IOWA DOT
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AGGREGATE TECHNICIAN

REFERENCE MANUAL

2023-2024

TECHNICAL TRAINING AND CERTIFICATION PROGRAM

Aggregate Reference Book Summary Guide

Gradation Specifications	Aggregate Gradation Table Spec 4109	• Iowa DOT standard gradation limits in terms of percent passing. • HMA and PCC mix design gradation limits are determined by the contractor and supplied to the producer on 955's
Field Equipment Cleaning, Calibration, Repair	IM 104	Associated costs
Project Sampling and Testing	IM 204	IM 204 is used by project inspection personnel: • Sampling/testing frequencies at time of use • Methods, documentation or test reports needed to incorporate various products into the work
Qualified Testing Laboratories	IM 208	• Basic required information, documentation, and equipment • Equipment checklists
Aggregate Certification Program and Approved Aggregate Producers	IM 209	Requirements for the aggregate producer/supplier • Sampling and testing frequencies during production (1/1500 or 1/3000 tons) • Information needed to properly certify aggregates
Aggregate Quality Requirements	IM 209 App C	• Quality (F&T tests, abrasions, etc.) specifications for aggregate products
Production of Certified Aggregate From Reclaimed Roadways	IM 210	Requirements for furnishing certified aggregate produced from reclaimed materials
Iowa DOT Certification Programs	IM 213	Requirements for the various certification programs required by Iowa DOT. Training and recertification procedures: Iowa and Federal Codes; Unsatisfactory Performance Notice
Guidelines for Verifying Correlation Test Results	IM 216	Allowed variances between two tests performed on the same product, i.e., slumps, air content, gradations, specific gravity, etc.
Aggregate Sampling Methods and Minimum Sample Size	IM 301	Minimum field and gradation test sample sizes

Sieve Analysis (Gradation)	IM 302	Step instructions to determine particle size distribution (gradation) in a representative sample. • Required equipment • Sieve 'overload' restrictions • Calculations • Fineness Modulus Calculation
Fractured Face Count in Crushed Gravel (+3/8")	IM 305	Gravel granular subbase required 30% of the +3/8" particles have at least one fractured face determined by this test method.
Total Percent Passing The #200 Sieve by Washing & Dry Sieving	IM 306	Step instructions to determine percent passing the #200 sieve. • Restrictions on washing the entire sieve analysis sample or a separate smaller sample. • Sample sizes when determining only the amount passing the #200. • Calculations
Specific Gravity Tests On Coarse and Fine Aggregates	IM 307	Step instructions to perform specific gravity tests on either coarse or fine aggregates. Procedure "A" using a 'pycnometer', and Procedure "B" using a 'water bath'.
Free Moisture Absorption	IM 308	Step instructions to determine free moisture 'at time of use' on PCC aggregates using the pycnometer, moisture by weight loss and absorption value of coarse or fine aggregates.
Aggregate Sample Reduction	IM 336	Aggregate Field sample reduction methods • Mechanical splitters for aggregates in a surface dry condition • Miniature stockpile for damp, fine aggregate only • Quartering, not recommended for coarse aggregates
Percent of Shale in Coarse or Fine Aggregate	IM 344 (Fine) IM 345 & 372 (Coarse)	Step instructions for test procedures to determine shale content in coarse or fine aggregates using Zinc chloride and visual pick.
Clay Lumps and Friable Particles	IM 368	Step instructions to perform 'clay lump' test on representative coarse aggregate samples.
Aggregate Source Locations and Basic Source Information	IM 409 IM T-203	• Aggregate source approvals • Fine aggregate approval • PCC coarse aggregate durability ratings • Friction typing • Source locations and approvals alphabetized by county
$W-W_1$ Table for Pycnometer Moisture Determination	IM T215A	Table

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SPEC 4109
AGGREGATE GRADATION TABLE

TABLE 4109.02-1: AGGREGATE GRADATION TABLE														
Grad. No.	Section No.	Std. Sieve Sz.	1 1/2”	1.00”	3/4”	1/2”	3/8”	4	8	30	50	100	200	
		Intended Use	Percent Passing											Notes
1	4110, 4125, 4133, 4134	PCC FA, Cover Agg.					100	90-100	70-100	10-60			0-1.5	1
2	4112	PCC Intermediate				95-100			0-10					
3	4115 (57, 2-8), 4118	PCC CA	100	95-100		25-60		0-10	0-5				0-1.5	2, 10
4	4115 (2-8)	PCC CA	100	50-100	30-100	20-75	5-55	0-10	0-5				0-1.5	10
5	4115 (67, 2-8)	PCC CA		100	90-100		20-55	0-10	0-5				0-1.5	10
6	4115.~~06~~ 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				
8	4116.03 (Class V)	Fine Limestone					100	90-100					0-30	
9	2556	Grout Aggregate				100	85-100		0-10				0-1.5	
10	4119, 4120.02, 4120.03 (C gravel)	Granular Surface			100			50-80	25-60					3, 11
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				0-6	6, 11
12b	4121 (Cr. Gravel)	Granular Subbase	100			50-80			10-30		5-15		3-7	7, 11
13a	4122.02 (Cr. St.)	Macadam St. Base	3” nominal maximum size screened over 3/4” or 1.00” screen.											
13b	4122.02	Macadam Choke St.		100									6-16	11
14	4123	Modified Subbase	100		70-90				10-40				3-10	5, 7, 11
18	4117 (No. 4 Cr. Gr., Cr. St., or Nat. Sand)	Leveling Aggregate					100	95-100	50-80		0-15		0-4	11
19	4117, 4125 (1/2” Cr. Gr. or Cr. St.)	Cover Aggregate			100	97-100	40-90	0-30	0-15				0-1.5	11
20	4125 (1/2” Scr. Gr.)	Cover Aggregate			100	95-100	40-80	0-15	0-7				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			0-1.5	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	70-90	40-70	19-42			5-15	11
29	4131	Porous Backfill			100	95-100	50-100	0-50	0-8					11
30	4132.02 (Cr. St.)	Special Backfill	100						10-40				0-10	5, 11, 14
31	4132.03 (Gravel)	Special Backfill		100	90-100	75-100			30-55				3-7	11
32	4133 (Sand/Gr./Cr. St.)	Granular Backfill	100% passing the 3” screen						10-100				0-10	8, 11
35	4134 (Natural Sand/Gr.)	Floodable Backfill	100						20-90				0-4	11
36	4134 (Natural Sand)	Floodable Backfill						100					0-2	11
37	2320 (Quartzite/Granite/Slag)	Polymer-Modified Microsurfacing					100	90-100	65-90	30-50	18-30	10-21	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: (Gradations No. 15, 16, 17, 24, 25, 26, 27, 28, 33, and 34 have been deleted)

1. For Section 4110, 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.

2. When used in precast and prestressed concrete bridge beams, 100% shall pass the 1.00" sieve. When used for pipe bedding the No. 200 restriction does not apply.

3. When compaction of material is a specification requirement, the minimum percent passing the No. 200 sieve is 6%.

4. See specifications for combination of gravel and limestone.

5. 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.

6. The gradation requirement for the No. 8 sieve shall be 5% to 20% when recycled material is supplied.

7. 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.

8. Crushed stone shall have 100% passing the 1½" sieve.

9. 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.

10. Maximum of 2.5% passing the No. 200 sieve allowed if for crushed limestone or dolomite when documented production is 1% or less.

11. 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 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 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 gradation limits.

12. 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.

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IM 204
SAMPLING & TESTING

INSPECTION OF CONSTRUCTION PROJECT SAMPLING & TESTING

INTRODUCTION

The Iowa Department of Transportation (DOT) has established a Quality Assurance Program (IM 205) to assure that the quality of materials and construction workmanship incorporated into all highway construction projects is in reasonable conformity with the requirements of the approved plans and Specifications, including approved changes. It consists of an Acceptance Program and an Independent Assurance Program (IAP), both of which are based on test results obtained by qualified persons and equipment.

The acceptance portion of the program covers quality control (QC) sampling and testing and verification sampling and testing. The IAP portion of the program covers the evaluation of all sampling and testing procedures, personnel, and equipment used as part of an acceptance decision (includes contractor, contracting agency, and consultant).

ACCEPTANCE PROGRAM FOR MATERIALS

To fulfill the materials acceptance requirements, several methods are used by the DOT.

Sampling & Testing (Test Report)
Certification
Approved Brands
Approved Sources
Approved Shop Drawings
Approved Catalog Cut
Inspection Report
Visual Approval by the Engineer

The Instructional Memorandum IM 204 Appendices A through W contain the material acceptance information for the type of work being done. If there is a conflict in wording between the appendix and another Instructional Memorandum or appendix Z, the appendix A through W will supersede the others.

In many cases more than one method may be required for acceptance in the 204 Appendices and tables in the back of this guide. For some new or special materials, the District Materials Engineer may need to determine the most appropriate acceptance requirements.

In order to provide the Contractor the opportunity to construct a project with minimal sampling and testing delays, inspection is performed at the source for many materials. Source inspection may consist of inspecting process control, sampling for laboratory testing or a combination of these procedures. All source-inspected or certified materials are subject to inspection at the project site prior to being incorporated into the work. Project site inspections are for identification of materials with test reports and for any unusual alterations of the characteristics of the material due to handling or other causes. Verification samples secured by project agency personnel of source-inspected, certified, or project processed materials are also required for some materials in order to secure satisfactory validation for acceptance.

When certification procedures are required, the Contractor may, on the Contractor's own responsibility and at the Contractor's risk, incorporate these materials into the work. Acceptance will be based on satisfactory certification and compliance of the test results of any verification samples. When verification samples are not taken, acceptance will be based on satisfactory certification.

A. SAMPLING & TESTING (TEST REPORT)

When a material is sampled and tested, the results will be documented on a construction form or a test report. There is quality control sampling and testing done by the Contractor or producer and verification sampling testing done by the Project Engineer, the District Materials Engineer, the Central Materials Laboratory, or an independent laboratory.

In many cases, in addition to sampling and testing, some other type of acceptance method will also be required. Sampling and testing may be done at the project, supplier, or source depending on which is the most appropriate.

B. CERTIFICATION OF COMPLIANCE

For many materials, a fabricator, manufacturer, or supplier is required to provide the Project Engineer with a certification document stating that the material meets the requirements of the plans and specifications. In most cases, the fabricator, manufacturer, or supplier must also be on an approved list in the Materials Approved Products Listing Enterprise (MAPLE). For some of these materials, sampling and testing is also required before final acceptance. The certification comes in a variety of forms:

- Stamped or preprinted on truck tickets as with aggregates,
- Stamped or preprinted on invoices as with Portland Cement and asphalt binder,
- Stamped or printed on the Mill Analysis as with reinforcing steel, structural steel, and other metals,
- Furnished as a separate document with each shipment as with zinc-silicate paint, engineering fabrics, epoxy coatings, and dowel baskets,
- Stamped or printed on a list of materials for each shipment as with CMP, concrete pipe, and corrugated plastic subdrain,

The inspector will verify that the certification has been entered into DocExpress.

C. APPROVED SOURCE

(May also be referred to as "Approved Producer, Approved Supplier, Approved Fabricator, or Approved Brand") The source, producer, and the material must be evaluated and approved by the Office of Construction and Materials according to the appropriate Materials IM in order to be used on a project. Once a letter of approval is issued, the source or producer is approved for use on projects (with the exception of steel fabricators and precast concrete plants). Approved products, sources, and producers are listed in the Materials Approved Products Listing Enterprise (MAPLE). Approval for a source or producer may be rescinded at any time if it no longer meets the requirements of the IM. The plans, developmental specifications, and special provisions may also contain lists of approved sources.

The project inspector will document information about this material such as product name, source, date, producer, and lot number in the project files.

Most approved sources also require a certification.

D. APPROVED WAREHOUSE STOCK

For some items made up of miscellaneous materials, inspection and approval will be done by the District Materials Engineer at the supplier's warehouse.

E. APPROVED SHOP DRAWING & APPROVED CATALOG CUT

This information must be submitted to, and reviewed by the Iowa DOT Design Office or Bridges and Structures Office, before the material can be incorporated in the project.

F. INSPECTION REPORT

The project inspector must have a copy of the final inspection report prior to incorporating the item into the project. The report will vary depending on the Materials IM requirements for the item fabricated. Final acceptance is by construction personnel at the project site, and is based on the proper documentation and the condition of the component.

G. VISUAL APPROVAL BY PROJECT ENGINEER

(May also be referred to as "As Per Plan, Approved By RCE, or Manufacturer Recommendations") The project inspector must document information about this material such as product name, source, producer, lot number and date produced in the project files. The inspector will make sure the material meets the requirements of the plans, the Engineer, or the manufacturer before the material is used. Visual approval requires construction personnel to visually inspect the material to determine if it complies with the specifications. Visual approval is appropriate for non-critical items such as sod stakes, where compliance can be readily determined by visual means. If there are questions on specification compliance, samples will be taken for testing.

INDEPENDENT ASSURANCE PROGRAM

The IAP evaluates all sampling and testing procedures, personnel, and equipment used as part of an acceptance decision (Includes Contractor, Contracting Agency, and consultant). Independent assurance includes evaluation based on:

Calibration checks
Split samples
Proficiency samples
Observation of sampling and testing performance

The test method and the frequency of test are in the Appendices. Calibration checks and proficiency samples testing is covered in IM 208.

SMALL QUANTITIES

The FHWA allows and encourages alternative acceptance methods for small quantities of non-critical materials. Appendix X contains a list of those materials and maximum quantities for which alternative acceptance methods may be appropriate. The Project Engineer or District Materials Engineer may still require the normal acceptance method for a material when it is considered critical in the intended application.

IM 204 APPENDIXES

Appendix A	Roadway & Borrow Excavation & Embankments
Appendix B	Soil Aggregate Subbase
Appendix C	Modified Subbase
Appendix D	Granular Subbase
Appendix E	Portland Cement Concrete Pavement, Pavement Widening, Base Widening, Curb & Gutter & Paved Shoulders
Appendix F	Asphalt Mixtures
Appendix H	Structural Concrete, Reinforcement, Foundations & Substructures, Concrete Structures, Concrete Floors, & Concrete Box, Arch & Circular Culverts
Appendix I	Concrete Drilled Shaft Foundations
Appendix K	Cold-In-Place Recycled Asphalt Pavement
Appendix L	Granular Surfacing/Driveway Surfacing
Appendix M	Concrete Bridge Floor Repair & Overlay & Surfacing
Appendix P	Surface Treatment (Seal Coat, Microsurfacing, Slurry, Joint Repair, Crack Filling & Fog Seal)
Appendix T	Base Repair, Pavement Repair
Appendix U	Granular Shoulders
Appendix V	Subdrains
Appendix W	Water Pollution Control, Erosion Control
Appendix X	Acceptance of Small Quantities of Materials
Appendix Z	Supplemental Guide, Basis of Acceptance

Sampling & Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, & PAVED SHOULDERS

April 20, 2021 | Matls. IM 204

Supersedes October 15, 2019 | Section 2122, 2201, 2213, 2301, 2302, 2310, Quality Management Concrete (QM-C) | Appendix E (US) Units

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPT.	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Fine (4110)		AS 209												
Aggregate-Coarse (4115), Intermediate		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Curing Compounds (4105)	Lab Tested	405												
Clear Curing Compounds (4105)		AB 405.07												
Air Entraining Admixture (4103)	Quality	AB 403												
Water Reducing Admix. (4103)	Quality	AB 403												
Retarding Admixture (4103)	Quality	AB 403												
Joint Sealer (4136.02)	Lab Tested	436.01, 436.02,436.03												
Backer Rod (4136.02)	Lab Tested	AB 436.04												
Mixing Water (4102)	Lab Tested							V	RCE/ CONTR	1/ source	1 pint	CTRL		Not required for potable water from municipal supply (1)

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(1) DME may waive sampling of water from an established well that has shown past compliance.

NOTE: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.

Sampling & Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, & PAVED SHOULDERS

April 20, 2021 | Matls. IM 204

Supersedes October 15, 2019 | Section 2122, 2201, 2213, 2301, 2302, 2310, Quality Management Concrete (QM-C) | Appendix E (US) Units

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Reinforcement (4151)														
Dowels	Quality	AS 451												
Tie Bars	Quality	AS 451												
General Use	Quality	AS 451												
PLANT INSPECTION														
Aggregates-Fine (4110/4111)	Grad QMC	302 306 336	CONTR	1/1500cy	IM 301	CONTR	800240	V IA	RCE/ CONTR	Sample 1/day, test 1st day + 2/week	IM 301	RCE DME		IM 530 for intermittent production
	Grad Non-QMC	302 306 336	CONTR	1/day	IM 301	CONTR		V IA	RCE/ CONTR	Sample 1/day, test 1st day + 1/-week	IM 301	RCE DME		IM 527 for intermittent or low production
	Moist	308, 527	CONTR	IM 527	1000 gm	CONTR								Not applicable with probe
	Sp. Gr.	307	CONTR	IM 527	1000 gm	CONTR								
	Quality	AS 209												

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NOTE: IA may be accomplished by system approach or on a per project basis (IA at 1 per 100,000 sy of concrete) at the discretion of the DME.
NOTE: When Certified Plant Inspection is not provided, the engineer is responsible for performing quality control sampling and testing.
NOTE: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.
NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.
NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

Sampling & Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, & PAVED SHOULDERS

April 20, 2021 | Matls. IM 204

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMP. SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregates-Coarse (4115), Intermediate	Grad QMC	302 306 336	CONTR	QMC 1/1500 cy	IM 301	CONTR	800240	V IA	RCE/ CONTR	Sample 1/day,test 1st day+2/-week	IM 301	RCE DME		IM 530 for intermittent production
	Grad Non-QMC	302 306 336	CONTR	1/day	IM 301	CONTR		V IA	RCE/ CONTR	Sample 1/day, test 1st day + 1/week	IM 301	RCE DME		IM 527 for intermittent or low production
	Moist	308	CONTR	IM 527	IM 301	CONTR								
	Sp. Gr.	307	CONTR	IM 527	IM 301	CONTR								
	Quality	AS 209						V	DME	1/100,000 sy	50 lb	CTRL		
Portland Cement (4101)	Quality	AS Cert		Each Load				V	DME	1/100,000 sy	15 lb	CTRL		
	Cement Yield		CONTR	1/10,000 cy		CONTR	820912							
Fly Ash	Quality	AS Cert		Each Load			800240	V	DME	1/100,000 sy	15 lb	CTRL		
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Each Load				V	DME	1/100,000 sy	15 lb	CTRL		
Air Admixture	Quality	AB 403						M	DME	1/project	1 pint	CTRL		Sample batches not previously reported or as required by DME
Water Reducer	Quality	AB 403						M	DME	1/project	1 pint	CTRL		
Retarding Admixture	Quality	AB 403						M	DME	1/project	1 pint	CTRL		

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NOTE: IA may be accomplished by system approach or on a per project basis (IA at 1 per 100,000 sy of concrete) at the discretion of the DME.
NOTE: When Certified Plant Inspection is not provided, the engineer is responsible for performing quality control sampling and testing.
NOTE: Quality samples not required when mix quantity is less than 2000 sq. yds., except for curing compound.
NOTE: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.
NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.
NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

Sampling & Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, & PAVED SHOULDERS

April 20, 2021 | Matls. IM 204

Supersedes October 15, 2019 | Section 2122, 2201, 2213, 2301, 2302, 2310, Quality Management Concrete (QM-C) | Appendix E (US) Units

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPT.	S&T TYPE	SAMP. BY	FREQ.	SAMPLE SIZE	TEST BY	REPT.	
GRADE INSPECTION														
Chloride Solution	Concentration	373	RCE	1/day										
Steel Reinforcement:														
Dowels	Quality	AS 451.03B						V	DME	1/Source/Yr	1 dowel bar	CTRL		
Dowel Basket Assembly	Quality	AS 451 Cert 451.03B												
Tie Bars	Quality	AS 451						V	DME	1/Source/Yr	1 tie bar	CTRL		
General Use	Quality	AS 451						V	DME	1/Source/Yr	48 in	CTRL		
Curing Compound (4105)	Quality	Tested 405						V	DME	1/batch	1/qt	CTRL		Sample batches not previously reported or as required by DME

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*IA thickness cores sent to Central Lab for additional project information testing (Interstate and Primary only.) **None required when maturity is used.

NOTE: IA may be accomplished by system approach or on a per project basis (IA at 1 per 100,000 sy of concrete or as noted in the table) at the discretion of the DME.

NOTE: Quality samples not required when mix quantity is less than 2000 sq. yds., except for curing compound.

NOTE: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.

NOTE: Form #E115 available from the Construction & Materials Bureau.

NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

Sampling & Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, & PAVED SHOULDERS

April 20, 2021 | Matls. IM 204

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPT.	S&T TYPE	SAMP. BY	FREQ.	SAMPLE SIZE	TEST BY	REPT.	
GRADE INSPECTION														
Plastic Concrete	Air QMC	318 327	CONTR	1/350 cy, 1/100 cy ready mix		CONTR	E115	V IA	RCE	1/700 cy,1/200 cy ready mix 1/100,000 sy		RCE DME		Min. 1 test/pour
	Air Non-QMC	318 327					E115	V IA	RCE	1/700 cy,1/100 cy ready mix 1/100,000 sy		RCE DME		Min. 1 test/pour
	Slump	317						V	RCE	1/700 cy,1/100 cy ready mix		RCE		For hand finish or fixed form only. Min. 1/pour
	Grade Yield		RCE	1/1000 cy		RCE								
	Beams**	316, 327, 328	RCE	2/day		RCE	E115							
	Beams QMC	327, 328, 530	RCE	1/10000 cy		CTRL								Maximum 3 sets
Hardened Concrete	Thickness*	346, 347						V IA V IA	RCE/ CONTR	1/2000 sy 10% MIT 1/2000 sy# 10 locations#		RCE DME RCE DME		See IM 396 for Bid item <3500 SY #Minimum
	Smoothness	341	CONTR		100%	CONTR		V	DME		10%	DME		

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*IA thickness cores sent to Central Lab for additional project information testing (Interstate and Primary only.) **None required when maturity is used.

NOTE: IA may be accomplished by system approach or on a per project basis (IA at 1 per 100,000 sy of concrete or as noted in the table) at the discretion of the DME.

NOTE: Quality samples not required when mix quantity is less than 2000 sq. yds., except for curing compound.

NOTE: RCE/CONTR indicates that the contractor shall assist in the sampling at the direction of and witnessed by the project engineer.

NOTE: Form #E115 available from the Construction & Materials Bureau.

NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

NOTE: For Local agency projects with no Federal funding, smoothness verification testing may be tested and evaluated by the DME.

Sampling & Testing Guide-Minimum Frequency
ASPHALT MIXTURES
Section 2303 & 2213

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4127)		AS 491.04												
Asphalt Binder		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
Recycled Asphalt Shingles		AS 506												
PLANT INSPECTION														
Aggregates (2303)	Quality							V	DME	1/20,000 Ton	50 lb.	CTRL		
Combined Aggregate (4127)	Gradation	302, 306, 336	RCE/ CONTR	1/lot	IM 301	CONTR		V IA	RCE/ CONTR	Sample 1/day, Test 1st day + 20% Systems Approach*	IM 301	DME/ RCE	IM 216 IM 216	
	Moisture		CONTR	1 / half day	1000 gm	CONTR								Drum Mix Plants Only
Asphalt Binder	DSR Quality	AS Cert 323						V V IA	RCE/ CONTR DME	Sample 1/day Test 1st 1/week 1/20,000 T of Mix Systems Approach	4 oz tin 1 qt	DME CTRL		Log all shipments ** Interlayer
Cutback		AS Cert												Log all shipments
Emulsion	Residue	AS 360						V	RCE	1/project	1 qt	DME		Plastic bottle required

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*A project approach may be applied at the discretion of the DME at the frequency 1/project.

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE, & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density & Lab Voids	321,322, 350 325G, 357, 338	RCE/ CONTR	As per 2303	40 lb	CONTR		V IA	RCE/ CONTR	As per 2303 Test 1/day Systems Approach	40 lb	DME		***Interlayer
	Moisture Sensitivity	319, 322, 325G Article 2303.02, E.2						V	RCE/ CONTR	Test 1st Sample at 500 tons then sample 1/10,000 tons per 2303 until 1st sample accepted (test as needed)	70 lb	CTRL		
Compacted Mixture	Mat Density, Thickness & Voids	320, 321 337						V IA	RCE/ CONTR DME	Lot 1 lot/project*	Min 8/lot	RCE DME		
	Joint Density	SS-15004 Or DS-15036						V	RCE/ CONTR	Lot	3/lot	RCE		6-inch core
	Smoothness	341	CONTR	100%	100%	CONTR		V	DME	10%		DME		

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*** A system approach may be applied at the discretion of the DME.**
NOTE: A Verification sample for asphalt binder quality and aggregate quality not required under 2000 tons of mix.
NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.
****NOTE: For interlayer construction, as a minimum, sample 1 Qt. each day, and perform the MSCR test on the first and last day's binder sample of interlayer placement.**
***** NOTE: For interlayer construction, in addition to the required uncompacted mix sample(s) tested by the contractor and district lab, sample and retain at least one additional box of uncompacted mix each day of interlayer placement.**
NOTE: For Local agency projects with no Federal Funds Independent Assurance, IA, tests are not required.
NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.
NOTE: For Local agency projects with no Federal funding, smoothness verification testing may be tested and evaluated by the DME.

Sampling & Testing Guide-Minimum Frequency

STRUCTURAL CONCRETE, REINFORCEMENT, FOUNDATIONS & SUBSTRUCTURES, CONCRETE STRUCTURES, CONCRETE FLOORS, & CONCRETE BOX, ARCH & CIRCULAR CULVERTS

April 21, 2020 | Sections 2403, 2404, 2405, 2406, 2412, & 2415 | Matls. IM 204

Supersedes October 15, 2019 | Appendix H (US) Units

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregate-Fine (4110)		AS 209												
Aggregate-Coarse (4115)		AS 209												
Granular Backfill (4133)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
Mixing Water (4102)	Quality							V	RCE	1/source	1pt	CMB		Not required for potable water from Municipal Supply (2)
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Air Entraining Admixture	Quality	AB 403												
Retarding Admixture	Quality	AB 403												
Water reducing Admixture	Quality	AB 403												
Curing Compound, White (4105)	Lab Tested	AS 405						V	DME	1/batch	1qt	CMB		Sample batches not previously reported or as required by DME
Curing Compound, Clear (4105)		AB 405.07												

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(2) DME may waive sampling of water from an established well that has shown past compliance.

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Pre-formed Joint Sealer (4136)	Lab-Tested	AB 436.02 436.05												
Reinforcing Steel Bars (4151)	Quality	AS 451 451.03B												
Steel Pile (4167)	Quality	467												
Concrete Pile (4166)	Quality	AS 570												
Timber Pile (4165)	Quality	Cert 462 AS												
Timber (4162) & Lumber (4163		Treated-Cert 462 AS												
Concrete Anchors	Quality	AB 453.09												
Epoxy Grout	Quality	AB 491.11												
Concrete Sealer	Quality	AB 491.12												
Subdrain Pipe (4143)	Quality	AS 443, 448												
Neoprene Bearing Pads (4195)		AS 495.03												
Bronze Bearing Plates (4190.03)		AS Cert												

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NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

Sampling & Testing Guide-Minimum Frequency

STRUCTURAL CONCRETE, REINFORCEMENT, FOUNDATIONS & SUBSTRUCTURES, CONCRETE STRUCTURES, CONCRETE FLOORS, & CONCRETE BOX, ARCH & CIRCULAR CULVERTS

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Masonry Plate (4152)		AS Cert												
Prestress Units, Precast Units (2407)	Quality	AS Cert Inspection Report 570												
Precast Units (2419)	Quality	AS Cert 445												
Anchor Bolts (lighting, signing, handrail, structures) (4153)	Lab Tested	ASD												
Structural Steel (4152)	Quality	Cert												Monitor Sample According to plans or other instructions
Aluminum & Steel Bridge Rail & Anchor Assembly		ASD												
Conduit (Electrical) (4185.10)) Steel		AS												
Conduit (Plastic) (4185.10)	Lab Tested							V	DME	1/size	4'	CMB		
Bentonite		Visual												
Flowable Mortar	Lab Tested	Approved 525, 375 Trial Mix												Tested by DME
Fabric Formed Revetment		Approved 375 Trial Mix												Tested by DME

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NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregate- Fine (4110)	Gradation Deck	302, 306 336	CONTR	IM 528	IM 301	CONTR	800240	V IA	RCE/ CONTR	Sample & Test 1/deck pour	IM 301	RCE DME	Plant Monitor Workbook	See IM 528
	Gradation All other		CONTR	IM 528	IM 301	CONTR		V IA	RCE/ CONTR 1/project	Sample 1/wk Test 1st day +20%	IM 301	RCE DME	Plant Monitor Workbook	See IM 528 Systems approach applicable
	Moisture	308, 528	CONTR	IM 528	IM 301	CONTR								See IM 528 if Moisture Probe is used
	Sp. Gr.	307	CONTR	IM 528	IM 301	CONTR								
	Quality	AS 209												
Aggregate- Coarse (4115)	Gradation Deck	302, 306 336	CONTR	IM 528	IM 301	CONTR		V IA	RCE/ CONTR	Sample & Test 1/deck pour	IM 301	RCE DME	Plant Monitor Workbook	See IM 528
	Gradation All other		CONTR	IM 528	IM 301	CONTR		V IA	RCE/ CONTR 1/project	Sample 1/wk Test 1st day +20%	IM 301	RCE DME	Plant Monitor Workbook	See IM 528 Systems approach applicable
	Moisture	308, 528	CONTR	IM 528	2000gm	CONTR								
	Sp. Gr.	307	CONTR	IM 528	2000gm	CONTR								
	Quality	AS 209						V	DME	1/1000 cy	50 lb	CMB		(1)
Portland Cement	w/c ratio	528	CONTR	1/pour		CONTR								
	Quality	AS Cert						V	DME	1/1000 cy	15 lb	CMB		(1)

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(1) These verification samples for concrete materials not required when mix quantity is less than 50 cu. yd. For placements greater than 1000 cu. yd., sample 1/placement.

NOTE: IA may be accomplished by system approach or on a per project basis (IA at 1 per 1000 cy of concrete) at the discretion of the DME according to IM 207.

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

Sampling & Testing Guide-Minimum Frequency

STRUCTURAL CONCRETE, REINFORCEMENT, FOUNDATIONS & SUBSTRUCTURES, CONCRETE STRUCTURES, CONCRETE FLOORS, & CONCRETE BOX, ARCH & CIRCULAR CULVERTS

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			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Fly Ash	Quality	AS Cert		Each Load			800240							
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Each Load										
Air-Entraining Admixture (4103)		AB 403						M	DME	1/project	1pt	CMB		(1) Sample lots/batches not previously reported or as required by DME
Retarding Admixture		AB 403						M	DME	1/project	1pt	CMB		
Water Reducing Admixture (4103)		AB 403						M	DME	1/project	1pt	CMB		
GRADE INSPECTION														
Plastic Concrete	Air Content	318, 327					E145*	V IA	RCE	1/30 cy, min. 1/day		RCE DME		If >350 cy placement, DME may increase to 1/50 cy, if consistent during first 90 cy
	Slump	317, 327						V IA	RCE	1/30 cy, min. 1/day		RCE DME		DME may adjust
	Beams	316, 327, 328							RCE	2/placement		RCE		If required per 2403
	Cylinders								DME			DME		See Note

AS-Approved Source
ASD-Approved Shop Drawing
S&T-Sampling & Testing
AB-Approved Brand

Cert – Certification Statement

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CMB-Construction Materials Bureau
CONTR-Contractor

IA-Independent Assurance
V-Verification
M-Monitor

(1) These verification samples for concrete materials not required when mix quantity is less than 50 cu. yd. For placements greater than 1000 cu. yd., sample 1/placement.
(2) **NOTE:** IA may be accomplished by system approach or on a per project basis (IA at 1 per 1000 cy of concrete) at the discretion of the DME according to IM 207.

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: Cylinders for strength on primary project bridge decks only and where specifically called for in the plans or specifications.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

*Available from the Construction and Materials Bureau.

Sampling & Testing Guide-Minimum Frequency

STRUCTURAL CONCRETE, REINFORCEMENT, FOUNDATIONS & SUBSTRUCTURES, CONCRETE STRUCTURES, CONCRETE FLOORS, & CONCRETE BOX, ARCH & CIRCULAR CULVERTS

April 21, 2020 — Sections 2403, 2404, 2405, 2406, 2412, & 2415 — Matls. IM 204

Supersedes October 15, 2019 — Appendix H (US) Units

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TES BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Reinforcing Steel (4151)	Quality	AS Cert		Each Shipment			Field Book	V	DME	IM 451	6 ft	CMB		
Reinforcing Steel Epoxy Coated (4151)	Quality	AS Cert		Each Shipment			Field Book	V	DME	1 bar	6 ft	CMB		Will be verification tested for coating
Reinforcing Stainless Steel (4151)	Quality	AS Cert		Each Shipment			Field Book	V	DME	IM 452	6 ft	CMB		
Steel Pile (4167)	Quality	AS Cert		Each Heat			Field Book		DME	IM 467		CMB		
Timber Pile (4165)	Quality	AS 462 Cert						V	DME	IM 467		CMB		No grade requirement Charge numbers on butt end.
Anchor Bolts (lighting, signing, handrail, structures)	Lab Tested	ASD						V	DME	1/diameter/ source/year	1 bolt w/nut & washer	CMB		Sample only if not source inspected
Steel Masonry Plates (4152)		ASD Cert		Each Shipment			Field Book							Approved by Materials Department
Bronze Bearing Plates (4190.03)	Lab Tested							V	DME	1/project	1 only	CMB		Sample only if not source inspected
Neoprene Bearing Pads (4195)		AS 495.03		Each Shipment			820905							
Alum. Bridge Rail & Anchor Assembly		ASD		Each Shipment			Field Book							Approved By Materials Dept.
Drains (Std Steel Pipe)(as per plan)	Dimensions Galvanized	ASD Visual 332						V	DME	1/project		DME		

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CONTR-Contractor

IA-Independent Assurance
V-Verification
M-Monitor

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

Sampling & Testing Guide-Minimum Frequency

STRUCTURAL CONCRETE, REINFORCEMENT, FOUNDATIONS & SUBSTRUCTURES, CONCRETE STRUCTURES, CONCRETE FLOORS, & CONCRETE BOX, ARCH & CIRCULAR CULVERTS

April 21, 2020 | Sections 2403, 2404, 2405, 2406, 2412, & 2415 | Matls. IM 204

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MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE & RELATED IMs	QUALITY CONTROL					INDEPENDENT ASSURANCE & VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Timber (4162) & Lumber (4163)	Quality	AS 462 Treated-Cert												
Subdrain Pipe (4143)	Quality	AS Cert 443, 448		Each Shipment										
Flowable Mortar (2506)	Flow Test	375						V	RCE	1/4 hours (critical) Visual (noncritical)		RCE	Plant Report	Mix Design approval by DME Lab mix for critical flow only
Grout for Stone Revetment 2507 and Fabric Formed Revetment	Air Content	318 340						V	RCE	1/half day			Plant Report	Fabric Formed Mix Design approval by DME
	Flow Test	375						V	RCE	1/half day				Fabric Formed Revetment Only
	Compressive Strength	315												Only when required by the DME
Foamed Cellular Concrete	Density		CONTR	Each Load										RCE Witness density test by CONTR
Bentonite	Flow Test	Visual 375				RCE								
Hardened Concrete	Smoothness	341	CONTR	100%		CONTR	821301	V	DME	10%		DME		

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IA-Independent Assurance
V-Verification
M-Monitor

NOTE: RCE/CONTR indicates that the Contractor shall assist in the sampling at the direction of and witnessed by the Project Engineer.

NOTE: For Local agency projects with no Federal funding, Independent Assurance, IA, tests are not required.

NOTE: For Local agency projects with no Federal funding, verification samples or monitor samples sampled by the DME are not required. These samples may be sampled by the contracting authority. With prior approval, these samples may be tested by the Iowa Department of Transportation Central Laboratory.

NOTE: For Local agency projects with no Federal funding, smoothness verification testing may be tested and evaluated by the DME.

IM 209
AGGREGATE PRODUCERS

APPROVED PRODUCER PROGRAM AND CERTIFIED AGGREGATES

APPROVED PRODUCER PROGRAM

In order to furnish certified aggregates to projects, an aggregate producer shall be on the approved aggregate producer listing Appendix B. This will also apply to recycled product yards and/or processors. The specific requirements, including the details of the required quality control program are in Appendix A.

Specification limits for aggregates being produced are found in Appendix C and the Aggregate Gradation Table in the Standard Specifications. For complete details on aggregate quality and gradation requirements, refer to the appropriate referenced specification.

Non-compliance to the approved Producer Quality Control Program shall constitute grounds for the source and/or producer to be placed on conditional status by the District Materials Engineer. Continued non-compliance will be considered sufficient grounds to remove the producer from the Approved Producer List.

Appendix E contains the "Notification of Violations of the Approved Producer's Quality Control Program". This is a written notice from the District Materials Coordinator or District Materials Engineer to a Producer identifying violation(s) of the Producer's Quality Control Program or requirements of the Approved Producer Program. A written response is required from the Producer describing how the violation occurred, how the violation will be rectified, and what will be done so the violation will not occur or continue to occur in the future.

An Aggregate Review Board will meet, as needed, for disciplinary actions and appeals involving Approved Producers.

The Aggregate Review Board shall consist of:

- The State Construction and Materials Engineer
- The Chief Construction and Materials Geologist

CERTIFIED AGGREGATES – SAMPLING AND TESTING

The Aggregate Producer shall be responsible for source product quality control. Aggregate quality will be determined by testing samples secured by District Materials personnel. This will not relieve the producer or supplier of their responsibility for quality of the material. Producers must meet the responsibilities outlined in *Guidelines for Aggregate Producer Quality Control Program,* IM 209 Appendix A.

Not less than 24 hours before start up, or as soon as possible for a production change, the appropriate District Materials Engineer shall be notified. The notification shall include the estimated daily production and total production, the intended use (project or warehouse stock), production ledge(s) if applicable, and responsible person(s). Failure to notify may result in additional quality sampling and testing, or rejection of the material.

Aggregates to be used in highway construction projects shall be subject to sampling and testing, including Producer Quality Control (QC) sampling and testing. Sampling and testing shall be performed during production in accordance with the minimum frequencies listed in the table below.

TABLE 1. SOURCE SAMPLING AND TESTING REQUIREMENTS

Sample Type	Producer Quality Control Testing Frequency	Iowa DOT Verification Testing Frequency
Proportioned Aggregates		
Gradation	1/1500 T(1) minimum	1/18,000 T(2)
Quality	1/12,000 T or 1/month, whichever is more frequent (3)	1/12,000 T or 1/month, whichever is less frequent (2)
Non-Proportioned Aggregates		
Gradation	1/3000 T(1) minimum	1/18000 T(2)
Quality	1/12,000 T or 1/month, whichever is more frequent (3)	1/12,000 T or 1/month, whichever is less frequent (2)

1 Additional QC testing may be required at the time material is shipped to a project, for a stockpiled material carried over a winter season or if there is evidence of segregation, contamination, or degradation.
2 May be adjusted by the DME for source specific needs.
3 When required by the DME for sources where historic quality test results have approached or exceeded the specification limits (IM 307, 344, and 368).

A. Producer Quality Control Sampling & Testing

Producer QC sampling and testing personnel, laboratories, and equipment shall be qualified in accordance with the Iowa DOT Technical Training & Certification Program (IM 213) and the Materials Laboratory Qualification Program (IM 208). If Producer gradation test results are used as part of an acceptance decision, they will be evaluated under the Independent Assurance Program.

It is recommended that a Producer Quality Control Program include quality control testing to assist with ledge control and pit quality. Such tests may include: specific gravity (IM 307), clay lumps and friable material (IM 368), or shale in fine aggregate (IM 344). If historic data from a source indicate that quality test results approach or exceed specification limits the Engineer may require specific data be provided by the aggregate producer or supplier to the Iowa DOT (obtained by qualified persons and procedures). These data may include those tests listed above. See Table 1 for frequencies.

B. Iowa DOT Verification Sampling & Testing

The District Materials Office will be responsible for monitoring the Producers Quality Control Program. Verification of quality and gradation is through independent sampling and testing. Verification sampling and testing is done by Agency personnel. Agency sampling and testing personnel, laboratories, and equipment will be qualified in accordance with the Iowa DOT Technical Training & Certification Program (IM 213) and the Materials Laboratory Qualification Program (IM 208).

TABLE 1. SOURCE SAMPLING AND TESTING REQUIREMENTS

Sample Type	Producer Quality Control Testing Frequency	Iowa DOT Verification Testing Frequency
Proportioned Aggregates		
Gradation	1/1500 T[1] minimum	1/18,000 T[2]
Quality	1/12,000 T or 1/month, whichever is more frequent [3]	1/12,000 T or 1/month, whichever is less frequent [2]
Non-Proportioned Aggregates		
Gradation	1/3000 T[1] minimum	1/18000 T[2]
Quality	1/12,000 T or 1/month, whichever is more frequent [3]	1/12,000 T or 1/month, whichever is less frequent [2]

1 Additional QC testing may be required at the time material is shipped to a project, for a stockpiled material carried over a winter season or if there is evidence of segregation, contamination, or degradation.

2 May be adjusted by the DME for source specific needs.

3 When required by the DME for sources where historic quality test results have approached or exceeded the specification limits (IM 307, 344, and 368).

When requested by the Agency, Producer or Contractor personnel shall assist with the sampling as directed and witnessed by the certified Agency personnel. The sample location and time will be randomly selected by the Agency (except when noted elsewhere) and will only be given to the Producer immediately prior to sampling. To maintain the integrity of the sample, it will be transported by Agency personnel or secured by a tamper proof method and transported by the Producer. The Agency may spilt the verification sample and give a portion to the Producer.

Verification gradation test results, when non-complying, will normally be provided to the Producer within 3 working days of sampling.

At no time will the District Materials Office representative issue directions to the producer. However, the representative will have authority and responsibility to question and where necessary reject any operation, which is not in accordance with the Specifications, Special Provisions, and Instructional Memorandums.

C. Validation of Non-Proportioned Aggregate Test Results

The verification gradation test results will be compared to the QC test results to validate the QC results for non-proportioned aggregate. Validation is based on the verification test results being within the specification limits. When the QC test results cannot be validated, the dispute resolution process will be used. Material shall not be shipped from the stockpile until the dispute is resolved. **NOTE:** Verification test results may be used solely for acceptance. When verification test results are used solely for acceptance, the acceptance criteria is Article 4109.

D. Dispute Resolution System

Validation disputes arising between the Contracting Agency and the Producer or Contractor will be resolved in a reliable, unbiased manner usually within two weeks of notification of a dispute. If necessary, an evaluation will be performed by the Iowa DOT Central Materials Laboratory. Resolution decisions by the Iowa DOT Central Materials Laboratory will be final.

Unless specified elsewhere, the District Materials Engineer will select some or all of the following steps for the dispute resolution:

1. Perform a comparison between the verification result and QC result(s) for the same time period (If the QC sample is from a split with the verification sample, also compare the previous independently taken QC result). Use the tolerances in IM 216. If the results are within the tolerance, validation is achieved.
2. Check all numbers and calculations.
3. Isolate material in dispute and begin a new stockpile. Resample stockpile material in dispute.
4. Perform tests on split obtained by Agency personnel.
5. Review past proficiency and validation data.
6. Review sampling and testing procedures.
7. Check equipment operation, calibrations and tolerances.
8. In the event of multiple validation failures for a source, the DME may use F-test and t-test statistical methods to compare the set of QC results with the set of verification results. A 0.05 level of significance will be used and a set of at least 5 verification test results.
9. Involve the Central Materials Laboratory.

If the discrepancy cannot be resolved using the steps listed above then the Agency test results will be used for the acceptance decision for that lot.

E. Small Quantities

Verification sampling and testing may be waived by the DME for product quantities of less than 2000 tons. For quantities of less than 200 tons of non-critical aggregate, the DME may waive QC testing and approve the stockpile based on a visual inspection by the DME or the Engineer.

CERTIFIED AGGREGATES – DOCUMENTATION

A. Producer Test Documentation

All producer test results performed on certified aggregates, whether compliant or non-compliant, shall be reported weekly or as designated to the District Materials Engineer on Form #821278. These reports shall indicate whether the aggregate is being produced for direct project delivery, stockpiling for a specific project, or for advance warehouse stock.

Selected production limits shall be included on Form #821278.

Production limits for aggregate produced for use in HMA are generated by the contractor and supplied to the aggregate producer on Form #955.

B. Certified Aggregate Delivery Documentation

Documentation may be accomplished by numbered truck ticket, transfer list or shipment statement (such as Form #821278), or by a bill of lading (for rail or barge shipments). The certified documentation shall be furnished to project inspection personnel or receiving contractor before material is incorporated.

- For aggregates as bid items measured by weight (mass), the certified truck tickets shall be numbered and include signatures or initials in accordance with Article 2001.07.

- A "secure electronic signature" as defined by IM 209 Appendix G may be acceptable for certification of truck tickets in lieu of an original signature.

- In the case of shipment by rail or barge, the documentation shall be sent to the project engineer and receiving contractor or ready mix operator no later than the same day as shipment source departure. The documentation shall include the rail car or barge number(s).

- Documentation not having an exact weight (mass) shall include an estimated quantity (i.e. transfer listings or Form #821278, etc.).

- ~~Non-Proportioned Aggregate Summaries~~

  - ~~If the Producer/Supplier QC test results are used in the acceptance decision for non-proportioned aggregates, the Producer shall supply a signed certified summary documentation to the Project Engineer, including: the source, the type of material, the total quantity delivered, and project number.~~

  - ~~When Agency test results are used in the acceptance decision of for non-proportioned aggregate, the Producer/Supplier shall supply a signed certified summary documentation to the Project Engineer and District Materials Engineer, including: the source, type of material, the total quantity delivered, and project number.~~
    ~~The District Materials Engineer will provide test reports to the Project Engineer.~~

The following certification statement is required to be on the document used to certify the material being delivered (i.e. truck ticket, Form #821278, etc.): "**This is to certify the material herein described meets applicable contract specifications.**" **NOTE:** This certification statement shall be signed or initialed by an authorized representative of the aggregate supplier.

To ensure proper identification of delivered aggregates, the following additional information is required on the certification document:

Proportioned Aggregate
When the aggregate represented is for use in HMA or PCC mixtures, the project number is preferred when practical, as in the case when shipping to a single project paving plant site, and not required when impractical, as in the case when shipping into warehouse stock at a ready mix plant or when shipping to a plant supplying material to multiple projects.

PCC Aggregate: Gradation number, quantity, source name and T203 A-number, production beds (for quarried stones) and the delivery date.

HMA Aggregate: Product size, quantity, source name and T203 A-number, production beds (for quarried stones), and delivery date.

Non-proportioned Aggregate
Iowa DOT gradation number, project number, quantity, source name and T203 A-number and the delivery date. **NOTE:** Documentation for revetment stones shall include production beds.

Recycled Aggregate Materials
Iowa DOT gradation number, project number, quantity, source name and the delivery date. **NOTE:** A T203 A-number is not required for Recycled plants.

REHANDLING OF CERTIFIED AGGREGATES

When certified aggregates are rehandled the District Materials Engineer shall be notified and afforded the opportunity to monitor the re-handling procedure.

For the purpose of this IM, re-handling is meant to include the physical unloading and reloading of aggregate at a temporary storage site before the aggregate is delivered to its final destination. Rehandled certified aggregates may be required to be re-tested, with or without re-weighing and recertified on a numbered shipment ticket with proper identification and certification statement.

ACCEPTANCE

At the Contractor's and Producer's own risk, aggregates may be certified for project use before quality sample test results are reported based on the following:

- Complying Quality Control and Verification gradations
- Documentation of consistent previous compliance to specified quality requirements from the source or ledge.

A. Proportioned Aggregate

In the case of HMA or PCC proportioned aggregates, acceptance tests will be performed on verification samples obtained at the proportioning plant.

Certified proportioned aggregate may be incorporated into a project on the basis of the certified truck ticket, certified bill of lading, shipment listing, certified transfer listing or Certified Gradation Test Report (Form #821278).

A file of certified shipment or transfer documents for the HMA or PCC proportioned aggregate will be maintained by the contractor or ready mix operator and made available for inspection at each plant or project site during the project period. Project inspection personnel 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.

B. Non-Proportioned Aggregate

Acceptance of non-proportioned aggregates will be based on proper certification, visual examination by the contracting authority to ensure against obvious contamination or segregation, Producer quality control test results, and Agency verification test results.

Minor quantities of non-critical aggregates may be visually inspected by the contracting authority and recorded in the project field book. Quantities less than 200 Mg (ton) are considered minor. An example of a non-critical aggregate is a non-proportioned aggregate such as granular backfill material for bridge abutments.

If a non-proportioned aggregate has a C-freeze of 10 or greater and has gone through winter freeze thaw cycles without recertification, that material must remain visibly identifiable in the stockpile.

C. Independent Assurance Program (IAP)

If Producer QC test results are used in the acceptance decision for non-proportioned aggregate, each certified technician who performs the QC sampling or testing and their test equipment will be independently checked by Iowa DOT certified technicians (IAP personnel) as per Materials IM 205 at least once per year. IAP personnel must not be involved in gradation verification testing for the aggregate source being tested.

IAP personnel will witness the Producer technician taking a random sample and splitting that sample. The splits of the sample will be tested by the Producer's technician and by the Iowa DOT District Laboratory. District Laboratory IAP testing equipment must not be the same equipment that is used for gradation verification for that source.

The results will be compared using IM 216. If acceptable correlation is not found, IAP personnel will contact the Producer's technician and review the results for the following:

1. Check for recording, weighing, or calculating errors.
2. Check to see that the balance is working correctly.
3. Check the sieves for damage or out of tolerance openings.
4. Check for overloading of sieves.
5. Check for incomplete sieving.
6. Resolve any problems, repeat the sampling, splitting, and observe the testing of a new sample.

The IAP results are not to be used in the acceptance decision for the material. Any non-complying IAP results should result in a visit by the Iowa DOT inspector responsible for verification testing at that location.

This method of IAP is called a System Approach and requires the Iowa DOT to report a summary of the results annually to the FHWA. Document when the Producer's Technician was visited, which Producer's laboratory was used, the results, and any follow-up if required. This documentation should be retained in the event of an FHWA audit.

IM 209 C
AGGREGATE QUALITY REQ

AGGREGATE SPECIFICATION LIMITS & SAMPLING AND TESTING GUIDE

October 18, 2022
Supersedes October 20, 2020

(See Specifications for Complete Details.)

Matls. IM 209
Appendix C

TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Fine Aggregate for PCC													
PCC	4110						2						1
		Note: Maximum 40% between sieves											
		Note: The fineness modulus must be no lower than 2.60. A target fineness modulus (or base-line) will be established for each source for continued approval.											
		Note: Shale + Coal not to exceed 2% max.											
PCC, Class L	4111						2						1
		Note: Only from approved PCC sources.											
		Note: Maximum 45% between sieves and must have a fineness modulus no lower than 2.30.											
		Note: Shale + Coal not to exceed 2%max.											
Intermediate Aggregate for PCC													
Crushed Stone and Pea Gravel	4112	6						0.5			0.5		2
		Note: For Pea Gravel see Table 4112.03-2 for maximum allowable objectionable materials											
Coarse Aggregate for PCC													
Crushed Stone	4115												
-Structural		6		50		2	1	0.5		0.01	0.5		3-5
-Nonstructural		6		50		3	1	0.5		0.01	0.5		3-5
		Note: See 4115.02 for maximum allowable objectionable materials.											
Gravel	4115												
-Structural		6		35		2	1	0.5					3-5
-Nonstructural		6		35		3	1	0.5					3-5
		Note: See 4115.02 for maximum allowable objectionable materials.											
Bridge Deck	4115.05												
-Surfacing, Repair & Overlay		6		40	2.5	0.5				0.01	0.4		6
		Note: Unsound Chert+Shale+Coal+Iron not to exceed 1%.											
		Note: Unsound Chert particles are defined in 4115.02.											

AGGREGATE SPECIFICATION LIMITS & SAMPLING AND TESTING GUIDE

October 18, 2022
Supersedes October 20, 2020

(See Specifications for Complete Details.)

Matls. IM 209
Appendix C

TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Class V Aggregate													
	4116.02	6		40			2 (+#16)						7
		Note: Coarse Aggregates as in 4115 (except abrasion) and Fine Aggregates as in 4110.											
Combination of Materials With Class V													
Coarse Limestone													
Limestone Screenings													
		Note: See 4116 for cement requirements.											
		Note: Acquire limestone from sources meeting the specified coarse aggregate durability class for PCC.											
		Note: Must meet the requirements of 4116 and be only from sources acceptable as coarse aggregate.											8
Granular Leveling Material													
Aggregate	4117.02	6	20	50							0.5		18,19,21
		Note: Meet at least one of the C-Freeze, A-Freeze, or Almina requirements.											
Pipe Bedding													
Aggregate	4118.02		20	50									3
(Non-Primary Roads)		Note: >75% Crushed Gravel or Crushed Stone. Crushed PCC may be used if approved by the Engineer.											
Pipe Bedding and Backfill													
Aggregate	4119.02		15	45				4					10,11
(Interstate and Primary)		Note: >75% Crushed Gravel or Crushed Stone. Crushed PCC may be used if approved by the Engineer.											
		Note: If a Crushed Gravel is used meet the requirements of 4120.03.											
Granular Surfacing													
Aggregate for Granular Shoulders	4120.02												Per 4120.02
		Note: Requirements are equivalent to 4120.04, 4120.05 or 4120.06.											
Class C Gravel	4120.03		15				10						10
		Note: Percent of Clay Lumps + percent passing #200 sieve not to exceed 15%.											
		Note: Percent of Clay Lumps + percent of (+4) shale + percent passing #200 not to exceed 20%.											
Class A Crushed Stone	4120.04		15	45				4.0					11
		Note: For shoulders only; Abrasion limit is 50.											
Class B Crushed Stone	4120.05		20	55				4					11
		Note: “C” Freeze + Abrasion not to exceed 65%											
Class D Crushed Stone	4120.06												
		Note: “C” Freeze, Abrasion, and Gradation to be specified by Contract Documents.											
Paved Shoulders Fillets	4120.07		15	45				4					11
		Note: Material with Al_2O_3 not exceeding 0.7 or A-freeze not exceeding 10 may have an abrasion maximum of 55.											

AGGREGATE SPECIFICATION LIMITS & SAMPLING AND TESTING GUIDE

October 18, 2022
Supersedes October 20, 2020

(See Specifications for Complete Details.)

Matls. IM 209
Appendix C

TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Granular Subbase													
	4121	25		50							1.5		12a(Cr. St.) 12b(Grav.)
		Note: Combinations of crushed PCC, sand, crushed gravel, or crushed stone may be used. Note: Specification limits are for crushed stone or crushed gravel.											
Crushed Stone-Base													
Macadam Stone	4122		15	50									13a (Visual)
Choke Stone		Note: Choke stone see 4122.03 for details; when produced from Macadam has certified inspection of 1/3000 ton.											13b
Modified Subbase													
	4123		15	50					7 (Gravel)		None		14
		Note: If gravel only, 75% of +3/8" must be crushed with a minimum of one fractured face. Note: Reclaimed pavements meeting Materials IM 210 may be used with no more than 50% RAP.											
Aggregate for Slurry Mixture													
	4124.03	10		40			5			0.01	0.7		22 or 23
		Note: Friction Type 4 or better, sand equivalent of not less than 45, and organic materials maximum 0.01%.											
Aggregate for Bituminous Sealcoat													
	4125.03		10	40		0.5		0.5					1, 19-21
		Note: Friction Type 4 or better, shale on sand cover aggregate shall not exceed 2% maximum.											
Aggregate for Polymer-Modified Microsurfacing													
	4126.03		10	40		0.5		0.5		0.01	0.7		37, 38
		Note: Sand Equivalence of 45 Minimum. Note: Total of all combined unsound chert+shale+coal+iron 1.0 Note: For Friction Type 2 crushed stone requires Abrasion loss 30 max and Sand Equivalence of 60 Minimum.											
Coarse Aggregate for HMA													
Type A	4127.02	15		45	6.0			2.0		0.01	1.0		Per Form 955
Type B													
Primary	4127.02	25	10	45	6.0					0.01	1.5		Per Form 955
Non-Primary	4127.02	45	10	45	6.0					0.01	2.5		Per Form 955
		Note: Organic materials maximum 0.01%.											
Fine Aggregate for HMA													
Type A	4127.03						2.0			0.01			Per Form 955
Type B							5.0						
		Note: Use Natural sand. For the wearing course have no more than 50% retained between two consecutive sieves below the #4 sieve. Note: Crushed gravel or stone processed from coarse aggregate meeting requirements of 4127.02.											

AGGREGATE SPECIFICATION LIMITS & SAMPLING AND TESTING GUIDE

October 18, 2022
Supersedes October 20, 2020

(See Specifications for Complete Details.)

Matls. IM 209
Appendix C

TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Stabilization (Foundation) Material													
	4128.03		20	50									13
Revetment Stone		Note: Rocks that split into layers less than 4" thick shall not be used.											
Class A	4130.01	10		50							0.7	25	Visual
Class B	4130.01	10		50							0.7	25	Visual
Class D	4130.01		10	50									Visual
Class E and C	4130.01	10		50							0.7	25	Visual
		Note: See Specification 4130.01 for bedding plane/concrete slab thickness requirements.											
		Note: See 4130.02 for gradation requirements.											
Erosion and Gabion Stone													
Erosion Stone	4130.05		15	50				5					Visual
		Note: See 4130.04 for gradation requirements.											
Gabion Stone	4130.08	10		50							0.7		Visual
		Note: See 4130.07 for gradation requirements.											
Porous Backfill													
	4131	10		50			5(+4)				0.7		29
		Note: Material shall be free of visible clay and objectionable clay coating.											
Special Backfill													
	4132.01												30,31
Crushed Stone/PCC/CCP/Reclaimed HMA; Mixtures of Gravel, Sand and Soil or Uniformly blended combinations of the above.													
Gravel	4132.03								10				31
		Note: Organic material of no more than 1% on fraction passing the #40 sieve.											
Granular Backfill													
	4133		20	55				4					32
		Note: "C" Freeze + Abrasion not to exceed 65%.											
		*Note: When backfill is under flowable mortar see 4133.04 or as floodable backfill see 4134.02 for gradations.											
Floodable Backfill													
	4134	Note: Meet requirements for gradations No. 1, 5, or 36.											
Recycled PCC		Note: Recycled PCC and Recycled Composite must meet gradation and sampling frequency of the intended product; and meet the requirements of IM 210.											
Recycled Composite													

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TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Fine Aggregate for PCC													
PCC	4110						2						1
		Note: Maximum 40% between sieves											
		Note: The fineness modulus must be no lower than 2.60. A target fineness modulus (or base-line) will be established for each source for continued approval.											
		Note: Shale + Coal not to exceed 2% max.											
PCC, Class L	4111						2						1
		Note: Only from approved PCC sources.											
		Note: Maximum 45% between sieves and must have a fineness modulus no lower than 2.30.											
		Note: Shale + Coal not to exceed 2%max.											
Intermediate Aggregate for PCC													
Crushed Stone and Pea Gravel	4112	6						0.5			0.5		2
		Note: For Pea Gravel see Table 4112.03-2 for maximum allowable objectionable materials											
Coarse Aggregate for PCC													
Crushed Stone	4115												
-Structural		6		50		2	1	0.5		0.01	0.5		3-5
-Nonstructural		6		50		3	1	0.5		0.01	0.5		3-5
		Note: See 4115.02 for maximum allowable objectionable materials.											
Gravel	4115												
-Structural		6		35		2	1	0.5					3-5
-Nonstructural		6		35		3	1	0.5					3-5
		Note: See 4115.02 for maximum allowable objectionable materials.											
Bridge Deck	4115.05												
-Surfacing, Repair & Overlay		6		40	2.5	0.5				0.01	0.4		6
		Note: Unsound Chert+Shale+Coal+Iron not to exceed 1%.											
		Note: Unsound Chert particles are defined in 4115.02.											

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Class V Aggregate													
	4116.02	6		40			2 (+#16)						7
		Note: Coarse Aggregates as in 4115 (except abrasion) and Fine Aggregates as in 4110.											
Combination of Materials With Class V													
Coarse Limestone													
Limestone Screenings													
		Note: See 4116 for cement requirements.											
		Note: Acquire limestone from sources meeting the specified coarse aggregate durability class for PCC.											
		Note: Must meet the requirements of 4116 and be only from sources acceptable as coarse aggregate.											8
Granular Leveling Material													
Aggregate	4117.02	6	20	50							0.5		18,19,21
		Note: Meet at least one of the C-Freeze, A-Freeze, or Almina requirements.											
Pipe Bedding													
Aggregate	4118.02		20	50									3
(Non-Primary Roads)		Note: >75% Crushed Gravel or Crushed Stone. Crushed PCC may be used if approved by the Engineer.											
Pipe Bedding and Backfill													
Aggregate	4119.02		15	45				4					10,11
(Interstate and Primary)		Note: >75% Crushed Gravel or Crushed Stone. Crushed PCC may be used if approved by the Engineer.											
		Note: If a Crushed Gravel is used meet the requirements of 4120.03.											
Granular Surfacing													
Aggregate for Granular Shoulders	4120.02												Per 4120.02
		Note: Requirements are equivalent to 4120.04, 4120.05 or 4120.06.											
Class C Gravel	4120.03		15				10						10
		Note: Percent of Clay Lumps + percent passing #200 sieve not to exceed 15%.											
		Note: Percent of Clay Lumps + percent of (+4) shale + percent passing #200 not to exceed 20%.											
Class A Crushed Stone	4120.04		15	45				4.0					11
		Note: For shoulders only; Abrasion limit is 50.											
Class B Crushed Stone	4120.05		20	55				4					11
		Note: “C” Freeze + Abrasion not to exceed 65%											
Class D Crushed Stone	4120.06												
		Note: “C” Freeze, Abrasion, and Gradation to be specified by Contract Documents.											
Paved Shoulders Fillets	4120.07		15	45				4					11
		Note: Material with Al_2O_3 not exceeding 0.7 or A-freeze not exceeding 10 may have an abrasion maximum of 55.											

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TEST LIMITS	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Organic Material	Al_2O_3 Limit	Pore Index	Gradation Number
Granular Subbase													
	4121	25		50							1.5		12a(Cr. St.) 12b(Grav.)
		Note: Combinations of crushed PCC, sand, crushed gravel, or crushed stone may be used.											
		Note: Specification limits are for crushed stone or crushed gravel.											
Crushed Stone-Base													
Macadam Stone	4122		15	50									13a (Visual)
Choke Stone		Note: Choke stone see 4122.03 for details; when produced from Macadam has certified inspection of 1/3000 ton.											13b
Modified Subbase													
	4123		15	50					7 (Gravel)		None		14
		Note: If gravel only, 75% of +3/8" must be crushed with a minimum of one fractured face.											
		Note: Reclaimed pavements meeting Materials IM 210 may be used with no more than 50% RAP.											
Aggregate for Slurry Mixture													
	4124.03	10		40			5			0.01	0.7		22 or 23
		Note: Friction Type 4 or better, sand equivalent of not less than 45, and organic materials maximum 0.01%.											
Aggregate for Bituminous Sealcoat													
	4125.03		10	40		0.5		0.5					1, 19-21
		Note: Friction Type 4 or better, shale on sand cover aggregate shall not exceed 2% maximum.											
Aggregate for Polymer-Modified Microsurfacing													
	4126.03		10	40		0.5		0.5		0.01	0.7		37, 38
		Note: Sand Equivalence of 45 Minimum. Note: Total of all combined unsound chert+shale+coal+iron 1.0											
		Note: For Friction Type 2 crushed stone requires Abrasion loss 30 max and Sand Equivalence of 60 Minimum.											
Coarse Aggregate for HMA													
Type A	4127.02	15		45	6.0			2.0		0.01	1.0		Per Form 955
Type B													
Primary	4127.02	25	10	45	6.0					0.01	1.5		Per Form 955
Non-Primary	4127.02	45	10	45	6.0					0.01	2.5		Per Form 955
		Note: Organic materials maximum 0.01%.											
Fine Aggregate for HMA													
Type A	4127.03						2.0			0.01			Per Form 955
Type B							5.0						
		Note: Use Natural sand. For the wearing course have no more than 50% retained between two consecutive sieves below the #4 sieve.											
		Note: Crushed gravel or stone processed from coarse aggregate meeting requirements of 4127.02.											

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Stabilization (Foundation) Material													
	4128.03		20	50									13
Revetment Stone		Note: Rocks that split into layers less than 4" thick shall not be used.											
Class A	4130.01	10		50							0.7	25	Visual
Class B	4130.01	10		50							0.7	25	Visual
Class D	4130.01		10	50									Visual
Class E and C	4130.01	10		50							0.7	25	Visual
		Note: See Specification 4130.01 for bedding plane/concrete slab thickness requirements.											
		Note: See 4130.02 for gradation requirements.											
Erosion and Gabion Stone													
Erosion Stone	4130.05		15	50				5					Visual
		Note: See 4130.04 for gradation requirements.											
Gabion Stone	4130.08	10		50							0.7		Visual
		Note: See 4130.07 for gradation requirements.											
Porous Backfill													
	4131	10		50			5(+4)				0.7		29
		Note: Material shall be free of visible clay and objectionable clay coating.											
Special Backfill													
	4132.01												30,31
Crushed Stone/PCC/CCP/Reclaimed HMA; Mixtures of Gravel, Sand and Soil or Uniformly blended combinations of the above.													
Gravel	4132.03								10				31
		Note: Organic material of no more than 1% on fraction passing the #40 sieve.											
Granular Backfill													
	4133		20	55				4					32
		Note: "C" Freeze + Abrasion not to exceed 65%.											
		*Note: When backfill is under flowable mortar see 4133.04 or as floodable backfill see 4134.02 for gradations.											
Floodable Backfill													
	4134	Note: Meet requirements for gradations No. 1, 5, or 36.											
Recycled PCC		Note: Recycled PCC and Recycled Composite must meet gradation and sampling frequency of the intended product; and meet the requirements of IM 210.											
Recycled Composite													

IM 210
RECLAIMED

PRODUCTION OF CERTIFIED AGGREGATE FROM RECLAIMED ROADWAYS

GENERAL

This IM deals with requirements for furnishing certified aggregate produced from reclaimed materials.

The requirements of Office of Materials IM 209 (Certified Aggregates Approved Producer Program) also apply to the production of aggregate from reclaimed roadway materials.

Processing Requirements for Aggregates Produced from Reclaimed Materials

Notification to District Materials personnel of new production, as well as testing frequency, sampling, documentation, and acceptance of recycled materials, are the same as for virgin materials as outlined in IM 209. The District Materials Engineer shall be afforded the opportunity to witness the stockpiling of unprocessed recycled material.

Processing of reclaimed PCC crushed composite pavement (CCP), and salvaged HMA (RAP) shall include a means of eliminating material other than PCC, RAP, or CCP in the finished product. This may be accomplished by pre-screening or other methods acceptable to the District Materials Engineer. Stockpiles contaminated with soil or excessive recycled fines may require processing using a grizzly at the time of delivery to the recycle yard or as directed by the District Materials Engineer. Figures 1 through 6 show examples of poor (unacceptable) and clean stockpiles.

Stockpiles contaminated with reinforcing steel, soil, or other material can be rejected upon visual inspection. The producer or contractor shall be informed immediately that the stockpile has been rejected. Recycled yards must have controlled access and delivered material shall be inspected prior to incorporation into unprocessed stockpiles.

Moving Crusher Recycling Operations (such as a Paradigm)

- If multiple crushers and screening plants are used, each plant's production must have its own Q/C and monitor gradation testing.
- Sampling and testing frequency need to be in agreement between the Producer and DME before production.
- Sampling locations must be identified using stationing, GPS, or other accurate and reliable method.
- Material must be from a known aggregate source, or the quality establish prior to incorporation.

- Material cannot be incorporated until the material is represented by a complying gradation test result.

Modified Subbase and Granular Subbase

These products require that the reclaimed material be identifiable, and the following shall apply:

A. For Modified Subbase: recycled crushed PCC pavement or subbase, crushed composite pavement (CCP), and salvaged HMA (RAP) or HMA subbase can be reclaimed from an Interstate or Primary roadway pavement under the jurisdiction of the contracting authority and shall be certified based on gradation testing. If recycling subbase material, soil shall not be incorporated into the subbase. See: Modified Subbase Production, below.

B. For Granular Subbase: recycled crushed PCC pavement or subbase can be reclaimed from an Interstate or Primary roadway pavement under the jurisdiction of the contracting authority and shall be certified based on gradation testing. If recycling subbase material, soil shall not be incorporated into the subbase.

C. For Primary or Interstate projects, recycled PCC roadway pavement or recycled composite roadway pavement obtained from secondary roads or municipal streets may be used (as described above) if the source of the aggregate is known and the PCC coarse aggregate durability is Class 2 or better and shall be certified based on gradation testing. The producer shall be responsible for documentation of the pavement source.

   When the source or quality of the material from the secondary or municipal pavement is unknown, the material shall be certified based on quality requirements identified in the Standard Specifications for crushed stone for the aggregate being produced and gradation requirements for the aggregate product.

   1. If the concrete originated from multiple locations, the crushed material from each location must be stockpiled in separate but homogeneous stockpiles with removal location clearly identified.

   2. Prior to certification and furnishing to projects, each stockpile must be readily identifiable, and have compliant results on applicable tests on samples taken from each of these stockpiles.

D. On secondary and municipal projects, recycled material can also be reclaimed from roadway pavement under the jurisdiction of the contracting authority and shall be certified based on gradation testing.

Modified Subbase Production

Some aggregate products allow the blending of RAP with virgin aggregate or crushed PCC. The virgin aggregate or crushed PCC shall meet the gradation and quality requirements of the intended product before blending with RAP. HMA shall be processed into RAP, meeting the

applicable nominal maximum size for the intended product before blending with other aggregate.

The addition of unprocessed HMA shall only be allowed if it is generated from a composite pavement where the aggregate source in the PCC is Class 2 or better. This recycled composite material does not require testing.

If the aggregate source in the PCC is not known, the HMA must be removed, stockpiled separately, and the recycled PCC must meet modified subbase quality specifications. If the HMA cannot be separated from the PCC, the material cannot be tested and is not allowed for use as modified subbase.

For Modified Subbase, the amount of recycled HMA shall not exceed 50%. Blending of RAP back into recycled PCC pavements or with virgin aggregate shall be accomplished using-belt feeders and bins equipped with adjustable gates or drive systems that can be calibrated and controlled.

Material from HMA shoulders shall be processed separately from composite pavement and only used for Special Backfill due to possible contamination from material below the HMA shoulders. RAP containing soil or other foreign material other than HMA will be considered contaminated and subject to rejection.

Granular Shoulders

Crushed recycled materials may total no more than 30% of the shoulder aggregate for new construction and no more than 50% of the total for existing granular shoulders. The intended proportions shall be provided to the District Materials Engineer at least 24 hours before the start of production. The District Materials Engineer shall be afforded the opportunity to witness the calibration of the blending equipment. The blending restrictions described in Modified Subbase also apply to Granular Shoulders.

Recycled PCC for Class D and Class E Revetment

Recycled PCC revetment must be reclaimed from Interstate or Primary roadway pavements or airport runways.

To meet the nominal top size of 250 pounds for Class D and Class E revetment, recycled PCC used for revetment must be 10 inches or greater in thickness. If the Engineer or project requires using riprap containing material larger than 250 pounds, recycled PCC will not meet the dimensional requirements of Section 4130.02. Recycled PCC will not meet the dimensional requirements for Class A, B, and C revetment.

Certified Aggregates Produced from Reclaimed Materials Delivery Documentation

As outlined in Materials IM 209: an Iowa DOT gradation number, project number, quantity, source name and the delivery date. **NOTE:** A T203 A-number is not required for Recycled plants.

Figure 1. Recycled stockpile contaminated with steel.

Figure 2. Recycled stockpile contaminated with organic material.

Figure 3. Recycled stockpile with excessive fines.

Figure 4. Recycled stockpile contaminated with non-pavement material.

Figure 5. Example of a clean stockpile of recycled HMA.

Figure 6. Example of a clean stockpile of recycled PCC.

IM 213
TRAINING/CERTIFICATION

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. Appendix C of this IM lists what tests and procedures the technician is qualified to perform for each level of certification they obtain.

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

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

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

Director – 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-Iowa)
Coordinator of Technical Training & Certification Program**

** Appointed by Program Director

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.

TRAINING

The Iowa 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 Appendix A.

3. Once the candidate has met all the criteria and has received certification, it is recommended the Certified Technician work under the supervision of an experienced technician until they become efficient in the inspection and testing methods they will be performing.

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

4. Registered Professional Engineers, engineering graduates, and geology graduates from accredited institutions will be exempt from the training requirement in the areas they have had instruction. 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 Iowa Department of Transportation. Failure of the examination shall require the applicant to take the applicable schooling 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 shall be valid for five years.

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

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

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

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 permanent file with the District Materials Office in which the technician resides. The notice will also be placed on the statewide computer file. 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.

CERTIFICATION LEVELS

CERTIFICATION LEVEL	TITLE	PRE-REQUISITES
	AGGREGATE	
Aggregate Sampler	Certified Sampling Technician	None
Aggregate Technician	Certified Aggregate Technician	None
	CONTRACT ADMINISTRATION	
Level II Contract Admin.	Level II Contract Admin. Tech	Level I Contract Admin.
Level III Contract Admin.	Level III Contract Admin. Tech	Level II Contract Admin., Level I HMA, Level II PCC
	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	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: _____

_____

_____

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

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

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

Unsatisfactory Performance:

_____

_____

_____

_____

_____

_____

_____

_____
District Materials Engineer

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

LEVEL II CONTRACT ADMINISTRATION

- N/A

LEVEL III CONTRACT ADMINISTRATION

- IM 101 – Review of Materials Used in Construction & Maintenance Projects
- IM 103 – Inspection Services Provided to Counties, Cities, and Other State Agencies
- IM 204 – Inspection of Construction Project Sampling & Testing

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
- IM 325G - 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
- 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

Duties of the Aggregate Sampling Technician are detailed in IM 209 and the IM 300 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

Duties of the Aggregate Technician are detailed in IM 209 and the IM 300 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

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.

CONTRACT ADMINISTRATION TECHNICIAN DUTIES

Levels II and III perform duties described in Article 1105.06 “Authority & Duties of Inspector”. Duties of the Contract Administration Technician consist of, but are not limited to the following:

Level I

A. Field inspection on a single, or few, projects.

1. Conduct measurements.
2. Collect materials certifications.
3. Perform inspection on small/medium projects.
4. Daily log of contractor’s activities.
5. Measure contract quantities for pay.

Level II

A. Lead inspector of medium-sized project or multiple small projects.

1. Ensure work is completed according to contract documents.
2. Ensure proper materials certifications.
3. Coordinate and review inspector activities.
4. Maintain project records.
5. Prepare authorization for project progress reports and pay vouchers.
6. Identify and report non-complying materials or activities.

Level III

A. Manages the inspection and documentation of large, complex highway construction projects and/or several small highway projects.

1. Ensure work is done according to applicable contract documents, permits, laws, and other government regulations.
2. Review project daily to ensure adequate inspection and compliance of work.
3. Coordinate solution when contract documents do not completely and accurately address site conditions. Assists in negotiating change orders.

4. Make timely decisions to prevent non-complying work, avoid delays in project completion, and avoid potential claims due to loss of production by the contractor.

5. Perform end of project audit on incorporated materials.

6. Prepare project documents for final review.

7. Make determination on necessity of interest payment to the contractor and calculate that value.

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 IM 323 and IM 204.

B. Field Sampling (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.

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. (Article 2303.03 & 2001.01, IM 508)

    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) (Articles 2001.07 & 2001.20) (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)
    a. 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)
    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) (Article 2303.04, IM 204 & 511)

1. Obtain cold-feed gradation samples as directed by Contracting Authority personnel per IM 301and IM 204.

2. Obtain asphalt binder samples as directed by Contracting Authority personnel per IM 323 and IM 204.

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 IM 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 IM 302 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 235.
b. Document corrective actions taken when not correlating.
c. Document all test equipment calibrations.
d. Update IM's, test procedures and specs as required.

I. Documentation. (daily) (Article 2303.04, IM 204, 511 & 508)
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.

a. 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 IM 205.

L. Project Duties. (1/project) (IM 508 & 511)

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

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 IM 527 (Paving) and IM 528 (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 IM 570 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 IM 341 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 IM 204.

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.

IM 301
SAMPLING

AGGREGATE SAMPLING & MINIMUM SIZE OF SAMPLES FOR SIEVE ANALYSIS

SCOPE

This IM sets forth approved sampling methods and the minimum amount of dry materials necessary for the determination of particle size distribution.

LOCATION FOR SAMPLING

Safety must be foremost when determining sample locations. The Contractor/Producer shall make adequate provisions, satisfactory to the Engineer, for the safety of personnel responsible to obtain representative samples of the aggregate.

Provisions shall include guards for moving belts, pulleys, and wheels near the sampling point, and a stable platform with adequate safety rails when sampling is to be done from an elevated location.

Stopped belt sampling locations must be equipped with an on-off switch near, and in plain view of the sampling location. This switch, when in the off position, must have full control of the belt.

When sampling stockpiles, care must be taken when approaching the stockpile. Do not approach stockpiles with steep or unstable slopes, or with partially frozen slopes. These conditions pose a high risk of stockpile collapse, which may result in either trapping, injuring, or causing the death of the sampler.

As an option for quality samples, the sampler may request the Producer use an end loader to create “mini-stockpiles” by using the loader bucket sampling up the slope of the stockpile. By sampling around the stockpile in this fashion several mini stockpiles can be made at a safe distance from the pile and sampled safely.

1. Conveyor Belt/Template Method

A minimum of three locations is required when obtaining a sample using this method. Normally, the belt should be recharged for each location to help assure a representative sample. (Review section titled ‘Sampling Stockpiles For Gradation Confirmation’).

The ends of the template should be spaced to yield approximately one third of the total minimum required sample weight. More increments may be needed to achieve the required minimum weight.

Stop the belt and insert the template as illustrated. Remove all material from the belt contained within the template. A brush or whisk broom will be useful in capturing the finer particles.

The increments are combined together to make one field sample.

2. Stream Flow Method

   When obtaining a sample by interception of the aggregate stream flow, care must be exercised, so the sampling device (See picture below.) passes quickly through the entire stream flow and does not overflow. At least three separate passes shall be made with the sampling device when obtaining a sample. Each pass is an increment of the sample. This is normally considered to be the best method to obtain a representative sample of coarse aggregate.

3. Stockpile Method for fine aggregate (or as directed by the District Materials Engineer)

Stockpile sampling of fine aggregate may be accomplished by either using a shovel or a sand probe. When obtaining a field sample by the stockpile method, a minimum of three increments shall be taken at different locations around the stockpile. Avoid sampling in areas prone to segregation, such as along the bottom of cone stockpiles.

NOTE: Stockpile sampling of coarse ***or combined*** aggregate should be avoided. If it becomes absolutely necessary to obtain a sample from a ***production*** stockpile, consult the District Materials Engineer to help devise an adequate and proper sampling plan.

MECHANICAL SAMPLERS

Mechanical or industrial samplers are used to extract samples from many kinds of free-flowing materials. While there are many different sampler designs, they basically function in the same fashion as the methods described above. The design and operation of the sampler eliminates issues inherent with hand sampling methods, especially if the production plant is capable of producing a large volume of material. Mechanical samplers can be installed in chutes or at the end and middle of moving belts. Not only do they facilitate collecting representative samples, they increase the level of safety by minimizing exposure to moving components of the stream flow. The practice of collecting production over a sufficient time to produce a representative sample should also be applied to mechanical samplers. If the mechanical sampling system produces a very large sample, use the reduction methods described in Materials IM 336 or continue correlations until a minimum time period can be established.

If a mechanical sampler is newly installed, the sampler gradation should be compared to a manually collected sample with acceptability being IM 216 tolerances. Sampling should be done in collaboration with the production plant personnel. If stop-belt sampling is used for the comparison, controls for the belt will need to be “locked out” by the Producer for both safety and to meet MSHA requirements.

SAMPLING STOCKPILES FOR GRADATION CONFIRMATION

Stockpile sampling of coarse or mixed coarse and fine aggregate is difficult due to segregation. When sampling to determine gradation compliance of these materials, the Contractor, Producer or Supplier will supply equipment such as a sampling bin or flow-boy to provide a streamflow or stopped conveyor belt sampling location.

An end-loader will open the pile to be sampled in at least three locations. One end-loader bucket from each opened area is then placed into the sampling bin and sampled in a manner to assure representation of the entire quantity.

Alternately, material from each of the opened areas may be combined in a small stockpile, carefully blended to minimize degradation of the aggregate, and placed into the sampling bin.

Avoid obtaining sample increments at the beginning or end of bin discharge due to the natural tendency of segregation through the bin.

SHIPPING SAMPLES

Transport aggregate samples in bags or other containers constructed to preclude loss or contamination of the sample, or damage to the contents from mishandling during shipment.

Shipping containers for aggregate samples shall each have suitable identification attached and enclosed so that field reporting, laboratory logging and testing may be facilitated.

SAMPLE SIZES

Minimum sample sizes for sieve analysis of aggregates are based on the smallest sieve through which at least 95% of the sample will pass. The following table lists the required minimum field sample and test sample sizes:

SIEVE SIZE	FIELD SAMPLE (lbs.)	TEST SAMPLE (gms)
1½ in.	50	5,000 ‹1›
1 in.	30	3,500
¾ in.	20	2,000
½ in.	20	1,500
⅜ in.	10	1,000‹2›
No. 4 sieve	10	500
No. 8 sieve	10	200

(Products with maximum sizes over 1½ in. (37.5 mm) are normally visually inspected. Contact the appropriate District Materials Engineer.)

(1) When testing 1½” aggregate for Special Backfill, Granular Subbase, or Modified Subbase the minimum test sample is 2500 grams.
(2) When testing fine aggregate with no more than 10% retained on the No. 4 sieve the minimum test sample is 500 grams.

SAMPLE SIZES

Minimum sample sizes for sieve analysis of aggregates are based on the smallest sieve through which at least 95% of the sample will pass. The following table lists the required minimum field sample and test sample sizes:

SIEVE SIZE	FIELD SAMPLE (lbs.)	TEST SAMPLE (gms)
1½ in.	50	5,000 ‹1›
1 in.	30	3,500
¾ in.	20	2,000
½ in.	20	1,500
⅜ in.	10	1,000‹2›
No. 4 sieve	10	500
No. 8 sieve	10	200

(Products with maximum sizes over 1½ in. (37.5 mm) are normally visually inspected. Contact the appropriate District Materials Engineer.)

(1) When testing 1½" aggregate for Special Backfill, Granular Subbase, or Modified Subbase the minimum test sample is 2500 grams.
(2) When testing fine aggregate with no more than 10% retained on the No. 4 sieve the minimum test sample is 500 grams.

IM 302
SIEVE ANALYSIS

SIEVE ANALYSIS OF AGGREGATES

SCOPE

This method of test covers the procedure for determination of the particle size distribution of aggregates.

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1 percent of the weight (mass) of the sample to be tested. **NOTE:** The balance shall be reset to zero before each weighing.

2. Sieves with square openings mounted on substantial frames, constructed in such a manner to prevent loss of material during sieving. Use suitable sieve sizes to furnish the information required by the specifications covering the material to be tested. The woven wire cloth shall conform to AASHTO M-92. This will normally consist of a set of **Box Sieves** for testing coarse aggregates consisting of the following sizes:

   1 ½ in., 1 in., ¾ in., ½ in., ⅜ in., No. 4, and No. 8.

   A set of **8 in. Diameter Sieves** for testing fine aggregates consisting of the following sizes:

   No. 4, No. 8, No. 16, No. 30, No. 50, No.100, No. 200, and Pan.

   A set of **12 in. Diameter Sieves** may be used for testing fine aggregate, coarse aggregate or aggregate containing both coarse and fine material.

Figure 1. Box Sieves for testing coarse aggregates.

Figure 2. 12 and 8 in. sieves.

3. Mechanical and hand-powered sieve shakers

4. Drying oven or stove

5. Fiber bristle sieve cleaning brush (similar to stencil brush or cropped paintbrush)

B. Test Sample

1. Test samples for sieve analysis shall conform to the sample size for the applicable material as indicated by Materials IM 301.

2. Obtain the sample for sieve analysis (test sample) from the material to be tested (field sample) by the appropriate method as outlined in Materials IM 336. The test sample shall be approximately of the weight (mass) desired when dry and must be the end result of the reduction. Reduction to an exact predetermined weight (mass) shall not be permitted.

C. Preparation of Sample

1. When a determination of the amount of material passing the No. 200 sieve is required, test the sample according to Materials IM 306, *"Determining the Amount of Material Finer Than the No. 200 Sieve",* before completing the sieve analysis. For coarse aggregates with a nominal maximum size greater than ½ in., a single test sample may be used to determine both sieve analysis and the amount passing the No. 200, or separate test samples may be used for Materials IMs 306 and 302.

2. When the absorbed moisture stays essentially the same for different particle sizes the sample may be sieved at a surface-dry condition (no free water present).

3. Samples with a significant amount of material finer than the No. 4 sieve, or highly absorptive coarse aggregates (i.e. lightweight aggregates) which have changes in

moisture for different particle sizes, must be dried to a constant weight (mass) before performing sieve analysis.

4. Coated particles may also be a problem. When this condition exists, the dried material must be washed over the smallest sieve for which there is a specification requirement (usually the No. 8 sieve), and dried again.

5. Recycled Materials: Material from crushed composite (HMA/PC) pavements must be sieved at a surface-dry condition using no artificial heat. No gradation determination will be made for material finer than the No. 8 sieve. In some instances, larger particles may be coated to the extent that dry sieving will not accurately reflect the true gradation of the material. In these instances, the air-dried sample must be washed over the No. 8 sieve and allowed to come to a surface-dry condition by air-drying.

   Note: For material made from crushed PC pavement, determination of the percent passing the No. 200 sieve may be required.

D. Test Procedure

1. Weigh and record the weight (mass) of the test sample as the Original Dry Mass. (This is the 'Dry Mass Washed Weight" if tested by Materials IM 306.)

2. Sieve the sample over the required sieves. The sieving operation must be accomplished by using a lateral and vertical motion of the sieve(s), accompanied by a jarring action, which keeps the sample moving continuously over the surface of the sieve. Do not attempt to turn or manipulate the aggregate particle through the sieve openings by hand.

   When using a mechanical sieve shaker, excessive sieving times may result in degradation of the sample.

   Method A

   When testing a sample with a mixture of coarse and fine aggregate (combined aggregate), and sieve overload of the fine aggregate sieves is anticipated, the material finer than the No. 4 may be distributed among two or more sets of sieves and each increment recombined for weighing:

   Method B

   Alternately, weigh and record the total minus No. 4 material (W1). Reduce the minus No. 4 material through the 1 in. or smaller mechanical splitter to a minimum 500 g. sample size. Weigh and record the selected reduced portion (W2) and place this material into the nest of fine aggregate sieves and continue step 2 (above).

   The conversion factor is calculated by dividing W_1 by W_2, and recorded to the nearest 0.0001.

   NOTE: Method B is recommended when using 8 in. sieves to test the fine aggregate portion of a sample, when overload is anticipated. If using 12 in. sieves and the original test sample is reasonably close to the required weight (mass), overload should not

occur. When sieve overload is anticipated on the No. 8 sieve only, sieve the original sample through the No. 8 box sieve before placing the fine portion in the nest of 8 in. round sieves.

3. The sieving operation may be considered complete when not more than 0.5 percent by weight (mass) of the original sample passes any sieve during an additional one minute of hand-sieving.

   On the No. 4 and larger sieves, limit the amount of material carried on the sieve to a single layer when determining sieving to completion.

   When using 8 in. and 12 in. diameter sieves, the weights retained should not exceed the following:

8 in. diameter sieves	12 in. diameter sieves
No more than 200 grams on each sieve	No. 4 no more than 850 grams No. 8 and smaller no more than 450 grams

   If sieving to completion (as described above) is not readily accomplished, reduce the amount of material carried on the sieve.

4. Clean the retained material from each sieve for weighing. Remove as much material as practical without damaging the wire cloth. Particles may be removed most readily from a sieve by inverting the sieve over a pan and tapping the sieve by hand and/or pushing (without force) the particles out of the mesh into the pan. Care must be taken while cleaning the sieves, so no damage occurs to the wire mesh by bending or breaking the wires. A fiber-bristle brush should be used for cleaning the No. 16, No. 30 and No. 50 sieves. When cleaning the No. 100 or No. 200 sieves, a *soft* fiber bristle brush and gentle tapping may be employed. Avoid excessive force on the wire cloth. If clogging of the mesh occurs on these finer sieves, they should be sent to the District Materials Laboratory for cleaning.

5. Weight the fraction of material retained on each sieve and in the pan, to at least the nearest 0.5 gram and record.

6. Total the weight (mass) of the material retained on the sieves and in the pan. An accuracy check must be made comparing the weight (mass) of the material before sieving to the total of the weights (mass) after sieving. The total of the weights retained on the sieves and in the pan must be within 0.5 percent of the weight of the sample before sieving.

   When the percent finer than the No. 200 sieve is <u>not</u> determined:

$$\frac{\text{Total}}{\text{Original Dry Mass}} \times 100 = \text{Tolerance (99.5 to 100.5)}$$

   When the percent finer than the No. 200 sieve is determined by washing (IM 306):

$$\frac{\text{Total - Washing Loss}}{\text{Dry Mass Washed}} \times 100 = \text{Tolerance (99.5 to 100.5)}$$

If the difference exceeds the 0.5 percent tolerance, check all the calculations, the sieves for retained material and the balance for proper care. If needed, weigh each increment of material retained again. If the error cannot be found, the test is void and a new sample shall be tested.

E. Calculations

1. When alternate step (D,2 b) has been used and a conversion factor determined, multiply each of the retained weights (B) from the sieved, reduced sample by the conversion factor and record to the nearest 0.1 as the *calculated weight* (A). Add this column and determine accuracy (Step D, 6).

2. Calculate the percent retained on each sieve by dividing the total *or calculated* weight (mass) of the material retained on each sieve, and in the pan, by the Original Dry Weight (mass) of the sample. Record to the nearest 0.1 percent when determining percent retained and the consequent percent passing. When computing the percent retained of a **washed** sample, divide the **sum** of the washing loss and pan weight (mass) by the Original Dry Weight (mass).

3. Total the percent retained column. The percent-retained column should equal 100 percent. Because the weight (mass) of material retained on the sieves may not equal the Original Dry Weight (mass), the total of the percentages retained may not equal 100 percent. If this occurs, the percentages retained should be altered by prorating on the larger quantities, so they do equal 100 percent.

4. The percent passing is then determined by subsequent subtraction starting with the sieve with no material retained (100 percent passing).

5. Sieve analysis results are to be reported as percent passing and recorded to two significant figures, i.e., to the nearest whole percent for percentages above 10.0 and to the nearest tenth of a percent for lower results.

   Examples:

Test Result	Report
10.5	11
11.5	12
11.4	11
9.8	9.8
0.5	0.5

6. The Fineness Modulus, when required, may now be calculated by cumulative addition of the percent retained on each of the following sieves coarser than the No. 200 sieve and dividing that sum by 100: No.100; No. 50; No. 30; No. 16; No. 8; No. 4. The Fineness Modulus is typically calculated on the fine aggregate but the 3/8 in.; 3/4 in.; 1 ½ in., and larger, may be used in the calculation (i.e. doubling the previous sieve size).

Form 820180ex 11-01

EXAMPLE #1, COARSE AGGREGATE

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:	5793.0	Total Minus No. 4 (W1):	
Dry Weight Washed:		Reduced Minus No. 4 (W2)	
Washing Loss:		Conversion Factor: W1/W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"		0.0	0.0	100.0	
1"		657.0	11.3	88.7	
¾"		1068.0	18.4	70.3	
½"		1448.0	25.0 (25.1)	45.2	
⅜"		1383.0	23.9 (24.0)	21.2	
No.4		1082.0	18.7 (18.8)	2.4	
No. 8	(B)	141.0 (A)	2.4	0	
No.16	(B)	(A)			
No. 30	(B)	(A)			
No. 50	(B)	(A)			
No. 100	(B)	(A)			
No. 200	(B)	(A)			
Washing Loss					
Pan	(B)	1.5 (A)	0		
Total		5780.5	99.7 (100.0)		
Accuracy Check		99.8			

Wash Sample				
	Original Dry Weight:		2571.0	
	Dry Weight Washed:		2555.0	
	Washing Loss:		16.0	
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200			0.8	
Washing Loss	16.0			
Pan	4.0	0.8		

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____

Form 820180ex 11-01

EXAMPLE # 2, FINE AGGREGATE

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:	594.0	Total Minus No. 4 (W1):	
Dry Weight Washed:	591.5	Reduced Minus No. 4 (W2)	
Washing Loss:	2.5	Conversion Factor: W1/W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"					
1"					
¾"					
½"					
⅜"		0.0	0.0	100.0	
No.4		29.0	4.9	95.1	
No. 8	(B)	64.5 (A)	10.9	84.2	
No.16	(B)	102.0 (A)	17.2	67.0	
No. 30	(B)	181.5 (A)	30.6**(30.7)**	36.3	
No. 50	(B)	154.5 (A)	26.0**(26.1)**	10.2	
No. 100	(B)	51.0 (A)	8.6	1.6	
No. 200	(B)	6.0 (A)	1.0	0.6	
Washing Loss		2.5			
Pan	(B)	1.0 (A)	0.6		
Total		592.0	99.8**(100.0)**		
Accuracy Check		99.7			

Wash Sample				
	Original Dry Weight:			
	Dry Weight Washed:			
	Washing Loss:			
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____

Form 820180ex 11-01
EXAMPLE #3, COMBINED AGGREGATE,
8" AND BOX SIEVES

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:	2457.2	Total Minus No. 4 (W1):	2115.7
Dry Weight Washed:	2410.5	Reduced Minus No. 4 (W2)	537.2
Washing Loss:	46.7	Conversion Factor: W1/W2	3.9384
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"					
1"		0.0	0.0	100.0	
¾"		14.6	0.6	99.4	
½"		45.9	1.9	97.5	
⅜"		81.0	3.3	94.2	
No.4		154.0	6.3	87.9	
No. 8	57.6 (B)	226.9 (A)	9.2	78.7	
No.16	93.0 (B)	366.3 (A)	14.9	63.8	
No. 30	178.3 (B)	702.2 (A)	28.6 **(28.5)**	35.3	
No. 50	172.5 (B)	679.4 (A)	27.6 **(27.5)**	7.8	
No. 100	32.7 (B)	128.8 (A)	5.2	2.6	
No. 200	3.9 (B)	15.4 (A)	0.6	2.0	
Washing Loss		46.7			
Pan	0.8 (B)	3.2 (A)	2.0		
Total	538.8	2464.4	**100.2 (100.0)**		
Accuracy Check	100.3	100.2			

Wash Sample				
	Original Dry Weight:			
	Dry Weight Washed:			
	Washing Loss:			
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____

Form 820180ex 11-01

EXAMPLE #4, COMBINED AGGREGATE, 12" SIEVES

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:	2051.2	Total Minus No. 4 (W1):	
Dry Weight Washed:	2011.4	Reduced Minus No. 4 (W2)	
Washing Loss:	39.8	Conversion Factor: W1/W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"					
1"		0.0	0.0	100.0	
¾"		26.8	1.3	98.7	
½"		80.7	3.9	94.8	
⅜"		55.1	2.7	92.1	
No.4		182.7	8.9	83.2	
No. 8	(B)	229.7 (A)	11.2	72.0	
No.16	(B)	362.8 (A)	17.7	54.3	
No. 30	(B)	**610.5*** (A)	29.8	24.5	
No. 50	(B)	377.1 (A)	18.4	6.1	
No. 100	(B)	72.2 (A)	3.5	2.6	
No. 200	(B)	10.2 (A)	0.5	2.1	
Washing Loss		39.8			
Pan	(B)	3.4 (A)	2.1		
Total		2051.0	100.0		
Accuracy Check		100.0			

Wash Sample				
	Original Dry Weight:			
	Dry Weight Washed:			
	Washing Loss:			
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: ***The No. 30 sieve was overloaded. Sieving to completion was verified by hand sieving.**

Fineness Modulus Calculation
For Concrete Sand (Grad. #1 – Spec. 4110)
AASHTO T27

The Fineness Modulus is simply a calculation based on the 'cumulative' percent retained from the sieve analysis sample.

Starting with the largest sieve retaining any material, add the cumulative percents retained on each sieve through the No. 100 sieve and divide this total by 100. The result is reported to the nearest 0.01%.

Note: The percent retained on the No. 200 sieve is not calculated in determining the Fineness Modulus.

Example:

Sieve	Percent Retained	Cumulative Percent Retained
3/8"	0	0
No. 4	3.6	3.6
No. 8	16.9	20.5
No. 16	19.6	40.1
No. 30	23.4	63.5
No. 50	26.1	89.6
No. 100	9.5	99.1

Total Cumulative Percent Retained = 316.4

316.4 ÷ 100 = 3.16 Fineness Modulus

IM 305
FRACTURED PARTICLES

******THIS IS A NEW IM. – PLEASE READ CAREFULLY.******

FIELD METHOD TO DETERMINE PERCENTAGE OF FRACTURED PARTICLES IN COARSE AGGREGATE GRAVELS

SCOPE

This test method is used for evaluating the crushed content of gravel by determining the amount of fractured particles. For this method, a fractured face is an angular or broken surface caused by mechanical crushing. A face is considered a "fractured face" whenever one-half or more of the surface has been broken, with sharp and well defined edges, when looking directly at the fracture. A fractured particle is a particle having at least one fractured face.

PROCEDURE

A. Apparatus

1. Sieves - a 3/8 in. (9.5 mm) sieve having wire cloth conforming to AASHTO M-92

2. Oven or hot plate

3. Balance - A balance having a capacity of at least 5000 grams, accurate to 0.5 gram

B. Sample

Obtain a representative sample by appropriate methods as detailed in Materials IM 301. The weight of the representative sample after reduction must be large enough to yield a minimum of 2500 grams of material after sieving over a 3/8 in. (9.5 mm) sieve.

C. Sample Preparation

The sample must be sieved on the 3/8 in. (9.5 mm) sieve and the material passing the 3/8 in. (9.5 mm) sieve is discarded.

D. Test Procedure

1. Wash and decant the sample to remove dust from the surface of the aggregate particles.

2. Dry the sample to a constant mass (weight) in an oven at a temperature of 230°F ± 9°F (110°C ± 5°C) or on a hot plate at low heat setting. Cool and weigh total sample to the nearest 0.5 gram and record as: *Dry Mass (Wt.) of Original Sample*.

3. Spread the sample out on a flat surface. Visually examine the aggregate particles and remove fractured aggregate particles.

4. Weigh the total amount of fractured particles to the nearest 0.5 gram.

E. Calculations

1. Calculate the percent of fractured particles based upon the total mass (weight) of the sample [plus 3/8 in. (9.5 mm)].

2.

PERCENT FRACTURED PARTICLES =

$$\frac{Dry\ Mass\ (Wt.)\ of\ Fractured\ Particles}{Dry\ Mass\ (Wt.)\ of\ Original\ Sample} \times 100$$

IM 306
FINER THAN #200

DETERMINING THE AMOUNT OF MATERIAL FINER THAN THE No. 200 SIEVE IN AGGREGATE

SCOPE

This test method outlines the procedure for determining the quantity of material finer than a No. 200 sieve by washing and dry sieving.

PROCEDURE

A. Apparatus

1. A No. 200 sieve (wash sieve)
2. A wash pan large enough to prevent loss of water and material
3. Oven or drying stove
4. Balance accurate to 0.1 percent of the sample weight
5. A set of 8-in. or 12-in. diameter sieves for dry sieving

B. Test Sample

1. Select the test sample from the material to be tested by an appropriate method as outlined in Materials IM 336.
2. When determination of specification compliance is needed on each or any of the following sieves: No. 16, No. 30, No. 50, or No. 100, subject the entire sample to this test procedure.
3. When determination of specification compliance is needed for only the amount of material finer than the No. 200 sieve, reduce the remaining portion of the field sample from which the original test sample was selected, by the appropriate method as outlined in IM 336. A representative sample, sufficient to yield not less than the appropriate weight of dried material, as shown in the following table shall be selected:

Sieve Analysis Sample Weight (grams) (See Materials IM 301)	Appropriate Minimum Weight (grams) of Sample
5,000 g	2,500 g
3,500 g	2,500 g
2,000 g	1,000 g
1,500 g	*
1,000 g	*
500 g	*
200 g	*

*Use entire sample.

C. Test Procedure

1. Place the sample in the oven at 230˚F or on the stove and dry to a constant weight. Care must be taken in drying the sample to avoid overheating causing the sample to “pop” or “sputter.”

2. Allow the sample to cool, weigh and record as the Original Dry weight.

3. Place the sample in the wash pan and add a sufficient amount of water to cover it. A detergent, dispersing agent, or other wetting solution may be added to the water to ensure a thorough separation of fine material from the coarser particles.

4. Agitate the sample vigorously using a rotary motion of the pan for five to ten seconds.

5. Pour off the water through the No. 200 wash sieve. When washing samples with a high silt content, it may be necessary to vibrate or lightly tap the wash sieve in order to keep the mesh open so the water and the minus No. 200 sieve material may pass through freely. Repeat this operation until the wash water appears almost clear.

6. Rinse any material retained on the No. 200 sieve back into the sample and decant as much water as possible by carefully pouring the water through the No. 200 sieve.

7. Dry the washed sample, allow to cool, weigh and record as the Dry weight of the washed sample.

8. When determining only the amount passing the No. 200 sieve, screen the sample over the No. 8 sieve and discard the retained material. Place the portion of material passing the No. 8 sieve on a nest of sieves including the No. 50, No. 100 and No. 200 sieves and the pan. The sieves larger than the No. 200 sieve are included for protection of the No. 200 sieve. Place the nest of sieves in the mechanical sieve shaker and sieve to completion (normally five minutes or less). Weigh and record only the material retained in the pan.

9. When a complete sieve analysis is required, test the entire sample using the appropriate method as outlined in IM 302.

D. Calculations

$$\text{\% Passing No. 200 sieve} = \frac{\text{Washing Loss} + \text{Pan}}{\textit{Original}\ \text{Dry Weight}} \text{ x } 100$$

IM 307
SPECIFIC GRAVITY

DETERMINING SPECIFIC GRAVITY OF AGGREGATES

SCOPE

This method describes two procedures used for determining the bulk specific gravity of aggregates proposed for use in Portland Cement Concrete. This method is also described in Laboratory Test Method 201.

PROCEDURE A – SPECIFIC GRAVITY OF AGGREGATES USING A PYNCNOMETER

A. Apparatus

1. Balance having a capacity of at least 5,000 grams, accurate to 0.5 grams

2. Pycnometer – a fruit jar supplied with a gasket and conical pycnometer top. A two-quart pycnometer is used for coarse aggregates, and a one-quart pycnometer is used for fine aggregate. If a two-quart pycnometer cannot be obtained, a one-quart jar may be substituted (The engineer may require 2 samples be obtained and tested in separate 1-quart pycometers for some aggregates).

3. Thermometer – a thermometer with a range of at least 50°F to 100°F

4. Sieve – a No. 4 sieve

B. Field Sample

1. Obtain a field sample as prescribed in IM 301.

C. Preparation of Test Sample

1. Fine Aggregate

a. Obtain a test sample of approximately 1,100 grams from the material to be tested by one of the following methods:

(1) Use of a sample splitter

(2) Method of quartering after being thoroughly mixed and in a damp condition

(3) By taking small scoops of material from various places over the field sample, after it has been dampened and thoroughly mixed. In order to avoid segregation, the material must be damp enough to stand in a vertical face when cut with a trowel. This method of sample reduction is applicable to sands only.

b. If the material has been continuously wet before being received on the job, it may be assumed to be saturated. Otherwise, the sample must be saturated by immersing it in water for period of not less than 15 hours.

c. After soaking, pour off the free water, spread the wet sample on a flat, non-absorbent surface, and allow it to come to a saturated-surface-dry condition by natural evaporation of free moisture. Circulation of air by means of a fan may also be used to attain the surface-dry condition. The sample should be stirred frequently to secure uniform drying.

2. Coarse Aggregate

a. Obtain the test sample as prescribed in IM 336, Methods of Reducing Aggregate Field Samples to Test Samples (See Sections on Quartering or Splitting).

b. Sieve the test sample over the No. 4 sieve. The sample should be of sufficient size to produce approximately 2,100 grams for a two-quart pycnometer or 1,100 grams for a one-quart pycnometer from the material retained on the No. 4 sieve. Discard the material that passes this sieve.

c. Immerse the sample (plus No. 4 sieve size) in water for a period of not less than 15 hours.

d. Remove the sample from the water and dry to a saturated surface dry (SSD) condition by rolling it in a large absorbent cloth until all visible films of water are removed. Wipe the larger particles individually. Place the coarse portion of the sample in a large, flat pan or on a clean hard surface. A moving stream of air by means of fan may be used to assist the drying operation. Take care to avoid evaporation of water from aggregate pores during the operation of surface-drying. (Note: When the surface dry condition is achieved, aggregate particles will have lost the glossy wet appearance and leave no streaks of moisture, but will still have a damp and darkened appearance). Weigh the test sample in the SSD condition. Record this and all subsequent weights to the nearest 0.5 gram.

e. The sample may be considered to be saturated-surface-dry when the particles look comparatively dull as the free moisture is removed from their surfaces. For highly absorptive aggregates, the saturated-surface-dry condition is reached when there is an absence of free moisture.

D. Calibration of Pycnometers

1. Fill the pycnometer jar nearly full of water at the temperature to be used in the actual test, plus or minus 3°F. This may be done either before or after the actual test.

2. Screw the pycnometer top down tightly on the jar and mark the position of the top on the jar by a scratch or mark on the threaded rim and a scratch in a corresponding position on the jar, which will establish a constant volume.

3. Fill the pycnometer completely by pouring water into the hole of the pycnometer top until a bead forms above the opening. Immediately wipe the bead of water level with the pycnometer opening. Wipe all other excess moisture from the outside surfaces of the pycnometer. If a bead of water forms at the opening during the final wiping, it should remain for weighing. Weigh the pycnometer to the nearest 0.5-gram.

E. Test Procedure

1. Weigh the saturated-surface-dry sample to the nearest 0.5-gram. For ease in calculations, the fine aggregate sample may be brought to exactly 1,000 grams weight, and the coarse aggregate sample may be brought to exactly 2,000 grams weight.

2. Place the sample in the appropriate pycnometer containing approximately two inches of water.

3. Nearly fill the pycnometer jar with water at the same temperature plus or minus 3°F as used in the calibration.

4. Screw the cap down into the proper position by lining up the mark on the pycnometer top and the jar.

5. Entirely fill the pycnometer by adding additional water through the hole in the pycnometer top.

6. Hold one finger over the hole in the top and gently roll and shake the pycnometer to remove any trapped air in the sample.

7. When further rolling and shaking brings no more air bubbles to the top, fill, dry and weigh as in step C3.

F. Calculations

1. Calculate the saturated-surface-dry (SSD) specific gravity to the nearest 0.01 by the following formula:

$$\text{Bulk Specific Gravity (SSD)} = \frac{S}{P + S - W}$$

Where:

S = Weight in grams of aggregate in a saturated-surface-dry condition.

P = Weight in grams of the pycnometer filled with water.

W = Weight in grams of the pycnometer containing the sample and sufficient water to fill the remaining space in the pycnometer.

Pycnometers for Coarse and Fine Aggregates

PROCEDURE B – SPECIFIC GRAVITY OF COARSE AGGREGATE (AASHTO T85)

A. Apparatus

1. Balance having a capacity of at least 5,000 grams, accurate to 0.5 grams

2. Sample Container – A wire basket of No. 6 (0.132 in.) or finer mesh, or a bucket of approximately equal breadth and height, with a capacity of 4 to 7 L. The container shall be constructed so as to prevent trapping air when the container is submerged.

3. Water Tank – A watertight tank, into which the sample and container are placed for complete immersion while suspended below the balance, equipped with an overflow outlet for maintaining a constant water level.

4. Suspended Apparatus – Wire suspending the container shall be of the smallest practical size to minimize any possible effects of a variable immersed length.

5. Sieve - A No. 4 sieve

6. Thermometer – a thermometer with a range of 50°F to 100°F

B. Field Sample

1. Obtain a field sample as prescribed in IM 301.

C. Preparation of Test Sample

1. Prepare the test sample identical to that described in Procedure A.

D. Test Procedure

1. Weigh the saturated-surface-dry sample to the nearest 0.5-gram. For ease in calculations, the fine aggregate sample may be brought to exactly 1,000 grams weight, and the coarse aggregate sample may be brought to exactly 2,000 grams weight.

2. After weighing, immediately place the saturated-surface-dry sample in the sample container, remove all entrapped air by shaking the immersed container, and determine its weight in water at 73.4°F ± 3°F. Make sure the water is at a depth sufficient enough to cover the container and sample.

E. Calculations

1. Calculate the saturated-surface-dry (SSD) specific gravity to the nearest 0.01 by the following formula:

$$\text{Bulk Specific Gravity (SSD)} = \frac{S}{S - W}$$

Where:

S = Weight in grams of aggregate in a saturated-surface-dry condition.
W = Weight in grams of the saturated-surface-dry sample in water

IM 308
FREE MOISTURE

DETERMINING FREE MOISTURE & ABSORPTION OF AGGREGATES

SCOPE

This method describes several procedures for determining free moisture and absorption of aggregates.

PROCEDURE A - FREE MOISTURE IN AGGREGATES USING A PYCNOMETER

A. Apparatus

1. Balance having a capacity of at least 5,000 grams accurate to 0.5 grams

2. Pycnometer - A fruit jar supplied with a gasket and conical pycnometer top. A two-quart pycnometer is used for coarse aggregates. If a two-quart pycnomter cannot be obtained, a one-quart jar may be substituted (The engineer may require 2 samples be obtained and tested in separate 1-quart pycnometers for some aggregates). The quantity of aggregate would be approximately 1000 grams for the one-quart pycnomter. A one-quart pycnometer is used for fine aggregates.

3. Thermometer -30°F to 120°F thermometer

4. Scoop

B. Field Sample

1. Obtain a field sample as prescribed in IM 301.

C. Preparation of Test Sample

1. Obtain a test sample of about 1000 grams of fine aggregate or about 2000 grams of coarse aggregate by the following method:

   Place the field sample on a clean, hard non-absorbent surface. Mix the sample thoroughly, form a miniature stockpile and obtain small increments of materials from random locations from the stockpile until the desired sample size is obtained. **NOTE:** The moisture test should be completed as soon as possible after obtaining the field sample to avoid moisture loss due to evaporation.

2. Weigh to the nearest 0.5-gram, a 1,000-gram sample of fine aggregate, or 2000-gram sample of coarse aggregate. To avoid moisture loss due to evaporation the weighing should be done immediately after obtaining the test sample. Also avoid any excessive manipulation of the aggregate, prior to weighing, which could cause a loss of moisture.

D. Calibration of Pycnometer

1. Calibrate the pycnometer by the procedure in IM 307.

E. Test Procedure

1. The test procedure is identical to IM 307 with the exception that the test sample is wet, as received, and not in a saturated surface dry condition. This procedure is intended for determining the moisture content of aggregates for Portland Cement Concrete.

F. Calculation

1. Calculate the moisture content, based on wet sample weight, to the nearest 0.1 percent as follows:

$$\text{Percent Moisture as received} = \frac{(W - W_1)Gs \times 100}{(Gs - 1)s}$$

Where:

W = Weight in grams of the pycnometer containing a saturated-surface-dry sample of the same weight as "s" and sufficient water to fill the remaining volume of the pycnometer as determined in IM 307.

W_1 = Weight in grams of the pycnometer containing the wet sample and sufficient amount of water to fill the remaining volume of the pycnometer.

Gs = Specific gravity of material in a saturated-surface-dry condition. (This is obtained from IM 307 Method).

s = Weight in grams of wet sample

2. The percent of moisture, based on the saturated-surface-dry weight, is calculated as follows:

$$\text{Percent Moisture (SSD)} = \frac{\%\text{Moisture as received}}{100 - \%\text{Moisture as received}} \times 100$$

PROCEDURE B – FREE MOISTURE IN AGGREGATE BY WEIGHT DIFFERENCE

This procedure is an alternate to using a pycnometer and is also intended for determining the moisture content of aggregates for Portland Cement Concrete.

A. Apparatus

1. Balance having a capacity of at least 5,000 grams and accurate to 0.5 gram

B. Preparation of Sample

1. Prepare the test sample identical to that described in Procedure A.

C. Test Procedure

1. Bring the weighed wet sample to a saturated-surface-dry condition in the manner described in Materials IM 307 and weigh to the nearest 0.5 gram.

D. Calculation

1. Calculate the moisture content, based on wet weight, to the nearest 0.1 percent as follows:

$$\text{Percent Moisture} = \frac{\text{Weight as received - Weight SSD}}{\text{Weight as received}} \text{ x } 100$$

A negative result is due to absorption of the aggregate rather than free moisture.

2. The percent of moisture, based on saturated-surface-dry weight, is calculated to the nearest 0.1 percent as follows:

$$\text{Percent Moisture (SSD)} = \frac{\text{\% Moisture as received}}{\text{100 - \% Moisture by wet weight as received}} \text{ x } 100$$

or

$$\text{Percent Moisture (SSD)} = \frac{\text{Wet weight - Saturated - surface - dry weight}}{\text{Saturated - surface - dry weight}} \text{ x } 100$$

PROCEDURE C - WATER ABSORPTION IN AGGREGATE

This procedure is used for determining absorption of aggregates for use in asphaltic concrete as well as determining specification compliance for absorption.

A. Apparatus

1. Balance having the capacity of at least 5,000 grams and accurate to 0.5 gram

2. Oven or hot plate

B. Preparation of Sample

1. Obtain a test sample of at least 1,000 grams of fine aggregate and 2,000 grams of coarse aggregate by following the appropriate procedure outlined in IM 307.

2. When the sample is not in a saturated condition it must be immersed in water at room temperature for a minimum of 15 hours before continuing with the test.

3. Allow the saturated sample to attain a surface-dry condition by following the procedure in IM 307.

C. Test Procedure

1. Weigh the saturated, surface-dry sample to the nearest 0.5 gram.

2. Dry the sample in the oven or on the hot plate or stove to a constant weight.

3. Allow the sample to cool and weigh to the nearest 0.5 gram.

D. Calculation

1. The percent absorption, based on the oven dry weight is calculated to the nearest 0.01 percent as follows:

   Percent Absorption =

$$\frac{\text{Saturated - surface - dry weight - Oven dry weight}}{\text{Oven dry weight}} \text{ x } 100$$

IM 336
REDUCING

REDUCING AGGREGATE FIELD SAMPLES TO TEST SAMPLES

SCOPE

This method outlines the proper procedure for reducing an aggregate sample to the proper test sample size.

PROCEDURE

The sample for testing should be approximately of the weight desired, conforming to the sample size for the material as indicated by Office of Materials IM 301. The test sample must be the end result of the sample reduction method. Do not attempt to select a sample to an exact predetermined weight.

I. RIFFLE CHUTE SPLITTING METHOD

A. Apparatus

1. Mechanical Splitter – Riffle Chute Splitter (conforming to equipment requirements of AASHTO R76)

   1) Three catch pans

   2) Wide, flat-edged scoop

B. Sample Preparation

1. The sample shall be dry enough to allow free flow of the aggregate through the chutes.

Note: A preliminary reduction of fine aggregate in a damp condition may be made using the 2-inch riffle chute splitter. The resultant sample size shall be not less than 5,000 grams.

C. Test Procedure

1. Place the field sample on a hard, clean surface, such as a counter-top, concrete floor, or in a large, flat pan.

2. Thoroughly mix the field sample until it appears homogenous.

3. Place a catch pan under the chutes on each side of the splitter.

4. Place increments of the field sample on the wide, flat-edged scoop and uniformly distribute it from edge to edge, so when it is introduced into the chutes, approximately equal amounts will flow through each chute.

5. Repeat the above step until the entire field sample has been introduced into the chutes. It may be necessary to use a brush to collect the fine material of the sample for splitting.

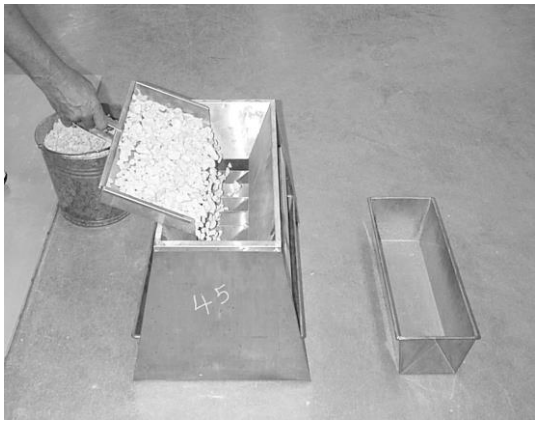
6. The rate at which the sample is introduced shall be such as to allow a free flow of material from the scoop and through the chutes into the catch pans below.

7. Use the material contained in one of the catch pans and repeat the previous steps until the sample is reduced to the desired size. Be sure to split entire increments during this procedure.

D. General Comments

1. If the catch pans are equal to, or slightly less, than the total combined width of the riffle chutes, they may be used to place the material through the splitter in lieu of using the scoop. Do not use containers longer than the combined width of the riffle chutes to avoid overloading the end chutes.

2. Use the size of sample splitter best suited for the maximum particle size of the aggregate to be tested. Generally use the splitters with 1 in. riffle openings for aggregates with a 3/4 in. maximum particle size, and the splitters with 2 in. openings for samples containing larger particle sizes up to 1 3/4 in. Samples of material with particles larger than 1 3/4 in. shall be quartered. (See IV. Below.)



II. STREAMFLOW OR CAROUSEL SPLITTER METHOD

A. Apparatus

1. Mechanical Sample Splitter– Streamflow or Carousel Splitter

2. Ten Catch Pans

3. Buckets

4. Shovel

B. Sample Preparation

1. The sample shall be dry enough to allow free flow of the aggregate through the chutes.

C. Test Procedure

1. Place the ten small pans of the splitter in the appropriate area of the splitter.

2. Place the entire field sample in buckets. Turn on the splitter and pour material slowly into the top of the hopper.

3. Complete the pouring of the entire field sample into the hopper (catch pans will hold one bag without overflowing). If more than one bag is used, you will have to pour each catch pan into separate, larger containers and then resume splitting. It may be necessary to use a brush to collect the fine material of the sample.

4. Use all of the material contained in one or more of the catch pans to obtain the desired size.

D. General Comments: This method of sample reduction is typically not a field method but intended for larger, laboratory- scale samples.

Carousel Splitter

III. MINIATURE STOCKPILE METHOD (Fine Aggregate Only)

A. Apparatus

1. Shovel

2. Small scoop

B. Sample Preparation

1. This sample reduction method is only for fine aggregate samples in moist condition. Fine aggregates, which are in a substantially surface-dry condition or drier, should be reduced with a sample splitter.

C. Test Procedure

1. Place the moist field sample on a hard, clean, level and non-absorbent surface. Thoroughly mix the sample with the shovel and form a “miniature stockpile.”

2. Obtain the test sample by selecting at least five increments of material at random locations from the miniature stockpile using the scoop.

IV. QUARTERING METHOD

A. Apparatus

1. Shovel (square-nosed)

2. Brush

3. Quartering Device (optional)

B. Test Procedure

1. Place the sample on a hard, clean, smooth surface where there will be neither loss of material from the sample, nor the accidental addition of foreign material.

2. Mix the sample thoroughly by turning the entire lot over three times with a shovel. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one.

3. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down the apex with the shovel, so each quarter will contain the amount of material originally in it.

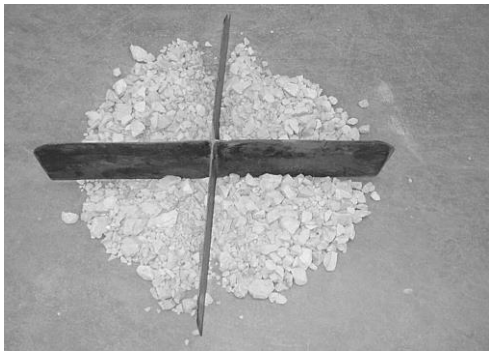
4. Mark the flattened pile into quarters (or use the quartering device) by two lines that intersect at right angles at the center of the pile.

5. Remove two diagonally opposite quarters and brush the cleared spaces clean, placing the brushed, fine aggregates into the removed quarters.

6. Successively mix and quarter the remaining materials as above, until the sample is reduced to the desired size, with the two remaining quarters giving the sample for the test.

C. General Comments

1. The quartering method is not recommended for sample reduction of coarse aggregate due to potential problems with segregation. This method should only be used when use of a sample splitter is not possible.



IM 344
SHALE - FINE

DETERMINING THE AMOUNT OF SHALE IN FINE AGGREGATE

SCOPE

This test method covers the procedure for the approximate determination of the shale content in fine aggregate. This test method is the field procedure for Laboratory Test Method 209.

PROCEDURE

A. Apparatus

1. Balance having a capacity of not less than 1,000 g and sensitive to at least 0.1 g

2. A strainer with openings smaller than No. 16 sieve

3. Two bowls of sufficient capacity

4. A solution of zinc chloride ($ZnCl_2$) having a specific gravity between 1.950 and 1.999 at 70°F

   NOTE: To prepare one gallon of solution, slowly add 5670 g of technical grade zinc chloride to 2248 g of water with constant stirring. The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 70°F and measure specific gravity with a hydrometer. If the sp. gr. is below 1.95, add zinc chloride in 227 g. increments until the sp. gr. of the solution is at least 1.95 at 70°F. It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

   CAUTION: There is no particular hazard from the fumes of the zinc chloride solution, but protective clothing should be worn. This includes gloves, goggles, and face shield. Mix in a well-ventilated area.

5. Drying oven or hot plate

6. Mixing spoon

B. Sample Preparation

1. Select a representative sample by appropriate methods detailed in Materials IM 301 and 336. The weight of the representative sample shall be large enough to yield at least 500 grams of dry material passing the No. 4 sieve.

2. Sieve the representative sample over the No. 4 sieve unless the material is Fine Aggregate for use in PC Concrete. In this case, any material retained on the No. 4 sieve is also part of the test sample.

3. Dry the test sample to a constant weight, allow to cool, weigh, and record as the Original

Dry Weight of the Test Sample.

4. Sieve the test sample over the No.16 sieve. Discard the material passing this sieve and subject the test sample to the test procedure.

   NOTE: The test sample may be accumulated from a completed sieve analysis. This would include the material retained on the No. 8 and No.16 sieves, as well as any material retained on the No. 4 sieve if the intended use is PC Concrete.

   The Original Dry weight of the test sample would then be the difference between the Original Dry Weight of the sieve analysis sample and the total of the weights retained on and above the No. 4 sieve. (The test sample weight of Fine Aggregate for PC Concrete would be the Original Dry weight of the sieve analysis sample.)

C. Test Procedure

1. Pour the zinc chloride solution into a mixing bowl until the volume of the liquid is at least 3 times the absolute volume of aggregate.

2. Stir the fine aggregate sample into the solution until all particles are coated.

3. Pour the liquid off into a second container, passing it through the strainer. Make sure that only the floating pieces are poured off and that none of the fine aggregate is decanted onto the skimmer.

4. Return to the first container the liquid that has been collected in the second container and after further agitation of the sample by stirring, repeat the decanting process just described until the sample is free of floating pieces.

5. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant weight in an oven at a temperature of 230 ± 9°F or on a hot plate at a low heat setting. Weigh to the nearest 0.1 g.

D. Calculations

1. Calculate the percentage of shale (and other low specific gravity materials) by the following formula:

$$\% \text{ Shale} = \frac{\text{Dry Weight of Washed Decanted Particles (Shale)}}{\text{* Dry Weight of Original Sieve Analysis Sample}} \text{ x } 100$$

*This weight includes the material passing the No. 16 sieve and represents the total sample weight of the fine aggregate. Report the result to the nearest 0.1 percent.

IM 368
CLAY & FRIABLE

DETERMINING THE AMOUNT OF CLAY LUMPS & FRIABLE PARTICLES IN COARSE AGGREGATE

SCOPE

This method of test covers the procedure for the determination of clay lumps and friable particles in coarse aggregates. Clay lumps and friable particles are objectionable materials in the aggregate due to contamination at the time the deposit was formed, at the time of quarrying, or at the time of hauling and handling. Clay lumps and friable particles are considered any agglomerated or soft particles retained on the #4 sieve and greater, and will include such terms as mud and clay balls. Method A or Method B may be used to evaluate either stream flow or stock pile samples. The Engineer shall determine the method most appropriate for individual sources. If a sample does not meet specification limits for either test method, the sample is considered non-compliant.

PROCEDURE

A. Apparatus

1. Balance - A balance having a capacity of at least 5000 grams, accurate to 0.5 gram.

2. Oven capable of maintaining temperature of 110 ± 5°C (230 ± 9°F) or hot plate used at a reduced temperature, and capable of providing a uniform heat until sample has dried to a constant weight.

3. Containers - Containers of a size and shape that will permit the spreading of the sample on the bottom in a thin layer.

4. Sieves - Sieves conforming to AASHTO M92, wire cloth sieves for testing purposes.

B. Sample

1. Select a representative sample of material retained on the 4.75-mm (No. 4) sieve that will weigh at least 3000 grams.

METHOD A (Field or Hand Pick Test Method)

C. Test Procedure

1. Separate clay lumps and friable particles from the test sample by hand picking. The sample may be wetted and decanted if this aids identification. Oven-dry the clay lumps and friable particles to a constant weight.

2. Allow the clay lumps and friable particles to cool and determine the dry weight (L).

3. Dry the test sample to a constant weight.

4. Allow to cool and determine the dry weight (W).

D. Calculation

Percent of clay lumps and friable particles (P) = 100 X L/(L+W)

Where:

P = percent of clay lumps and friable particles
L = dry weight of clay lumps and friable particles
W = dry weight of test sample

METHOD B (Laboratory Test Method)

E. Test Procedure

1. Wash over No. 4 (75-μm) sieve.

2. Oven-dry for at least 16 hours at a temperature of 230° ± 9°F (110°± 5° C)

3. Allow sample to cool and determine the dry weight (W).

4. Spread sample in a thin layer on the bottom of the container, cover it with water and allow it to soak for a period of 24 ± 4 hours.

5. After soaking period any particles that can be broken with fingers into fines removable by wet sieving over the No. 8 (2.36-mm) sieve shall be classified as clay lumps or friable particles.

   NOTE: The breaking of clay lumps and/or friable particles shall be accomplished by squeezing and rolling them between the thumb and forefinger. The fingernails or mechanical tools shall not be used to break up the particles nor shall they be pressed against a hard surface.

6. Wet sieving is to be accomplished by passing water over the sample through the sieve while manually agitating the sieve, until all undersize has been removed.

7. The retained particles shall then be carefully removed from the sieve and dried at a temperature of 230° ± 9°F (110° ± 5°C).

8. Allow sample to cool, and weigh (R).

F. Calculation

Calculate the percent of clay lumps and friable particles of coarse aggregates as follows:

$$P = \left(\frac{W - R}{W} \right) \times 100$$

Where:

P = Percent of clay lumps and friable particles.
W = Dry weight of test sample after washing on the #4 sieve.
R = Dry weight of particles retained on the No. 8 (2.36-mm)(wt. of test sample after removal of clay lumps).

IM 409
SOURCE APPROVALS

SOURCE APPROVALS FOR AGGREGATES

GENERAL

Written source approval is required for PCC crushed stone, PCC gravel, PCC fine aggregate, and revetment (forms are available at: https://iowadot.gov/construction_materials/Materials-forms or in the appendices of this IM). Only those sources, which can provide aggregates consistently compliant with the applicable specification shall be approved.

For proportioned aggregates, aggregate sources shall not be blended to produce a single stockpile. An aggregate source is defined by an individual A-number. For PCC, approved ledges shall not be blended without written approval.

APPROVAL PROCESS

A. A producer request for source approval shall be made, in writing, to the appropriate District Materials Engineer with a copy to Geology Section, Construction and Materials Bureau in Ames, Iowa. Any production process shall be documented in the source approval and approved by the District Materials Engineer and the Chief Geologist.

B. Following documentation of the basis of approval (described below), the District Materials Engineer will respond to the Chief Geologist with supportive evidence and recommendations to:

   1. Approve the source
   2. Not approve the source, or
   3. Request that specific additional information is obtained as a basis for a final decision

C. Upon the signature of the Chief Geologist, the approval will be returned to the District Materials Engineer who will return the signed document to the aggregate producer.

APPROVALS FOR AGGREGATES USED IN PCC

A. Source approvals shall describe, in detail, any physical limitations of the subject source and any special production methods, or restrictions required to produce specification material.

B. Preliminary source approvals may be issued whenever sufficient quality information is available. This will expedite the development of new sources or ledges by establishing the primary quality level without requiring production material to be available. A final source approval will follow only after adequate amounts of compliant material have been produced. Aggregate producers may quote from ledges with preliminary approvals assuming full responsibility for the timely delivery of compliant materials to the projects in question.

C. A new or updated source approval will be required if the aggregate durability of a quarry ledge changes or a new bed grouping is approved. The source approval remains with the source. Any changes in management of the source may be documented by letter and will be recorded in IM T203, with a copy maintained in the District source files and Geology Section of the Materials Laboratory. Changes to production restrictions, resulting from joint producer/District quality control discussions, may also be documented by letter, which will be signed by the producer and the District Materials Engineer. A copy of this letter will be

maintained in the District source file and Geology Section of the Materials Laboratory.

D. For crushed stone, the ledges shall contain no more than 5% noncompliant materials within the approved bedding planes. At least 95% of carbonate coarse aggregate particles produced by crushing rock shall be derived from ledges in which the rock complies with the requirements for the durability class for which it is being produced.

E. When processing coarse aggregate for PCC no material larger than the gradation top size may be removed from the product unless allowed by the source approval. When processing multiple PCC products simultaneously, crush to 1.5" nominal before fractionating. Removal of other products may be allowed by the District Materials Engineer if the PCC durability meets or exceeds the original full-face Durability Class and the production method is documented in an amended source approval.

F. Limestone and Dolomite sources greater than 100 miles from the nearest Iowa DOT District Materials Office or area inspection laboratory may not be allowed to furnish aggregate to Iowa DOT projects. These may be considered too distant to provide source monitoring by Department employees as required in Materials IM 209.

APPROVAL PROCEDURES FOR AGGREGATES USED IN PCC

The basis of approval shall be by one of three methods or combination of methods:

1. Service History
2. Geologic Correlation
3. Testing

A. Approval by Service History

1. Aggregate will be considered durable when it does not contribute to the premature deterioration in concrete. Durability classes will be assigned on the basis of qualifying performance in air-entrained concrete pavements of appropriate age.

2. Meet the durability requirements of Article 4115.01.

B. Approvals by Geologic Correlation

1. Sources may be approved based on geologic correlation to a source with an established service history.

2. Sources may be approved if there is a satisfactory similarity to any approved source with no aggregate-related deterioration as determined by the Department through pavement coring and petrographic examination.

C. Approvals by Chemical & Physical Testing

Aggregate sources without qualifying performance records or satisfactory similarity to any approved source can be provisionally assigned to a Durability Class based on physical and chemical tests meeting the following requirements:

Table 209-1. PCC aggregate Durability Class approval requirements based on test limits.

DURABILITY CLASS	QUALITY	TEST LIMITS	TEST METHOD
Class 2	Salt susceptibility quality Secondary Pore Index	Max. 4.5 Max. 30	Iowa 223 Iowa 219
Class 3	Salt susceptibility quality Secondary Pore Index	Max. 1.5 Max. 25	Iowa 223 Iowa 219
Class 3i	Salt susceptibility quality Secondary Pore Index	Max. 1.0 Max. 20	Iowa 223 Iowa 219

NOTE: If there is a discrepancy in classification between Quality Number and Pore Index classification, the source will be assigned to the lower Durability Class.

CONTINUED PCC COARSE AGGREGATE APPROVAL

An approved Portland cement concrete aggregate must have Secondary Pore Index test results of no greater than 26 for a Durability Class 3 or 3i or a Secondary Pore Index test result of no greater than 30 for a Durability Class 2. A pore index failure will trigger an investigation of possible changes to ledge quality and if proper ledge control has been maintained. If the ledge has been properly controlled, a second stockpile sample can be obtained and tested. If the second sample fails, the approval may be suspended until complying test results are obtained or a pavement performance review has been performed with results matching the PCC durability class of the source approval.

PCC FINE AGGREGATE APPROVAL

A. Quality

For Fine Aggregate (glacial sands) for Portland Cement Concrete (4110), meet the requirements in the Table below. Sampling for approval should be a minimum of three samples taken at a frequency of one per 2,000 tons or one per week once the working depth has been established.

Table 209-2. Quality requirements for PCC Fine Aggregate Approval.

Fine Aggregate Quality	Test Limits	Test Method
Shale and Coal	2.0% (maximum)	Materials I.M. 344

B. Gradation

The fineness modulus must be no lower than 2.60. A target fineness modulus (or base-line) will be established for each source at the time of approval. The target should be the average of at least 5 Iowa DOT gradations taken at the sampling frequency outlined in Paragraph A. Establishing the target may be supplemented using Producer gradations. Sources with a variation of the fineness modulus of lower than 0.2 and greater than 0.25 from the proposed

target will not be approved until the variability is eliminated.

C. The DME may approve a gravel source to allow up to 20 percent crushed particles in the fine aggregate with the concurrence of the Chief Iowa DOT Geologist. This allowance would require a new source approval with a revised target fineness modulus.

Meet the following requirements:

- The proportioning must be through a controlled and measured process.
- The crushed material must be from an approved Class 3 or 3i source with not less than 70 percent igneous and metamorphic particles and meeting the requirements of Article 4115 of the Standard Specifications. The crushed material must be from the same source as the natural fine aggregate.
- The fine aggregate angularity as determined using AASHTO T 304 (modified) may not exceed 40%.
- The crushed fine aggregate must meet Gradation 1 and the fineness modulus restrictions listed in this section.
- The crushed material must be compared to the uncrushed and tested using ASTM C 1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method) and shall not exceed the uncrushed results by 0.10% which is the Precision and Bias of the Test Method. Testing must be done by a certified independent laboratory at the expense of the Producer and reported directly to the DOT Testing Engineer.

D. With the approval of the DME and the Chief Geologist of the Iowa DOT, natural sand produced simultaneously with coarse gravel PCC aggregate from the same deposits may contain trace amounts of crushed particles in a quantity resulting from the normal crushing and screening of oversize particles to produce ***coarse*** aggregate. This process shall be annotated on the source approval.

- The angularity of fine aggregate with the addition of “incidental” crushed material may not exceed the original sand value (as determined using AASHTO T 304 modified) or may not exceed by more than 1% for aspect ratio and roundness as determined through CamSizer analyses.

CONTINUED PCC FINE AGGREGATE APPROVAL

A. Existing sources with a fine aggregate approval must establish a target fineness modulus, as described above. This should be done using Iowa DOT gradations which may be supplemented with Producer gradations if a correlation exists. Variation from the target fineness modulus should be monitored by both the aggregate Producer and Iowa DOT personnel.

B. Variation of the fineness modulus of lower than 0.2 and greater than 0.25 from the target should be investigated. Variability in fineness may result in rejection of the stockpile.

STONE FOR REVETMENT

A. Source approvals, written by the appropriate District Materials Engineer, shall be required for limestone, dolomite, and quartzite materials. The source approvals shall identify the ledges and the types of revetment for which they are approved.

B. The basis of approval shall be by one of the three methods stipulated in 4130.01:

   1. Service History
   2. Test Plot Performance (see Appendix F for construction guidelines)
   3. Testing

C. All revetment stone from ledges containing conglomerate or breccia, where the performance history has not been established shall be evaluated using a two-year wet test plot before approval. Conglomerate and breccia shall be defined as any rock that contains clasts (i.e., fragments or pieces) of a pre-existing material.

D. The distribution of approvals will include the producer and the Materials Engineer.

E. The District may place restrictions on the revetment approval prohibiting winter production of revetment.

F. When subsequent performance indicates the source approval to be in error it shall be modified or rescinded as necessary.

G. For Erosion stone or stone for Gabion baskets the only requirements are the stone shall not exceed a maximum C-Freeze test limit of 15 when tested in accordance with Iowa 211 Method C and the abrasion maximum shall not exceed 50% when tested in accordance with AASHTO T96.

H. Material meeting the specifications for any of the revetment classes can be certified for use as Erosion Stone or Gabion stone. Otherwise meet the requirements of Article 4130.03 through 4130.08 as appropriate.

APPROVAL PROCEDURES

A. Approvals by Service History

   1. The source approvals shall document the location, age, and sources of all usage forming the basis of the approvals.

   2. The historical usage must conform to the revetment class approved.

B. Approvals by Test Plot Performance

   1. Test plots may be of any size that incorporates all beds of the ledge under evaluation.

   2. For Class A, B, C, D, and E revetment, the test plots must be constructed in an

environment of wetting and drying cycles combined with seasonal freezing and thawing cycles that meet with the approval of the District Materials Engineer.

3. The test plots will be evaluated after two years and shall have no more than 25% of the stones showing cracks or fractures.

C. Approvals by Testing.

1. A record of Alumina Content (Iowa DOT Test Method 222) or freeze and thaw tests (Test Method 211, Method A) and Iowa Pore Index Tests (Test Method 219) should exist such that the District Materials Engineer is assured of reasonable conformance to the specifications. When no record exists, test results may be secured from production samples; ledge samples (block stoning), or samples from rock cores.

2. When the source test plot or service history is not available, the virgin stone shall meet the following requirements on stone crushed to 3/4 inch to 1 1/2inch (19 mm to 37.5 mm) nominal maximum sizes:

REVETMENT TYPE	REVETMENT QUALITY	TEST LIMITS	TEST METHOD
Class A, B, C, and E revetment	Alumina	0.7	Iowa 222
	A Freeze	10	Iowa 211, Method A
	Secondary Pore Index	25	Iowa 219
Class D revetment	C Freeze	10	Iowa 211, Method C

NOTE: Revetment may pass either Alumina or A-Freeze for compliance.

The abrasion loss for all revetment shall not exceed 50% when tested in accordance with AASHTO T96.

OTHER AGGREGATES

A. When appropriate, and after review and concurrence of the Geologist, the District Materials Engineer may establish source approval procedures, including production restrictions.

B. A copy of such source approvals, and any subsequent changes to them, shall be provided to the Geologist in the Construction and Materials Bureau.

C. The District aggregate source files should retain all documentation of materials approved for production, including production equipment, production methods, restrictions, etc.

IM T-203
AGGREGATE SOURCES

GENERAL AGGREGATE SOURCE INFORMATION

GENERAL

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 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 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.

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 Iowa 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.

Class 2 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 years.

NOTE: Those sources with a “B” in their durability class designation are approved for 1/2 in. Bridge Deck Overlay/Repair material.

HOT MIX ASPHALT AGGREGATES

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 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 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.

Type 1: Aggregates, which are generally, a heterogeneous combination of minerals with coarse-grained microstructure of very hard particles (generally, a Mohs 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 such as calcined bauxite (synthetic) and emery (natural). They are not available from Iowa sources. Due to their high cost, these aggregates would be specified only for use in extremely critical situations.

Type 2: 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 Iowa 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
Class D and Class E	250 pounds

SOURCE LISTING – Explanation

NOTE: - Number indicates additional source restrictions (see bottom of page)

Revetment class approval for size and quality of quarried stone used for river, lake bank, and water-way stabilization

Bed number shown for PCC aggregate are those on the formal source approval letter, Beds shown for HMA source are those which have prior approval for use and have the designated friction type. Beds are also indicated for revetment (rip rap) approvals.

Source restrictions for L2 Friction HMA surface mix designs. L=limestone (<15% MgO) and D=dolomite (≥15% MgO), defines rock type.

Frictional Classification – as indicated on page 2
Hot Mix Asphalt – Type A and B

Durability Class for Portland Cement Concrete Coarse Aggregate
("B" indicates acceptability for Bridge Deck Overlay/Repair)
Fine Aggregate (X=PCC and HMA Approval, H=HMA use only)

Source Code Number (A-number) used to identify sources.
Ex. A29002: 29=County, 0=crushed stone, 02= unique source identifier
Ex. A29502: 29=County, 5=sand & gravel, 02= unique source identifier
Out of State Sources: Ex. AMN004: MN=State, 0=crushed stone, 04= unique source identifier

Specific Gravity
DWU-Determine When Used by

CODE	OPERATOR		SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS		REVETMENT CLASS	NOTES
29	**DES MOINES**	**DIST 5**	**CRUSHED STONE**											
A29002	L&W QUARRIES INC		YARMOUTH	SE 01 T071 R04W	2.65	3		4	4	L	15			1
								4	4	L	15	18	A B C D E	
								5	5	L	20			
											3	7	A B C D E	
			SAND AND GRAVEL											
A29502	CESSFORD CONST CO		SPRING GROVE	SW 36 T069 R04W	DWU 2.66	3	X	4	4					

NOTE 1: AASHTO 57 GRADATION MAXIMUM

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
1	**ADAIR DIST 4**	**CRUSHED STONE**										
A01002	SCHILDBERG CONSTRUCTION CO	MENLO	NE 21 T77N R31W				5	5	L	15A-15C	A B C D E	
								4		14		
A01006	SCHILDBERG CONSTRUCTION CO	HOWE	SW 1 T76N R31W					5		25		
										25B-25E	D	
A01008	SCHILDBERG CONSTRUCTION CO	JEFFERSON	NE 17 T77N R31W					5		20		
								5		25		
										25B-25E	D	
2	**ADAMS DIST 4**	**CRUSHED STONE**										
A02002	SCHILDBERG CONSTRUCTION CO	MT ETNA	SW 14 T73N R34W					4		11-13	D	
A02004	SCHILDBERG CONSTRUCTION CO	CORNING	NE 08 T71N R34W					4		3-5	D	
3	**ALLAMAKEE DIST 2**	**CRUSHED STONE**										
A03002	BRUENING ROCK PRODUCTS INC	WEXFORD	NE 36 T98N R03W	2.70	3i		4	4	D	1C-6		
							4	4	D	1-8		
										1B-8	A B C D E	
A03004	BRUENING ROCK PRODUCTS INC	LANGE	E2 17 T96N R06W	2.60	3		4	4	L	2-5	A B C D E	
A03008	BRUENING ROCK PRODUCTS INC	MCCABE	NE 6 T97N R05W				4	4	L	1-5		
A03010	SKYLINE MATERIALS LTD	RUDE	SE 17 T100N R06W									
A03014	BRUENING ROCK PRODUCTS INC	HAMMEL-BOONIES	SW 2 T99N R06W	DWU	3i		4	4	D	2-4C	A B C D E	
A03022	SKYLINE MATERIALS LTD	LIVINGOOD	SW 7 T96N R06W				4	4	L	4-7		
								4		2-7		
A03026	BRUENING ROCK PRODUCTS INC	BYRNES	SE 25 T99N R06W									
A03028	BRUENING ROCK PRODUCTS INC	WELPER-JOHNSON	SW 35 T99N R04W							FULL FACE	A B C D E	
A03036	BRUENING ROCK PRODUCTS INC	SWENSON	SE 19 T96N R05W									
A03038	RIEHM CONSTRUCTION CO INC	RIEHM	SE 7 T100N R04W	DWU	3i		4	4	D	1-4	A B C D E	
A03040	BRUENING ROCK PRODUCTS INC	DEE	SE 21 T99N R04W	DWU	3i		4	4	D	5A-5D	A B C D E	
A03042	BARD MATERIALS	CHURCHTOWN	SW 29 T99N R04W					4		1-3		
							4	4	D	3		
A03046	BRUENING ROCK PRODUCTS INC	MOHS	SW 29 T96N R04W	DWU	2		5	5		1-2		
								5		1-4		
A03048	BRUENING ROCK PRODUCTS INC	POSTVILLE	SW 16 T96N R06W	2.61	3		4	4	L	6-8		
								4		2-5		
A03050	BRUENING ROCK PRODUCTS INC	GREEN	NW 16 T96N R06W	2.63	3		4	4	L	2-3A		
										1-3	A B C D E	
A03052	BRUENING ROCK PRODUCTS INC	ROSSVILLE	NE 35 T97N R05W				4	4	L	1-5	A B C D E	
A03054	BRUENING ROCK PRODUCTS INC	WEST RIDGE	NE 8 T98N R06W									
A03058	BRUENING ROCK PRODUCTS INC	ELON	SW 33 T98N R04W									
A03064	RAINBOW QUARRY LLC	RAINBOW	SE 26 T97N R05W							FULL FACE	D	

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
3	**ALLAMAKEE** **DIST 2**	**CRUSHED STONE**								**CONTINUED**		
A03064	RAINBOW QUARRY LLC	RAINBOW	SE 26 T97N R05W							1-5	A B C D E	
A03066	SKYLINE MATERIALS LTD	ELSBERN	NW 29 T97N R06W	2.61	3		4	4	L	2	A B C D E	
A03068	BRUENING ROCK PRODUCTS INC	JEFFERSON	SW 30 T97N R05W				5	5	L	2-4		
A03072	STRONG ROCK & GRAVEL	STRONG	SE 24 T99N R04W				4	4	D	1-8	A B C D E	
A03074	RON WEYMILLER	WW	NE 12 T100N R05W									
		SAND AND GRAVEL										
A03502	SKYLINE MATERIALS LTD	HARPERS FERRY	SW 7 T97N R02W	2.67	3iB		3	3				
				2.67		X						
A03506	BRUENING ROCK PRODUCTS INC	HAMMEL-BOONIES	SW 2 T99N R06W			H	4	4				
A03518	BRUENING ROCK PRODUCTS INC	IVERSON	NW 09 T99N R06W			H						
A03520	BRUENING ROCK PRODUCTS INC	IVERSON 2	NE 08 T99N R06W	2.65		X						
		CRUSHED STONE										
4	**APPANOOSE** **DIST 5**	**CRUSHED STONE**										
A04016	L&W QUARRIES INC	WALNUT CITY	CT 35 T70N R19W	2.70	2		5	5	L	1-3	D	1
							5	5	L	6	A B C D E	
A04018	L&W QUARRIES INC	CLARKDALE #8	SE 15 T69N R18W					5		4	D E	
										1A	D E	
										1C	A B C D E	
A04020	CANTERA AGGREGATES	PLANO	5 T69N R19W				5	5	L	1	A B C D E	2
										3	A B C D E	
A04022	CANTERA AGGREGATES	CONFIDENCE	20 T70N R19W				5	5		BED 1		
5	**AUDUBON** **DIST 4**	**SAND AND GRAVEL**										
A05506	HALLETT MATERIALS CO	EXIRA	SW 8 T78N R35W	2.68	3i		3	3				
				2.66		X						
6	**BENTON** **DIST 6**	**CRUSHED STONE**										
A06006	WENDLING QUARRIES INC	GARRISON B	NE 33 T85N R11W	2.64	2		4	4	L	6-16		
							5	5	L	6-28		
										6-TOP 2'	A B C D E	
										BED 27		
							5	5	L	32-37		
A06012	WENDLING QUARRIES INC	JABENS	SW 7 T85N R11W	DWU	2		5	5	L	6-11		
				DWU	2		5	5	L	9-12	A B C D E	
				2.63	2		4	4	L	12	A B C D E	
							4	4	L	10-12		
							4	4	L	13-18	D	
							4	4	L	20-23	A B C D E	

NOTE 1: AASHTO 67 GRADATION #5 40% MAXIMUM; RESTRICTION DOES NOT APPLY TO STRUCTURAL CONCRETE
NOTE 2: BED 1, LOWER HALF ONLY

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
6	**BENTON** **DIST 6**	**CRUSHED STONE**								**CONTINUED**		
A06012	WENDLING QUARRIES INC	JABENS	SW 7 T85N R11W							1-5	D	
A06014	WENDLING QUARRIES INC	VINTON-MILROY	S2 10 T85N R10W					4	L	1-4		
										1-7	D	
A06016	WENDLING QUARRIES INC	COOTS	SW 36 T86N R11W							2A ON DOWN	D	
		SAND AND GRAVEL										
A06502	WENDLING QUARRIES INC	VINTON-MILROY	S2 10 T85N R10W	2.65		X	4	4				
A06504	WENDLING QUARRIES INC	COOTS SAND/VINTON	SW 31 T86N R10W	2.65		X	3	3				
A06506	WENDLING QUARRIES INC	PORK CHOP	CT 11 T85N R09W	DWU		X	4	4				
A06508	WENDLING QUARRIES INC	BRIGHT SAND	NW 28 T86N R10W									
7	**BLACK HAWK** **DIST 2**	**CRUSHED STONE**										
A07004	BMC AGGREGATES LC	WATERLOO SOUTH	NW 18 T87N R12W	DWU	3		5	5	L	25		
							4	4	L	17-24		
							4	4	L	32-36	A B C D E	
							5	5	L	5-24		
										1-23	A B C D E	
										17-23	A B C D E	
A07008	BMC AGGREGATES LC	MORGAN	NE 15 T89N R12W	2.48	3i		4	4	L	5		
				2.63	3i		4	4	D	TOP 30' OF 9		
							5	5	L	1		
								5		1-3		
								5		4A-4B		
A07018	BMC AGGREGATES LC	RAYMOND-PESKE	SW 1 T88N R12W	2.66	2		4	4	L	1B-5,2-5		
				DWU	2		4	4	L	3-12,3-13		
				2.59	2		4	4	D	2-10		
				2.59	2		4	4	L	3-10		
							4	4	D	1-10	A B C D E	
							4	4	L	6-10		
A07020	BMC AGGREGATES LC	STEINBRON	SE 1 T88N R11W	2.60	3		4	4	L	1B		
				2.60	2		4	4	L	1A-1B		
A07022	BMC AGGREGATES LC	MESSERLY	NE 8 T90N R14W									
		SAND AND GRAVEL										
A07504	BMC AGGREGATES LC	WATERLOO SAND	SW 9 T89N R13W				3	3				
				2.65		X						
A07506	WENDLING QUARRIES INC	ASPRO	NW 1 T88N R13W				4	4				
				2.65		X						
A07508	BMC AGGREGATES LC	GILBERTVILLE	16 T88N R12W	DWU	2		4	4				

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR		SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
7	**BLACK HAWK**	**DIST 2**	**SAND AND GRAVEL**								**CONTINUED**		
A07508	BMC AGGREGATES LC		GILBERTVILLE	16 T88N R12W	2.65		X						
A07512	BMC AGGREGATES LC		ZEIEN S&G	NW 23 T87N R12W	2.65		X						
A07518	BMC AGGREGATES LC		JANESVILLE	NE 14 T90N R14W				3	3				
					2.66		X						
8	**BOONE**	**DIST 1**	**SAND AND GRAVEL**										
A08504	STRATFORD GRAVEL INC		JENSEN	SE 35 T85N R25W			H						
A08526	STRATFORD GRAVEL INC		POWERS	SE 29 T84N R28W			H						
A08528	STRATFORD GRAVEL INC		LEININGER	SW 26 T85N R25W			H						
9	**BREMER**	**DIST 2**	**CRUSHED STONE**										
A09002	BMC AGGREGATES LC		FREDERIKA	NE 12 T93N R13W					5		2-8		
A09006	BMC AGGREGATES LC		TRIPOLI-PLATTE	SW 36 T93N R13W	2.65	3iB		4	4	D	1-6		
					2.65	3iB		4	4	D	1-4	A B C D E	
A09008	BMC AGGREGATES LC		DENVER #2	NE 20 T91N R13W							2	A B C D E	
			SAND AND GRAVEL										
A09508	BMC AGGREGATES LC		TRIPOLI-PLATTE	SW 36 T93N R13W			H						
A09510	CROELL REDI MIX		PLAINFIELD/ADAMS	NE 32 T93N R14W	2.66		X						
A09512	BMC AGGREGATES LC		BOEVERS	NE 31 T92N R11W	2.64		X						
10	**BUCHANAN**	**DIST 6**	**CRUSHED STONE**										
A10002	BARD MATERIALS		WESTON-LAMONT	NW 14 T90N R07W	2.61	3iB		4	4	D	1-6	A B C D E	
					2.57	3i		4	4	D	6-7	A B C D E	
					2.65	3i		4	4	D	8-9	A B C D E	
								4	4	D	1-7		
A10004	BMC AGGREGATES LC		BLOOM-JESUP	SW 32 T89N R10W	2.63	3		4	4	L	2-5	A B C D E	
								4	4	L	1-7		
											2-8	D	
A10008	BRUENING ROCK PRODUCTS INC		OELWEIN	NW 2 T90N R09W	2.65	3i		4	4	D	4-5	A B C D E	
								4	4	D	4-6		
A10010	BRUENING ROCK PRODUCTS INC		HAZELTON	NW 11 T90N R09W	2.63	3iB		4	4	D	4	A B C D E	
A10012	BMC AGGREGATES LC		MILLER-INDEPENDENCE	NW 14 T88N R09W									
A10014	BMC AGGREGATES LC		OELWEIN #1	SW 2 T90N R09W				5	5	L	1-12		
A10016	BMC AGGREGATES LC		OELWEIN #2	SE 3 T90N R09W	2.68	3i		4	4	D	13-16		
											13-17	A B C D E	
A10022	BRUENING ROCK PRODUCTS INC		BROOKS	NW 2 T88N R09W	2.60	3i		4	4	L	7		
									5		1-6		
A10024	BMC AGGREGATES LC		RASMUSSEN #2	SE 21 T88N R08W							1-6 + QRY	D	
											FLR		
A10028	WENDLING QUARRIES INC		HERTZBERGER	NE 36 T87N R10W					5				
A10030	BARD MATERIALS		SOUTH AURORA	NW 19 T90N R07W	2.63	3iB		4	4	D	1-3	A B C D E	
A10040	BMC AGGREGATES LC		ZUPKE-OELWEIN	NE 4 T90N R09W									

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
10	**BUCHANAN DIST 6**	**CRUSHED STONE**								**CONTINUED**		
A10042	BRUENING ROCK PRODUCTS INC	BRANDON I-380	E2 23 T87N R10W									
A10044	BMC AGGREGATES LC	PARKER	NE 6 T88N R10W									
		SAND AND GRAVEL										
A10516	BMC AGGREGATES LC	MILLER	NW 14 T88N R09W	2.65		X						
A10518	WENDLING QUARRIES INC	YEAROUS	SE 19 T89N R09W	2.65		X						
A10520	BRUENING ROCK PRODUCTS INC	BROOKS	SW 2 T88N R09W	DWU		X						
A10522	BARD MATERIALS	NIEMANN-DECKER	NW 14 T90N R07W	2.66		X						
A10524	BRUENING ROCK PRODUCTS INC	CRAWFORD	SE 10 T90N R07W	2.64		X						
11	**BUENA VISTA DIST 3**	**SAND AND GRAVEL**										
A11512	BUENA VISTA COUNTY	MARATHON	SE 19 T93N R35W			H	4	4				
A11514	REDINGS GRAVEL & EXCAVATING CO	OATMAN	SW 18 T90N R36W			H	4	4				
A11516	HALLETT MATERIALS CO	SIOUX RAPIDS	W2 12 T93N R37W			H	3	3				
A11518	STRATFORD GRAVEL INC	MOLGAARD	NW 3 T93N R38W			H						
A11520	WETHERELL SAND & GRAVEL	WETHERELL	02 T93N R38W			H						
12	**BUTLER DIST 2**	**CRUSHED STONE**										
A12004	BRUENING ROCK PRODUCTS INC	LUBBEN	NW 25 T93N R17W				5	5	L	4-16		
								5		1-21		
										1-20	D	
A12008	BRUENING ROCK PRODUCTS INC	FLORRY-STEERE	CT 8 T93N R17W					5		1-11		
A12010	SKYLINE MATERIALS LTD	CLARKSVILLE-ENGLE	NE 16 T92N R15W									
A12014	BMC AGGREGATES LC	OLTMANN	SE 8 T91N R16W				5	5	L	1-4		
										1-TOP 1/2	D	
										BED 10		
										9-16	D	
										17-18	D	
A12016	BRUENING ROCK PRODUCTS INC	WIEGMANN-BRISTOW	SE 23 T92N R18W							1-11		
A12018	BRUENING ROCK PRODUCTS INC	NEYMEYER	SW 28 T90N R18W									
A12020	BRUENING ROCK PRODUCTS INC	BRUNS #2	NW 21 T91N R18W					5		1-5	D	
		SAND AND GRAVEL										
A12502	CROELL REDI MIX	CLARKSVILLE	NW 1 T92N R16W	2.67	2		4	4				
				2.67		X						
A12516	BRUENING ROCK PRODUCTS INC	JENSEN	S2 18 T93N R16W			H	4	4				
A12518	BMC AGGREGATES LC	SHELL ROCK-ADAMS	NE 3 T91N R15W				3	3				
				2.66		X						
A12520	CROELL REDI MIX	PARKERSBURG	E2 19 T90N R16W	DWU		X						
A12522	BMC AGGREGATES LC	HOBSON	34 T92N R15W	2.66		X						
13	**CALHOUN DIST 3**	**SAND AND GRAVEL**										
A13502	STRATFORD GRAVEL INC	KRUSE	NE 26 T86N R34W			H	4	4				
A13504	TIEFENTHALER AG-LIME INC	JENSEN	SW 7 T86N R34W	2.67		X						

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	L2 ROCK BEDS	REVETMENT CLASS	NOTES
13	**CALHOUN DIST 3**	**SAND AND GRAVEL**								**CONTINUED**		
A13506	MOHR SAND, GRAVEL, & CONST LLC	MOHR	NW 23 T86N R34W	DWU		X						
A13508	STRATFORD GRAVEL INC	PACKER	NE 26 T86N R34W			H	3	3				
A13510	MOHR SAND, GRAVEL, & CONST LLC	SMITH	NW 23 T86N R34W									
14	**CARROLL DIST 3**	**SAND AND GRAVEL**										
A14504	STRATFORD GRAVEL INC	REINHART	NW 21 T85N R33W	DWU	2	X						
A14510	TIEFENTHALER AG-LIME INC	LANESBORO	NW 17 T85N R33W	2.72	2		4	4				
				2.68		X						
A14514	TIEFENTHALER AG-LIME INC	MACKE	SW 6 T85N R33W	2.69	2		4	4				
				2.66		X						
A14516	STRATFORD GRAVEL INC	RICHLAND	NE 23 T83N R33W			H	4	4				
A14518	TIEFENTHALER AG-LIME INC	MILLER	21 T85N R33W	DWU	2							
				DWU		X						
15	**CASS DIST 4**	**CRUSHED STONE**										
A15004	SCHILDBERG CONSTRUCTION CO	LEWIS	SE 17 T75N R37W									
A15008	SCHILDBERG CONSTRUCTION CO	ATLANTIC MINE	SW 13 T76N R37W					5		25		
										25B-25E	D	
										20A-20C	D	
A15012	SCHILDBERG CONSTRUCTION CO	HANSEN	SE 29 T76N R36W				5	5	L	ARGENTINE		
16	**CEDAR DIST 6**	**CRUSHED STONE**										
A16004	WENDLING QUARRIES INC	LOWDEN-SCHNECKLOTH	NW 4 T81N R01W	DWU	3i		4	4	D	1-4	A B C D E	
A16006	WENDLING QUARRIES INC	STONEMILL	SE 14 T80N R03W	DWU	3iB		4	4	D	4	A B C D E	
										1-4B	D	
A16012	WEBER STONE CO INC	ONION GROVE	NW 14 T82N R02W	2.61	3i		4	4	D	1-7	A B C D E	
A16014	WENDLING QUARRIES INC	TOWNSEND	NW 2 T79N R02W							2-10	A B C D E	
A16022	WENDLING QUARRIES INC	TRICON	N2 9 T82N R04W	DWU	3i		4	4	D	1	A B C D E	
				DWU	3i		4	4	D	1-4	A B C D E	
A16026	WENDLING QUARRIES INC	PEDEN #2	SW 10 T79N R03W									
		SAND AND GRAVEL										
A16502	WENDLING QUARRIES INC	SHARPLISS	NW 12 T79N R03W				4	4				
				2.65		X						
A16506	WEBER STONE CO INC	ONION GROVE	NE 14 T82N R02W	2.65		X						
A16510	CROELL REDI MIX	CEDAR BLUFF	SW 28 T81N R04W	DWU		X						
17	**CERRO GORDO DIST 2**	**CRUSHED STONE**										
A17008	MARTIN MARIETTA AGGREGATES	PORTLAND WEST	NE 19 T96N R19W	2.75	3iB		4	4	L	1-8	A B C D E	
A17012	MARTIN MARIETTA AGGREGATES	UBBEN	SW 26 T94N R20W	2.68	2		5	5	L	3		
							5	5	L	1-3		
A17020	MARTIN MARIETTA AGGREGATES	MASON CITY	NE 29 T97N R20W	DWU	3i		5	5	L	7		
				2.73	3		5	5	L	7-9	A B C D E	

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	L2 ROCK BEDS	REVETMENT CLASS	NOTES
17	**CERRO GORDO DIST 2**	**CRUSHED STONE**								**CONTINUED**		
A17020	MARTIN MARIETTA AGGREGATES	MASON CITY	NE 29 T97N R20W				4	4	L	8-9		
							4	4	D	9-15		
										1-6	A B C D E	
A17022	NORTH IA SAND & GRAVEL INC	HOLCIM	SE 19 T97N R20W									
A17024	HEARTLAND ASPHALT INC	RIVERVIEW	NE 29 T96N R19W				4	4	L	1-12		
							4	4	L	1-15		
							4	4	L	13-15		
							5	5	L	13-17		
							5	5	L	16-17		
		SAND AND GRAVEL										
A17514	MARTIN MARIETTA AGGREGATES	HOLCIM SAND	NE 19 T97N R20W	DWU	3		3	3				
				2.65		X						
A17518	HEARTLAND ASPHALT INC	AIRPORT	NE 8 T96N R21W			H	3	3				
A17520	NORTH IA SAND & GRAVEL INC	TUTTLE	NE 13 T97N R21W	2.64		X						
18	**CHEROKEE DIST 3**	**SAND AND GRAVEL**										
A18506	HALLETT MATERIALS CO	CHEROKEE SOUTH	NE 16 T91N R40W	2.70	2		3	3				
				2.69		X						
A18514	L G EVERIST INC	LARRABEE-MONTGOMERY	NE 20 T93N R39W	2.67	3		3	3				
				2.63		X						
A18526	HALLETT MATERIALS CO	CHEROKEE NORTH	SW 23 T92N R40W	2.70	3		3	3				
				2.67		X						
A18528	L G EVERIST INC	WASHTA	SW 31 T90N R41W	2.68	3		3	3				
				2.64		X						
A18534	HALLETT MATERIALS CO	NELSON	CT 23 T92N R40W	2.67	2		3	3				
				2.68		X						
19	**CHICKASAW DIST 2**	**CRUSHED STONE**										
A19004	BRUENING ROCK PRODUCTS INC	DEERFIELD-MAHONEY	SE 33 T97N R14W									
A19008	BRUENING ROCK PRODUCTS INC	BOICE	NE 16 T95N R14W							2-5	D	
		SAND AND GRAVEL										
A19508	SKYLINE MATERIALS LTD	BUSTA	SE 23 T96N R11W	2.65		X	4	4				
A19512	BRUENING ROCK PRODUCTS INC	PEARL ROCK	SE 31 T94N R14W				4	4				
				2.65		X						
A19514	BRUENING ROCK PRODUCTS INC	NASHUA	SW 33 T95N R14W				3	3				
				DWU		X						
A19516	BMC AGGREGATES LC	REWOLDT	NE 25 T94N R13W	2.64		X						
A19520	BMC AGGREGATES LC	ROSONKE	SE 16 T95N R14W			H						
A19522	CROELL REDI MIX	BUCKY'S	NW 3 T95N R11W	2.68	3iB		3	3				
				2.65		X						

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
20	**CLARKE DIST 5**	**CRUSHED STONE**										
A20002	SCHILDBERG CONSTRUCTION CO	OSCEOLA	NW 12 T72N R26W					5		25A-25E	D	
										20A-20C		1
										20A	A B C D E	
										25B-25C	A B C D E	
21	**CLAY DIST 3**	**SAND AND GRAVEL**										
A21506	DAVE'S SAND AND GRAVEL INC	EVERLY	SW 31 T97N R38W	2.70	3		3	3				
				2.68		X						
A21516	SIEH SAND & GRAVEL	SPENCER #1	SW 24 T96N R36W	2.69	2		3	3				
				2.66		X						
A21518	HALLETT MATERIALS CO	SPENCER #2	SW 5 T97N R37W			H	4	4				
A21526	CLAY COUNTY	CLAY COUNTY	NW 20 T96N R35W			H						
A21528	DAVE'S SAND AND GRAVEL INC	GOEKEN	NE 5 T96N R38W	DWU	2	H						
A21530	HALLETT MATERIALS CO	BRAUNSCHWEIG	16 T94N R36W			H	3	3				
A21532	CLAY COUNTY	ELSER	CT 3 T94N R36W			H	3	3				
A21534	HALLETT MATERIALS CO	CLARK EVERLY	NW 6 T96N R38W			H						
A21536	HALLETT MATERIALS CO	GILLETT GROVE	NE 3 T94N R36W			H	3	3				
A21538	NSG, LLC	NORGAARD SAND & GRAVEL	NW 20 T96N R35W	2.65		X						
A21540	BD CONSTRUCTION SERVICES LLC	DELOSS	20 T96N R35W			H						
22	**CLAYTON DIST 2**	**CRUSHED STONE**										
A22002	BARD MATERIALS	TWIN ROCK-SCHRADER	NW 14 T94N R05W				4	4	D	1-11		
							4	4	D	3-11	A B C D E	
A22004	SKYLINE MATERIALS LTD	BENTE-ELKADER-WATSON	SW 12 T93N R05W	2.66	2		4	4	L	6-9		
							4	4	D	1-9		
										5-9	A B C D E	
A22008	BARD MATERIALS	ANDEREGG	SE 32 T92N R02W				4	4	D	2-8	A B C D E	
A22010	BARD MATERIALS	OSTERDOCK	SE 2 T91N R03W	2.67	2					2-5		
							4	4		1-8		
										3-8	A B C D E	
A22012	BARD MATERIALS	SCHMIDT	NE 33 T91N R01W	2.66	3i		4	4	D	4B -6		
							4	4	D	2-6	A B C D E	
A22014	SKYLINE MATERIALS LTD	BLUME	NE 9 T93N R03W	2.64	2		4	4	D	1-7		
							4	4	D	1-12	A B C D E	
A22016	BARD MATERIALS	GISLESON	NW 6 T95N R04W	2.66	3i		4	4	D	1-8		
							4	4		1-15	A B C D E	
A22018	CJ MOYNA & SONS INC	ZURCHER	SE 1 T94N R05W				4	4				
A22020	BARD MATERIALS	MUELLER	NE 30 T94N R03W	DWU	3i		4	4	D	1-8	A B C D E	

NOTE 1: FRICTION TYPE TO BE DETERMINED WHEN USED ON WINTERSET BEDS 20A-20C

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
22	**CLAYTON DIST 2**	**CRUSHED STONE**								**CONTINUED**		
A22024	MIELKES QUARRY	MIELKE QUARRY	NE 21 T95N R04W				4	4	D	1-2	A B C D E	
A22026	BARD MATERIALS	DOERRING-LUANA	SE 5 T95N R05W							3-5	A B C D E	
A22030	BARD MATERIALS	EBERHARDT	NW 27 T93N R05W	2.72	3		4	4		1-5		
								4		1-8		
										1-6	A B C D E	
A22032	BARD MATERIALS	WELLMAN	NW 25 T92N R06W					4		1-6		
A22034	BARD MATERIALS	KRUSE	NW 17 T92N R04W	2.70	3B		4	4		5-11		
				2.70	2		4	4		5-12	A B C D E	
							4	4		2-12		
A22038	BARD MATERIALS	FASSBINDER	SW 9 T92N R03W	2.67	3i		4	4	D	2B -6		
										2-6	A B C D E	
A22040	BARD MATERIALS	HARTMAN	NW 29 T91N R06W	2.68	3i		4	4	D	1-4	A B C D E	
A22042	SKYLINE MATERIALS LTD	MORAREND	CT 35 T92N R03W							1-8		
							4	4	D	1-10		
										1-9	A B C D E	
A22044	BARD MATERIALS	BOGE	SW 18 T91N R02W									
A22048	SKYLINE MATERIALS LTD	TUCKER	SW 18 T91N R05W							1-3	D	
A22058	SKYLINE MATERIALS LTD	ST. OLAF	NW 25 T94N R05W									
A22060	CROELL REDI MIX	JOHNSON	NW 26 T93N R04W	2.64	3i		4	4	D	2-5	A B C D E	
							4	4	D	1-5		
A22062	CJ MOYNA & SONS INC	SNY MAGILL	SE 22 T94N R03W	2.73	3i		4	4	D	6-10	A B C D E	
A22068	RIVER CITY STONE INC	MILLVILLE	NW 10 T91N R02W	DWU	3i		4	4	D	1-8	A B C D E	
A22070	BRUENING ROCK PRODUCTS INC	BERNHARD/GIARD	NW 35 T95N R04W	DWU	3i		4	4	D	1-3	A B C D E	
A22074	RIVER CITY STONE INC	STRAWBERRY POINT	NE 19 T91N R06W	2.69	3i		4	4	D	1-2	A B C D E	
A22076	BRUENING ROCK PRODUCTS INC	LARSON	NW 8 T93N R05W									
A22080	BARD MATERIALS	HILINE	NW 8 T91N R03W									
A22084	CJ MOYNA & SONS INC	MOYNA	14 T93N R05W	2.66	3i				L	BED 6-		
										TOP 3' OF		
										8		
							4	4	L	6-9	A B C D E	
A22086	CJ MOYNA & SONS INC	WILLIE	SW 18 T93N R02W									
A22088	CJ MOYNA & SONS INC	KEPPLER	NW 29 T94N R05W									
A22090	PATTISON SAND COMPANY LLC	FRENCHTOWN	7 T93N R02W	2.68	3iB		4	4	D	S1C-S1D		
				DWU	3		4	4	D	S1B		
				2.68	3		4	4	D	S1B-S1D		
				2.68	3i		4	4	D	G4	A B C D E	
				2.66	3		4	4	D	G2-G3	A B C D E	
				2.72	3i		4	4	D	O1A	A B C D E	
										G2-G4	A B C D E	
										G1	A B C D E	

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
22	**CLAYTON DIST 2**	**CRUSHED STONE**								**CONTINUED**		
A22092	CJ MOYNA & SONS INC	LARSON	07 T94N R06W									
A22094	CJ MOYNA & SONS INC	BACKES	SE 19 T92N R03W									
		SAND AND GRAVEL										
A22510	SKYLINE MATERIALS LTD	BENTE	SE 15 T93N R05W	2.66		X	4	4				
A22520	BARD MATERIALS	WELTERLEN	SE 32 T91N R05W	2.65		X						
A22522	CJ MOYNA & SONS INC	MOYNA	13 T93N R05W	2.64		X	4	4				
23	**CLINTON DIST 6**	**CRUSHED STONE**										
A23002	PRESTON READY MIX CORP	ELWOOD-YEAGER	NW 8 T83N R02E	DWU	3i		4	4	D	1-2	A B C D E	
							4	4	D	5-6		
A23004	WENDLING QUARRIES INC	BEHR	SW 2 T81N R03E	2.61	3i		4	4	D	1-2	A B C D E	
A23006	WENDLING QUARRIES INC	SHAFFTON	NE 11 T80N R05E	DWU	3i		4	4	D	16-17		
				DWU	3i		4	4	D	17-18		
				DWU	3i		4	4	D	18-19		
				DWU	3i		4	4	D	20-21		
				DWU	3		4	4	D	20-23	A B C D E	
				DWU	3		4	4	D	3-14	D	
							4	4	D	3-15		
										16-21	A B C D E	
A23010	WENDLING QUARRIES INC	GOOSE LAKE	SW 22 T83N R05E				4	4	D	1-10		
										2-4	D E	
A23012	WENDLING QUARRIES INC	TEEDS GROVE	SW 3 T83N R06E							2-4	A B C D E	
A23016	WENDLING QUARRIES INC	LYONS	NW 18 T82N R07E							UPPER OR LOWER LEDGE	D E	
A23026	WENDLING QUARRIES INC	MILL CREEK	NE 22 T82N R06E									
A23028	WENDLING QUARRIES INC	DELMAR	SE 6 T83N R04E									
A23030	WENDLING QUARRIES INC	EDEN VALLEY	4 T83N R01E									
A23032	ANDERSON SAND AND GRAVEL CO	ANDERSON	23 T81N R03E									
		SAND AND GRAVEL										
A23504	WENDLING QUARRIES INC	BEHR	SW 2 T81N R03E	2.68	2		4	4				
				2.68		X						
A23506	WENDLING QUARRIES INC	SCHNECKLOTH	S2 10 T80N R05E				4	4				
				2.67		X						
A23508	WENDLING QUARRIES INC	GATEWAY	NE 27 T81N R06E				4	4				
				2.66		X						
A23510	WENDLING QUARRIES INC	SHAFFTON	N2 11 T80N R05E				4	4				
				2.66		X						
A23514	ANDERSON SAND AND GRAVEL CO	ANDERSON	NW 23 T81N R03E	2.68		X						
A23516	WENDLING QUARRIES INC	OLSON	NW 23 T81N R02E	DWU		X						

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR		SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
24	**CRAWFORD**	**DIST 3**	**SAND AND GRAVEL**										
A24512	HALLETT MATERIALS CO		DUNLAP	SE 27 T82N R41W	2.70	2		3	3				
					2.66		X						
25	**DALLAS**	**DIST 4**	**SAND AND GRAVEL**										
A25510	HALLETT MATERIALS CO		PERRY	NW 1 T81N R29W	2.70	2		4	4				
					2.67		X						
A25514	HALLETT MATERIALS CO		BOONEVILLE	S2 26 T78N R26W	2.68	2		3	3				
					2.66		X						
A25516	HALLETT MATERIALS CO		VAN METER SOUTH	21 T78N R27W	2.68	2		3	3				
					2.66		X						
A25518	MARTIN MARIETTA AGGREGATES		RACCOON RIVER SAND	27 T78N R26W	2.66	2		3	3				
					2.65		X						
A25520	LEGACY MATERIALS		LEGACY MATERIALS	29 T78N R26W	DWU	2							
					2.66		X						
A25522	HALLETT MATERIALS CO		BOONEVILLE WEST	25 T78N R27W	DWU	2							
					2.66		X						
26	**DAVIS**	**DIST 5**	**CRUSHED STONE**										
A26004	DOUDS STONE LLC		LEWIS	W2 2 T69N R12W	2.60	3		4	4	L	1	D E	
								5	5	L	3-7	D E	
									5		3-5	D	
								4	4	L	6-7	D E	
A26006	DOUDS STONE LLC		BROWN	NW 2 T69N R12W	2.60	3		4	4	L	1	D E	
								5	5	L	3-7	D E	
									5		3-5		
								4	4	L	6-7		
			SAND AND GRAVEL										
A26502	DOUDS STONE LLC		ELDON-FRANKLIN	SW 1 T70N R12W	2.67		X						
27	**DECATUR**	**DIST 5**	**CRUSHED STONE**										
A27002	SCHILDBERG CONSTRUCTION CO		GRAND RIVER	NW 22 T70N R27W					5		25A-25C		1
											TOP 5.5'	D	
											BED 25E		
A27008	SCHILDBERG CONSTRUCTION CO		DECATUR	05 T68N R26W							20C	A B C D E	2
									5		25A-25E		3
											25C	D	
											20A	C D E	

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.

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
28	**DELAWARE** **DIST 6**	**CRUSHED STONE**										
A28008	BARD MATERIALS	EDGEWOOD WEST	CT 4 T90N R05W	2.67	3i		4	4	D	2-7	A B C D E	
				2.69	3i		4	4	D	2B-3B		
							4	4	D	1-7		
A28010	BARD MATERIALS	TIBBOTT	SW 23 T90N R04W	2.70	3i		4	4	D	1-5	A B C D E	
							4	4	D	1-7		
A28012	BARD MATERIALS	BAHL	SE 22 T89N R06W	2.69	3i		4	4	L	1-4		
A28014	BARD MATERIALS	LOGAN	SW 10 T88N R05W	2.69	3		4	4	L	2-8	A B C D E	
							4	4	L	1-8		
A28016	BARD MATERIALS	WHITE	NW 2 T88N R04W	2.67	3i		4	4	D	1-2	A B C D E	
A28030	BARD MATERIALS	HOPKINTON	NE 18 T87N R03W							1-2	A B C D E	
A28038	BARD MATERIALS	EDGEWOOD EAST	NW 6 T90N R04W	2.68	3i		4	4	D	1B-5	A B C D E	
										2-6	D E	
A28040	BARD MATERIALS	KRAPFL	SE 23 T89N R03W	2.66	3iB		4	4	D	4	D E	
							4	4	D	1-4		
							4	4	D	4-7		
							4	4	D	7		
										1-5	A B C D E	
A28044	BARD MATERIALS	DUNDEE	NE 20 T90N R06W	DWU	3i		4	4	D	2-7		
A28046	BARD MATERIALS	PINS	NW 27 T88N R03W									
A28050	BARD MATERIALS	BUCK CREEK	NW 20 T87N R04W									
A28052	RIVER CITY STONE INC	MANCHESTER	SW 9 T88N R05W	DWU	3		4	4	D	5-8		
										6-8	A B C D E	
										TOP	D	
										LEDGES-N		
A28056	RIVER CITY STONE INC	THORPE	NW 33 T90N R05W							FULL FACE	A B C D E	
A28058	RIVER CITY STONE INC	ROSSOW/MANCHESTER	NW 16 T88N R05W				4	4	L	1-8		
										2-8	A B C D E	
		SAND AND GRAVEL										
A28504	BARD MATERIALS	TEGLER	NE 36 T89N R03W				4	4				
				2.65		X						
A28510	BARD MATERIALS	LOGAN	SW 10 T88N R05W	2.65		X						
A28520	RIVER CITY STONE INC	MANCHESTER	SW 10 T88N R05W	2.64		X						
A28526	BARD MATERIALS	HAWK	SW 22 T89N R06W	2.67		X						
A28528	BARD MATERIALS	CAR 6	NW 36 T89N R03W	2.64		X						
A28530	BRUENING ROCK PRODUCTS INC	SUMMERS PIT	NE 24 T89N R06W	2.65		X						
29	**DES MOINES** **DIST 5**	**CRUSHED STONE**										
A29002	L&W QUARRIES INC	YARMOUTH	SE 1 T71N R04W	2.65	3		4	4	L	15		1

NOTE 1: AASHTO 57 GRADATION MAXIMUM

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
98	**WORTH DIST 2**	**CRUSHED STONE**								**CONTINUED**		
A98016	ULLAND BROTHERS INC	EMIL OLSON-BOLTON	SW 10 T99N R20W				4	4	L	3-7		
								5		1-7		
										2-5B	A B C D E	
A98020	FALKSTONE LLC	TRENHAILE	SE 9 T99N R20W	DWU	3		5	5	L	1		
				DWU	2		4	4	D	2A1		
				DWU	2		4	4	D	2A2	A B C D E	
				DWU	2		4	4	D	2A1-2A2	A B C D E	
							4	4	D	2B-3		
										2B1-3	A C D E	
							4	4	D	4-7	A B C D E	
										2B1-7	A C D E	
		SAND AND GRAVEL										
A98502	FALKSTONE LLC	RANDALL TRANSIT MIX	NW 31 T100N R20W	DWU	2		4	4				
				2.66		X						
A98504	BMC AGGREGATES LC	FERTILE	NW 36 T98N R22W	DWU	2		3	3				
				2.63		X						
A98518	FALK L R- CONSTRUCTION CO	COOPER	NE 12 T98N R20W			H		4				
A98522	ULLAND BROTHERS INC	EMIL OLSON-BOLTON	SW 10 T99N R20W			H						
A98524	FALKSTONE LLC	TRENHAILE	NE 09 T99N R20W	2.64		X						
A98526	FALK L R- CONSTRUCTION CO	MOUW	SE 31 T100N R20W			H						
99	**WRIGHT DIST 2**	**CRUSHED STONE**										
A99002	MARTIN MARIETTA AGGREGATES	VOSS	36 T90N R26W	2.59	3i		4	4	L	8	A B C D E	
								5		3-7		
A99004	STRATFORD GRAVEL INC	LESHER	SE 26 T90N R26W									
		SAND AND GRAVEL										
A99502	WRIGHT MATERIALS CO	WRIGHT	NW 12 T93N R24W	2.65	3		3	3				
				2.63		X						
A99506	STRATFORD GRAVEL INC	LESHER	SE 26 T90N R26W			H	4	4				
A99510	STRATFORD GRAVEL INC	MEINEKE	NE 14 T90N R23W				4	4				
				2.65		X						
A99514	MARTIN MARIETTA AGGREGATES	VOSS	36 T90N R26W			H						
A99518	STRATFORD GRAVEL INC	REICHTER	SE 6 T92N R26W			H						
A99520	STRATFORD GRAVEL INC	DENNIS PETERSON	NE 15 T90N R23W			H						
A99522	STRATFORD GRAVEL INC	LOUX	SW 10 T91N R23W			H						
A99524	WRIGHT MATERIALS CO	STECHER	13 T93N R23W	2.63		X						
IL	**ILLINOIS DIST 5**	**CRUSHED STONE**										
AIL002	CESSFORD CONST CO	BIGGSVILLE-HENDERSON CO	17 T10N R04W							6-8	A B C D E	

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR		SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
IL	**ILLINOIS**	**DIST 5**	**CRUSHED STONE**								**CONTINUED**		
AIL014	CESSFORD CONST CO		DALLAS CITY-HENDERSON CO	SW 36 T08N R07W	DWU	3i		4	4	L	5A-6		1
									4	L	2-3		
								5	5	L	8-10		
											5-6	A B C D E	
AIL020	GRAY QUARRIES INC		HAMILTON-HANCOCK CO	NE 31 T05N R08W	2.65	3		4	4	L	2	A B C D E	1
					DWU	3		4	4	L	4		
					DWU	2		5	5		7		
AIL046	BLUFF CITY MINERALS LLC		BLUFF CITY MINERALS-MADISON CO	11 T05N R10W	DWU	2				L	1-7		
			SAND AND GRAVEL										
AIL526	BLUFF CITY MINERALS LLC		BLUFF CITY SAND-MADISON CO	14 T05N R10W	2.64		X						
		DIST 6	**CRUSHED STONE**										
AIL006	RIVERSTONE GROUP INC		MIDWAY(MC45)-ROCK ISLAND CO	SW 16 T18N R02E	DWU	3iB		4	4	D	1-5		
					DWU	3i		4	4	D	6		
											1-6	A B C D E	
AIL010	RIVERSTONE GROUP INC		ALLIED(MC30)-ROCK ISLAND CO	14 T17N R02W	DWU	3i		4	4	D	18	A B C D E	
					2.72	3i		4	4	L	16-17	A B C D E	
					2.69	3		5	5	L	7-13	A B C D E	
											14	A B C D E	
AIL016	RIVERSTONE GROUP INC		CLEVELAND(MC31)-HENRY CO	SW 31 T17N R02E	DWU	3i		4	4	D	5,6,7,8		2
											1-4	A B C D E	
											5	A B C D E	
											6	A B C D E	
											7	A B C D E	
											8	A B C D E	
AIL028	WENDLING QUARRIES INC		TURNBAUGH-MT CARROLL-CARROLL CO	SW 10 T24N R04E	DWU	3		4	4	D	3-7	A B C D E	
AIL042	MILL CREEK MINING		SAVANNA-CARROLL CO	SE 13 T24N R03E									
AIL048	MILL CREEK MINING		MILL CREEK MINING-ROCK ISLAND	25 T17N R02W									
			SAND AND GRAVEL										
AIL522	RIVERSTONE GROUP INC		CORDOVA INLAND(MC17)-ROCK ISLAND CO	7 T20N R02W	DWU	3iB							
					DWU		X						
KS	**KANSAS**	**DIST 4**	**SAND AND GRAVEL**										
AKS504	HOLLIDAY SAND & GRAVEL CO		FRISBIE- PLANT #3-JOHNSON CO	32 T11S R23E	2.63		X						3
AKS506	BUILDERS CHOICE AGGREGATES		OAKLAND SAND PLANT-SHAWNEE	23 T11S R16E	DWU		X						4
AKS508	BUILDERS CHOICE AGGREGATES		SILVER LAKE SAND PLANT-SHAWNEE	20 T11S R15E	DWU		X						4

NOTE 1: AASHTO 57 GRADATION MAXIMUM
NOTE 2: LEDGES 2-10 APPROVED FOR CLASS 3I CONCRETE STONE. LEDGE 2 = BED 5, LEDGES 3-9 = BEDS 6-7,AND LEDGE 10= BED 8.
NOTE 3: FOR PRESTRESS AND PRECAST APPLICATIONS ONLY
NOTE 4: FOR PRECAST PCC ONLY

RECENTLY ACTIVE AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT HMA A	FRICT HMA B	L2 ROCK TYPE	BEDS	REVETMENT CLASS	NOTES
MN	**MINNESOTA DIST 2**	**CRUSHED STONE**										
AMN004	MILESTONE MATERIALS	POOL HILL-HOUSTON CO	SW 33 T101NR04W	DWU	3i		4	4	D	1-8	A B C D E	
AMN006	SKYLINE MATERIALS LTD	OTTERNESS-FILLMORE CO	E2 11 T101NR08W	2.75	3i		4	4	D	1-2		
AMN008	NEW ULM QUARTZITE QUARRY	QUARTZITE-NICOLLET CO	SW 35 T110NR30W	2.63	3i		2	2		2ND LEDGE		
AMN010	MARTIN MARIETTA AGGREGATES	ST CLOUD-GRANITE-STEARNS CO	19 T124NR28W	DWU	3		2	2		FULL FACE		
AMN014	SKYLINE MATERIALS LTD	BIG SPRINGS-FILLMORE CO	SW 9 T101NR10W					4		1-6		
AMN018	ULLAND BROTHERS INC	GRAND MEADOW-MOWER CO	NE 9 T103NR14W									
AMN030	MILESTONE MATERIALS	GENGLER-HOUSTON CO	SW 16 T102NR05W	DWU	3B		4	4	D	1-2		
										1-4	A B C D E	
AMN034	MILESTONE MATERIALS	ENGRAV-HOUSTON CO	NE 24 T101NR08W	DWU	3i		4	4	D	1A-2B	A B C D E	
AMN044	MILESTONE MATERIALS	BIESANZ-WINONA CO	SW 19 T107NR07W	DWU	3i		4	4	D	1-2		
AMN046	MILESTONE MATERIALS	43 QUARRY-WINONA CO	NW 16 T106NR07W	DWU	3i		4	4	D	1-2		
AMN052	MILESTONE MATERIALS	ABNET-HOUSTON CO	SW 2 T104NR05W	DWU	3i		4	4	D	4-5		
				DWU	3		4	4	D	1-3		
		SAND AND GRAVEL										
AMN504	BRUENING ROCK PRODUCTS INC	NEW ALBIN-HOUSTON CO	9 T101NR04W			H	4	4				
AMN516	ULLAND BROTHERS INC	OLSON-FREEBORN CO	NW 31 T102NR20W	DWU		X	4	4				
AMN518	SKYLINE MATERIALS LTD	LANESBORO-FILLMORE CO	SE 7 T104NR10W	DWU		X						
AMN522	AGGREGATE INDUSTRIES	PRAIRIE ISLAND #3-GOODHUE CO	23 T114NR15W	DWU	2	X						1
AMN524	AGGREGATE INDUSTRIES	HASTINGS #2-DAKOTA CO	2 T114NR17W			H						
AMN532	ULLAND BROTHERS INC	LARSON-FREEBORN CO	25 T102NR21W			H						
AMN536	AGGREGATE INDUSTRIES	ELK RIVER-SHERBURNE CO	9 T33N R26W	DWU	3i							
				DWU		X						
AMN538	ULLAND BROTHERS INC	SHADE-MOWER CO	NW 4 T101NR18W	DWU		X						
AMN544	AGGREGATE INDUSTRIES	LAKEVILLE-DAKOTA CO	06 T114NR19W	DWU	2	X						1
AMN546	M.R. PAVING & EXCAVATION	WALLNER-BROWN CO	NW 24 T110NR30W			HL						2
AMN548	CEMSTONE PRODUCTS COMPANY	HENDERSON-SIBLEY CO	23 T113NR26W	DWU	2	H						
AMN550	DAKOTA AGGREGATES	SACHS-DAKOTA CO	W2 24 T114NR19W	DWU	3i		3	3				
				DWU		X						
AMN552	EUREKA SAND AND GRAVEL INC	WINDMILL-DAKOTA CO	12 T113NR20W	DWU		X						
AMN554	ANNANDALE ROCK PRODUCTS	ANNENDALE-WRIGHT CO	35 T121NR28W	DWU		X						
AMN558	AGGREGATE INDUSTRIES	ST CROIX-CHISAGO CO	SW 21 T33N R19W	DWU	2		3	3				
				DWU		X						
AMN560	DAKOTA AGGREGATES	ROSEMOUNT-DAKOTA CO	NE 33 T115NR19W	DWU	3	X	3	3				
AMN564	MIDWEST ASPHALT CORPORATION	HASTINGS-MAR FARMS-DAKOTA CO	SE 11 T114NR17W	DWU	3	H	3	3				
AMN566	BARTON SAND & GRAVEL CO	ELK RIVER-SHERBURNE CO	10 T33N R26W	DWU	3i		3	3				

NOTE 1: SAND IS LIMITED TO PRECAST ONLY
NOTE 2: APPROVED FOR CLASS L FINE AGGREGATE.

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2
A				
AGGREGATE INDUSTRIES	2915 WATERS ROAD STE 105	EAGAN, MN 55121	(651)683-0600	
ALEXANDRIA GRAVEL PRODUCT, LLC	PO BOX 38	ALEXANDRIA, MN 56308	(320)762-5620	
AMES CONSTRUCTION	2500 COUNTY RD 42W	BURNSVILLE, MN 55306	(952)435-7106	
ANDERSON SAND AND GRAVEL CO	2578 270TH AVE	DEWITT, IA 52742	(563)659-5506	
ARCADIA LIMESTONE CO	19011 CRYSTAL AVENUE	ARCADIA, IA 51430	(712)689-2299	
B				
BARD MATERIALS	2021 325TH AVENUE	DYERSVILLE, IA 52040	(563)875-7145	(563)875-7860 (FAX)
BARTON SAND & GRAVEL CO	7200 HEMLOCK LANE N	MAPLE GROVE, MN 55369	(763)425-4191	
BD CONSTRUCTION SERVICES LLC	P O BOX 1134	SPENCER, IA 51301	(712)363-1499	
BEDROCK GRAVEL CO	1002 HWY 59 S	SCHLESWIG, IA 51461	(712)676-3752	
BELLCO OF NEBRASKA INC	2826 SOUTH AVE	COUNCIL BLUFFS, IA 51503	(712)322-8501	(712)322-8526 (FAX)
BELLEVUE SAND & GRAVEL CO	29427 HWY 52	BELLEVUE, IA 52031	(563)872-3886	
BENTONS SAND & GRAVEL	905 CENTER STREET	CEDAR FALLS, IA 50613	(319)266-2621	(319)266-5926 (FAX)
BLACKHEART SLAG	5401 VICTORIA AVE SUITE 110	DAVENPORT, IA 52807	(563)359-8251	
BLENDED EQUIPMENT SOLUTIONS	108 5TH AVE SW	ALTOONA, IA 50009	(515)393-9631	
BLUFF CITY MINERALS LLC	4007 COLLEGE AVENUE	ALTON, IL 62002	(314)315-7478	
BLUFF CITY SAND	658 W. BROADWAY	ALTON, IL 62002	(314)713-8876	
BMC AGGREGATES LC	101 BMC DRIVE	ELK RUN HEIGHTS, IA 50707	(319)235-6583	(319)235-7065 (FAX)
BOON CONSTRUCTION CO	N 5399 STATE HWY 73	NEILLSVILLE, WI 54456	(715)743-4262	
BOYER SAND & ROCK INC	4162 BIRCH AVENUE	HAWARDEN, IA 51023	(712)552-2308	
BRIDGEPORT MATERIALS	2241 PORT NEAL ROAD	SERGEANT BLUFF, IA 51054	(712)253-8449	
BROCKMAN SAND CO	2397 263RD AVE P.O. BOX 312	FORT MADISON, IA 52627	(319)372-7138	
BRUENING ROCK PRODUCTS INC	325 WASHINGTON STREET P.O. BOX 127	DECORAH, IA 52101	(563)382-2933	(563)382-8375 (FAX)
BUILDERS CHOICE AGGREGATES	6721 NW 17TH ST	TOPEKA, KS 66618	(785)233-7263	
BUSHMAN EXCAVATING INC	600 FAIRFAX ROAD	FAIRFAX, IA 52228	(319)551-8092	
C				
CANTERA AGGREGATES	1847 100TH STREET	CORYDON, IA 50060	(641)872-2800	
CAP, LLC	3150 RUSTIN STREET	SIOUX CITY, IA 51105	(402)925-8011	
CARNARVON SAND & GRAVEL	811 N. 10TH ST	DENISON, IA 51442	(712)263-3582	
CAVE CRUSHING INC	5139 B AVE	MARCUS, IA 51035	(712)261-0565	
CEMSTONE PRODUCTS COMPANY	2025 CENTRE POINTE BOULEVARD SUITE 300	MENDOTA HEIGHTS, MN 55120	(651)688-9292	
CENTRAL IOWA READY MIX DBA GREEN COUNTY MATERIALS	5550 NE 22ND STREET	DESMOINES, IA 50313	(515)266-5173	
CENTRAL STONE CO#1	RR 1 P.O. BOX 236	HANNIBAL, MO 63401-9622	(573)735-4525	

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2	
C Continued					
CESSFORD CONST CO	2320 ZELLER AVENUE	LE GRAND, IA 50142	(641)479-2435	(641)479-2003	(FAX)
CESSFORD CONST CO- SE DIV	3808 OLD HWY 61	BURLINGTON, IA 52601	(319)753-2297	(319)753-0926	(FAX)
CJ MATERIALS INC	14849 LYNDON ROAD	MORRISON, IL 61270	(815)772-7181		
CJ MOYNA & SONS INC	24412 HWY 13	ELKADER, IA 52043	(563)245-1442		
CLEVERINGA EXCAVATING LLC	4451 KENNEDY AVE	ALTON, IA 51003	(712)737-4763		
COHRS CONSTRUCTION INC	15700 NORTH TRADEWIND DR	SPIRIT LAKE, IA 51360	(712)832-3714		
CON-STRUCT, INC.	305 S. DAYTON AVE.	AMES, IA 50010	(515)232-6443		
CONCRETE INC	1710 EAST MAIN STREET	MARSHALLTOWN, IA 50158	(641)752-3696		
CONCRETE MATERIALS CO	1201 WEST RUSSELL	SIOUX FALLS, SD 57104	(605)357-6000		
CONCRETE TECHNOLOGIES INC	1001 SE 37TH ST	GRIMES, IA 50111	(515)240-9433		
CONRECO INC	4901 G STREET	OMAHA, NE 68117	(402)733-4100	(402)733-5774	(FAX)
CORELL RECYCLING	200 SOUTH 13TH STREET	WEST DES MOINES, IA 50265	(515)223-8010		
COUNTY MATERIALS CORPORATION	205 NORTH ST. POB 100	MARATHON, WI 54448	(715)848-1365		
CRAWFORD QUARRY CO	HWY 94 NW P.O. BOX 1027	CEDAR RAPIDS, IA 52046	(319)396-5705		
CROELL REDI MIX	POB 430	NEW HAMPTON, IA 50659	(641)394-3770		
CRUSHED AGGREGATE PRODUCTS LLC	2325 S. 27TH AVE	OMAHA, NE 68105	402-345-9723		
CTI READY MIX	1001 SE 37TH ST	GRIMES, IA 50111	(515)276-9567		
D					
DAVE'S SAND AND GRAVEL INC	1070 330TH STREET	EVERLY, IA 51338	(712)834-2515		
DELONG RECYCLING, INC	1320 N 8TH AVENUE PO BOX 488	WASHINGTON, IA 52353	(319)653-3334		
DES MOINES ASPHALT & PAVING	5109 NW BEAVER DRIVE	JOHNSTON, IA 50131	(515)262-8296		
DOUDS STONE LLC	13133 ANGLE RD SUITE B P.O. BOX 187	OTTUMWA, IA 52501	(641)683-1671	(641)683-1673	(FAX)
DUININCK BROS INC	408 6TH ST P.O. BOX 208	PRINSBURG, MN 56281	(320)978-6011		
E					
ELDER CORPORATION	5088 EAST UNIVERSITY AVE	PLEASANT HILL, IA 50327	(515)266-3111		
F					
FALK L R- CONSTRUCTION CO	227 W 4TH STREET P.O. BOX 189	ST ANSGAR, IA 50472-0189	(641)713-4569		
FALKSTONE LLC	227 W 4TH STREET P.O. BOX 189	ST ANSGAR, IA 50472-0189	(641)713-4569		
FLOYD RIVER MATERIALS	32138 HICKORY AVE	SIOUX CITY, IA 51101	(712)233-1111		
FORT DODGE ASPHALT CO	2516 7TH AVENUE SOUTH	FORT DODGE, IA 50501	(515)573-3124		
G					
GEHRKE QUARRIES INC	P. O. BOX 521	ELDORA, IA 50627	(641)858-3821	(641)858-2564	(FAX)

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2
G Continued				
GEO TECH MATERIALS	13091 EAGLE DRIVE	DOUDS, IA 52551	(641)799-1235	
GIZA CONTRACTING	1739 COMMERCE RD	CRESTON, IA 50801	641-782-8820	
GRAY QUARRIES INC	P. O. BOX 386	HAMILTON, IL 62341	(217)847-2712	
GREENE COUNTY REDI MIX DBA HAMILTON REDI MIX	1295 ORCHARD AVE	JEFFERSON, IA 50129	(515)370-2066	
GRIMES ASPHALT & PAVING	5550 NE 22ND ST.	DES MOINES, IA 50313	(515)986-3649	
GROUND ZERO SERVICES	308 FOURTH ST	COURTLAND, MN 56021	(507)354-3973	
H				
HALLETT MATERIALS CO	2401 SE TONES DRIVE SUITE 13	ANKENY, IA 50021	(515)266-9928	(515)263-3878 (FAX)
HANCOCK CONCRETE PRODUCTS, LLC	17 ATLANTIC AVENUE	HANCOCK, MN 56244	(320)392-5207	(320)392-5155 (FAX)
HANK STALP GRAVEL CO	1598 RIVER ROAD	WEST POINT, NE 68788	(402)372-5491	(402)372-5477 (FAX)
HARDROCK AGGREGATE	1338 221ST STREET	HARDWICK, MN 56134	(612)655-1504	
HAWKEYE PAVING CORPORATION	801 42ND STREET S	BETTENDORF, IA 52722	(563)355-6834	
HEARTLAND ASPHALT INC	2601 SOUTH FEDERAL AVE	MASON CITY, IA 50401	(641)424-1733	
HEIMES EXCAVATING & UTIL CO	9144 SOUTH 147TH ST	OMAHA, NE 68138	(402)894-1000	
HENNING AGGREGATE	201 LOUISIANA AVE	ADRIAN, MN 56110	(612)655-1504	
I				
IDEAL SAND CO	3902 MT PLEASANT ST P.O. BOX 416	WEST BURLINGTON, IA 52655	(319)754-4747	
INROADS PAVING & MATERIALS LLC	4224 HUBBELL AVE STE 1	DES MOINES, IA 50317	(515)348-8148	
IOWA DRAINAGE INC	703 E. GILMAN ST P.O. BOX 7	SHEFFIELD, IA 50475	(641)892-4330	
IRON MOUNTAIN TRAPROCK CO	1325 HIGHWAY N	IRONTON, MO 63650	(314)223-0830	
J				
JB HOLLAND CONSTRUCTION INC	2092 HWY 9 WEST	DECORAH, IA 52101	(563)382-2901	
K				
KINNEY & SONS EXCAVATING AND GRADING INC.	1105 W. Washington St. Suite 102	Mt. Pleasant, IA 52641		
KNIFE RIVER MIDWEST, LLC	2220 HAWKEYE DRIVE	SIOUX CITY, IA 51104	(712)252-2766	
KNOPIK SAND & GRAVEL INC	1574 375TH AVE	ESTHERVILLE, IA 51334	(712)362-4231	
KOSSUTH COUNTY	114 W. STATE ST.	ALGONA, IA 50511	(515)295-3320	
L				
L G EVERIST INC	300 S. PHILLIPS AVE SUITE 200	SIOUX FALLS, SD 57117	(605)334-5000	
L&M SAND & GRAVEL INC	426 2ND AVE NE	LE MARS, IA 51031	(712)546-5359	

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2
L Continued				
L&W QUARRIES INC	P. O. BOX 335	CENTERVILLE, IA 52544	(641)437-4830	(641)437-4837 (FAX)
LA HARV CONST CO INC	P. O. BOX 267	FOREST CITY, IA 50436	(641)581-3643	
LANGMAN CONSTRUCTION, INC.	220-34TH AVENUE	ROCK ISLAND, IL 61201	(309)786-8944	
LEGACY MATERIALS	35740 UTE COURT	BOONEVILLE, IA 50038	515)336-2245	
LESSARD CONTRACTING INC	P. O. BOX 705	SERGEANT BLUFF, IA 51054	(712)252-4131	
LIBERTY READY MIX	3921 121ST ST	URBANDALE, IA 50323	(515)278-4807	
LINWOOD MINING & MINERALS CORP	5401 VICTORIA AVE SUITE 110	DAVENPORT, IA 52807	(563)359-8251	(563)344-3730 (FAX)
LOUNSBURY LANDSCAPING	6000 RACCOON RIVER DR	WEST DES MOINES, IA 50266	(515)225-7100	
LUNDELL CONSTRUCTION CO, INC	1420 EAST RICHLAND ST	STORM LAKE, IA 50588	(712)732-4059	
LYMAN-RICHEY SAND & GRAVEL	4315 CUMING STREET	OMAHA, NE 68131	(402)558-2727	
M				
MALLARD SAND & GRAVEL	P. O. BOX 638	VALLEY, NE 68064	(402)359-5287	
MANATTS INC	1755 OLD 6 ROAD P.O. BOX 535	BROOKLYN, IA 52211	(641)522-9206	(641)522-9407 (FAX)
MANATTS SAND & GRAVEL	1928 340TH STREET P.O. BOX 87	TAMA, IA 52339	(641)484-4022	
MARENGO READY MIX INC	P. O. BOX 121	MARENGO, IA 52301-0121	(319)642-3811	
MARK ALBENESIUS, INC.	608 152ND STREET	SOUTH SIOUX CITY, NE 68776	(402)494-2815	(402)494-2873 (FAX)
MARTIN MARIETTA - KC DISTRICT	7381 W. 133RD STREET - SUITE 401	OVERLAND PARK, KS 66213	(816)452-1219	
MARTIN MARIETTA AGGREGATES	11252 AURORA AVE	DES MOINES, IA 50322	(515)254-0030	(515)254-0035 (FAX)
MASHUDA CONTRACTORS, INC	POB 16	PRINCETON, WI 54968	(920)295-3329	
MAXIM TRUCKING INC	902 WEST 8TH STREET	PELLA, IA 50219	(641)780-2050	
MCCARTHY IMPROVEMENT COMPANY	5401 VICTORIA AVENUE	DAVENPORT, IA 52807	(563)529-6084	
MELLER EXCAVATING & ASPHALT , INC.	3321 190TH ST	FORT MADISON, IA 52627	(319)372-7410	
MIELKES QUARRY	13303 SPOOK CAVE RD	MCGREGOR, IA 52157	(563)539-4227	
MILESTONE MATERIALS	920 10TH AVE NORTH P.O. BOX 189	ONALASKA, WI 54650	(608)783-6411	(608)783-4311 (FAX)
MILL CREEK MINING	510 10TH AVE EAST	MILAN, IL 61264	(309)787-1414	
MILLER MATERIALS	3303 JOHN DEERE ROAD	SILVIS, IL 61282	(563)529-5060	
MOBILE CRUSHING & RECYCLING, INC.	2663 OSCEOLA AVENUE	OTHO, IA 50569	(515)576-8080	
MOHR SAND, GRAVEL, & CONST LLC	P.O. BOX 232 104 ASH STREET	LOHRVILLE, IA 51453	(712)210-7078	
MONEY PIT LLC	6340 180TH ST	OCHEYEDAN, IA 51354	(712)758-3729	
MURPHY HEAVY CONTRACTING CORP	101 ROOSEVELT ST	ANITA, IA 50020	(712)762-3386	(712)762-4197 (FAX)
MYRL & ROYS PAVING INC	1300 NORTH BAHNSON AVE	SIOUX FALLS, SD 57103	(605)334-3204	(605)334-0468 (FAX)
N				
NELSTAR	210 WALNUT	MERIDEN, IA 51037	(712)443-8832	

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2	
N Continued					
NEW ULM QUARTZITE QUARRY	ROUTE 5 P.O. BOX 21	NEW ULM, MN 56073	(507)354-2925	(507)359-7870	(FAX)
NORRIS QUARRIES LLC	219 3RD ST P.O. BOX 190	CAMERON, MO 64429	(816)324-0310		
NORTH IA SAND & GRAVEL INC	18237 KILLDEER AVE	MASON CITY, IA 50401	(641)424-5591	(641)423-1894	(FAX)
NORTHERN CON-AGG, LLP	1450 131ST STREET	LUVERNE, MN 56156	(507)283-2124		
NORTHWEST MATERIALS	16 NORTH TAFT ST P.O. BOX 632	HUMBOLDT, IA 50548	(515)332-4208	(515)332-3653	(FAX)
NORTHWEST R/M CONCRETE INC	6340 180TH ST	OCHEYEDAN, IA 51354	(712)758-3683		
NSG, LLC	2935 HIGHWAY 18	DICKENS, IA 51333	(712)836-2345		
NU AGGREGATES	300 NORKA DRIVE	AKRON, IA 51001	(712)568-2181		
P					
PARR CONTRACTING, LLC	11329 State Hwy 141	Mapleton, IA 51034	(712)870-4856		
PATRICK M PINNEY CONTRACTORS, INC	1915 FLOYD BLVD P.O. BOX 5107	SIOUX CITY, IA 51102	(712)252-2774		
PATTISON SAND COMPANY LLC	701 1ST ST	CLAYTON, IA 52049	(563)964-2984		
PBI CONSTRUCTION	4953 D AVE	MARCUS, IA 51035	(712)376-4886		
PELLA CONSTRUCTION CO., LTD	P. O. BOX 25	PELLA, IA 50219	(641)628-3840		
PERFORMANCE GRADING LLC	1404 - 800TH ST	HARLAN, IA 51537	(402)682-2464		
PERU QUARRY	2587 265TH ST	PERU, IA 50222	(515)468-0315		
PETERSON CONTRACTORS INC	104 BLACKHAWK P.O. BOX A	REINBECK, IA 50669	(319)345-2713		
PETTENGILL CONC & GRAVEL INC	800 NORTH BOONE	ROCK RAPIDS, IA 51246	(712)472-2571		
PIERCE SAND	220 S. OAK	STANBERRY, MO 64489	(660)562-8645		
PNB PROCESSORS LLC	P.O. BOX 80	DENMARK, IA 52624	(319)470-0050		
PORTZEN CONSTRUCTION	205 Stone Valley Drive	Dubuque, iA 52003	(563)542-3574		
PRAIRIE SAND & GRAVEL	P. O. BOX 210	PRAIRIE DU CHIEN, WI 53821	(608)326-6471		
PRESTON READY MIX CORP	P. O. BOX 399	PRESTON, IA 52069	(563)689-3381		
Q					
QBQ INDUSTRIES, LLC	2577 SOUTH AVE	COUNCIL BLUFFS, IA 51503	(608)314-4868		
R					
RAINBOW QUARRY LLC	800 VOLNEY RD	MONONA, IA 52159	(563)535-7606		
RECYCLED AGGREGATE PROD CO	2131 18TH STREET	SIOUX CITY, IA 51105	(712)252-7732		
RED ROCK QUARRY	12226 KNOX AVE	SANBORN, MN 56083	(507)648-3382		
REDINGS GRAVEL & EXCAVATING CO	2001 EAST OAK STREET	ALGONA, IA 50511	(515)295-3661		
REILLY CONSTRUCTION CO	110 MAIN STREET P.O. BOX 99	OSSIAN, IA 52161	(563)532-9211	(563)532-9759	(FAX)
RIEHM CONSTRUCTION CO INC	2340 9TH ST SW	WAUKON, IA 52172	(563)568-3314		

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2	
R Continued					
RIVER CITY STONE INC	3747 CONSTRUCTORS COURT P.O. BOX 160	KEILER, WI 53812-0160	(608)568-3433		
RIVER PRODUCTS CO INC	3273 DUBUQUE ST NE P.O. BOX 2120	IOWA CITY, IA 52244-2120	(319)338-1184	(319)353-6606	(FAX)
RIVERSTONE GROUP INC	1701 5TH AVE	MOLINE, IL 61265	(309)757-8250	(309)757-8257	(FAX)
ROCK HARD CONCRETE RECYCLING INC	214 E MAIN ST PO BOX 217	WEST BRANCH, IA 52358	(319)631-3903		
ROCKY MOUNTAIN ENTERPRISES	6515 COUNTY HIGHWAY H	ATHENS, WI 54411	(715)257-1440	(715)257-1140	(FAX)
ROGERS CONCRETE CONSTRUCTION, INC.	22802 COUNTY RD E-34	ANAMOSA, IA 52205	(319)462-4290		
S					
S&A CONSTRUCTION LTD	P. O. BOX 20	ALLENDALE, MO 64420	(660)786-2233		
S&G MATERIALS	4213 SAND ROAD SE	IOWA CITY, IA 52240	(319)354-1667		
SAYLORCREEK SAND COMPANY	1600 NW 66TH AVE	DES MOINES, IA 50313	(515)289-1850		
SCHILDBERG CONSTRUCTION CO	P. O. BOX 358	GREENFIELD, IA 50849	(641)743-2131		
SCHMILLEN CONST INC	4772 C AVE	MARCUS, IA 51035-0488	(712)376-2249		
SEAN NEGUS CONSTRUCTION LLC	11828 N 34TH AVE	OMAHA, NE 68112	(402)740-5320		
SHIPLEY CONTRACTING	2671 240TH STREET	FORT MADISON, IA 52625	(319)372-1804		
SIEH SAND & GRAVEL	101 WEST 18TH STREET P.O. BOX 1503	SPENCER, IA 51301	(712)836-2244	(712)262-4580	
SKYLINE MATERIALS LTD	325 WASHINGTON STREET POB 127	DECORAH, IA 52101	(563)382-2933	(563)382-8375	(FAX)
SPENCER QUARRIES	25341 430TH AVE	SPENCER, SD 57374	(605)246-2344		
SPI, INC	5424 1/2 S.Lewis Blvd.	Sioux City, IA 51106	(712)540-1177		
STENSLAND GRAVEL CO	1741 ASHLEY AVE	LARCHWOOD, IA 51241	(712)477-2280		
STERZINGER CRUSHING INC	3273 290TH AVE	TAUNTON, MN 56291	(507)872-6547		
STONER SAND	33463 EAST 250TH	RIDGEWAY, MO 64481	(660)824-4211		
STRATFORD GRAVEL INC	600 HIGHWAY 175 PO BOX 229	STRATFORD, IA 50249	(515)838-2475		
STRONG ROCK & GRAVEL	721 SOUTH FRONT ST	LANSING, IA 52151	(563)880-8150		
SWAIN CONSTRUCTION INC.	6002 NORTH 89TH CIRCLE	OMAHA, NE 68134	(402)571-1110		
SWAN LAND IMPROVEMENT OF MO LLC	28542 E 230TH PLACE	RIDGEWAY, MO 64481	(660)872-6221		
SWAN ROCK & SAND PRODUCTS LLC	27453 210TH AVE P.O. BOX 111	CINCINNATI, IA 52549	(641)658-2474		
T					
TIEFENTHALER AG-LIME INC	11975 HAWTHORNE AVE P. O. BOX 157	BREDA, IA 51436	(712)673-2686		
TRAP ROCK & GRANITE QUARRIES LLC	11313 HWY N	IRONTON, MO 63650	(573)546-4016		
TRI STAR QUARRIES	11278 474TH ST	PLANO, IA 52581	(641)649-2666		
TUBE CITY IMS CORP	1500 WEST 3RD STREET	WILTON, IA 52778	(563)732-4010		
U					
ULLAND BROTHERS INC	2400 MYERS ROAD	ALBERT LEE, MN 56007	(507)373-1960	(507)433-1819	

APPROVED PRODUCERS
WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP	PHONE	PHONE 2
U Continued				
UNITED CONTRACTORS, INC	3101 SW BROOKSIDE DRIVE	GRIMES, IA 50111	(515)669-6897	
V				
VALLEY CONSTRUCTION COMPANY	3610 78TH AVENUE WEST	ROCK ISLAND, IL 61201	(309)787-0209	
VALLEY SAND & GRAVEL	POB 9	ROCK VALLEY, IA 51247	(712)476-2063	
W				
WEATHERTON CONTRACTING CO., INC.	307 N 16TH STREET P.O. BOX 151	BERESFORD, SD 57004	(605)763-2078	
WEBER STONE CO INC	12791 STONE CITY ROAD	ANAMOSA, IA 52205	(319)462-3581	(319)462-3585 (FAX)
WEDEKING PIT & PLANT INC.	13810 253RD AVE	SPIRIT LAKE, IA 51360	(712)336-2981	
WENDLING QUARRIES INC	P. O. BOX 230	DEWITT, IA 52742	(563)659-9181	(563)659-3393 (FAX)
WEST DES MOINES SAND CO	3888 WALNUT WOODS DR	DES MOINES, IA 50265	(515)287-2340	
WESTERN ENGINEERING COMPANY	P. O. BOX 350	HARLAN, IA 51537	(712)755-5191	
WINN CORP SAND & GRAVEL	2334 JUNIPER AVENUE	FAIRFIELD, IA 52556	(641)693-3333	
WINONA AGGREGATE	6930 WEST 5TH STREET	MINNESOTA CITY, MN 55987	(507)454-2913	
WRIGHT MATERIALS CO	1127 HWY 69 P. O. BOX 244	BELMOND, IA 50421	(641)444-3920	

IM T-215A
PYCNOMETER MOISTURE

W-W1 TABLE FOR PYCNOMETER MOISTURE DETERMINATION

W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample	W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample	W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample
0	0.0	0.0	**15**	2.4	1.2	**30**	4.8	2.4
1	0.2	0.1	**16**	2.6	1.3	**31**	5.0	2.5
2	0.3	0.2	**17**	2.7	1.4	**32**	5.1	2.6
3	0.5	0.2	**18**	2.9	1.4	**33**	5.3	2.6
4	0.6	0.3	**19**	3.0	1.5	**34**	5.5	2.7
5	0.8	0.4	**20**	3.2	1.6	**35**	5.6	2.8
6	1.0	0.5	**21**	3.4	1.7	**36**	5.8	2.9
7	1.1	0.6	**22**	3.5	1.8	**37**	5.9	3.0
8	1.3	0.6	**23**	3.7	1.8	**38**	6.1	3.1
9	1.4	0.7	**24**	3.9	1.9	**39**	6.3	3.1
10	1.6	0.8	**25**	4.0	2.0	**40**	6.4	3.2
11	1.8	0.9	**26**	4.2	2.1	**41**	6.6	3.3
12	1.9	1.0	**27**	4.3	2.2	**42**	6.7	3.4
13	2.1	1.0	**28**	4.5	2.2	**43**	6.9	3.5
14	2.2	1.1	**29**	4.7	2.3			

W-W1 TABLE FOR PYCNOMETER MOISTURE DETERMINATION

W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample	W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample	W-W1 In Grams	% Moisture/Absorp. 1000 gm Sample	% Moisture/Absorp. 2000 gm Sample
0	0.0	0.0	**15**	2.4	1.2	**30**	4.8	2.4
1	0.2	0.1	**16**	2.6	1.3	**31**	5.0	2.5
2	0.3	0.2	**17**	2.7	1.4	**32**	5.1	2.6
3	0.5	0.2	**18**	2.9	1.4	**33**	5.3	2.6
4	0.6	0.3	**19**	3.0	1.5	**34**	5.5	2.7
5	0.8	0.4	**20**	3.2	1.6	**35**	5.6	2.8
6	1.0	0.5	**21**	3.4	1.7	**36**	5.8	2.9
7	1.1	0.6	**22**	3.5	1.8	**37**	5.9	3.0
8	1.3	0.6	**23**	3.7	1.8	**38**	6.1	3.1
9	1.4	0.7	**24**	3.9	1.9	**39**	6.3	3.1
10	1.6	0.8	**25**	4.0	2.0	**40**	6.4	3.2
11	1.8	0.9	**26**	4.2	2.1	**41**	6.6	3.3
12	1.9	1.0	**27**	4.3	2.2	**42**	6.7	3.4
13	2.1	1.0	**28**	4.5	2.2	**43**	6.9	3.5
14	2.2	1.1	**29**	4.7	2.3			

TEST WORKSHEETS

Fineness Modulus Calculation
(Fine Aggregate for PCC)
AASHTO T27-93

Determine the cumulative percents retained for each sieve, starting with the largest sieve retaining any material, through the #100 sieve. Add the cumulative percents retained and divide that sum by 100. results are reported to the nearest 0.01 (one-hundreth).

Sieves	Percent Retained	Cumulative Percent Retained
⅜"		
#4		
#8		
#16		
#30		
#50		
#100		

Total Cumulative Percent =

Fineness Modulus =

Fineness Modulus Calculation
(Fine Aggregate for PCC)
AASHTO T27-93

Determine the cumulative percents retained for each sieve, starting with the largest sieve retaining any material, through the #100 sieve. Add the cumulative percents retained and divide that sum by 100. results are reported to the nearest 0.01 (one-hundreth).

Sieves	Percent Retained	Cumulative Percent Retained
⅜"		
#4		
#8		
#16		
#30		
#50		
#100		

Total Cumulative Percent =

Fineness Modulus =

Form 820180ex

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:		Total Minus No. 4 (W1):	
Dry Weight Washed:		Reduced Minus No. 4 (W2)	
Washing Loss:		Conversion Factor: W1 ÷ W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"					
1"					
¾"					
½"					
⅜"					
No.4					
No. 8	(B)	(A)			
No.16	(B)	(A)			
No. 30	(B)	(A)			
No. 50	(B)	(A)			
No. 100	(B)	(A)			
No. 200	(B)	(A)			
Washing Loss					
Pan	(B)	(A)			
Total					
Accuracy Check					

Wash Sample			
	Original Dry Weight:		
	Dry Weight Washed:		
	Washing Loss:		
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____

Form 820180ex

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:		Total Minus No. 4 (W1):	
Dry Weight Washed:		Reduced Minus No. 4 (W2)	
Washing Loss:		Conversion Factor: W1 ÷ W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½"					
1"					
¾"					
½"					
⅜"					
No.4					
No. 8	(B)	(A)			
No.16	(B)	(A)			
No. 30	(B)	(A)			
No. 50	(B)	(A)			
No. 100	(B)	(A)			
No. 200	(B)	(A)			
Washing Loss					
Pan	(B)	(A)			
Total					
Accuracy Check					

Wash Sample			
	Original Dry Weight:		
	Dry Weight Washed:		
	Washing Loss:		
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8" sieves. No more than 850 grams should be retained on the 12" No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____

Form 820180ex

Lab. No.:		
Material:		Grad. No.:
Co. & Proj.#:		
Producer:		
Contractor:		
Sampled By:	Date:	
Sample Loc.:		

Original Dry Weight:		Total Minus No. 4 (W1):	
Dry Weight Washed:		Reduced Minus No. 4 (W2)	
Washing Loss:		Conversion Factor: W1 ÷ W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus No. 4	Total or Calc. Weight Retd.	% Retained	% Passing	Specs.
1½”					
1”					
¾”					
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⅜”					
No.4					
No. 8	(B)	(A)			
No.16	(B)	(A)			
No. 30	(B)	(A)			
No. 50	(B)	(A)			
No. 100	(B)	(A)			
No. 200	(B)	(A)			
Washing Loss					
Pan	(B)	(A)			
Total					
Accuracy Check					

Wash Sample			
	Original Dry Weight:		
	Dry Weight Washed:		
	Washing Loss:		
Sieve Size	Weight Retd.	% Retd.	% Passing	Specs.
No. 200				
Washing Loss				
Pan				

Date Reported:	Cert No.:
Tested By:	

NOTE: No more than 200 grams should be retained on the 8” sieves. No more than 850 grams should be retained on the 12” No. 4 sieve, and a maximum of 450 grams on the No. 8 and smaller sieves.

Comments: _____