	
Mix No ·	C-3WR-C20S20	Δł	os Vol. Cement:	0.1080	Type: I	I
IIIX IVOII	<u> </u>		,		. ypo. <u>.</u>	_
Cement (IM 401):	566	lbs	Source:	PC0009-Ash Grove - Louisv	Sp. Gr.:	3.11
,	%	•				
Fly Ash (IM 491.17):	:20	113	Source:	FA009C-Louisa Generating	Sp. Gr.: _	2.69
	%		=			
Slag (IM 491.14):		113	Source:	SL00A-Skyway Cement	Sp. Gr.: _	2.87
	%		1			
CarbonCure:	0	0	Cement Reduc	tion		
	Adjusted Cement:	340	lbs			
	Aujusteu Cement.	340	_ins			
	Total Cementitious	566	lbs	Total % Replacement =	46	
	Total Comonition					
IM T203	Fine Aggregat	te Source:	A19522-BUCKY	'S	Sp. Gr.:	2.65
IM T203	Interm. Aggreg	ate Source:			Sp. Gr.:	
IM T203	Coarse Agrega	ate Source:	A22040-HARTM	AN	Sp. Gr.:	2.68
Basic w/c		Water	•	= Basic w/c X (Total Cementiti	_	243
Max w/c	0.450	Max. Water	· Ibs/cy	= Max w/c X (Total Cementitio	us) = _	254
				// / \// O O Y OO / Y OT \		
Absolute Volumes	Cement			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	0.065
	Fly Ash			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.025
	i iy Asii			(IDS/CY) / (Op. Of. A 02.4 A 27)		0.023
	Slag			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.023
				,	_	
	Water			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	0.144
	Air					0.060
				Subtotal	= -	0.317
				1.000 - Subtotal Total	-	0.683
				iotai	-	1.000
% FA Agg.:	45	Fine Ag	gregate (1.000 -	Subtotal) X % In Mix	=	0.307
% In. Agg.:		-		- Subtotal) X % In Mix	= -	
% CA Agg.:		-		- Subtotal) X % In Mix	= -	0.376
		•		Aggregate Total	= _	0.683
Aggregate Weights		Fine:	Abs Vol. X Sp. C	Gr. X 62.4 X 27	=_	1371
		Intermediate:	Abs Vol. X Sp. C	6r. X 62.4 X 27	=_	0
		Coarse:	Abo Vol. V Sp. C	Y Y 62 4 Y 27	_	1698
		Coarse:	Abs Vol. X Sp. G	31. A 62.4 A 21		1030
Summary			Cement	340 lbs/cy		
,			Fly Ash			
Plant Name & Location:	:		Slag			
CPI:	:		Water			
Cert #:	:		Fine Agg.	1371 lbs/cy		
			Interm. Agg.	0 lbs/cy		
			Coarse Agg.	1698 lbs/cy		

Aggregate Moisture Corrections/Adjusted (Wet) Batch Weights

Calculate the adjusted (wet) batch weights for the following aggregate weights with the moistures given:

Fine Aggregate – 1418 pounds Coarse Aggregate – 1560 pounds

Moistures -

1.	Fine	3.5	Fine Adjusted Batch Weight	1469
	Coarse	0.7	Coarse Adjusted Batch Weight	1571
2.	Fine	2.9	Fine Adjusted Batch Weight	1460
	Coarse	0.6	Coarse Adjusted Batch Weight	1569
3.	Fine	2.1	Fine Adjusted Batch Weight	1448
	Coarse	0.3	Coarse Adjusted Batch Weight	1565
4.	Fine	3.9	Fine Adjusted Batch Weight	1476
	Coarse	0.9	Coarse Adjusted Batch Weight	1574

Aggregate Moisture Corrections/Adjustments

Calculate the free water for each cubic yard of concrete from the previous page:

1.	Total Adjusted Batch Weights Total Dry Batch Weights Total Water in Aggregate	3040 2978 62
2.	Total Adjusted Batch Weights Total Dry Batch Weights Total Water in Aggregate	3029 2978 51
3.	Total Adjusted Batch Weights Total Dry Batch Weights Total Water in Aggregate	3013 2978 35
4.	Total Adjusted Batch Weights Total Dry Batch Weights Total Water in Aggregate	3050 2978 72

Water/Cement Ratio (W/C)

Calculate the water/cement ratio for each of the following cubic yard batches using the batch weights given:

1.	Cement Total Water	624 lbs. 274 lbs.	w/c0.439
2.	Cement Fly Ash Total Water	564 lbs. 76 lbs. 265 lbs.	w/c0.414
3.	Cement Water at plant Water in Materials. Water added grade		w/c0.404
4.	Cement Fly Ash GGBFS Water at plant Water in materials Water added grade	385 lbs. 72 lbs. 68 lbs. 135 lbs. 44 lbs. 60 lbs.	w/c0.455

Maximum Water Adjustments

What is the maximum water allowed that can be added at the grade for each mix after the water in the aggregate and the water added at the plant have been determined: (convert to gallons)

1.	C-4WR-C20 205 lbs. water added at the plant 36 lbs. water in the aggregate 594 lbs. of cementitious material Maximum water that can be added at the grade26 lbs	
2.	M-4 220 lbs. water added at the plant 47 lbs. water in the aggregate 825 lbs. cementitious material Maximum water that can be added at the grade63	lbs.
3.	C-3WR 190 lbs. water added at the plant 43 lbs. water in the aggregate 565 lbs. cementitious material Maximum water that can be added at the grade	lbs.
4.	M-3-C20 225 lbs. water added at the plant 55 lbs. water in the aggregate 788 lbs. cementitious material Maximum water that can be added at the grade36	5 lbs.

Reissued April 20, 2010 Supersedes April 20, 2004 Matls. IM 527 Appendix C

Form	83021	2
10-05		

READY MIX CONCRETE

Kirk's Ready Mix		Plant
Truck No	Ticket No. 2	
Date	Des. No	
Proj. No. 5TP-53-405)2C-53	
Mix No. C-3WR-C15-530 Retarde	er/Water Reducer? Yes	□ No
Conc. This Truck		C.Y./m³
Air agent added this truck		oz./mL
Time Batched 8:45 AM	Discharged 9:30 AM	
Rev. Mixed (Plant) 72	Grade <u>35</u>	
Water (gal./L or lbs./kg This Truck)) 8.33lbs./aal.	
In Aggregate 47	nal /l	lbs./kg
Added (Plant) 108	_ gal./L _ gal./L	lbs./kg
Subtotal	_gal./L	lbs./kg
Added Grade	_gal./L	lbs./kg
TOTAL WATER 169	_gal./L	lbs./kg
Maximum Water Allowed <u>185</u>	_gal./Llbs./cy or	kg/m³
Air <u>6,8</u>	Slump <u>234"</u>	
Plant Insp. John Doe	NWOOD	
Receiving Insp. David Tones	NW999	

April 20, 2004 Supersedes April 20, 2003 Matls. IM 527 Appendix C

Form 830212 10-95 READY MIX	CONCRETE
Kirk's Room	Plant
Truck No.	Ticket No
Date8/5/14	Des. No
Proj. No. 5TP-53-4	(15) 2C-53
Mix No Retarde	er/Water Reducer? Tyes Mo
Conc. This Truck	C.Y./m³
Air agent added this truck	oz./mL
Time Batched 10:15 Am	Discharged// OS Am
Rev. Mixed (Plant)	Grade 33
Water (gal./L or lbs./kg This Truck)) 8.33lbs./gal.
In Aggregate	_ gal./L lbs./kg
	_ gal./Llbs./kg
Added Grade 27	_ gal./L lbs./kg _ gal./L lbs./kg
TOTAL WATER 294	_ gal./Llbs./kg
Maximum Water Allowed <u> </u>	_gal./Llbs./cy or kg/m³
Air	Slump3
Plant Insp	Due NWOOD 1 Jones NW999
Receiving Insp.	1 Jones NW999

Total = 3, 461, 034 lb
$$\div$$
 2000 = 1730.52

Left in scale hopper: $3000 \text{ lb} \div 2000 = 1.50$

Left from last check: $4096 \text{ lb} \div 2000 = 2.05$

$$1730.52 + 1.50 - 2.05 = 1729.97$$
Total billed = 3, 333, 333 ÷ 2000 = 1666.67
$$(1729.97 \div 1666.67) \times 100 = 103.8 \%$$

Remember:

- 1. Cement shipment yield determination must be made every 10,000 yd³ after the original determination has been made near the end of the first full day of production.
- 2. Cement yield cannot be under 99% or above 101.0%
- 3. Check your calculation, records, and equipment.

1480 yd.³ X 492 lb./ yd.³ = 728,160 lb.. ÷ 2000 lb./ton = **364.08 ton**

 $500 \text{ yd.}^3 \text{ X } 571 \text{ lb./ yd.}^3 = 285,500 \text{ lb.} \div 2000 \text{ lb./ton} = 142.75 \text{ ton}$

Total batched 506.83 ton

Left in scale

Last check $2600 \div 2000 = 1.30 \text{ ton}$

This check $3000 \div 2000 = 1.5 \text{ ton}$

Total billed: $1,024,100 \div 2000 = 512.05 \text{ ton}$

Total Cement + Left in Scale - Left in Scale

<u>Batched</u> This Check From Last Check X 100 = Cement Yield

Total Cement Billed

 $\frac{506.83 + 1.50 - 1.30}{512.05}$ X 100 = Cement Yield

507.03

512.05 X 100 = **99.0%**

4/3/2023

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Form E820150 E - Units

Project No.:	FM-6(222)14733	-54	_	County : <u>54-</u> 1	Keokuk	_
Mix No.:	C-3WR-C20	Ab	s Vol. Cement:	0.1080	Type:	IL
Cement (IM 401):	571	lbs	Source:	PC3209-Holcim - ST. Gen-IL	Sp. Gr.:	3.11
Fly Ash (IM 491.17):		114	Source:	FA010C-Muscatine Power 8	Sp. Gr.:	2.76
Slag (IM 491.14):	%	0	Source:		Sp. Gr.:	
	%		1			
CarbonCure:	0	0	Cement Reduc	tion		
	Adjusted Cement	t: <u>457</u>	lbs			
	Total Cementitiou	s 571	lbs	Total % Replacement =	20	=
IM T203	Fine Aggreg	ate Source:	A58504-FREDO	NIA	Sp. Gr.:	2.66
IM T203	Interm. Aggre	gate Source:			Sp. Gr.:	
IM T203	Coarse Agre	gate Source:	A54002-KESWI	CK	Sp. Gr.:	2.61
Basic w/c	0.430	Water	lhe/ev	- Basic w/c Y /Total Comontitio	us) =	246
Max w/c		Water Max. Water	•	Basic w/c X (Total CementitionMax w/c X (Total Cementitions		246 257
max wo	0.400		iboroy	max w/o x (10tal 00montations	•1	
Absolute Volumes	Cemer	ıt		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.086
	Fly As	h		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.025
	Sla	g		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Wate	r		(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.146
	Ai	ir				0.060
				Subtotal	=	0.317
				1.000 - Subtotal	=	0.683
				Total	=	1.000
% FA Agg.:	45	Fine Ag	gregate (1.000 -	Subtotal) X % In Mix	=	0.307
% In. Agg.:				- Subtotal) X % In Mix	=	
% CA Agg.:	55	Coarse A	ggregate (1.000	- Subtotal) X % In Mix	=	0.376
		_		Aggregate Total	=	0.683
Aggregate Weights		Fine:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1376
		Intermediate:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	
		Coarse:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1653
						,
Summary			Cement			
Diant Nama & Lagation	Shinlay Kaata		Fly Ash	114 lbs/cy		
Plant Name & Location: CPI:			Slag Water	0 lbs/cy 246 lbs/cy		
Cert #:			Fine Agg.	1376 lbs/cy		
out #.			Interm. Agg.	0 lbs/cy		
			Coarse Agg.	1653 lbs/cy		
			33			
		,	Nie Entrolomossts	Siko AEA 44 Siko	Date	E 0 07/ml
				Sika AEA-14-Sika Eucon WR-75-Euclid		5.0 oz/yd
			Water Reducer:	Eucon WK-/5-Eucha	Rate:	3 oz./100lbs
		_	Water Reducer:		Rate:	
		ingii-Naiige	Retarder:		Rate:	
		Special Performa			Rate:	
		.,	Fibers:		Rate:	
			CarbonCure:		oz/cy:	
Distribution: DMF Pro	i Engr Contractor				•	

E - Units	Report	Continuous A (Dairy) (Weekly)	Non-structural (Monthly)	Miscellaneous (Project)		Max On Grade W/C Ratio:		Avg Max		Grade Ratio	151.0 26.0 0.426 0.450	0.0	0.0	0.0	0.0	Batched	Total Waste Waste	To Date To Date	00.0			Rate Lot Number	5.0 ozlyd 77 AA4356 3 oz /1001bs ME88934C						Source	PC3209-Holcim - ST. Gen-IL	FA010C-Muscatine Power & Water			urce Grad. No.	м				
		L AVE				Мах		lbs/yd3		Coarse In Agg.	1665 66						Check Daily	One (X) X	yd3 1256.00	tons 287.00		onice	Į.						Sp. Gr.					T-203 A # & Source	ESWICK	REDONIA			
	Plant Type (x)	7/16/2014 Ready						Actual Quantities Used -		Fine Inter.	1430					lbs/yd3		1	Concrete:	Cement:	%	;	Air Entraining: Sika AEA-14-Sika		r Reducer:	Retarder:	dmixturer:	Concrete Fibers:	Type	ļ		GGBFS:			Coarse: A54002-KESWICK	ermediate: A58504-FREDONIA			
	1000	Date This Report:	Date Of Last Report:	Structures Des. No:	Curve / Validation Date:	Curve Expiration Date:	TTF:	Actual (Cement Fly Ash GGBFS	457 114					Conc. Treatment (X)	lce	Heated Water	Heated Materials		(oz/cy) Redux.	Carboncure:	Air Entraining: Normal Water Reducer	Mid-Range Water Reducer:	High-Range Water Reducer:		Special Performance Admixturer:	Conci					Within CW	Target Zone	1	Í		C.P.I. #1:	C.P.I. #1:
PCC Plant Report		County: 54-Keokuk	Min: 68 °F	Max: 87 °F	× D:	igth:	ype:	Coarse Aggregate	Moist. T-203 Wt. SSD	Sp. G. lbs	0.7 2.61 1653					#200 Comply	0-2.5 Y/N					≥	Z .				#200 Comply	0-1.5 Y/N					#50 #100 #200				Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications		
		Contract ID:		Temp. Max:	Maturity Mix ID:	Curve Strength:	Curve Type:	Intermediate Aggregate	SD	sql						#4 #8	0-10 0-5 0				\$	##					#20 #100 #	0				ined Gradation	#16 #30 #				oduced in compliance wit		
	- FM 6/00034 47 00 E4	Plant Name: Shipley-Keota	Contractor: Shipley Construction		: Overcast/warm				/t. SSD Mc	sql	1,376					1/2" 3/8"	25-60				_	1/2" 3/8"					#16 #30	10-60				Adjusted % Passing Calculated Combined Gradation	#4 #8				addredates, and was pr		
			Contractor	SubContractor:	Weather:	Maturity?:		Fine Aggregate	Moist	(%)	0 3.8 2.66					2" 1" 3/4"	0 95-100				į	2 1 3/4					#4 #8	0 30-100 70-100			-	Adjusted % Pa	1/2" 3/8"				ed materials, approved		
v10.1	catio	8/6/2013					-		Batched % Of Est. Waste	Nsed	1,256.00 0.0 0.00					Coarse 1 1/2"	100					Intermediate 1/2"					Fine 1/2" 3/8"	100			-	=	1 1/2" 1" 3/4"				PCC mix contains certifie		
800240 computer	100000000000000000000000000000000000000	Mix 1 8/6/	Mix 2	Mix 3	Mix 4	Mix 5			Mix Bat		1 C-3WR-C20 1,25	2	3	4	2	S	Sample Date:						Sample Date:	10-1			L	SampleDate:					-	Target			Certified RM The F	Remarks	Remarks

4/3/2023

lowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Form E820150 E - Units

Project No.:	STP-64(12)28-58		<u>-</u>	County : <u>58</u>	3-Louisa	<u>-</u>
Mix No.:	C-3WR-C20	Ab	s Vol. Cement:	0.1080	Type:	IP(25)
Cement (IM 401):	557 %	lbs	Source:	PC0108-Ash Grove - Chanu	Sp. Gr.:	2.97
Fly Ash (IM 491.17):	20	111	Source:	FA004C-Council Bluffs Unit	Sp. Gr.:	2.62
Slag (IM 491.14):	%	0	Source:		Sp. Gr.:	
	%		-		-	
CarbonCure:	0	0	Cement Reduc	tion		
	Adjusted Cement:	446	Ibs			
	Total Cementitious	557	lbs	Total % Replacement =	40	-
IM T203	00 0		A10516-MILLER	₹	Sp. Gr.:	2.65
IM T203	00 0		A40020 COUTU	ALIDODA	Sp. Gr.:	2.63
IM T203	Coarse Agrega	ate Source:	A10030-SOUTH	AURURA	Sp. Gr.:	2.63
Basic w/c	0.430	Water	lbs/cy	= Basic w/c X (Total Cementiti	ous) =	240
Max w/c		Max. Water	lbs/cy	= Max w/c X (Total Cementitio	-	251
Absolute Volumes	Cement			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.087
	Fly Ash			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.025
	Slag			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	
	Water			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.142
	Air					0.060
				Subtotal	=	0.314
				1.000 - Subtotal	=	0.686
				Total	=	1.000
% FA Agg.: % In. Agg.:	45	-		Subtotal) X % In Mix - Subtotal) X % In Mix	=	0.309
% III. Agg % CA Agg.:	55			- Subtotal) X % In Mix	_	0.377
33			33 -3 (Aggregate Total	=	0.686
Aggregate Weights		Fine:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1380
		Intermediate:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	0
		Coarse:	Abs Vol. X Sp. 0	Gr. X 62.4 X 27	=	1670
Summary			Cement	446 lbs/cy		
•			Fly Ash	111 lbs/cy		
Plant Name & Location:	=	2	Slag	·		
CPI:			Water	240 lbs/cy		
Cert #:			Fine Agg.	1380 lbs/cy		
			Interm. Agg. Coarse Agg.	0 lbs/cy 1670 lbs/cy		
				1010		
		ı	Air Entrainment:	Daravair 1000-GCP	Rate:	5.0 oz/yd
				Eucon WR-75-Euclid		3 oz./100lbs
		_	Water Reducer:		Rate:	
		High-Range	Water Reducer:		Rate:	
	_	enocial Dorfess	Retarder:		Rate:	
	S	ppeciai Periorma	nce Admixture:		Rate:	
			Fibers: CarbonCure:		Rate: oz/cy:	
Distribution: DME, Pro	j. Engr., Contractor		Jan Son Guile.		ozicy.	

Courty Street S	Ĕ	ŏ	Location													Plant Type (x)	(x) ed/	Place	Placement Type	~	Report	SEND
County; 58-Louisa	From	_	То		roject No.	STP-64(1	2)28-58		Š ⊢	ntract ID:	67592			Report No		Central	×	Paving	Continous	sn	×	(Daily)
Furnithment	8/6/2013			Δ.	lant Name	KR - Hw	, 218 &F62		1	County:	58-Louisa		Õ	ate This Repor	ı	_					2	(Weekly)
Structures Des. No:	8/6/2013			_	Contractor	Knife Riv	er		Ĭ,	mp. Min:		¥.	Date	Of Last Repor	4	ĺ			Non-s	Non-structural	5	(Monthly)
Strength:		ı,		Sub(Sontractor				PE -	mp. Max:		F.	Stru	ıctures Des. No	ö	1			Misce	Miscellaneous	Ē	(Project)
Concrete Agrication Concrete Agrication Concrete Flower Tre- T		- 1			Weather				Maturi	y Mix ID:			Curve /	Validation Date	:6	1				Į	Ī	
Concrete Agreement Fly Ash GGBFS Fine Inter. Coarse Garse Gars					Maturity?:		Curve #:		Curve	Strength:			Curve	Expiration Date	:6			Max	Max On Grade W/C Ratio:	C Ratio:		
10 10 10 10 10 10 10 10	-								Cui	ve Type:				TT.	á:							
Woist T-203 Wt. SSD Coment Fly Ash GGBFS Fine Inter. Coarse 1678				-	ine Aggre	gate	Interi	nediate Ag	gregate	Coa	ırse Aggreg	late		Actu	ial Quantities	Used -	lbs/yd3				Avg	Мах
1,000 2,000 1,00	Batched %	2						T-203	Wt. SSD			Wt. SSD							Water		w/c	w/c
1427 1427 1475		Use			Sp. G.		(%)	Sp. G.	sql	(%)	Sp. G.					Inter.	Coarse		Plant	Grade	Ratio	Ratio
1475 1470 1416 1416 1413 1413 1415		0.0			2.65	1,380				0.5	2.63	1670		111	1427		1678	22	175.0	0.0	0.414	0.450
#200 Comply Conc. Treatment	1,384.00	0.0			2.65	1,380				0.3	2.63	1670		111	1423		1675	48	190.0	0.0	0.427	0.450
#200	-																			0.0		
#200																				0.0		
#200 Comply Conc. Treatment (X) Ibsyd3 Concrete Check Concrete Concrete (A)																				0.0		
Heated Materials			1 1/2		3/4"	1/2"	3/8"	#4	8#	#200	Comply		Conc. Treatn		lbs/yd3		-		Batched	þ		
Heated Materials Concrete Vd3 Heated Materials Concrete Vd3 Liquid Nitrogen Coment Voment V	Į		100			25-60		0-10	9-0	0-2.5	X/N		eol				Check	Daily		Total	Waste	Waste
#200 Comply Packer Packer													Heated Wat	ter		·	One (X)	×	-	To Date		To Date
#200 Comply CarbonCure: Comply Redux. 9/6 Eucon WR-75-Euclif													Heated Mater	rials		Concrete:	yd3	2640.00			0.00	
#200 Compty CarbonCure: Air Entraining: Brand / Sou													Liquid Nitro	den		Cement:	tons	588.72				
#200 Comply Alientalining Daravair 1000-GCP Alientalining Daravair 1000-GCP Alientalining Daravair 1000-GCP	J														1	J	-					
Normal Water Reducer: Eucon WR-75-Eucling Baravair 1000-GCP	Intermediate		1 1/2		3/4"	1/2"	3/8"	#4	#	#200	Comply	Cart	bonCure:			Br	rand / Sour	96	Rate	Lot Number		
Mid-Range Water Reducer: Eucon WR-75-Euclit #200											N/A				Air Entraining		000-GCP	.5	5.0 oz/yd 233	233998		_
100 3.16" 4.4 4.8 4.16 4.20 4.10 4.20 5.10 4.10 4.20 4.10 4.20 4.10 4.20 4.10 4.														Normal W	/ater Reducer		R-75-Euclid	30	oz./100lbs 557882	7882		
High-Range Water Reducer: Retarder: Retarder														Mid-Range W	/ater Reducer							
#200 Comply Special Performance Admixturer: Concrete Fibers: Type Sp. Gr.														High-Range W	/ater Reducer							_
#200	L														Retarder							-
0-1.5 Y/N Concrete Fibers: Type Sp. Gr.		1/2			#8	#16	#30	#20	#100	#200	Comply		Spec	ial Performanc	e Admixturer							-
#50 #100 #200 Within CW Fly Ash: C 2.62 GGBFS: C 2.62 C 2.62	+		100				10-60			0-1.5	N/A			ပိ	ncrete Fibers							
#50 #100 #200 Within CW Target Zone Coarse: Fine: Fine																T	Sp. Gr.		Source			or
#50 #100 #200 Within CW Target Zone Coarse: A10030-SOUTH AUI Intermediate: Fine: A10516-MILLER Fine: C. P.L.#1:															Cement	1		C0108-Ash G	rove - Chan	Ite-IP(25)		Ī
#50 #100 #200 Within CW Target Zone Coarse: A10030-SOUTH AUI Intermediate: Fine: A10516-MILLER C. D. I. #1:															Fly Ash			A004C-Counc	il Bluffs Uni	t #3		Ī
#50 #100 #200 Within CW Target Zone Coarse: A10030-SOUTH A Intermediate: Fine: A10516-MILLER Coavith applicable specifications C. P.I.#1:				Adius	sted % Pas	sing Calcu	lated Comb	vined Grada	tion						GGBFS							
Coarse: A10030-SOUTHA Intermediate: Fine: A10516-MILLER C.P.I.#1:		-			3/8"	#4	#	#16		#20	#100	#200		CW								
Coarse: A10030-SOUTH A Intermediate: Fine: A10516-MILLER Ce with applicable specifications C.P.I.#1:														Zone			T-2	03 A # & Sour	rce	ō	Grad. No.	-
ce with applicable specifications C.P.I.#1:															Coarse		OUTH AUR	ORA			က	
Ce with applicable specifications C.P.I.#1:															Intermediate							
ce with applicable specifications	H														Fine		ILLER				-	_
	×	ontai	ns certified	1 materials, a	pproved a	ggregates,	and was pi	oduced in c	ompliance	with applic	cable specif	fications										Ī
													C.P	.l. #1:								-
														- #2								
In case of the second s													֝֞֞֞֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓									
Wohitor#1:													Monito	or #1:								

Chapter 11 IM 213 CERTIFICATION

April 16, 2024 Supersedes October 16, 2018 Matls, IM 213

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), Soils, Erosion Control, 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. <u>Appendix C</u> 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 – Construction and Materials Bureau

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

Representative of American Council of Engineering Companies (ACEC-lowa)

Coordinator of Technical Training & Certification Program**

The Director of the Construction and Materials Bureau 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.

^{**} Appointed by Program Director

TRAINING

The lowa DOT will provide the training necessary to become certified. Producers/Contractors are encouraged to conduct their own pretraining program. A complete listing of training opportunities is available at the Technical Training & Certification Program website, https://iowadot.gov/training/technical-training-and-certification-program.

CERTIFICATION REQUIREMENTS

- 1. A candidate must attend Iowa DOT course 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 <u>Appendix A</u>.
- 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. It is, however, strongly recommended that they attend the certification classes. In order to obtain certification for any technical level, these persons must pass all applicable written examinations for the level of certification they wish to obtain. If the written examination attempt does not meet the required score, the candidate must take the certification class before another attempt can be made. 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.
- 5. Technicians will be issued certifications by reciprocity when the following criteria are met:
 - a. The applicant must be certified in another state or certification program determined equivalent by the Program Director or someone designated by the Program Director, in each level of certification they are requesting.
 - b. The applicant must pass an examination for each level of certification desired, which will be administered by the lowa Department of Transportation. Failure of the examination shall require the applicant to take the full certification class before they can retake the exam.

c. The applicant must follow the prerequisite requirements of the Technical Training & Certification Program.

Reciprocity requests should be made through the Technical Training and Certification office in Ames. Copies of all the applicant's certifications will be required.

CERTIFICATION

Upon successfully completing the requirements for certification, the Program Director will issue a pocket certification card. The certification is not transferable. A certification earned in a training season shall be valid until March 31st of the fifth succeeding training season. A training season is defined as October 1st, XXXX to September 30th, XXXX+1.

CERTIFICATION IDENTIFICATION

The certification card will identify the certificate holder, their certification number, the level(s) of certification, and the expiration date of each level.

RENEWAL OF CERTIFICATION

A certification shall be valid through March 31st of the fifth succeeding training season. If the individual has not renewed their certification by the certification expiration date, they are automatically decertified.

All certified technicians will be required to pass an examination before recertification will be issued. Failure of the examination shall require the applicant to retake the full certification class and pass the examination. If the individual does not take the examination within one year after their certification(s) expire-they must retake the full certification class and pass the examination.

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 until the prerequisite certification has once again been obtained.

The certificate holder shall be responsible for applying for certification renewal and for maintaining a current address on file.

PROVISIONAL CERTIFICATION

Provisional certification will be allowed through a special request to the TTCP Director. The request can be mailed or emailed to the TTCP Director and must include the need for a provisional certification, such as, company technician quit and they need to replace, an unforeseen workload, etc. Provisional certifications will only be granted to contractors. If the request is granted the following requirements will apply.

- 1. The provisional certification applicant must work under the direct supervision of a certified technician until such time that the applicant is competent in the required skills of the certification and has taken the written exam. The applicant must also take the web based review offered by the TTCP in the area they are seeking provisional certification.
- 2. The applicant must take and pass the written exam for the provisional certification they are requesting. There will be a testing fee in the amount of the TTCP recertification fee due at the time of the exam. CIT funds may not be used for provisional certification testing. The exams will be offered at the District Materials offices or the TTCP office in Ames.
- 3. The technician must demonstrate proficiency to an Iowa DOT certified technician at the first available opportunity.

- 4. After the provisional certification applicant has successfully completed the steps in 1 and 2, they will become provisionally certified until the end of the calendar year in which they obtained certification.
- 5. If the provisional certified technician wishes to keep their certification they must attend the full class at the full class cost for the certification during the training season immediately following their provisional certification.
- 6. A provisional certification is not intended to be an annual request. The provisional certification will only be allowed for one construction season. Repeated requests for provisional certifications for the technician will be denied.
- 7. Any prerequisites for the certification must be met prior to number 2 above.
- 8. HMA Basic Tester is a new certification that may only be used as a provisional certification. This certification follows all the requirements previously listed and the technician will be required to take Level I HMA at the first available opportunity after the provisional expires.
- 9. Provisional Certification will be offered for:
 - a. Aggregate Sampler
 - b. Aggregate Technician
 - c. Level I PCC
 - d. HMA Sampler
 - e. HMA Basic Tester

UNSATISFACTORY PERFORMANCE NOTICE

A certified technician failing to perform the required specified duties or inadequately performing these duties, will receive an Unsatisfactory Notice (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 record with the Iowa Department of Transportation's Technical Training & Certification Program (TTCP). The notice will remain in their file for five years. The notice may be removed prior to the five years upon the recommendation of the District Materials Engineer.

SUSPENSION

A technician receiving two Unsatisfactory Work Performance Notices for work performed under a specific certification will be given a three-month suspension of the applicable certification. Suspended technicians shall not perform any duties governed by the suspended certification, including any duties which require the suspended certification as 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.

The suspension will be effective on the date the Program Director issues the suspension.

DECERTIFICATION

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

Certifications will be revoked 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 a certificate.
- 3. Use of false or fraudulent documentation by the certificate holder.
- 4. Use of misleading, deceptive, untrue or fraudulent representations by the certificate holder.
- 5. Cheating on certification exams or performance evaluations. This includes removing, or attempts to remove, exam questions, answers, or other exam materials from the testing location.
- 6. Receipt of 3 Unsatisfactory Performance notifications, as stated above under suspension.

The Program Director, or designee, will notify an individual in writing of the intent to suspend or revoke the individual's certification(s). Notice will also be sent to the technician's last known employer. For DOT employees, notice will also be sent to their immediate supervisor.

An individual's certifications will be suspended during the appeal process, and the individual can't perform any duties governed by the certification during this time, until the first day following the end of the appeal process described below.

Technicians that are decertified shall not perform any duties requiring certification.

APPEALS & REINSTATEMENT REQUESTS

An individual has 10 business days to respond to the revocation notice. If the individual fails to respond with an appeal within 10 days of receipt of the original revocation notice, the suspension or revocation becomes effective on the 10th day.

Appeal step 1: First step appeals will be heard by the program director and a representative panel. The individual will have an opportunity to present information to support their continued certification to the panel. The Program Director and representative panel will then render a written decision, taking into account the technician's actions or omissions, the existence of past infractions, and any mitigating factors. This step 1 appeal will become final if further action is not taken as described in appeal step 2 and the suspension or revocation will become effective on the day the decision is issued by the panel.

Appeal step 2: If the individual is not satisfied with the decision of the Program Director and representative panel, the individual shall, within 10 days of receipt of the written decision, submit a request for further review to the Program Director. This appeals request will be considered by the entire Certification Board. The decision of the Certification Board will be the final decision on behalf of Technical Training & Certification Program.

Any violation will remain on the violator's record for five years, at which time the violation will be removed from their record.

A technician may request reinstatement after one year of being decertified unless the Program Director authorized a shorter period of time, which shall not be less than three months. If a reinstatement is authorized, the individual must attend and successfully complete the applicable certification courses.

FUNCTIONS & RESPONSIBILITES

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.

Matls. IM 213 Appendix A

CERTIFICATION LEVELS

CERTIFICATION LEVEL	TITLE	PRE-REQUISITES
---------------------	-------	----------------

AGGREGATE

Aggregate Sampler Certified Sampling Technician None Aggregate Technician Certified Aggregate Technician None

EROSION CONTROL

Erosion Control Erosion Control Technician None

HOT MIX ASPHALT

HMA Sampler HMA Sampler None

Level I HMA HMA Technician Aggregate Technician

Level II HMA HMA Mix Design Technician Level I HMA

PORTLAND CEMENT CONCRETE

Level I PCC** PCC Testing Technician None

Level II PCC PCC Plant Technician Agg. Technician & 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.

PRESTRESS

Prestress Technician Level I PCC or ACI Grade I

If the technician will be

performing gradations, they will need to be Aggregate Technician

certified.

RIDE QUALITY

Ride Quality Ride Quality Technician None

SOILS

Soils Soils Technician None

	UNSATISFACTORY PERFORMANCE NOTICE
Issued To:	Date:
_	
	to inform you that your performance as a Certified Inspector/Technician was for the reason(s) listed below.
	nd all supporting documentation will be placed in your record with the lowar Transportation's Technical Training & Certification Program (TTCP).
producers, cit	e Technical Training and Certification Program (TTCP) is to work with contractors, ies, counties, and consultants to continually improve the quality of Iowa's rojects. We hope you will work with us to achieve this goal.
Unsatisfactory	Performance:
	District Materials Engineer
TTCP Coo	virector –Construction and Materials Engineer, Ames rdinator Construction Engineer

CERTIFIED TECHNICIANS QUALIFICATIONS

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

AGGREGATE SAMPLER

- 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
- IM 336 Methods of Reducing Aggregate Field Samples to Test Samples

AGGREGATE TECHNICIAN

- 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 210 Production of Certified Aggregate From Reclaimed Roadways
- IM 216 Guidelines for Verifying Certified Testing Results
- IM 301 Aggregate Sampling Methods
- 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
- IM 368 Determining the Amount of Clay Lumps & Friable Particles in Coarse Aggregate
- IM 409 Source Approvals for Aggregate

HMA BASIC TESTER (This is for Provisional Certification Only)

- IM 321 Method of Test for Compacted Density of Hot Mix Asphalt (HMA) (Displacement Method)
- IM 322 Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 Method of Sampling Asphaltic Materials
- IM 325G Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory Compactor (SGC)
- IM 350 Maximum Specific Gravity of Hot Mix Asphalt (HMA) Mixtures
- IM 357 Preparation of Hot Mix Asphalt (HMA) Mix Samples for Test Specimens
- All forms must be signed by an HMA I or HMA II certified technician

HMA SAMPLER

- IM 320 Method of Sampling Compacted Asphalt Mixtures
- IM 321 Method of Test for Compacted Density of Hot Mix Asphalt (HMA) (Displacement Method)
- 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 Method)
- IM 322 Method of Sampling Uncompacted Hot Mix Asphalt
- IM 323 Method of Sampling Asphaltic Materials
- <u>IM 325G</u> Method of Test for Determining the Density of Hot Mix Asphalt (HMA) Using the Superpave Gyratory 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

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
- AASHTO T283 Resistance of Compacted Hot Mix Asphalt (HMA) to Moisture-Induced Damage

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 347 Measuring Length of Drilled Concrete Cores
- IM 383 Testing the Strength of PCC Using the Maturity Method
- IM 385 Temperature of Freshly-Mixed Concrete

Matls. IM 213 Appendix C

- IM 525 Designing Flowable Mortar
- 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

PRESTRESS

IM 570 - Precast & Prestressed Concrete Bridge Units

RIDE QUALITY

• IM 341 - Determining Pavement & Bridge Ride Quality

SOILS

- IM 309 Determining Standard Proctor Moisture Density Relationship of Soils
- IM 312 Sampling of Soils for Construction Project
- IM 335 Determining Moisture Content of Soils
- ASTM D-2937 Field density by drive-cylinder method

AGGREGATE SAMPLING TECHNICIAN DUTIES

Matls. IM 213

Appendix D

Duties of the Aggregate Sampling Technician are detailed in <u>IM 209</u> and the <u>IM 300</u> Series and consist of, but are not limited to the following:

A. Sampling

- 1. Obtain representative samples by approved method(s).
- 2. Sample at required frequencies.
- 3. Identify samples with pertinent information such as:
 - a. Type of material
 - b. Intended use
 - c. Production beds working depth
 - d. Sampling method
- 4. Reduce samples by approved method(s).

AGGREGATE TECHNICIAN DUTIES

Matls. IM 213

Appendix D

Duties of the Aggregate Technician are detailed in <u>IM 209</u> and the <u>IM 300</u> Series and consist of, but are not limited to the following:

A. Sampling

- 1. Obtain representative samples by approved method(s).
- 2. Sample at required frequencies.
- 3. Identify samples with pertinent information such as:
 - a. Type of material
 - b. Intended use
 - c. Production beds working depth
 - d. Sampling method
- 4. Reduce samples by approved method(s).
- B. Gradation Testing
 - 1. Follow appropriate testing methods.
 - 2. Maintain current applicable specifications.
 - 3. Post test results within 24 hours of sampling.
- C. Other Testing as required (specific gravity, moisture, deleterious material, etc.)
 - 1. Follow appropriate testing methods.
 - 2. Maintain current applicable specifications.
 - 3. Complete required reports.
- D. Sampling & Testing Equipment
 - 1. Clean and check testing sieves for defects.
 - 2. Assure scale accuracy.
 - 3. Maintain sampling and testing equipment.
- E. Communication

- Matls. IM 213 Appendix D
- 1. Notify the District Materials office for production start-up or changes.
- 2. Relay test results to appropriate production or supervisory personnel.
- 3. Report failing test results immediately to appropriate personnel (including District Materials office) and assure remedial actions are taken.

F. General

- 1. Monitor stockpiling procedures to avoid contamination and excess segregation.
- 2. Assure proper identification of stockpiles.
- 3. Assure specification requirements for intended use are met before shipment.
- 4. Assure sampling locations are safe.
- 5. Assure proper bedding planes or production depths are maintained.

G. Documentation

- 1. Report all production test results of certified aggregates on Form #821278 and distribute as required.
- 2. Assure "plant production log" is maintained.

EROSION CONTROL TECHNICIAN DUTIES

Duties of the Erosion Control Technician consist of, but are not limited to the following:

- A. Carefully review and be familiar with the details in the contract documents.
- B. Assign erosion and sediment control monitoring responsibilities to Erosion & Sediment Control (ESC) Basics trained field staff.
- C. Review copies of storm water inspection reports.
- D. Provide input on initial Erosion Control Implementation Plan (ECIP) submittal and ECIP updates.
- E. Provide onsite reviews when requested by Contracting Authority or Contractor field staff.

HOT MIX ASPHALT (HMA) SAMPLING TECHNICIAN INSPECTION DUTIES

Duties of the Hot Mix Asphalt Sampling Technician consist of, but are not limited to the following:

- A. Plant Sampling. (Article 2303.04, IM 204 & 511)
 - 1. Obtain asphalt binder samples as directed by Contracting Authority personnel per <u>IM</u> 323 and <u>IM 204</u>.
- B. Field Sampling (<u>Article 2303.04</u>, <u>IM 204</u> & <u>511</u>)
 - 1. Obtain uncompacted mix random samples as directed by Contracting Authority personnel, and identify time, station, lift and side.
 - 2. Obtain compacted mix core random samples as directed by Contracting Authority personnel.

HOT MIX ASPHALT (HMA) TECHNICIAN INSPECTION DUTIES

The following is a list of the duties that must be performed by the Certified Level I HMA Technicians doing quality control work for the Contractor on all projects where the Quality Management-Asphalt (QM-A) specification applies. The Quality Control Technician shall have no other duties while performing certified inspection duties.

These duties consist of, but are not limited to, the following:

- A. Aggregate Stockpiles.
 - 1. Assure proper stockpiling of aggregate deliveries. (stockpile build & additions) (IM 508)
 - a. Prevent intermingling of aggregates.
 - b. Check for and prevent contamination.
 - c. Prevent segregation.
 - d. Check for oversize material.
 - 2. Document certified aggregate deliveries. (each delivery) (IM 508). When the aggregate supplier can provide a summary document of all deliveries, do not enter into Plant Book.
 - a. Obtain truck tickets.
 - b. Check for proper certification.
 - c. Check for proper approved source.
 - d. Enter deliveries in Plant Book Program when other documentation cannot be provided, Aggregate Certification page.
 - 3. Observe loader operation. (daily) (IM 508)
 - a. Check for proper stockpile to bin match-up.
 - b. Check that loader does not get stockpile base material in load.
 - c. Check that loader does not intermingle aggregate by overloading bins.
- B. Asphalt Binder Delivery. (each delivery) (IM 508 & 509)
 - 1. Check that material is pumped into correct tank.
 - 2. Document Deliveries.
 - a. Obtain truck tickets.
 - b. Check for proper approved source.
 - c. Check for proper certification.
 - d. Check for proper grade.
 - e. Check for addition of liquid anti-strip if required.
 - f. Check if weight per gallon or specific gravity has changed.
 - g. Enter deliveries into Plant Report Program.

C. Plant Operations. (daily)

- 1. Prepare Plant Report Program for daily entries. (IM 511)
 - a. Enter Date.
 - b. Enter Report Number.
 - c. Enter expected tonnage for the day.
 - d. Enter any proportion or target changes that apply.
- 2. Aggregate Delivery System. (IM 508)
 - a. Check for proper cold feed gate settings.
 - b. Check for proper cold feed belt speed settings.
 - c. Check for proper moisture setting (drum plants).
 - d. Monitor RAP proportions.
- 3. Mixing System. (Article 2303.03, IM 508)
 - a. Check for proper asphalt binder delivery setting.
 - b. Check for proper interlock operation.
 - c. Monitor coating of aggregates.
 - d. Monitor mixing time (batch plants).
- 4. Loading System. (<u>Article 2303.03</u> & <u>2001.01</u>, <u>IM 508</u>)
 - a. Check hopper/silo gates for proper open/close
 - b. Check trucks for proper loading and possible segregation.
 - c. Check trucks for diesel fuel contamination in box and remove contaminated trucks from service (5 hrs with box raised).
- 5. Asphalt Binder Quantity Determination.
 - a. Obtain totalizer printout readings and periodically check against tank stick readings.
 - b. If using batch count for quantity, obtain printouts of each batch and add up the asphalt binder used for total quantity.
- D. Plant Operations. (2 hour intervals) (IM 508)
 - 1. Temperatures.
 - a. Monitor and record mix temperature at discharge into truck box.
 - b. Monitor and record asphalt binder temperature.
 - c. Monitor and record air temperature.
 - 2. Observe plant operation for any irregularities.

E. Weighing Equipment.

- 1. Proportioning scales (batch plants). (min. 1/day) (<u>Articles 2001.07</u> & <u>2001.20</u>) (IM 508)
 - a. Perform sensitivity checks of scales.
 - b. Check for interference at scale pivot points.
- 2. Pay Quantity Scales. (min. 1/day) (Articles 2001.07 & 2001.20, IM 508)
 - Regularly perform check weighing comparisons with a certified scale as necessary. (min. 1st day and one additional if >5000 tons, and as directed by Engineer)

Matls. IM 213

Appendix D

- b. Perform sensitivity checks of scales.
- c. Check for interference at scale pivot points.
- d. Perform verification weighing (truck platform scales).
- 3. Weigh Belts. (daily)
 - a. Check weigh belt for excess clinging fines that effects speed reading.
 - b. Check weigh belt for interference at bridge pivot points.
 - c. Check for proper span setting.
- 4. Enter scale checks in Plant Report Program. (daily)
- F. Plant Sampling. (daily) (<u>Article 2303.04</u>, <u>IM 204</u> & <u>511</u>)
 - 1. Obtain cold-feed gradation samples as directed by Contracting Authority personnel per <u>IM 301</u> and <u>IM 204</u>.
 - 2. Obtain asphalt binder samples as directed by Contracting Authority personnel per <u>IM</u> 323 and <u>IM 204</u>.
 - 3. Obtain cold-feed moisture samples at a minimum of every ½ day (drum mix plants).
- G. Field Sampling (if not performed by others). (daily) (Article 2303.04, IM 204 & 511)
 - 1. Obtain uncompacted mix random samples as directed by Contracting Authority personnel, and identify time, station, lift and side.
 - 2. Obtain compacted mix core random samples as directed by Contracting Authority personnel.
- H. Testing. (daily) (Article 2303.04, IM 204 & 511)
 - 1. Field cores.
 - a. Provide properly calibrated equipment for Contracting Authority technician's use.
 - b. Obtain and record core location station and offset information.

- c. Obtain copy of core thickness measurements from Contracting Authority Technician.
- d. Obtain copy of core weights from Contracting Authority technician.
- e. Record weights and thickness in Plant Report Program.

2. Uncompacted mix.

- a. Properly store Contracting Authority secured portion of paired sample.
- b. Split Contractor half of paired sample into test portions as per IM 357.
- c. Perform gyratory compaction as per IM 325G.
- d. Perform bulk specific gravity test of laboratory-compacted specimen as per <u>IM</u> 321.
- e. Perform maximum specific gravity test as per IM 350.
- f. Enter test data into Plant Report Program.
- g. Submit secured samples to DOT District Lab.

3. Aggregate.

- a. Split one sample each day as directed by Contracting Authority personnel and provide half for testing by Contracting Authority.
- b. Perform gradation analysis as per <u>IM 302</u> and enter weights into Plant Report Program.
- c. Perform moisture tests and produce results upon request.
- 4. Testing Lab Qualification. (as needed) (IM 208 & 511)
 - a. Record all HMA sample validations with DOT on form <u>235</u>.
 - b. Document corrective actions taken when not correlating.
 - c. Document all test equipment calibrations.
 - d. Update IM's, test procedures and specs as required.
- Documentation. (daily) (<u>Article 2303.04</u>, <u>IM 204</u>, <u>511</u> & <u>508</u>)

The Plant Report, Chart, Plant Book, and other HMA worksheets are available on the following website: https://iowadot.gov/construction_materials/Hot-mix-asphalt-HMA

- 1. Prepare computerized Daily Plant Report.
 - a. Check that all data is correct.
 - b. Check that all data is complete.
 - c. Compute tons of mix used to date.
 - d. Enter mix adjustment data on report.
 - e. Check for spec compliance.
 - f. Immediately report non-complying results.
 - g. Obtain and record mat temperatures and stationing.
 - h. Provide electronic daily Plant Report to DME.
- 2. Maintain a daily diary of work activity in Plant Report Program.
 - Record weather conditions.

- b. Record daily high and low temperatures.
- c. Record sunrise and sunset times.
- d. Record any interruptions to plant production.
- e. Record any other significant events.
- 3. Import daily data into charting program.
- 4. Enter tack shipment quantities in Plant Report Program.
- 5. Total all truck tickets delivered to project and deduct any waste to determine HMA pay quantity.
- 6. Complete Daily Check List
- J. Miscellaneous. (daily) (IM 208 & 511)
 - 1. Clean lab.
 - 2. Back-up computer files.
 - 3. Dispose of samples as directed by District Lab.
 - 4. Clean and maintain lab equipment.
- K. Independent Assurance Duties. (Every 3 months) (IM 205 & 216)
 - 1. Pick up HMA and aggregate proficiency sample from District Lab.
 - 2. Test aggregate proficiency sample for gradation per IM 302.
 - 3. Test HMA proficiency sample per IM 357, 325G, 321 & 350.
 - 4. Report test results on proficiency samples to Construction Materials Bureau per <u>IM</u> 205.
- L. Project Duties. (1/project) (<u>IM 508</u> & <u>511</u>)
 - 1. Be in possession of appropriate mix design.
 - 2. Be present during plant calibration.
 - 3. Observe scale calibrations.
 - 4. Perform plant site and set-up inspection and fill out Plant Site Inspection List.
 - 5. Set up Plant Report Program and enter all project information to create Project Master files at beginning of project.

- 6. Check that release agents used in truck boxes are on the approved list in MAPLE.
- 7. Copy all computer files and provide to the Contracting Authority at completion of project.
- 8. Copy all paperwork and control charts and provide to the Contracting Authority at completion of project.

PORTLAND CEMENT CONCRETE (PCC) TECHNICIAN DUTIES PAVING & STRUCTURAL CONCRETE

Matls. IM 213

Appendix D

The Quality Control Technician shall have no other duties while performing certified inspection duties. Refer to IM 528 for exceptions. The District Materials Engineer may approve all quality control activities be performed by a single certified technician for low production situations.

Many of the duties of the PCC Level II Technician are detailed in <u>IM 527</u> (Paving) and <u>IM 528</u> (Structural) and consist of, but are not limited to the following:

A. Stockpiles

- 1. Assure proper stockpiling procedures.
- 2. Prevent intermingling of aggregates.
- 3. Prevent contamination.
- 4. Prevent segregation.

B. Plant Facilities

- 1. Assure safe sampling locations.
- 2. Check for equipment compliance.
- 3. Assure proper laboratory location and facilities.

C. Calibration

- 1. Be present during calibration (paving).
- 2. Check plant calibration (structural).
- 3. Assure proper batch weights.
- D. Cement (Fly Ash) & Aggregate Delivery
 - 1. Check for proper sources and certification.
 - 2. Document quantities delivered.
 - 3. Monitor condition of shipments.

E. Plant Sampling

1. Check aggregate gradations by obtaining, splitting, and testing samples.

2. Check aggregate moistures and specific gravity.

F. Proportion Control

- 1. Check scale weights and operation.
- 2. Check admixture dispensers.
- 3. Check mixing time and revolutions.
- 4. Check cement yield. (Paving plant only, unless over 10,000 cu. yds.)

G. Concrete Tests

- 1. Cure flexural test specimens.
- 2. Test flexural specimens (Contract agency will perform test in structural plant).
- 3. Conduct maturity testing.

H. Test Equipment

1. Clean and maintain scales, screens, pycnometers and beam molds, and laboratory facility.

I. Documentation

- 1. Prepare daily plant reports (paving), weekly plant reports (structures).
- 2. Document all checks and test results in the field book.
- 3. Maintain daily diary of work activity.

PRESTRESS TECHNICIAN DUTIES

Duties of the Prestress Technician are detailed in <u>IM 570</u> and consist of, but are not limited to the following:

A. Pre-pour

- 1. Identify and document materials requiring outside fabrication inspection.
- 2. Identify potential fabrication or production problems and notify Iowa DOT inspectors.
- 3. Verify that all materials incorporated meet the requirements of the contract documents.
- 4. Review concrete placement documents for strand locations.
- 5. Check tension calculations.
- 6. Measure elongation and gauge pressure during tensioning.
- 7. Check hold down and insert locations.
- 8. Check stress distributions.
- 9. Check steel reinforcement and placement.
- 10. Check strand position.
- 11. Check condition of pallet.
 - a. Level
 - b. Holes
 - c. Gaps
 - d. Other deformities
- 12. Determine moisture of aggregates.
- 13. Check form condition and placement.
 - a. Oil
 - b. Line alignment level
 - c. Tightness
- B. Concrete Placement

- 1. Check on use of an approved mix design and batching operations (sequence).
- 2. Assure appropriate placement and proper vibration techniques.
- 3. Measure and record concrete temperature.
- 4. Assure test cylinders are properly made.
- 5. Assure appropriate finish.
- 6. Assure appropriate curing operations.

C. Post-pour

- 1. Check temperature and record during curing process.
- 2. Assure concrete strength has been met prior to releasing the line.
- 3. Assure proper detensioning procedure.
- 4. Check unit for defects and obtain approval for repairs.
- 5. Identify and store cylinders with the respective units.
- 6. Check beam ends for fabrication in accordance with the plans.
- 7. Assure exterior sides of facia beams are grouted.
- 8. Inspect after patching and desired surfacing.
- 9. Measure and record overall dimensions of beam.
- 10. Measure and record camber at release and compare to design camber.
- 11. Check and/or measure and record lateral sweep before shipping.
- 12. Assure proper cylinder cure.

RIDE QUALITY TECHNICIAN DUTIES

Duties of the Ride Quality Technician are detailed in <u>IM 341</u> and consist of, but are not limited to the following:

- A. Test pavement and bridge surfaces for ride quality.
- B. Evaluate the test data.
 - 1. Indentify bumps and dips.
 - 2. Summarize the roughness into segments and sections.
 - 3. Identify the segments for incentive, disincentive, or grind.
 - 4. Retest and evaluate bumps, dips, and must grid segments for specification compliance.

C. Documentation

- 1. Document the evaluation on a test report. A copy is sent to the Project Engineer, District Materials Engineer, and Central Materials.
- 2. Notify the Project Engineer if the daily average profile index exceeds the specification tolerance.
- 3. Submit the profilograms to the Project Engineer for all areas tested.

SOILS TECHNICIAN DUTIES

A certified Soils Technician is required for all projects with Compaction with Moisture Control, Compaction with Moisture and Density Control, or Special Compaction of Subgrade (including for Recreation Trails). Refer to contract documents for Contractor QC testing requirements. Duties of the Soils Technician consist of, but are not limited to the following:

- A. Sampling: Obtain samples at required frequencies per IM 204.
- B. Proctor Testing
- C. Other Testing as Required
 - 1. For projects with Compaction with Moisture Control: Determine moisture content per frequencies in <u>IM 204</u>.
 - 2. For projects with Compaction with Moisture and Density Control or Special Compaction of Subgrade: Determine moisture content and in-place density per frequencies in IM 204.
- D. Sampling & Testing Equipment
 - 1. Clean and check testing sieves for defects.
 - 2. Assure scale accuracy.
 - 3. Check and maintain other testing equipment.
- E. Evaluate the test data.
 - 1. For projects with Compaction with Moisture Control: Confirm soils are being placed within required moisture content range.
 - 2. For projects with Compaction with Moisture and Density Control or Special Compaction of Subgrade: Confirm soils are being placed within required moisture content range and soil is compacted to density equal to or greater than density requirement.
- F. Documentation and Communication
 - 1. Document test data. A copy is sent to the Project Engineer.
 - 2. Relay test results to appropriate supervisory personnel.
 - 3. Notify the Project Engineer if any test results do not meet contract requirements and assure corrective actions are taken.

Chapter 12 IM 401 INSPECTION & ACCEPTANCE - CEMENT





HYDRAULIC CEMENTS

GENERAL

Portland cement shall meet the requirements of ASTM C150 for the type specified. When blended cement is to be furnished, it shall meet the requirements of ASTM C595. Cement Type I, II, III, IP, IS, IT and IL shall also meet the additional requirements outlined in <u>Section 4101</u> of the Standard Specifications. Approval of any type of Portland and blended cements will be based on certification by an approved source or upon source sampling and testing before being incorporated into the work. Approved cement sources and distribution terminals are listed in the Materials Approved Products Listing Enterprise (MAPLE) as <u>Appendixes A and B</u>.

The available cement types are:

ASTM C150

Type I For general use.

Type II For moderate sulfate resistance. C₃A less than 8%.

Type III High early strength. Generally, a finer ground Type I cement.

White Cement White cement sources shall meet the requirements of ASTM C150, except the maximum Fe_2O_3 shall not exceed 0.5%. Approved sources of white cement are listed in the <u>Appendix</u> B.

ASTM C595

Type IP

Type IS Type I Slag is a Portland cement blended, or clinker interground, up to 40% GGBFS.

Type I Pozzolan is a Portland cement blended or clinker interground, up to 25% pozzolan.

Type IL Type I Limestone is a Portland cement blended or clinker interground, between 5% and 15% limestone. Type IL cements are a direct replacement for Type I or Type I/II cement. Use specific gravity of 3.11 and a 10% limestone addition will be

assumed.

Type IT Type IT(SX)(LX) is a limestone/slag Portland cement blended or clinker interground with up to 35% slag and between 5% and 15% limestone. Type IT(SX)L(X) cements are a direct replacement for Type IS(X) cement. Type IT(PX)(LX) is a limestone/pozzolan blend with up to 25% pozzolan and between 5% and 15% limestone. Type IT(PX)L(X) cements are a direct replacement for Type IP(X) cement

ASTM C1157

Type GU General use cement, similar to Type I.

Type MS Moderate sulfate resistance, similar to Type II.

Type HE High early strength, similar to Type III.

Type MH Moderate heat of hydration.

Option R designation indicates low reactivity with alkali-silica reactive aggregates. ASTM C 1157 cements with option R, typically include pozzolans or slag, are a direct replacement when Type IP or IS are required.

SOURCE APPROVAL

For consideration for approval, the manufacturer shall provide the following to the Construction and Materials Bureau:

- 1. A quality control program that meets the requirements of Section A.
- 2. A copy of the latest CCRL inspection report on quality control laboratory, including documentation of resolution of any discrepancies noted.
- A 3-month strength uniformity report prepared in accordance with the requirements of ASTM C917, "Standard Test Method for Evaluation of Cement Strength Uniformity from a Single Source".
- 4. A letter indicating the type of each processing addition, and the percent range that will be used in Type I cement.

The manufacturer shall also prepare a 24-hour composite sample of cement from current production according to ASTM C183. This sample will be tested by the Central Materials Laboratory for acceptance.

lowa may approve a source based on another state source approval, provided that state will agree to the terms specified in this IM, and the source meets <u>Section 4101</u> of the lowa DOT Standard Specifications.

Mixing of cement from different sources, different plants, or of different types in one storage bin or silo will not be allowed.

When less than 5% of limestone is used, the manufacturer shall inform the Construction and Materials Bureau in writing on the amount of the addition. The manufacturer shall also supply comparative test data on chemical and physical properties of the cement with and without limestone. The amount of limestone used shall be included in the manufacturer's Mill Test Reports.

A. Quality Control Program

The control of the production from each grinding mill type shall be considered separately. The following minimum testing frequencies are presented as a general guideline:

 One sample representing 24 hours of production to be tested for air content, false set, and soundness. Determinations of free lime may be used to alter the frequency of testing soundness.

- 2. One sample representing 4 hours production to be tested for time of set and fineness.
- 3. One sample representing 48 hours production to be tested for chemical analysis.
- 4. One sample representing 4 day's production to be tested for 3- and 7-day compressive strength.

The sampling, tests and testing frequencies required may vary from the above guidelines depending of the particular production problems of the plant. In all cases, the quality control procedure used shall be submitted in writing to the District Materials Engineer for approval.

Sampling, handling and testing of cement samples shall follow ASTM C183.

The plant sample test records shall be available for study by Highway Division personnel for at least seven years after the cement represented has been produced.

B. Quality Control Laboratory

The Portland cement plant is required to have a control laboratory compliant with ASTM C1222, Standard Practice for Evaluation of laboratories Testing Hydraulic Cement. The control laboratory shall be AASHTO accredited. This laboratory will perform testing on the applicable types of cement meeting ASTM C150 and C595. Any major difference on test results between the control laboratory and the Highway Division Ames Laboratory shall be resolved quickly. Continued unresolved differences in test results will be considered a basis for discontinuing control laboratory approval.

SOURCE APPROVED BY OTHER STATES

lowa DOT will accept cements and cement blends approved or certified by other state transportation agencies, providing that state agrees to the following terms and that source meets Article 4101 of Standards Specifications. Sources tested by NTPEP may also be used for approval.

- 1. The host state agency will require the cement plant within its boundaries to have a laboratory compliant with ASTM C1222, Standard Practice for Evaluation of Laboratories Testing Hydraulic Cement. This laboratory shall be AASHTO accredited and will perform testing on the applicable types of cement produced (ASTM C 150/AASHTO M 85, C595/AASHTO M 240, C 1157) and shipped for state agencies consumption. Agency laboratories used for verification testing must meet the same criteria.
- 2. The host state agency will require the cement plant within its boundaries to have a printed, agency acceptable quality control/quality assurance plan for the production of cements used by state agencies. The plan must include commitments to comply with ASTM C1222 and ASTM C183, Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement. The host state agency will verify compliance with the quality control plan.
- 3. The host state agency will require the cement producer to maintain and provide, for each lot (silo) of cement shipped, a compilation of Mill Test Reports in an electronic form (Excel spread

sheet). The applicable data will be provided to the host state agency at least semiannually.

- 4. The host state agency will require the cement producer to submit split samples of a regular Portland cement (ASTM C150/AASHTO M85) and a blended cement (ASTM C595/AASHTO M240) or performance specification cement (ASTM C1157) if produced, semiannually for verification testing.
- 5. The host state agency will require the cement producer to submit reports for ASTM C917, Standard Test Method for Evaluation of Cement Strength Uniformity From a Single Source, for both a regular Portland cement and a blended cement, if produced, at least semiannually.
- The host state agency will require the cement producer to maintain production and quality control/quality assurance records for at least seven years and make those records available if requested.
- 7. The host state agency will review submittals from the cement producer along with agency test results. If deficiencies are discovered, the state agency will monitor corrective actions taken by the producer until the deficiencies are corrected. The reciprocal agreement state agency will be notified of the deficiencies and of each occurrence.
- 8. Any test results or submittals collected by the host state agency may be made available to the reciprocal agreement state agency upon request.
- 9. All cement plant information and data is confidential within the limits of a public agency and is for state agencies information and inspection only.
- 10. Quality assurance test results of field samples, performed by a reciprocal state, shall be reported to the host state agency when non-compliance occurs. The reciprocal state agency will deal directly with the cement producer. The host state agency will take action as described in Item 7. The host state agency shall notify all reciprocal agreement state agencies when non-compliance occurs.
- 11. Cement tests or requirements beyond the standards stated above may be provided to reciprocal state agencies by agreement between the host state and reciprocal state agencies.

CONTINUED SOURCE APPROVAL

A. DOT Sampling and Testing

After initial approval, random samples will be taken and tested at a minimum rate of one sample semiannually. The samples may be taken at the source or at the distribution terminal if the source is outside the district's normal area of travel.

A split-sample will be obtained from the plant of a Regular Supplier twice a year, preferably in January and July. The sample will be split and tested for complete chemical and physical properties by supplier's control laboratory and the Highway Division Ames Laboratory, respectively. The date of the split sampling and load out silo number will be identified on the sample identification report for later comparison.

Verification samples will be secured at the project site just before incorporation into the work. Test results, which do not comply with the specifications, may be considered sufficient cause to rescind approval to furnish cement. Construction that contains cement represented by verification samples showing deficient test results will be subject to the requirements of <u>Article-1105.04</u> of the Standard Specifications.

B. Mill Test Reports

Mill Test Reports covering cement to be certified shall be submitted to the Cement and Concrete Engineer at the Central Laboratory at Ames, and if requested, to the District Materials Engineer who monitors the plant. An electronic form (Excel spreadsheet) is acceptable.

The plant of a regular supplier is required to submit reports for ASTM C917, Standard Test method for Evaluation of Cement Strength Uniformity at least annually.

PROJECT DOCUMENTATION

All approved cements shipped for intended use in Iowa shall be clearly identified. The producer of approved cement shall furnish for the project records, two invoices or bill of lading copies, which bear the following certification statement.

CERTIFICATION STATEMENT

The material herein described has been sa	mpled and tested as prescribed by the Highway
Division of the Iowa Department of Transporta	ation and complies with the applicable specification
requirements for type	cement.
Bin No	
Date	

The bills of lading or invoices shall include project number, if available, source name, source location, source code, type, and quantity in the shipments. For blended cements (Types IT, IL, IP and IS), the above type designation shall include the suffix (X), where (X) equals the targeted percentage of limestone, slag or pozzolan in the product.

In the case of truck shipments, these copies of the bill of lading or invoice shall accompany each load, and shall be retained at the project or ready mixed concrete plant for the project engineer records. In the case of rail shipments, these copies shall be mailed to the project or ready mix plant.



Materials Approved Products List

401aa - Appendix A - Portland Cement

ج ڍ				
Specific Gravity	3.01	3.11	3.11	£.
Terminal/Supplier	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Mason City, IA; Des Moines, IA; Cedar Rapids, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA
Marketer	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)
Plant Location	Florence, CO	Ada, OK	Alpena, MI	Grand Chain, IL
≧	<u>401</u>	<u>401</u>	<u>401</u>	401
Material Item	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT
Company Name	Amrize Cement Inc.	Amrize Cement Inc.	06/25/2025 Amrize Cement Inc.	Amrize Cement Inc.
Approved	06/25/2025	06/25/2025	06/25/2025	06/25/2025
Brand Name	Amrize IP(25) - Florence (Code PC2008)	Amrize IL(10) - Ada (Code PC1909)	Amrize IL(10) - Alpena (Code PC1809)	Amrize IL(10) - Joppa (Code PC1309)

Created: 8/20/2025 10:14:45 AM



Materials Approved Products List

401aa - Appendix A - Portland Cement

Specific Gravity	е. 1-	3.11	3.11	2.85
Terminal/Supplier	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO	Des Moines, IA; St. Paul, MN; Fremont, NE; Superior, NE; Sioux Falls, SD; Bettendorf, IA: LaCrosse, WI; Kansas City, MO; St. Louis, MO
Marketer	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)
Plant Location	Ste. Genevieve, MO Amrize Cement (Holcim US)	Florence, CO	Exshaw, AB Canada	St. Genevieve, MO/Fremont, NE
≧	401	<u>401</u>	<u>401</u>	401
Material Item	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT
Company Name	Amrize Cement Inc.	Amrize Cement Inc.	Amrize Cement Inc.	Amrize Cement Inc.
Approved	06/25/2025	06/25/2025	06/25/2025	06/25/2025
Brand Name	Amrize IL(10) - ST. Genevieve (Code PC3209)	Amrize IL(10) Florence (Code PC2009)	Amrize IL(13) Exshaw (Code PC4009)	Amrize IT(P25)(L6) - St. Genevieve (Code PC3206)

Created: 8/20/2025 10:14:45 AM



401aa - Appendix A - Portland Cement

Terminal/Supplier Specific Gravity	Des Moines, IA; St. 2.96 Paul, MN; Fremont,
	Or. FOG
Amrize Cement (Holcim US) Ash Grove Cement	Ash Grove Cem
St. Genevieve, Amrize Cement MO/Fremont, NE (Holcim US) Chanute, KS Ash Grove Cement	
401 St. (MO) MO) 401 Cha	
PORTLAND CEMENT PORTLAND CEMENT PORTLAND A00	
Amrize Cement Inc. CE	
06/25/2025	
	Amrize II (s30)(P10) - st. genevieve (Code PC3216)

Created: 8/20/2025 10:14:45 AM



401aa - Appendix A - Portland Cement

Specific Gravity	3.11	3.07	3.07	3.05	3.14	3.15	3.15	3.11	3.11	3.05	3.15	3.11	3.11	3.14
Terminal/Supplier	Sugar Creek, MO; Omaha, NE	Sugar Creek, MO; Omaha, NE	Sugar Creek, MO, Omaha, NE	Sugar Creek, MO, Omaha, NE	Sioux Falls, SD; Hawarden, IA	Sioux Falls, SD; Hawarden, IA	Sioux Falls, SD; Hawarden, IA	Sioux Falls, SD; Hawarden, IA	Sioux Falls, SD; Hawarden, IA	Sioux Falls, SD; Hawarden, IA	Mason City, IA	Mason City, IA	Worthington, MN	LaSalle, IL
Marketer	Central Plains Cement	Central Plains Cement Company	Central Plains Cement Company	Central Plains Cement Company		GCC USA		GCC, USA	GCC, USA	GCC USA - Rapid City Terminal	Heidelberg Materials	Heidelberg Materials	Heidelberg Materials	Illinois Cement Company
Plant Location	Sugar Creek, MO	Sugar Creek, MO	Sugar Creek, MO	Sugar Creek, MO	Samalayuca, Mexico	Rapid City, SD	Samalayuca, Mexico	Pueblo, CO	Rapid City, SD	Rapid City, SD	Mason City, IA	Mason City, IA	Mitchell, IN	LaSalle, IL
≧	401	401	401	401	401	401	401	401	401	401	401	401	401	401
Material Item	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT
Company Name	Central Plains Cement Company	Central Plains Cement Company	Central Plains Cement Company	Central Plains Cement Company	GCC USA	GCC USA	GCC USA	GCC USA	GCC USA	GCC USA	Heidelberg Materials	Heidelberg Materials	Heidelberg Materials	Illinois Cement Company
Approved	06/11/2021	04/17/2024	04/17/2024	01/11/2023	09/04/2019	09/02/2015	09/25/2019	02/16/2022	02/24/2022	05/06/2014	10/03/2024	10/03/2024	05/21/2025	09/07/2023
Brand Name	Central Plains IL(12) - Sugar Creek (Code PC0709)	Central Plains IT(S20) (L10) - Sugar Creek (Code PC0706)	Central Plains IT(S25) (L9) - Sugar Creek (Code PC2816)	Central Plains IT(S38) (L7) - Sugar Creek (Code PC2806)	GCC I/II - Samalayuca (Code PC3602)	GCC III - Rapid City (Code PC1003)	GCC III - Samalayuca (Code PC3603)	GCC IL(10) - Pueblo (Code PC2909)	GCC IL(10) - Rapid City (Code PC1009)	GCC IP(25) - Rapid City (Code PC1008)	Heidelberg III - Mason City (Code PC0403)	Heidelberg IL(10) - Mason City (Code PC0409)	Heidelberg IL(10) - Mitchell (Code PC4109)	Illinois I/II (Code PC3302)

Created: 8/20/2025 10:14:45 AM



401aa - Appendix A - Portland Cement

Specific Gravity	3.11	3.15	3.11	3.12	3.14	3.14	3.15	3.11	3.11	3.14	
Terminal/Supplier Sp	Sugar Creek, MO, Omaha, NE	West Des Moines, IA	West Des Moines, IA	South Chicago Terminal	Chicago, IL	Chicago, IL	Hannibal, MO; West Des Moines, IA; St. Paul, MN; Minneapolis, MN; LaCrosse, WI	Hannibal, MO; West Des Moines, IA; St. Paul, MN; Minneapolis, MN; LaCrosse, WI	Hannibal, MO; West Des Moines, IA; St. Paul, MN; Minneapolis, MN; LaCrosse, WI		
Marketer	Central Plains/Eagle Materials	The Monarch Cement Company	The Monarch Cement Company	Ozinga Cement	Ozinga Cement	Ozinga Cement	Continental Cement Company	Continental Cement Company	Continental Cement Company	St Marys Cement Group	St. Marys Cement
Plant Location	Louisville, KY	Humboldt, KS	Humboldt, KS	Chicago, IL	Thanh Hoa Province, Vietnam	Nghe An Province, Vietnam	Hannibal, MO	Buffalo, IA	Hannibal, MO	St. Mary's, Ontario	Charlevoix, MI
≧	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	<u>401</u>	401	401	<u>401</u>	401
Material Item	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT	PORTLAND CEMENT
Company Name	Kosmos Cement Company	The Monarch Cement Company	The Monarch Cement Company	Ozinga Cement	Ozinga Cement	Ozinga Cement	Quikrete Cement	Quikrete Cement	Quikrete Cement	St Marys Cement Group	St Marys Cement Group
Approved	06/07/2024	02/17/2015	02/24/2022	06/27/2024	05/13/2024	11/13/2023	05/07/2025	05/07/2025	05/07/2025	04/24/2014	08/05/2025
Brand Name	Kosmos Cement IL(10) (Code PC3909)	Monarch III - Humboldt (Code PC0803)	Monarch IL(12) - Humboldt (Code PC0809)	Ozinga CarbonSense IS (20) (Code PC3807)	Ozinga I/II - Long Son Cement (Code PC3802)	Ozinga I/II - Song Lam JSC (Code PC3702)	Quikrete III - Hannibal (Code PC0203)	Quikrete IL(10) - Davenport (Code PC0509)	Quikrete IL(10) - Hannibal (Code PC0209)	St Marys II - Ontario (Code PC1702)	St Marys IL(10) - Charlevoix (Code PC3409)

Created: 8/20/2025 10:14:45 AM



401ab - Appendix B - White Cement

Specific Gravity	3.15	3.15
Terminal/Supplier	Plainfield, IL; Burnsville, MN	Plainfield, IL
Marketer	Heidelberg Materials	Heidelberg Materials
Plant Location	Cimsa, Turkey	York, PA
≧	401	<u>401</u>
Material Item	PORTLAND CEMENT	PORTLAND CEMENT
Company Name	Heidelberg Materials	Heidelberg Materials
Approved	10/03/2024	10/03/2024 Heidelberg Materials
Brand Name	Heidelberg White Cimsa I 10/03/2024 Heidelberg Materials	Heidelberg White York I

Created: 8/20/2025 12:00:56 PM

Chapter 13 IM 403 INSPECTION & ACCEPTANCE - AD MIX.

October 21, 2025 Supersedes April 15, 2025

CHEMICAL ADMIXTURES FOR CONCRETE

GENERAL

Air entraining admixtures shall meet the requirements of AASHTO M154. Water reducing and retarding, water-reducing, high range water reducing, and non-chloride accelerating admixtures shall meet the requirements of AASHTO M194. All chemical admixtures used for Portland Cement Concrete shall meet the requirements outlined in Section 4103 and other applicable lowa Department of Transportation Standard Specifications. Approved brands of chemical admixtures for concrete are listed in the Materials Approved Products Listing Enterprise (MAPLE) as Appendixes A, B, C, D, E, F, G and H for different types of applications.

For all types of admixtures, the source, brand name, and lot/batch number must be identifiable by description on the invoice, bill of lading or delivery ticket. The manufacturer and supplier shall maintain a record of each shipment, which identifies source, the brand, lot/batch number and certified test data for each shipment. This data shall be made available to the contracting authority when requested.

The end user (concrete supplier) shall keep records of deliveries available for inspection for a minimum of 3 years after delivery.

MANUFACTURER, BRAND NAME APPROVAL, USAGE GUIDELINES

To obtain approval for any admixture type, the manufacturer shall submit the following items to the Construction and Materials Bureau in Ames:

- 1. Product identification including brand name and product number
- 2. Complete manufacturer's recommendation for usage
- 3. A copy of Level 1 product test report for the submitted admixture from the AASHTO Product Evaluation and Audit Solutions program National Transportation Product Evaluation Program (NTPEP). The test result reported will be evaluated for compliance with appropriate AASHTO specification. The NTPEP report is not required for admixtures for prestressed and precast concrete listed in the Appendix F.
- 4. A current Materials Safety Data Sheet (MSDS)
- A one-quart (one-liter) representative sample may be required upon request

Specific requirements for each type of admixture are as follows:

A. Air Entraining Admixtures

Air entraining admixtures shall meet the requirements of Iowa Department of Transportation Standard Specifications Section 4103 and AASHTO M154.

Approved brands of air entraining admixtures are listed in the Appendix A of this IM.

B. Retarding, and Water-Reducing & Retarding Admixtures for Bridge Deck and Drilled Shaft Concrete Requiring Extended Working Time

Retarding, and water-reducing & retarding admixtures shall meet the requirements of AASHTO M194, Type B or Type D. These admixtures can be used for water reduction, retardation, or

water reduction and retardation for bridge deck and drilled shaft concrete when extended working time is required.

Approved brands of retarding, and water-reducing & retarding admixtures for bridge deck and drilled shaft concrete requiring extended working time are listed in the <u>Appendix B</u> of this IM. The <u>Appendix B</u> also contains a guideline for dosage rates and working time limits based on an estimated maximum temperature of the concrete during placement at the point of discharge. Working time limits have been determined by AASHTO T197 using 200 psi (1.38 MPa) penetration resistance and shall be provided by manufacturer. In addition to the AASHTO M194 requirements, a minimum working time of 4.5 hours is required for the Type I/II cement mix using the maximum normal recommended dosage of an admixture and tested at the normal temperature (between 70°F and 75°F).

Retarding admixtures from Appendix B also act as water reducers. At higher dosages of retarding admixtures may necessitate a dosage reduction or elimination of water reducers from Appendix C. Water reducers from Appendix C can also aid with air entrainment. Check with the admixture supplier for recommendations.

C. Water-Reducing Admixtures

Water-reducing admixtures shall meet the requirements of AASHTO M194, Type A.

Approved brands of water-reducing and mid-range water-reducing admixtures with the recommended dosage rates are listed in the <u>Appendix C</u> of this IM. The recommended dosage rate is for general concrete under ideal conditions. Dosage rates may be adjusted, within manufacturers range limits, to improve workability for the conditions on the project.

A combination of a water-reducing admixture and a retarding admixture may be used to aid in air entrainment and slump retention. A water-reducing admixture may be used in any mix design, even if it is not designated by the mix number.

D. High Range Water-Reducing Admixtures

High range water-reducing admixtures shall meet the requirements of AASHTO M194, Type F.

Approved brands of high range water-reducing admixtures with their recommended dosage rates are listed in the <u>Appendix D</u> of this IM. Dosage rates may be adjusted, within manufacturers range limits, to improve workability for the conditions on the project. As indicated, some of these high range water reducers listed can be used to cast self-consolidated concrete. If needed, a viscosity-modified admixture produced by the same manufacturer is allowed to cast self-consolidated concrete.

E. Non-Chloride Accelerating Admixtures

Non-chloride accelerating admixtures shall meet the requirements of AASHTO M194, Type C or E. Total chloride content, which may come from some indirect sources, shall not exceed 0.1% in the admixtures.

Approved brands of non-Chloride accelerating admixtures with their recommended dosage rates are listed in the Appendix E of this IM.

F. Admixtures for Prestressed & Precast Concrete

In addition to the admixtures listed in other Appendixes of this IM, the admixtures listed in the Appendix F can also be used in prestressed and precast concrete. Benefits of those admixtures in the Appendix F include increasing production rate, improvement of visual appeal, greater strength, more durable, better compactability, and extension of life of molds and machines parts for dry-cast concrete. In order to get an admixture approval, its producer shall prove that the use of the admixture will not reduce strength of concrete, and provide evidence of the above-mentioned benefits.

G. Retarding, Water-Reducing & Retarding Admixtures for Concrete with Normal Working Times

Retarding, water-reducing and retarding admixtures shall meet the requirements of AASHTO M194, Type B or Type D. These admixtures can be used for water reduction, retardation, or water reduction and retardation for concrete.

When use as a retarder is specified or authorized by the engineer, the contractor shall be responsible for its use and application of the proper dosage rate. It may also be necessary to adjust the quantity of air entraining agent. When fly ash is used in the concrete, the dosage rate shall be applied to both the cement and fly ash combined.

Mixed-to-placed time period may be extended as per lowa DOT Standard Specifications <u>Section</u> <u>2301.02.C.4</u>. For patching during hot temperatures or with extended haul time, rate may be reduced to half dosage.

Approved brands of water-reducing and retarding admixtures with their recommended dosage rates are listed in the Appendix G of this IM.

H. Special Performance Admixtures

Special performance admixtures shall meet the requirements of AASHTO M194, Type S. These admixtures will provide a desired performance characteristic(s) other than reducing water content, or changing the time of setting of concrete, or both, without any adverse effects on fresh, hardened and durability properties of concrete as specified, excluding admixtures that are used primarily in the manufacture of dry-cast concrete products. Special performance admixtures with their recommended dosage rates are listed in the Appendix H of this IM.

CarbonCure or carbon dioxide are considered a special performance admixture. Carbon dioxide shall be added to the mix using the manufacturers delivery system. The delivery system shall be provided and calibrated by manufacturers and integrated into the PCC plant batching system. Use of carbon dioxide addition without Portland cement reduction requires no approval. Use of carbon dioxide addition with up to a 3 percent Portland cement reduction is allowed, provided the producer has completed the approval process in Appendix J of this IM. Portland cement reductions and mix proportions shall be completed as shown in IM 529.

I. Flowable Fill Admixtures

Flowable fiil admixtures are used to develop high volume of stable air (>20%) for use in foamed cellular concrete and alternate mix designs in accordance with <u>Section 2506</u>. Flowable fill admixtures are listed in the Appendix I of this IM.

A hydration stabilizer/controller will be evaluated for approval as a retarder (Type B) or a water reducing & retarding admixture (Type D), and listed and identified in the <u>Appendix B</u> or the <u>Appendix B</u> after approved.

If alternative requirements specified in AASHTO M194 are met, an admixture may be provisionally approved based on six-month test results. Producer shall submit one-year test results for final approval as soon as they become available. The failure or delay in submitting one-year results may lead to revoking of provisional approval.

FOR MANUFACTURER

At the beginning of each calendar year, the manufacturer shall submit an annual certification statement to the Construction and Materials Bureau. If the admixture to be supplied during that year is identical with the formulation previously tested and approved, then the manufacturer shall complete the quality control limits in the certification statement.

FOR DISTRIBUTOR

At the beginning of each calendar year, The distributor shall certify that admixtures to be supplied are not altered and will be distributed as received from the manufacturer.

Approval of admixtures may be withdrawn because of deficient test results; product changes made after original approval, or unsatisfactory field performance.

AGITATION OF ADMIXTURES

Air entraining admixtures shall be stirred, agitated, or circulated at least weekly, or as recommended by manufacturer, to ensure a uniform and homogeneous mixture of solids and solution. It is the admixture supplier's responsibility to the contractor to provide a quality product. Therefore the admixture suppliers shall be responsible for the system used to maintain the quality product described above.

Retarding, water-reducing, and high range water-reducing admixtures shall be stirred, circulated, or agitated thoroughly once a day prior to operation of the proportioning plant to maintain the solids in suspension. The agitating shall be done in such a way that the solution in the holding or storage tank is circulated for a minimum of five minutes each day per 100 gallons (380 liters) of solution or any fraction thereof. Use of a timer on the pump is recommended to prevent excessive heat from the pump. 5 minutes is adequate for smaller tanks to a maximum of 15 minutes for larger tanks. A circulating pump with a 250-watt (1/3 hp) pump motor and a 1-inch (25 mm) inside diameter hose will be considered as a minimum requirement. The engineer shall approve the method of agitation. **NOTE:** Introducing air into a tank will not be acceptable.

MONITOR SAMPLING & TESTING, AND REJECTION OF MATERIAL

District Materials Inspector or plant monitor shall check approved brand and lot number of admixture prior to use.

For new lot numbers not previously sampled, monitor samples will be obtained and sent to Central Materials for testing. Minimum sampling frequency shall be according to <u>IM 204</u>. The sample size shall be one 1 pint (0.5 liter).

Admixtures that exceed the manufacturer's recommended shelf life will be sampled and tested prior to use. If retesting complies, the admixture will be allowed to use for another six months. Manufacturers shall be responsible to their customers to know if their product's effectiveness diminishes during storage.

Samples will be tested for variation from the manufacturer target for solids, specific gravity and chloride content if needed.

If the test result of a monitor sample is outside the quality control limits specified by the manufacturer, another sample may be obtained after the product has been recirculated. If the retest result of a monitor sample is outside the quality control limits specified by AASHTO M154 or M194 and provided by the manufacturer, all material in the storage tank shall be rejected. The admixture company is not allowed to mix new replacement material with the non-compliance material. The admixture manufacturer is responsible for the condition of storage tanks and should determine if the tanks should be cleaned to prevent cross contamination and further product failures.



403aa - Appendix A - Air Admixtures

					:		:	(
Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	l erminal/Supplier	Dosage
Air Plus	04/24/2014	Fritz-Pak Corporation	ADMIXTURES, AIR ENTRAINING	403	Dallas, TX	Fritz-Pak Corporation		
Airalon 3000	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Airalon 7000	03/21/2019	GCP Applied Technologies		403		GCP Applied Technologies		
Chryso Air 260	03/02/2017	CHRYSO Inc	ADMIXTURES, AIR ENTRAINING	403	Rockwall, TX	Chryso, Inc.		
ConAir 260	12/01/2016	Premiere Concrete Admixtures	ADMIXTURES, AIR ENTRAINING	403	Pioneer, OH	Premiere Concrete Admixtures™		
ConAir X	03/05/2018	Premiere Concrete Admixtures	ADMIXTURES, AIR ENTRAINING	403		Premiere Concrete Admixtures		
DSA 110	02/04/2021	DarCole Products, Inc	ADMIXTURES, AIR ENTRAINING	403		Darcole Products, Inc.		
DSA 112	02/18/2025	DarCole Products, Inc	ADMIXTURES, AIR ENTRAINING	403		Darcole Products, Inc.		
Daravair 1000	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Daravair 1400	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Daravair AT 30	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Daravair AT 60	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Daravair M	06/26/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	403	Boston, MA	GCP Applied Technologies		
Darex II AEA	04/24/2014	GCP Applied Technologies	ADMIXTURES, AIR ENTRAINING	<u>403</u>	Boston, MA	GCP Applied Technologies		
Eucon AEA-92	04/24/2014	Euclid Chemical Company	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	
Eucon AEA-92S	04/24/2014	Euclid Chemical Company	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	
Eucon Air MAC12	06/01/2017	Euclid Chemical Company	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	

Created: 8/20/2025 12:11:16 PM



403aa - Appendix A - Air Admixtures

Eucon Air MAC6 06/0 Eucon Air Mix 04/2			Material Item	<u> </u>	rialit Eucation	Marketer	l erminal/Supplier	Dosage
_	06/01/2017	Euclid Chemical Company	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	
	04/24/2014	Euclid Chemical Company	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	
Mapeair SA 06/2:	06/28/2023	Mapei Corporation	ADMIXTURES, AIR ENTRAINING	403	Eagan, MN	Mapei Corporation		
Mapeair SA-50 06/2:	06/28/2023	Mapei Corporation	ADMIXTURES, AIR ENTRAINING	403	Eagan, MN	Mapei Corporation		
Mapeair VR 06/2:	06/28/2023	Mapei Corporation	ADMIXTURES, AIR ENTRAINING	403	Eagan, MN	Mapei Corporation		
MasterAir AE 200 10/1.	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Master Builders Solutions US LLC		
MasterAir AE 400 10/1.	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Master Builders Solutions US LLC		
MasterAir AE 90 10/1:	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, AIR ENTRAINING	403	Cleveland, OH	Master Builders Solutions US LLC		
MasterAir VR 10 10/1:	10/12/2020	Master Builders Solutions US LLC		403	Cleveland, OH	Master Builders Solutions US LLC		
Miracon 2315 04/2.	04/24/2014	Miracon Technologies	ADMIXTURES, AIR ENTRAINING	403	Richardson, TX	Miracon™ Technologies		
Polychem SA-14 04/1'	04/17/2024	Mapei Corporation	ADMIXTURES, AIR ENTRAINING	403	Eagan, MN	Mapei Corporation		
RAE-260 05/1	05/15/2017	RussTech, Inc.	ADMIXTURES, AIR ENTRAINING	403		RussTech Inc.		
RSA-10 04/2	04/24/2014	RussTech, Inc.	ADMIXTURES, AIR ENTRAINING	403	Louisville, KY	RussTech, Inc.		
Sika AEA-14 04/2.	04/24/2014	Sika Corporation	ADMIXTURES, AIR ENTRAINING	403	Ottawa, IL	Sika Corporation (Construction)		
Sika AER C 07/3	07/30/2020	Sika Corporation	ADMIXTURES, AIR ENTRAINING	403	Ottawa, IL	Sika Corporation		
Sika Air 04/2.	04/24/2014	Sika Corporation	ADMIXTURES, AIR ENTRAINING	403	Ottawa, IL	Sika Corporation (Construction)		
Sika Air-260 04/2.	04/24/2014	Sika Corporation	ADMIXTURES, AIR ENTRAINING	403	Ottawa, IL	Sika Corporation (Construction)		

Created: 8/20/2025 12:11:16 PM



403aa - Appendix A - Air Admixtures

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier Dosage	Dosage
Sika Air-360	04/24/2014	04/24/2014 Sika Corporation	ADMIXTURES, AIR 403 ENTRAINING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		
SikaControl AIR-160	11/14/2018	11/14/2018 Sika Corporation	ADMIXTURES, AIR 403 ENTRAINING	403	Ottawa, IL	Sika Corporation		
Stable Air	04/24/2014 CCT	ССТ	ADMIXTURES, AIR 403 ENTRAINING	403	Irvine, CA	Cellular Concrete Technologies LLC		
Super Air Plus	04/24/2014 Fritz-Pak Corporati	Fritz-Pak Corporation	ADMIXTURES, AIR 403 ENTRAINING	403	Dallas, TX	Fritz-Pak Corporation		
Terapave AEA	04/24/2014	04/24/2014 GCP Applied Technologies	ADMIXTURES, AIR 403 ENTRAINING	403	Boston, MA	GCP Applied Technologies		

Created: 8/20/2025 12:11:16 PM

Appendix B IM 403 March 14,2024 Supercedes July 25, 2024

APPROVED SOURCES RETARDING & WATER REDUCING & RETARDING ADMIXTURES EXTENDED WORKING TIME IS REQUIRED for BRIDGE DECK (2412) & DRILLED SHAFT CONCRETE (2433)

Dosage is in fluid ounces per 100 lbs of cement, fly ash, and ggbfs.

Check percent of air as retarding admixtures may tend to increase air contents

Approximate working time limits for various cements with -NO RETARDER

-		Type I/II or IL	Type I/II or IL	Type IS, IP
Mix Temp at point of discharge	Dosage	No fly ash	With fly ash	With fly ash
				or Ternary
d۰	fl. oz./cwt	hours	hours	hours
22	0	3.8	4.8	5.8
99	0	3.1	3.8	4.6
75	0	2.5	3.0	3.5
85	0	2.2	2.5	2.7
98	0	1.9	1.9	1.9

Ternary mixes utilize cement, fly ash, and slag-

July 25, 2024

Ö	Mix	od sib																														
MasterSet Delvo	Type IS, IP	With fly ash or Ternary		hours	6.4	6.9	7.4	7.9	8.4	9.4	10.4	5.3	5.8	6.3	6.8	7.3	7.8	8.8	5.0	5.5	6.0	6.5	7.0	7.5	8.5	2.7	3.2	3.7	4.2	4.7	5.2	6.2
BRAND:	Type I/II or IL	With fly ash	-	hours	5.4	5.9	6.4	6.9	7.4	8.4	9.4	4.3	4.8	5.3	5.8	6.3	6.8	7.8	4.0	4.5	5.0	5.5	0.9	6.5	7.5	2.7	3.2	3.7	4.2	4.7	5.2	6.2
ion	Type I/II or IL	No fly ash		hours	4.4	4.9	5.4	5.9	6.4	7.4	8.4	3.3	3.8	4.3	4.8	5.3	5.8	6.8	3.0	3.5	4.0	4.5	5.0	5.5	6.5	2.7	3.2	3.7	4.2	4.7	5.2	6.2
BASF Corporation		Dosage		fl. oz./cwt	2	3	4	2	9	2	8	2	3	4	2	9	2	8	3	4	2	9	2	8	6	4	2	9	2	8	6	10
COMPANY:		IVIIX Temp at point of discharge	Ļ	L ₀				65							22							85							96			

	BRAND:	MasterSet Delvo	COMPANY:	COMPANY: BASF Corporation	on	BRAND:	MasterSet R 100
_	Type I/II or IL	Type IS, IP	Mix Temp at		Type I/II or IL	Type I/II or IL	Type IS, IP
ť	With fly ash	With fly ash	point of	Dosage	No fly ash	With fly ash	With fly ash
		or Ternary	discharge				or Ternary
	hours	hours	J۰	fl. oz./cwt	hours	hours	hours
	5.4	6.4		2			
	6'9	6.9	7	3			
	6.4	7.4	CC	4			
	6.9	7.9		2			
	7.4	8.4		3	0.6	6.7	10.5
	8.4	9.4	ŭ	4			
	9.4	10.4	CO	2			
	4.3	5.3		9			
	4.8	5.8		3	6.1	9'9	7.1
	5.3	6.3		4	8.7	8.3	8.8
	5.8	6.8	75	2	9.2	2.6	10.2
	6.3	7.3		9			
	8.9	7.8		2			
	7.8	8.8		3	5.2	5.5	2.7
	4.0	2.0		4	2'9	7.0	7.2
	4.5	5.5	85	2	8.1	8.4	8.6
	2.0	0.9		9			
	5.5	6.5		7			
	0.9	7.0		3	4.5	4.5	4.5
	6.5	7.5		4	0.9	0.9	6.0
	2.7	8.5	30	2	7.4	7.4	7.4
	2.7	2.7	C G	9			
	3.2	3.2		2			
	3.7	3.7		8			
	4.2	4.2					
	4.7	4.7					

IM 403

Supercedes March 14,2024

July 25, 2024

MasterSet R 300 With fly ash Type IS, IP or Ternary hours 8.8 7.0 9.5 5.5 6.3 8.3 7.0 2.8 6.9 9.9 8.2 4. 5.1 6.1 4.7 2.2 BRAND: Type I/II or IL With fly ash hours 7.5 5.2 6.5 9.5 9.9 9.9 5.5 6.3 7.8 5.3 6.2 4.9 4 4.7 6.7 Type I/II or IL No fly ash hours 4.5 5.3 6.8 4.6 5.5 0.9 4.6 9.5 9.9 5.3 7.2 6.4 4 4.7 4.7 COMPANY: BASF Corporation fl. oz./cwt Dosage 4 2 5 9 3 2 9 3 3 4 3 4 2 9 က 4 4 Mix Temp at point of discharge 22 65 75 85 92 ₽

Appendix B

	March 14,2024
July 25, 2024	Supercedes

Eucon Stasis	Type IS, IP	With fly ash	or Ternary	hours	7.5	9.5	11.5	0.0	7.0	8.0	9.5	5.0	5.5	6.5	7.5	8.5	5.0	5.5	9.0	7.0	8.0	4.0	5.0	5.5	6.0	7.0		
BRAND:	Type I/II or IL	With fly ash		hours	6.5	8.5	10.5	5.5	6.5	7.5	0.6	4.5	5.0	0.9	7.0	8.0	4.7	5.2	2.7	6.7	7.7	4.0	5.0	5.5	0.9	0.7		
Company	Type I/II or IL	No fly ash		hours	5.5	7.5	9.5	5.0	0.9	7.0	8.5	4.0	4.5	5.5	6.5	7.5	4.5	5.0	5.5	6.5	7.5	4.0	5.0	5.5	0.9	7.0		
COMPANY: Euclid Chemical Company		Dosage		fl. oz/cwt	2	3	4	2	3	4	2	3	4	2	9	7	4	2	9	7	8	4	2	9	7	8		
COMPANY:	Mix Temp at	point of	ulscriarge	٤,		22			ŭ u	6				75					85					92				
Eucon Retarder 100	Type IS, IP	h fly ash	or Lernary	Irs		9	4	15.3	9.7	11.5	13.2	4	-													8		
		Wit	or I	hours		11.6	12.4	15	6	11	13	14.4	8.5	10.9	12.9	13.5		7.3	10.1	12.4	12.4		8'9	6.6	11.8	11.8		
BRAND:		With fly ash	or I	hours		10.6	11.4	13.3	6.8	10.7	12.4	13.6	8.0	10.4	12.4	13.0 13.5		7.1	9.9	12.2	12.2		8.9	6.6	11.8	11.8		
	ור		Or I																									
COMPANY: Euclid Chemical Company BRAND:	Type I/II or IL Type I/II or IL	With fly ash	Or I	hours	2	10.6	11.4	13.3	8.9	10.7	12.4	13.6	8.0	10.4	12.4	13.0	7	7.1	6.6	12.2	12.2	7	6.8	6.6	11.8	11.8	7	8

IM 403 Appendix B

Supercedes March 14,2024

July 25, 2024

<u> </u>	2																							<u> </u>
Eucon WR-91	Type IS, IP With fly ash or Ternary	hours	6.8	7.8	9.8	11.8	6.1	7.1	8.6	10.1	2.0	5.5	6.5	7.5	8.5	4.2	4.7	5.2	6.2	7.2	3.9	4.4	4.9	5.4
BRAND:	Type I/II or IL With fly ash	hours	5.8	6.8	8.8	10.8	5.3	6.3	7.8	9.3	4.5	2.0	0.9	7.0	8.0	4.0	4.5	2.0	6.0	7.0	3.9	4.4	4.9	5.4
al Company	Type I/II or IL No fly ash	hours	4.8	5.8	7.8	8.6	4.6	5.6	7.1	8.6	4.0	4.5	5.5	6.5	7.5	3.7	4.2	4.7	5.7	6.7	3.9	4.4	4.9	5.4
COMPANY: Euclid Chemical Company	Dosage	fl. oz./cwt	2	3	4	5	3	4	5	9	4	5	9	7	8	4	5	9	7	8	5	9	7	8
COMPANY:	Mix Temp at point of discharge	d∘	55				99				22					85					96			

Eucon WR-91	COMPANY:	Euclid Chem	Euclid Chemical Company	BRAND:	Eucon DS
Type IS, IP	H		Type I/II or IL	Type I/II or IL	Type IS, IP
With fly ash	Mix Temp at point of discharge	Dosage	No fly ash	With fly ash	With fly ash
or Ternary					or Ternary
hours	٤.	fl. oz./cwt	hours	hours	hours
8.9		2	1.5	2.5	2.5
7.8		3	2.0	3.0	3.0
8.6		4	2.5	3.5	4.0
11.8	65	5	3.0	4.0	4.5
6.1		9	4.0	5.0	5.5
7.1		7	5.0	6.0	6.5
9.8		8	6.0	7.0	7.5
10.1		2	1.0	1.5	1.5
5.0		3	1.5	2.0	2.5
5.5		4	2.0	3.0	3.5
6.5	75	5	2.5	3.5	4.0
7.5		9	3.5	4.5	5.0
8.5		7	4.5	5.5	6.0
4.2		8	5.5	6.5	7.0
4.7		3	1.0	1.5	1.5
5.2		4	1.5	2.0	2.5
6.2		5	2.0	3.0	3.5
7.2	85	9	2.5	3.5	4.0
3.9		7	3.5	4.5	5.0
4.4		8	4.5	5.5	6.0
4.9		6	5.5	6.5	7.0
5.4		4	1.0	1.5	1.5
		5	1.5	2.0	2.5
		9	2.0	3.0	3.5
	95	7	2.5	3.5	4.0
		8	3.5	4.5	5.0
		6	4.5	5.5	6.0
		10	5.5	6.5	7.0

1 4 doz	2
N	<u>⊽</u>
مول	200
Orco	500

COMPANY:	COMPANY: GCP Applied Technologies	Technologies	BRAND:	Daratard 17	COMPANY :	COMPANY GCP Applied Technologies:	schnologies	BRAND:	RECOVER
Mix Temp at point of discharge	Dosage	Type I/II or IL No fly ash	Type I/II or IL With fly ash	Type IS, IP With fly ash or Ternary	Mix Temp at point of discharge	Dosage	Type I/II or IL No fly ash	Type I/II or IL With fly ash	Type IS, IP With fly ash or Temary
d۰	fl. oz/cwt	hours	hours	hours	d۰	fl. oz/cwt	hours	hours	hours
	3					3	5.4	6.5	7.5
9	4				9	4	0'9	0.7	8.0
CO	5				CO	2	6.8	7.8	8.8
	9					9	7.4	8.9	9.8
	3	4.3	4.7	5.3		3	4.8	5.8	8.9
75	4	9'9	7.1	7.6	75	4	5.5	6.5	7.5
	2	9.7	8.1	8.6		2	6.3	7.3	8.3
	9					9	9.7	9.8	9.6
	3	4.3	4.6	4.8		3	4.4	5.4	6.4
85	4	5.2	2.5	2.7	85	4	4.7	2.7	6.7
	2	6.5	8'9	7.0		2	5.3	6.3	7.3
						9	0.9	7.0	8.0
	3	3.9	3.9	3.9					
	4	4.4	4.4	4.4		3	2.8	3.8	4.8
92	5	5.7	2.2	2.7	98	4	3.0	4.0	5.0
	9					2	3.7	4.7	2.7
	2					9	4.5	2.5	6.5

IM 403 Appendix B

July 25, 2024 Supercedes March 14,2024

													<u> </u>		<u> </u>		<u> </u>																	
Zyla 640	Type IS, IP	With fly ash	or Ternary	hours	10.7	11.0	11.7	12.5	13.0	14.0	8.5	8.7	9.1	2.6	10.2	10.8	0.9	6.3	9.9	7.0	7.3	7.7	4.9	5.0	5.2	5.4	5.8	6.1	3.7	4.0	4.2	4.3	4.5	4.6
BRAND:	Type III or IL	With fly ash		hours	10.2	10.5	11.2	12.0	12.5	13.5	8.0	8.2	8.6	9.2	2.6	10.3	5.5	5.8	6.1	6.5	6.8	7.2	4.4	4.5	4.7	4.9	5.3	5.6	3.2	3.5	3.7	3.8	4.0	4.1
echnologies	Type Wor L	No fly ash		hours	9.2	9.5	10.2	11.0	11.5	12.5	0.7	7.2	9.7	8.2	2'8	6.3	4.5	4.8	5.1	5.5	2.8	6.2	3.4	3.5	3.7	3.9	4.3	4.6	2.2	2.5	2.7	2.8	3.0	3.1
COMPANY: GCP Applied Technologies		Dosage		fl. oz./cwt	2	3	4	5	9	7	2	3	4	2	9	7	2	3	4	5	9	7	2	3	4	5	6	7	2	3	4	5	9	7
COMPANY:	Mix Temp at	point of	discharge	ا√			, E	000					Q	00					70	2					C	0					O))		

March 14 2024	17071
Supercedes	

July 25, 2024

Mapetard R	Type IS, IP With fly ash or Ternary	hours	6.7	8.5	10.2	11.0	13.0	0.9	7.5	9.0	9.6	11.3	5.3	6.5	7.8	8.8	9.8	4.5
BRAND:	Type I/II or IL With fly ash	hours	2.7	7.5	9.2	10.0	12.0	5.2	6.7	8.2	0.6	10.5	4.8	6.0	7.3	8.3	9.3	4.3
on	Type I/II or IL No fly ash	hours	4.7	6.5	8.2	0.6	11.0	4.5	0.9	7.5	8.3	8.6	4.3	5.5	6.8	7.8	8.8	4.0
COMPANY Mapei Corporation :	Dosage	fl. oz./cwt	2	3	4	2	9	2	8	4	2	9	7	8	4	2	9	2
COMPANY :	Mix Temp at point of discharge	d۰			55					65					75			
Mapeplast 400 NC	Type IS, IP With fly ash or Ternary	hours	2.0	5.8	8.4	12.0	4.7	5.6	8.3	11.6	4.4	5.5	8.2	11.3	3.7	5.3	7.6	10.8
BRAND: Mapeplast 400 NC	Type I/I or IL Type IS, IP With fly ash or Ternary	hours	4.8 5.0	5.5 5.8	8.1 8.4	11.5 12.0	4.5 4.7	5.4 5.6	7.9 8.3	11.2	4.3 4.4	5.3 5.5	7.8 8.2	10.8	3.6 3.7	5.1 5.3	7.2 7.6	10.4
BRAND:	- - - - -																	
ÿ	Type I/II or IL With fly ash	hours	4.8	5.5	8.1	11.5	4.5	5.4	7.9	11.2	4.3	5.3	7.8	10.8	3.6	5.1	7.2	10.4

5.5 6.5 7.8 9.0

5.3 6.3 7.6 8.8

5.0 6.0 7.3 8.5

4

82

Supercedes March 14,2024

July 25, 2024

COMPANY:	COMPANY: Mapei Corporation	tion	BRAND:	Mapecrete Resolve
Mix Temp at point of discharge	Dosage	Type I/II or IL No fly ash	Type I/II or IL With fly ash	Type IS, IP With fly ash or Ternary
J۰	fl. oz./cwt	hours	hours	hours
22	2	3.5	4.0	4.2
	4	4.8	5.5	5.8
	9	6.3	6.8	7.1
	8	7.3	8.4	8.8
	10	8.1	9.3	9.7
	12	9.6	11.0	11.5
	2	3.4	3.9	4.1
	4	4.5	5.2	5.4
u u	9	2.7	9.9	6.8
S	8	7.1	8.2	8.5
	10	7.8	9.0	9.4
	12	9.3	10.7	11.2
	2	3.2	3.7	3.8
	4	4.2	4.8	5.0
7.6	9	5.4	6.2	6.5
C	8	6.9	7.9	8.3
	10	7.6	8.7	9.1
	12	9.1	10.5	10.9
	2	3.1	3.6	3.7
	4	3.9	4.5	4.7
06	9	5.2	0.9	6.2
60	8	6.7	7.7	8.0
	10	7.4	8.5	8.9
	12	6.8	10.2	10.7

	March 14,2024
July 25, 2024	Supercedes

	Ψ Φ																									
Plastiment	Type IS, IP With fly ash or Ternary	hours					9.9	8.7	13.0	19.0	4.2	5.4	7.8	12.1	20.5	3.1	3.8	5.1	7.2	10.3	2.2	2.7	3.5	4.9	7.4	12.1
BRAND:	Type I/II or IL With fly ash	hours					5.8	7.8	12.0	20.8	4.0	5.1	7.4	11.4	19.3	3.3	3.9	5.1	7.1	10.5	2.2	2.7	3.5	4.9	7.4	12.1
no	Type I/II or IL No fly ash	hours					5.1	7.1	11.4	20.2	3.6	4.7	6'9	10.9	18.9	3.0	3.6	4.9	6'9	10.2	2.2	2.7	3.5	4.9	7.4	12.1
COMPANY: Sika Corporation	Dosage	fl. oz./cwt	2	3	4	2	3	4	5	9	3	4	2	9	7	3	4	2	9	7	3	4	2	9	7	8
COMPANY:	Mix Temp at point of discharge	J۰		ų	cc			S	CO				75					85					90			

COMPANY:	COMPANY: Sika Corporation	ا	BRAND:	Plastiment XR
Mix Temp at		Type I/II or IL	Type I/II or IL	Type IS, IP
point of	Dosage	No fly ash	With fly ash	With fly ash
discharge				or Ternary
d∘	fl. oz./cwt	hours	hours	hours
22	2	5.2	6.2	7.2
	3	6.1	7.1	8.1
	4	7.2	8.1	9.1
	2	8.5	6.5	10.4
9	2	4.5	5.3	6.1
	3	2.5	6.2	7.0
	4	9'9	7.4	8.1
	9	6'2	9.8	9.3
75	2	3.6	4.1	4.6
	3	4.5	2.0	5.5
	4	2.5	0.9	6.5
	2	9.9	7.1	7.7
85	3	4.1	4.6	5.1
	4	5.1	5.4	5.7
	2	0.9	6.3	6.5
96	4	3.8	3.9	4.0
	2	4.8	4.9	5.0
	9	2.2	2.8	6'9

IM 403 Appendix B

July 25, 2024 Supercedes March 14,2024

Plastocrete 10N	Type IS, IP	With fly ash	or Ternary	hours	7.3	8.2	9.3	10.6	6.1	7.2	8.3	9.5	4.6	5.7	6.7	7.8	8.9	4.2	5.1	0.9	7.1	3.6	4.5	5.4	0.0
BRAND:	Type I/II or IL	With fly ash		hours	6.3	7.2	8.3	9.6	5.3	6.4	7.5	8.7	4.1	5.2	6.2	7.2	8.4	4.0	4.9	5.8	6'9	3.6	4.5	5.4	0.9
on	Type I/II or IL	No fly ash		hours	5.3	6.2	7.3	8.6	4.6	2.7	8.9	8.0	3.6	4.7	2.7	6.8	6.7	3.7	4.6	5.5	9'9	3.6	4.5	5.4	0.9
COMPANY: Sika Corporation		Dosage		fl. oz./cwt	2	3	4	2	2	3	4	2	2	3	4	5	9	3	4	2	9	4	2	9	7
COMPANY:		Mix Temp at point of discharge		J۰	22					2	6				22				ŭ o	3			J 0	G G G	

IY: Sika Corporation Dosage fl. oz./cwt 3 3	BRAND: SikaTard 440	or IL Type I/II or IL Type IS, IP	sh With fly ash With fly ash	or Ternary	hours	5.9 7.1	7.1 8.3	100			9.9	9.9 12.1	9.9 12.1 13.9 14.6	9.9 12.1 13.9 14.6	9.9 12.1 13.9 14.6 4.9	9.9 12.1 13.9 14.6 4.9 5.8	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0 9.4 10.0	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0 9.4 11.8	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0 9.4 10.0 11.8 4.3	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0 9.4 10.0 11.8 4.3	9.9 12.1 13.9 14.6 4.9 5.8 6.2 8.0 8.0 9.4 10.0 11.8 4.3 4.3	9.9 12.1 13.9 14.6 4.9 6.2 8.0 8.0 9.4 10.0 11.8 4.3 6.1	9.9 12.1 13.9 14.6 4.9 6.2 8.0 8.0 9.4 10.0 11.8 4.3 4.3 6.1 6.9	9.9 12.1 13.9 14.6 4.9 6.2 8.0 8.0 9.4 10.0 11.8 4.3 4.3 6.1 6.1 6.9	9.9 12.1 13.9 14.6 4.9 6.2 8.0 9.4 10.0 11.8 4.3 4.3 6.9 6.9 6.9 8.8	9.9 14.6 4.9 5.8 6.2 8.0 9.4 10.0 11.8 4.3 4.3 6.9 6.9 6.9 8.8 8.8	9.9 12.1 13.9 14.6 4.9 6.2 8.0 9.4 10.0 11.8 4.3 4.3 6.1 6.9 6.9 7.8 8.8 8.8 8.8	9.9 14.6 14.6 4.9 6.2 8.0 8.0 9.4 10.0 11.8 4.3 6.9 6.9 6.9 7.8 8.8 8.8 8.8 7.8 7.8	9.9 12.1 12.1 14.6 4.9 5.8 6.2 8.0 8.0 9.4 10.0 11.8 4.3 6.9 6.9 6.9 6.9 7.8 8.8 8.8 8.8 7.8 6.7	9.9 12.1 13.9 14.6 4.9 6.2 8.0 9.4 10.0 11.8 4.3 4.3 6.9 6.9 6.9 6.9 7.8 8.8 8.8 8.8 6.9 6.9 6.9 6.9 6.9 7.8 6.9
	Type I/II or IL No fly ash					4.3	2.5	7.2	8.3	10.5	12.3	13.0	3.5	4.4	5.4	9.9	8.0	9.6	10.4	3.1	3.6	4.2	4.9	2.7	9.9	9.7	2.7	3.3	4.0	4.8	2.7	6.7	7.8
C xight of the state of the sta		Mix Temp at		discharge	°F fl. oz./cv	65 2	3	4	5	9	7	8	75 2	3	4	5	9	7	8	85 3	4	5	9	7	8	6	95 4	2	9	7	8	6	10
	BRAND:	I/II or IL	ו fly ash		nours	6.3	7.2	8.3	9.6	5.3	6.4	7.5	8.7	4.1	5.2	6.2	7.2	8.4	4.0	4.9	5.8	6.9	3.6	4.5	5.4	0.9							

IM 403 Appendix B

March 14,2024 July 25, 2024 Supercedes

ProLong L	Type IS, IP	With fly ash	or Ternary	hours	5.5	6.5	7.0	8.0	9.5	10.5	12.0	5.0	5.5	0.9	7.0	8.0	9.5	10.5	4.5	5.0	0.9	7.0	8.5	9.5	11.5	4.0	5.0	0.9	7.5	8.5	10.5	12.5
BRAND:	Type I/II or IL	With fly ash		hours	2.0	6.0	6.5	7.5	9.0	10.0	11.5	4.5	5.0	5.5	6.5	7.5	9.0	10.0	4.0	4.5	5.5	6.5	8.0	9.0	11.0	3.5	4.5	5.5	7.0	8.0	10.0	12.0
	Type I/II or IL	No fly ash		hours	4.0	5.0	5.5	6.5	8.0	9.0	10.5	3.5	4.0	4.5	5.5	6.5	8.0	9.0	3.0	3.5	4.5	5.5	7.0	8.0	10.0	2.5	3.5	4.5	0.9	7.0	0.6	11.0
Premiere		Dosage		fl. oz./cwt	2	3	4	2	9	2	8	2	3	4	2	9	2	8	3	4	2	9	2	8	6	4	2	9	2	8	6	10
COMPANY: Premiere		Mix Temp at point of discharge		J۰				65							75							85							92			



403ab - Appendix B - Retarders Bridge Deck

			-		D			
Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Daratard 17	04/12/2019	GCP Applied Technologies	ADMIXTURES, RETARDING EXTENDED SET	403		GCP Applied Technologies		Extende d Time- See File
Eucon DS	02/27/2025	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH	Euclid Chemical Company		4 fl oz./100 lbs
Eucon Retarder 100	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH; Albertville, MN; Marengo, IA	Euclid Chemical Company		Extende d Time- See File
Eucon Stasis	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403		Euclid Chemical Company		Extende d Time- See File
Eucon WR-91	04/12/2019	Euclid Chemical Company	ADMIXTURES, RETARDING EXTENDED SET	403	Cleveland, OH; Albertville, MN; Marengo, IA	Euclid Chemical Company		Extende d Time- See File
Mapecrete Resolve	01/19/2024	Mapei Corporation	ADMIXTURES, RETARDING EXTENDED SET	403		Mapei Corporation		2 fl oz./100 lbs
Mapeplast 400 NC	06/28/2023	Mapei Corporation	ADMIXTURES, RETARDING EXTENDED SET	403		Mapei Corporation		Extende d Time- See File
Mapetard R	04/06/2023	Mapei Corporation	ADMIXTURES, RETARDING EXTENDED SET	403		Mapei Corporation		Extende d Time- See File
MasterSet Delvo	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING EXTENDED SET	403		Master Builders Solutions US LLC		Extende d Time- See File
MasterSet R 100	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING EXTENDED SET	403		Master Builders Solutions US LLC		Extende d Time- See File
MasterSet R 300	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING EXTENDED SET	403		Master Builders Solutions US LLC		Extende d Time- See File
Polychem Renu	10/16/2020	Mapei Corporation	ADMIXTURES, RETARDING EXTENDED SET	403		Mapei Corporation		Extende d Time- See File



403ab - Appendix B - Retarders Bridge Deck

lier Dosage	2.0 fl oz./100 lbs	Extende d Time- See File					
Terminal/Supplier							
Marketer	Premiere Concrete Admixtures	GCP Applied Technologies	Sika Corporation (Construction)	Sika Corporation (Construction)	Sika Corporation	Sika Corporation (Construction)	GCP Applied Technologies
Plant Location			Ottawa, IL	Ottawa, IL	Ottawa, IL	Ottawa, IL	
≧	403	403	403	403	403	403	403
Material Item	ADMIXTURES, RETARDING EXTENDED SET	ADMIXTURES, RETARDING					
Company Name	Premiere Concrete Admixtures	GCP Applied Technologies	Sika Corporation	Sika Corporation	Sika Corporation	Sika Corporation	03/14/2024 GCP Applied Technologies
Approved	10/05/2023	04/12/2019	07/30/2020	07/30/2020	07/30/2020	04/12/2019	03/14/2024
Brand Name	ProLong L	RECOVER	Sika Plastiment	Sika Plastiment XR	Sika Plastocrete-10N	SikaTard 440	Zyla 640



403ac - Appendix C - Water Reducers

		:		:	:		:	
Brand Name	Approved	Company Name	Material Item	≥	Plant Location	Marketer	Terminal/Supplier	Dosage
ADVA 140M	01/22/2021	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>		GCP Applied Technologies		3.0 oz per 100 lbs
ADVA 140M	06/23/2021	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>		GCP Applied Technologies		6 fl. oz. per 100 lbs
ADVA Cast 575	05/10/2022	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>		GCP Applied Technologies		2.0 fl. oz/100 lbs
ADVA Cast 600	12/14/2021	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	403				
ADVA Cast 600	08/21/2023	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>				
Accelguard G3	09/14/2017	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Euclid Chemical Company	Albertville, MN; Marengo, IA	16.0 fl. oz/100 lb
Chryso Fluid Optima 256	03/02/2017	CHRYSO Inc	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>		Chryso, Inc.		2.0 fl. oz/100 lb
Chryso Fluid Optima 256	03/02/2017	CHRYSO Inc	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>		Chryso, Inc.		5.0 fl. oz/100 lbs
Chryso Optima 249	01/16/2024	CHRYSO Inc	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>		Chryso Inc.		2.5 fl oz./100 lbs
Clarena MC 2000	05/03/2017	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	403		GCP Applied Technologies		6.0 fl. oz/100 lb



403ac - Appendix C - Water Reducers

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Concera SA8080	08/23/2019	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	403		GCP Applied Technologies		2.5 fl. oz/100 lb
DNL 485	02/04/2021	DarCole Products, Inc	ADMIXTURES, NORMAL WATER REDUCING	403		Darcole Products, Inc.		5 oz per 100 lbs
DNL 785	02/04/2021	DarCole Products, Inc	ADMIXTURES, NORMAL WATER REDUCING	403		Darcole Products, Inc.		7 oz per 100 lbs
Dynamon 850	01/18/2024	Mapei Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403		Mapei Corporation		4.5 fl oz./100 lbs
Dynamon 850	04/06/2023	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		2.5 fl. oz. / 100 lbs
Dynamon Easy 75	07/21/2025	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		4 fl oz./100 lbs
Dynamon NRG 1092	10/16/2020	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		3.0 fl. oz/100 lb
Dynamon NRG 546	10/16/2020	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		3 oz./100 lbs
Dynamon SX	01/18/2024	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		2 fl oz./100 lbs
Dynamon SX	10/16/2020	Mapei Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403		Mapei Corporation		4.0 fl. oz/100 lb
Eucon MR	07/02/2014	Euclid Chemical Company	ADMIXTURES, MID-RANGE WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	6.0 fl. oz/100 lb



403ac - Appendix C - Water Reducers

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Eucon MRX	07/02/2014	Euclid Chemical Company	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	5.0 fl. oz/100 lbs
Eucon MRX	04/24/2014	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	3.0 fl. oz/100
Eucon SE	05/22/2018	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Euclid Chemical Company	Albertville, MN; Marengo, IA	2.5 fl. oz/100 lb
Eucon WR	04/24/2014	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	3.0 fl. oz/100 lb
Eucon WR-75	04/24/2014	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	3.0 fl. oz/100 lb
Eucon WR-91	04/24/2014	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	3.0 fl. oz/100 lb
Eucon X-15	05/19/2023	Euclid Chemical Company	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Euclid Chemical Company		14.0 fl oz./100 lbs
Eucon X-15	05/19/2023	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	403	Cleveland, OH	Euclid Chemical Company		6.0 fl oz./100 lbs
Extendflo X90	05/15/2017	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RussTech Inc. & Mapei Corporation		3.0 fl. oz/100 lbs
FinishEase-NC	06/08/2015	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RuthTech Inc.		3.0 fl. oz/100 lb
FinishEase-NC	07/02/2014	RussTech, Inc.	ADMIXTURES, MID-RANGE WATER REDUCING	403		RussTech, Inc.		6.0 fl. oz/100 lb



403ac - Appendix C - Water Reducers

Approved Company Name Material Item IIM 04/24/2014 RussTech, Inc. ADMIXTURES, 403 09/02/2015 GCP Applied ADMIXTURES, 403 Technologies MID-RANGE REDUCING 05/03/2021 GCP Applied ADMIXTURES, 403 Technologies REDUCING 02/12/2015 GCP Applied ADMIXTURES, 403 Technologies MID-RANGE REDUCING 02/12/2015 GCP Applied ADMIXTURES, 403 Technologies REDUCING 02/12/2015 GCP Applied ADMIXTURES, 403 Technologies NATER REDUCING 10/16/2020 Mapei Corporation ADMIXTURES, 403 NORMAL WATER REDUCING 06/28/2023 Mapei Corporation ADMIXTURES, A03									
09/02/2014 RussTech, Inc. ADMIXTURES, NORMAL WATER REDUCING 09/02/2015 GCP Applied ADMIXTURES, Technologies WATER REDUCING 07/02/2014 GCP Applied ADMIXTURES, Technologies MID-RANGE WATER REDUCING 02/12/2015 GCP Applied ADMIXTURES, Technologies REDUCING 02/12/2015 GCP Applied ADMIXTURES, Technologies REDUCING 10/16/2020 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING 06/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING 07/21/2025 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING 06/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING 06/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING ADMIXTURES, NORMAL WATER RE	Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
09/02/2015 GCP Applied MID-RANGE WATER REDUCING CP Applied MID-RANGE WATER REDUCING CP Applied NORMAL WATER REDUCING CP Applied MID-RANGE WATER REDUCING CP Applied MID-RANGE WATER REDUCING CP Applied ADMIXTURES, Technologies REDUCING ADMIXTURES, Technologies REDUCING Technologies MID-RANGE WATER REDUCING CP Applied ADMIXTURES, Technologies MID-RANGE WATER REDUCING CP Applied MID-RANGE WATER REDUCING ADMIXTURES, NORMAL WATER REDUCING REDUCIN	-400P	04/24/2014	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RussTech, Inc.		3.0 fl. oz/100 lb
05/03/2021 GCP Applied RDMIXTURES, NORMAL WATER REDUCING Technologies MID-RANGE WATER REDUCING NORMAL WATER REDUCING Technologies REDUCING Technologies REDUCING Technologies REDUCING Technologies MID-RANGE WATER REDUCING Technologies MID-RANGE WATER REDUCING NORMAL WATER REDUCING REDUCIN	RA 110	09/02/2015	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	403		GCP Applied Technologies		6.0 fl. oz./100 lb
07/02/2014 GCP Applied MID-RANGE WATER REDUCING O2/12/2015 GCP Applied ADMIXTURES, Technologies REDUCING Technologies MID-RANGE WATER REDUCING Technologies MID-RANGE WATER REDUCING NORMAL WATER REDUCING O6/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING NORMAL WATER NORMAL WATER REDUCING NORMAL WATER NORMAL WAT	RA 62	05/03/2021	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	403		GCP Applied Technologies		3.5 fl. oz. per 100 lbs
02/12/2015 GCP Applied NORMAL WATER REDUCING O2/12/2015 GCP Applied ADMIXTURES, Technologies MID-RANGE WATER REDUCING 10/16/2020 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING O6/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING NORMAL WATER REDUCING REDUCING REDUCING NORMAL WATER REDUCING ADMIXTURES, NORMAL WATER REDUCING REDUCING REDUCING REDUCING REDUCING ADMIXTURES,	RA 62	07/02/2014	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	403		GCP Applied Technologies		4.0 fl. oz/100 lb
02/12/2015 GCP Applied MID-RANGE WATER REDUCING Mapei Corporation NORMAL WATER REDUCING O6/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING NORMAL WATER NORMAL WATER NORMAL WATER REDUCING	RA 95	02/12/2015	GCP Applied Technologies	ADMIXTURES, NORMAL WATER REDUCING	403		GCP Applied Technologies		3.0 fl. oz/100 lb.
10/16/2020 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING O6/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING NORMAL WATER NORMAL WATER NORMAL WATER NORMAL WATER NORMAL WATER NORMAL WATER REDUCING ADMIXTURES, NO6/26/2023 Mapei Corporation ADMIXTURES,	RA 95	02/12/2015	GCP Applied Technologies	ADMIXTURES, MID-RANGE WATER REDUCING	403		GCP Applied Technologies		5.0 fl. oz/100 lb.
06/28/2023 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING O7/21/2025 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING REDUCING O6/26/2023 Mapei Corporation ADMIXTURES,	apefluid N200	10/16/2020	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		4 fl. oz./100 lbs
07/21/2025 Mapei Corporation ADMIXTURES, NORMAL WATER REDUCING D 06/26/2023 Mapei Corporation ADMIXTURES,	apeplast 400 NC		Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		3.0 fl. oz/100 lb
06/26/2023 Mapei Corporation ADMIXTURES,	apeplast 440 NS		Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	403		Mapei Corporation		4 fl oz./100 lbs
MID-RANGE WATER REDUCING	apeplast KB 1200	06/26/2023	Mapei Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403		Mapei Corporation		6.0 fl. oz/100 lbs



403ac - Appendix C - Water Reducers

Dosage	3.0 fl. oz/100 lb	5 oz./100 lbs	4 oz./100 lbs	2 fl. oz. / 100 lbs	3.0 fl. oz/100 lb		2.5 fl oz./100 lbs	4.0 fl. oz/100 lb	2.0 fl. oz/100 lb	4 fl. oz/100 lbs	2.0 fl. oz/100 lbs
Terminal/Supplier											
Marketer	Mapei Corporation	Mapei Corporation	Mapei Corporation	Mapei Corporation	Mapei Corporation	Master Builders Solutions, Inc.	Master Builders Solutions, Inc.	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC
Plant Location							Cleveland, OH				
≧	403	403	403	<u>403</u>	403	403	403	403	403	403	403
Material Item	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING						
Company Name	Mapei Corporation	Mapei Corporation	Mapei Corporation	Mapei Corporation	Mapei Corporation	Master Builders Solutions US LLC	Master Builders Solutions US LLC				
Approved	06/26/2023	10/16/2020	10/16/2020	03/11/2021	06/28/2023	09/28/2023	04/22/2024	10/12/2020	10/12/2020	10/12/2020	10/12/2020
Brand Name	Mapeplast KB 1200	Mapeplast MR 107	Mapeplast MR 107	Mapeplast N	Mapeplast Paver Plus	Master X-Seed 66	MasterEase 5000	MasterGlenium 1466	MasterGlenium 3030	MasterGlenium 3030	MasterGlenium 7920



403ac - Appendix C - Water Reducers

Dosage	4.0 fl oz./100 lbs	5.0 fl. oz/100 lb	5.0 fl. oz/100 lb	5.0 fl. oz/100 lb	5.0 fl. oz/100 lb	5.0 fl. oz/100 lb	7.0 fl. oz/100 lb	6.0 fl. oz/100 lb	3.0 fl. oz/100 lb
Terminal/Supplier									Type A, Water Reducing
Marketer	Master Builders Solutions, Inc.	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC			
Plant Location									
≧	403	403	403	<u>403</u>	403	403	<u>403</u>	403	403
Material Item	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING
Company Name	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Master Builders Solutions US LLC				
Approved	11/08/2023	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/12/2020
Brand Name	MasterGleniuum 7500	MasterPolyheed 1020	MasterPolyheed 1025	MasterPolyheed 1720	MasterPolyheed 1725	MasterPolyheed 900	MasterPolyheed 900	MasterPolyheed 997	MasterPolyheed 997



403ac - Appendix C - Water Reducers

Dosage	3.0 fl. oz/100 lb	3.0 fl. oz/100 lb	3.0 fl. oz/100 lb	4.0 fl. oz/100 lb	2.6 oz/100 lbs	2.0 fl. oz/100 lb	3.0 fl. oz./100 lb		7.0 fl. oz/100 lb		2.5 fl. oz/100 lb
Terminal/Supplier											Albertville, MN; Marengo, IA
Marketer	Master Builders Solutions US LLC	Mapei Corporation	Premiere Concrete Admixtures™	Premiere Concrete Admixtures		Premiere Concrete Admixtures [™]					
Plant Location											Cleveland, OH
≧	<u>403</u>	403	403	403	403	<u>403</u>	403	403	403	403	403
Material Item	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, MID-RANGE WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING							
Company Name	Master Builders Solutions US LLC	Mapei Corporation	Premiere Concrete Admixtures	Premiere Concrete Admixtures	Premiere Concrete Admixtures	Premiere Concrete Admixtures	Premiere Concrete Admixtures	Euclid Chemical Company			
Approved	10/12/2020	10/12/2020	10/12/2020	10/12/2020	10/16/2020	12/01/2016	03/05/2018	02/25/2022	12/01/2016	02/11/2022	06/01/2017
Brand Name	MasterPozzolith 200	MasterPozzolith 322	MasterPozzolith 700	MasterPozzolith 80	Melchem 38	OptiFlo 500	OptiFlo 700	OptiFlo MR	OptiFlo MR	Optifle 700	Plastol 6420



403ac - Appendix C - Water Reducers

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Plastol 6420	06/01/2017	Euclid Chemical Company	ADMIXTURES, MID-RANGE WATER REDUCING	403	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	4.0 fl. oz/100 lb
Plastol 6425	03/14/2023	Euclid Chemical Company	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>	Cleveland, OH	Euclid Chemical Company		4.0 fl oz./100 lbs
Polychem 3000	10/16/2020	Mapei Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>		Mapei Corporation		4.0 fl. oz/100 lb
Polychem 3000	10/16/2020	Mapei Corporation	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>		Mapei Corporation		2.0 fl. oz/100 lb
Sika Plastocrete-10N	07/30/2020	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		2.0 fl. oz/100 lb
Sika Plastocrete-161	07/30/2020	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation		2.0 fl. oz./100 lb
Sika Plastocrete-250	07/30/2020	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation		2.0 fl. oz/100 lb
Sika ViscoFlow-2020	08/14/2017	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation		6.0 fl. oz/100 lb
Sika ViscoFlow-2020	08/14/2017	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation		3.0 fl. oz/100 lb
Sika Viscocrete-1000	09/18/2023	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 lb



403ac - Appendix C - Water Reducers

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Sika Viscocrete-1100	09/18/2023	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	403	Ottawa, IL	Sika Corportation		2.3 fl oz./100 lbs
Sikament 686	04/24/2014	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		4.0 fl. oz/100 lb
Sikament AFM	07/02/2014	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 lb
Sikament-475	08/19/2016	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation		5.0 fl. oz./100 lb
Sikament-475	08/19/2016	Sika Corporation	ADMIXTURES, NORMAL WATER REDUCING	403	Ottawa, IL	Sika Corporation		3.0 fl. oz./100 lb
Sikaplast 200	07/02/2014	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		4.0 fl. oz/100 lb
Sikaplast 300GP	07/02/2014	Sika Corporation	ADMIXTURES, MID-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		4.0 fl. oz/100 lb
Superflo 2000 RM	05/15/2017	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RussTech Inc.		2.0 fl. oz/100 lbs
Superflo 2000 SCC	05/15/2017	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RussTech Inc.		1.0 fl. oz/100 lbs
Superflo 2040 RM	05/15/2017	RussTech, Inc.	ADMIXTURES, NORMAL WATER REDUCING	403		RussTech Inc.		1.0 fl. oz/100 lbs



403ac - Appendix C - Water Reducers

er Dosage	3.0 fl. oz/100 lb	3.0 fl. oz/100 lb	4.0 fl. oz/100 lb	3.0 fl. oz/100 lbs
Terminal/Supplier Dosage				
Marketer	GCP Applied Technologies	GCP Applied Technologies	GCP Applied Technologies	GCP Applied Technologies
Plant Location				
≧	403	403	403	403
Material Item	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, NORMAL WATER REDUCING	ADMIXTURES, NORMAL WATER REDITCING
Company Name	04/24/2014 GCP Applied Technologies	05/01/2014 GCP Applied Technologies	11/02/2015 GCP Applied Technologies	03/10/2015 GCP Applied Technologies
Approved	04/24/2014	05/01/2014	11/02/2015	03/10/2015
Brand Name	WRDA 82	ZYLA 620	ZYLA 630	ZYLA 640



403ad - Appendix D - High Range WR

Dosage	10.0 fl. oz/100 lb	5.0 fl. oz/100 lb.	4.0 fl. oz/100 lb.	4.0 fl. oz/100 lb.	13.0 fl. oz/100 lb	10.0 fl. oz/100 lb	4.0 fl. oz/100 lb	4.0 fl. oz/100 lb	4.0 fl. oz/100 lb
	10. oz/ lb	5.0 fl. oz/100 lb.	4.0 fl. oz/10 lb.	4.0 fl. oz/100 lb.	13. 02/ lb	10. oz/ lb	4.0 fl. oz/100 lb	4.0 fl. oz/10 lb	4.0 fl. oz/10 lb
Terminal/Supplier									
erminal									
_									
Marketer	olied ogies	ogies	olied ogies	ogies	ogies	olied	olied	ogies	olied
Ma	GCP Applied Technologies	GCP Applied Technologies							
uo	O F	O F	O F	O F		O F	O F	O F	O F
Plant Location									
Plai									
≧	<u>403</u>	<u>403</u>	403	<u>403</u>	<u>403</u>	<u>403</u>	403	<u>403</u>	403
Item	8, ш	8, ш							
Material Item	ADMIXTURES, HIGH-RANGE WATER REDUCING	ADMIXTURES, HIGH-RANGE WATER							
2	ADMIXTI HIGH-RA WATER REDUCI	ADMIXTI HIGH-RA WATER REDUCI	ADMIXTI HIGH-RA WATER REDUCI	ADMIXT HIGH-R/ WATER REDUCI	ADMIXT HIGH-RA WATER REDUCI	ADMIXTI HIGH-RA WATER REDUCI	ADMIXT HIGH-R/ WATER REDUCI	ADMIXT HIGH-RA WATER REDUCI	ADMIXT HIGH-RA WATER
/ Name	pe es	pe es							
Company Name	GCP Applied Technologies	GCP Applied Technologies							
	01			<u> </u>				-	
Approved	04/24/2014	04/24/2014	04/24/2014	02/12/2015	04/24/2014	04/24/2014	04/24/2014	11/07/2014	08/21/2023
4	40	40	40	02	0	04	40	<u></u>	80
lame						55	ئ ر	55	0
Brand Name	140M	190	195	198	405	ADVA Cast 555	ADVA Cast 575	ADVA Cast 585	ADVA Cast 600
	ADVA 140M	ADVA 190	ADVA 195	ADVA 198	ADVA 405	ADVA	ADVA	ADVA	ADVA



403ad - Appendix D - High Range WR

Dosage	4.5 fl. oz/100 lb		9.0 fl. oz./100 lb	4.5 fl oz./100 lbs	10.0 fl. oz/100 lb	11 fl oz./100 lb.	12.0 fl. oz/100 lb	7 fl. oz. /100 lbs	8 fl oz./100 lbs
Terminal/Supplier									
Marketer	GCP Applied Technologies		Chryso, Inc.	Chryso Inc.	GCP Applied Technologies	GCP Applied Technologies	GCP Applied Technologies	Mapei Corporation	Mapei Corporation
Plant Location									
≧	403	403	403	403	403	403	403	403	403
Material Item	ADMIXTURES, HIGH-RANGE WATER REDUCING								
Company Name	GCP Applied Technologies	GCP Applied Technologies	CHRYSO Inc	CHRYSO Inc	GCP Applied Technologies	GCP Applied Technologies	GCP Applied Technologies	Mapei Corporation	Mapei Corporation
Approved	11/14/2018	01/07/2022	03/02/2017	01/16/2024	05/03/2017	06/20/2018	04/24/2014	04/06/2023	07/21/2025
Brand Name	ADVA ITM750	Adva Cast 593	Chryso Fluid Optima 256	Chryso Optima 249	Clarena MC 2000	Concera SA8080	Daracem 19	Dynamon 850	Dynamon Easy 75



403ad - Appendix D - High Range WR

Brand Name	Approved	Company Name	Material Item	≥	Plant I ocation	Marketer	Terminal/Supplier	Dosade
Dynamon NRG 1092	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		4.5 fl. oz./100 lb
Dynamon NRG 546	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		5.5 oz./100 lbs
Dynamon SX	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		8.0 fl. oz./100 lb
Dynamon SX 37	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		4 oz. / 100 lbs
Eucon 1037	04/24/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Euclid Chemical /Brett Admixtures	Albertville, MN; Marengo, IA	10.0 fl. oz/100 lb
Eucon 37	04/24/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Euclid Chemical/Brett Admixtures	Albertville, MN; Marengo, IA	10.0 fl. oz/100 lb
Eucon MRX	05/06/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Euclid Chemical/Brett Admixtures	Albertville, MN; Marengo, IA	8.0 fl. oz./100 lb
MIRA 110	09/02/2015	GCP Applied Technologies	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>		GCP Applied Technologies		10.0 fl. oz./100 lb
	05/06/2014	GCP Applied Technologies	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		GCP Applied Technologies		9.0 fl. oz./100 lb



403ad - Appendix D - High Range WR

		:					:	
Brand Name	Approved	Company Name	Material Item	≥	Plant Location	Marketer	Terminal/Supplier	Dosage
Mapecrete Resolve	01/19/2024	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		4 fl oz./100 lbs
Mapefluid N200	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		8.5 oz/100 lbs
MasterGlenium 1466	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		4.0 fl. oz./100 lb
MasterGlenium 3030	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		9.0 fl. oz./100 lb
MasterGlenium 3400	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		4.0 fl. oz/100 lb
MasterGlenium 7500	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		6.0 fl. oz/100 lb
MasterGlenium 7700	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		5.0 fl. oz/100 lb
MasterGlenium 7920	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		4.0 fl. oz/100 lbs
MasterRheobuild 1000	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Master Builders Solutions US LLC		10.0 fl. oz/100 lb



403ad - Appendix D - High Range WR

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Melchem 38	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>		Mapei Corporation		6.5 oz/100 lbs
Plastol 341	04/24/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	4.0 fl. oz/100 lb
Plastol 341-S	04/24/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	4.0 fl. oz/100 lb
Plastol 5000	04/24/2014	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Brett Admixtures	Albertville, MN; Marengo, IA	5.0 fl. oz/100 lb
Plastol 6400	06/01/2017	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	4.0 fl. oz/100 lb
Plastol 6420	06/01/2017	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	7.0 fl. oz/100 lb
Plastol 6425	03/14/2023	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Cleveland, OH	Euclid Chemical Company		9.0 fl oz./100 lbs
Plastol Ultra 209	01/23/2017	Euclid Chemical Company	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Cleveland, OH	Euclid Chemical Copany	Albertville, MN; Marengo, IA	3.0 fl. oz/100 lb
Polychem 3000	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		9.0 fl. oz./100 lb



403ad - Appendix D - High Range WR

Brand Name	Approved	Company Name	Material Item	≧	Plant I ocation	Marketer	Terminal/Supplier	Dosade
Polychem SPC	10/16/2020	Mapei Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Mapei Corporation		9.0 fl. oz/100 lb
Sika ViscoCrete 1000	05/06/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation		10.0 fl. oz./100 lb
Sika ViscoCrete 2100	04/24/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 lb
Sika ViscoCrete 2110	04/24/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 lb
Sika ViscoCrete 4100	04/24/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 lb
Sika ViscoCrete 6100	04/24/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		5.0 fl. oz/100 Ib
Sika Viscocrete-1100	09/18/2023	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corportation		4.5 fl oz./100 lbs
Sikament 686	05/06/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation		6.0 fl. oz./100 lb
Sikament AFM	05/06/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation		9.0 fl. oz./100 lb



403ad - Appendix D - High Range WR

Vame Approved Company Name VIN 04/24/2014 Sika Corporation ADP WA WA WA WA NA MA NA MA NA MA NA ADP NA ADP NA ADP NA REI NA NA									
04/24/2014 Sika Corporation 08/19/2016 Sika Corporation 04/24/2014 Fritz-Pak Corporation Dof/15/2017 RussTech, Inc. 05/15/2017 RussTech, Inc. Dof/15/2017 RussTech, Inc.	Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
04/24/2014 Fritz-Pak Corporation 04/24/2014 Fritz-Pak Corporation O5/15/2017 RussTech, Inc. O5/15/2017 RussTech, Inc. O5/15/2017 RussTech, Inc. D5/15/2017 RussTech, Inc. D5/15/2017 RussTech, Inc.	ikament SPMN	04/24/2014	Sika Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>	Ottawa, IL	Sika Corporation (Construction)		15.0 fl. oz/100 lb
04/24/2014 Fritz-Pak Corporation 04/24/2014 Fritz-Pak Corporation Daylogout Corporation Co	ikament-475	08/19/2016		ADMIXTURES, HIGH-RANGE WATER REDUCING	403	Ottawa, IL	Sika Corporation		7.0 fl. oz./100 lb
04/24/2014 Fritz-Pak Corporation 05/15/2017 RussTech, Inc. 04/24/2014 RussTech, Inc. 05/15/2017 RussTech, Inc. 05/15/2017 RussTech, Inc. 12/04/2021 DarCole Products, Inc.	upercizer 5	04/24/2014	Fritz-Pak Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Fritz-Pak Corporation		5.0 oz/100 lb
05/15/2017 RussTech, Inc. 04/24/2014 RussTech, Inc. 05/15/2017 RussTech, Inc. 3 02/04/2021 DarCole Products, Inc.	upercizer 7	04/24/2014	Fritz-Pak Corporation	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Fritz-Pak Corporation		6.0 oz/100 lb
04/24/2014 RussTech, Inc. 05/15/2017 RussTech, Inc. 02/04/2021 DarCole Products, Inc.	uperflo 2000 RM	05/15/2017		ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>		RussTech Inc.		9.0 fl. oz/100 lbs
05/15/2017 RussTech, Inc. 02/04/2021 DarCole Products, Inc.	uperflo 2000 SCC	04/24/2014		ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>		RussTech, Inc.		9.0 fl. oz/100 lb
02/04/2021 DarCole Products, Inc	uperflo 2040 RM	05/15/2017	RussTech, Inc.	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		RussTech Inc.		5.0 fl. oz/100 lbs
12/01/2016 Dramiara Concrete	uperflo DSF 1443	02/04/2021	DarCole Products, Inc	ADMIXTURES, HIGH-RANGE WATER REDUCING	<u>403</u>		Darcole Products, Inc.		4.5 oz per 100 lbs
Admixtures	UltraFlo 2000	12/01/2016	oncrete	ADMIXTURES, HIGH-RANGE WATER REDUCING	403		Premiere Concrete Admixtures		8.0 fl. oz./100 lb





403ad - Appendix D - High Range WR

Dosage	9.0 fl. oz./100 lb	6.0 fl. oz/100 lb
Terminal/Supplier Dosage		
Marketer	Premiere Concrete Admixtures	Premiere Concrete Admixtures [™]
Plant Location		
≧	403	403
Material Item	ADMIXTURES, HIGH-RANGE WATER REDUCING	ADMIXTURES, HIGH-RANGE WATER REDUCING
Approved Company Name	03/05/2018 Premiere Concrete Admixtures	12/01/2016 Premiere Concrete Admixtures
Approved	03/05/2018	12/01/2016
Brand Name	UltraFlo 5600	UltraFlo DP



403ae - Appendix E - Non CL Accelerators

Dosage	18 oz per 100 lbs	16.0 fl. oz/100 lb	12.0 fl. oz/100 lb	2.0-6.0 gal./cubi c yeard of concrete	18 oz per 100 lbs	5 oz per 100 lbs	18 fl oz./100 lbs	10.0 fl. oz/100 lb	1 lb per 100 lbs cement	15.0 fl. oz/100 lbs	8.0 fl. oz/100 lb
Terminal/Supplier		Albertville, MN; Marengo, IA	Albertville, MN; Marengo, IA								
Marketer	Euclid Chemical Company	Euclid Chemical Company	Brett Admixtures	GCP Applied Technologies	Darcole Products, Inc.	Darcole Products, Inc.	Darcole Products, Inc.	GCP Applied Technologies	Fritz-Pak Corporation	RussTech Inc.	Mapei Corporation
Plant Location		Cleveland, OH	Cleveland, OH								
≧	403	403	403	<u>403</u>	403	403	403	403	403	403	403
Material Item	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR	ADMIXTURES, NON-CHLORIDE ACCELERATOR
Company Name	Euclid Chemical Company	Euclid Chemical Company	Euclid Chemical Company	GCP Applied Technologies	DarCole Products, Inc	DarCole Products, Inc	DarCole Products, Inc	GCP Applied Technologies	Fritz-Pak Corporation	RussTech, Inc.	Mapei Corporation
Approved	05/21/2021	09/14/2017	04/24/2014	05/07/2014	02/04/2021	02/04/2021	03/19/2024	04/24/2014	10/25/2022	05/15/2017	06/28/2023
Brand Name	Accelguard 80	Accelguard G3	Accelguard NCA	DCI	DNS 166	DWR 385	DarNset 130	Daraset 400	Fritz-Pak NCA	LCNC-166	Mapefast Super Set



403ae - Appendix E - Non CL Accelerators

Brand Name	Approved	Company Name	Material Item	₹	Plant Location	Marketer	Terminal/Supplier	Dosage
Mapefast Super Set Plus	04/05/2023	Mapei Corporation	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Mapei Corporation		20.0 fl. oz/100 lb
Mapeshield CI 300	06/28/2023	Mapei Corporation	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403				
MasterLife Cl 30	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Master Builders Solutions US LLC		1.0-6.0 gal./cubi c yard of concrete
MasterSet AC 534	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Master Builders Solutions US LLC		10.0 fl. oz/100 lb
MasterSet FP 20	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Master Builders Solutions US LLC		5.0 fl. oz/100 lb
NG 135	01/22/2025	Nanogence	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Nanogence		21 fl oz./100 lbs
NitroCast NC	12/01/2016	Premiere Concrete Admixtures	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		Premiere Concrete Admixtures™		10.0 fl. oz/100 lb
Plastocrete 161FL	01/12/2021	Sika Corporation	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403	Ottawa, IL	Sika Corporation		25 oz. per 100 lbs
Polarset	04/24/2014	GCP Applied Technologies	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403		GCP Applied Technologies		8.0 fl. oz/100 lb
Sika CNI	01/12/2021	Sika Corporation	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403	Ottawa, IL	Sika Corporation		65 oz. per 100 lbs
Sika Rapid-1	04/24/2014	Sika Corporation	ADMIXTURES, NON-CHLORIDE ACCELERATOR	403	Ottawa, IL	Sika Corporation (Construction)		8.0 fl. oz/100 lb



403ae - Appendix E - Non CL Accelerators

er Dosage	10.0 fl. oz/100 lb
Terminal/Supplie	
Marketer	Sika Corporation (Construction)
Plant Location	Ottawa, IL
≧	403
Material Item	ADMIXTURES, NON-CHLORIDE ACCELERATOR
Company Name	04/24/2014 Sika Corporation
Approved	04/24/2014
Brand Name	SikaSet NC



403af - Appendix F - Precast Admixtures

10/14/2015 GCP Applied ADMIXTURES. PRE 403 Technologies 04/24/2014 GCP Applied ADMIXTURES. PRE 403 Cleveland, OH Composition 04/24/2014 Euclid Chemical Chemical Company ADMIXTURES. PRE 403 Cleveland, OH Company Euclid Chemical Chemic	Brand Name	Approved	Company Name	Material Item IM	Plant Location	Marketer	Terminal/Supplier	Dosage
04/24/2014 GCP Applied Technologies ADMIXTURES, PRE 403 Cleveland, OH Euclid Chemical Chemical Chemical Company 04/24/2014 Euclid Chemical Chemical Company CAST-DRY CAST Cleveland, OH Euclid Chemical Company 12/04/2023 Master Builders ADMIXTURES, PRE 403 Cleveland, OH Euclid Chemical Company 12/04/2023 Master Builders ADMIXTURES, PRE 403 Solutions, US LLC CAST-DRY CAST 10/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Solutions US LLC Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Solutions US LLC Solutions US LLC 04/24/2014 GCP Applied ADMIXTURES, PRE 403 Sika Corporation GCP Applied 10/12/2020 Sika Corporation CAST-DRY CAST ADMIXTURES, PRE 403 Sika Corporation	CBP 2	10/14/2015	GCP Applied Technologies	ADMIXTURES, PRE 403 CAST-DRY CAST		GCP Applied Technologies		4.0 fl. oz/100 lb
04/24/2014 Euclid Chemical Company ADMIXTURES, PRE 403 Cleveland, OH Company Euclid Chemical Company 04/24/2014 Euclid Chemical Company ADMIXTURES, PRE 403 Cleveland, OH Company Euclid Chemical Company 12/04/2023 Master Builders Solutions US LLC CAST-DRY CAST Solutions US LLC ADMIXTURES, PRE 403 Master Builders Solutions US LLC ADMIXTURES, PRE 403 Master Builders Solutions US LLC 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST Solutions US LLC ADMIXTURES, PRE 403 Master Builders Solutions US LLC 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST Solutions US LLC ADMIXTURES, PRE 403 Master Builders Solutions US LLC 04/24/2014 GCP Applied CAST-DRY CAST Technologies ADMIXTURES, PRE 403 GCP Applied Technologies 08/08/2025 Sika Corporation ADMIXTURES, PRE 403 Ottawa, IL Sika Corporation 07/30/2020 Sika Corporation ADMIXTURES, PRE 403 Ottawa, IL Sika Corporation	Daravair M	04/24/2014	GCP Applied Technologies	ADMIXTURES, PRE 403 CAST-DRY CAST		GCP Applied Technologies		0.3 fl. oz/100 lb
04/24/2014 Euclid Chemical Company ADMIXTURES, PRE 403 Cleveland, OH Euclid Chemical Company 12/04/2023 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC Master Builders Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC 10/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC 20/12/2020 Master Builders ADMIXTURES, PRE 403 Master Builders Solutions US LLC 30/12/2020 ADMIXTURES, PRE 403 GCP Applied Technologies 04/24/2014 GCP Applied CAST-DRY CAST Technologies GCP Applied Technologies 08/08/2025 Sika Corporation CAST-DRY CAST CAST Sika Corporation CAST-DRY CAST Sika Corporation CAST-DRY CAST Sika Corporation CAST-DRY CAST Sika Corporation CAST-DRY CAST Sika C	Eucon For-Cast N	04/24/2014	Euclid Chemical Company	ADMIXTURES, PRE 403 CAST-DRY CAST	Cleveland, OH	emical	Albertville, MN; Marengo, IA	2.0 fl. oz/100 lb
12/04/2023 Master Builders Solutions US LLC ADMIXTURES, PRE 403 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST ADMIXTURES, PRE 403 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST ADMIXTURES, PRE 403 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST ADMIXTURES, PRE 403 04/24/2014 GCP Applied GAST-DRY CAST Technologies CAST-DRY CAST ADMIXTURES, PRE 403 08/08/2025 Sika Corporation GAST-DRY CAST CAST CAST GAST-DRY CAST CAST Sika Corporation GAST-DRY CAST CAST CAST CAST GAST-DRY CAST CAST CAST CAST CAST CAST CAST CAST	Eucon For-Cast S	04/24/2014	Euclid Chemical Company	ADMIXTURES, PRE 403 CAST-DRY CAST	Cleveland, OH	emical	Albertville, MN; Marengo, IA	2.0 fl. oz/100 lb
10/12/2020 Master Builders CAST-DRY CAST 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST 10/12/2020 Master Builders CAST-DRY CAST Solutions US LLC CAST-DRY CAST CAST-DRY CAST 10/12/2020 Master Builders CAST-DRY CAST CAST-DRY CAST 10/12/2020 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST	Master X-Seed 66	12/04/2023	· ·	ADMIXTURES, PRE 403 CAST-DRY CAST		Master Builders Solutions, Inc.		
10/12/2020 Master Builders CAST-DRY CAST 10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST Solutions US LLC CAST-DRY CAST 10/12/2020 Master Builders CAST-DRY CAST 10/12/2020 Sika Corporation CAST-DRY CAST 10/13/2016 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST	MasterCast 730S	10/12/2020		ADMIXTURES, PRE 403 CAST-DRY CAST		Master Builders Solutions US LLC		2.0 fl. oz/100 lb
10/12/2020 Master Builders Solutions US LLC CAST-DRY CAST Solutions US LLC CAST-DRY CAST Technologies CAST-DRY CAST Technologies CAST-DRY CAST	MasterCast 750HS	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, PRE 403 CAST-DRY CAST		Master Builders Solutions US LLC		2.0 fl. oz/100 lb
04/24/2014 GCP Applied CAST-DRY CAST Technologies CAST-DRY CAST 08/08/2025 Sika Corporation CAST-DRY CAST R 07/30/2020 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST 10/13/2016 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST CAST-DRY CAST	MasterPel 240	10/12/2020	<u> </u>	ADMIXTURES, PRE 403 CAST-DRY CAST		Master Builders Solutions US LLC		2.0 fl. oz/100 lb
08/08/2025 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST CAST-DRY CAST 10/13/2016 Sika Corporation ADMIXTURES, PRE 403 CAST-DRY CAST CAST-DRY CAST	Quantec PL-490	04/24/2014	GCP Applied Technologies	ADMIXTURES, PRE 403 CAST-DRY CAST		GCP Applied Technologies		2.0 fl. oz/100 lb
07/30/2020 Sika Corporation ADMIXTURES, PRE 403 Ottawa, IL 10/13/2016 Sika Corporation ADMIXTURES, PRE 403 Ottawa, IL CAST-DRY CAST	SIkaMix AE-3	08/08/2025	Sika Corporation	Ä		Sika Corporation		
10/13/2016 Sika Corporation ADMIXTURES, PRE 403 Ottawa, IL CAST-DRY CAST	Sika Stabilizer-4 R	07/30/2020	Sika Corporation	ADMIXTURES, PRE 403 CAST-DRY CAST	Ottawa, IL	Sika Corporation		3.0 fl. oz/100 lb
	SikaMix HC-300	10/13/2016	Sika Corporation	ADMIXTURES, PRE 403 CAST-DRY CAST	Ottawa, IL	Sika Corporation		3.0 fl. oz/100 lb

Created: 8/20/2025 12:24:22 PM



403af - Appendix F - Precast Admixtures

Dosage	2.0 fl. oz/100 lb	3.0 fl. oz/100 lb	5.0 fl. oz/100 lb
Terminal/Supplier Dosage			
Marketer	Sika Corporation	Sika Corporation	GCP Applied Technologies
Plant Location	Ottawa, IL		
≧	<u>403</u>	403	403
Material Item	ADMIXTURES, PRE 403 CAST-DRY CAST	ADMIXTURES, PRE 403 CAST-DRY CAST	ADMIXTURES, PRE 403 CAST-DRY CAST
Company Name	02/10/2015 Sika Corporation	01/27/2020 Sika Corporation	04/24/2014 GCP Applied Technologies
Approved	02/10/2015	01/27/2020	04/24/2014
Brand Name	Sikamix PL-100	Sikamix PL-200	V-Mar F100

Created: 8/20/2025 12:24:22 PM





403ag - Appendix G - WR Retarding

		:	- - - - -		; ;		:	
Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
DHS	03/19/2024	DarCole Products, Inc	ADMIXTURES, RETARDING	403		Darcole Products, Inc.		4 fl oz./100 lbs
DWR 385R	03/19/2024	DarCole Products, Inc	ADMIXTURES, RETARDING	403		Darcole Products, Inc.		4 fl oz./100 lbs
Daratard 17	05/07/2014	GCP Applied Technologies	ADMIXTURES, RETARDING	403		GCP Applied Technologies		2.0 fl. oz./100 lb
Eucon DS	03/24/2023	Euclid Chemical Company	ADMIXTURES, RETARDING	403	Cleveland, OH	Euclid Chemical Company		4.0 oz. per 100 lbs
Eucon Retarder 100	05/07/2014	Euclid Chemical Company	ADMIXTURES, RETARDING	403	Cleveland, OH	Euclid Chemical/Brett Admixtures	Albertville, MN; Marengo, IA	2.0 fl. oz./100 lb
Eucon SE	07/30/2018	Euclid Chemical Company	ADMIXTURES, RETARDING	403	Cleveland, OH	Euclid Chemical Company	Albertville, MN; Marengo, IA	4.5 fl. oz/100 lb
Eucon Stasis	06/01/2017	Euclid Chemical Company	ADMIXTURES, RETARDING	403	Cleveland, OH	Euclid Chemical	Albertville, MN; Marengo, IA	5.0 fl. oz./100 lb
Eucon WR-91	05/07/2014	Euclid Chemical Company	ADMIXTURES, RETARDING	<u>403</u>	Cleveland, OH	Euclid Chemical/Brett Admixtures	Albertville, MN; Marengo, IA	4.0 fl. oz./100 lb
LC-400P	05/15/2017	RussTech, Inc.	ADMIXTURES, RETARDING	403		RussTech, Inc.		6.0 fl. oz/100 lbs
LC-400R	05/07/2014	RussTech, Inc.	ADMIXTURES, RETARDING	403		RussTech, Inc		3.0 fl. oz./100 lb
Mapecrete Resolve	01/19/2024	Mapei Corporation	ADMIXTURES, RETARDING	403		Mapei Corporation		2 fl oz./100 lbs
Mapeplast 400 NC	06/28/2023	Mapei Corporation	ADMIXTURES, RETARDING	<u>403</u>		Mapei Corporation		6.0 fl. oz./100 lb



403ag - Appendix G - WR Retarding

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Mapeplast 440 NS	07/21/2025	Mapei Corporation	ADMIXTURES, RETARDING	403		Mapei Corporation		6 fl oz./100 lbs
Mapeplast N	03/11/2021	Mapei Corporation	ADMIXTURES, RETARDING	403		Mapei Corporation		5.5 oz per 100 lbs
Mapetard Plus	10/26/2020	Mapei Corporation	ADMIXTURES, RETARDING	403		Mapei Corporation		2.5 fl. oz. / 100 lbs
Mapetard R	04/06/2023	Mapei Corporation	ADMIXTURES, RETARDING	403		Mapei Corporation		2.0 fl. oz./100 lb
MasterPozzolith 200	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		3.0 fl. oz./100 lbs
MasterPozzolith 322	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		5.0 fl. oz./100 lb
MasterPozzolith 700	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		5.0 fl. oz./100 lb
MasterPozzolith 80	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		6.0 fl. oz./100 lb
MasterSet Delvo	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		2 oz. per 100 lbs (See Manuf. Recom mendati on)
MasterSet Delvo ESC	10/12/2020	Master Builders Solutions US LLC	ADMIXTURES, RETARDING	403		Master Builders Solutions US LLC		See manufac turer recomm endation

Created: 8/20/2025 12:56:10 PM



Materials Approved Products List

403ag - Appendix G - WR Retarding

rerriinai/Supplier Dosage	2.0 fl. oz./100	q	1b 3.0 fl. oz./100 1b	1b 3.0 fl. oz./100 1b 1 bag (8 oz.) per cubic yard for 1 hr.	1b 3.0 fl. oz./100 lb lb lb cubic yard for 1 hr. delay 4.0 fl. oz./100 lb	1b 3.0 fl. oz./100 lb lb. 1 bag (8 oz.) per cubic yard for 1 hr. delay 4.0 fl. oz./100 lb lb. 2 oz. per 100 lbs (See Manuf. Recom mendati on)	1b 3.0 fl. oz./100 lb lb. 1 bag (8 oz.) per cubic yard for 1 hr. delay 4.0 fl. oz./100 lb lb. 2 oz. per 100 lbs (See Manuf. Recom mendati on) 2 oz. per 100 lbs (See Manuf. Recom mendati on) 2 oz. per 100 lbs (See Manuf. Recom mendati on)	1b 3.0 fl. oz./100 lb cubic yard for cubic yard for 1 hr. delay 4.0 fl. oz./100 lb coz./100 lb coz./100 lb coz./100 lb coz./100 lbs (See Manuf. Recommendation) 2 oz. per 100 lbs (See Manuf. Recommendation) 2 oz. per 100 lbs (See Manuf. Recommendation) 2 oz. per 100 lbs (See Manuf. Recommendation)	1b 3.0 fl. oz./100 lb cubic cubic yard for 1 hr. delay 4.0 fl. oz./100 lb coz./100 lb coz./100 lb coz./100 lb coz./100 lb coz./100 lb coz. per 100 lbs (See Manuf. Recommendation)
Si) 	LLC			crete	crete	crete crete	crete crete	crete crete
iliders US LLC iliders US LLC	iilders US LLC		uc		Concrete	Concrete s	Concrete s Poration Concrete is	Concrete soncrete is Inc.	Concrete s
Master Builders Solutions US LLC Master Builders	Master Builde	Solutions US	Fritz-Pak Corporation		Premiere Concrete Admixtures	Premiere Concrete Admixtures Mapei Corporation	Premiere Concrete Admixtures Mapei Corporation Premiere Concrete Admixtures	Premiere Condapei Corpora Mapei Corpora Admixtures RussTech Inc.	Premiere Con Mapei Corpora Premiere Con Admixtures RussTech Inc GCP Applied Technologies
<u>403</u>		403	403		403	403	403	403 403	403 403
	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING		ADMIXTURES, RETARDING	ADMIXTURES, RETARDING ADMIXTURES, RETARDING	ADMIXTURES, RETARDING ADMIXTURES, RETARDING RETARDING	ADMIXTURES, ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING	ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING ADMIXTURES, RETARDING
	Master Builders Solutions US LLC	Master Builders Solutions US LLC	Fritz-Pak Corporation		Premiere Concrete Admixtures	Premiere Concrete Admixtures Mapei Corporation	Premiere Concrete Admixtures Mapei Corporation Premiere Concrete Admixtures	Premiere Concrete Admixtures Mapei Corporation Admixtures Admixtures RussTech, Inc.	Premiere Concrete Admixtures Mapei Corporation Premiere Concrete Admixtures RussTech, Inc. GCP Applied Technologies
	10/12/2020	10/12/2020	10/25/2022		12/01/2016				
	MasterSet R 100	MasterSet R 300	Mini Delayed Set		OptiFlo 500	enu		Renu	em Renu



403ag - Appendix G - WR Retarding

er Dosage	3.0 fl. oz./100 lb	3.5 fl. oz./100 lb	4.0 fl. oz./100 lb	6.0 fl. oz/100 lb	2.0 fl. oz./100 lb	1.0 oz./100 lbs	7.0 fl. oz./100 lb	3 fl oz./100 lbs	4.0 fl. oz/100 lbs
Terminal/Supplier									
Marketer	Sika Corporation	Sika Corporation	Sika Corporation	Sika Corporation		Fritz-Pak Concrete Admixtures	GCP Applied Technologies		GCP Applied Technologies
Plant Location	Ottawa, IL								
≧	403	403	403	403	403	403	403	403	403
Material Item	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING	ADMIXTURES, RETARDING
Company Name	Sika Corporation	Fritz-Pak Corporation	GCP Applied Technologies	GCP Applied Technologies	GCP Applied Technologies				
Approved	07/30/2020	07/30/2020	07/30/2020	07/30/2020	05/07/2014	05/07/2014	05/07/2014	08/22/2023	05/12/2020
Brand Name	Sika Plastiment XR	Sika Plastocrete-10N	Sika Plastocrete-161	Sika Plastocrete-250	Sikatard 440	Standard Delayed Set	V-Mar VSC 500	Zyla 640	Zyla R



403ah - Appendix H - Special Performance

				:			:	
Brand Name	Approved	Company Name	Material Item	⅀	Plant Location	Marketer	Terminal/Supplier	Dosage
ADVA ITM750	11/14/2018	GCP Applied Technologies	ADMIXTURES, SPECIAL PERFORMANCE	403		GCP Applied Technologies		0.3 fl. oz/100 lb
CSXtreme	03/05/2021	Concrete Moisture Solutions, Inc.	ADMIXTURES, SPECIAL PERFORMANCE	403		Concrete Moisture Solutions/Barrier One Admixtures		14 oz per 100 lbs
CarbonCure	04/14/2021	CarbonCure Technologies, Inc.	ADMIXTURES, SPECIAL PERFORMANCE	403				
CarbonJect	10/11/2023	СКН	ADMIXTURES, SPECIAL PERFORMANCE	403		СКН		
Chem-Crete MCE	03/14/2025	International Chem- Crete	ADMIXTURES, SPECIAL PERFORMANCE	403				1 gal/CY
DG-F	01/20/2023	Mapei Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403		Mapei Corporation		See Manufac turers Recom mendati ons
E5 Internal Cure	11/10/2023	Specification Products	ADMIXTURES, SPECIAL PERFORMANCE	403		Specification Products		See Manufac turers Recom mendati ons
E5 Liquid Fly Ash	11/10/2023	Specification Products	ADMIXTURES, SPECIAL PERFORMANCE	403		Specification Products		See Manufac turers Recom mendati ons
Eucon AWA-P20	07/08/2021	Euclid Chemical Company	ADMIXTURES, SPECIAL PERFORMANCE	403		Euclid Chemical Company		8 fl. oz. / 100 lbs



403ah - Appendix H - Special Performance

Company Name
Hycrete ADMIXTURES, SPECIAL PERFORMANCE
Mapei Corporation ADMIXTURES, SPECIAL PERFORMANCE
06/28/2023 Mapei Corporation ADMIXTURES, SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE
Master Builders ADMIXTURES, Solutions US LLC SPECIAL PERFORMANCE



403ah - Appendix H - Special Performance

Brand Name	Approved	Company Name	Material Item	≧	Plant Location	Marketer	Terminal/Supplier	Dosage
Penetron Admix SB	02/13/2023	Penetron USA, Inc.	ADMIXTURES, SPECIAL PERFORMANCE	<u>403</u>		Penetron USA, Inc.		1% weight of cement
Sika WT-240 P	11/12/2019	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403				Contact manufac turer
SikaControl NS	12/20/2018	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	<u>403</u>		Sika Corporation		3.0% of cement by weight
SikaControl SC	10/06/2020	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403		Sika Corporation		3.5% of cement by weight
SikaFume 290 CS	08/04/2025	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403		Sika Corporation		4 fl oz./100 lbs
SikaFume 390 CS	08/04/2025	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403		Sika Corporation		4 fl oz./100 lbs
Slick-Pak	08/10/2018	Fritz-Pak Corporation	ADMIXTURES, SPECIAL PERFORMANCE	<u>403</u>		Fritz-Pak Corporation		See Manufac turer's Recom mendati on
Slick-Pak II	08/10/2018	Fritz-Pak Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403		Fritz-Pak Corporation		1.5 oz./cubic yard of concrete or grout
Stabilizer-4R	01/22/2018	Sika Corporation	ADMIXTURES, SPECIAL PERFORMANCE	403	Ottawa, IL	Sika Corporation		2.0 fl. oz/100 Ib



403ah - Appendix H - Special Performance

Dosage	See Manufac turer's Recom mendati on	4 fl oz./100 lbs	8.0 fl oz./100 lbs	6.0 fl oz./100 lbs		
Terminal/Supplier Dosage						
Marketer	Fritz-Pak Corporation	Premiere Concrete Admixtures	GCP Applied Technologies	GCP Applied Technologies		Euclid Chemical Company
Plant Location						
≧	<u>403</u>	403	403	403	403	403
Material Item	ADMIXTURES, SPECIAL PERFORMANCE	ADMIXTURES, SPECIAL PERFORMANCE	ADMIXTURES, SPECIAL PERFORMANCE	ADMIXTURES, SPECIAL PERFORMANCE	ADMIXTURES, SPECIAL PERFORMANCE	ADMIXTURES, SPECIAL PERFORMANCE
Company Name	Fritz-Pak Corporation	Premiere Concrete Admixtures	04/20/2018 GCP Applied Technologies	01/10/2020 GCP Applied Technologies	12/08/2021 RussTech, Inc.	Euclid Chemical Company
Approved	08/10/2018	03/11/2025	04/20/2018	01/10/2020	12/08/2021	02/06/2019
Brand Name	Super Slump Buster	UltraFinish 1L	V-Mar 3	V-Mar F100	VMA-758	Visctrol

Chapter 14 IM 491.14 INSPECTION & ACCEPTANCE - SLAG

April 16, 2024 Supersedes October 18, 2022 Matls, IM 491.14

INSPECTION & ACCEPTANCE GROUND GRANULATED BLAST FURNACE SLAG (GGBFS)

GENERAL

Acceptance of Ground Granulated Blast Furnace Slag (GGBFS), or slag cement, the glassy, granular material produced when molten blast furnace slag is rapidly chilled, will be on the basis of approved sources and upon satisfactory test results on samples obtained at the project site. Approved manufacturers and brands of slag cement (GGBFS) are listed in the Materials Approved Products Listing Enterprise (MAPLE).

Approval is based upon slag produced when the blast furnace is utilizing specific processes. Any change in the processes will void any source approval and require that a new approval be sought.

SOURCE APPROVAL

Approval of a slag cement (GGBFS) source is based on the requirement of ASTM C989.

A source may furnish Ground Granulated Blast Furnace Slag cement on the basis of certification provided:

A. The quality-monitoring program meets the minimum sampling and testing frequencies established in ASTM C-989. At least one sample for each 30 consecutive days shall be tested by the producer for conformance to Iowa Department of Transportation Specifications. The test reports for all monitor samples shall be submitted to the Iowa Department of Transportation, Office of Materials, within 45 days of the sampling date.

The Quality Control Laboratory will be considered approved if it is properly equipped and staffed to perform the tests required for an accepted Quality Control Program. Continued approval of the control laboratory will depend on the comparison of its test results with the lowa Department of Transportation Central Materials Laboratory. If major differences are found, an attempt to resolve them shall be made as quickly as possible. Continued unresolved differences in test results will be considered a basis for discontinuing control laboratory approval.

- B. The Ground Granulated Blast Furnace Slag cement has shown conformance to the applicable specifications for a continuous period of at least six months.
- C. Each shipment of Ground Granulated Blast Furnace Slag cement is properly certified.

The supplier of certified Ground Granulated Blast Furnace Slag cement shall furnish, for the project records, two invoices or bill of lading copies, which bear the following certification statement:

Certification Statement

The material herein described has been sampled and tested as prescribed by the Highway Division of the Iowa Department of Transportation and complies with the

applicable specification requirements for Ground Granulated Blast Furnace Slag.	
Date	

The bills of lading or invoices shall include project number, if available, source name, source location, source code, grade, and quantity of the shipments.

These copies of bill of lading or invoice shall accompany each load, and shall be retained at the project or ready mix plant for the Project Engineer record. The truck tanker shall have a copy of the invoice or bill of lading attached directly to the tanker portion of the truck. When the tanker unloads the contents at the project site, the unloading time and material final destination (storage "pig" number) shall be marked on this copy and left with the invoice or bill of lading copies.

In the case of more than one project being supplied by a ready mix plant, the plant shall furnish the Project Engineer, for each project, either a copy of each bill of lading or invoice, or a listing of the bills of lading or invoices representing the ground granulated blast furnace slag incorporated in the project. This listing shall bear the signature of a responsible supplier representative.

The source, car or truck number, ticket number, grade, and quantity of each shipment of ground granulated blast furnace slag used on a project shall be recorded on Form #830211, Form #830224, or other applicable form.

D. Monitor samples secured and tested by the Iowa Department of Transportation indicate compliance with current specifications. The District Materials Engineer will obtain annual samples.



491.14aa - Appendix A - Slag Cement

Specific Gravity	2.95	2.87	2.93	2.87
Terminal/Supplier Specific Gravity			Omaha, NE	
Marketer	Ozinga Cement	Heidelberg Materials	Amrize Cement (Holcim US)	Skyway Cement Co/Central Plains Cement Co
Plant Location	491.14 Anshan City, Liaoning, China	491.14 Speed, IN	491.14 Chicago	491.14 Chicago (Skyway), Skyway Cement Co/Central Plains Cement Co
≧	491.14	491.14	491.14	491.14
Material Item	SLAG CEMENT	SLAG CEMENT	Inc. SLAG CEMENT	SLAG CEMENT
Company Name	Ozinga Cement	Heidelberg Materials	Amrize Cement Inc.	04/24/2014 Skyway Cement Company
Approved	09/14/2020	05/08/2024	06/27/2025	04/24/2014
Brand Name	Carbon Smart Grade 100 09/14/2020 Ozinga Cement (Code SL05A)	Heidelberg Speed Plant 05/08/2024 Heidelberg (Code SL06A)	NewCem (Code SL02A) 06/27/2025 Amrize Cement I	Skyway Cement (Code SL00A)

Chapter 15 IM 491.17 INSPECTION & ACCEPTANCE - FLY ASH

Matls. IM 491.17

FLY ASH

GENERAL

Acceptance of fly ash or natural pozzolan will be on the basis of approved sources and upon satisfactory test results on samples obtained at the project site. Test results of fly ash or natural pozzolan shall meet the requirements of ASTM C 618, C 1697 and the Specifications of the lowa Department of Transportation. Approval will require identification of the specific sources of the coal from which the ash is derived.

Approval is based upon fly ash produced when the power plant is utilizing specific materials, equipment, and processes. Any change in materials, equipment, and processes will void any source approval and require that a new approval be sought. Approved fly ash sources are listed in the Materials Approved Products Listing Enterprise (MAPLE).

Fly ash produced immediately prior to shut down and after start up may be quite different from the fly ash normally obtained. The fly ash can be affected to the point that it does not meet specifications. Monitor samples or verification samples tested by the Iowa Department of Transportation not meeting specifications will void the source approval.

Fly ash used for soil stabilization shall meet the requirements of <u>Article 4108.01</u>, <u>E</u> of the Specifications. Acceptance will be on the basis of satisfactory test results.

SOURCE APPROVAL

A. Certified Source

Approved certified sources of fly ash or natural pozzolan are listed in the <u>Appendix A</u> of this IM. A source may furnish fly ash or natural pozzolan on the basis of certification provided:

1. The quality-monitoring program meets the minimum sampling and testing frequencies established in ASTM C 311. The tonnage units expressed therein are interpreted to refer to as-marketed material. The producer shall test at least one sample for each consecutive 30 days, for the months of March through October for conformance to lowa Department of Transportation specifications. The test reports for all monitor samples shall be submitted to the lowa Department of Transportation within 45 days of the sampling date.

In addition to the test frequencies established in ASTM C 311, daily control tests shall be made to establish the uniformity of the fly ash or natural pozzolan being produced. Specific tests shall be agreed to by the engineer and may vary from source to source. As a minimum, the loss on ignition and percent retained on the No. 325 mesh sieve shall be determined.

Sample test records and shipment reports shall be available for inspection by Iowa Department of Transportation personnel for at least three years after the fly ash or natural pozzolan has been tested.

The Quality Control Laboratory will be considered approved if it is properly equipped and

staffed to perform the tests required for an accepted Quality Control Program. Continued approval of the control laboratory will depend on the comparison of its test results with the lowa Department of Transportation Central Laboratory. If major differences are found, an attempt to resolve them shall be made as quickly as possible. Continued unresolved differences in test results will be considered a basis for discontinuing control laboratory approval.

- 2. The fly ash shall comply with ASTM C 618 or C 1697, either Class F or Class C, except the value of total equivalent alkalies (expressed as Na₂O_e) shall not exceed 3.80%.
- 3. Natural pozzolans shall comply with ASTM C 618. In addition, manufacturer shall submit to the Construction and Materials Bureau, test results of two lowa DOT Concrete Mix Designation C-3WR-C20, or C-4WR-C20, concrete mixtures, one as a control and one with the natural pozzolan at a replacement rate recommended by the manufacturer. The coarse aggregate used shall be an lowa DOT approved limestone or dolomite. Fly ash, sand, air entraining agent and chemical admixtures used shall also be from lowa DOT approval lists. The air content shall be in the range of 5.5% and 7.0%.

The tests and approval requirements are listed below:

- ASTM C39, Compressive Strength at 7, 28, and 56 Days: 90% or better of control.
- ASTM C78 or C293, Flexural Strength, at 28 Days: 95% or better of control
- ASTM C157, Concrete Shrinkage up to 56 Days: 95% or better of control or 56-day shrinkage less than 0.040%.
- ASTM C666, Freeze-Thaw Resistance up to 300 Cycles: 95% or better of control or a durability factor greater than 90%.
- ASTM C1202, Rapid Chloride Permeability, 50% or lower of control.
- 4. The fly ash or natural pozzolan has shown conformance to the applicable specifications for a continuous period of at least the last six months.
- 5. Each shipment of fly ash or natural pozzolan is properly certified.

The supplier of certified fly ash or natural pozzolan shall furnish for the project records two invoices or bill of lading copies that bear the following certification:

Certification Statement

The material herein described has been sampled and tested as presc	ribed
by the Highway Division of the Iowa Department of Transportation and	d
complies with the applicable specification requirements for Class	fly
ash/pozzolan.	

Date

The bills of lading or invoices shall include project number, if available, name of marketing company, source name, source location, source code, class, and quantity in the shipment.

These copies of the bill of lading or invoice shall accompany each load and shall be

retained at the project or ready mix plant for the Project Engineer records.

The truck tanker shall have a copy of the invoice or bill of lading attached directly to the tanker portion of the truck. When the tanker unloads the contents at the project site, the unloading time and material final destination (storage "pig" number) shall be marked on this copy and left with the invoice or bill of lading copies.

In the case of more than one project being supplied by a ready mix plant, the plant shall furnish the Project Engineer, for each project, either a copy of each bill of lading or invoice, or a listing of the bills of lading or invoices representing the fly ash or natural pozzolan incorporated in the project. This listing shall bear the signature of a responsible supplier representative.

The source, car or truck number, ticket number, ash type, and quantity of each shipment of fly ash or natural pozzolan used on a project shall be recorded on Form #830211, or Form #830224, whichever is applicable.

 At least one monitor sample shall be secured annually from power plant sites, located in lowa or within 50 miles from lowa borders, and be tested by the lowa Department of Transportation. The test results of monitor samples shall be in compliance with current specifications.

7. Blending and Co-Mingling of Fly Ash

Each approved fly ash source shall be stored separately. Unless approved by the Construction and Materials Bureau, mixing of fly ashes from different sources, different generating plants/units, or different classes into one storage bin or silo will not be allowed. Blending or co-mingling of fly ashes may be allowed under the following circumstances.

- a. Two approved fly ashes may be blended according to ASTM C 1697. Individual fly ash constituents are not required to conform to ASTM C 618, as long as the blended product meets ASTM C 618 for the predominant constituent. The finished blended product will be approved by the Construction and Materials Bureau as a new source prior to use. The finished blended product shall be stored separately and be inspected and tested according to ASTM C 311. Manufacturer is required to conform that the amount of pozzolan in the finished blended product shall not vary from the target value by more than +5 percentage points, with a 99 % probability of compliance.
- b. When the same coal stockpile, the same brand and model of generating equipment, the same process of operation, and the same brand and model of fly ash collection equipment are used; fly ashes from different units at a generating plant may be considered for approval as a single blend and stored in a silo. To apply for the approval, the producer or marketer shall provide the composite sample test data (composite samples should represent 3200 ton increments of fly ash collection or the month whichever comes first) from the separate units for the previous 12 months. The Construction and Materials Bureau will conduct a statistical t-test to compare major physical and chemical properties of the two fly ash sources. If the t-test results show the test data means to be equal at a significance level of 0.05, the blending process may be

allowed. Annual analysis may be required for continued approval. Blending will only be allowed within the storage silo.

At ready mixed concrete plants and paving batch plants, a fly ash storage bin shall be emptied, as far as practical, prior to refilling from a different source.

B. Sources for Pavement Undersealing and Jacking

- 1. Class C Fly ash listed in the <u>Appendix A</u> may be used for pavement undersealing and jacking, provided that it meets the setting time criterion given below.
- A mixture of 3 parts fly ash and 1 part Portland cement shall have an initial setting time between 30 minutes and 3.0 hours. Initial set is defined as 100-psi resistance when measured in accordance with ASTM C 403.

PROJECT ASSURANCE SAMPLING

Required verification samples will be secured at the project site just before incorporation into the work. Test results, which do not comply with the specifications, may be considered sufficient cause to rescind approval to furnish fly ash or natural pozzolan on certification basis. Construction, which contains fly ash or natural pozzolan represented by verification samples, which show deficient test results, will be subject to the requirements of <u>Article 1105.04</u> of the Standard Specifications.

Depending upon certain chemical characteristics, fly ash is marketed as either Class F or Class C ash, or Class N for natural pozzolans, per ASTM C 618 or C 1697. The identification submitted with the verification samples sent to the Central Laboratory should include the normal descriptive information as well as the source of the ash, the marketer and the class of the ash.

Precautionary measures shall be taken to prevent cement contamination of fly ash or natural pozzolan samples obtained at the proportioning plants. The samples shall be taken preferably as follows:

- 1. Directly from the delivery transport vehicles
- 2. Drop a sufficient amount of material in a clean container or a clean end loader bucket and obtain a representative sample.

UNIFORMITY CHECK AND DENSITY UPDATE

For checking the AASHTO M 295 uniformity requirement, the average density for a source will be computed based on the values tested and reported by the Central Materials Laboratory. The value of average density will be updated if it is more than 0.10 gram/cm³ different than the current value listed in the Appendix A. The density update will generally be done in the October IM revision unless a change in fly ash operation or coal source occurs.



491.17aa - Appendix A - Fly Ash

Specific Gravity	2.79	2.46	2.60	2.61	2.63	2.48	2.75	2.62	2.50	2.71	2.55	2.66	2.78	2.71	2.72
Terminal/Supplier															
Marketer	Ozinga Cement	Ozinga Cement	Ozinga Cement	National Minerals Corporation	EM Resources LLC	EM Resources LLC	Amrize Cement (Holcim US)	EM Resources LLC	Heidelberg Materials	EM Resources LLC	Ash Grove Cement Co.	EM Resources LLC	Amrize Cement (Holcim US)	EM Resources LLC	EM Resources LLC
Plant Location	Joppa, IL	Springfield, IL	Mokena, IL	Cohasset, MN	Bismark, ND	Bismark, ND	Portage, WI	Council Bluffs, IA	Cumberland City, TN	Canton, IL	Chanute, KS	Newton, IL	Sheboygan, WI	Bartonville, IL	Bartonville, IL
≧	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17
Material Item	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH
Company Name	Ozinga Cement	Ozinga Cement	Ozinga Cement	National Minerals Corporation	EM Resources LLC	EM Resources LLC	Amrize Cement Inc.	National Minerals Corporation	Heidelberg Materials	EM Resources LLC	Ash Grove Cement Company	EM Resources LLC	Amrize Cement Inc.	EM Resources LLC	EM Resources LLC
Approved	04/08/2022	04/08/2022	04/08/2022	04/05/2016	07/21/2022	07/21/2022	06/27/2025	01/17/2023	05/28/2025	07/21/2022	09/17/2014	07/21/2022	06/27/2025	07/21/2022	07/21/2022
Brand Name	CarbonSense C Ash (Code FA223C)	CarbonSense CWLP F Ash (Code FA055F)	CarbonSense F Ash (Code FA323F)	Clay Boswell Generating Station, Unit 3 (Code FA039C)	Coal Creek Micron 3 (Code FA003F3)	Coal Creek Power Plant (Code FA003F)	Columbia Generating Station #1, #2 or Combined (Code FA001C)	Council Bluffs Unit #3 (Code FA004C)	Cumberland Power Station (Code FA058F)	Duck Creek Power Station (Code FA050C)	Durapoz F (Code FA043F)	Dynegy Newton Power Station (Code FA044C)	Edgewater Unit #5 Generating Station (Code FA020C)	Edwards Power Station, Unit #2 (Code FA249C)	Edwards Power Station, Unit #3 (Code FA349C)

Created: 8/20/2025 1:20:47 PM



Materials Approved Products List

491.17aa - Appendix A - Fly Ash

5
Oak Creek, WI
Oak Creek, WI
Oak Creek, WI
Genoa, WI
Sutherland, NE
Weston, MO
Weston, MO
Alma, WI
St. Marys, KS
Joliet, IL
La Cygne, KS
Labadie, MO

Created: 8/20/2025 1:20:47 PM



Materials Approved Products List

491.17aa - Appendix A - Fly Ash

Approved Company Name Material Item 06/13/2024 EM Resources LLC FLY ASH 07/21/2025 Innovative FLY ASH 09/29/2023 EM Resources LLC FLY ASH 04/24/2014 National Minerals FLY ASH 04/24/2014 Kansas City Fly FLY ASH 06/27/2025 Amrize Cement Inc. FLY ASH					
EM Resources LLC FLY ASH Innovative Consulting ND LLC EM Resources LLC FLY ASH Corporation National Minerals FLY ASH Corporation National Minerals FLY ASH Ash, LLC Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals FLY ASH Corporation T.Y. ASH Corporation T.Y. ASH EM Resources LLC FLY ASH	Company Name	IM Plant Location	n Marketer	Terminal/Supplier	Specific Gravity
Innovative Consulting ND LLC EM Resources LLC FLY ASH Corporation National Minerals FLY ASH Corporation Kansas City Fly Ash, LLC Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals FLY ASH Corporation T.Y. ASH Corporation T.Y. ASH EM Resources LLC FLY ASH FLY ASH	EM Resources LLC FLY ASH	491.17 Lawrence, KS	EM Resources LLC		2.67
EM Resources LLC FLY ASH Corporation National Minerals FLY ASH Corporation Kansas City Fly Ash, LLC Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals FLY ASH Corporation T.Y. ASH Corporation	Innovative Consulting ND LLC	491.17 Stanton, ND	Innovative Consulting ND LLC		
National Minerals Corporation National Minerals Corporation Kansas City Fly Ash, LLC Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals FLY ASH Corporation TY ASH Corporation TY ASH Corporation TY ASH Corporation	EM Resources LLC	491.17 Jewett, TX	EM Resources LLC		2.69
National Minerals Corporation Kansas City Fly Ash, LLC Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals FLY ASH Corporation T.Y. ASH Corporation	National Minerals FLY ASH Corporation	491.17 Grandview, IA	EM Resources LLC	Croell-Cedar Bluff	2.69
Kansas City Fly Ash, LLC Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation National Minerals Corporation T.Y. ASH EM Resources LLC FLY ASH EM Resources LLC FLY ASH Corporation T.Y. ASH Corporation	National Minerals Corporation	491.17 Clinton, IA			2.73
Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Corporation TY ASH Corporation TY ASH Corporation TY ASH Corporation	Kansas City Fly FLY ASH Ash, LLC	491.17 Clinton, MO	Kansas City Fly Ash, LLC		2.67
Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH EM Resources LLC FLY ASH Corporation T.Y. ASH Corporation T.Y. ASH Corporation T.Y. ASH Corporation	Amrize Cement Inc.	491.17 Muscatine, IA	Amrize Cement (Holcim US)		2.76
EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH Corporation TY ASH TY ASH TY ASH TY ASH Corporation TY ASH Corporation TY ASH	Amrize Cement Inc.	491.17 Muskogee, OK	Amrize Cement (Holcim US)		2.69
EM Resources LLC FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH National Minerals FLY ASH Corporation	EM Resources LLC FLY ASH	491.17 Nebraska City, NE	VE EM Resources LLC		2.73
Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH National Minerals FLY ASH Corporation Corporation Corporation Corporation Corporation Corporation Corporation Corp	EM Resources LLC	491.17 Omaha, NE	EM Resources LLC		2.68
Amrize Cement Inc. FLY ASH Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH National Minerals FLY ASH Corporation	Amrize Cement Inc.	491.17 Oak Creek, WI	Amrize Cement (Holcim US)		2.70
Amrize Cement Inc. FLY ASH EM Resources LLC FLY ASH National Minerals FLY ASH Corporation Corporati	Amrize Cement Inc.	491.17 Oolagah, OK	Amrize Cement (Holcim US)		2.68
09/29/2023 EM Resources LLC FLY ASH 04/24/2014 National Minerals FLY ASH C) Corporation	Amrize Cement Inc.	491.17 Oak Creek, WI	Amrize Cement (Holcim US)		2.70
04/24/2014 National Minerals FLY ASH Corporation	EM Resources LLC	491.17 Franklin, TX	EM Resources LLC		2.42
	National Minerals Corporation	491.17 Chillicothe, IA	National Minerals Corporation	RGI Storage, Des Moines	2.75
LC FLY ASH	EM Resources LLC FLY ASH	491.17 Marissa, IL and Grandview, IA	EM Resources LLC	Eldridge, IA	2.46

Page 3 of 4 Created: 8/20/2025 1:20:47 PM





Materials Approved Products List

491.17aa - Appendix A - Fly Ash

Specific Gravity	2.52	2.59	2.66	2.42	2.80	2.70	2.64	2.74
Terminal/Supplier S				Eldridge, IA				
Marketer	Charah, Inc	Nebraska Ash	EM Resources LLC	EM Resources LLC	National Minerals Corporation	Charah, Inc.	Amrize Cement (Holcim US)	Amrize Cement (Holcim US)
Plant Location	491.17 Petersburg, IN	491.17 Grand Island, NE	Sioux City, IA	491.17 Marissa, IL	Cedar Rapids, IA	491.17 Thomas Hill, MO	Rothschild, WI	491.17 Hastings, NE
≧	491.17	491.17	491.17	491.17	491.17	491.17	491.17	491.17
Material Item	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH	FLY ASH
Company Name	Charah, Inc	Nebraska Ash	National Minerals Corporation	EM Resources LLC FLY ASH	National Minerals Corporation	Charah, Inc	Amrize Cement Inc.	06/27/2025 Amrize Cement Inc.
Approved	05/06/2014 Charah, Inc	10/12/2020		07/21/2022	11/14/2018	11/12/2021 Charah, Inc	06/27/2025	06/27/2025
Brand Name	Petersburg Generating Station, Unit #3 (Code FA038F)	Platte Generating Station 10/12/2020 (Code FA057C)	Port Neal Power Plant #3, 01/17/2023 #4 or Combined (Code FA015C)	Praire State Generating Station (Code FA046F)	Prairie Creek Generating Station, Unit #3 (Code FA041C)	Thomas Hill Energy Center (Code FA025C)	Weston Generating Station (Code FA026C)	Whelan Hastings Generation Plant, Unit 2 (Code FA052C)

Created: 8/20/2025 1:20:47 PM

Chapter 16 IM 527 PAVING PLANT INSPECTION



PAVING PLANT INSPECTION

GENERAL

The following definitions are used to establish individual roles for plant inspection duties.

- CPI Certified Plant Inspector working for the concrete producer
- Plant Monitor Project Engineer or construction inspector
- DME District Materials Engineer or materials Inspector

The following instruction is to be used when inspecting the operation of a PC Concrete paving plant.

Materials and proportions must be controlled in accordance with the specifications and the following detailed instructions.

The CPI will normally be assigned the following duties:

- 1. Inspection or monitoring of proportioning and plant operation
- 2. Gradation determination of the aggregates used
- 3. Identification and tabulation of materials received and used
- 4. Protection, curing, and testing of the strength specimens, and care of the specimen forms
- 5. Maintenance of a daily diary and preparation of the Daily Plant and Strength Reports

Certified Plant Inspectors will assume a number of duties, as specified in IM 213.

The contract documents provide for the class of concrete to be used in a given project. Standard and slip form are the two types of pavements specified. All classes of concrete contain entrained air to improve durability. Unit absolute volume proportions for the four classes of concrete and the various mix numbers are provided in IM 529. The class of concrete is designated in the contract documents and the Contractor may use any of the numbered mixes designated in the respective class of concrete. The gradation of the coarse aggregate must comply with the requirements of the mix number chosen.

The Engineer will see that the plant monitor is provided with proper equipment for carrying on the work. The Certified Plant Inspectors will provide their own equipment. Furnished equipment will be provided upon request from the Ames Laboratory and the Inventory Management storerooms. Requests for equipment or supplies to be checked out must be made on lowa Department of Transportation Stock Issue Form #133005.

The following statement shall apply to all phases of equipment and material testing and/or examinations:

Tests and/or examinations must be made at least as frequently as described herein or in other applicable memorandums. All test and examination results are

to be recorded in the CPI Field Book. All field books and records shall become the property of the Contracting Authorities at the completion of the project.

If a test result on a project verification sample indicates specification noncompliance, appropriate action in accordance with the applicable specifications, instructional memorandums, and resident engineer instructions shall be taken. (See IM 204) Normally, the Contracting Authority will issue a Form #830246, Noncompliance Notice.

If a test result on a project quality control sample indicates specification noncompliance, the Contractor must take corrective action. It must be noted that the Contractor is responsible for deciding what corrective action must be taken, for directing that it be taken and for the results. The plant monitor must not in any way assume responsibility for the corrective action or its results.

It is the plant monitor's responsibility, based on prescribed tests and examinations, to monitor the progress of the work, to make available to the Contractor the results of tests and examinations on a continuing basis and to inform the Engineer and Contractor when tests show noncompliance. The Contractor is responsible for furnishing compliant material and finished work.

A checklist of the detailed plant inspection duties is included as part of these instructions. Refer to this checklist before the work begins, and periodically thereafter, to be certain that all the required tests and inspection procedures are being included in the routine activities.

SAFETY

Safety should be uppermost in the minds of those working in a concrete plant. In the past there have been injuries and even deaths because proper attention was not given to safety details. Certain requirements have been made a part of the contract documents as safety measures. It is not possible, however, to remove all unsafe conditions from a paving plant situation.

The CPI must make certain all contractual requirements are met, including those related to safety. The CPI should encourage the elimination of hazards not specifically covered by the specifications. Some hazards will be impractical to remove. The CPI should be familiar with these hazards and thus be better able to protect against them. Protective headgear should be worn when working around bins and other plant equipment.

Safety considerations mandate that stopped belt sampling locations must be equipped with an on-off switch near and in plain view of the sampling point. This switch must have sole control of the sampling belt when the switch is in the off position.

EQUIPMENT

1. BINS

The following requirements shall apply to bins used in connection with the production and delivery of materials and to bins used in connection with the proportioning of materials for mixtures. Standard Specifications in Article 2001.06 authorize the Engineer to examine the bin each time it is erected for use.

The Contractor shall maintain any stress-carrying parts of the bin frame, which support the load in proper working condition. No stress-carrying member shall be absent while the bin is in use. All members must be straight and full-size. If any member has become bent or

deformed, it shall be straightened by methods, which will not injure the material, or a new member must replace it. Piles of aggregate shall be kept from introducing stresses into the bin legs caused by lateral pressure against the legs. If all footings under one bin settle uniformly after the bin has been loaded, the settlement is not considered a problem. However, if the settlement differential of the footings under one bin exceeds 1/10 foot, the District Materials Engineer must be informed.

The Contractor shall periodically observe the bin for settlement after the bin has been loaded. Before concrete proportioning at a new plant installation, the bins should have been fully loaded for at least 12 hours and the amount of settlement determined by the contractor. Checks of settlement by the contractor shall be furnished to the Engineer. If a scale is affected by the above unequal settlement, its operation must also be re-evaluated.

All conveyers and other plant machinery shall meet current OSHA Standards. The Contractor shall be responsible for complying with these requirements for both design and erection. The Contractor shall furnish a certification or design calculations to the Engineer to confirm compliance, if requested to do so.

2. PROPORTIONING EQUIPMENT

Requirements for scales or meters for proportioning aggregates, cement, fly ash, water, or admixtures are found in <u>Article 2001.20</u> of the Standard Specifications. These essential requirements are in addition to the safety requirements referred to in Section 1 above for bins.

When a proportioning plant has been moved and set up, it is essential that the proportioning scales are test loaded and the proportioning meters are tested for specification compliance.

Proportioning scales and meters shall be test loaded to the maximum load expected during production. Proportioning during production shall not exceed the maximum load tested during calibration.

It is the duty of the District Materials Engineer or designated staff to witness calibration of all proportioning and plant equipment before concrete work begins. The CPI is encouraged to be present while the scales and other equipment are being tested and evaluated.

When it has been determined that all proportioning devices and plant equipment comply with the specification requirements for accuracy, a Plant Calibration Report, Form #820917, will be prepared by the contractor's representative and signed by the District Materials Engineer, or representative, as a witness to the calibration. This report authorizes the use of the plant to which it applies, and the materials and proportions listed thereof. It is to remain at the plant in the CPI's files during progress of the work. A sample copy of Form #820917 is shown later in Appendix C and a calibration checklist is shown in Appendix D. The CPI must be familiar with all features of the plant operation before the work begins. While the CPI must not personally make any of the plant manipulations or adjustments, understanding the basic machinery operation and being able to recognize the significance of a malfunction is important.

For ready mix plants, the District Materials Engineer may allow plant scales and water metering devices to be calibrated and sealed by a licensed commercial scale service. The District Materials Engineer will be given the opportunity to witness the annual calibration. A

copy of the certification and calibration shall be provided to the engineer during laboratory inspection.

The proportioning equipment must be examined at least at **3-hour intervals** for correctness of the **amount being batched** and for damage of the equipment. Special attention must be given to the empty balance and the position of the poises for beam and dial scales. The normal plant operation causes vibration, which tends to change these adjustments.

Accumulation of material clinging to the inside of the hopper can also cause these adjustments to drift. Small amounts of material accumulation clinging to the inside of the hopper are not considered objectionable. If the amount exceeds one percent of the material batch mass, however, it must be removed and the indicator on the empty hopper readjusted to indicate a zero load within $\pm 0.5\%$ (See Article 2001.20). The scale sensitivity shall be checked at least twice during a normal working day by placing a mass equal to 1/10 percent of the batch on the fully loaded scales and observing the movement of the indicator. A properly sensitive scale will exhibit a visible indicator movement when so tested. If no indicator movement is visible and immediate corrective action by the Contractor does not yield successful results, the District Materials Engineer must be informed.

The following procedure is required for setting or adjusting the various items of proportioning equipment in order that they will deliver the proper amount of material to the batch:

- The plant superintendent or other authorized contractor representative must make all necessary scale and equipment settings and/or adjustments. The CPI is specifically directed not to participate in this activity.
- 2. Before the plant operation begins or resumes, the CPI will independently determine that the settings and/or adjustments are accurate and that the masses of material being delivered to the batch are correct. Errors must be corrected immediately.

Strict adherence to the above procedure is necessary to maintain a proper division of authority and responsibility between the Contractor and the Contracting Authority and to minimize the possibility of operating with erroneous proportions.

Suitable wind protection on all sides of the scales is required by the specification. This protection, if not provided by the plant design, can be fabricated from burlap, Masonite, plywood or other suitable material and should provide adequate room for the scale operator to work unobstructed. The District Materials Engineer may waive wind protection when non-suspended load cells are used and proven to be unaffected by wind.

a. CEMENT & FLY ASH SCALES. Cement and fly ash scales at the contractor proportioning plant are usually required to be automatic. The scales must be accurate to within plus or minus 0.5% of the load and must operate (delivery tolerance) within plus or minus 1%. (See Article 2001.20 and 2301.02, C) If all cementitious materials are weighed on the same scale, delivery tolerance shall be within plus or minus 1% for the cement and the total cementitious for the batch.

The delivery tolerance, however, can be determined only when the automatic device is in operation. The following formula can be used to determine the delivery tolerance from batch tickets. The delivery tolerance average should be based on a minimum of 100 cubic

yards, using the target batched weight. Target batched weight is typically the design batch weight x cubic yards batched for cementitious materials. For aggregates the target batched weight will vary slightly from design, due to the large amount of material. Delivery tolerance for total cementitious materials only needs to be checked if the delivery tolerance average for cement is outside $\pm 1\%$ tolerance.

Delivery Tolerance = [(Target Batched – Actual Batched)/Target Batched] x 100

Example delivery tolerance average: HPC-D mix 353 lbs cement/cy for 10 cy batch

Target Batched	Actual Batched
3530	3520
3530	3560
3530	3540
3530	3540
3530	3575
3530	3540
3530	3515
3530	3520
3530	3545
3530	3570
Target total batched	Actual total batched
35300	35425

Delivery Tolerance Average = $[(35300-35425)/35300] \times 100 = -0.35\%$

CPI should check scale operations to monitor delivery tolerance at least once during each day of normal production.

Minor adjustments of numerous phases of the automatic batching cycle are normally required on a continuing basis because of changing weather and material conditions. Varying material conditions, such as fine aggregate moisture and cementitious materials packing, can cause individual batches to be wider variance on the delivery tolerance, These material conditions will cause normal variations in the ability of gates to close before extra material is added. Thus, individual batch ticket material tolerance cannot be used to determine delivery tolerance. On individual batches exceeding ±2% delivery tolerance, the producer shall work toward adjusting individual materials to within the delivery tolerance (2301.02, C) within 10 consecutive batches. If an individual material (cement, coarse, or fine aggregate) is consistently outside the delivery tolerance for more than 10 consecutive batches, the DME may allow batching automatically under the required weight and trim to achieve batch weights within tolerance.

For small loads of 3 cubic yards or less, the scale gradations may be larger than the delivery tolerance for the batch. A delivery tolerance of plus or minus **two percent** of the required batch amount may be used.

The CPI must become intimately familiar with the automatic scale operation to be able to recognize when these minor adjustments are needed. As a general rule, if the operator has to manually adjust the amount of material in the hopper or charge or discharge

manually more often than once in each ten batches the automatic measuring device needs repair, adjustment, or servicing. Specific approval of the DME is required for continued manual operation. The DME's approval should be based on a consideration of the following:

- Immediate steps were taken to repair the automatic malfunction.
- If repair within a 24-hour period is not possible and beyond the control of the Contractor and the malfunction could not reasonably have been anticipated.
- Manual measuring is within the accuracy required for automatic scales.
- It would be to the advantage of the contracting authority for the paving operation to continue.
- Manual measuring of cement shall be under the constant surveillance of the CPI. The
 empty scales must be tare-balanced after discharging each batch and before charging
 another.

Cement Yield Check

The Standard Specification requires that the cement shipment yield determination must be made at intervals of approximately 10,000 cubic yards after the original determination made near the end of the first full day of production. When a permanent, commercial-ready mix plant is dedicated to furnishing greater than 10,000 cubic yards of continuous concrete production, cement yield determinations are required. When a permanent, commercial-ready mix plant furnishes greater than 10,000 cubic yards on an intermittent basis, cement yield determinations shall be at the option of the District Materials Engineer. If fly ash is batched on the same scale as cement, no yield determination is needed for the fly ash.

The purpose of the cement yield test is to compare the amount of cement, which is measured, on the contractor's batch scales with the amount, which is measured on the scales at the cement manufacturing plant. The assumption is made that the mass shown by the manufacturer (billed amount) is correct.

The cement storage bin or bins must be empty and free of cement before the test is started. In the event a bin is partially filled with cement left over from a previous project, it should be used and the bin completely empty before the yield determination is started. The removal of all cement from the bins provides the necessary starting point in addition to assurance that cement lumps and foreign debris have been eliminated.

Make the first cement yield near the end of the first full day of production, being sure each cement car or truck is completely empty after unloading into the storage bin.

At the end of the test the storage bin must be completely empty again. Estimating the amount of cement in a storage bin is not suitable and by doing so the test result is virtually meaningless.

A careful record must be made of the total batches used and from this figure calculate the total cement batched. Also calculate the yield expressed as a percent of the billed total.

If the yield percent is less than 99.0, or greater than 101.0, refer to the section entitled, General, in this IM for special action required. If the results of the first test are within the above limits no special action is necessary. Follow the same procedure for following yield tests, except extend the test over about 10,000 cubic yards intervals of work. For the longer interval tests, the amount of cement in a bin at the beginning and ending can be estimated without introducing appreciable error. Report each cement yield test performed on Form #820912, Portland Cement Shipment Yield Report. (See sample Yield Report in Appendix C).

- b. AGGREGATE SCALES. Aggregate scales may be operated either manually or automatically and must operate within a delivery tolerance of plus or minus one percent of the required batch amount. If the scales are operated automatically, the delivery tolerance can be determined in the same manner described in 2a, Cement Scales. If it is operated manually note the location of the balance indicator or dial indicator when a one percent over and under load is added to and subtracted from the correct amount in the hopper. Aggregate delivered to the batch must be within the above limits. CPI should check scale operation to monitor delivery tolerance at least once during a normal production.
- c. WATER MEASURING DEVICE. Scales or volume meters are permissible for measuring water. Scales may be operated manually or automatically. Regardless of the type of measuring equipment used, the amount of water delivered to the batch must be accurate to 2.2 lbs. or within plus or minus one percent of the amount shown by the indicator whichever is greater. If water is measured with a scale, the delivery tolerance must be determined at least once for each day of normal operation as described in 2b, Aggregate Scales. If a volume meter is used, the delivery tolerance need not be determined other than during the original calibration or at such time that a water-measuring problem is indicated. Volume meter shall be tested by weight during calibration at ambient temperature (40 90°F). Testing a water meter is the duty of the District Materials Engineer or their representative.
- d. ADMIXTURE DISPENSING EQUIPMENT. Admixtures (air or water reducing) may be proportioned manually or by automatic equipment. If they are proportioned manually, the method and procedure must be approved by the engineer and should be performed by a person having no other duties. If they are proportioned automatically, the dispensers must be equipped with a transparent chamber that will permit visual observation of the admixtures as they are introduced into the batch. The visual inspecting chamber requirement may be waived in lieu of admixture dispensing systems utilizing positive electronic flow metering and computer-controlled delivery that prevents improper admixture incorporation into the mix. Equipment for dispensing liquid admixtures shall be accurate within plus or minus 3.0 percent of the quantity required. The operation of the dispenser when operated either manually or automatically must be observed for uniform dispensing at least once during each 3 hours of normal operation. The dispensing equipment must be flushed with water at least once daily to minimize the possibility of material accumulation that will impair the

equipment performance. The use of malfunctioning dispenser equipment will be discontinued immediately upon detection of the malfunction and its use must not be resumed until the malfunction has been eliminated.

3. MIXING EQUIPMENT

Central mixer is the most popular, and is the type normally used when high production is desired, ready-mix trucks are used for limited amounts of pavement, and mobile mixers are typically used in bridge deck overlays.

Mixing equipment for paving projects will be one of the following types as described in Article 2001.21:

a. CENTRAL MIXERS. For central mixers, the maximum batch size and the mixing speed recommended by the manufacturer are shown on the Mixer Manufacturer Bureau (MMB) rating plate that is attached to the mixer. The batch size shall not exceed that recommended on the MMB plate and the rotational speed of the mixer drum shall be at least equal to that shown on the MMB plate. After all materials are in the mixer, the mixing time shall be a minimum of 60 seconds and a maximum of 5 minutes.

The following is the recommended method for determining mixing time:

There are three parts of the batch cycle: the charging of the drum, the mixing, and the discharge. In order to check the mixing time; first determine the time required to add all ingredients to the mixing drum. Then determine the time to discharge, from the time the first concrete falls out of the drum into the delivery vehicle until the drum is back into the mixing position and material begins to be charged into the drum. The charge time plus discharge time plus a minimum mixing time of 60 seconds is the minimum batch cycle time.

The mixing time must be determined and recorded at least once per day by the Certified Plant Inspector. By timing the batch cycle and subtracting the charge time and discharge time, the mixing time can be determined. Determining the average cycle times over a number of batches where the batching operation is running uninterrupted is preferable. The total batch cycle time, as well as the time needed for charging and discharging, should also be recorded initially for a given batch size. This enables mixing time to be determined through timing of the total batch cycle.

The batch cycle time may change if the size of the batch changes. The size of the batch should be noted if changes in the cycle time are found.

The plant monitor should check the mixing time when visits are made to the project. The monitor should then compare the determined mixing time to those recorded by the Certified Plant Inspector. The contractor is required to furnish individual batch tickets or a daily summary of the materials in each batch and the time the batching begins or in the case of batch tickets, the time of discharge of each batch.

If the mixing time is less than 60 seconds, an immediate correction must be made.

b. READY MIX. The maximum size of the batch and the mixing speed recommended by the

manufacturer for ready mix trucks shall be shown on a plate attached to the mixer. The Truck Mixer Manufacturer's Bureau (TMMB) may issue the plate; if not, an independent, recognized laboratory, shall determine compliance as defined in Article 4103.01, and complete test results may be required. The batch size must not exceed that shown on the plate and the mixing speed must be in the range shown. Determine and record the mixing speed for each mixer at least once daily. The batch must be mixed from 70 to 90 revolutions at mixing speed unless otherwise directed by the engineer. All mixers must be equipped with a revolution counter. If the counter is one that counts revolutions only when the drum is turning at mixing speed, mixing may be permitted while the truck is in transit. If the counter is a simple re-settable counter, which counts all revolutions regardless of the drum speed, mixing must be accomplished at a location where it can be observed by the CPI. It is permissible for the mixing to be done either at the plant or the project site. A clear understanding must exist between the CPI and grade inspectors as to where the mixing will be done.

Ready mix trucks must carry, in the vehicle; a current certification signed by a responsible company representative stating that the mixer condition has been examined during the previous 30 days and is free of hardened concrete and is in proper working condition. Mixers not carrying the required certification must not be used.

4. TRANSPORTATION VEHICLES

a. CENTRAL MIXING. When the concrete is centrally mixed it may be transported in either agitating or non-agitating hauling units. If non-agitating units are used, the fresh concrete must be placed on the grade within 30 minutes after it has been discharged from the mixer. If agitating units are used, the fresh concrete must be placed on the grade within 90 minutes after the water and cement have made contact with each other (See <u>Article</u> 2301.02, C.).

When approved by the engineer, an approved retarding admixture may be used at the rate prescribed in IM 403, and the mixed-to-placed time period, for concrete transported without agitation, may be extended an additional 30 minutes. The DME may approve alternate mixed-to-placed time period factoring mix design, retarder, and temperatures, regardless of agitation.

b. READY MIX. When the concrete is mixed in ready mix trucks and agitated thereafter, the fresh concrete must be placed on the grade within 90 minutes after the water and cement have made contact with each other. If continuous agitation is not used, the time limit is 30 minutes (See Article 2301.02, C.). When Class M mix is used for pavement patching, ready mix concrete must be delivered and placed within 60 minutes without retarder, or 90 minutes when retarder is used. Concrete must be placed within 30 minutes after calcium chloride is added. (See Articles 2529.02, B and 2530.02, B.) Concrete, which has been mixed, agitated, or held in excess of the above time limits, must not be used.

Determine and record the cement to water contact time at least once during each day of normal operation.

MATERIAL

1. IDENTIFICATION

Arriving shipments of material must be examined for damage and contamination. Before material is incorporated into the project, the CPI must be assured that approval reports for the material have been received or will be received shortly.

For shipments of cement and fly ash the CPI shall examine the invoice or bill of lading that is attached to the tanker when shipments arrive. When nighttime delivery occurs, the CPI shall examine the invoice or bill of lading before production begins on the next working day. The inspector must be ensured the proper material is placed in the proper storage unit.

Record in the plant book when the shipment arrived, the amount and identification of materials involved and the laboratory report number, invoice number, ticket number, on which the material has been approved is necessary for documenting that material used has been tested and approved. Telephone conversations regarding material approval must also be summarized in this record.

A file of proportioned aggregate tickets, cementitious materials delivery tickets, and admixture delivery tickets will be maintained by the CPI. Retain files for three years at the end of the project and make available for review by the Engineer, as needed.

- a. AGGREGATES. Certified aggregate may be incorporated into a project on the basis of the certified truck ticket. When the material represented is non-proportioned aggregate the project number must show on the truck ticket and a copy furnished for project inspection personnel. When the material represented is proportioned aggregate, the project number is preferred when practical as in the case when shipping to a paving plant site and not required when impractical as in the case when shipping into warehouse stock at a readymix plant. The CPI shall verify that all material incorporated in the project is properly certified and document this verification and quantity on each of the appropriate daily or periodic construction reports. No other project documentation for the incorporated aggregate is required (See IM 209).
- b. CEMENTITIOUS MATERIAL. Cement, fly ash, and Ground, Granulated, Blast Furnace Slag (GGBFS) may be incorporated into the project on the basis of the manufacturer certification. (See IM 401, 491.17, and 491.14.)
- c. WATER. Water secured from streams, lakes, and other non-potable sources will be tested and approved by the Central Laboratory before it is used. Water from municipal supply systems and other potable sources may be used without testing provided the source is documented.
- d. ADMIXTURES. Admixtures may be incorporated into the project without further sampling and testing if they are listed in IM 403.
- e. Approved brands of water reducing admixtures, retarding admixtures, and dosage rates are in <u>IM 403</u>. Any admixtures suspected of being frozen or materials exceeding manufacturer's shelf life shall not be used before being tested and approved. These admixtures shall be agitated in accordance with <u>IM 403</u> to maintain the solids in suspension.

NOTE: A stream of air bubbles during agitation will not be acceptable. Proper storage of

the admixtures during the winter months is recommended to avoid freezing of the material.

2. STORAGE & HANDLING OF MATERIALS

The contractor shall notify the Engineer of the stockpiling procedures to be used and of the date when stockpiling will begin. This shall be done ahead of commencement of stockpiling in order to allow discussion of procedures and inspection of the stockpile sites and dumping areas. District Materials personnel may also be a part of this review and inspection.

The storage and handling of all aggregates must comply with Article 2301. 02, C If alternate methods are used as permitted and the required sampling and testing indicates non-specification aggregate gradation, the District Materials Engineer must be informed immediately. The responsibility of and the authorization for proper changes, if necessary, lies with the District Materials Engineer. It is important that the moisture content of the aggregates be uniform. Fine aggregate must be drained at least 24 hours before it is placed in the batch. For both coarse and fine aggregate, moisture content of successive batches must not vary more than 0.5 percent, or this will be considered non-compliant. In such a case, the engineer and the contractor must be immediately informed. The problem must be corrected within a reasonable amount of time, generally one day. The work must not be permitted to progress when such a problem is not corrected. Unless aggregates are stored on platforms or other smooth hard surfaces some material in the bottom of the pile will be unfit for use because of contamination by the underlying soil. (See Article 2301.02, C)

Aggregates may become contaminated or degraded from a number of sources. Examples of these are foreign material from the pit or quarry, foreign material in the rail cars or other hauling units, boards or bags used to plug holes in rail cars, and degradation from handling or prolonged storage. When aggregates are being taken from the lower portion of the pile, particularly when the work is approaching completion and the stockpiles are small, the CPI must be continually alert and forbid the use of contaminated aggregates. The CPI must understand that all of the above sources and numerous others can furnish objectionable contaminants. If contamination does occur, the aggregates affected must not be used.

Cement, fly ash, and GGBFS must be stored in weatherproof enclosures, which will protect against dampness. If lumps develop in the cement or fly ash it must not be used until it has been reprocessed, re-tested and approved as provided in <u>Articles 4101</u> and <u>4108</u>. Cement, fly ash, and GGBFS, which has been in storage more than 60 days at the project site or in the producer silo for more than a year must also be re-tested and approved.

SAMPLING & TESTING

1. AGGREGATES

The explanation below describes the sampling and testing required for proper plant inspection. <u>IM 204</u> describes the minimum sampling and testing frequencies required for the inspection of construction projects.

a. SAMPLES. Aggregate samples are necessary to determine moisture content, specific gravity, and gradation. Care must be taken to ensure that the samples are representative of the materials being used. Secure fine and coarse aggregate samples as prescribed in <u>IM 301</u>. The Contractor is required to furnish, at the proportioning plant site, facilities for collecting representative samples of the coarse aggregate from a ribbon or stream. Refer to Article 2001.20. Do not attempt to secure samples in dangerous locations. Under no circumstance should samples be secured from a partially opened clam bucket or from the discharge end of a belt where proper walkways and stairs do not exist. Refer to Article 2001.06.

Secure and test aggregate samples at least as frequently as described in <u>IM 204</u>.

b. GRADATION. Determine the fine and coarse aggregate sieve analysis in accordance with IMs 302 and 306. These Instructional Memorandums prescribe the test sample size and the procedures for fine and coarse aggregate sieve analysis and for determining the amount of material finer than the No. 200 sieve. Sample calculations are included.

<u>Article 4109</u> of the Standard Specifications allows an increase of the minus No. 200 material from 1.5% to 2.5% for certain aggregate types. Determination to allow this increase shall be made by consultation with the District Materials Engineer.

For projects requiring certified plant inspection, the CPI results shall be quality control tests. Quality control testing is performed to ensure the proper material is being delivered to the plant from the source and identify stockpile changes. Verification sampling and testing will be performed by the Engineer at the frequency described below. IM 205 describes the agency responsibility to randomly select sample location and time, and witness sampling with the contractor providing assistance in obtaining the samples.

Quality Control Sampling, Testing, and Reporting

addity continu	or camping, recarry, a	na rtoporting		
Production	Specific Gravity	Moisture	Gradation	Report
Continuous	1/day 1 st 3 days, 1	1/day >500 yd ³	1/day >500 yd ³	1/day
	per 3 days	2/day >1000 yd ³		-
	thereafter	•		
Intermittent	1/week	1/day >500 yd ³	1/day >500	1/week
		2/day >1000 yd ³	yd ³	
Low	1/ week	1/ week	1/ week	1/ week

As a general rule, for each day production greater than 500 cubic yards, one gradation and one moisture shall be sampled and tested. If production is greater than 1000 cubic yards for the day, one additional moisture test shall be performed.

Continuous operation is defined as production greater than 500 cubic yards per day, for three or more days in a week. Quality control sampling and testing shall be performed daily. If production is less than 500 cubic yards for a day, sampling and testing may be grouped with a previous or subsequent day.

Intermittent operation is defined as a week of paving with two days or less of production greater than 500 cubic yards. A minimum of one quality control sample shall be obtained and tested on each day of production greater than 500 cubic yards.

Low construction operation is defined as a week of paving with production less than 500 cubic yards per day. A minimum of one quality control sample shall be obtained and tested

during the week.

When a quality control gradation test does not comply with the graduation requirements of <u>Article 4109</u>, the <u>CPI</u> shall contact the Engineer. After corrections have been made, the Engineer will obtain and test another verification sample.

Verification Sampling and Testing

Production	Gradation Sampling	Gradation Testing
Continuous	1/day >500 yd ³	1 st day, then 1/ week
Intermittent and Low	1/ week	1 st week, then 20%

For continuous construction operation, a verification lot is defined as a week of paving. Lots less than three days of paving will be grouped with the previous or subsequent lot. A verification lot may include a minimum of three days up to eight days. Verification sampling and testing will be performed the first day of paving. Thereafter, verification sampling will be performed daily and tested once per lot. If production on a given day is less than 500 cubic yards, verification sampling may be grouped with the previous or subsequent full day of paving.

Intermittent and low construction operation shall be grouped to establish a lot not to exceed one week. A minimum of one verification sample will be obtained and tested during the week. When intermittent production is longer than one week, sample once per week and test 20% of the samples obtained.

A lot is accepted when a verification test result by the Contracting Authority is determined to be in compliance. The Engineer will retain the samples until the lot is accepted. The Contractor may elect to run a split sample when the verification samples are obtained. The Engineer will witness the splitting and secure their portion of the sample. Since the contracting authority tests are verification, correlation with IM 216 is not required but may be performed as a check of sampling and testing procedures only.

When a verification gradation test does not comply with the gradation requirements of Article 4109, the Engineer will contact the contractor and the District Materials Engineer. The District Materials Engineer may investigate sampling and testing procedures, stockpiling, source material, etc. After corrections have been made, the Engineer will obtain and test another verification sample.

c. SPECIFIC GRAVITY. Determine in accordance with <u>IM 307</u> and <u>IM 308</u>. The W-W₁ chart, <u>IM T215A</u>, which shows the corresponding moisture content values, is also included. It must be noted that the mass of the sample for determining both W and W₁ must be 1000 to 2000 grams respectively for the fine and coarse aggregate for the W-W₁ chart to be valid.

Minimum testing will be one sample per day for both coarse and fine aggregates for the first three days of normal operation and one for each three days of normal operation for both coarse and fine thereafter, assuming the first three days' results are consistent.

The specific gravity should not vary more than 0.02 from the tabular value (<u>T203</u>-General Aggregate Source Information) or from one day's test to the next. If the above variations are greater than 0.02, inform the Engineer and the District Materials Engineer immediately.

The District Materials Engineer may adjust the specific gravity used to determine batch weights.

d. MOISTURE. Tables <u>T214A</u>, showing the Moisture Reciprocals (multiplication factors) that can be used for adjusting the aggregate batch amounts for the moisture content are included. The method most preferred for adjusting batch amounts is located in the Proportions section of this instruction. The District Materials Engineer may approve the use of the Chapman flask (ASTM C70) for fine aggregate moisture provided accurate specific gravity of the source is known. The District Materials Engineer may approve oven dry moisture content (AASHTO T 255) provided an accurate absorption (SSD) is determined.

Document all original test result information in the field book or other permanent records. Record the following for each test:

- All W and W₁ determinations
- The mass retained on each sieve for gradation
- All calculations for arriving at the final test result, i.e., moisture and gradation

The Specifications (<u>Article 2301.02</u>, <u>C</u>.) provide that coarse aggregate with absorption of 0.5% or more shall be wetted in the stockpile or cars, and methods of handling shall be such that change in moisture content in excess of 0.5% between successive batches must be prevented.

The use of materials that have varying amounts of moisture shall not be permitted. When the moisture content varies more than one-half percent from one batch to the next, the material must not be used unless something can be done to make the moisture uniform. It is the responsibility of the plant operator to devise remedial measures.

When the moisture content in either aggregate is high enough that water can be observed dripping from the bin between batches, or when the water will drip from the sample as described in Article 2301.02, C., the moisture cannot be measured successfully with the pycnometer nor can it be uniformly controlled. Materials with too much free water as described above must not be used until the moisture content has stabilized. It is the CPI's responsibility to recognize when this condition occurs and to secure the necessary corrective measures. Close communication with the construction grade inspector will inform the CPI when difficulties caused by moisture variation arise. The frequency of moisture testing may need to be increased if variations arise, such as rain events, etc.

When proportioning equipment is equipped with features, which allow instantaneous moisture content measurement of an aggregate, the following shall apply:

- 1. The acceptance of this system will be based on a correlation of the aggregate moisture content in a batch as determined by the proposed system and the moisture content determined by tests described in <u>IM 308</u>. The proposed system should be able to accurately determine the moisture content within 0.5 percent when compared to a sample obtained from a point in the plant as close as possible to the point of measurement used by the proposed system.
- 2. Prior to project startup, the contractor shall provide the engineer with the current

calibration range data for the proposed system. The calibration range shall be used to establish the upper and lower limits of the range. After plant calibration, a check between the moisture content obtained by the system and the moisture content determined the test described in IM 308 shall be made prior to production.

- 3. Batch weights for the aggregates proportioned using this proposed system may be adjusted automatically on an individual batch basis. Moisture content results outside the upper and lower range limits of system shall not be used to adjust batch weights.
- 4. The limit in moisture content variation between successive batches will not apply. (Ref. Standard Specification Article 2301.02, C. and IM 527)
- 5. Moisture contents determined by the test described in <u>IM 308</u> shall be performed at the frequency prescribed in <u>IM 204</u> to establish correlation with results from the moisture determination system as per Paragraph 1. After correlation is demonstrated, the Engineer may reduce the frequency of moisture testing (<u>IM 308</u>) to a minimum of once <u>per week</u> for verification of the system.
- 6. The proposed system will provide a batch-by-batch record of the material weights, percent of moisture of the aggregates, time, date, batch number, truck number, mix type, water in aggregate, total water in batch and end tares for all scales and meters. This may be in the form of a printed summary report or as a ticket to be sent to the project, provided the ticket includes the required information as shown on Form #830212 and described in IM 527.

2. STRENGTH

Test specimens shall be cast, cured, and tested as per the appropriate IM (i.e., <u>IM 315</u>, <u>IM</u> 316, and IM 328).

PROPORTIONS

The following procedure is required for determining basic proportions of dry materials in order that the proportions used in the work are correct:

- 1. The Contractor representative must make the calculations necessary to determine the quantities of dry ingredients and water necessary to comply with the mix proportions specified.
- 2. Before the plant operation begins or resumes the CPI and the plant monitor will independently determine the batch quantities and cross check them against the generated computer batch proportions.
- 3. Batching operations shall not commence until both independent determinations have been made and documented in the field records.

The proportions in the Standard Specifications are stated in terms of absolute volume per unit volume of freshly mixed concrete. Refer to <u>IM 529</u>. To obtain the weight of aggregate or cement per batch, the specified absolute volume per unit volume must be multiplied by the number of cubic feet of concrete per batch, and this product multiplied by the mass of saturated surface dry aggregate or dry cement per cubic foot. The weight per cubic foot of aggregate will be determined using the aggregate specific gravities shown in Table <u>T203</u>, General Aggregate Source

Information.

<u>Table T203</u> is revised often, and care must be taken to use the current value. Follow the same procedure for determining the cement batch weight. However, the specific gravity for Type I/II Portland Cement is constant for all brands at 3.14.

The following is an example of a basic mix without fly ash.

Determine the mass of the cement and aggregate batch for a C-3 mix using crushed stone from Wendling Quarries, Inc. Montour Quarry, and sand from Manatt's Flint pit.

abs. vol. x cubic feet/cubic yard x sp.gr. x lbs. of water/cubic foot = lbs./cubic yard

Cement - specific gravity 3.14 Specified unit absolute volume, From <u>IM 529</u>, 0.114.

 $(0.114 \times 27 \times 3.14 \times 62.4) = 603$ lbs.

Fine aggregate - specific gravity 2.65 Specified unit absolute volume, from IM 529, 0.302.

 $(0.302 \times 27 \times 2.65 \times 62.4) = 1348$ lbs.

Coarse aggregate - specific gravity 2.63 Specified unit absolute volume, From IM 529, 0.370.

 $(0.370 \times 27 \times 2.63 \times 62.4) = 1639$ lbs.

The above masses are for one cubic yard of concrete and would have to be multiplied times the total cubic yards being batched.

The Batch Tables contain the masses of the batch including cement predetermined for the respective mixes using the above calculation procedure. These aggregate amounts must be corrected for the amount of moisture determined by the pycnometer method. While the CPI is instructed to make specific gravity determinations in the field, these determinations are for the cross checking the tabular value and must <u>not</u> be used for batch calculations. THE SPECIFIC GRAVITY VALUES FURNISHED IN THE CURRENT TABLE <u>T203</u>, AGGREGATE SOURCE INFORMATION, MUST BE USED FOR CALCULATING THE DRY BATCH.

1. ADJUSTMENTS FOR MINERAL ADMIXTURE SUBSTITUTION & CEMENT MODIFICATION

Fly ash or GGBFS may be substituted for cement at the contractor's option within certain restrictions. <u>Article 2301.02</u>, <u>B</u>. specifies the substitution rates as they relate to time of the year.

<u>IM 529</u> lists each standard concrete mix. These mixes contain only cement but may be adjusted to accommodate fly ash or GGBFS substitution. Explanation of how those adjustments are to be performed is discussed later. The procedure to make necessary adjustments for increasing cement content in a mix is also explained later in the IM.

PROPORTIONING A MIX FOR A MINERAL ADMIXTURE SUBSTITUTION.

- a. To adjust a standard mix for fly ash or GGBFS substitution, the amount of cement specified for a basic mix is multiplied by the percentage of fly ash that is to be substituted. This product will give the pounds of fly ash in the mix. To calculate the adjusted cement in the mix, subtract the fly ash or GGBFS amount from the basic cement weight. The basic water must also be adjusted. This is done by taking the design w/c, which is found in IM 529, and multiplying that number by the total amount of cementitious material in the mix. The product of that calculation will be the adjusted pounds of basic water.
- b. The absolute volumes must also be adjusted for the new mix. This is done by multiplying the specific gravity of the material by the pounds of water per cubic yard times cubic feet in a cubic yard or 62.4 x 27, then dividing the pounds per cubic yard by that amount. This procedure is used for the cement, fly ash, GGBFS, and water. Those absolute volumes plus the absolute volume of air, which is designated as 0.060, must be summed and subtracted from 1.000. The remaining volume is the aggregate portion of the mix.
- c. To determine the volumes of the coarse and fine aggregate, the number from the difference above would be multiplied by the percentage of each aggregate used in the mix. The percentage would depend on the mix number being used, for example, a C-4 mix would have 50% coarse aggregate and 50% fine aggregate, a C-3 mix would have 55% coarse aggregate and 45% fine aggregate. After the absolute volumes of the fine and coarse aggregate are determined, the pounds of each shall be determined. This is done by multiplying the absolute volumes of the aggregate by the specific gravity of that aggregate and by the pounds of water in a cubic foot x cubic foot in a cubic yard.

Example A, in <u>Appendix B</u>, shows the process of adjusting a mix for 15% fly ash usage in a C-mix using the form provided.

3. ADJUSTING BATCH WEIGHTS FOR AGGREGATE MOISTURE

The above dry aggregate batch amounts must be adjusted to account for moisture or lack of moisture in the aggregates. If additional moisture is present above the amount for the saturated and surface-dry condition (SSD), refer to IM 308. The aggregate dry batch amount must be increased an amount equal to the mass of the water in the aggregate batch. If aggregates have less moisture than is present for the SSD condition, the aggregate dry batch amount must be reduced an amount equal to the mass of the water in the batch, below what is required for the SSD condition. When the latter condition occurs, the aggregate is described as having absorption. It occurs infrequently and for short duration and will generally be found during or at the end of a prolonged hot dry period in mid or late summer. The maximum permissible absorption limit is 0.5 percent. If the absorption exceeds 0.5 percent refer to the section entitled, "General" in this IM for the special action necessary.

There are two procedures that can be used for adjusting the dry aggregate batch amount to account for the free moisture in the aggregates. If a system with instantaneous moisture content measurement equipment is used to automatically adjust individual batch weights, see previous section, **Sampling & Testing/Moisture**, for instructions on an approval, use, and monitoring of the system.

The following example illustrates one of the methods used:

Assume the fine aggregate contains 3.4 percent and the coarse aggregate contains 0.7 percent of free moisture.

```
Fine aggregate -- 100.0 percent minus 3.4 percent = 96.6 percent 1348 \div 96.6 \times 100 = 1395 lbs.
```

```
Coarse aggregate -- 100.0 percent minus .7 percent = 99.3 percent 1639 \div 99.3 \times 100 = 1651 lbs.
```

To determine the free water in the aggregates, subtract the dry aggregate quantity from the adjusted dry aggregate weight for both aggregates and add the two differences.

```
1395 lbs. - 1348 lbs. = 47 lbs.
1651 lbs. - 1639 lbs. = 12 lbs.
```

47 lbs. + 12 lbs. = 59 lbs. of free moisture in one cubic yard of concrete.

The less preferred method is to use the moisture reciprocal tables <u>T214A</u> in which the correction factors are for 3.4 and 0.7, 1.0351967 and 1.0070493 respectively. Multiply the dry aggregate batch weight determined previously by the respective moisture reciprocal correction factor.

Fine aggregate 1348 lbs. × 1.0351967 = 1395 lbs.

Coarse aggregate 1639 lbs. × 1.0070493 = 1651 lbs.

These adjusted quantities are for one cubic yard and would have to be multiplied times the total cubic yards being batched. To determine the free water in the aggregates, subtract the dry aggregate weight from the adjusted dry aggregate amount for both aggregates and add the two differences as you did above in the example.

Add the total free water in the aggregates to the water proportioned into the mixer to determine the total water for mixing. Determine and record also at the same time the adjusted dry aggregate batch amounts, the water in the materials, the water proportioned and the total water available in the batch for mixing.

Record in the plant field book all weight determinations and calculations and initial each day's entry.

Check the aggregate scale settings, also at three-hour minimum intervals, as indicated by the adjusted dry aggregate batch weights. Refer to the section entitled Equipment, in this IM, for the procedure to follow when scale adjustments are required.

The water demand of a particular mix is dependent upon the materials used in the mix. For this reason, the water batch weight is determined by trial when the mixing begins. The water batch weight is controlled indirectly by the slump requirements.

Many central mixing plants have equipment for introducing additional water into the mixer after

the batch has been in the mixer and has been mixed. The additional water is added manually through a system, which is independent from the main water proportioning system. The auxiliary water meter must be read at the same interval as the moisture determinations and scale adjustments are made. The total water through the auxiliary system is reduced to the pounds per batch basis by dividing by the number of batches produced during the three-hour interval and the per batch amount must be included in the total mixing water recorded per batch.

The CPI must keep a record in the plant field book of the total mixing water used, including the water in the aggregates, for at least each three (3) hours of normal operation to determine that the maximum permissible water content is not exceeded and to determine the batch volume. When ready mix trucks are used, water added on the grade must also be reported to the CPI.

Whenever the water demand, to achieve the desired workability, exceeds the design water/cement ratio and approaches the maximum water allowed, the Engineer and the District Materials Engineer Office should be notified. At the same time, aggregate moisture contents, batch weights, cement scales, water meter, etc., should all be immediately checked. In no circumstance should the maximum water/cement ratio be knowingly exceeded.

If, after the District Materials Engineer investigation and evaluation, additional workability above that which is attainable with the maximum permissible water content is desired, the cement content may be increased in accordance with Article 2301.02, B. This should be done only with the approval of the District Materials Engineer or their representative. The District Materials Engineer will provide the revised and adjusted mix proportions for these situations.

If the batch yield variation is less than 98 percent or greater than 102 percent for the water content being used, refer to Specification <u>Article 2301.02</u>, <u>B</u> for the special action necessary. The District Materials Engineer may allow adjustments in the proportions after checking moisture contents of the material and the operation of the batching equipment.

Mixes using fly ash as a substitution for cement are permitted as a contractor option, as allowed in the specifications.

REPORTS & REPORTING

1. PLANT PAGE – FORM #240

Plant reports are to be recorded in the computer program or on hand completed forms, both provided by the lowa Department of Transportation. A copy of the completed PCC Plant Page shall be submitted to Doc Express Project Engineer on the next working day, within four hours after start-up of the plant. If Doc Express is not utilized, use electronic mail as the method of delivery unless otherwise approved by the Engineer. The CPI shall keep a copy of the PCC Plant Page and send the original to the Engineer. Copies of the files containing the project information are to be available to the engineer upon request until the project is final. The plant book shall be available for audit checks by the Engineer.

A separate report is to be made for each day concrete is placed. These reports are to be consecutively numbered for each project. A sample copy and the instructions on completing this report are in <u>Appendix A</u>.

2. PERSONAL COMPUTER

The personal computer shall be capable of running Microsoft Excel 365 or newer version to use lowa DOT Programs.

3. READY MIXED CONCRETE, TRUCK TICKET FORM - FORM #830212

When concrete source for a paving project is a commercial ready-mix plant, each truckload of concrete must be identified by Form #830212 or acceptable computer-generated plant ticket. For continuous mainline paving, Form 830212 shall be filled out completely for the first truck. Tickets for subsequent trucks need only to have the Truck No., Ticket No., Conc. This Truck, Time Batched, Water Subtotal, and Maximum Water Allowed portion filled out. When any change in the moisture content, plant adjustments in mixing water, or any other changes to the batching or materials in the concrete are made, a complete ticket must be filled out for the first load that includes the changes. The Engineer and District Materials Engineer will approve any variations to accepting the truck ticket form or computer-generated form.

The CPI must fill in the information pertaining to the plant, and the construction grade inspector must collect and record the information pertaining to the grade, assemble the tickets by day and store with the other project records. These completed tickets will contain primary information and must not be lost or destroyed. A sample is shown in Appendix C.

PORTLAND CEMENT SHIPMENT YIELD REPORT - FORM #820912

The cement shipment yield test is described in section 2a, Cement Scales. Report the cement yield results on Form #820912. A sample copy of Form #820912 is included in Appendix C.

PORTLAND CEMENT CONCRETE BATCH PROPORTIONS - FORM #820150

Submit the batch proportions report #820150 to the Engineer or Doc Express for review. For standard mix designs, do not delay work if not submitted prior to placement.

IMs & SPECIFICATIONS

A list of the IMs and Specifications used in PCC Plant Inspection are located at the end of this IM.

CONCRETE PLANT INSPECTION CHECKLIST

- A. The proportioning equipment must be examined at least at 3-hour intervals for correctness of the amount being delivered and for damage.
- B. The scale sensitivity shall be checked at least twice during a normal working day by placing a mass equal to 1/10 percent of the batch on the fully loaded scales and observing the movement of the indicator.
- C. Check scale operation to determine cement delivery tolerance conformance at least once during each day of normal operation.
- D. The Standard Specification requires that the cement shipment yield determination must be

- made at intervals of approximately 10,000 cubic yards after the original determination made near the end of the first full day of production.
- E. Check scale operation to determine aggregate delivery tolerance conformance at least once during a normal working day and document.
- F. If water is measured with a scale, the delivery tolerance must be determined at least once for each day of normal operation and document.
- G. Admixture dispensers shall be observed for uniform delivery at least once during each 3 hours of normal operation and document.
- H. Admixture dispensers must be flushed with water at least once daily.
- I. Determine and record the mixing speed and the mixing time at least once daily by using the sweep hand of a watch and counting the drum revolutions in one minute.
- J. Determine and record the time between batching and placement at least once during each day of normal operation.
- K. Specific gravity One sample per day for both coarse and fine aggregates for the first three days of normal operation and one for each three days of normal operation for both coarse and fine thereafter, assuming the first three days results are consistent.
- L. Moisture A minimum of one test per each day of operation greater than 500 cubic yards. Two per day, if production is greater than 1000 cubic yards.
- M. Gradation Obtain and test one sample per day. Show sample number, name of sampler, and name of tester on lab work sheet.
- N. If opening not determined by maturity method, cast one beam for each 2000 cu. yd. of concrete placed. Make flexural tests representing alternating 2000 cu. yd. placement units at 7 and 14 days.
- O. At the plant, the CPI shall remove the specimens, clean the molds, oil, and return the molds to the grade at the direction of the construction inspector. The CPI shall store the specimens until date of test. The storage space shall be a pit adequate for the project, and for normal projects it should be at least 4 ft. x 6 ft. x 18 in. The specimens shall be wet at all times. If the temperature in the sand filled pit drops below 40°F, remove the specimens, and place them under wetted burlap in a heated enclosure or in lime-saturated water. See IM 328. NOTE: Lime-saturated water is prepared by mixing 0.4 ounces of hydrated lime with 1 gallon of water.
- P. When opening is determined by the maturity method, casting beams every 2000 cubic yards is not required. The CPI should ensure curve development is performed according to IM 383.
- Q. Other duties include:
- Close observation of stockpiling and handling of aggregates. There must be no intermingling of aggregates and no contamination.

- Frequent check on wet batch or dry batch truck cleanliness and degree of discharge.
- Document all the above data in diary.
- Make the following report daily: Plant Reports Form #800240
- Make the following report as prescribed: Cement Yield Report Form #820912E
- At the end of the project, submit the plant book to Doc Express, within ten days.
- When required by <u>Article 2301.03</u>, make a copy of vibration-monitoring device records in electronic format.

IMS/SPECIFICATIONS USED IN PCC PLANT INSPECTION BY VOLUME

Volume II IMs:

<u>IM 527</u>	Paving Plant Inspection
<u>IM 528</u>	Structural Concrete Plant Inspection
<u>IM 529</u>	Portland Cement (PC) Concrete Proportions
<u>IM 401</u>	Hydraulic Cements
<u>IM 403</u>	Chemical Admixtures for Concrete
<u>IM 491.14</u>	Ground Granulated Blast Furnace Slag (GGBFS)
IM 491.17	Fly Ash
<u>IM 203</u>	Consultation Provided by Materials Personnel on Construction Projects
<u>IM 204</u>	Inspection of Construction Project Sampling & Testing
<u>IM 213</u>	Technical Training & Certification Program
<u>IM 216</u>	Guidelines for Validating Testing Results
<u>IM 301</u>	Aggregate Sampling & Minimum Size of Samples for Sieve Analysis
<u>IM 302</u>	Sieve Analysis of Aggregate
<u>IM 306</u>	Determining Amount of Material Finer than the No. 200 Sieve in Aggregate
<u>IM 307</u>	Determining Specific Gravity of Aggregate
<u>IM 308</u>	Determining Free Moisture & Absorption of Aggregates
<u>IM 316</u>	Flexural Strength of Concrete
<u>IM 317</u>	Slump of Hydraulic Cement Concrete
<u>IM 318</u>	Air Content of Freshly Mixed Concrete by Pressure
<u>IM 327</u>	Sampling Freshly Mixed Concrete
<u>IM 328</u>	Making, Protecting & Curing Concrete Flexural Strength Field Specimens
<u>IM 383</u>	Estimate of Portland Cement Concrete Strength by Maturity Method

Volume IV IMs:

IM 209	Certified Aggregates & Approved Producer Program
IM 409	Source Approvals for Aggregates
IM T203	General Aggregate Source Information

Specifications:

<u>2301</u>	Portland Cement Concrete Pavement
2403	Structural Concrete
4100	General Provisions

2001 General Equipment Requirements

Supplemental or Developmental Specification that was in effect at the time of the project letting.

INSTRUCTIONS FOR COMPLETION OF PCC PAVING & STRUCTURAL REPORTS

The new reporting process does not include Mobile Mixer information. Use the following forms and reports when using a Mobile Mixer:

Form E 115 Air & Slump Record Form E 120 Mobile Mixer Data Record

Report #820180 Gradation Test

Report #821297 Nuclear Density of Plastic PC Concrete

Report #820020 Mobile Mixer Calibration

Project No.

Enter the project number listed on the plans.

Plant Name

Enter the name of the ready-mix plant and location for structural concrete. Enter the approximate location of a paving plant set up by a contractor.

Example: Croell - Waverly (Ready Mix)

2 miles NW of Waverly (Paving Plant)

Contractor/Sub

A group of people or a company must perform the work being done, either a prime or sub contractor. Enter the name of the contractor performing the work. If it is a subcontractor, list this after the contractor's name.

<u>Weather</u>

Enter a brief description of the actual weather conditions at the paving plant. Weather conditions are not required for structural concrete (Ready Mix).

Contract ID

Enter the nine-digit contract number listed at the top of a contract. This is <u>not</u> the five-digit accounting ID number listed with the project number.

County

Enter the county listed on the project plans.

Temperatures, Min. & Max.

An air temperature shall be recorded early in the morning for the minimum and around midafternoon for the maximum. Take the temperatures in a shaded area, otherwise they are meaningless. Temperatures are not required for structural concrete, except bridge decks.

Report No.

Start with the number 1 at the beginning of work for each project. The ending report number shall coincide with the last day each item is completed for paving and the last week for structural. Do not restart the report sequence if the project carries over to the next year.

Matls. IM 527 Appendix A

16 days of 10.5-inch slip form paving - report 1 through 16. (Paving) Example:

> (Ready Mix) 8 weeks of concrete on Des. 1290 - report 1 through 8.

Date This Report

Enter the date the concrete is placed for each day of paving. Enter the last day of the workweek for structures (normally the Saturday date).

Date of Last Report

Self-explanatory.

Design No.

Enter the design number of the structure where the concrete is being placed on each project. Leave this space blank on paving projects.

Check Mix (Central or Ready)

Place an "X" in the appropriate box provided indicating how the concrete is being produced.

Check Usage (Paving, Structural, Incidental, Patching)

Place an "X" in the appropriate box provided to indicate the type of work where the concrete is used.

Date (Mo./Day)

This column is only used for Ready Mix concrete applications. Enter the month and the date for each day of production during the week.

Example: 5/24, 7/01, 12/03, etc.

Mix Number

Enter the mix number being used that is listed in the proportion tables of IM 529.

Location- Station (Beg. /End/Dir)

Enter the beginning and ending station for concrete placed daily by mix. Enter the direction (N, S, E, W) for divided sections or B for 2-lane sections. For structural concrete enter the unit placed (Example: pier, cap, footing, deck). Enter item placed for other work. (Example: sidewalk, drive) The grade inspector will provide the location or item placed to the plant inspector.

Batched

Enter the total cu. yds. batched for each mix for a paving plant. Enter the total cu. yds. batched for each unit poured for structures.

% Of Est. Used

Enter the percent of estimated concrete used. The grade inspector will provide the % of estimate used ((cubic yards used / cubic yards estimated) X100) to the plant inspector

Fine, Intermediate & Coarse Aggregate (Moisture)

Enter the percent moisture once in the morning and once in the afternoon for paving projects. Enter the percent moisture for each unit poured on structures.

Fine, Intermediate & Coarse Aggregate (T203 sp gr)

Enter the specific gravity for each aggregate listed in the T203 source tables.

Fine, Intermediate & Coarse Aggregate (Dry Wt.)

Enter the weight of each aggregate calculated by absolute volumes.

Actual Quantities Used Per cu. yds. (Pounds)

Cement Enter the pounds of cement calculated by absolute volumes. Enter the pounds of fly ash calculated by absolute volumes. Enter the pounds of GGBFS calculated by absolute volumes.

Fine Enter the actual pounds of fine aggregate adjusted by moisture content.

Inter. Enter the actual pounds of intermediate aggregate adjusted by moisture content. **Coarse** Enter the actual pounds of coarse aggregate adjusted by moisture content.

In Agg. Enter the calculated difference between the actual weights and the dry weights of all

aggregates.

Plant Enter the average pounds of water added at the plant for each cu. yd., including ice Enter the average pounds of water added on the grade (if permitted by specification).

Avg. W/C Ratio

Enter the ratio of total water, including water in the aggregates and water added on the grade, in one cu. yd. divided by the total sum of cement, fly ash, and ggbfs in one cu. yd., report to three decimal places.

CPI Gradations

This section of the report is for reporting the Certified Plant Inspector gradation test results for the coarse and fine aggregates being used in the mix.

Batched (Today or Week)

Place an "X" under the Today column if the report is being submitted daily (paving).

Place an "X" under the Week column if the report is being submitted weekly (structures).

Concrete Batched

Enter the total cu. yd. of concrete batched under the appropriate column. Paving plant totals are normally under the Today column; structural concrete totals are normally under the Week column.

To Date Total

Enter the running total for both concrete and cement.

Air Entraining (Air Ent.)

Enter the brand name or source, average rate per cu. yd., and lot number.

Water Reducer (Wat. Red.)

Enter the brand name or source, average dosage rate, and lot number.

Retarder

Enter the brand name or source, average dosage rate, and lot number.

Calcium Chloride (Cal. Chlor.)

Matls. IM 527 Appendix A

Enter the brand name or source, average dosage rate, and lot number only when added at the plant site.

Superplasticizer (Superplas.)

Enter the brand name or source, average dosage rate, and lot number.

Concrete Treatment

Place an "X" directly behind Ice, Heated Water, or Heated Materials, if one or more are used. If ice is used to cool the mix, enter the pounds of ice per cu. yd. Include weight of ice with plant water.

Cement

Enter the cement type, specific gravity, and source. See IM 401 for the actual source name.

Fly Ash

Enter the type and specific gravity and source. See <u>IM 491.17</u> for the actual source name.

<u>Example:</u> Chillicothe and ISG Headwaters are <u>not</u> source names. Ottumwa is the source name.

Rock

Enter the T203 A number, and gradation number.

GGBFS

Enter the grade, specific gravity, and source. See IM 491.14 for the actual source name.

Sand

Enter the T203 A number, and gradation number.

Intermediate

Enter the T203 A number.

Remarks

Enter delays, which may take place. Enter description of noncomplying test results.

CP

Enter the Certified Plant Inspector name and certification number.

Monitor

Enter the plant monitor name and certification number.

If using the computer spreadsheet, most of this information will be entered on the Project Information and Mix Information sheets and automatically transferred to the Report. For QMC and BR mixes, the combined gradation will be calculated from aggregate percentages entered in the Mix Information Station From and To, Totals to Date Cement and Concrete, and Remarks will be entered directly on the Report.

The next page is an example of a completed Paving Plant Report.

(Monthly) (Weekly) (Project) (Daily) Report SEND Grad. No. Waste E - Units 0.415 0.428 Ratio Avg w/c 0.00 3.06 PC0707-Central Plains - EaglePave-IS(25) Lot Number Max On Grade W/C Ratio: Non-structural Miscellaneous To Date Total Grade 0.0 0.0 0.0 0.0 0.0 5.0 oz/yd 233998 3 oz./100lbs 557882 FA004C-Council Bluffs Unit #3 Continous Batched Placement Type Plant Water 175.0 190.0 Rate T-203 A # & Source Paving In Agg. 2640.00 588.72 Daily 48 99 A10030-SOUTH AURORA A06502-VINTON-MILROY Brand / Source Eucon WR-75-Euclid Coarse Check One (X) Daravair 1000-GCP tons Plant Type (x) lbs/yd3 yd3 2.62 1682 1678 Central Type IS(25) Date This Report: 9/17/2014 Ready Concrete: Cement: Inter. Actual Quantities Used . Fine: Fly Ash: Coarse: Air Entraining: Normal Water Reducer: Mid-Range Water Reducer: High-Range Water Reducer: Retarder: Special Performance Admixturer: Concrete Fibers: Cement: GGBFS: Intermediate: lbs/yd3 004 Fine 1424 1420 % Structures Des. No: ΉH Date Of Last Report: Curve / Validation Date: Curve Expiration Date: GGBFS Cement Redux. 8 Fly Ash Monitor #2: Conc. Treatment Liquid Nitrogen Dose (oz/cy) C.P.I. #1: C.P.I. #2: CW Heated Materials 111 11 Heated Water Cement CarbonCure: e Target Within 446 446 Certified RM The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications PCC Plant Report Wt. SSD 1670 1670 #200 sq Coarse Aggregate ۴ ιO #100 County: 58-Louisa T-203 Comply Comply Comply Sp. G. 2.63 2.63 Ķ × Y/N 87 Contract ID: 67592 Temp. Min: Temp. Max: Moist. Maturity Mix ID: Curve Strength: Curve Type: #200 0-2.5 #200 #200 0-1.5 #20 0.5 (%) 0.7 Wt. SSD #30 #100 sq 8# 0-5 **8**# Intermediate Aggregate Adjusted % Passing Calculated Combined Gradation T-203 #16 Sp. G. # 0-10 #4 #20 Curve #: Plant Name: KR - Hwy 218 &F62 Moist. 10-60 #8 (%) 3/8" £30 3/8.. Project No.: STP-64(12)28-58 Contractor: Knife River T-203 Wt. SSD 1/2.. 25-60 #16 1,380 #4 Plant 1,380 1/2.. sq Weather: Sunny Fine Aggregate SubContractor: Maturity?: Sp. G. 2.65 70-100 3/8" 2.65 3/4" 3/4" 8# Proj. Eng. 90-100 Moist. 95-100 1/5... --(%) 5.8 #4 3.1 1 1/2" 1 1/2" Waste 0.00 100 3/8.. 3/4" yd3 0.00 100 DME Location % Of Est. -From **Used** 1/2" 0.0 0.0 Distribution: Intermediate v10.1 Batched 1 1/2" 8/6/2013 8/6/2013 1,256.00 Coarse 1,384.00 yd3 Fine Target Remarks Date of Placement C-3WR-C20 C-3WR-C20 Sample Date Sample Date SampleDate Mix 1 Mix 3 Mix 4 Mix 2 Mix 5 .≚ ⊠ 800240 computer

To Date

Waste

0.450 Ratio 0.450

Max w/c

Supersedes April 18, 2023 April 16, 2024

EXAMPLE A

4/3/2023			nent Of Transpo	rtation		Form E820150
			e Of Materials	DETE		E - Units
		PORTLAND	CEMENT CONC	REIE		
Project No.:	FM-91(15)66-91		-	County: 91-Wa	arren	-
Mix No.:	C-3WR-C20S20	Ab	s Vol. Cement:	0.1080	Type:	IL
Cement (IM 401):	566 %	lbs	Source:	PC0009-Ash Grove - Louisv	Sp. Gr.:	3.11
Fly Ash (IM 491.17):	20	113	Source:	FA004C-Council Bluffs Unit	Sp. Gr.:	2.62
Slag (IM 491.14):		113	Source:	SL02A-NewCem	Sp. Gr.:	2.93
CarbonCure:	% 0	0	Cement Reduc	tion		
	Adjusted Cement:	340	Ibs			
	Total Cementitious	566	lbs	Total % Replacement =	46	-
IM T203	00 0		A06502-VINTON	-MILROY	Sp. Gr.:	2.65
IM T203 IM T203	00 0		A22010-OSTERI	роск	Sp. Gr.: Sp. Gr.:	2.67
Basic w/c Max w/c		Water Max. Water	•	= Basic w/c X (Total Cementitious = Max w/c X (Total Cementitious)	s) = =	243 255
Absolute Volumes	Cement			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.065
	Fly Ash			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.026
	Slag			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.023
	Water			(lbs/cy) / (Sp. Gr. X 62.4 X 27)	=	0.144
	Air					0.060
				Subtotal	=	0.318
				1.000 - Subtotal Total	=	0.682 1.000
% FA Agg.:	45			Subtotal) X % In Mix	=	0.307
% In. Agg.:				- Subtotal) X % In Mix	=	0.075
% CA Agg.:	55	Coarse A	ggregate (1.000	- Subtotal) X % In Mix Aggregate Total	=	0.375 0.682
Aggregate Weights		Fine:	Abs Vol. X Sp. G		=	1371
ragiogate moignio			Abs Vol. X Sp. G		=	0
		Coarse:	Abs Vol. X Sp. G		=	1687
Summary			Cement	340 lbs/cy		
Cumum, y			Fly Ash			
Plant Name & Location:	Warren _R63		Slag	113 lbs/cy		
CPI:			Water	243 lbs/cy		
Cert #:			Fine Agg.			
			Interm. Agg. Coarse Agg.			
			Course Agg.	ISSIGY		
			Air Entrainment:			6.0 oz/yd
				Plastocrete 161-Sika		2 oz./100lbs
		-	Water Reducer:		Rate:	
		nign-Kange	Water Reducer: Retarder:		Rate:	
		Special Performa			Rate:	
	`	-p-01411 6110/1118	Fibers:		Rate:	
			CarbonCure:		oz/cy:	
Distribution: DME, Pro	oj. Engr., Contractor				-	

Form 830212

READY MIX CONCRETE

10-12-16

		Plant
Truck No.:	Ticket No:	
Date:	Des. No.:	
Proj. No.:		
	Retarder/Water Reducer? Y	′es
Conc. This Truck:		CY
Air agent added this truck:		OZ.
Time Batched:	Discharged:	
Rev. Mixed (Plant)	Grade:	
Water (gal. or lbs. This Truck)	8.33 lbs./gal.	
In Aggregate:	gal	lbs.
Added (Plant):	gal	lbs.
Subtotal:	gal	lbs.
Added Grade:	gal	lbs.
TOTAL WATER:	gal	lbs.
Maximum Water Allowed:	gal	lbs.
Air:	Slump:	
Plant Inspector:		
Receiving Inspector:		

Portland Cament Sulpment Yield Report	2000175 00	amoutor													
Post	320912E - CO	omputer													
Contract Contract															
Project No. Project No. Project No. Project No. No.												Report No.:	1		
Page Page Page Page Page Page Page Pa				Portlan	d Cement Sh	ipment Yield	Report				Date Su	bmitted:	01/02/04		
Policy Mode Month Policy Poli															
Novice N			5-85								Contractor:	Manatt's			
Date Number Tones Type Date Number Tones Type Date Number Tones Tones Type Date Number Tones Type Type Date Type Type Date Type T	ounty: St	tory				Plant Lo	cation:	NW Corr E29							_
Date Number Tones Tope Date Number Tones Tope CREATIS TOPE TOPE															
				_		_					_				
GROUGES 107313 281 4														Туре	
SenDoug 1973 27 95														1/11	-
DECOURD 107316 27 81														/ /	-
GROUND 107316 27 92														1/11	
GEOLIZIA 107317 28-21														1/11	
SECURIA 107316 25.49														1/11	
DECENTIAN 107319 25.57														1/11	
DEGING 107320 22 06														1/11	
														1/11	
														1/11	
Dental 107324 28 08				1/11					I/II		0	0		I/II	
G66/36/33 107325 22 73	03/03	107323	28.36	1/11		06/04/03	107363	28.28	I/II		0	0	0.00	1/11	
D6G10303 107326 28 28 MI	03/03	107324	28.08	1/11		06/04/03	107364	27.90	1/11		0	0	0.00	1/11	
D6G03G3 10732P 25.55 MI														I/II	
D66/30/33 107336 28 19	03/03	107326	28.26	1/11		06/04/03	107366	28.00	I/II		0	0	0.00	I/II	
D6.03.03 107329 27.61		107327					107367							1/11	_
D6G0303 107330												_		1/11	_
D6G0303 107331 28.37														I/II	_
D60303														1/11	
060303 107333 28 20														1/11	
D60/30/30 107/334 28.03 VII D D D D D D D D D														1/11	_
D60/30/30 107336 28.18														1/11	_
D60/03/03 107336 28.03														1/II 1/II	
0603/03 107337 21.00 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107338 27.78 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107339 28.15 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107340 28.25 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107341 28.32 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107341 28.32 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107342 27.99 VII 0 0 0 0.00 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107343 27.96 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107344 28.50 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107345 28.28 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107346 28.28 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107346 27.27 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107346 27.27 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107348 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107350 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107350 28.34 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107350 28.35 VII 0 0 0 0.00 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107350 28.35 VII 0 0 0 0.00 VII 0 0 0 0.00 VII 0 0 0 0.00 0604/03 107350 28.35 VII 0 0 0 0.00 VII 0 0 0 0 0.00 VII 0 0 0 0 0.00 0604/03 107350 28.35 VII 0 0 0 0.00 VII 0 0 0 0 0.00				1										1/11	
0604/03 107338 27.78 VII														1/11	
06/04/03 107339 28.15 VII 0 0 0 0.00 VII 0 0 0 0.00														1/11	
D6/04/03 107340 28.25														1/11	
D6/04/03 107341 28.32 I/I														I/II	
06/04/03 107343 27.96 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107344 28.50 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107345 28.28 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107346 27.27 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107346 27.27 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107346 28.34 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107348 28.34 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107349 27.88 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107349 27.88 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107350 28.34 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 06/04/03 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 07/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0.00 I/I 0 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0 0.00 I/I 0 0 0 0.00 08/04/05 107351 28.35 I/I 0 0 0 0 0 0 0 0 0	04/03		28.32	1/11		0	0	0.00			0	0	0.00	1/11	
06/04/03 107344 28.50 I/II 0 0 0 0.00 I/II 0 0 0 0.00	04/03	107342	27.89	I/II		0	0	0.00	MI		0	0	0.00	I/II	
D6/O4/03 107345 28.28	04/03	107343	27.96	1/11		0	0	0.00	I/II		0	0	0.00	1/11	
D6/04/03 107346 27.27														1/11	
D6/04/03 107347 27.91														I/II	
06/04/03 107348 28.34														I/II	
107349														1/11	1
06/04/03 107350 28.34 I/I 0 0 0.00 I/I 0 0 0.00														1/11	
OB/04/03 107351 28.35 I/I O O 0.00 I/I O O 0.00														1/11	-
Cement C														/ /	
Per CY Batched Batched Image: Composition of the province of the pro	J-7/UJ	107331	20.33	1/11		U	J	0.00	WII		0	U	0.00	1/11	
Per CY Batched Batched Image: Composition of the province of the pro		Cement				Cement									
Mix No. (lbs) (CY) (Tons) Total Billed Weight (Tons) 1,454.17 M-4 825 168.00 69.30 Total Billed Weight (Tons) 1,555.84 C-4WR 593 147.00 43.59 Total Billed Weight (Tons) 1,555.84 0 0 0.00 0.00 Yield = 100.7 % Left In This Check (+) 1.53 Total Weighed (Batch Scale) C.P.I.: Signature Total Weighed (Batch Scale) 1,566.91 Signature Signature			Batched												
C-4WR-C15 503 5,782.00 1,454.17 M-4 825 168.00 69.30 Total Billed Weight (Tons) 1,555.84 C-4WR 593 147.00 43.59 Total Billed Weight (Tons) 1,555.84 0 0 0.00 0.00 Yield = 100.7 % Left In This Check (+) 1.53 Total Weighed (Batch Scale) C.P.I.: Total Weighed (Batch Scale) 1,566.91 Signature	No.														
M-4 825 168.00 69.30 Total Billed Weight (Tons) 1,555.84 C-4WR 593 147.00 43.59 1,555.84 0 0 0.00 0.00 7 0 0 0.00 7 1,55 Left In This Check (+) 1.53 1,56 1,56 Scale (Tons) Previous Yield Check (-) 1,68 C.P.I.: 1,566.91 Signature															
C-4WR 593 147.00	1-4										Total Billed \	Veight (Tons)	1,555.84		
0 0 0.00		593	147.00												
Left In This Check (+) 1.53 Scale (Tons) Previous Yield Check (-) 1.68 C.P.I.: Total Weighed (Batch Scale) 1,586.91 Signature			0.00												
Scale (Tons) Previous Yield Check (-) 1.68 C.P.I.: Total Weighed (Batch Scale) 1,586.91 Signature	0	0	0.00								Yield =	100.7	%		
Total Weighed (Batch Scale) 1,566.91 Signature															
	(Tons)								C.F	P.L.:					
Distribution: DME RCE Central Materials Contractor Inspector		T	otal Weighed	(Batch Scale)	1	1,566.91						Signature			
Distribution: DME RCE Central Materials Contractor Inspector															
	tion:	DME	RCE	Central Mate	rialsC	ontractor	Inspector								

Form 820917 11-94



Office of Materials PLANT CALIBRATION REPORT

haded area to be completed for paving plants Contractor/Producer	and when applicable for	or ready mixed concrete plant County	s.	
Plant Location		Project		
			25 CALL	
Class of Concrete		Mix No.(s)		
Design W/C Ratio(s)		Max W/C Ratio(s)		
MATERIAL	SOURCE Producer Name & Loc	ation	SPECIFIC GRAVITY	DRY BATCH MASS
Aggregate (Coarse)				
Aggregate (Find)				
Cement				
Fly Ash		-		
Water			·····	
Air Entraining Agent				
All Cittaining Agent				
0				
Curing Compound				
Curing Compound Water Reducing Agent				
Water Reducing Agent . Retarding Admixture	Title		Da	te:
Water Reducing Agent Retarding Admixture				te:
Water Reducing Agent Retarding Admixture Calibrated by: Coarse Aggregate Sampling Point:				te:
Water Reducing Agent Retarding Admixture calibrated by: coarse Aggregate Sampling Point:				te:
Water Reducing Agent Retarding Admixture calibrated by: coarse Aggregate Sampling Point:				te:
Water Reducing Agent Retarding Admixture Calibrated by: Coarse Aggregate Sampling Point:				te:
Water Reducing Agent				te:
Water Reducing Agent Retarding Admixture Salibrated by: Coarse Aggregate Sampling Point: Semarks:				te:
Water Reducing Agent Retarding Admixture alibrated by: oarse Aggregate Sampling Point: emarks:	cing, and retarding adm	ixtures is required prior to us	e.	te:
Water Reducing Agent Retarding Admixture Calibrated by: Coarse Aggregate Sampling Point:	cing, and retarding adm stor/Producer as set ant operations. The		e.	te:

Matls. IM 527 Appendix D

PORTLAND CEMENT & READY MIX PLANT CALIBRATION CHECKLIST

References: IM 527, 528 and noted Specifications

STORAGE & HANDLING OF MATERIALS

Aggregates: 2301.02

- Certified compliance
- Separation of materials
- Storage area floor shall be a minimum of 18" of similar material
- Fine aggregates shall drain a minimum of 24 hours on new bridge deck floors-2412.02

Cementitious Material: 2301.02

- Approved certified sources
- No intermingling of products or sources
- Stored in suitable weather proof enclosures

WATER

Sample when required

<u>ADMIXTURES</u>

- Verify acceptance of lot
- Circulate 5 min. per 100 gal. of solution
- Proper storage to prevent freezing

PLANT REQUIREMENTS

Safety:

- Guards, ladders, railings and walkways
- Sampling location
- Proper template if belt sample
- Safety switches and belt lockouts in place
- Bins are structurally safe: <u>2001.06</u>
- Settlement of footings is uniform
- Suitable wind protection for scale operation
- Automatic interlocks for projects over 6000 sq. yds: <u>2001.20</u> & <u>2301.13</u>
- Weight indicator or digital readouts are in full view of the plant operator.

Scale Calibration: 2001.20

Calibration of batch plant scales as required by the specifications is performed by incrementally loading the scales with standard test weights and partial batches through the operating range of the scales. As each increment of load is applied, the actual observed weight and the required weight are compared. The differences plus or minus, are determined and converted to percentages of the required weight. If the percentage deviations are less than the tolerance allowed by the specifications and the scales are sensitive to the test loads, the scales will be considered in calibration. If the scales do not meet the various requirements, the contractor should be notified immediately and required to make the necessary repairs or adjustments. The engineer may order recalibration if the scale equipment malfunctions, material quantities do not agree with actual material quantities, or any repairs or replacement of equipment occurs.

- Calibrate scales to include the maximum weight for projected batches
- Commercially manufactured weights that have the weight stamped on the exterior and appear to be unaltered and in good condition may be assumed to meet the requirements of ASTM E617.
- Non-commercially manufactured test weights may be used in providing accumulating weight
 for loading the scales, if validated against commercially manufactured test weights, or a
 certified scale, a minimum of once every two years. Some manufactured weights may vary
 and require more frequent validation.

Example: Aggregate Scale Calibration.

Aggregate Scale 1 (0.5% tolerance)		Date Calibrated:	3/9/23 Grads		20		
Weight	Material Weight	Total	Scale Reading	Error (%)	Return Reading	Return Error (%)	Compliance
2000	0	2000	2000	0.00%	0	0.00%	Yes
4000	0	4000	4000	0.00%	0	0.00%	Yes
4000	4080	8080	8060	-0.25%	4080	0.00%	Yes
4000	8080	12080	12060	-0.17%	8080	0.00%	Yes
4000	16400	20400	20380	-0.10%	16420	0.10%	Yes
4000	22320	26320	26280	-0.15%	22320	0.00%	Yes
4000	27980	31980	31940	-0.13%	27980	0.00%	Yes
						0.00%	

As a guide, a working form to help record field calibration measurements is on page 4. Certified scale company reports may be used or use District Materials Engineer Excel spreadsheets.

Water Calibration: 2001.20B

- Equipment shall be such that accuracy will not be affected by variations in pressure of the water supply.
- Weighing equipment to verify water calibration shall meet specification
- Repairs or adjustments will require equipment to be recalibrated.

Equipment for Dispensing Liquid Admixtures: 2001.20C

- Calibrate per Specification
- Measuring container of digital readout shall be on view of plant operator.

Truck Mixer & Agitator: 2001.21B

- Meet the requirements of specification
- Truck mixer certification (Form #820907) kept in truck and is up to date.

CONCRETE PLANT CALIBRATION WORKSHEET

DATE				_	PAVIN	IG PLANT	
LOCATION				_	READ	Y MIX PLAN	١T
	CEMEN	NT SCALE -	ACCURATE	E TO 0.5% C	F BATCH W	/EIGHT	
		EMPTY D.1% OF BA		JLL T OR 2 LBS	LBS. @	'ER IS GRE	LBS. ATER
	applied weight	scale reading	Error, %	applied weight	scale reading	Error, %	

AGGREGATE SCALE – ACCURATE TO 0.5% OF BATCH WEIGHT SENSITIVITY – EMPTY _____ FULL ___ LBS. @ ____ LBS. TOLERANCE – 0.1% OF BATCH WEIGHT OR 2 LBS., WHICHEVER IS GREATER

applied weight	scale reading	Error, %	applied weight	scale reading	Error, %

WATER-ACCURATE TO +/-1.0% OR 2 LBS., WHICHEVER IS GREATER

ADMIXTURES-ACCURATE TO +/-3.0% OF QUANTITY REQUIRED

met	ered	scale			ea meas.	water r meter	educer meas.	Reta meter	
gal.	lbs.	reading	Error. %	OZ.	OZ.	OZ.	OZ.	OZ.	OZ.
			_						

Chapter 17 IM 528 STRUCTURAL PLANT INSPECTION

Matls, IM 528

READY MIX CONCRETE PLANT INSPECTION

GENERAL

Refer to IM 527 (General, Safety).

The following instruction is to be used when inspecting the operation of a ready mix concrete plant typically used for structural concrete, patching, and other concrete items. Refer to IM 527 for sampling and testing for paving.

EQUIPMENT

1. ELEVATED, LOW PROFILE, AND GROUND-LEVEL BINS

Refer to <u>IM 527</u> (Equipment Bins) and the following:

Permanent ready mix concrete plants often have facilities for storing sizable quantities of a number of different aggregates. There is a tendency for the stockpiles to become too large for the available area and for the bins to be filled beyond their normal capacity. Aggregates thus tend to become intermingled. Aggregates may also become contaminated with foreign material from a number of sources, including the material, which underlies some stockpiles, if proper care is not taken. Materials, which have been intermingled or otherwise contaminated, must not be incorporated into the work.

2. PROPORTIONING EQUIPMENT

Requirements for scales or meters for proportioning aggregates, cement, fly ash, water or air entraining agents or other admixtures are found in Article 2001.20 of the Standard Specifications, as modified by Supplemental Specifications. These requirements are in addition to Section 1 above for elevated bins.

It is the duty of the District Materials Engineer to examine and evaluate all proportioning and plant equipment annually, and maintain a current list of approved ready mix concrete plants. The Calibration Report, Form #820917, with any appropriate restrictions, conditions, comments, etc., will be posted at the plant site. (See M 527, Appendix C for a sample copy and Appendix D for calibration checklist.) Before concrete work begins on a project, the Project Engineer must communicate with the District Office and determine that the plant to be used has received annual approval.

The PCC Level II certified technician must be familiar with all features of the plant operation before work begins. While the inspector must not personally make any of the manipulations or adjustments, an understanding of the basic machinery operation and the ability to recognize the significance of a malfunction is important.

The proportioning equipment must be examined at regular intervals during a placement for correctness of the amount being delivered and for possible damage or malfunction. Special attention must be given to the empty balance and the position of the poise weights for beam and dial scales.

The normal plant operation causes vibration, which tends to change these adjustments. Accumulation of material clinging to the inside of the hoppers can also cause these adjustments to drift. Small amounts of material accumulation clinging to the inside of a hopper are not considered objectionable. If the amount exceeds one percent of the material batch, however, it must be removed and readjusted to indicate a zero load within 0.5% (<u>Article 2001.20</u>).

The scale sensitivity shall be checked at least at the beginning of a placement if operations are intermittent, and at the beginning of each day if the operations are continuous in the following manner:

Place a weight equal to 1/10 percent of the batch on the fully-loaded scales while observing the movement of the indicator.

A properly sensitive scale will exhibit a visible indicator movement when tested in this manner. If no indicator movement is visible and immediate corrective action by the owner does not yield successful results, the District Materials Engineer must be informed.

Periodic observation of the measuring operation must be made to determine that the proper amounts of materials are being delivered to the concrete batch. The plant inspector must be able to recognize when the hopper is overloaded or underloaded by one percent of the batch. For a dial scale, these limits are readily recognizable on the graduated dial chart. For scales with a balance indicator, the location of the indicator hand when a one percent over and underload is applied and removed can be noted before work begins.

If an examination reveals that the scales are not properly sensitized or the proper amounts of material are not being furnished to the concrete batch, refer to <u>IM 527</u>, General, for the necessary action.

Document all routine scale sensitivity, delivery tolerance checks and any necessary corrective action taken, in the plant inspection diary.

The following procedure is required for setting or adjusting the various items of proportioning equipment so that they will deliver the proper amount of material to the batch:

- The plant superintendent or other authorized operator representative must make all necessary scale and equipment setting and/or adjustments. The PCC Level II certified technician is specifically directed not to participate in this activity.
- Before the plant operation begins or resumes, the PCC Level II certified technician will
 independently determine that the settings and/or adjustments are correct and that the
 amounts of material being delivered to the batch are correct. Errors must be corrected
 immediately. Strict adherence to the above procedure is necessary to maintain a proper
 division of authority and responsibility between the contractor and the contracting authority,
 and to minimize the possibility of operating with erroneous proportions.

Suitable wind protection on all sides of the scales is required by the specification. This protection, if not provided by the plant design, can be fabricated from burlap, plywood or other suitable material and should provide adequate room for the scale operator to work unobstructed.

An air-entraining admixture is required for all structural concrete, except Class X, and can be proportioned either manually or automatically. Mechanical dispensers must have a transparent measuring chamber so that each batch can be observed as it is measured and dispensed. Mechanical dispensers must be cleaned daily to minimize the possibility of deposits accumulating and causing a malfunction.

The amount of air entraining admixture required is determined by the results of the pressure meter air tests run on the plastic concrete, as described in <u>IM 318</u>. The contractor must decide the quantity to be used and the adjustments necessary, if any, after the pressure meter testing has been completed. Provision shall be made for agitation of the air-entraining agent. (See <u>Article 4103.01, A</u>)

An admixture for set retardation may be required. The list of approved retarding admixtures, and recommended dosages, is found in <u>IM 403</u>. An admixture for water reduction may be used at the contractor's option in mixes so designated in <u>IM 529</u>. (See <u>Article 2301.02</u>, <u>B</u>.)

See IM 527 (Materials, Admixtures), regarding dosage, handling and storage of admixtures.

Most air entraining and retarding admixtures, when intermingled with each other tend to neutralize each other and negate the effects of each. Care must therefore, be taken to introduce each admixture into the mixer separately and allow the first to become intermingled into the batch before the second is introduced. A procedure, which has been used successfully, is to introduce the air-entraining agent first along with most of the mixing water and other ingredients, and after these have become intermingled then introduce the balance of the mixing water and the retardant admixture.

3. MIXING EQUIPMENT

Mixing equipment for structural projects will be one of the following types:

Truck-mounted transit mixers
Stationary central mixers with in-transit agitation
Stationary mixers located at the project site
Concrete-Mobiles

The truck-mounted transit mixers are the most popular with stationary, central mixers increasing in popularity. Stationary site mixers are seldom used.

Refer to <u>IM 527</u> (Mixing Equipment) for inspection instructions relating to stationary central mixers and truck-mounted transit mixers, and <u>IM 534</u> for Concrete-Mobiles.

Transit mixers must carry a current certification signed by a responsible company representative stating that the mixer condition has been examined during the previous 30 days, is free of hardened concrete, and is in proper working condition. Mixers not carrying the required certification must not be used.

MATERIAL

Refer to IM 527 (Material) for the necessary inspection instructions relating to material identification.

handling and storage.

OTHER ADMIXTURES (See Article 2403.02, B, 4)

Certain structural placements with congested steel and narrow forms may require higher slump to place the concrete. The Engineer may approve the use of a high range water reducer with standard mixes in accordance with <u>IM 529</u>. If a highly flowable mix is needed for the placement, the Engineer may approve the use self-consolidating concrete (SCC) in accordance with <u>IM 529 Appendix A</u>.

Conditions on the project may require a retarding admixture due to long delivery times, etc. With the Engineer's approval, the mixed to placed time period may be extended an additional 30 minutes when using a retarding admixture at the prescribed rate in <u>IM 403</u>. If longer times are required, the dosage rate will be based on manufacturers recommendation with Engineers approval.

BATCHING

A PCC Level II certified technician may also act as a batch person for the following items only:

- Non-structural items less than 100 cubic yards per day
- Miscellaneous items
- Night work patching
- Structural concrete items, 50 cubic yards or less, produced per day.

A PCC Level II certified technician shall perform required plant inspection duties prior to start up and a minimum of once per lot. A PCC Level II certified technician responsible for quality control shall be available by cell phone.

SAMPLING & TESTING

Quality Control

1. AGGREGATES

Refer to IM 527 (Sampling & Testing) for related inspection instructions.

Personnel performing aggregate testing shall be Aggregate certified. The PCC Level II certified technician may direct this person performing the testing. The minimum frequencies for testing aggregates for structural concrete are as follows:

Specific Gravity - One sample for both coarse and fine aggregate as described in the table, unless the first two tests indicate variations greater than 0.02 from the tabular value <u>T203</u>, Aggregate Source Information, or from one test to the next. If the above variations are greater than 0.02, inform the Project Engineer and the District Materials Engineer immediately. The District Materials Engineer may adjust the specific gravity used to determine batch weights.

Moisture - One sample for each aggregate as described in the table. If a system with instantaneous moisture content measurement equipment is used to automatically adjust individual batch weights, see section titled Sampling & Testing/Moisture in IM 527 for instructions on approval, use, and monitoring of the system. Frequency shall be increased if stockpile changes occur. When specific gravity is not tested, moisture content may be

determined by the mass (weight) difference method (IM 308 Method B).

Gradation - One sample for each aggregate per lot.

For structural concrete, a quality control lot shall consist of one week. If 50 cubic yards or less are produced in one calendar week, testing may be grouped with previous or subsequent lot, or 1 per two weeks. A bridge deck is considered a lot.

For non-structural concrete items as described below, a quality control lot shall be one per month. Testing and sampling for non-structural concrete is based on that being the only concrete being produced. If structural or paving concrete is being produced, no additional gradation sampling and testing is required for non-structural concrete produced from the same plant, since the sampling and testing frequency for structural and paving concrete is greater. If multiple projects are being supplied by the plant, one representative sample for the lot covers quality control sampling and testing for all of the projects.

Miscellaneous concrete and structural or non-structural concrete bid items supplied at 10 cubic yards or less for a project will be accepted without gradation testing. A gradation test for flowable mortar, revetment grout, or fabric formed revetment grout is required for the mix design only. The PCC Level II certified technician shall provide, for these bid items, materials certifications, batch tickets, and plant reports with the following statement on the PCC Plant report (Form 800240):

"The PCC mix contains certified materials, approved aggregates, and was produced in compliance with applicable specifications."

For projects requiring certified plant inspection, the certified inspector will obtain and test one gradation sample per lot, unless operations are prematurely shut down.

Quality Control Sampling, Testing, and Reporting

PRODUCTION	Specific Gravity	Moisture	Gradation	Report
Structural	1/first week, monthly thereafter or 1/two weeks thereafter for DWU sources	2/week or 1/deck	1/deck, or 1/week If <50 yd ³ produced in week 1/two weeks	1/week or 1/deck
Non-Structural	1/month	1/two weeks	1/month	1/week
Miscellaneous	N/A	N/A	N/A	1/project

Verification

The engineer will perform verification sampling and testing at the minimum frequency described in the table for each aggregate. <u>IM 205</u> describes the agency responsibility to randomly select sample location and time, and witness sampling with the contractor providing assistance in obtaining the samples. For production of less than 50 cubic yards of structural concrete per week, verification sampling will be grouped with the previous or subsequent

week, or 1 per two weeks. The engineer will split samples obtained with the plant inspector, or observe splitting by the plant inspector, and immediately take possession of the agency sample. Report test results to producer in a timely manner.

Testing and sampling for non-structural concrete is based on that being the only concrete being produced. If structural or paving concrete is being produced, no additional gradation sampling and testing is required for non-structural concrete produced from the same plant, since the sampling and testing frequency for structural and paving concrete is greater. If multiple projects are being supplied by the plant, one representative gradation sample for the lot covers sampling and testing for all of the projects.

Verification Sampling and Testing

PRODUCTION	Gradation Sampling	Gradation Testing
Structural Concrete	1/deck, or 1/week If <50 yd³ produced in a week 1/two weeks	First week, then 20% of samples obtained or 1/deck
Non-Structural	1/project	1/project
Miscellaneous	N/A	N/A

Non-structural and Miscellaneous Concrete

The following Items of work are designated as non-structural and miscellaneous concrete. Other items may be designated by the Engineer as non-structural or miscellaneous concrete, for gradation sampling and testing, provided they are not structurally critical items that could directly affect the safety of the travelling public.

Non-structural Concrete

Article	Work Type
<u>2201</u>	PCC Base
<u>2212</u>	Base Repair
<u>2213</u>	Base Widening
<u>2405</u>	Seal course
<u>2415</u>	Curtain wall
<u>2511</u>	Sidewalks
<u>2511</u>	Trails
<u>2512</u>	Curb & Gutter
<u>2515</u>	Driveways
<u>2517</u>	Railroad Approach Sections
<u>2529</u>	Patching (Full Depth), Rumble Strips
<u>2530</u>	Patching (Partial Depth)

Miscellaneous Concrete

Article	Work Type
<u>2304</u>	Detour Pavement

<u>2416</u>	Pipe collars
2435	Sanitary & Storm Sewer Structures
<u>2503</u>	Catch basins, abandonment, collars
<u>2506</u>	Flowable Mortar
<u>2507</u>	Revetment Grout or
	Fabric Formed Revetment Grout
<u>2519</u>	Fence construction
<u>2524</u>	Type A and B signs
<u>2554</u>	Thrust Blocks

Test air at the minimum rate for structural concrete or at least once daily for concrete exposed to freezing and thawing.

Non Complying Gradation

When a quality control gradation test does not comply with the gradation requirements of <u>Article 4109</u>, the certified plant inspector shall contact the Engineer. After corrections have been made, the Engineer will obtain and test another verification sample.

When a verification gradation test does not comply with the gradation requirements of Article 4109, the Engineer will contact the contractor, producer and the District Materials Engineer. The District Materials Engineer may investigate sampling and testing procedures, stockpiling, source material, etc. After corrections have been made, the Engineer will obtain and test another verification sample.

Acceptance of lots will be based on complying verification test results. The engineer will retain all samples representing the lots until the lots have been accepted. Since the contracting authority tests are verification, correlation with IM 216 is not required, but may be performed as a check of sampling and testing procedures.

2. WATER/CEMENT RATIO

Whenever the water demand, to achieve the desired workability, exceeds the design water/cement ratio and approaches the maximum water allowed the Project Engineer and the District Materials Engineer Office should be notified. At the same time, aggregate moisture contents, batch amounts, cement scales, water meter, etc., should all be immediately checked. In no circumstance should the maximum water/cement ratio be knowingly exceeded.

If, after the District Materials Engineer investigation and evaluation, additional workability above that which is attainable within the maximum permissible water content is desired, the cement content may be increased in accordance with Article 2403.02, B. This should be done only with the approval of the District Materials Engineer or the engineer representative. The District Materials Engineer will provide the revised and adjusted mix proportions for these situations.

Also, in accordance with <u>Article 2403.02</u>, <u>B</u>, the engineer may authorize the use of a water-reducing admixture to improve workability. When authorized, only the water-reducing admixtures and dosage rates, as shown in IM 403 should be used.

When calcium chloride solution is added for patching M mix, water included in the calcium chloride solution should not be included in calculation of water-to-cement ratio.

3. STRENGTH TESTS

The test for Modulus of Rupture is the only strength test determined in the field. Test specimens are required for each day's placement of a structural unit in flexure.

Meet the requirements of <u>2403</u> for flexural beam strength. Contract requirements may also require cylinders for compressive strength.

Test the flexural specimens as prescribed in <u>IM 316</u>, Flexural Strength of Concrete. Testing will be done by contract authority personnel. <u>IM 204</u> lists minimum testing requirements.

PROPORTIONS

Refer to IM 527 (Proportions)

REPORTS & REPORTING

1. PCC PLANT PAGE - FORM #240

The same form is to be used for PCC Paving and PCC Structures. Refer to <u>IM 527</u> for instructions on completing the form and an example form.

Structural Reports are to be recorded in the computer program provided by the lowa Department of Transportation. A separate, consecutively numbered, report is to be made for each project as required in the Quality Control Sampling, Testing, and Reporting table. A copy of the completed PCC Plant Page shall be submitted to Doc Express within four hours on the next working day after the end of the lot. If not submitted to Doc Express, use electronic mail as the method of delivery unless otherwise approved by the Engineer. When supplying multiple projects, one quality control gradation may be reported on all test reports.

The PCC Level II certified technician shall keep a copy of the PCC Plant Page and send the original to the Project Engineer. At the end of the project, submit a copy of the plant book to Doc Express, within ten days.

Report non-structural and miscellaneous concrete as required in the Quality Control Sampling, Testing, and Reporting table.

2. READY MIXED CONCRETE, TRUCK TICKET FORM - FORM #830212

Each truckload of concrete must be identified by Form #830212 or an acceptable computer-generated plant ticket. If available, computer generated batch tickets shall be used. Computer generated batch tickets shall include wet and dry batch weights and information on Form #830212. Any information unable to be printed by the computer will be written on the computer generated batch ticket. See MM 527. The Engineer and District Materials Engineer will approve any variations to accepting the truck ticket form or computer generated form. With electronic ticketing, do not use printed or paper batch tickets.

When a paper Form #830212 is used, A a PCC Level II certified individual must verify and sign all truck ticket forms to ensure accuracy. The PCC Level II certified person may assign

any personnel to complete portions of the form, such as time and water additions, however, only the PCC Level II certified person is authorized to pre-sign verify the ticket, if not present when the concrete is batched. The certified individual remains accountable for the correctness of all information on the batch ticket.

3. PORTLAND CEMENT CONCRETE BATCH PROPORTIONS - FORM #820150

Submit the batch proportions report #820150 to the Engineer or Doc Express for review. For standard mix designs, do not delay work if not submitted prior to placement.

Chapter 18 IM 529 PCC PROPORTIONS



PORTLAND CEMENT (PC) CONCRETE PROPORTIONS

GENERAL

Materials for pavement concrete and structural concrete shall be mixed in any one of the following proportions for the class of concrete specified. Each mixture will have specific requirements for the coarse and fine aggregates and the type of cement. Concrete mix proportions include the unit volumes of all materials.

Mix numbers designate numerous aspects of the particular mix. The following is an explanation of the various aspects of the mix number:

- The first letter designates the class of concrete as designated in the contract documents.
- In certain mix designations, the letter V or L appears after the first hyphen. This indicates either Class V or Class L aggregate is to be used. If no letter is shown, aggregate other than Class V or Class L shall be used.
- The number indicates the relationship of coarse aggregate to fine aggregate. A mix with a 4 is a 50/50 mix. The following chart shows the number within the mix number and the proportions of the aggregates for each number:
 - 2 is composed of 40% fine and 60% coarse
 - 3 is composed of 45% fine and 55% coarse
 - 4 is composed of 50% fine and 50% coarse
 - 5 is composed of 55% fine and 45% coarse
 - 6 is composed of 60% fine and 40% coarse
 - 7 is composed of 65% fine and 35% coarse
 - 8 is composed of 70% fine and 30% coarse
 - is composed of 50% fine and 50% coarse
 - 57-6 is composed of 60% fine and 40% coarse
- The letters WR indicate water reducer is used in this mixture.
- When a C or an F is shown toward the end of the mix number, fly ash is a part of the mixture and C-fly ash or an F-fly ash, respectively, is used. The percentage of fly ash being used in the mixture shall be designated at the end of the mix number.
- When used as a mineral admixture, Ground Granulated Blast Furnace Slag (GGBFS) shall be designated through the letter "S," followed by the percent substitution, and shown at the end of the mix number. This would be in the same convention used for fly ash substitution. When GGBFS is a portion of a blended cement, the cement type will be designated as IS, but special notation will not be made in the mix number.
- The following example illustrates a mix number showing a Class C concrete mixture, 50/50 aggregate proportions, using Class L aggregate, water reducer, and 35% GGBFS substitution.

Example: C - L 4 W R - S35

The following example illustrates a mix number showing a Class C concrete mixture, 50/50 aggregate proportions, using water reducer and a Class C fly ash substitution at a rate of 10%.

Example: C - 4 W R - C10

The following example illustrates a mix number showing a Class C concrete mixture, 50/50 aggregate proportions, using a water reducer, Class C fly ash substitution at 20%, and GGBFS substitution at 20%.

Example: C - 4 W R - C20-S20

The Class D mixtures and the Class V mixtures vary somewhat from the above pattern but follow the general format.

MIX REQUIREMENTS

General requirements for the mixes are:

- Fly Ash and GGBFS used in concrete mixtures shall meet the requirements of <u>Section 4108</u>.
 Fly Ashes for use in concrete mixtures shall be included on the list of approved sources (Materials <u>IM 491.17</u>). GGBFS for use in concrete mixtures shall be included on the list of approved sources (Materials <u>IM 491.14</u>).
- 2. A water-reducing admixture shall be used in concrete mixtures with the designation as follows: Those mixtures have mixture numbers which have the letters "WR" following a single digit number, all following the first hyphen in the mixture number. These mixtures have reduced cementitious contents to produce concrete of approximately equal strength compared with other mixtures in a particular class of concrete. A water-reducing admixture may be added to other concrete mixtures, without cement reduction, to aid in workability and air entrainment. Other admixture combinations may be approved based on manufactures recommendations.

The water-reducing admixture shall meet the requirements of <u>Section 4103</u> and shall be included on the list of Approved Sources of Water Reducing Admixtures (<u>Materials IM 403</u>, <u>Appendix C</u>) or High Range Water reducing (Materials IM 403, Appendix D). The dosage rates are described in <u>IM 403</u>.

- 3. The total quantity of water in the concrete, including water in the aggregate, shall not exceed the maximum water to cement and fly ash ratio.
- 4. Type II, Type III, Type IP, and Type IS Cement shall be used as provided for in the specifications. All cement shall be from an approved source as per <u>IM 401</u>. The cement type shall be documented on all reports pertaining to a project.
- 5. The fine aggregates other than Class V (<u>Section 4117</u>) and Class L (<u>Section 4111</u>) shall meet the requirements of <u>Section 4110</u> of the current specifications. The coarse aggregates for mixtures using aggregates, other than Class V aggregates, shall meet the requirements of <u>Articles 4115.01</u> through <u>4115.04</u> of the current specifications. The coarse aggregates for Class O or Class HPC-O concrete mixtures shall meet the requirements of <u>4115.05</u> of the current specifications, for overlays (<u>Article 2413</u>). Intermediate aggregates used for QMC, BR, or HPC-D mixes shall meet 4112.
- 6. When approved by the Engineer, combined fine and coarse aggregate may be used in combination with screened coarse aggregate to produce proportions specified for Class D and Class X concrete mixtures according to the percentage of particles passing the No. 4 sieve in

the combined aggregate at the time the material is used.

- 7. With Engineer approval, proportions designated for mixtures A-V or C-V with and without fly ash may be substituted for Class X concrete.
- 8. With Engineer approval, Class M concrete may be substituted for Class A or Class C concrete.
- 9. Certain structural placements with congested steel and narrow forms may require higher slump to place the concrete. The Engineer may approve the use of a high range water reducer with standard mixes. When a high range water reducer is used, the allowable slump may be increased to a target range of 1 to 7 inches, with a maximum of 8 inches. If highly flowable concrete is needed for the placement, the Engineer may approve the use self-consolidating concrete (SCC) in accordance with Appendix A.

A-MIX

A-Mixes are specified primarily as paving mixes. They have a lower cement content and lower ultimate strength when compared to a Class C-Mix. A-Mix may be used on lower traffic roadways or detour pavement.

C-MIX

C-Mixes are specified for use in both paving and structures. The C-WR mixes are typically used in paving and bridge decks. Class C mixes are typically used in box culverts, bridge piers, bridge abutments, and other miscellaneous placements. When Class C is specified, any mix beginning with the letter C may be utilized.

D-MIX

D-Mixes are specified for use primarily in structures. A typical use includes drilled shafts.

M-MIX

M-Mixes are designed for high early strength, suitable for many applications for which they are allowed. Calcium chloride should only be used when needed, for patching and other placements without steel reinforcement. Do not include water in calcium chloride solution when calculating water cement ratio.

O-MIX

O-Mixes are specified for low slump concrete, primarily for use in bridge deck overlays. The water-cement ratio is intended to be controlled by the slump specified elsewhere for concrete where these mixtures are used. A water-reducing agent is required for this mix, as described in IM 403. O-Mixes require coarse aggregate specifically intended for repair and overlay. See Article 4115.05. HPC-O is also used in bridge deck overlays. The HPC-O mix requires the use of slag or blended cements. Fly ash replacement up to a maximum of 20%. The maximum water-cement ratio is 0.42 (basic of 0.39).

X-MIX

X-Mixes are specified to be used as seal course concrete, primarily in cofferdams. No air

entraining is required. No maximum water-cementitious ratio is specified. See <u>Article 2405.05</u> for limits on water usage.

QMC

Contractor-designed aggregate proportioning mixes for paving. Minimum absolute volume of cement is 0.106. Basic water-cement ratio is 0.40. Maximum water-cement ratio is 0.435.

BR

BR mixes are used in slip form barrier rail in accordance with <u>Section 2513</u>. Determine aggregate proportions based on production gradations. Unless major changes occur to aggregate gradations, utilize aggregate proportions determined and assess gradation of individual aggregates during concrete production. The minimum absolute volume of cement is 0.114. Maximum water-cement ratio is 0.45.

HPC

HPC mixes are used in bridge substructures and decks to achieve low permeability and higher compressive strength. HPC mixes require the use of slag or blended cements. For specification compliance, Type IL with a minimum of 25% slag replacement will be considered the same as Type IS cement and Type IL with a minimum of 25% Class F replacement will be considered the same as Type IP cement. Additional Ffly ash replacement up to a maximum of 20% Class C or F for Type IL or IS and Class C for Type IP or IT. Maximum water-cement ratio is 0.42 0.435 (basic of 0.40) for decks and 0.45 (basic of 0.42) for substructures. Aggregate proportioning is required for HPC-D mixes with an absolute volume of cement of 0.118.

MCM

Mass Concrete Mix (MCM) mixes are used for mass concrete placements. MCM Mixes may utilize higher replacement rates of slag. Minimum absolute volume of cement is 0.106. Basic water-cement ratio is 0.40. Maximum water-cement ratio is 0.45.

CLASS V

Class V is an aggregate classification, specified in <u>Section 4116</u>. The fine limestone aggregates in concrete mixes using Class V aggregate with/without fly ash shall meet the requirements of <u>Article 4116.03</u> of the current specifications. Allowable cements and substitutions shall meet the requirements of <u>Article 4116.05</u>. This material may be used in various concrete mixes, including HPC mixes. The mixes utilizing this material will be designated with a Roman numeral V, in the Mix Number.

SUDAS CONCRETE MIXTURES

Class C-SUD and CV-SUD mixes are utilized on SUDAS projects where higher durability is desired to reduce joint deterioration due to deicing chemicals. These mixes are designed with a lower water to cement ratio of 0.42 maximum (basic w/c 0.40) to reduce permeability.

QMC and C-SUD mixes are designed for slipform paving with a very low w/c ratio. For handwork, a C-3WR or C-4WR mix is recommended.

FLY ASH & GGBFS SUBSTITUTION

At Contractor option, fly ash or GGBFS may be substituted for a portion of the cement in concrete mixes, within the limitations set forth in the appropriate Article for each type of placement. <u>IM 527</u> gives instructions on how to determine the proper batch proportions in a mix.

When fly ash or GGBFS is substituted for the cement, the replacement shall be on a pound-for-pound basis. Tables 1, 2, and 3 define concrete mixes with no substitution. These mixes shall be used as the basis for determining the final batch proportions and shall be adjusted accordingly. The change in volume resulting from the substitution shall be determined and an adjustment in both coarse and fine aggregate proportions shall be determined in order to ensure a unit volume. The change in aggregate proportions shall be in the same ratio as that of the specific mix. In those cases where the cement content is increased, relative to the standard design mix, the mix proportions shall be adjusted and a change in the aggregate content shall be determined, as described above.

When both fly ash and GGBFS are substituted for the cement in ready-mixed concrete, the replacement shall be on a pound-for-pound basis and shall be substituted as shown in the following example.

Example: C-3WR-C20-S20

Absolute Volume Cement = 0.108

Cement = 0.108 X 62.4 X 27 X 3.14 = 571 lbs. per cubic yard

Fly ash substitution 20% = 571 X 0.20 = 114 lbs. per cubic yard

Slag substitution 20% = 571 X 0.20 = 114 lbs. per cubic yard

Type IP, Type IS, Type IL, and Type IT cements shall be considered cement with regard to substitution of fly ash. Refer to appropriate Article for limitations. A Type IS(25) cement with a 20% fly ash replacement is equivalent to a 40% weight replacement of Portland cement.

Example: C-3WR-C20 using Type IS(20) cement

Absolute Volume Cement = 0.108

Cement = 0.108 X 62.4 X 27 X 3.10 = 564 lbs. per cubic yard

Fly ash substitution 20% = 564 X 0.20 = 113 lbs. per cubic yard

Weight of cement = 564 - 113 = 451 lbs. per cubic yard

Type IS(20) cement contains Portland cement and slag

451 x 0.80 = 361 lbs. Portland cement 451 X 0.20 = 90 lbs. slag

Total replacement of Portland cement

 $((113 + 90) / 564) \times 100 = 36\%$

Example: C-3WR-C10-S20 using Type IL cement

Absolute Volume Cement = 0.108

Cement = 0.108 X 62.4 X 27 X 3.11 = 566 lbs. per cubic yard

Fly ash substitution 10% = 566 X 0.10 = 57 lbs. per cubic yard

Slag substitution 20% = 566 X 0.20 = 113 lbs. per cubic yard

Weight of cement = 566 - 57 - 113 = 396 lbs. per cubic yard

Type IL(10) cement contains Portland cement and inter-ground limestone

 $396 \times 0.90 = 356 \text{ lbs.}$ Portland cement $396 \times 0.10 = 40 \text{ lbs.}$ inter-ground limestone

Total replacement of Portland cement $((57 + 113 + 40) / 566) \times 100 = 37\%$

CARBONCURE PORTLAND CEMENT REDUCTION

Producers that are using CarbonCure or other carbon sequestration admixtures and have been approved for Portland cement reduction following the approval process in M. 403 are eligible to reduce Portland cement content by up to 3 percent. The reduction is for Portland cement only and is determined after substitutions of fly ash and GGBFS have occurred. Blended cements will be considered cement when determining Portland cement reductions. The reduced Portland cement content should be used when calculating total replacement of Portland cement.

<u>Example: C-3WR-C20 using Type IL(10) cement and CarbonCure with a 3 percent Portland cement reduction</u>

Absolute Volume Cement = 0.108

Cement = 0.108 X 62.4 X 27 X 3.11 = 566 lbs. per cubic yard

Fly ash substitution 20% = 566 X 0.20 = 113 lbs. per cubic yard

Weight of cement = 566 - 113 = 453 lbs. per cubic yard

3 percent Portland cement reduction = 0.03 X 453 = 14 lbs. per cubic yard

Weight of cement = 453 - 14 = 439 lbs. per cubic yard

Type IL(10) cement contains Portland cement and inter-ground limestone

439 X 0.90 = 395 lbs. Portland cement 439 X 0.10 = 44 lbs. inter-ground limestone

Adjusted original cement weight = 566 - 14 = 552 lbs. per cubic yard

Total replacement of Portland cement ((113 + 44) / 552) X 100 = 28%

Proportion Table 1 Concrete Mixes

Using Article 4110 and 4115 Aggregates

	Basic Absolute	Volumes of Ma	aterials Per Uni	t Volume of Co	ncrete		
A MIXES	Basic w/c = 0	.474 Max v	v/c = 0.532				
Mix No.	Cement	Water	Air	Fine	Coarse		
A-2	0.101	0.150	0.060	0.276	0.413		
A-3	0.104	0.155	0.060	0.306	0.375		
A-4	0.108	0.161	0.060	0.335	0.336		
A-5	0.111	0.165	0.060	0.365	0.299		
A-6	0.115	0.171	0.060	0.392	0.262		
BR MIXE	S Basic w/	c = 0.400 N	lax w/c = 0.450)			
Mix No. Cement Water Air Fine Coarse							
BR	0.114	0.143	0.060	*	*		
	Basic w/c = 0	.430 Max v	v/c = 0.488				
Mix No.	Cement	Water	Air	Fine	Coarse		
C-2	0.110	0.149	0.060	0.272	0.409		
C-3	0.114	0.154	0.060	0.302	0.370		
C-4	0.118	0.159	0.060	0.331	0.332		
C-5	0.123	0.166	0.060	0.358	0.293		
C-6	0.128	0.173	0.060	0.383	0.256		
C-WR MIXES Basic w/c = 0.430 Max w/c = 0.450							
Mix No.	Cement	Water	Air	Fine	Coarse		
C-3WR	0.108	0.146	0.060	0.309	0.377		
C-4WR	0.112	0.151	0.060	0.338	0.339		
C-5WR	0.117	0.158	0.060	0.366	0.299		
C-6WR	0.121	0.163	0.060	0.394	0.262		
D MIXES	Basic w/c = 0	.423 Max v	v/c = 0.450				
Mix No.	Cement	Water	Air	Fine	Coarse		
D-57	0.134	0.178	0.060	0.314	0.314		
D-57-6	0.134	0.178	0.060	0.377	0.251		
M MIXES	Basic w/c = 0	.328 Max v	v/c = 0.400				
Mix No.	Cement	Water	Air	Fine	Coarse		
M-3	0.149	0.153	0.060	0.287	0.351		
M-4	0.156	0.161	0.060	0.311	0.312		
M-5	0.160	0.165	0.060	0.338	0.277		
O MIXES	Basic w/c = 0		v/c =				
Mix No.	Cement	Water	Air	Fine	Coarse		
O-4WR	0.156	0.160	0.060	0.312	0.312		
HPC-O MIX	ES Basic w/	c = 0.390 N	lax w/c =0.420				
Mix No.	Cement	Water	Air	Fine	Coarse		
HPC-O	0.134	0.164	0.060	0.321	0.321		
HPC-S N	IIXES Basic w		lax w/c =0.450				
Mix No.	Cement	Water	Air	Fine	Coarse		
HPC-S	0.118	0.156	0.060	0.333	0.333		
			·				

HPC-D MIXES Basic w/c = 0.400			Max $w/c = 0.435$		
Mix No.	Cement	Water	Air	Fine	Coarse

HPC-D	0.118	0.148	0.060	*	*				
QMC MIX	QMC MIXES Basic w/c = 0.400 Max w/c = 0.435								
Mix No.	Cement	Water	Air	Fine	Coarse				
QMC	0.106	0.133	0.060	*	*				
MCM MI	MCM MIXES Basic w/c = 0.400 Max w/c = 0.450								
Mix No.	Cement	Water	Air	Fine	Coarse				
MCM	0.106	0.133	0.060	0.315	0.386				
X MIXES	Basic w/c = 0.4	23 Max w/c	=						
Mix No.	Cement	Water	Air	Fine	Coarse				
X-2	0.124	0.165	0.000	0.284	0.427				
X-3	0.129	0.171	0.000	0.315	0.385				
X-4	0.134	0.178	0.000	0.344	0.344				

Above mixtures are based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in $\underline{IM 401}$.

Proportion Table 2 Concrete Mixes

Using Class V Aggregates Combined with Limestone Basic Absolute Volumes of Materials Per Unit Volume of Concrete

V47B MIXES

Mix No.	Cement	Water	Air	Class V.	Coarse Limestone	Basic w/c	Max. w/c
A-V47B	0.107	0.148	0.060	0.479	0.206	0.440	0.560
C-V47BP ¹	0.113	0.145	0.060	0.477	0.205	0.430	0.488
C-V47BS ³	0.113	0.145	0.060	0.477	0.205	0.430	0.488
M-V47B ²	0.155	0.170	0.060	0.338	0.277	0.350	0.400

V MIXES

Mix No.	Cement	Water	Air	Class V.	Fine Limestone	Basic w/c	Max. w/c
A-V	0.135	0.188	0.060	0.586	0.031	0.444	0.467
C-V	0.135	0.188	0.060	0.586	0.031	0.444	0.467
M-V	0.160	0.196	0.060	0.555	0.029	0.390	0.420

CV-HPC MIXES

Mix No.	Cement	Water	Air	Class V.	Coarse Limestone	Basic w/c	Max. w/c
CV-HPC-D1	0.123	0.147	0.060	0.368	0.302	0.400	0.435
CV-HPC-S ¹	0.123	0.155	0.060	0.364	0.298	0.420	0.450

Above mixtures are based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in IM 401.

^{*}These mixes require optimized aggregate proportioning in accordance with the specifications.

¹When Type IP or IL cement is used. See Section 4116 for requirements when Type IL used.

²M-V47B mix shall use Type I/II or IL cements for patching projects.

³When Type IS or IT cement is used.

Proportion Table 3 SUDAS Concrete Mixes

Using Article 4110 and 4115 Aggregates

Basic Absolute Volumes of Materials Per Unit Volume of Concrete

C-SUD N	C-SUD MIXES Basic w/c = 0.400			420	
Mix No.	Cement	Water	Air	Fine	Coarse
C-SUD	0.106	0.133	0.060	*	*

Above mixture is based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in MIX 10.2. *These mixes require optimized aggregate proportioning in accordance with the specifications.

Using Class V Aggregates (4116) Combined with Limestone Basic Absolute Volumes of Materials Per Unit Volume of Concrete

CV-SUD MIXES Basic w/c = 0.400Max w/c = 0.420Coarse Mix No. Cement Water Air Class V. Limestone CV-SUD 0.114 0.135 0.060 0.379 0.311

Above mixture is based on Type IP, IS, or IT cements.

Mix No.

HPC-S

Cement

0.118

Proportion Table 1 Concrete Mixes

Using Article 4110 and 4115 Aggregates

	Basic Absolute	Volumes of Ma	aterials Per Uni	t Volume of Co	ncrete		
A MIXE	S Basic w/c =	0.474 Max v	v/c = 0.532				
Mix No.	Cement	Water	Air	Fine	Coarse		
A-2	0.101	0.150	0.060	0.276	0.413		
A-3	0.104	0.155	0.060	0.306	0.375		
A-4	0.108	0.161	0.060	0.335	0.336		
A-5	0.111	0.165	0.060	0.365	0.299		
A-6	0.115	0.171	0.060	0.392	0.262		
BR MIX	ES Basic w	c = 0.400 M	lax w/c = 0.450)			
Mix No.	Cement	Water	Air	Fine	Coarse		
BR	0.114	0.143	0.060	*	*		
C MIXE	S Basic w/c =	0.430 Max v	v/c = 0.488				
Mix No.	Cement	Water	Air	Fine	Coarse		
C-2	0.110	0.149	0.060	0.272	0.409		
C-3	0.114	0.154	0.060	0.302	0.370		
C-4	0.118	0.159	0.060	0.331	0.332		
C-5	0.123	0.166	0.060	0.358	0.293		
C-6	0.128	0.173	0.060	0.383	0.256		
C-WR MIXES Basic w/c = 0.430 Max w/c = 0.450							
Mix No.	Cement	Water	Air	Fine	Coarse		
C-3WR	0.108	0.146	0.060	0.309	0.377		
C-4WR	0.112	0.151	0.060	0.338	0.339		
C-5WR	0.117	0.158	0.060	0.366	0.299		
C-6WR	0.121	0.163	0.060	0.394	0.262		
D MIXE	S Basic w/c =	0.423 Max v	v/c = 0.450				
Mix No.	Cement	Water	Air	Fine	Coarse		
D-57	0.134	0.178	0.060	0.314	0.314		
D-57-6	0.134	0.178	0.060	0.377	0.251		
M MIXE	S Basic w/c =	0.328 Max v	v/c = 0.400				
Mix No.	Cement	Water	Air	Fine	Coarse		
M-3	0.149	0.153	0.060	0.287	0.351		
M-4	0.156	0.161	0.060	0.311	0.312		
M-5	0.160	0.165	0.060	0.338	0.277		
O MIXE	S Basic w/c =	0.327 Max v	v/c =				
Mix No.	Cement	Water	Air	Fine	Coarse		
O-4WR	0.156	0.160	0.060	0.312	0.312		
HPC-O MIX	KES Basic w	/c = 0.390 M	lax w/c =0.420				
Mix No.	Cement	Water	Air	Fine	Coarse		
HPC-O	0.134	0.164	0.060	0.321	0.321		
HPC-S	MIXES Basic w	v/c = 0.420 N	lax w/c =0.450				

Air

0.060

Water

0.156

Fine

0.333

Coarse

0.333

HPC-D N	IIXES Basic w/c	= 0.400 Max	w/c =0.435				
Mix No.	Cement	Water	Air	Fine	Coarse		
HPC-D	0.118	0.148	0.060	*	*		
QMC MIXES Basic w/c = 0.400 Max w/c = 0.435							
Mix No.	Cement	Water	Air	Fine	Coarse		
QMC	0.106	0.133	0.060	*	*		
MCM MI	MCM MIXES Basic w/c = 0.400 Max w/c = 0.450						
Mix No.	Cement	Water	Air	Fine	Coarse		
MCM	0.106	0.133	0.060	0.315	0.386		
X MIXES	Basic $w/c = 0.42$	23 Max w/c	=		_		
Mix No.	Cement	Water	Air	Fine	Coarse		
X-2	0.124	0.165	0.000	0.284	0.427		
X-3	0.129	0.171	0.000	0.315	0.385		
X-4	0.134	0.178	0.000	0.344	0.344		

Above mixtures are based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in <u>IM 401</u>.

Proportion Table 2 Concrete Mixes

Using Class V Aggregates Combined with Limestone
Basic Absolute Volumes of Materials Per Unit Volume of Concrete

V47B MIXES

Mix No.	Cement	Water	Air	Class V.	Coarse Limestone	Basic w/c	Max. w/c
A-V47B	0.107	0.148	0.060	0.479	0.206	0.440	0.560
C-V47BP ¹	0.113	0.145	0.060	0.477	0.205	0.430	0.488
C-V47BS ³	0.113	0.145	0.060	0.477	0.205	0.430	0.488
M-V47B ²	0.155	0.170	0.060	0.338	0.277	0.350	0.400

V MIXES

Mix No.	Cement	Water	Air	Class V.	Fine Limestone	Basic w/c	Max. w/c
A-V	0.135	0.188	0.060	0.586	0.031	0.444	0.467
C-V	0.135	0.188	0.060	0.586	0.031	0.444	0.467
M-V	0.160	0.196	0.060	0.555	0.029	0.390	0.420

CV-HPC MIXES

Mix No.	Cement	Water	Air	Class V.	Coarse Limestone	Basic w/c	Max. w/c
CV-HPC-D ¹	0.123	0.147	0.060	0.368	0.302	0.400	0.435
CV-HPC-S ¹	0.123	0.155	0.060	0.364	0.298	0.420	0.450

Above mixtures are based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in $\underline{IM 401}$.

^{*}These mixes require optimized aggregate proportioning in accordance with the specifications.

¹When Type IP or IL cement is used. See Section 4116 for requirements when Type IL used.

²M-V47B mix shall use Type I/II or IL cements for patching projects.

³When Type IS or IT cement is used.

Matls. IM 529

Proportion Table 3 SUDAS Concrete Mixes

Using <u>Article 4110</u> and <u>4115</u> Aggregates Basic Absolute Volumes of Materials Per Unit Volume of Concrete

C-SUD MIXES Basic w/c = 0.400 Max w/c = 0.420

Mix No.	Cement	Water	Air	Fine	Coarse
C-SUD	0.106	0.133	0.060	*	*

Above mixture is based on Type I or Type II cements (Sp. G. = 3.14). Mixes using blended cements (Type IP, IS, IL, or IT) must be adjusted for cement gravities listed in $\underline{\text{IM 401}}$. *These mixes require optimized aggregate proportioning in accordance with the specifications.

Using Class V Aggregates (4116) Combined with Limestone Basic Absolute Volumes of Materials Per Unit Volume of Concrete

CV-SUD MIXES Basic w/c = 0.400 Max w/c = 0.420

Mix No.	Cement	Water	Air	Class V.	Coarse Limestone
CV-SUD	0.114	0.135	0.060	0.379	0.311

Above mixture is based on Type IP, IS, or IT cements.

GUIDELINES FOR APPROVING AND TESTING SCC MIX DESIGNS FOR FIELD PLACED CONCRETE

Description

- **A.** Develop and provide self-consolidating concrete (SCC) for cast in place structural concrete. SCC is defined as a concrete mix that provides the following:
 - Filling ability to flow and fill completely spaces within formwork, under its own weight.
 - Passing ability to flow through tight spaces between reinforcement without segregation or blocking.
 - Ability to resist segregation by remaining homogenous during transport and placement.
- **B.** Apply Sections 2403, 2412, and Division 41 of the Standard Specifications with the following modifications.

Typically aggregates are well graded with a maximum top size of ¾" or less. Aggregate angularity and shape can affect the slump flow. Typical sand to aggregate ratio is 0.40 to 0.50. Paste volume can range from 28 to 40% depending on slump flow required. Water to cementitious ratio is typically in the 0.25 to 0.44 range.

If the producer has no previous experience with SCC, it is recommended that a technical representative of the admixture company be present during initial trial batches.

Materials

Meet the requirements of Division 41 for the appropriate materials and the following:

- Use a high range water reducer (HRWR) from Material IM 403 Appendix D.
- When a viscosity modifying admixture (VMA) is used, manufacturer shall provide documentation indicating compatibility with HRWR.
- Use maximum nominal aggregate size no larger than one third the minimum clear spacing between reinforcing steel
- Maximum w/c ratio of 0.45
- Minimum cementitious content shall be 624 700 pounds per cubic yard
- When required to maintain plasticity during a placement, use a retarding admixture or hydration stabilizer.

Mix Design

Mix designs will be approved by the District Materials Engineer (DME). New mix designs for SCC shall be verified through trial batches. Other mix designs will be qualified by previous performance. Field validation shall be required for all new mixes.

- Work with the admixture supplier representative to develop the mix design
- Slump flow in accordance with Materials IM 389. The target slump flow value is 23.0 inches. The allowable tolerance range of the slump flow is plus or minus 3 inches. The contractor may submit a target slump flow, if placement requires different flow characteristics.

- Target Visual Stability Index (VSI) in accordance with Materials IM 389. The VSI Rating shall not exceed 1.0.
- Passing ability by J-Ring in accordance with ASTM C 1621. Calculate the difference between slump flow and J-Ring flow. The maximum allowable difference is 2 inches (50 mm).
- Static segregation using hardened cylinders in accordance with Material IM 390

Producer shall submit material sources, proportions, individual gradations of each aggregate, combined aggregate gradation, slump flow, visual stability index, air content, and compressive strength for the proposed mix design.

Trial Batch Validation

- 1. Allow the District Materials Engineer ample opportunity to witness the trial batching. Provide the District Materials Engineer notice and mix proportions 7 calendar days prior to this event.
- 2. Mix the trial batch with a minimum of 3 cubic yards at least 30 calendar days prior to planned placement. Establish the batching sequence of the materials during the trial batch.
- **3.** Transport the concrete a distance comparable to the distance from the ready mix plant to the placement site.
- 4. Test concrete samples that are representative of the entire batch for air content, slump flow, visual stability index, J-Ring, density (unit weight), static segregation and temperature. Cast specimens from each sample for compressive strength tests. Modify the consolidation method of all materials test procedures, including IM 315, IM 316, IM 318, and IM 340 by placing the concrete in the molds in one layer without vibration or tamping.
- **5.** Cast a minimum of eight 4 inch by 8 inch cylinders for testing. Trial batch concrete will be tested for strength and static segregation. All samples will be cast, cured, and handled according to Materials IM 315.
- **6.** Strength samples will be stripped of their molds and wet cured until their break age. Strength samples will be tested according to AASHTO T 22. Three cylinders will be tested for strength at each age of 7 and 28 days. The District Materials Engineer may witness the strength testing. The samples for static segregation may be sent to the Central Materials Laboratory for sawing.
- 7. Submit a trial batch report to the District Materials Engineer no later than 7 calendar days after trial batching. Approval will be based on successful trial batch mixing and properties. The District Materials Engineer may waive the trial batch testing provided satisfactory mix properties have been achieved through testing of previous trial batches or production placements.

Quality Control Plan

Submit for approval a written Quality Control Plan describing the procedures to be used to control the production and placement of SCC. Submit the Quality Control Plan at least 30 calendar days before the first intended structural concrete placement. Do not place structural concrete before receiving written approval from the engineer of the Quality Control Plan and having all equipment and materials necessary to facilitate the plan on site and ready for use.

Include the following in the Quality Control Plan:

- Develop mix design that meets the design criteria for strength, flowability, passing ability, and consistency.
- Define concrete batching sequence, mixing time, and minimum revolutions to prevent cement balls and mix foaming. Include procedures for ensuring wash water is removed before batching.
- Define concrete placement pattern and methods. Include maximum horizontal flow distance from point of discharge.
- Describe additional quality control procedures at the plant to ensure consistent delivery of concrete.
- Define field procedures to accept or reject concrete during production.
- Describe procedures used when continuous placements are interrupted.
- Other information as needed.

Provide stability analysis of proposed formwork for full static pressure and proposed methods used to prevent leakage.

Placement

Deliver concrete without any interruption of flow such that a continuous placement is achieved. Deposit concrete continuously or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. Do not exceed 30 minutes between placement of successive batches unless engineer has reviewed placement conditions. If a section cannot be placed continuously, provide construction joints as specified.

If deemed necessary by the Engineer, construct a mock-up of the section to verify placement procedures.

Do not re-temper SCC.

Do not vibrate SCC without permission of the Engineer. If Engineer approves vibration, maximum insertion time is 2 seconds or less. If emergency delay occurs, concrete may be rodded with a piece of lumber or conduit if the material has lost its fluidity prior to placement of additional concrete. The DME may approve other methods of consolidation, if necessary.

Validate drop distance to demonstrate that separation does not occur.

Testing

Notify the Engineer 48 hours prior to placement of production concrete. Use only approved SCC mixes for production concrete. Ensure mix has the same materials, proportions, and properties established in the trial batch.

Perform air content testing in accordance with Materials IM 318, except place SCC in one layer, without consolidation or tapping. Cast cylinders in accordance with Materials IM 315, except place SCC in one layer, without consolidation or tapping.

The Engineer will perform air content testing at sampling at testing rate described in IM 204. The contractor will perform quality control testing of slump flow in accordance with IM 389 at rate of 1/30 cubic yards. Slump flow range shall be ±2 inches of the mix design target value. The visual stability index shall not exceed 1. If the slump flow exceeds the range up to a maximum of 28 inches, the concrete may be placed provided the visual stability index does not exceed 1. The producer will make adjustments to move the slump flow back into range.

The District Materials Engineer will obtain verification strength samples on a minimum of two random placements. Strength samples will be tested at the District Materials Laboratory according to AASHTO T 22. A set of five cylinders will be cast, cured, and handled according to Materials I.M. 315. Three cylinders will be tested for strength at 28 days. The remaining two cylinders will be checked for static segregation of hardened cylinders in accordance with Material IM 390.

Since SCC mixes are highly sensitive to moisture, the Producer should perform aggregate moistures at a minimum of once per day prior to mixing. The DME may adjust moisture testing depending on weather conditions and aggregate storage.

Chapter 19 IM 535 PCC PLANT MONITOR





PCC PLANT MONITOR

GENERAL

The following instruction is to be used when monitoring the operation of a ready mix concrete plant or a central batch plant. The plant monitor is responsible for monitoring the plant operation, quality control procedures performed by the plant inspector, and ensure that proper concrete mix is being batched and delivered.

DUTIES

The following duties are performed by the plant monitor for structural and paving concrete. If non-structural concrete is being produced during the time that structural or paving concrete is produced, no additional plant site visits are required. When non-structural concrete is the only concrete being placed, perform monitor duties at least once per project.

Duty	Task	Minimum Frequency
1. Inspect stockpiles	Observe stockpiling procedures. Check for segregation. Check for contamination. Check for degradation. Check for proper storage and handling of aggregates per Article 2301.02.C.1 and	

C Dlamt music authorize	Observa delivery televers	Candral Datala are
6. Plant proportion control	Observe delivery tolerance. Observe scale sensitivity. Observe admixture dispenser operation. Check for proper batch proportions on computer generated or hand written batch tickets	Central Batch– once during first week
7. Observe mix times for central batch plant	•Per <u>Article 2001.21</u> .	During visits
Audit Checks and Test results in Plant Book	Check for proper completion of Daily Plant Checklist and Plant Site Inspection List. Observe record of test results for moistures and specific gravities.	During visits
9. Audit Daily Diary	•Review for proper recording of events.	During visits
10. Plant Reports	Check for proper project and mix identification. Check for dates and report number. Review batch weights and aggregate gradations. Check materials brands and sources. Check for correct concrete and cement totals (daily, weekly, and to date). Check for appropriate Plant Inspector signature or initials. Sign report after review. Check for hard copy or electronic backup of files	Daily / Weekly
11. Inspect Transit Mixers	 Inspect for buildup in drum per Article 2001.21 B. Inspect for fin wear or broken fins per Article 2001.21 B. Check for current truck certification per Article 2001.21 B. 	1/Month
12. Monitor agitors & dump trucks	Check for properly cleaned dump box.	During visits
13. Inspect plant facility	Observe plant calibration to assure compliance with Materials IM 527. Check lab qualifications. Inspect test equipment.	Central Batch - startup Ready Mix - Yearly

SAMPLING & TESTING

AGGREGATES

Verification Gradation – One sample for each aggregate per lot in accordance with <u>IM 527</u> for paving or <u>IM 528</u> for all other concrete.

The engineer will split samples obtained with the plant inspector, or observe splitting by the plant inspector, and immediately take possession of the agency sample. Report test results to producer in a timely manner. Contracting authority tests are verification and correlation with <u>IM 216</u> is not required but should be performed as a check of sampling and testing procedures.

Testing and sampling for non-structural concrete is based on that being the only concrete being produced. If structural or paving concrete is being produced, no additional gradation sampling and testing is required for non-structural concrete produced from the same plant, since the sampling and testing frequency for structural and paving concrete is greater. If multiple projects are being supplied by the plant, one representative gradation sample for the lot covers sampling and testing for all of the projects.

Example 1: If a sample was obtained for a footing and the ready mix produces concrete for a sidewalk project the next week, the gradation sample for the footing can be used for the sidewalk project.

Example 2: If a sample was obtained for a paving project and the ready mix produces concrete for a patching and a bridge pier, the gradation sample for the paving can be used for all projects.

Non Complying Gradation

When a verification gradation test does not comply with the gradation requirements of Article 4109, the Engineer will contact the contractor, producer and the District Materials Engineer. The Engineer will test any remaining sample to check results, test any backup samples, or obtain a resample. The District Materials Engineer may investigate sampling and testing procedures, stockpiling, source material, etc. After corrections have been made, the Engineer will obtain and test another verification sample.

Acceptance of lots will be based on complying verification test results. The engineer will retain all samples representing the lots until the lots have been accepted. Since the contracting authority tests are verification, correlation with MM 216 is not required, but may be performed as a check of sampling and testing procedures.

Note: Mechanical shaking and over washing should be cautioned when testing certain softer limestone aggregates, as excessive fines will be produced. Contact the District Materials Engineer for information on proper test procedures for these sources.

REPORTS & REPORTING

Enter monitor checks on plant monitor workbook for structural or paving. Report gradations on gradation verification form 821283.

PCC PAVING - FIELD AND PLANT SAMPLING AND TESTING GUIDE (See Specifications for Complete Details.)

		Field Acceptance	Plant Acceptance	
Article	Article Work Type	Air & Slump	Gradation QC	Gradation Verification
		(No slump for slipform paving)		
00.00		****	S/T 1st day, then 1/day>500 yd³,	S/T 1st/day, S 1/day >500 yd ³ & T 1/wk,
27.22	PCC Shoulders	1//00 ya": 1/100 ya" KM	If <500 yd²/day 1/wK	IT <500 yd/day S 1/WK & T 20% (4)
			S/T 1st day, then 1/day>500 yd ³ ,	S/T 1st/day, S 1/day >500 yd ³ & T 1/wk,
2301	PCC Pavement	1/700 yd ³ : 1/100 yd ³ RM	If <500 yd³/day 1/wk	If <500 yd³/day S 1/wk & T 20% (4)
			If >500 yd³/day S/T 1/1500 yd³,	S/T 1st/day, S 1/day >500 yd³, Test 2/week,
2301	PCC Pavement - QMC	1/700 yd ³ : 1/200 yd ³ RM	If <500 yd³/day S/T 1/wk	If <500 yd³/day, S/T 1 wk
	Bridge Approaches,		S/T 1st day, then 1/day>500 yd ³ ,	
2301	Gores, tapers, radiuses	1/700 yd ³ : 1/100 yd ³ RM	If <500 yd³/day 1/wk	n/a
			S/T 1st day, then 1/day>500 yd ³ ,	S/T 1st/day, S 1/day >500 yd ³ & T 1/wk,
2302	PCC Widening	1/700 yd ³ : 1/100 yd ³ RM	If <500 yd³/day 1/wk	If <500 yd³/day S 1/wk & T 20% (4)
			S/T 1st day, then $1/day>500 yd^3$,	S/T 1st/day, S 1/day >500 yd ³ & T 1/wk,
2310	PCC Overlay	1/700 yd ³ : 1/100 yd ³ RM	If <500 yd³/day 1/wk	If <500 yd³/day S 1/wk & T 20% (4)
			S/T 1/1500 yd³,	S/T 1st/day, S 1/day >500 yd³, Test 2/week,
2310	PCC Overlay - QMC	1/700 yd ³ : 1/100 yd ³ RM	If <500 yd³/day 1/wk	If <500 yd³/day, S/T 1 wk

(4) If less than 500 yd³per day / intermittent construction continues for more than two weeks, obtain verification samples weekly and test 20% of the samples obtained.

PCC STRUCTURAL - FIELD AND PLANT SAMPLING AND TESTING GUIDE (See Specifications for Complete Details.)

<u>o</u>	Work Tyne	Field		
Φ	A TVD	Acceptance	Plant Acceptance	
		Air & Slump	Gradation QC	Gradation Verification
	Structural Concrete	1/30 yd ³ (2)	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd ³ /wk , T 20%
	Foundations	1/30 yd ³ (2)	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if $<$ 50 yd 3 /wk , T 20%
	Concrete Structures	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
	Bridge Decks	1/30 yd ³ (2)	S/T 1/deck pour	S/T 1/deck pour
+	Deck Repair	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
	Deck Surfacing/Overlay HPC-O	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1/project
2413 Dec	Deck Surfacing/Overlay Class O	$1/100 \text{ yd}^2(4)$	n/a	n/a
2414 Rail	Railings	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2415 Box	Box, Arch Circular Culverts	1/30 yd ³	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2416 Rigi	Rigid Pipe Culverts	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2423 Sup	Support Structures	1/30 yd3	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2424 Sho	Shotcrete		S/T for Field Test design mix	n/a
2433 Drill	Drilled Shaft	1/30 yd ³ (2)	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2503 Stor	Storm Sewers	1/30 yd ³	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
<u>2503</u> intal	intakes, utility access	1/30 yd ³	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	n/a
2501 Pile	Pile encasement	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
2505 Gua	Guardail-End Anchor/Terminal (5)	1/30 yd ³	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	n/a
<u>2513</u> Con	Concrete barrier	1/30 yd ³	S/T 1/week, if <50 yd ³ /wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%
<u>2516</u> Wal	Walls and Steps	1/30 yd ³	S/T 1/week, if <50 yd³/wk S/T 1/ 2 weeks	S/T 1st/wk; S 1/wk or S 1/2 wks if <50 yd3/wk, T 20%

⁽²⁾ On large structural placements >350 yd³, the DME may adjust air and slump testing to 1/50 yd³ based on consistent results in the first 100 yd³ placed (4) See 204 Appendix M for overlays >300 yd². (5) Guardrail posts under miscellaneous IM 535ac.

PCC NON-STRUCTURAL & MISCELLANEOUS - FIELD AND PLANT SAMPLING AND TESTING GUIDE

(See Specifications for Complete Details.)

			,	
		Field Acceptance	Plant Acceptance	
Article	Work Type	Air & Slump	Gradation QC	Gradation Verification
	NON-STRUCTURAL			
2212	Base Repair	$1/30 \text{ yd}^3(1)$	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2201	PCC Base	1/700 yd³: 1/100 yd³ RM	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2213	Base Widening	1/700 yd³: 1/100 yd³ RM	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2415	Curtain Wall	1/30 yd³	n/a	n/a
2435	Sanitary & Storm Sewer Structures	1/30 yd³	n/a	n/a
2507	Revetment Grout	Air -1/half day	S/T for Mix Design only	n/a
	Slope Protection	Air -1/day	n/a	n/a
	Fabric Formed Revetment	Air- 1/half day	S/T for Mix Design only	n/a
2511	Sidewalks	1/100 yd³ (1)	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2511	Trails	1/100 yd³	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2512	Curb & Gutter	1/100 yd³ (1)	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2515	Driveways	1/100 yd³ (1)	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2517	Railroad Approach Sections	1/100 yd³ (1)	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2529	Patching (Full depth), rumble strip	$1/30 \text{ yd}^3(1)$	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
2530	Patching (Partial depth)	$1/30 \text{ yd}^3(1)$	S/T 1st week, S/T 1 per month (3)	S/T 1/project (3)
	MISCELLANEOUS			
2304	Detour Pavement, 3 yrs or less	n/a	n/a	n/a
2405	seal course	n/a	n/a	n/a
2416	Pipe collars	n/a	n/a	n/a
2503	Catch basins, abandonment, collars	n/a	n/a	n/a
2505	Guardrail - Posts	n/a	n/a	n/a
2506	Flowable Mortar	n/a	S/T for Mix Design only	n/a
2519	Fence construction	n/a	n/a	n/a
2524	Type A and B	n/a	n/a	n/a
2554	Thrust blocks	n/a	n/a	n/a
131 (1)				

(1) If less than 20 yd³/ day, the engineer may waive air testing if inspection is not available and producer has exhibited consistency in prior placements. When inspection available on project, test minimum of 1/day for concrete exposed to freezing and thawing.

(3) Sampling and testing rate if no other concrete supplied. Use structural or paving test results to cover non-structural concrete items.

Any concrete items not listed are considered miscellaneous concrete.

Chapter 20 IM T-203 AGGREGATE SOURCES



GENERAL AGGREGATE SOURCE INFORMATION

GENERAI

classification as defined herein for aggregates used in Hot Mix Asphalt (HMA) construction, durability class for coarse aggregates used in Portland Cement Concrete (PCC) construction, and Approved Fine Aggregate. Upon request, new sources or different combinations of beds within an existing source can be evaluated for Only those sources which have been sampled or tested within the last ten years are listed. This listing additionally ranks sources in accordance with a frictional classification. These rankings do not in any way waive the normal quality requirements for the particular types of aggregates indicated in contract documents.

Aggregate sources are continuously updated and the most current version of this IM can be found on the Materials Approved Product List Enterprise (MAPLE) website at https://maple.iowadot.gov/

Products listed in this document may not always be available. Contact the supplier for availability

Transload facilites are throughtout the state. Contract the facilites to determine aggregate availability. Transloads Facilites Report

PORTLAND CEMENT CONCRETE AGGREGATES

Aggregates shall be produced from sources approved in accordance with the requirements of Office of Materials IM 409. The engineer may approve scalping of some portion of the coarser fraction. All aggregates produced and inspected for intended use in contracts under lowa Department of Transportation Specifications shall be stored in identifiable stockpiles unless they are being delivered as produced

DURABILITY CLASSIFICATION

The coarse aggregates have been divided into three classes in accordance with their durability level as determined by performance or laboratory testing.

<u>Class 2</u> durability aggregates will produce no deterioration of pavements of the non-interstate segments of the road system after 15 years and only minimal deterioration in pavements after 20 years Class 3 durability aggregates will produce no deterioration of pavements of non-interstate segments of the road system after 20 years of age and less than 5% deterioration of the joints after 25 years. Class 3i durability aggregates will produce no deterioration of the interstate road system after 30 years of service and less than 5% deterioration of the joints after 35

NOTE: Those sources with a "B" in their durability class designation are approved for 1/2 in. Bridge Deck Overlay/Repair material.

T203

HOT MIX ASPHALT AGGREGATES

2025

22,

July

increases. One or more friction types may be specified for use in pavement surface courses. If a type is not specified in the contract documents, Type 5 or better will Aggregates for HMA construction have been classified into five main functional types in accordance with their frictional characteristics. Those aggregates with the potential to develop the greatest amount of friction under traffic conditions are classified as Type 1 with the potential for friction decreasing as the type number be acceptable. Tentative bed limitations are shown in this publication.

The frictional classification types are listed and defined in order of descending quality as follows.

such as calcined bauxite (synthetic) and emery (natural). They are not available from lowa sources. Due to their high cost, these aggregates would be specified only hardness range of 7 to 9) bonded together by a slightly softer matrix. These aggregates are typified by those developed for and used by the grinding-wheel industry Type 1: Aggregates, which are generally, a heterogeneous combination of minerals with coarse-grained microstructure of very hard particles (generally, a Mohs for use in extremely critical situations.

<u>Type 2:</u> Natural aggregates in this class are crushed quartzite and both fine and coarse-grained crushed igneous rocks. The mineral grains in these materials generally have a Mohs hardness range of 5 to 7. Synthetic aggregates in this class are some air-cooled steel furnace slags and others with similar characteristics. For asphalt mixtures, pipestone and sandstone in quartzite may not exceed 5 percent.

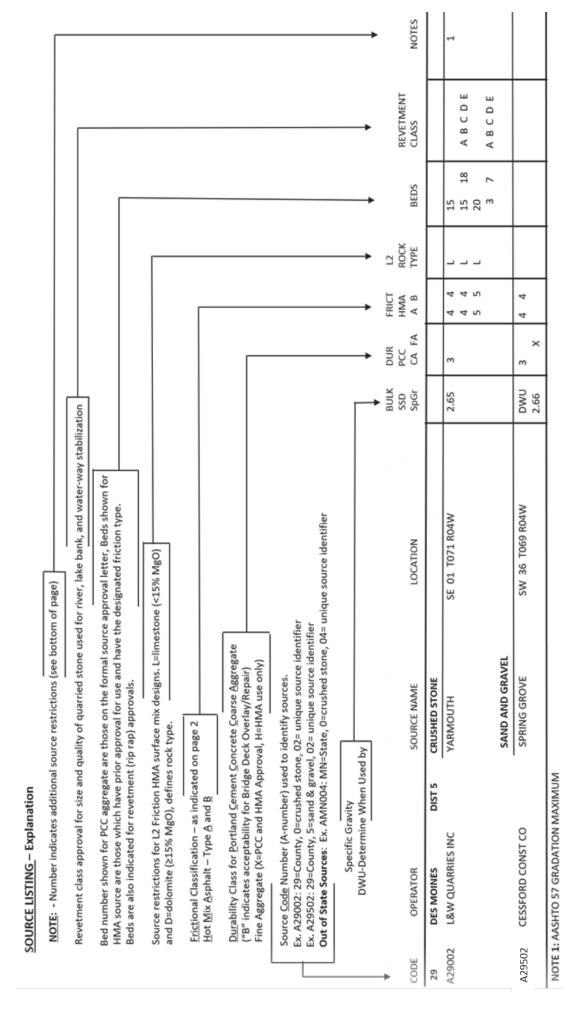
Type 3: Natural aggregates in this class are crushed gravels. The crushed gravels shall contain 40% or more igneous and metamorphic particles. Synthetic aggregates in this class are the expanded shales with a Los Angeles abrasion loss less than 35 percent. Type 4: Aggregates crushed from dolomitic or limestone ledges in which 80 percent of the grains are 20 microns or larger. The mineral grains in the approved ledges for this classification generally have a Mohs hardness range of 3 to 4. For natural gravels, the Type 5 carbonate (see below) particles, as a fraction of the total material, shall not exceed the non-carbonate particles by more than 20 percent.

Type 5: Aggregates crushed from dolomitic or limestone ledges in which 20 percent or more of the grains are 30 microns or smaller.

REVETMENT CLASSIFICATIONS

Revetment or rip-rap is rock or other material used to armor bridge abutments, pilings, and rivers or shorelines against scour and water erosion. The lowa DOT uses five Classes of Revetment based on the size of the aggregate. See the table below for nominal top size. The Engineer may approve revetment containing material larger than the nominal top size. For this product, individual beds are approved at each source based on quality and bed thickness.

Revetment Class	Nominal top size
Class A	400 pounds
Class B	650 pounds
Class C	450 pounds
Barrio bar O sario	offin pounds



(J)	
P-3	
프	
71	
_	
α	
=	
$\overline{}$	
\cup	
(J)	
E	
H	
н	
K	
7.17	
U	
区	
~	
144	
77	
Ü	
ч,	
Ø	
. ~	
6-7	
프	
-	
~	
Н	
-	
н	
53	
U	
\sim	
R	
. 7	
ы	
1	
ы	
н	
Z	
124	
żί	
\cup	
E	
H	
2	
_	

			BULK	DUR	FRICT		h F		
					HMA	KOCK CK	Y.	YE > FIMENT.	
CODE OPERATOR	SOURCE NAME	LOCATION		CA FA	A B	TYP	E BEDS	CLASS	NOTES
1 ADAIR DIST 4	CRUSHED STONE								
A01002 SCHILDBERG CONSTRUCTION CO	MENLO	NE 21 T77N R31W			5 5	П		ABCDE	
A01006 SCHILDBERG CONSTRUCTION CO	HOWE	SW 1 T76N R31W			 1 LO		2	۵	
A01008 SCHILDBERG CONSTRUCTION CO	JEFFERSON	NE 17 T77N R31W						<u>a</u>	
					n 			Q	
2 ADAMS DIST 4	CRUSHED STONE								
SCHILDBERG CONSTRUCTION	MI EINA	14 T73N R3			4			О	
UZUU4 SCHILDBERG CONSTRUCTION CO	CORNING	NE O8 T/IN R34W			4	4	3-5	Ω	
3 ALLAMAKEE DIST 2	CRUSHED STONE								
A03002 BRUENING ROCK PRODUCTS INC	WEXFORD	NE 36 T98N R03W	2.7	31	4 4	Ω	\circ		
						Ω	1 - 8 1 B - 8	Д С	
A03004 BRITENING ROCK PRODUCTS INC	H PN A'L	N96L	0	m	4	Ė	ا (ک		
BRITENIAN BOOK DROHINGES	M M M M M M M M M M M M M M M M M M M))	7 7	1 -])	
CET STATEMENT TO THE		T100N				7			
SALLINE MAIENTALS LID	NO VE	NOOTI / T	LIMIT			۲		, ,	
	HAMMEL BOON LES			J C	1, <	⊃ ⊦	l	A B C C C	
	LIVINGOOD	L'AON KO			4 4	7	7 - 7		
TANT SHOTTING BOOK BROTTING AND	RVRNFS	С Г			1				
BRITENING ROOK PRODITCES	T NA NA T	7 C					FITT.T. FACE	لم ر ت	
BELIENTING BOOK DECITIONS	SWENSON	10 TO 6N)	
DISCHILL INCOME THE PARTY OF TH		1 1 00N	דיזאַרר					ر د م	
	N. E.	7 ITOON		J - C	1, <	ם ב	L		
	 対対し 	N88.T. T7		31			5A-5D		
AU304Z BAKD MATEKIALS	CHOKCHTOWN	SW ZG TGGN KO4W					T − C		
AN3046 BRITHNING ROCK PRODUCTS INC	SHOW	SW 29 T96N B04W	DIWIT	0	וע)) [
)	1		1) [0		1-4		
A03048 BRUENING ROCK PRODUCTS INC	POSTVILLE	SW 16 T96N R06W	2.61	m	4 4	Ц	8 - 9		
			(2-5		
A03050 BRUENING ROCK PRODUCTS INC	GREEN	NW 16 T96N R06W	2.63	m	4 4	Н	2-3A	i	
A03052 BRITENING ROCK PRODUCTS INC	ROSSON F.T.TVSSON	г. Г			4		T - 1 1 - 1 21 - 32	A A A A A A A A A A A A A A A A A A A	
BRITENTING BOOK DRODITOHS	MENT BIDGE	NXOL				l)		
BRITENING ROCK PRODUCTS		33 T98N							
RAINBOW OUARRY LLC	RAINBOW	F 9					FULL FACE	О	

Ŋ	
~2	
r-1	
щ	
'nί	
\cup	
ď.	
ш	
=	
:	
\equiv	
\cap	
O	
ŭ	
Ŋ	
闰	
모	
=	
_	
ď	
P4	
rh	
U)	
囝	
⋈	
щ	
źπ	
U	
9	
ч.	
ď	
囝	
ь.	
>	
Þ.	
į.	
) TI	
) TI	
ZII.	
CTIC	
CTIC	
ZII.	
CTIC	
CTIC	
ACTIV	
ACTIV	
CTIC	
ACTIV	
ACTIV	
ACTIV	
LLY ACTIV	
LLY ACTIV	
LLY ACTIV	
NTLY ACTIV	
NTLY ACTIV	
ENTLY ACTIV	
CENTLY ACTIV	
CENTLY ACTIV	
CENTLY ACTIV	
ECENTLY ACTIV	
ECENTLY ACTIV	
ECENTLY ACTIV	
CENTLY ACTIV	
ECENTLY ACTIV	
ECENTLY ACTIV	

ALIAWAKEE	SE 26 T97N R05W 2.61 3 SW 30 T97N R05W SE 24 T99N R04W SE 24 T99N R04W SE 24 T99N R02W 2.67 31B SW 7 T97N R02W 2.67 31B SW 2 T99N R06W R06W R06W R06W R06W R06W R06W R06W	X X X X X X X X X X X X X X X X X X X	CONTINUED CONTINUED 1 - 5 2 - 4 1 - 8 1 - 8 6 4 4	CLASS NC A B C D E A B C D E A B C D E	NOTES
ALLAWAKEE ALLAWAKEE 64 FAINBOW QUARRY LLC 68 SKYLINE MATERIALS LTD 68 BRUENING ROCK PRODUCTS INC 74 RON WEYMILLER 75 STRONG ROCK PRODUCTS INC 76 BRUENING ROCK PRODUCTS INC 77 STRONG 78 SAND AND 79 SKYLINE MATERIALS LTD 70 BRUENING ROCK PRODUCTS INC 70 BRUENING ROCK PRODUCTS INC 71 SAND AND 72 STRONG 74 RON WEYMILLER 75 SAND AND 76 BRUENING ROCK PRODUCTS INC 76 SAND AND 77 SAND AND 78 BRUENING ROCK PRODUCTS INC 78 SAND AND 78 SAND 7	SE 26 T97N R05W 2.61 3 SW 30 T97N R05W 2.61 3 SW 30 T97N R05W 2.61 3 SW 30 T97N R05W 2.67 31B SW 7 T97N R02W 2.67 31B SW 7 T97N R02W 2.67 31B SW 2 T99N R06W R06W R06W R06W R06W R06W R06W R06W	4 404 W 4 200 2 404 W 4 200	CONTINUED CONTINUED 2 - 4 1 - 8 1 - 3 6 4 4		
ALLAMAKEE RAINBOW QUARRY LLC RAINBOW GUARRY LLC SKYLINE MATERIALS LTD RON WEYMILLER SKYLINE MATERIALS LTD SKYLINE MATERIALS LTD SKYLINE MATERIALS LTD SKYLINE MATERIALS LTD RON WEYMILLER SAND AND SKYLINE MATERIALS LTD HARPERS HAD SKYLINE MATERIALS LTD CANTERA AGGREGATES CONFIDENC AUDUBON BELIEFT CONFIDENC CANTERA AGGREGATES CONFIDENC BYIRA BYIRA BYIRA CONFIDENC CANTERA CONFIDENC CONFIDENC CANTERA CONFIDENC CON	SE 26 T97N R05W 2.61 3 SW 30 T97N R05W 2.61 3 SW 30 T97N R05W 2.61 3 SE 24 T99N R04W NE 12 T100NR05W 2.67 31B SW 2 T99N R06W 2.65 NW 09 T99N R06W 2.65 NW 09 T99N R06W 2.65 SE 15 T69N R19W 2.7 2 SE 15 T69N R19W 2.7 2	4 N 4 N N N N N N N N N N N N N N N N N	2 - 4 2 - 4 1 - 8 1 - 3 6 6 4 4	О О О О О О О О О О О О О О О О О О О	
RAINBOW QUARRY LLC SKYLINE MATERIALS LTD BRUENING ROCK PRODUCTS INC STRONG RON WEYMILLER SAND AND SKYLINE MATERIALS LTD STRONG RON WEYMILLER SAND AND SKYLINE MATERIALS LTD SAND AND SCANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC	SE 26 T97N R05W 2.61 3 SW 30 T97N R06W 2.61 3 SE 24 T99N R04W NE 12 T100NR05W 2.67 31B SW 7 T97N R02W 2.67 31B SW 2 T99N R06W NE 08 T99N R06W 2.65 SW 2 T99N R06W SE 15 T69N R18W 2.7 2 SE 15 T69N R18W 2.7 2	4 N 4 W 4 N N N	2	О О О С С С С С С С С С С С С С С С С С	1 11
SKYLINE MATERIALS LTD BRUENING ROCK PRODUCTS INC STRONG RON WEYMILLER RON WEYMILLER SAND AND SKYLINE MATERIALS LTD STRONG MANDUEN SCANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC BXIRA B	EL SW 30 T97N R05W 2.61 3 SW 30 T97N R05W SE 24 T99N R04W NE 12 T100NR05W SW 7 T97N R02W 2.67 3iB NW 09 T99N R06W NE 08 T99N R06W NE 08 T99N R06W SE 15 T69N R19W SE 15 T69N R18W	4 N 4 N N N N N N N N N N N N N N N N N	2 7 7 7 8 1 1 8 8 1 7 9 9 1 8 1 8 1 8 1 9 1 9 1 9 1 9 1 9 1 9	O O O O O O	1 11
BRUENING ROCK PRODUCTS INC STRONG RON WEYMILLER RON WEYMILLER RON WEYMILLER SAND AND SKYLINE MATERIALS LTD HARPERS F HARMEL-BC HARMEL-BC HARMEL-BC HARMEL-BC ROCK PRODUCTS INC IVERSON SRUENING ROCK PRODUCTS INC IVERSON SRUENING ROCK PRODUCTS INC IVERSON CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA	SE 24 T99N R04W NE 12 T100NR05W SE 24 T99N R04W NE 12 T100NR05W 2.67 SW 7 T97N R02W 2.67 SW 8 T99N R06W NE 08 T99N R06W SE 15 T69N R19W SE 15 T69N R18W	N 4, W 4, N N N	4-1 - 1 - 1 - 1 - 2 - 4 - 2 - 4 - 2 - 2	C B	1 11
STRONG ROCK & GRAVEL RON WEYMILLER SAND AND SKYLINE MATERIALS LTD HARPERS H HARPERS H HARPERS H HARBERS INC IVERSON SRUENING ROCK PRODUCTS INC IVERSON IVERSON RALINT CI CANTERA AGGREGATES CONFIDENC AUDUBON BEXIRA BEXIRA BEXIRA CONFIDENC AUDUBON BEXIRA CONFIDENC CANTERT CONFIDENC CONFIDENC CANTERT CONFIDENC CANTERT CONFIDENC CANTERT CONFIDENC CON	S 24 T99N R04W NE 12 T100NR05W 2.67 31B SW 7 T97N R02W 2.67 31B NW 09 T99N R06W NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W 5 T69N R19W	4, W 4, R R R R R R R R R R R R R R R R R R	8 -1 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7	О О В	1 11
RON WEYMILLER SAND AND SKYLINE MATERIALS LTD HARPERS H BRUENING ROCK PRODUCTS INC BRUENING ROCK PRODUCTS INC IVERSON BRUENING ROCK PRODUCTS INC IVERSON IVERSON APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA	S W 7 T97N R02W 2.67 3iB SW 2 T99N R06W NW 09 T99N R06W NE 08 T99N R06W S.65 CT 35 T70N R19W 2.7 SE 15 T69N R18W SE 15 T69N R18W	W 4, RYR	1 - 1 - 2 - 4 - 1 - 3 - 4 - 1		
SKYLINE MATERIALS LTD BRUENING ROCK PRODUCTS INC BRUENING ROCK PRODUCTS INC IVERSON BRUENING ROCK PRODUCTS INC IVERSON IVERSO	S W 7 T97N R02W 2.67 31B SW 2 T99N R06W NW 09 T99N R06W NE 08 T99N R06W S.65 CT 35 T70N R19W ST 15 T69N R18W SE 15 T69N R18W	W 4, RR	1 - 1 - 3 - 4 - 1 - 3		1 11
BRUENING ROCK PRODUCTS INC HAMMEL-BO BRUENING ROCK PRODUCTS INC IVERSON BRUENING ROCK PRODUCTS INC IVERSON 2 APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA	SW 7 T97N R02W 2.67 3iB SW 2 T99N R06W NW 09 T99N R06W NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W	W 4, RV	1 - 1 - 3 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4		11
BRUENING ROCK PRODUCTS INC BRUENING ROCK PRODUCTS INC IVERSON IVERSON APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON BIST 4 SAND AND HALLETT MATERIALS CO EXIRA	SW 2 T99N R06W NW 09 T99N R06W NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W	4 N.	1 - 1 - 2 - 4 - 1 - 3 - 4 - 1 - 3		11
BRUENING ROCK PRODUCTS INC HAMMEL-BO BRUENING ROCK PRODUCTS INC IVERSON BRUENING ROCK PRODUCTS INC IVERSON 2 APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA	SW 2 T99N R06W NW 09 T99N R06W NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W	4, R.	1 - 1 - 3 - 2 - 2 - 3 - 3 - 3 - 3 - 3 - 3 - 3		1.1
BRUENING ROCK PRODUCTS INC IVERSON BRUENING ROCK PRODUCTS INC IVERSON 2 APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON BIST 4 SAND AND HALLETT MATERIALS CO EXIRA	NW 09 T99N R06W 2.65 NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W	N N N	1 - 1 - 3 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4		11
APPANOOSE CANTERA AGGREGATES CONFIDENC AUDUBON ALTERT MATERIALS CO EXIRA EXIRA EXIRA	NE 08 T99N R06W 2.65 CT 35 T70N R19W 2.7 2 SE 15 T69N R18W 5 T69N R19W	N N N	11-3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		11
APPANOOSE CANTERA AGGREGATES LEW QUARRIES INC CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA	CT 35 T70N R19W 2.7 SE 15 T69N R18W 5 T69N R19W	טטט	- 1 9 4 L		П
CANTERA AGGREGATES LEW QUARRIES INC CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON BIST 4 SAND AND HALLETT MATERIALS CO EXIRA	35 T70N R19W 2.7 15 T69N R18W 5 T69N R19W	N N N	1 9 4 L		ı
LEW QUARRIES INC CLARKDALE CANTERA AGGREGATES PLANO CANTERA AGGREGATES CONFIDENC AUDUBON DIST 4 SAND AND HALLETT MATERIALS CO EXIRA	15 T69N R1 5 T69N R1	υu	0 4 t	D	
CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA EXIRA EXIRA	15 T69N R1 5 T69N R1	N	4 r		
CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA DIST 4 SAND AND HALLETT MATERIALS CO EXIRA	T69N R1		<		
CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA EXIRA PLANO CONFIDENC	T69N R1		4 7	Д	
CANTERA AGGREGATES CANTERA AGGREGATES CONFIDENC AUDUBON HALLETT MATERIALS CO EXIRA PRIMON PRIMON PAGE CONFIDENC CONFIDENC CONFIDENC CONFIDENC CONFIDENC AUTOMACO FILENC FILENC	TG NGOT	Г) ₋	۵ b 5 c	
AUDUBON AUDUBON AUDUBON HALLETT MATERIALS CO EXIRA BEXINGAL BEXING		n	-l (~	d E	
AUDUBON DIST 4 SAND AND HALLETT MATERIALS CO EXIRA DENIMON	20 T70N R19W	5 2	BED 1))	
HALLETT MATERIALS CO	EL				l
у шота	SW 8 T78N R35W 2.68 3i	e e			
3 HOTEL	.66	×			
DENTON					
A06006 WENDLING QUARRIES INC GARRISON B	NE 33 T85N R11W 2.64 2	4 4 L	6-16		
		Ŋ	00		
			6-TOP 2	ABCDE	
		-	o '		
		n n	$_{1}^{\circ}$		
A06012 WENDLING QUARRIES INC		٠	6-11		
	DWU 2	2 2	9-12	ABCDE	
	m	4	,	C C M	
		4	1		
		4		Ω	
		4	7	E C C E	
				a a	ı

(')
\subset	
F	
\geq	
U	
-	-
_	a
π	٦
"	J
$\overline{}$	4

July 22, 2025

SOURCE NA DIST 6 CRUSHED S TES INC COOTS TES INC COOTS TES INC COOTS SAND AND TES INC COOTS SAN TES INC BRIGHT SA TES INC		LOCATION	SpGr	CA F	A A 1	m	200		NOTES
MENDLING QUARRIES INC WENDLING QUARRIES INC WENDLING QUARRIES INC WENDLING QUARRIES INC BLACK HAWK BMC AGGREGATES LC DIST 2							Y F E BEDS	CLASS	1 +) 1
WENDLING QUARRIES INC WENDLING QUARRIES INC WENDLING QUARRIES INC WENDLING QUARRIES INC BLACK HAWK BMC AGGREGATES LC DIST 2							CONTINUED		
WENDLING QUARRIES INC WENDLING QUARRIES INC WENDLING QUARRIES INC BLACK HAWK BMC AGGREGATES LC		S2 10 T85N R10W				4 L	1-4	_	
WENDLING QUARRIES INC WENDLING QUARRIES INC BLACK HAWK BMC AGGREGATES LC		SW 36 T86N R11W					ZA ON	ЭΩ	
WENDLING QUARRIES INC WENDLING QUARRIES INC BLACK HAWK BMC AGGREGATES LC	GRAVEL								
BLACK HAWK BMC AGGREGATES LC		SW 31 T86N R10W NW 28 T86N R10W	2.65	פ	m	m			
TC			T		\perp	+			
		NW 18 T87N R12W	DMU	8		\vdash	25		
					4 4	4 4 I I	17-24	ABCDE	
								ABCDE	
A07008 BMC AGGREGATES LC		NE 15 T89N R12W	. 48	31			17-23	О О М	
			2.63	31	4	4 D	TOP 30'		
					rV.	Г	, H -		
						о го	B		
A07018 BMC AGGREGATES LC RAYMOND-PESKE		SW 1 T88N R12W	2.66 DWU	0 0	4 4	4 4 H H	1B-5,2-5 3-12,3-13		
			0	. (1)					
			0	CI.			3-10	ا ر د د	
							6-10)	
A07020 BMC AGGREGATES LC STEINBRON		SE 1 T88N R11W	9.0	m (1B 4		
A07022 BMC AGGREGATES LC MESSERLY SAND AND GRAVE	GRAVEL	NE 8 T90N R14W	0	NI			⊣ I		
		SW 9 T89N R13W	'	:	m	m			
A07506 WENDLING QUARRIES INC		NW 1 T88N R13W	N (≺ :	4	4			
A07508 BMC AGGREGATES LC	五九五	16 T88N R12W		× ×	4	4			
A07512 BMC AGGREGATES LC ZEIEN S&G A07518 BMC AGGREGATES LC JANESVILLE	EI .	NW 23 T87N R12W NE 14 T90N R14W	2 7 9 9 9 9 9	× ×	m	m			
A07520 BENTONS SAND & GRAVEL BENTON'S LAKE	LAKE	1 T89N R14W	2.66	$\times \times$					

	_
U	2
r.	я
[2	4
r	١
•	4
۵	r.
F	9
Ε	5
	7
c)
ri	ζ
u	2
r.	я
ß	4
Ė	a
ь	3
ø	ľ
-	션
7	r)
-	≤
Ľz	1
Ξ	J
Ω	G
7	ň
C	IJ
ď	ĥ
	d
Ñ	Ġ
	ζ
	ς
	ς
P	4
P	4
	4
P	4
P	4 4 4
A TYLE	4 4 4 4
P	2 2 4 4 4 7
A FILES	(1 / 1 / 1
A FILES	2 2 4 4 4 7
A TYLE	2 2 4 4 4 7
A FILES	2 2 4 4 4 7
	2 2 4 4 4 7
	2 2 4 4 4 7
A FILES	2 2 4 4 4 7
	2 2 4 4 4 7
A TITLE A TITLE	2 2 4 4 4 7
	2 2 4 4 4 7
A TATE A PIE	2 2 4 4 4 7
A TITLE A TITLE	2 2 4 4 4 7
A TATE A STERNE	2 2 4 4 4 7
A TATALY A THINE	2 2 4 4 4 7
A TATE A STENE	
A TATALY A THINE	
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	
A TATEOR STENES	

			BULK	DUR	FRICT	L2 ROCK	REVETMENT	
CODE OPERATOR	SOURCE NAME	LOCATION	SpGr	CA FA	A B	TYPE BEDS	CLASS	NOTES
8 BOONE DIST 1	SAND AND GRAVEL							
A08504 STRATFORD GRAVEL INC	JENSEN	5 T8		H				
A08526 STRATFORD GRAVEL INC	POWERS	29 T84N R2		田				
A08528 STRATFORD GRAVEL INC	LEININGER	26 T85N R2		H				
9 BREMER DIST 2	CRUSHED STONE							
A09002 BMC AGGREGATES LC	FREDERIKA	2 T93N R1			5	1		
A09006 BMC AGGREGATES LC	TRIPOLI-PLATTE	36 T	2.65	3iB	4 4	D 1-6	B C D	
			9	-H		<u> </u>	ABCDE	
A09008 BMC AGGREGATES LC	DENVER #2 SAND AND GRAVEL	NE 20 T91N R13W				7	D C B	
C F REEKSTEASSE SMA 805800K	THE TOTAL TO	36 TO 3N D1		٦				1
	TKIFOLI PLATTB	SO TUSN KI	(ц;				
CROELL REDI MIX	PLAINFIELD/ADAMS	NE 32 T93N R14W	00.0	×÷				
9012 BMC AGGREGATES LC	BOEVERS	31 TYZN KII	٥.	×				
10 BUCHANAN DIST 6								
A10002 BARD MATERIALS	WESTON-LAMONT	NW 14 T90N R07W	2.61	3iB		<u> </u>	C B	
				31		9	C C	
			9.	31		∞	BCD	
						<u>⊢</u>		
A10004 BMC AGGREGATES LC	BLOOM-JESUP	SW 32 T89N R10W	2.63	2	4 4	- 1	ABCDE	
						L 1-7		
						2-	Ω	
A10008 BRUENING ROCK PRODUCTS INC	OELWEIN	NW 2 T90N R09W	2.65	31		4-	ABCDE	
					4 4	1		
A10010 BRUENING ROCK PRODUCTS INC	HAZELTON	11 T90N R0	2.63	3iB			ABCDE	
BMC AGGREGATES	MILLER-INDEPENDENCE	14 T88N						
BMC AGGREGATES	#	T90N R0			2	-12		
A10016 BMC AGGREGATES LC	OELWEIN #2	3 H3	2.67	31		13		
		E C		- (13-1	A B C D E	
ALUUZZ BRUENING ROCK PRODUCTS INC	BROOKS	NM Z T.88N KOGW	9 N	31	44	, <u>, , , , , , , , , , , , , , , , , , </u>		
, t	=	E			Ω	- 0 (1 7 7		
AIOUZ4 BMC AGGREGAIES LC	KASMOSSEN # Z	SE ZI IOON ROOM				T I D	Z Z Z	
TNT SHEARTH SITURE OF A THE	HEREZER	MZ ST 9			r	4		
RARD MATERIALS	SOUTH AITRORA	19 T90N BO	0	7. E	4	1 3	м С	
	ZIIDKE-OFI.WETN	4 T90N R0	•	1		1	1	
BRITENTNG ROCK P	BRANDON 1-380	23 T87N R1						
BMC AGGREGATES LC	PARKER	T88N R1						
	SAND AND GRAVEL							
A10516 BMC AGGREGATES LC	MILLER	NW 14 T88N R09W	2.65	×				
			ı					

Matls. IM T203

July 22, 2025

			BULK DUR	FRICT		4	ENGWE GIVE	
CODE OPERATOR	SOURCE NAME	LOCATION		FA A	B TYPE I	PE BEDS	CLASS	NOTES
10 BUCHANAN DIST 6	SAND AND GRAVEL					CONTINUED		
	BROOKS	T88N	DMO	×				
BARD MATERIALS	NI EMANN-DECKER	NW 14 T90N R07W	2.65	×				
A10524 BRUENING ROCK PRODUCTS INC	CRAWFORD	0 T90N	2.6	×				
11 BUENA VISTA DIST 3	SAND AND GRAVEL							
A11512 BUENA VISTA COUNTY	MARATHON	19 T93N		4	ct			
A11514 REDINGS GRAVEL & EXCAVATING CO	OATMAN	18 T90N		4	4			
A11516 HALLETT MATERIALS CO	SIOUX RAPIDS	\vdash			<u> </u>			
A11518 STRATFORD GRAVEL INC	MOLGAARD	3 T93N		H				
A11520 WETHERELL SAND & GRAVEL	WETHERELL	2 T93N		н				
12 BUTLER DIST 2	CRUSHED STONE							
A12004 BRUENING ROCK PRODUCTS INC	LUBBEN	NW 25 T93N R17W		ιΩ	L L	1		
						1-21	Ω	
A12008 BRUENING ROCK PRODUCTS INC	FLORRY-STEERE	8 T93N			10	\vdash		
	CLARKSVILLE	16 T92N R1		ro To	2 L	П		
A12014 BMC AGGREGATES LC	OLTMAN							
						TOP	Ω	
						<i>ک</i> ر	۲	
				ט וע) L	17-18	9 6	
A12016 BRUENING ROCK PRODUCTS INC	WIEGMANN-BRISTOW	T92N				1	1	
A12018 BRUENING ROCK PRODUCTS INC	NEYMEYER	28 T						
BRUENING ROCK PRODUCTS	BRUNS #2	21 T91N			2	1-5	О	
	SAND AND GRAVEL							
A12502 CROELL REDI MIX	CLARKSVILLE	NW 1 T92N R16W	2.67 2	7 7	4			
ALZSI 6 BRUENING ROCK PRODUCTS INC		SZ IS TUSN RIEW		4 (4.0			
AIZOIO BMC AGGREGAIES LC	OHELL KOCN-ADAMS	O L'AIN KI	0	n				
A12520 CROFIL REDI MIX	PARKERSBURG	9 T90N R1	DWU	: ×				
	HOBSON	34 T92N	2.66	: ×				
13 CALHOUN DIST 3	SAND AND GRAVEL							
A13502 STRATFORD GRAVEL INC	KRUSE	26 T86N	_	4	4			
TIEFENTHALE	JENSEN	T86N	2.67	×				
MOHR SAND,	MOHR	23 T86N	_					
STRATFORD GRAVEL INC	PACKER	26 T8		m	<u>е</u>			
A13510 MOHR SAND, GRAVEL, & CONST LLC	SMITH	T86N			_			
_	SAND AND GRAVEL							
A14504 STRATFORD GRAVEL INC	REINHART	NW 21 T85N R33W	DWU 2	×				

			BULK D	DUR 1	FRICT	L2 ROCK	REVETMENT	
CODE OPERATOR	SOURCE NAME	LOCATION	Su	FА	A B	TYPE BEDS	CLASS	NOTES
14 CARROLL DIST 3	SAND AND GRAVEL					CONTINUED	Q.	
A14510 TIEFENTHALER AG-LIME INC	LANESBORO	NW 17 T85N R33W	7.9	×	4 4			
A14514 TIEFENTHALER AG-LIME INC	MACKE	SW 6 T85N R33W	2.69 2		4 4			
A14516 STRATFORD GRAVEL INC A14518 TIEFENTHALER AG-LIME INC	RICHLAND MILLER	NE 23 T83N R33W 21 T85N R33W		IH X	4			
15 CASS DIST 4	CRUSHED STONE							
A15004 SCHILDBERG CONSTRUCTION CO A15008 SCHILDBERG CONSTRUCTION CO	LEWIS ATLANTIC MINE	SE 17 T75N R37W SW 13 T76N R37W			Ŋ	L)		
A15012 SCHILDBERG CONSTRUCTION CO	HANSEN	SE 29 T76N R36W			5	25B-25E 20A-20C L 15A-C	ΩО	
16 CEDAR DIST 6	CRUSHED STONE							
WENDLING QUARRIES	LOWDEN-SCHNECKLOTH	8 F	DMU 3	.д .	4 4	D 1-4	ABCDE	
A16006 WENDLING QUARRIES INC	STONEMILL	14 T80N	DMU 3	i.B		1 4		
WEBER STONE CO INC	ONION GROVE	14 T8	2.61 3	i.	4 4	7	BCD	
WENDLING QUARRIES	TOWNSEND	2 T79N				2	D C B	
A16022 WENDLING QUARRIES INC	TRICON	∞ H	DWU 3		4 4	D 1 D 1-4	E E E C C C C C C C C C C C C C C C C C	
A16026 WENDLING QUARRIES INC	PEDEN #2 Sand and Cravet.	SW 10 T79N R03W						
CELT CARTE		C T						1
A1630Z WENDLING QUARRIES INC	SHAKFLISS	NW 17 T'USN KUSW	2.65		4 .			
A16506 WEBER STONE CO INC A16510 CROELL REDI MIX	ONION GROVE CEDAR BLUFF	NE 14 T82N R02W SW 28 T81N R04W	2.65 DWU	××				
17 CERRO GORDO DIST 2	CRUSHED STONE							
A17008 MARTIN MARIETTA AGGREGATES	PORTLAND WEST	9 T96N R1	.75	iB			ABCDE	
A17012 MARTIN MARIETTA AGGREGATES	UBBEN	\sim				η,		
A17020 MARTIN MARIETTA AGGREGATES	MASON CITY	NE 29 T97N R20W	DWU 3	·H	~ വ വ n	777	ABCDE	
							A B C D E	
A17022 BMC AGGREGATES LC A17024 HEARTLAND ASPHALT INC	HOLCIM RIVERVIEW	SE 19 T97N R20W NE 29 T96N R19W			4 4	T 1-12		
BMC AGGREGATES LC HEARTLAND ASPHALT	HOLCIM RIVERVIEW	19 T97N 29 T96N					I ←	1-12

Matls. IM T203

July 22, 2025

			BULK	DUR	FRICT	12		
					HMA	ROCK	REVETMENT	
CODE OPERATOR	SOURCE NAME	LOCATION	O	A FA	A B	TYPE BEDS	CLASS	NOTES
17 CERRO GORDO DIST 2	CRUSHED STONE					CONTINUED		
A17024 HEARTLAND ASPHALT INC	RIVERVIEW	NE 29 T96N R19W				1-15		
					2 2	m 9		
A17025 SKYLINE MATERIALS LTD	NISS QUARRY SAND AND GRAVEL	19 T97N R20W						
A17514 MARTIN MARIETTA AGGREGATES	HOLCIM SAND	NE 19 T97N R20W	DMU 3		т т			
			2.65	\times				
	AIRPORT	T96N R21W		田	m m			
BMC AGGREGATES		13 T97N R21W	2.64	\times				
BMC AGGREGATES LC	PIT	NE 20 T97N R20W		×				
/524 SKYLINE MATERIALS LTD		N/SI 6						
18 CHEROKEE DIST 3	SAND AND GRAVEL							
A18506 HALLETT MATERIALS CO	CHEROKEE SOUTH	NE 16 T91N R40W			т т			
			60	\times				
A18514 L G EVERIST INC	LARRABEE-MONTGOMERY	NE 20 T93N R39W	2.67	×	m			
A18526 HALLETT MATERIALS CO	CHEROKEE NORTH	SW 23 T92N R40W	. 7		3			
			.67	×				
A18528 L G EVERIST INC	WASHTA	SW 31 TGON K4TM		>	n			
A18534 HALLETT MATERIALS CO	NETSON	CT 23 T92N R40W	2.67 2	<	8			
			2.68	×				
19 CHICKASAW DIST 2	CRUSHED STONE							
A19004 BRUENING ROCK PRODUCTS INC	DEERFIELD-MAHONEY							
A19008 BRUENING ROCK PRODUCTS INC	BOICE	16 T				2-5	О	
	SAND AND GRAVEL							
A19508 SKYLINE MATERIALS LTD	BUSTA	R11W	2.65	×	4 4			
A19512 BRUENING ROCK PRODUCTS INC	PEARL ROCK	E 31 T94N R14W	(;				
			2.65	×				
A19514 BRUENING ROCK PRODUCTS INC	NASHUA	SW 33 T95N R14W	DWU	×	m m			
BMC AGGREGATES	REWOLDT	5 T94N R13W	2.64	×				
520	ROSONKE	16 T95N R14W						
A19522 CROELL REDI MIX	BUCKY'S	T95N R11W	2.68 3	iB	ж ж			
			9	×				_
CLARKE	CRUSHED STONE		+					
A20002 SCHILDBERG CONSTRUCTION CO	OSCEOLA	NW 12 T72N R26W			2	25A-25E	D	

70
Ω
뙤
'nί
\approx
NY.
_
$\overline{}$
\equiv
0
~~
Ś
闰
щ
i.i.
ď
rή
Ů.
r₊1
_
7
9
-Th
Ů.
ď
r-1
E
M.
B
M.
H
LI
ÞIE
DIE:
CHIC
CHIC
DIE:
ACTIV
ACTIV
ACTIV
Y ACTIV
ACTIV
LLY ACTIV
LLY ACTIV
LLY ACTIV
NTLY ACTIV
NTLY ACTIV
ENTLY ACTIV
CENTLY ACTIV
CENTLY ACTIV
CENTLY ACTIV
ECENTLY ACTIV
CENTLY ACTIV
ECENTLY ACTIV
ECENTLY ACTIV
ECENTLY ACTIV

Comparison Com	CODE OPERATOR	SOURCE NAME	LOCATION	SSD PCC SpGr CA	C FA	HMA A B	ROCK TYPE BEDS	REVETMENT CLASS	NOTES
CHANGE C	CLARKE DIST						CONTINUE	Q	
CLAY DIST 3 GNUD AND GRAVEL No. DIST 3 GNUD AND GRAVEL DIST 3 GNUD AND GRAVEL AN	SCHILDBERG CONSTRUCTION	OSCEOLA	12 T72N R2				-20	0 C	Н
STATE STAT	CLAY DIST	AND					1)	
HALLETT MATCRIALS CO. CLAY COUNTY SW 2 T97N MATCRIALS CO. CLAY COUNTY CLAY COUNT	DAVE'S SAND AND GRAVEL	EVERLY	31 T97N R38	7.09	>				
HALLETY MATERIALS CO SPENCER # 2 SW 5 T97M R37M LANGE	6 SIEH SAND &		24 T96N R3	000	< >				
SANDA COUNTY CARA COUNTY	HALLETT MATERIALS	SPENCER #2	5 T97N R3	•	< п				
SAND MADIGENAPEL INC CORDERN NE 5 796 N R36N NE 5 796	CLAY COUNTY	CLAY COUNTY	20 T96N R3		н				
CLANK COUNTY NATERIALS O ELSER NUSCHWEIG LIGAN NATERIALS O ELSER NUSCHWEIG LIGAN NATERIALS O CLARK EVERLY NW 6 796N 836M H 3 3 3 S S S S S S S S	DAVE'S SAND AND GRAVEL	GOEKEN	5 T96N		П				
CLAYE COUNTY COUNTY COUNTY CLAYE PURILY COUNTY CLAYE PURILY COUNTY COUNTY COUNTY COUNTY COUNTY COUNTY COUNTY COUNTY CLAYE CLAY	HALLETT MATERIALS	BRAUNSCHWEIG	6 T94N R3		I				
HALLETY MATERIALS CO		ELSER	3 T94N		田				
NEACH ILLY MATERIALS CO CILLETT GROVE NEACH DEAN EARDY & CRAVEL NEACH DEAN EARLY & NEACH DEAN	HALLETT MATERIALS	CLARK EVERLY	N96I 9		н				
NEASO, ILC LIC	HALLETT MATERIALS		3 T94N R3		н				
CLANTON SERVICES ILC DELOSS CRUSHED STONE CLANTON DELOSS CRUSHED STONE CLANTON DELOSS CRUSHED STONE CLANTON DELOSS CRUSHED STONE CLANTON DIST 2 CRUSHED STONE CLANTON DIST 2 CRUSHED STONE CLANTON DIST 2 CRUSHED STONE DELOSS CRUSHED STONE DIST 2 CRUSHER STONE DIST 2 CRUSHED STON	NSG, LLC	SAND & GR	20 T96N R3	9	×				
CLAYTON DIST CRUGHED STONE MILE TOLATON M	BD CONSTRUCTION SERVICES	DELOSS	0 T96N R3		Н				
Pard materials Thin mock-schader Thin materials Thin mock-schader Thin materials	CLAYTON DIST	CRUSHED STONE							
SECTIONE MATERIALS ITD BENTE-ELKADER-WATSON SW 12 T93N R05M 2.66		TWIN ROCK-SCHRADER	14 T94N R0				1-		
SERIOR MATERIALS LID ANDEREGG SE 32 T92N NO3M 2.67 4 4 4 1-9 1-9 A B C D C D S B B B B B B B B B B B B B B B B B B	SIKT GGERAM GNT IVAS	MOSHWH GEGRATE - GHAGG	10 TO 3N DO	9			۳ ا	ВС	
S B B A D M A TERIALS ANDER G G	STUTION THE PROPERTY OF	DENTE ELIVADEL WAS SON	17 17 170				- C		
S BARD MATERIALS ANDEREGG SE 3 19 1 2 2 3 4 4 4 4 4 5 2 5 4 4 4 4 5 5 5 5 5							1 TO	D C B	
C BARD MATERIALS C STERDOCK SE 2 T91N R03M 2.67 2 4 4 4 4 4 4 4 4 4		ANDEREGG	32 T92N				2	ВС	
E BARD MATERIALS SCHMIDT NE 33 T91N R01W O SARD MATERIALS LUME BLUME BLUME NE 9 T93N R03W C SARD MATERIALS NE 9 T93N R03W C SARD MATERIALS NE BARD MATERIA	BARD	OSTERDOCK	2 T91N	.67			- 1		
SCHMIDT SCHM							1 1	ے ر	
A SKYLINE MATERIALS LTD BLUME GISLESON NG T95N R04M 2.64 2 4 4 0 1-7 GISLESON NG T95N R05M 2.66 31 4 4 0 1-12 R CO BARD MATERIALS NG T95N R05M WUELLER NG MUELLER NG	BARD	SCHMIDT	33 T91N	.66			4B -)	
4 SKYLINE MATERIALS LTD BLUME GISLESON NM 6 T95N R04M 2.66 31 4 4 0 1-12 R S CJ MOXNA & SONS INC MUELLER MIELKE QUARRY MIELKE QUARRY NE 21 T95N R05M S CJ MATERIALS NE 21 T95N R05M NE							2-6	BCD	
S C D MATERIALS CISLESON NW 6 T95N R04M 2.66 31 4 4 4 D 1-12 A B C D A B C D	SKYLINE MATERIALS	BLUME	9 T93N	.64					
G BARD MATERIALS GISLESON NW 6 T95N R04M 2.66 31 4 4 4 D 1-8 A B C D							1-1	ВС	
S CJ MOYNA & SONS INC ZURCHER SE 1 T94N R05M A 4 4		GISLESON	0 T95N	.66			1-8		
O BARD MATERIALS MUELLER MUELLER MUELLER OUARRY NE 21 T95N R04M 3i 4 4 4 D 1-8 A B C D	CJ MOYNA & SONS	ZURCHER	1 T94N					O O M	
MIELKES QUARRY MIELKE QUARRY NE 21 T95N R04W 4 4 4 D 1-2 A B C D	A22020 BARD MATERIALS	MUELLER	30 T94N	m			1	BCD	
(6 BARD MATERIALS DOERRING-LUANA SE 5 I95N ROSW) 3-5 A B C D		MIELKE QUARRY	21 T95N				⊢ .	D C D	
	6 BARD MATERIALS	LUANA	SE 5 T95N R0				1.	B C D	

-	
≥ -	
7.0	
71	
7/	
U	
U	
U	
Ū	
Ū	
Ū	
U	
U	
U	
U	
Ū	
Ū	
Ū	
U	
Ū	
-) H
יי ו) H
-) H
-) H
-) H

July 22, 2025

NOTES																																			
REVETMENT CLASS			ABCDE		ABCDE		(A B C D E A B C D E			ABCDE		С	1	ABCDE		BCD	ABCDE	B C D	B C D					B C D						BCD	ВС	ABCDE	B C D	BCD
K BEDS	CONTINUED	1 - 5	0 9 1	1 - 6 7 - 1 - 1	5-12	12	2B -6	2-6 1-4	- 1	1-10	1	1	1 - 1		- 1	1-5	- 1	- 1	1	1				BED 6-TOP	9 0			S1C-S1D	S1B	S1B-S1D	G4	G2-G3	ONEOTA	G2-G4	G1
ROCK							Д	Д		О					О	Д	О	О	О	О				ы	Н	l		Д	О	О	О	Д	О	О	О
HMA A B		4		4 4	4	4	4	4		4		_	۲		4	4	4	4	4	4					4			4	4	4	4	4	4	4	4
HN FA A		4			4	4	4	4		4			۲		4	4	4	4	4	4					4			4	4	4	4	4	4	4	4
PCC CA E		m		Д	2 0		31	31				٠.	H		3;		31	31	31	31				31				3iB	m	m	31	m	31		
SSD E		72					67	89				ر. الا)		64		<u></u>			69				9								10	01		_
SS Q		W 2.		(W 2.	W 2				M 3		: 🛚	W 2				_	W 2.	M	M		M 2		M	M		DMO	ζ.	ζ.	Ν.	ζ.		_
		R05		RU6W RO4W			R03W	R06W	RO			R02W											R03W			R02W	R05W	R02W							
NO		T93N		TYZN	7 7 7		T92N	T91N	T92N		,	NIOF NIOF	101N	T94N	T93N		T94N	T91N	195N	T91N	T93N	193N	191N	193N		0	T94N	9							
LOCATION		27		227	H		0	29	35		7	ω σ	7 (0	25	26		22	10	35	19	∞	7	00	4		18	29								
Н		MN	i	MN	4		MS	MN	CI			MS MN	MS	MN	MN		SS	Z	MN	HZ	MN		MM			MS	MM								
SOURCE NAME	CRUSHED STONE	EBERHARDT		WELLMAN KRIISE			FASSBINDER	HARTMAN	MORAREND			BOGE TOV SEPTINGS PITEPACE	TUCKER	ST. OLAF	JOHNSON		SNY MAGILL	MILLVILLE	BERNHARD/GIARD	STRAWBERRY POINT	LARSON	LINK	HILINE	MOYNA		WILLIE	KEPPLER	FRENCHTOWN							
CODE OPERATOR	22 CLAYTON DIST 2	A22030 BARD MATERIALS		AZZU3Z BARD MATERIALS apponsa bard materials			A22038 BARD MATERIALS	A22040 BARD MATERIALS				A22044 BARD MATERIALS 322016 BECKED DOCK		SKYLINE MATERIALS	CROELL REDI MIX		CJ MOYNA &	RIVER CITY STONE INC	A22070 BRUENING ROCK PRODUCTS INC	A22074 RIVER CITY STONE INC	BRUENING ROCK PRODUCTS		BARD MATERIALS	A22084 CJ MOYNA & SONS INC		A22086 CJ MOYNA & SONS INC	A22088 CJ MOYNA & SONS INC	A22090 PATTISON COMPANY LLC							

١.	,
	`
_	1
(J
Ė	4
≥	1
Ξ	3
١.	١
	۰
U)
_	4
١.	ï
+	'
π	3
5	1

July 22, 2025

)
TROFF	
re'	1
,	4
r '	١
$\tilde{\sim}$,
_	١.
_	,
-	
C,)
V,	3
Ė	
-	ė.
a	
	9
U	1
Ŀ	,
Ĕ	
_	1
7	
P D	٠.
Ü	
ā	
E	1
×	4
١.	
	Þ
2	
-	1
е.	
_	1
= .	
_	
$\stackrel{\smile}{}$	4
ă	1
ď	4
d	4
R	i
R	i
R	i
м >	i
Α >-	
Α >-	
Α >-	
ν.Υ.Υ. Σ	
ν.Υ.Υ. Σ	
ν.Υ.Υ. Σ	
NTT-V	
THUM ATHUE	
Z Y.T.T.V.	
NTT-V	
Z Y.T.T.V.	

			BULK	DUR	FRICT			EMEMBER	
	E C GII C C	NO F) k) k		TYDE DEFINE	טַּ	AEVELMENT OT AGG	FOM
	CERTIFIED		7 7 9	4	4		COLLEGE		I I I
CLATION	N I					ŀ	킮		
A22090 PATTISON COMPANY LLC	FRENCHTOWN	7 T93N R02W			4 4	D G1.	-d3	A B C D E A B C D E	
						D G1-G	-G5 A-S1D		
A22092 CJ MOYNA & SONS INC	LARSON	07 T94N R06W							
A22094 CJ MOYNA & SONS INC	BACKES SAND AND GRAVEL	9 T92N							
A22510 SKYLINE MATERIALS LTD	BENTE	E 15 T93N R0	9	×	4 4				
A22520 BARD MATERIALS	WELTERLEN	32 T91N	2.65	\bowtie					
A22522 CJ MOYNA & SONS INC	MOYNA	3 T93N R0	9	×	4 4				
23 CLINTON DIST	6 CRUSHED STONE								
A23002 PRESTON READY MIX CORP	ELWOOD-YEAGER	NW 8 T83N R02E	DMU	31		1-5-	2	ABCDE	
A23004 WENDLING QUARRIES INC	ВЕНК	SW 2 T81N R03E	DMO	31	4 4	D 7 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	2A	ABCDE	
A23006 WENDLING OUARRIES INC	SHAFFTON	NE 11 T80N ROSE	DMO			16	-17		
ı			DMU			17	-18		
			DMC	31		-	-19		
			DMC			< <u>N</u>	-21		
			DMO	m		N	-23	ABCDE	
			DMO	m		m (14	О	
						ν) ۲	L5 -21	ام ر د د	
A23010 WENDLING QUARRIES INC	GOOSE LAKE	SW 22 T83N R05E			4	D 1-1(10)) A	
A23012 WENDLING QUARRIES INC	TEEDS GROVE	SW 3 T83N R06E				2 0	4 4	B C D E	
A23016 WENDLING QUARRIES INC	IYONS	8 T82N				UPPE	PER OR		
							LEDGE		
WENDLING QUARRIES	MILL CREEK	22 T82N							
WENDLING QUARRIES	DEIMAR	SE 6 T83N R04E							
WENDLING QUARRIES INC	EDEN VALLEY	T83N							
A23032 ANDERSON SAND AND GRAVEL CO	ANDERSON Sand and gravel	m							
A23506 WENDLING QUARRIES INC	SCHNECKLOTH	S2 10 T80N R05E	0	×	4 4				
ANDERSON SAND AND	ANDERSON	23 T81N	2 . 6 8 9	: ×					
A23516 WENDLING QUARRIES INC A23518 WENDLING QUARRIES INC	OLSON HARKSEN	NW 23 T81N R02E SE 10 T80N R05E	DMQ	\times \times					

CODE OPERATOR		SOURCE NAME	NOTHADOL	BULK	DUR	FRICT HMA FA A B	L2 ROCK TYPE BEDS	REVETMENT	SELON
COOMMECOO	C EST	CANA ANA CDATTET		1		-			
4512 HALLETT MATERIALS CO			SE 27 T82N R41W	2.7	2	m m			
				· I		×			
25 DALLAS DI	DIST 4	SAND AND GRAVEL							
A25510 HALLETT MATERIALS CO		PERRY	NW 1 T81N R29W	2.7	2	4 4			
A25514 HALLETT MATERIALS CO		BOONEVILLE	S2 26 T78N R26W	2.68	N	κ κ			
A25516 HALLETT MATERIALS CO		VAN METER SOUTH	21 T78N R27W	2.66	N	κ κ			
A25518 MARTIN MARIETTA AGGREGATES		RACCOON RIVER SAND	27 T78N R26W	2.66	N	м ж			
A25520 LEGACY MATERIALS		LEGACY MATERIALS	29 T78N R26W	2.65 DWU	N	×			
A25522 HALLETT MATERIALS CO		BOONEVILLE WEST	25 T78N R27W	2.66	~ ~	т т			
26 DAVIS DI	DIST 5	CRUSHED STONE		00.7		<			
A26004 DOUDS STONE LLC			W2 2 T69N R12W	2.6	m		T		
						77 72 73	L 3-7	ДОО	
A26006 DOUDS STONE LLC		BROWN	NW 2 T69N R12W	2.6	m	4 4 5	L 6-7 L 1 3-7		
		THE CONTRACTOR OF THE CONTRACT				4 5	3-5 L 6-7		
C TT TIMORES SCHILOG CORRE		SAND AND GRAVEL	MCTG MOTH 1 MO	0	Ĺ				
DECATUR	DIST 5		T T ON PT	٠.					
002 SCHILDBERG CONSTRUCTION CO			NW 22 T70N R27W			2	-25		Н
							TOP 5.5	Ω	
A27008 SCHILDBERG CONSTRUCTION CO		DECATUR	05 T68N R26W				ν .	ABCDE	7
						2	25A-25E		m
							25C		
						_	L ZUA	CDE	

NOTE 1: TOP 4' ONLY OF BED 25C NOTE 2: FRICTION TYPE TO BE DETERMINED WHEN USED FOR BED 20C. NOTE 3: TOP 2.5' ONLY OF BED 25E.

(''	
\subset	
()	
\sim	
ь.	
Е	
Z	
-	
U	
+	
π	
\geq	

July 22, 2025

			BULK	DUR	FRICI		L2		
			SSD		HMA			REVETMENT	
CODE OPERATOR	SOURCE NAME	LOCATION	SpGr	CA F	A A	B	(PE BEDS	CLASS	NOTES
28 DELAWARE DIST	6 CRUSHED STONE								
A28008 BARD MATERIALS	EDGEWOOD WEST	CT 4 T90N R05W	2.69	31	4 4	4 D	2B-3B 3B	A B C C C C C C C C C C C C C C C C C C	
)	4) I))	
A28010 BARD MATERIALS	TIBBOTT	SW 23 T90N R04W	2.7	31	4		- 1	ABCDE	
(((- (4		1-7		
	BAHL	SE ZZ T89N KU6W	N (77	7' '		1	(
AZ8014 BAKD MATEKLALS	LOGAN	NSST OT	ν.	n	7, 4		1	A B C D E	
((i i	(- (7 .		1	1	
BARD	WHITE	Z T88N	2.67	31	4		1	C B	
BARD	HOPKINTON	NE 18 T87N R03W					7	ABCDE	
A28038 BARD MATERIALS	EDGEWOOD EAST	N06L 9	2.68	31	4		М	BCD	
A28040 BARD MATERIALS	KRAPFL	3 T89N	2.6		4	4 D	4		
					4		1-4		
					4		- 1		
					4		7		
							1-5	ABCDE	
A28044 BARD MATERIALS	DUNDEE	0 T9	DMC	31	4	4 D	- 1		
A28046 BARD MATERIALS	PINS	7 T88N							
A28050 BARD MATERIALS	BUCK CREEK	20 T87N							
A28052 RIVER CITY STONE INC	MANCHESTER	N88I 6	DMC	\sim	4	4 D	5-8		
							8-9	ABCDE	
							TOP	О	
							LEDGES-N		
RIVER CITY STONE	THORPE						FULL FACE	A B C D E	
A28058 RIVER CITY STONE INC	ROSSOW/MANCHESTER	188N				П	1-8		
	SAND AND GRAVEL					-			
A28520 RIVER CITY STONE INC	MANCHESTER	0 T88N	2.6	\times					
A28526 BARD MATERIALS	HAWK	SW 22 T89N R06W	2.66	\times					
A28528 BARD MATERIALS	CAR 6	N68I 9	2.6	\times					
A28530 BRUENING ROCK PRODUCTS INC	SUMMERS PIT	4 T89N	2.6	\times					
29 DES MOINES DIST	5 CRUSHED STONE					H			
A29002 L&W QUARRIES INC	MEDIAPOLIS	SE 1 T71N R04W	2.65	m	4	\vdash	15		1
					4	4 L	15-18	ABCDE	
					Ŋ		20		
							_	A B C D E	
A29008 CESSFORD CONST CO- SE DIV	NELSON	NE 26 T72N R02W	2.62	.T.	4	4 d	21-24	C C M	
			DMC	7)	4	┪	8-14		
NOTE 1: AASHTO 57 GRADATION MAXIMUM									

U)
Γ÷	í
٣	
$\stackrel{\smile}{\sim}$,
	4
ㄷ)
C	
ŭ	į
٠.	•
Ŀ	1
۳	1
r	1
Ø	G
۱٦	j
ř.	í
뜻	J
ш	4
۲)
C	
-	4
_	4
	,
E	4
P	>
Н	4
F	á
7	i
d	4
N	á
⊱	4
2	j
Ε	i
-	7
Z	4
'n	
5	
-	'n
ŭ	

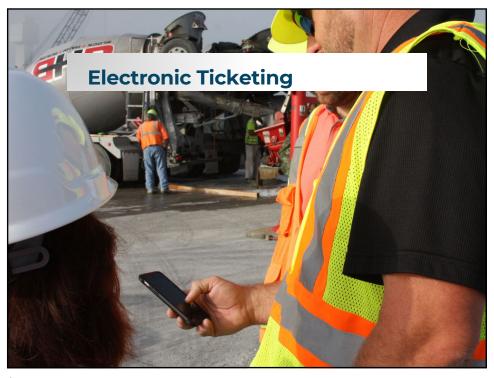
				BULK	DUR	FRICI		L2		
				SSD				CK	REVETMENT	
CODE OPERATOR	SO	SOURCE NAME	LOCATION	SpGr	CA F	A A	B TY	PE BEDS	CLASS	NOTES
53 JONES DIST	ဖ	CRUSHED STONE						CONTINUED		
A53018 RIVER CITY STONE INC	FI	FINN						FULL FACE	О	
A53024 RIVER CITY STONE INC	SU	SULLIVAN	14	DMC	31.	4	4 U	1-5 FIII.I. FACE	لم ر ر	
A53026 ROGERS CONCRETE CONST., INC.		ANAMOSA	SW 15 T84N R04W	DMO	31	4	4 D	1-2 REEF)	
A53030 WENDLING QUARRIES INC	MX SA	WYOMING NORTH SAND AND GRAVEL	21 T84N							
	ME	WEBER	8 H	2.64	×					
A53526 BARD MATERIALS	ST	STEPHENS	34 T86N	2	>	4	4			
A53528 WEBER STONE CO INC	AN	ANAMOSA	14 T84N	. 0	S ×					
A53530 ROGERS CONCRETE CONST., INC. A53532 BARD MATERIALS	AN	ANAMOSA-WOOD'S LOES	8 H	2.66	\times \times	m	m			
54 KEOKUK DIST	2	CRUSHED STONE								
A54002 DOUDS STONE LLC	N. M.	KESWICK	NW 21 T77N R12W	2.61	2	4	\vdash	13-15	ABCDE	\vdash
						4 4	4 4 J C	8-10		
						r 4		13-18		
								13-TOP 4'	О	
								BED 17		
								BED 17	Ω	
A54004 DOUDS STONE LLC	TO	ETTTO	SW 1 T74N R11W	9		4	4 T	13-18	Д С	
			1	2.57	1) M	1		27-29	D C C C C C C C C C C C C C C C C C C C	←
				•)	4		13-19)	4
						4	4 L	27-30		
						4	4	30-37	ABCDE	
							L 2	31-33		
								9-12	ABCDE	
								9-13	Ω	
								9-18	ABCDE	
								19-26	Д	
								30-33	Д	
A54008 DOUDS STONE LLC	HA	HARPER	SE 11 T76N R11W			4		15-24		
						4	4 L	32-37	D C D	
						4		38-40	BCD	
								13-22	BCD	
A54010 DOUDS STONE LLC	LY	LYLE MINE	NW 13 T74N R13W	DMO	m	4	4 ·	40	A B C D E	
						4		36-38	C C M	
						4	\exists	36-40		
NOTE 1: 1.25 INCH MAXIMUM TOP SIZE										

S
囯
'nί
Ų.
Ž,
=
SOI
\sim
Ω
闰
Ε.
ᇅ
ď
77
(1)
9
闰
7
뛵
Q
řħ.
ď
-
闰
Ю.
⊳.
н
-:
ď
щ
⋈
. 7
Н
H
Ε.
z
团
Q
F-1
뙤
74

			BULK DUR	R FRICT				
CODE OPERATOR	SOURCE NAME	LOCATION		FA	ш	TYPE BEDS	CLASS	NOTES
			\vdash		\vdash			
A55506 KOSSUTH COUNTY	WHITTEMORE	16 T		Н 4	4			
A55508 KOSSUTH COUNTY	IRVINGTON	0 T95N		H	4			
A55518 REDINGS GRAVEL & EXCAVATING CO	REDING	RZ		н				
A55534 KOSSUTH COUNTY	MCGUIRE	5 T95N		Н 4	4			
56 LEE DIST 5	S CRUSHED STONE				-			
A56006 CESSFORD CONST CO- SE DIV	ARGYLE	SE 18 T66N R06W		4	4			
				4		- 1		
					2	12		
A56008 CESSFORD CONST CO- SE DIV	DONNELLSON	SE 5 T67N R06W		4	4 L	10-15	р С	
ASECT OF SERVED CONST. CO. SE DIV	NE NNE CNED	MAAT 6				+))	
CONST CO- SE	BEACH	24 T69N R06W				6-21	BCD	
						21	ABCDE	
A56016 DOUDS STONE LLC	HERITAGE	26 T69N R04W	DWU 2	4	4 L	9-11	B C	
				4	4 L	9-10		
					4	о П П	E C C	
TITH BS -OO HSWOO HBCBSSBO 010354	KESIIDIIK CACABBATO OMO	THE ON)) Q	
DATE DESCRIPTION OF SE	ONG CESSFORD ACGOSTA) () () (20	т С	
CESSFORD CONST	VINCENNES SAND PIT OUARRY	32 T66N)))	
	GRAVEL							
A56504 CESSFORD CONST CO- SE DIV	VINCENNES	SE 32 T66N R06W		4	4			
			2.67	×				
A56506 BROCKMAN SAND CO	FT MADISON	SW 11 T67N R05W		4	4			
A56508 TDEAT, SAND CO AKA TDEAT, R/M CO	F S S ALMINE S & S	SF, 11 T67N R05W	2.67 DWU	× ×				
LINN	CRUSHED STONE				+			
A57002 WENDLING QUARRIES INC	BETENBENDER-COGGON	SW 3 T86N R06W		4	H	6 - 8		
			DWU 2	4	4 D	- 1		
						Π,	ABCDE	
A57004 WENDLING QUARRIES INC	PLOWER	SE 36 T86N RU6W		4 <		1 1		
A57006 WENDLING OUARRIES INC	ROBINS	NE 21 T84N R07W	2.57 31	T 7	1 4 J H	-		<
i i						1-3	О	I
A57008 WENDLING QUARRIES INC	BOWSER-SPRINGVILLE	SW 29 T84N R05W	DWU 3i	4	4 D	6-7A	ABCDE	
NOTE 1: TOP 6' REMOVED FROM BEDS 6 -8 NOTE 2: 1.25 INCH MAXIMUM TOP SIZE								

NEWDLING QUARRIES INC NEWBRENCE NAME NEWBRITTH MARIETTE AGREGATES INC NEWBRENCH NEWBRITTH MARIETTE INC NEWBRITTH GUARRIES INC NEWBRI					DUR	FRICT		L2		
NEW DETENTINE DIST CRUCKE NAME LOCATION Spec CA PA D TYPE					PCC	HMA		OCK	REVETMENT	
NEWEDLING QUARRIES INC EDWESR-SPRINGVILLE SW 29 T94N ROW DNU 31 4 4 D DNU SW 20 T94N ROW DNU 31 4 4 D DNU SW 20 T94N ROW DNU 31 4 4 D DNU SW 20 T94N ROW DNU 31 4 4 D DNU SW 20 T94N ROW DNU SW 20 T94N ROW DIST DIST SW 20 T94N ROW DIST SW 20 T94N ROW DIST DIST SW 20 T94N ROW DIST SW 20 T94N ROW DIST DIST DIST SW 20 T94N ROW DIST DIS		SOURCE NAME	LOCATION		Œi			YPE BEDS	CLASS	NOTES
NEW DILING QUARRIES INC BOWSER-SPRINGVILLE SW 29 T94N ROSM	LINN	CRUSHED STONE						CONTINUED		
NEW DILING CURRETES INC TROY WILLS SE 9 T86 N ROTW SI 6 4 0 D B 6 D B B C D B B C D B B C D B B C D B B C D B B C D B	WENDLING QUARRIES	BOWSER-SPRINGVILLE	29 T84N R05			4		7B	ABCDE	
Parametric color						4		-9	B C D	
MENDIING QUARRIES INC SMETING						4		∞		
1-4 MREDILING GUARRIES INC STREETING STR						4		<u> </u>		
MENDLING GUARRIES INC CRAMFORD GUARRIES INC CLAMOYNA & SONS INC CLAMOYNA & SONS INC CLAMOYNA & SONS INC CLAMOTH MARIETTA ACCRECATES CRAMFORD GUARRIES INC CRAMFORD GUARRIES INC CRAMFORD SOUTH MENDLING GUARRIES INC CRAMFORD SOUTH MENDLING GUARRIES INC CRAMFORD SOUTH MENDLING GUARRIES INC CROBER PRADIT COUNTY SAND COUNTY	WENDLING QUARRIES	TROY MILLS	E 9 T86N					1-4	О	
Name tertal marketar accretes cedar rapids Name tertal rapids Nambertal rapids Name tertal rapids Name tertal rapids Name t	WENDLING QUARRIES	SWEETING	18 T85N					1-4	Д	
CAMPODING QUARRIES INC COOK WILDING QUARRIES INC COOK WILDING QUARRIES INC COOK WILDING QUARRIES INC CEDAR RAPIDS SOUTH WILDING QUARRIES INC CEDAR RAPIDS SOUTH WILDING QUARRIES INC CEDAR RAPIDS SOUTH WILDING QUARRIES INC INN COUNTY SAND WILDING QUARRIES INC HESS WILDING QUARRIES WILDING QUARRI		CEDAR RAPIDS	15 T82N			4		3B-	ВС	
NW 23 T83N ROBY 2.55 3				_		4		9	ABCDE	
CTAMPORD QUARRY CO						4		2_	BCD	
MENDLING CUARRIES INC COOK NW 10 T96N ROTM NW 1 T92N ROTM NT92N ROTM NW 1 T92N	CRAWFORD QUARRY		23 T83N	10	m	4		∞		
MENDLING QUARRIES INC CEDAR RAPIDS SOUTH MENDLING QUARRIES INC CEDAR RAPIDS SOUTH MENDLING QUARRIES INC CEDAR RAPIDS SOUTH MENDLING QUARRIES INC TAMBORNO BY 182N RO7M CIVABLO GUARRIES INC TOWN COUNTY SAND TOWN COUNTS CO INC TOWN COUNTS CO INC TREDONIA A CINLAND) & FREDONIA TOWN STATEM RO5M TOWN CRAPIDS #1 TOWN CHAPTER INC TOWN CHAPTER I								3-7	Д	
NENDELING QUARRIES INC CEDAR RAPIDS SOUTH NW 7 T82N RO7M NW 7 T82N RO7M NW 1 T82N RO7M NW 1 T82N RO7M NW 1 T82N RO7M NW 1 T82N RO7M NW 2 T82N RO5M S.66 N 4 4 M 1 T85N RO4M RO5M S.65 N 4 M 2 M 2 M 2 M 2 M 2 M 2 M 2 M 2 M 2 M	WENDLING QUARRIES		10 T86N			,		(1	
CJ MOYNA & SONS INC	WENDLING QUARRIES	RAPIDS	7 T82N			4		9	A B C D E	
SAND AND GRAVEL No. 1974 No. 2012 No	SINCS 2 KINNOW F.O.	VECOUNTED	TAC OF						О (
WENDLING QUARRIES INC SAND AND GRAVEL NW 29 T82N R05W 2.66 X 4 4 4 Y 4 4 <td>CO MOINA & SONS</td> <td>nenneosei</td> <td>T TOZIN</td> <td></td> <td></td> <td></td> <td></td> <td>I Г I Г L</td> <td></td> <td></td>	CO MOINA & SONS	nenneosei	T TOZIN					I Г I Г L		
NW 29 TR2N ROSM 2.66 X 4 4 4 WENDLING QUARRIES INC BLAIRSFERRY SAND BLAIRSFERRY SAND SW 26 TR4N ROSM DWU 2.65 X 3 3 3 WENDLING QUARRIES INC HESS LINN COUNTY SAND LINN SAND SAND SAND SAND SAND SAND SAND SA								H I ⊃	<u> </u>	
MENDLING QUARIES INC MENDLING QUARIES INC MEDULING COUNTY SAND MEDULING DIGIT SCROWED NW 3 T74N R05M MEDULING CRAVEL NW 3 T74N R05M MEDULING CRAVEL INC MEDULING CRAVEL	WENDLING QUARRIES	IVANHOE	29 T82N R0			4	4			
NEMERTING QUARRIES INC HESS HES	WENDLING QUARRIES		26 T84N R0		<i< td=""><td>m</td><td>m</td><td></td><td></td><td></td></i<>	m	m			
MENDLING QUARRIES INC MARTIN MARIETTA AGGREGATES MARTIN MARIETTA AGGREGATES LINN COUNTY SAND POWER PLANT LOUISA ROUGHL REDI MIX LOUISA ROUGHRUS STONE ROUGHRUS STONE ROUGHRUS STONE ROUGHRUS JCT. ROUGHRUS JCT. ROUGHRUS JCT. ROUGHRUS SAND AND GRAVEL RIVER PRODUCTS CO INC ROCK RAPIDS #1 ROCK RAPIDS #2 ROCK RAPIDS #3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3				2.65	\times					
MARTIN MARIETTA ACGREGATES LINN COUNTY SAND NE 5 782N R06M 2.64 X R X R X		HESS	4 T82N	2.65	\times					
CKOELL REDI MIX DIST 5 CRUSHED STONE 16 T84N RO8M DWU X 7 </td <td></td> <td>COUNTY</td> <td>5 T82N</td> <td>2.64</td> <td>\times</td> <td></td> <td></td> <td></td> <td></td> <td></td>		COUNTY	5 T82N	2.64	\times					
LOUISA DIST 5 CRUSHED STONE COLUMBUS JCT. NW 3 T74N R05W 2.55 3 4 4 D 16-1 RIVER PRODUCTS CO INC SAND AND GRAVEL REDONIA A(INLAND) & FREDONIA B(REDONIA B(REDONIA) B(REDONIA) B(REDONIA B(REDONIA) B(REDONIA) B(REDONIA B(REDONIA B(REDONIA B(REDONIA) B(REDONIA B(REDONIA B(REDONIA) B(REDONIA B(REDONIA B(REDONIA B(REDONIA) B(REDONIA B(REDONI	CROELL REDI		6 T84N	DMO	\times					
SAND AND GRAVEL SAND AND GRAVEL SW 17 T75N R04M S.55 3 4 4 D 16-1	LOUISA DIST						H			
SAND AND GRAVEL FREDONIA A(INLAND) & FREDONIA SW 17 T75N R04W P. 6 19-2	RIVER PRODUCTS CO		3 T74N R05	.55	m	4	\vdash	16-1		
SAND AND GRAVEL FREDONIA A (INLAND) & FREDONIA SW 17 T75N R04W A 4 4 D 19-2						4		15-1		
RIVER PRODUCTS CO INC EREDONIA A(INLAND) & FREDONIA SW 17 T75N R04W 4						7		7 6 1		
DIST 3 SAND AND GRAVEL NW 33 T100NR45W 2.69 X PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #1 NW 33 T100NR45W 2.69 Z X PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #2 NW 21 T99N R45W	RIVER PRODUCTS CO	A(INLAND) &	17 T75N			4	4			
PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #1 NW 33 T100NR45W 2.69 2 3 PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #2 NB 9 T99N R45W R 1 3 HALLETT MATERIALS CO OLSON OLSON R48W R48W R48W R 3		B(RIVER)		9	×					
PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #1 NW 33 T100NR45W 2.69 2.69 2 3 PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #2 NE 9 T99N R45W H 3 HALLETT MATERIALS CO OLSON OLSON H 3	LYON DIST	SAND AND GRAVEL								
PETTENGILL CONC & GRAVEL INC ROCK RAPIDS #2 NE 9 T99N R45W HALLETT MATERIALS CO OLSON OLSON R48W H 3	PETTENGILL CONC & GRAVEL		33 T100NR45	69.		m	m			
HALLETT MATERIALS CO OLSON HALLETT MATERIALS CON	PETTENGILL CONC & GRAVEL	#	9 T99N R4	•	: H	m	m			
	HALLETT MATERIALS	OLSON	21 T99N		H	m	m			
STENSLAND GRAVEL CO STENSLAND STENSLAND H 4	A60518 STENSLAND GRAVEL CO	STENSLAND	17 T9		H	4	4			

ELECTRONIC TICKETING

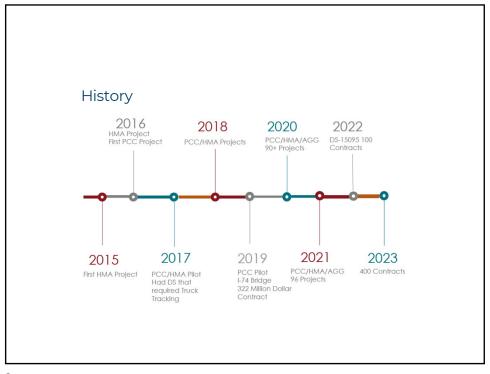


1

What is Electronic Ticketing (E-Ticketing)

• Digital process of generating, sending, tracking, and managing delivery tickets for ready mix concrete that is real time and accessible to all stakeholders





3

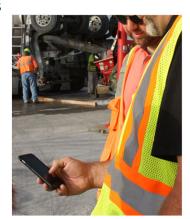
Paper Ticket Problems

- Safety concerns around trucks
- Information limited to person with the ticket
- Written test results or information could be unreadable
- Easily lost
- Inconsistent format
- Data reentry into other systems
- Retention and access difficulties



E-Ticket Advantages

- · Transferred remotely
 - Safer with reduced exposure to trucks
- Real time information available to everyone
 - Better QA/QC
 - Faster payment
 - Enhanced communication
- Consistent data and format
 - · Simpler to access and read
 - Easy to archive and search
- Stored remotely in cloud
 - Not easily lost or damaged
 - Easy to retain and access



5

E-ticketing Process

Business As Usual

Nothing changes in your daily operations. As trucks pull up to the plant, operators log the truck and job details, hit the print button to create a paper ticket. This action automatically logs the digital ticket information at the producer's scale database.

Collection of e-Tickets

The lowa DOT Portal collects digital ticketing data sent from the producer's scale in real-time.

JOBslip Mobile App

lowa DOT provides you complimentary access to the mobile app JOBslip to digitally view the same information on your paper ticket. This grants both parties access to the same digital ticket data.

Digital Receipt

JOBslip will now be your digital transaction receipt You can choose to download tickets in multiple formats to fit your needs.

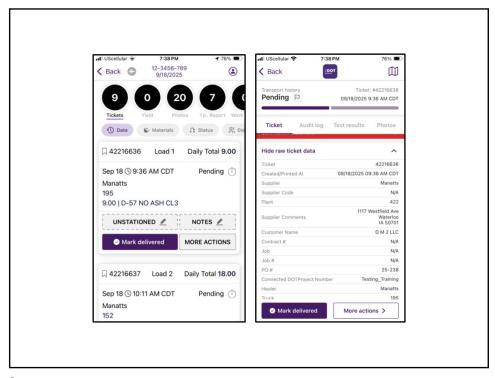
DS-23032 Electronic Ticketing

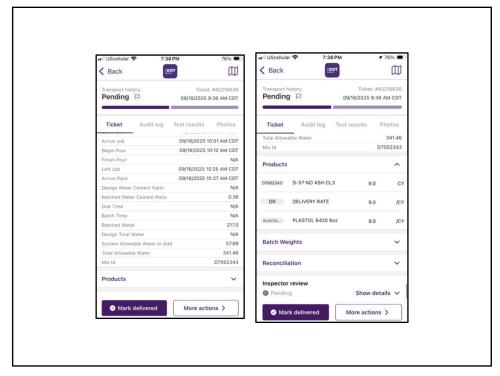
- Applied to select projects presently will grow to all over time
- Required for primary material supplied

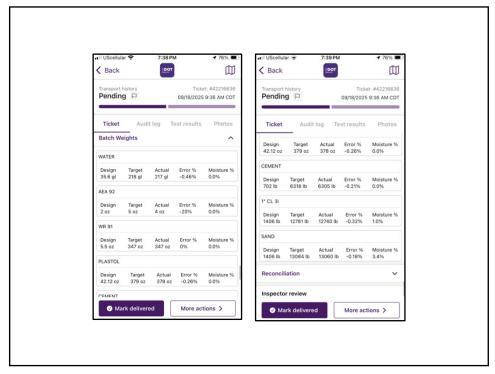
 - PCC for PCC paving (readv mix)

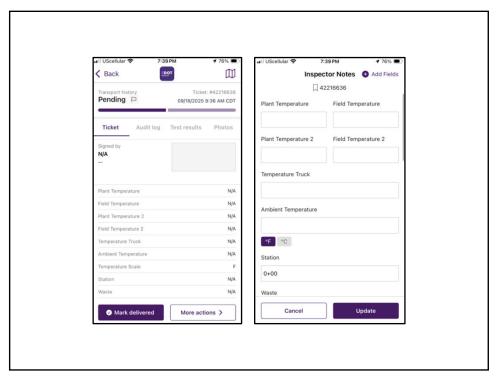
 1. General Ticket Information (All Material).
 a Date.
 b lowa DOT Project Number.
 c. Name of Contractor
 d. Name of material supplier.
 e. Unique truck ID.
 f. Plant/scale name (source).
 g. Truck Status Times.
 1) Loaded time (time batched) shall be available.
 2) Provided other truck status times as available.
 a) Ticketed.
 b) Load time.
 c) Left plant.
 d) Arrive at project.
 d) Arrive at project.
 d) Arrive at project.
 d) Arrive at project.
 d) Prinish unload.
 f) Finish unload.
 g) Leave project.
 f. CPI Name and certificate number.

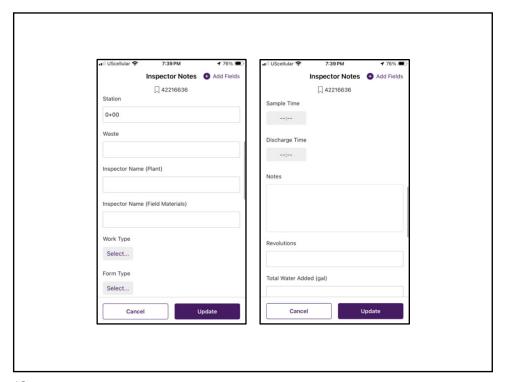
Example PCC Electronic Ticket



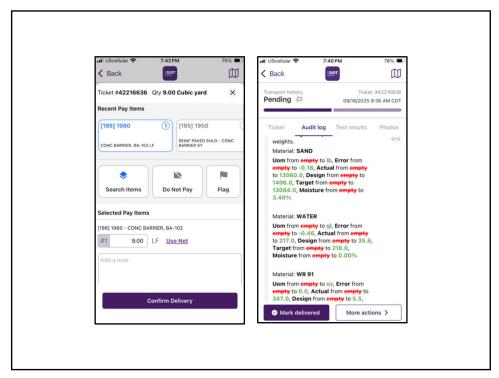


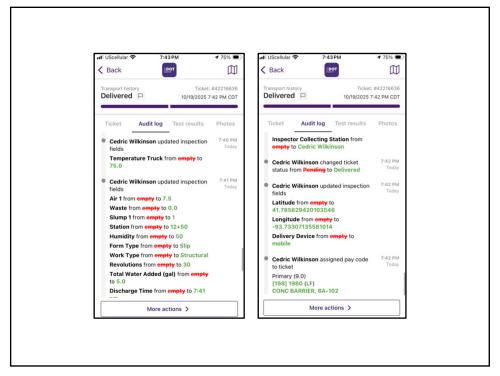


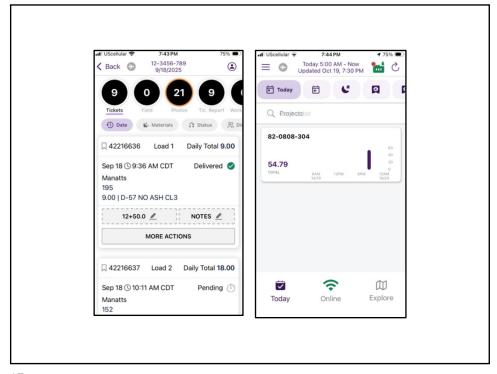




••Il UScellular 💎 7:3	9 PM	1 76% ■	•• UScell	ular 🛜	7:39 PM	1 76% ■
Inspect	or Notes	Add Fields	11	1	nspector Notes	Add Fields
□ 422	216636		HL.		□ 42216636	
Total Water Added (gal)						
			Humidit	ty		
Sample Number						
			Evapora	ation Rate		
Lift No.						
			Efflux			
Air 1						
			Yield (e	ntered)		
Air 2						
			Unit We	eight		
Slump 1 (entered)						
			Total W	ater in Bat	ch	
Cancel	ι	Jpdate		Cancel		Update







Getting Started

- For information on starting E-ticketing
 - https://www.haulhub.com/agency/iowa
- To obtain access to JOBSlip
 - support@haulhub.com
- To obtain mobile app use comp portal and search for EDOT
- Training site for EDOT by HaulHub
 - https://learn.haulhub.com/dotslip-for-mobile-and-web
- Missing tickets
- https://knowledge.haulhub.com/dot-e-ticketing-mobile-app-report-ticket-issues
- E-Construction State administrator
 - Cedric.Wilkinson@iowadot.us

EXAMWORKSHEETS

Distribution: ___ Materials, ___ DME, ___ Proj. Engr., ___ Contractor

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		<u> </u>	County :	
Mix No.:		Abs Vol. Cement:	Type:	
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17):	/6	Source:	Sp. Gr.:	
Slag (IM 491.14):		Source:	Sp. Gr.:	
Adj	usted lbs. Cement:			
	Total Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement -	+ wt Fly Ash +Slag) =_	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement +	+ wt Fly Ash +Slag) =	
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal	= -	
		Total	=	1.000
% FA Agg.:	Fine .	Aggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	= _	
% CA Agg.:	Coarse	Aggregate (1.000 - Subtotal) X % In Mix	= _	
		Aggregate Total	= _	
Aggregate Weights	Fine Aç	=_		
	Intermedia	te Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
	Coarse A	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
Summary		Cement(lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg (lbs/cy)		
		Interm. Agg. (lbs/cy)		
		Coarse Agg (lbs/cy)		

Distribution: ___ Materials, ___ DME, ___ Proj. Engr., ___ Contractor

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		<u> </u>	County :	
Mix No.:		Abs Vol. Cement:	Type:	
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17):	/6	Source:	Sp. Gr.:	
Slag (IM 491.14):		Source:	Sp. Gr.:	
Adj	usted lbs. Cement:			
	Total Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement -	+ wt Fly Ash +Slag) =_	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement +	+ wt Fly Ash +Slag) =	
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal	= -	
		Total	=	1.000
% FA Agg.:	Fine .	Aggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	= _	
% CA Agg.:	Coarse	Aggregate (1.000 - Subtotal) X % In Mix	= _	
		Aggregate Total	= _	
Aggregate Weights	Fine Aç	=_		
	Intermedia	te Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
	Coarse A	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
Summary		Cement(lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg (lbs/cy)		
		Interm. Agg. (lbs/cy)		
		Coarse Agg (lbs/cy)		

Distribution: ___ Materials, ___ DME, ___ Proj. Engr., ___ Contractor

Iowa Department Of Transportation Office Of Materials PORTLAND CEMENT CONCRETE

Project No.:		<u> </u>	County :	
Mix No.:		Abs Vol. Cement:	Type:	
Cement (IM 401):	lbs	Source:	Sp. Gr.:	
Fly Ash (IM 491.17):	/6	Source:	Sp. Gr.:	
Slag (IM 491.14):		Source:	Sp. Gr.:	
Adj	usted lbs. Cement:			
	Total Cementitious	Total % Replacement =		
IM T203	Fine Aggregate Source:		Sp. Gr.:	
IM T203	Interm. Aggregate Source:		Sp. Gr.:	
IM T203	Coarse Agregate Source:		Sp. Gr.:	
Basic w/c		Water (lbs/cy) = Design w/c (wt. cement -	+ wt Fly Ash +Slag) =_	
Max w/c		Max. Water (lbs/cy) = Design w/c (wt. cement +	+ wt Fly Ash +Slag) =	
Absolute Volumes	Cement	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Fly Ash	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Slag	(lbs/cy) / (Sp. Gr. X 62.4 X 27)	= _	
	Water	(lbs/cy) / (1.00 X 62.4 X 27)	=_	
	Air			0.060
		Subtotal	=	
		1.000 - Subtotal	= -	
		Total	=	1.000
% FA Agg.:	Fine .	Aggregate (1.000 - Subtotal) X % In Mix	=	
% In. Agg.:		Aggregate (1.000 - Subtotal) X % In Mix	= _	
% CA Agg.:	Coarse	Aggregate (1.000 - Subtotal) X % In Mix	= _	
		Aggregate Total	= _	
Aggregate Weights	Fine Aç	=_		
	Intermedia	te Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
	Coarse A	Aggregate (abs vol.) X Sp. Gr. X 62.4 X 27	=_	
Summary		Cement(lbs/cy)		
		Fly Ash (lbs/cy)		
		Slag (lbs/cy)		
		Water (lbs/cy)		
		Fine Agg (lbs/cy)		
		Interm. Agg. (lbs/cy)		
		Coarse Agg (lbs/cy)		

Form 820912E 8-00

lowa Department of Transportation Office of Materials PORTLAND CEMENT SHIPMENT YIELD REPORT

Report No	
Date Submitted	

Contract ID: _ Project No.: _ County: _			<u> </u>	Plant Lo	ocation:						
Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре
		10110			- Tunion	10110			- runnon		
			<u> </u>								
			\vdash								
			\vdash								
			++				1				
			 								
			 								
			+ + +								
			 								
			$oxed{igspace}$								
			igert								
		ļ	$\downarrow \downarrow \downarrow \downarrow \downarrow$								
			$\downarrow \downarrow \downarrow \downarrow \downarrow$				+				
			++				+				
			++				1				
			╁─┤├				+				
		1									
Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)							
	. ,	<u> </u>	 	, ,	1	Total	Rillad M	/eight (Tons)			
]			Total	Jineu V				
]		_						
]						Yield =	%	
					_						
Left in			heck (+)		_						
Scale (Tons)	Pr	evious Yield	Check (-)		1			C.P.I.:			

Previous Yield Check (-)
Total Weighed (Batch Scale)

____ RCE ____ Central Materials ____ Contractor ____ Inspector

Distribution:____ DME

Form 820912E 8-00

Office of Materials

Report No	
Date Submitted	

			RTLAND	Office of CEMENT SH		D REPORT			Date Submitted	1	
									e: r:		
				Plant L	ocation:						
Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре	Date	Invoice Number	Billed Tons	Туре
											-
											_
											_
											_
											-
											+

Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)
Left in		This Cl	heck (+)	
Scale (Tons)	Pre			
	Total V			

Total Billed Weight (Tons)		
	Yield =	%
C.P.I.:		

Distribution: ___ DME ____ RCE ___ Central Materials ____ Contractor ____ Inspector

lowa Department of Transportation Office of Materials

Report No	
Date Submitted	

C.P.I.: _____

		POF	RTLAND C	EMENT SHI	PMENT YIEL	D REPORT				·	
Contract ID:								Source			
Project No.:											
County: _				Plant Lo	cation:						
Date	Invoice	Billed	Туре	Date	Invoice	Billed	Туре	Date	Invoice	Billed	Туре
Duto	Number	Tons	, ypc	Duto	Number	Tons	Турс	Duto	Number	Tons	1,700
											
			++				+				
			+				1				
			+								
			+				-				
			+				+				
			+ + +								
			+				+				
			1								
			1								
			1								
			† † †								
			\downarrow								
			 								
			1								
			 								
			+-++				+				
			+								
			╁─┤├				+				
			╁┈┤├				+ -				
			+				+				
			╁─┤├				+				
			┼				+ +				
			+ -								
			 								
		1		1		<u>l</u>					1
Mix No.	Cement Per CY (Lbs.)	Batched (CY)		Cement Batched (Tons)							
					4	Total	Billed W	eight (Tons)			
					-				•		
					-				Yield =	%	
		1	4	 	4						

Distribution: ___ DME ____ RCE ___ Central Materials ____ Contractor ____ Inspecto

This Check (+)

Previous Yield Check (-)
Total Weighed (Batch Scale)

Left in

Scale (Tons)