IOWA DOT
GETTING YOU THERE

AGGREGATE SAMPLER

2023-2024

TECHNICAL TRAINING AND CERTIFICATION PROGRAM

IOWA DOT CONTACT INFORMATION

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Iowa DOT Websites of Interest

https://www.iowadot.gov/#/services

Home page for the Iowa DOT. Links to all departments and doing business with the Iowa DOT.

https://www.iowadot.gov/training/technical-training-and-certification-program

Training resource page with links to the Technical Training and Certification Program and Web-based training.

https://www.iowadot.gov/Construction_Materials

Office of Construction and Materials home page. It has the Shades program, updated IMs, PCC programs, HMA programs, and Training Information.

https://www.iowadot.gov/erl/index.html

Link to ERL containing Iowa DOT specifications. Also, you can order your own ERL CD. The ERL contains current specifications, general supplementals, and Materials IMs.

https://iowadot.gov/design

Office of Design home page. Contains links to Road Standards and Road Design Details that are referenced in the plans.

https://iowadot.gov/local_systems

Office of Local Systems publications. Contains Iowa gyratory mix design bulletins, local jurisdictions contact information, and Iowa DOT phone book.

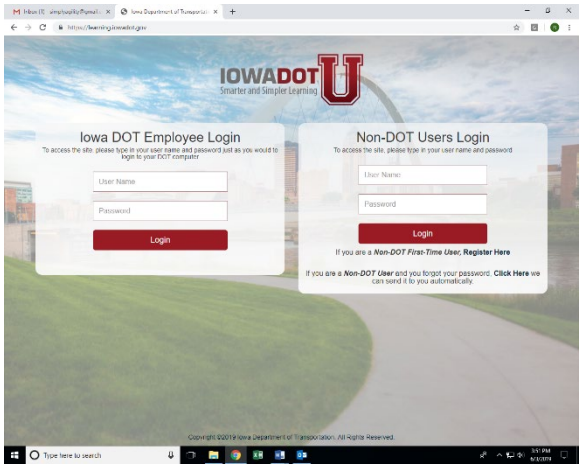
WEBSITES USED IN TTCP CLASSES

There are 2 websites you will use as a TTCP Student. You will set yourself up as a user of each of these websites. It's important that you remember your user name and password for each site (hint: since you are setting each of them up yourself, you could use the same password for each site.)

IOWADOTU

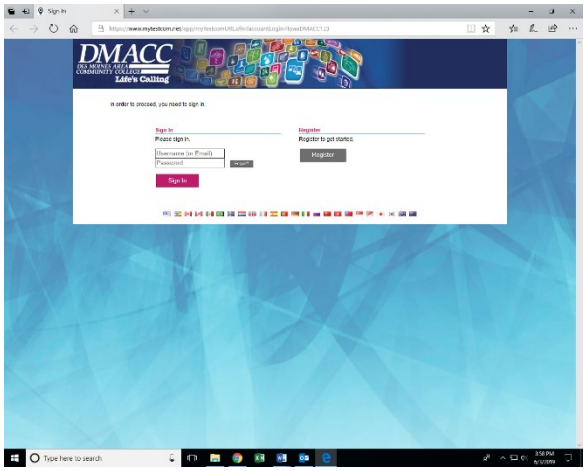
https://learning.iowadot.gov/

This is where you register for classes and take web-based training. You can also print your training records transcripts here. Step-by-step instructions are available at https://iowadot.gov/training/technical-training-and-certification-program



COMPUTER TESTING

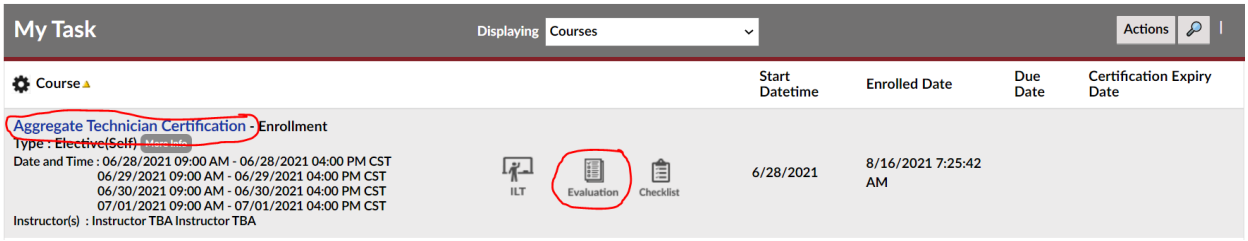
All TTCP Exams will be done on the computer. Your instructor will guide you to the Test.Com website and assist with any registration requirements. Questions are multiple choice, and you will be able to see your score immediately as well as the questions that you missed.



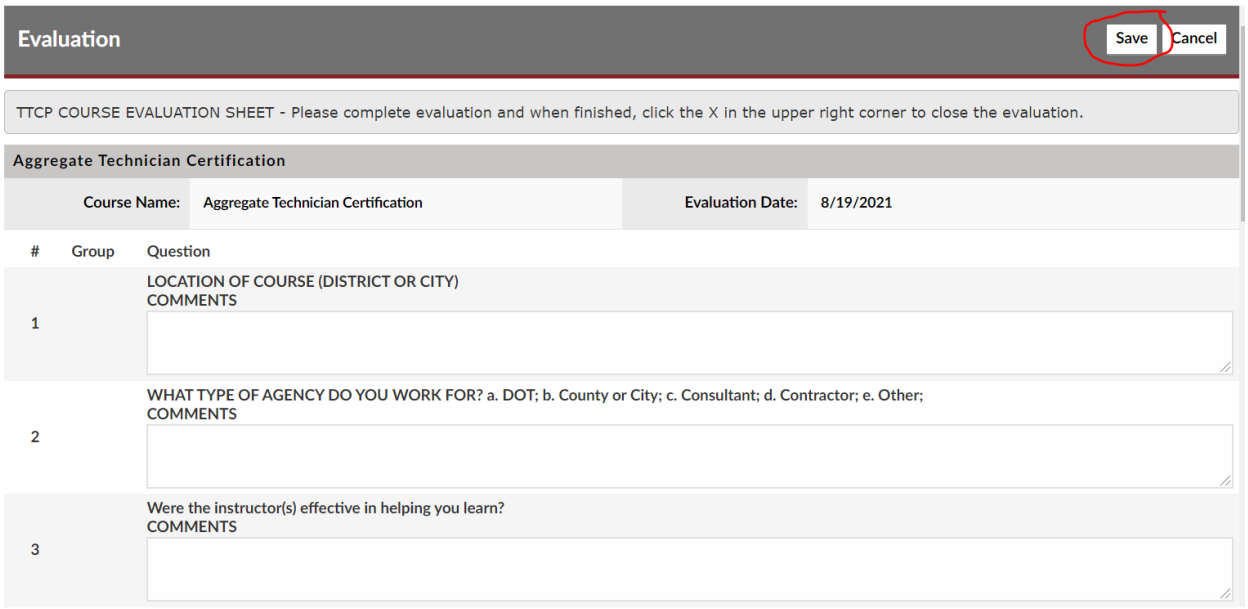
CLASS EVALUATIONS

Evaluations will now be completed outside of the classroom. They are available in IowaDOTU and can be found at this web address: https://learning.iowadot.gov/

Please login to the system and then scroll down to where you see the “My Task” line. Locate the class that you were enrolled in and completed. To the right of the class name, you will see an icon for the Evaluation. Click the Evaluation icon and it will open the evaluation for you to complete electronically.



Once you have completed the 11 questions on the evaluation, scroll to the top of the page and click the “Save” button. Thank you for completing this evaluation!



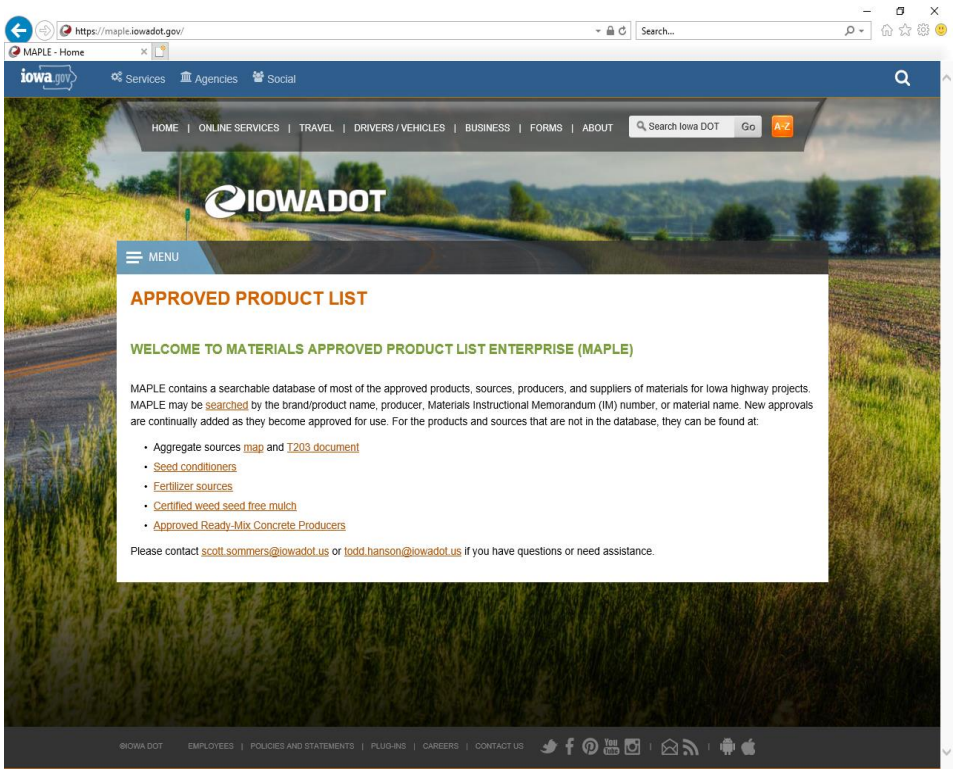
User's Guide for
Materials Approved List Enterprise (MAPLE)

1. Introduction

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

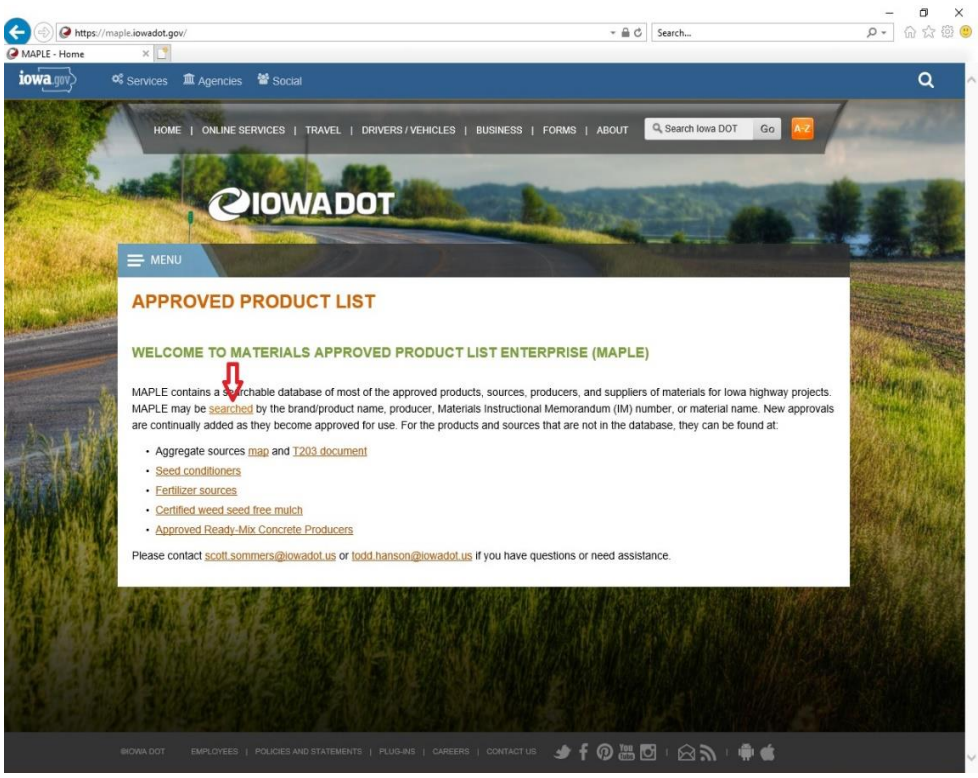
2 How to get to MAPLE

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

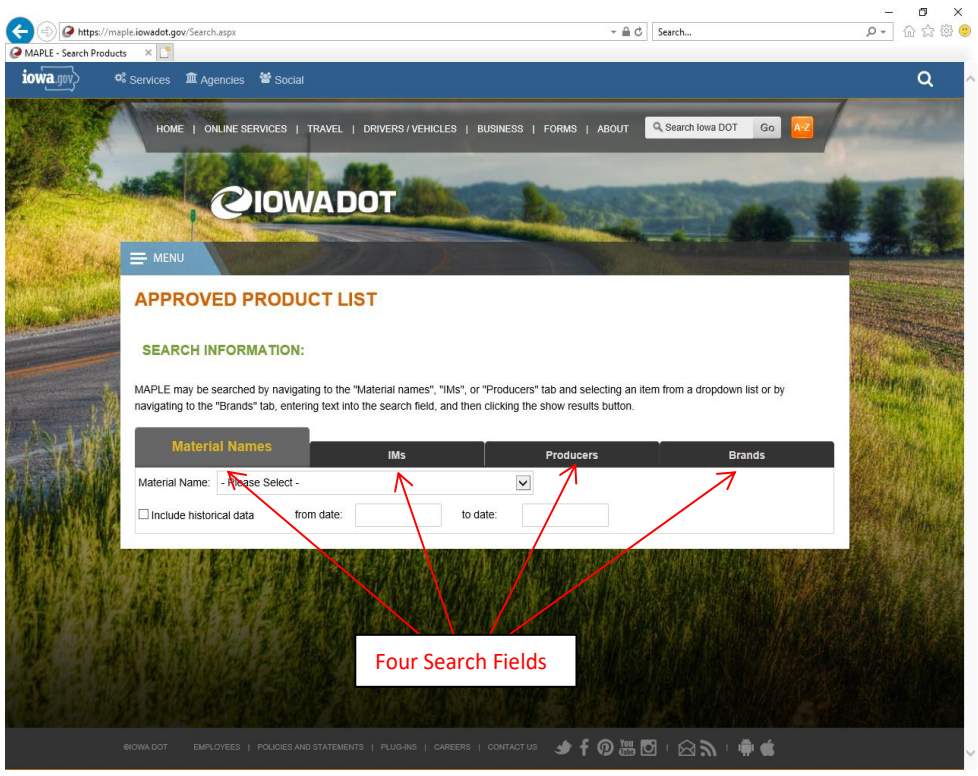


3. Searching MAPLE

Click on the **Searched** link as shown below.

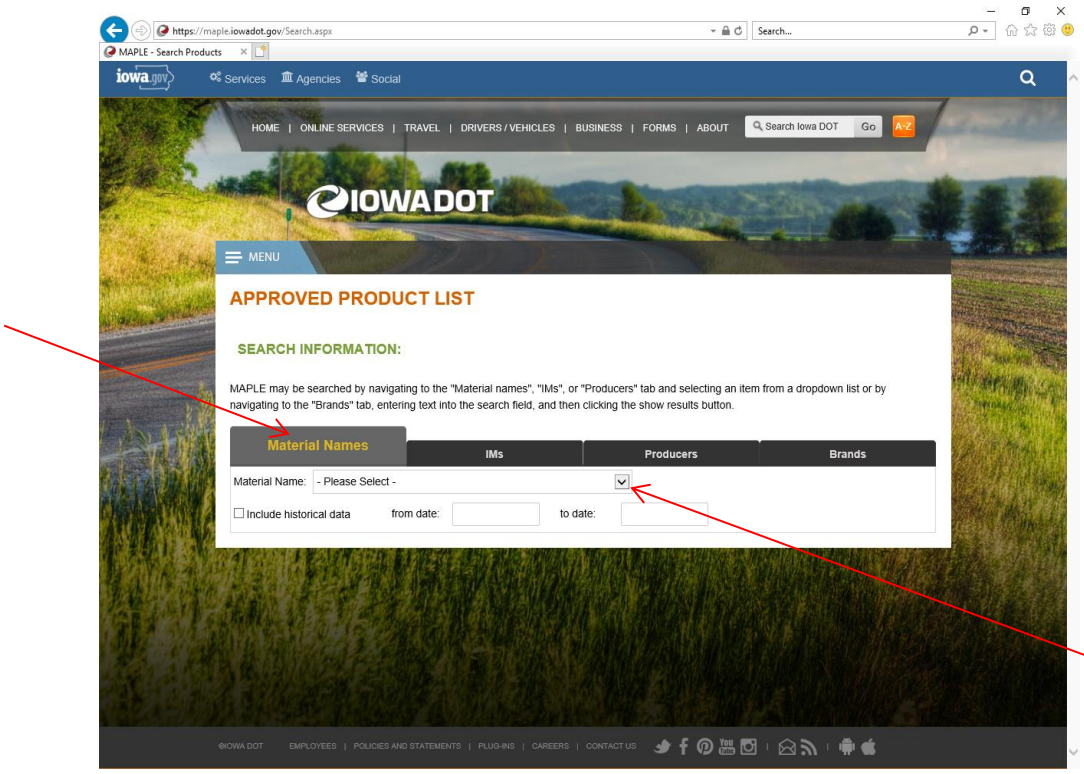


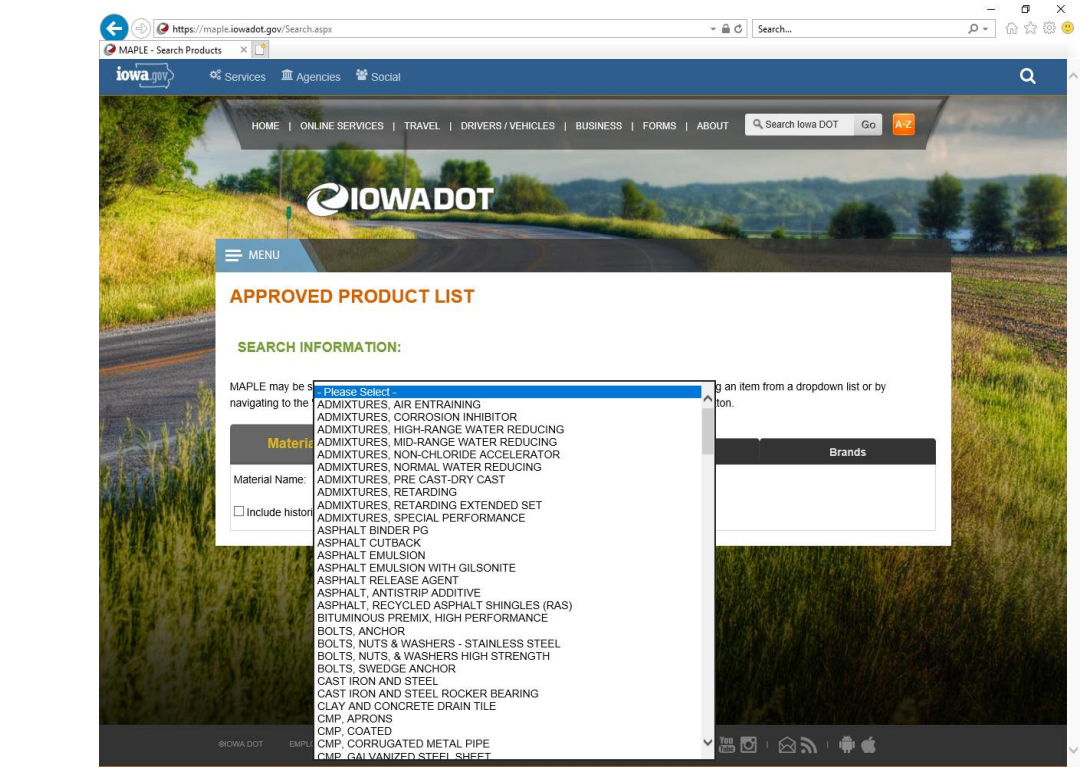
The user can search **MAPLE** through one of four fields listed: **Material Names, IMs, Producers, and Brands**.



4. Search by Material Names

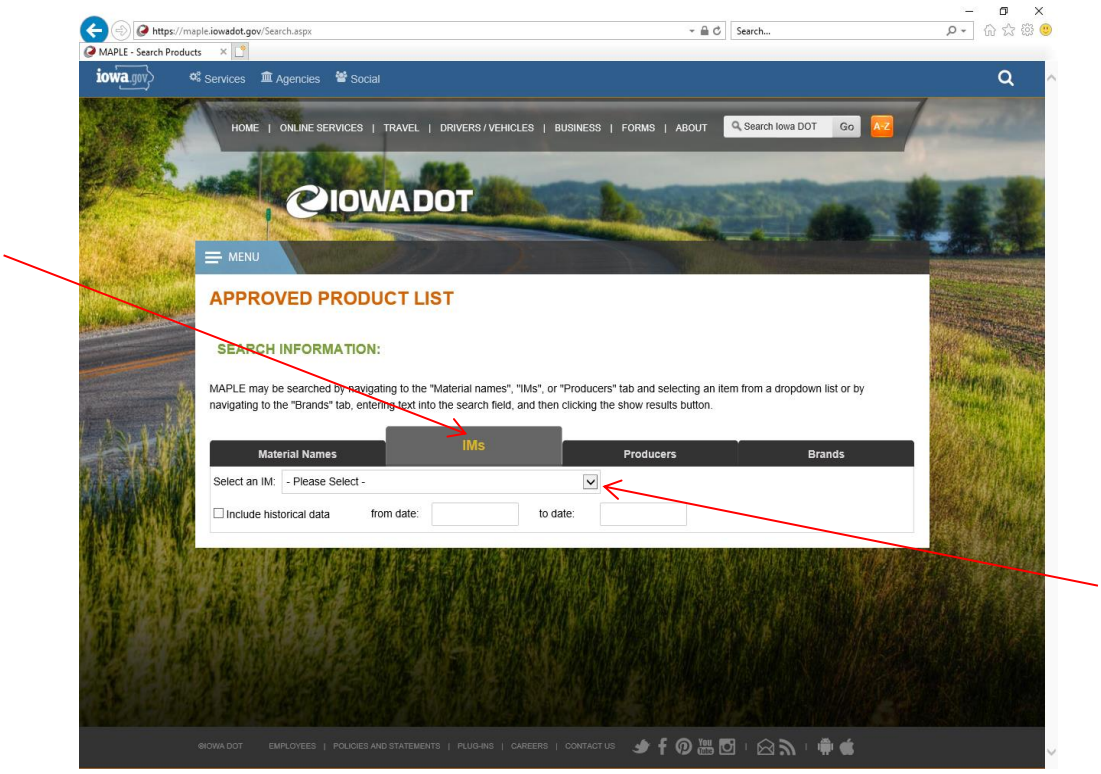
Click on the **Material Names** tab to search by type of material. Click on the arrow and a list will appear as shown. Click on any of the material names to produce an approved product list.

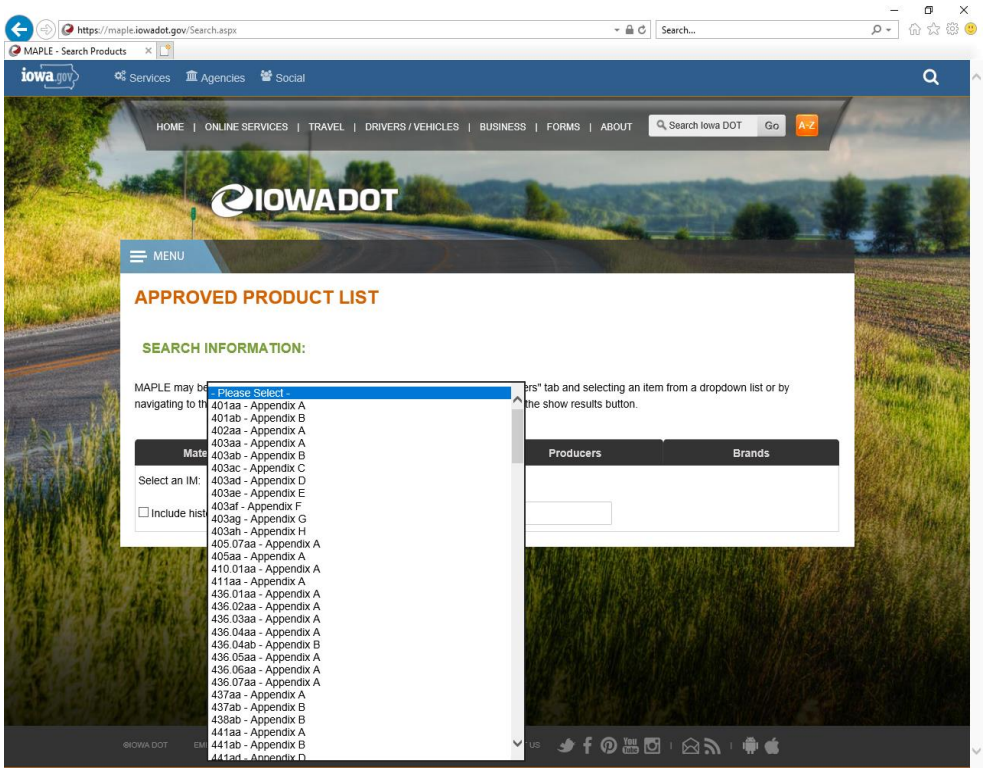




5. Searching by IMs

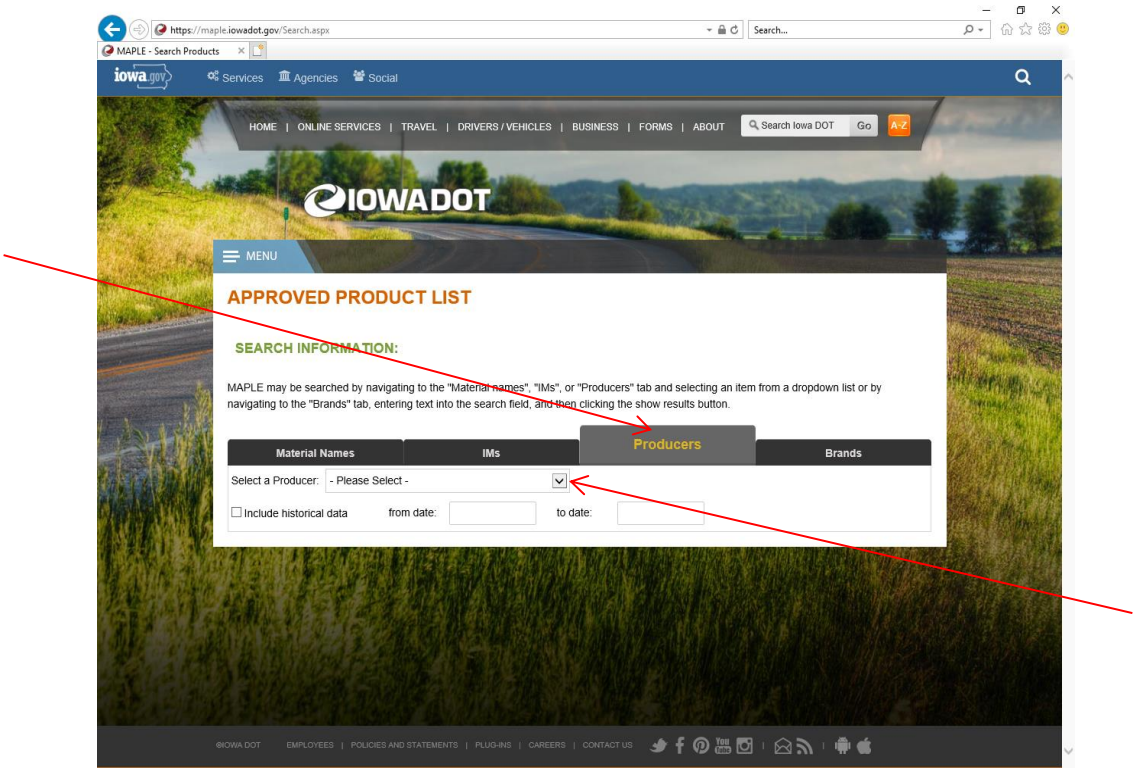
Click on the **IMs** tab to search by IM number. Click on the arrow and a list will appear as shown. Click on any of the IM's listed to produce a list of approved products in that IM.

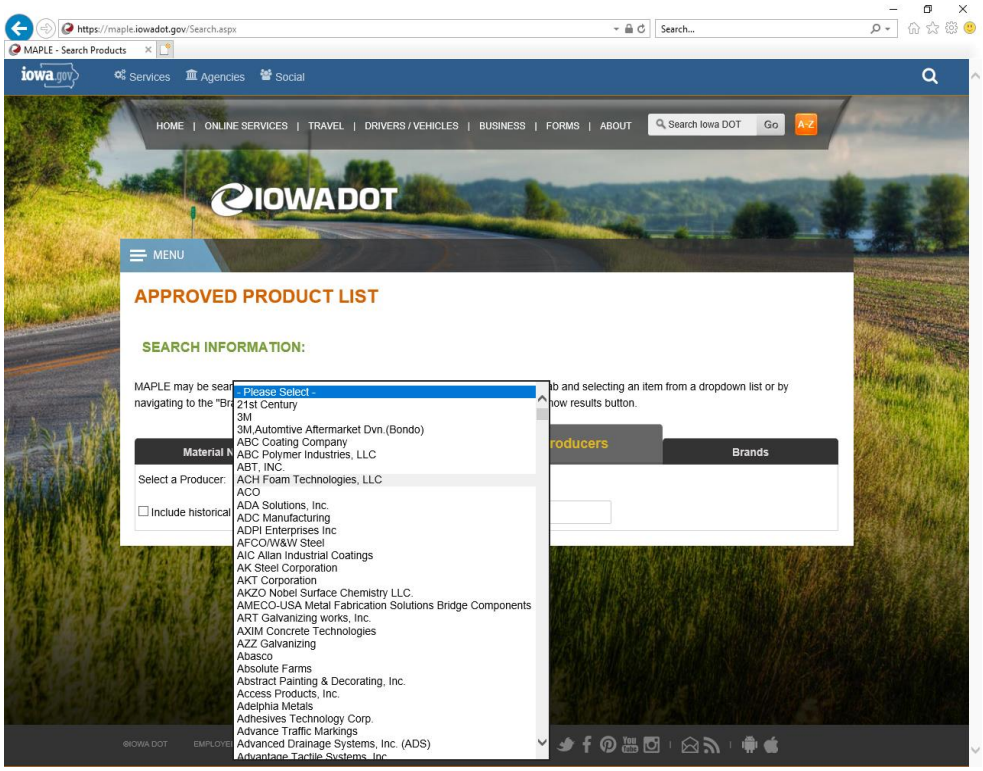




6. Searching by Producers

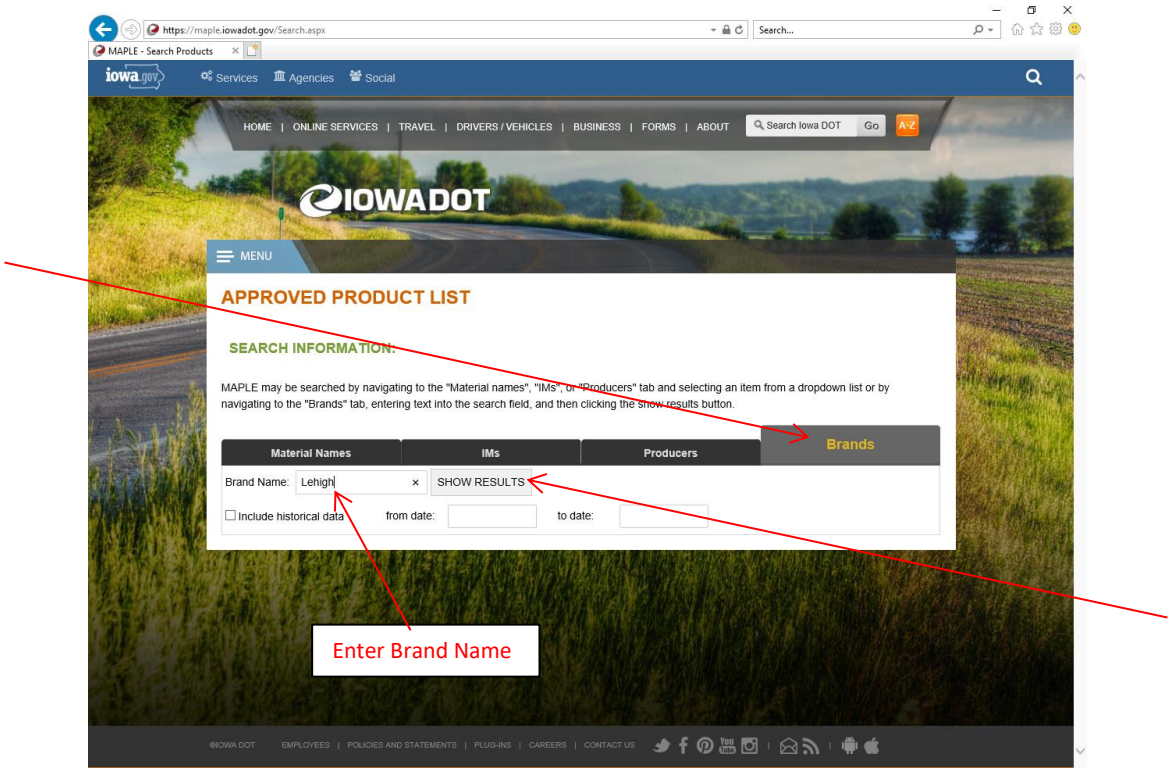
Click on the **Producers** tab to search by producer. Click on the arrow and a list will appear as shown. Click on any producer for a list of all approved products manufactured by that particular producer.

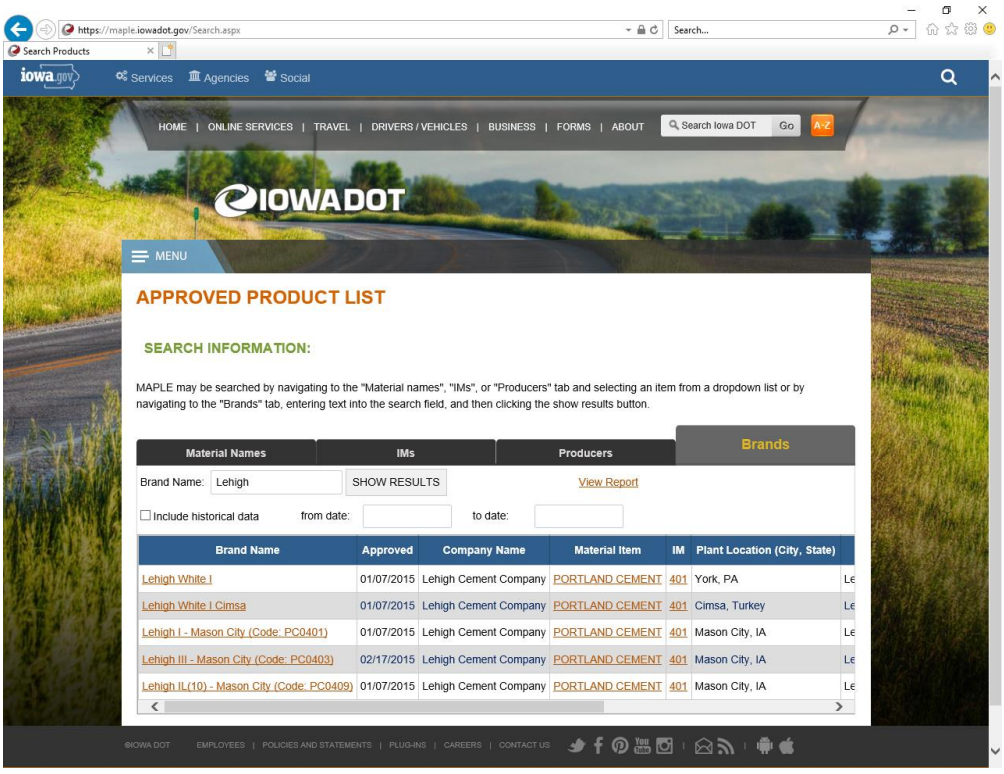




7. Searching by Brand Name

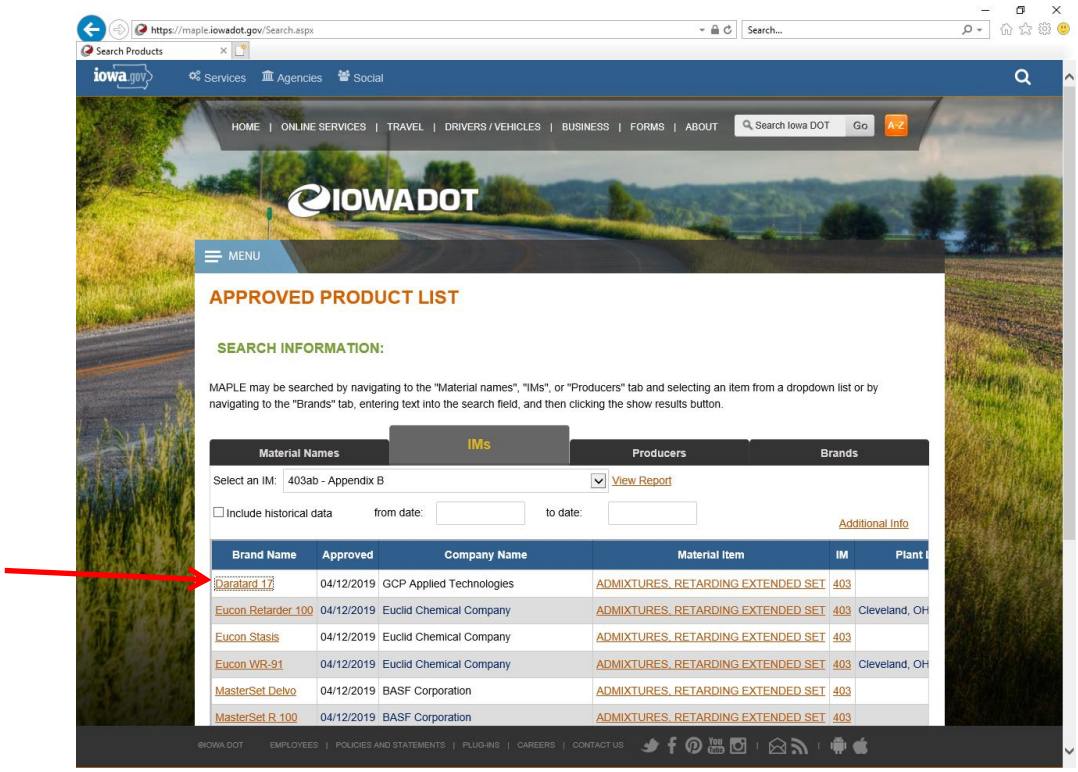
Click on the Brands tab to search by freeform typing the brand name of the product.



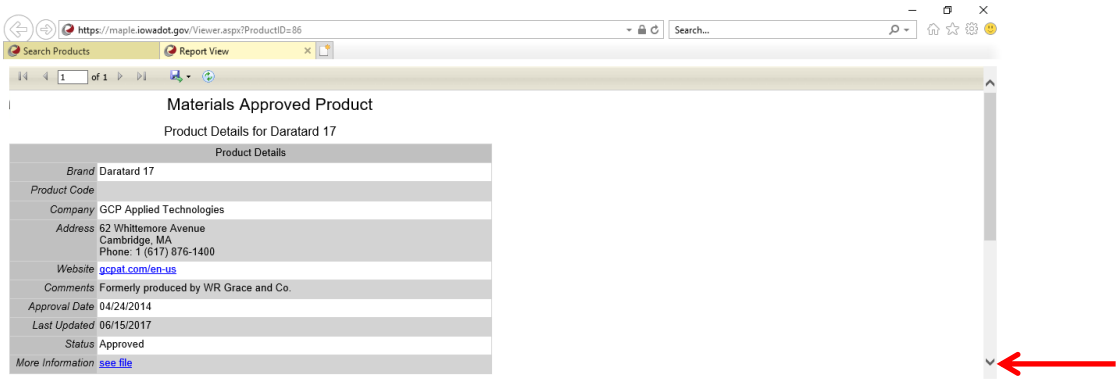


8. Selecting a Product

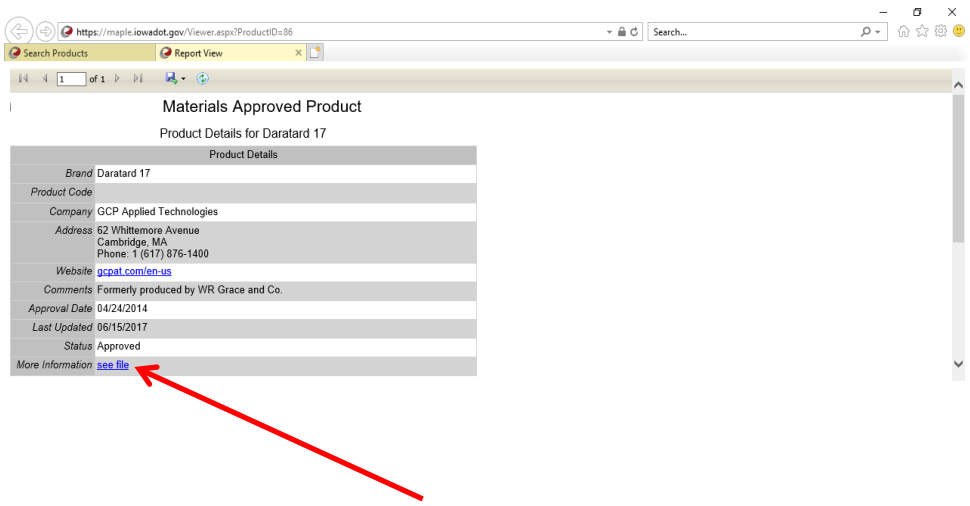
After a list of products has been displayed, click on the individual Brand Name to display more information about the product.

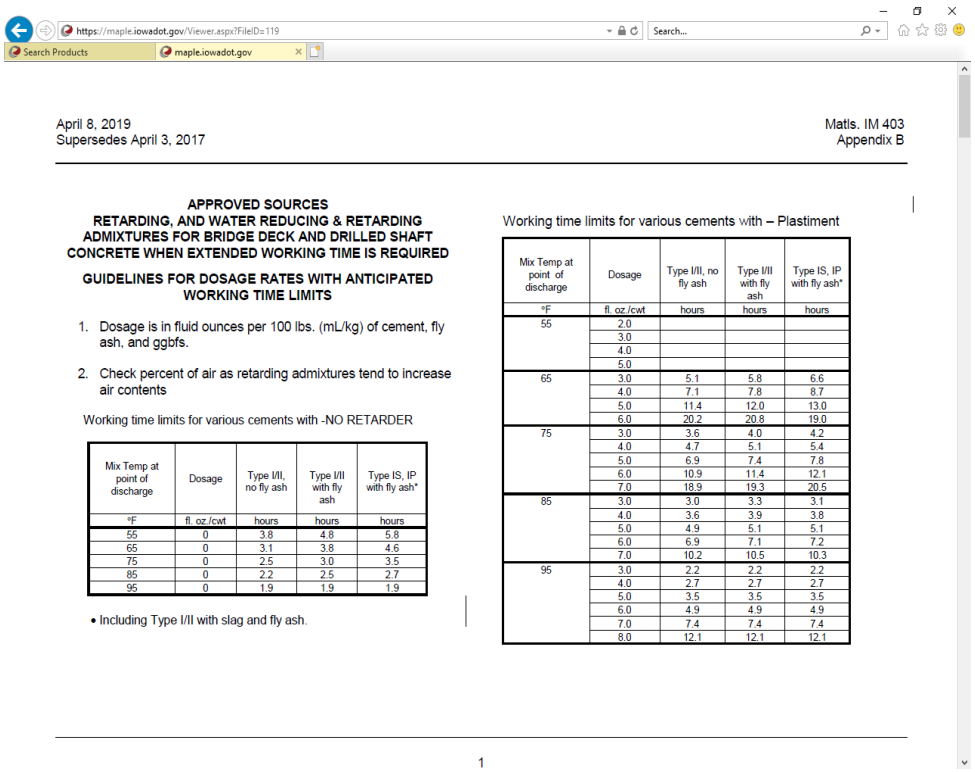


You can use the scroll bar on the right to scroll down for more information.

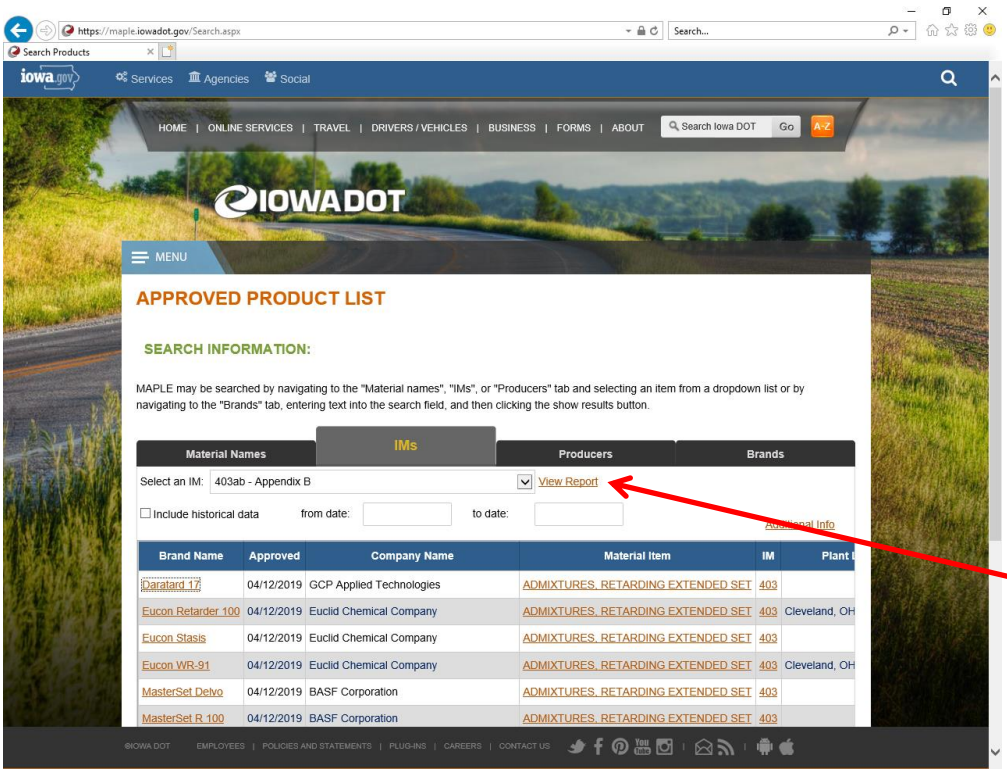


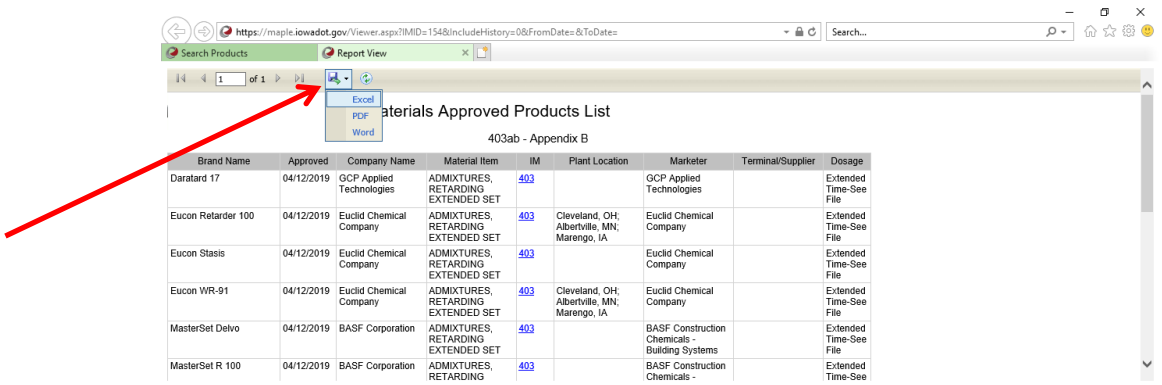
Some products may have a link in the **More Information** field. A pdf with the additional information will appear after clicking on see file. Additional info may be found on the following IM's: 403ab, 445.01ab, 451ad, 455.02aa, 455aa, 462aa, and 557ab.





Clicking on **View Report** will enable the user to export the list  to Excel, Word, or a pdf file.





FEDERAL CODE 1020 and IOWA CODE 714.8

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

FEDERAL AID PROJECTS

IX. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

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

NOTICE TO ALL PERSONNEL ENGAGED ON FEDERAL-AID HIGHWAY PROJECTS
18 U.S.C. 1020 reads as follows:

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

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in

connection with the construction of any highway or related project approved by the Secretary of Transportation; or

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

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

NON-FEDERAL AID PROJECTS

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

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

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

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Aggregate Reduction	Section III	Reducing a field sample of aggregate to test for: Correlation sieve analysis Sieve analysis
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Aggregate Source Locations and Basic Source Information	IM T-203	• Aggregate source approvals • Fine aggregate approval • PCC coarse aggregate durability ratings • Friction typing • Source locations and approvals alphabetized by county

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GLOSSARY & ABBREVIATIONS

AGGREGATE GLOSSARY

Abrasion – The mechanical wearing away of aggregate particles by friction and impact.

Absorption – The condition when an aggregate absorbs moisture into it's pore system.

Aggregate – Granular construction materials composed of hard mineral particles, crushed or uncrushed, which are or can be properly sized for the use intended.

Bed – A layer of material that is geologically similar.

Coarse Aggregate – All particles which are retained on No. 4 or larger sieves.

Combined Aggregate - An aggregate sample consisting of both coarse and fine particles.

Contamination – When a foreign material is mixed with an aggregate.

Conveyor Belt Sampling – A method of sampling aggregate by placing a template on a stopped conveyor belt and removing the aggregate.

Degradation – The breakdown of an aggregate due to mishandling, or freeze/thaw cycles of material stockpiled over a winter.

Deleterious Materials - Materials that are damaging or harmful to the intended use.

Dense Graded Aggregate – Aggregates that contain a proportion of material in each particle size present so as to minimize the void spaces between particles.

Fine Aggregate – All particles which will pass through a No. 4 sieve, and be predominately retained on the No. 200 sieve.

Fineness Modulus – A calculation based on a sieve analysis test to determine the coarseness of sand. This test is also used by other states for various purposes.

Free Moisture - The moisture on the surface of aggregate.

Gap Graded Aggregate – Aggregates that contain a disproportionate amount of particles, nearly the same size, creating voids between the particles.

Gradation – The particle size distribution of aggregates determined by using sieves with square openings and expressed in percent retained or passing.

Instructional Memorandum (I.M.) – Documents published by the Iowa DOT Material's Department to explain test procedures, materials acceptance, inspection procedures and other material's specifications.

Laboratory Qualification Program (I.M. 208) – A program for qualification or accreditation of laboratories to comply with regulations.
Ledge – A group of beds at a source that are all removed together.

Manufactured Aggregates - Manufactured aggregates are produced by the mechanical crushing and sizing of either natural or synthetic materials.

Maximum Aggregate Size - The smallest sieve opening, by specification, through which the entire sample of aggregate is required to pass.

Natural Aggregates - Natural aggregates are all those produced from naturally occuring materials, such as sand, gravel, and limestone.

Natural Sand and Gravels - Those aggregates referred to as "natural sand" or natural gravel" result from the natural disintegration of rock and are produced without artificial crushing.

Nominal Maximum Aggregate Size - The smallest sieve opening, by specification, through which the entire sample of aggregate may pass, but may also have a portion retained on the sieve.

Nominal Size - Term used to indicate an approximate size, either top size of material or average size in a range.

Non-proportioned Aggregate – An aggregate that is produced as the finished product.

Pit – An excavation of sand and gravel

Pore – The void system of an aggregate particle.

Proportioned Aggregate – An aggregate that will be mixed with other aggregate materials to make the finished product.

Pycnometer – A one or two quart jar supplied with a gasket and conical pycnometer top used for running specific gravity and moisture tests on aggregates.

Quality Assurance (QA) – A specified procedure where the **agency** independently checks on the Quality Control procedures. This is often done by testing split samples to verify the contractor/producers test results, and regular visits to observe their operations.

Quality Control (QC) – A specified procedure where the **contractor** and **producer** test the product on a regular basis, during production and use, to ensure compliance to the specifications.

Quarry – An open excavation from which rock is removed for construction purposes.

Random Sample – A sample that is not taken because of any particular reason or notion. All material produced should have an equal chance of being tested.

Reclaimed Aggregates - Aggregates from reclaimed Portland Cement Concrete (PCC), salvaged Hot Mix Asphalt (HMA-referred to as Recycled Asphalt Pavement (RAP), Recycled Asphalt Shingles (RAS) Recycled Asphalt Materials (RAM-combination of RAS and RAP used in HMA) and Crushed Composite Pavement (CCP-containing both PCC and HMA) which may be produced for use in applications allowed by specification.

Representative Sample – A sample that is representative of the total of the material being tested.

Sample Splitter – A device used to reduce a field sample for testing.

Saturated Surface Dry – The condition of an aggregate particle containing all the moisture possible but dry on the surface.

Segregation – When aggregate is improperly handled and a variation of the gradation occurs. The finer material will normally congregate in the center of the pile and the larger particles will tend to roll to the outside of the pile.

Sieve Analysis – The separation of material based on particle size.

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

Specification – A rule or limit that is to be followed when performing work for the Iowa DOT. There is a book of Highway Specifications with changes published twice a year as Supplemental Specifications.

Stockpile Sampling – A method of sampling fine aggregate by use of a sand probe or shovel.

Stream Flow Sampling – A method of sampling aggregate by intercepting the aggregate streamflow with a sampling device.

Verification - The Quality Assurance (QA) test result which is used to verify the Quality Control (QC) test result. The verification test is run on a split sample of material and should produce similar results when tested in two different laboratories.

Zinc Chloride ($ZNCl_2$) – A heavy liquid solution used to separate lightweight particles in aggregate samples by floatation.

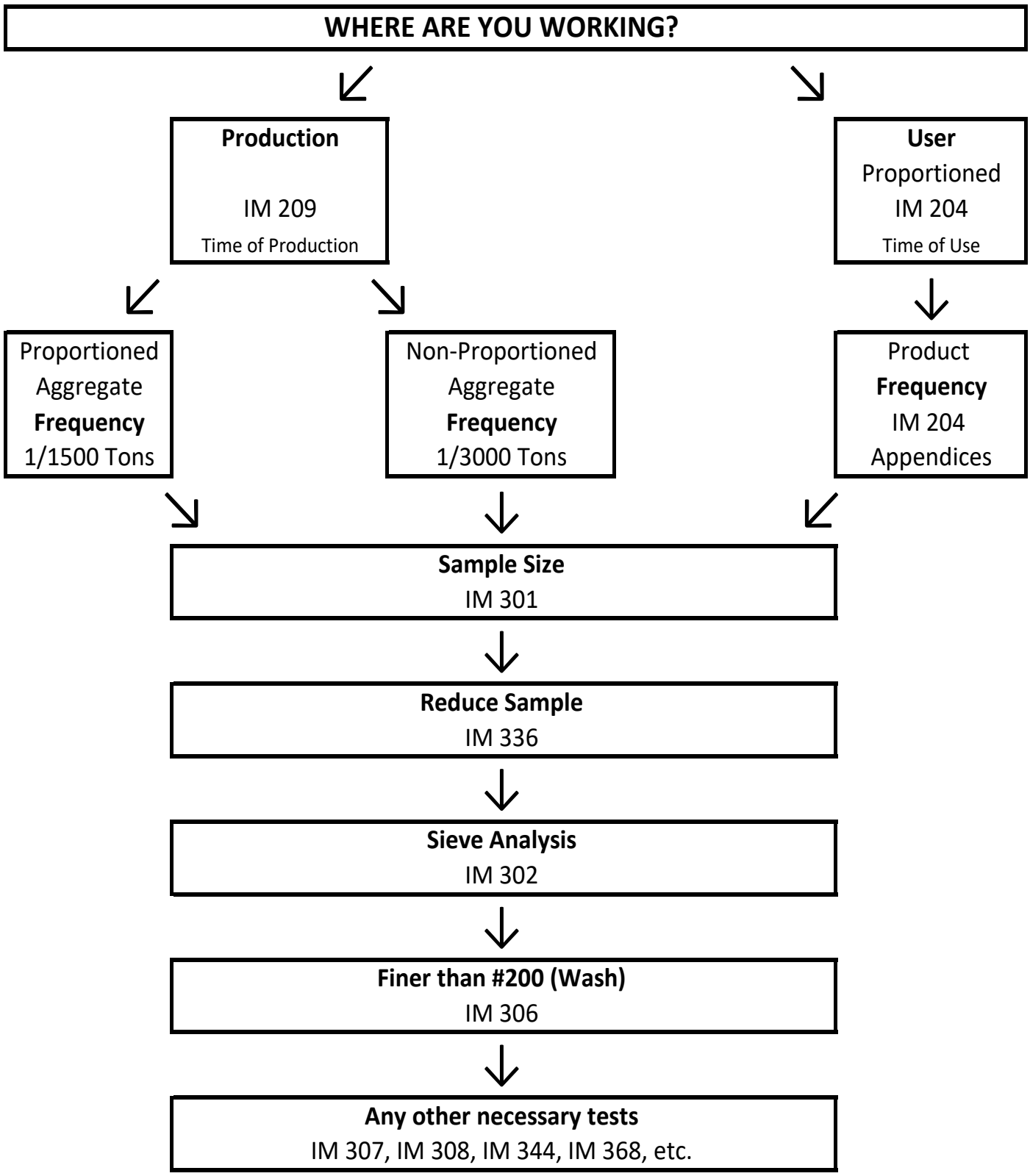
COMMONLY USED ABBREVIATIONS

AASHTO – American Association of State Highway and Transportation Officials
Al_2O_3 – Aluminum Oxide
AB – Approved Brand
Abr. – Abrasion
Abs. - Absorption
ACI – American Concrete Institute
Agg. – Aggregate
AMC – Area Materials Coordinator
AS – Approved Source
CA – Coarse Aggregate
CDM – Concrete Design Mixture
Contr. – Contractor
Corr. - Correlation
CML – Central Materials Laboratory
DME – District Materials Engineer
DOT – Department of Transportation
Dur. – Durability
FA – Fine Aggregate
FM – Fineness Modulus
Frict. – Friction
F & T – Freeze and Thaw
HMA – Hot Mix Asphalt
IA – Independent Assurance
I.M. – Instructional Memorandum
Matls. – Materials
PCC – Portland Cement Concrete
PL – Plastic Limits
QA – Quality Assurance
QC – Quality Control
QMA – Quality Management of Asphalt
QMC - Quality Management of Concrete
RAP – Recycled Asphalt Paving
RCE – Resident Construction Engineer
SpG – Specific Gravity
SSD – Saturated Surface Dry
S & T – Sampling and Testing
TTCP – Technical Training and Certification Program
Verif. – Verification
Wt. - Weight
$ZnCl_2$ - Zinc Chloride

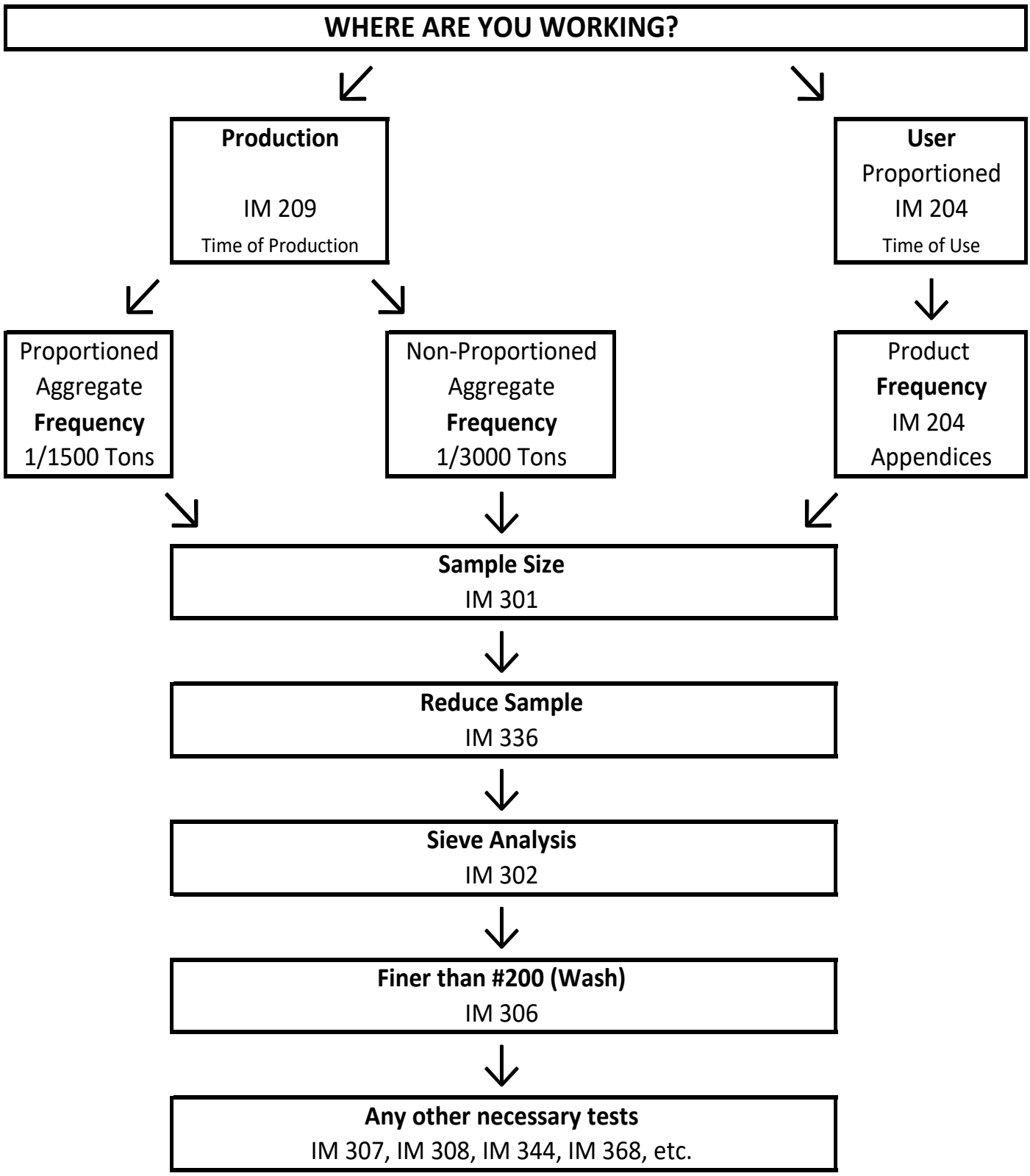
MEASUREMENTS

oz. - ounce
lb. - pound
T. - Ton
in. - inch
ft. – foot
^{2} - squared
^{3} - cubed

AGGREGATE SIEVE ANALYSIS



AGGREGATE SIEVE ANALYSIS



SECTION I
AGGREGATES

SECTION I
AGGREGATE

Today's highways must have the strength and durability to sustain high volumes of traffic for many years. Since pavements and base courses of these highways are composed largely of aggregates, these materials must be of a quality level that will permit satisfactory performance. Consequently, the role of the aggregate inspector is vital to securing good highway performance. Design and construction techniques can never satisfactorily compensate for the use of substandard aggregates. A well-designed and constructed highway using good aggregates will provide good service for many years. A well-designed and constructed highway using substandard aggregates will soon become a maintenance problem. This section contains general information on aggregates and the tests used to control their quality. Those aggregates commonly produced and used in Iowa will be emphasized, as will the tests that have been determined through experience to be the best measure of their quality.

Iowa requires aggregate for use on administered projects to be certified by producers/ suppliers on the Approved Aggregate Producers list, Materials Instructional Memorandum (I.M.) 209, App. B.

Aggregates are often referred to as rock, gravel, mineral, crushed stone, slag, sand, rock dust, or fly ash.

AGGREGATES DEFINED

Generally, aggregates are granular construction materials composed of hard mineral particles, screened or crushed, which are or can be properly sized for the use intended. Glacial clay is composed of minute granular mineral. However, the term "aggregate" as used in this booklet will be referring to granular materials that contain, at most, only a few percent of particles that will pass through a No. 200 sieve.

Reclaimed Asphalt and Portland Cement Concrete may also be recycled into usable aggregate products by milling or crushing, and properly sized to meet specified requirements.

Aggregate Classification

Coarse Aggregate: Any aggregate that is retained on the No. 4 sieve.

Fine Aggregate: Any aggregate that passes the No. 4 sieve.

Coarse and Fine Aggregates

Aggregates are frequently referred to as “fine” or “coarse.” There is no universally accepted particle size that separates fine aggregate from coarse aggregate. We have chosen the No. 4 sieve as the sieve size with which to make this separation for quality or physical characteristics tests. All particles which will pass through a No. 4 sieve, and be predominately retained on the No. 200 sieve, are referred to as “fine aggregates.” All particles which are retained on No. 4 or larger sieves are referred to as “coarse aggregate.”

Natural Aggregates

Natural aggregates are all those produced from naturally occurring materials, such as sand, gravel, limestone, etc., which can be modified by crushing, washing, or screening as necessary for the use intended.

Synthetic Aggregates

Synthetic aggregates are all those produced from materials that have been mineralogically altered by artificial means. Expanded shales and clays (lightweight aggregate), fly ash, slag, etc., are examples of synthetic aggregates.

Manufactured Aggregates

Manufactured aggregates are produced by the mechanical crushing and sizing of either natural or synthetic materials. Manufactured sand, for instance, could be made by crushing and sizing either a natural material such as limestone or synthetic material such as slag. However, even though a manufactured sand can be a natural aggregate, it cannot be a natural sand. The reason for this is explained in the next paragraph.

Natural Sands and Gravels

Those aggregates referred to as “natural sand” or “natural gravel” result from the natural disintegration of rock and are produced without artificial crushing. They can, however, be washed or mechanically sized.

Thus, the term “natural” is used in two different ways. There are natural aggregates as opposed to synthetic aggregates and natural sands as opposed to manufactured sands. Consequently, sand made by crushing quartzite or limestone is a natural aggregate but not a natural sand.

Reclaimed Aggregates
(IM 209 and IM 210)

Aggregates from reclaimed Portland Cement Concrete (PCC), salvaged Hot Mix Asphalt (HMA-referred to as Recycled Asphalt Pavement (RAP), Recycled Asphalt Shingles (RAS), Recycled Asphalt Materials (RAM-combination of RAS and RAP used in HMA) and Crushed Composite Pavement (CCP-containing both PCC and HMA) may be produced for use in applications allowed by specification.

Quality control during salvaging operations, processing, and use of these reclaimed materials is essential.

Aggregate Uses

Aggregates are used in portland cement concrete, asphaltic concrete, bases, subbases, granular backfills, revetment, etc. A summary of the quality and gradation specifications for the construction aggregates are listed in Division 41, Construction Materials of the Standard Specifications.

SECTION II
SAMPLING

SECTION II
SAMPLING METHODS AND EQUIPMENT

Introduction

This chapter deals with the different sampling methods and equipment. Before beginning to study, be sure to have a copy of the current Aggregate Reference Manual prepared by the Technical Training and Certification Program staff.

Importance of Proper Sampling

No other single phase of an Aggregate Inspector's duties is as important as obtaining a representative sample. At this point, all of the money and time which will be expended on the remaining activities of testing and evaluating may be lost or rendered useless by an improper sampling technique on the part of the Aggregate Inspector. In other words, if the sample you take is not representative of the total material, it is absolutely impossible to end up with a test result that means anything. At the completion of instruction you must know how to obtain a proper sample. Without this knowledge, it is useless to proceed further into the areas of test procedure.

No other single phase of an Aggregate Inspector's duties is as important as obtaining a representative sample.

Sampling Frequency

Minimum sampling and testing frequencies required at the **time of aggregate production** are listed in I.M. 209. The required minimum aggregate sampling and testing frequencies of aggregates at **time of use** (proportioned aggregate) are listed in the appendices of I.M. 204. Sampling frequencies referenced are minimums and may need to be increased for reasons such as low or intermittent production and widely varying or noncomplying test results.

Size of Sample

Refer to Materials I.M. 301 in the Field Testing Manual. Appropriate minimum aggregate sample sizes for the determination of sieve analysis are listed on page 4 of this I.M. The sample sizes are based on the maximum particle size in the finished products.

Random Sampling

The sample must be representative of the total of the material being tested. This is normally accomplished by random sampling. The random sample should not be obtained because of any particular reason or notion. All material being produced or used should have an equal chance of being tested. The inspector should not determine when or what to sample by judging if the material looks good, bad, or average, because that represents a judgement sample and not a random sample. Random samples are taken when the plant is operating at the usual rate for that plant.

It must be pointed out that not all test samples are random samples. Normally they will be the same, but there will be times when the inspector must choose the time of sampling such as new hammers placed on the secondary crusher, an area of clay in the quarry, or fine sand seams in a gravel pit. These things will directly affect gradation of the material and must be checked immediately to keep the material within proper limits. During a normal day's operation, all samples taken and tested may be random samples if all operations are running consistently. Some days will have no random samples taken, such as the first days to establish crusher settings, etc. Some days will have a combination of random and check samples. Keep in mind that during normal, steady production the samples should be taken on a random basis to represent the total of the material being produced.

Location for Sampling

To help assure that representative samples are taken, one of the following methods will be used for obtaining aggregate samples: 1) obtaining a portion of the material carried on a conveyor belt, 2) intercept the complete material streamflow from the end of a conveyor belt or from overhead bin discharge, 3) sampling from the production stockpile (only for fine aggregate or as directed by the District Materials Engineer). The preferred method of coarse aggregate sampling is the streamflow method.

Whichever sampling method is used, at least three separate increments must be taken for each field sample. Obtaining more than three increments, when possible, will better represent the material being tested by providing a wider cross-section of the product.

The field sample must also meet the minimum weight requirement as listed in I.M. 301 for the product being tested.

Conveyor Belt Sampling

To obtain an off-the-belt sample, stop the belt, insert a template, remove all material within the template, and combine it into the field sample. 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. In belt sampling, the ends of the template should be spaced just far enough apart to get an increment that weighs approximately one-third the minimum weight of the field sample. If the template does not yield the minimum size of field sample in three locations, additional locations will be necessary. No less than three separate locations should be used in obtaining one field sample.

Sampling from a conveyor belt using a template

Streamflow Sampling

When obtaining the field sample by intercepting the aggregate streamflow, care must be exercised so that the sampling device passes quickly through the entire streamflow and does not overflow. At least three separate passes shall be made with the sampling device when obtaining a field sample. Each pass is an increment of the field sample.

Streamflow Sampling

Stockpile Sampling

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 at different locations around the pile shall be taken. Care should be used to not sample at the bottom of the stockpile.

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

Stockpile sampling using a shovel.

Stockpile sampling using a sand probe.

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.

It is not always easy to get a proper sample, but it is very important to use all the care you can. Always remember, if your sample is not representative, your test results are not worth the paper they are written on.

Sampling Records

It is the responsibility of the aggregate sampler to get all the necessary information to fill out report headings. This may include type of material, intended use, sample location, T-203 A number, project number (if one is available), contractor who will be receiving the material, and other general information. The information on the source itself should include section of the quarry or pit and the bed numbers (quarries) or working depths (pit). If special processing equipment is used, it should be noted on the reports.

Samples are taken for either 1) field testing or 2) Central Laboratory testing. Those samples which are forwarded to the Central Laboratory of the Iowa DOT should be placed in a standard canvas sack and securely tied to prevent loss of material during shipping. An identification form should be filled out completely and placed inside the sample sack. Other identification tags should be attached to the tie for shipping information.

No less than three separate locations or passes should be used in obtaining one field sample.

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.

Review

Before you start out to take a sample, you should ask yourself these questions:

1. Are you sure that your plan for getting the sample is complete?
2. Have you checked on the approved method of taking the sample?
3. Do you know the weight of sample that is required?
4. Do you have the proper tools?
5. Do you have clean containers at hand for the sample?

After you have obtained the sample, you should ask yourself these questions:

1. Are you sure the sample really represents the material?
2. Should you divide the sample and retain part of it?
3. Is the sample completely identified?
4. Does your record show the nature of the material, its intended use, and exactly when, where, and how the sample was taken?

SECTION III
REDUCTION

SECTION III

FIELD SAMPLE REDUCTION
FOR HMA/PCC VERIFICATION SAMPLES

Introduction

Normally, aggregate field samples need to be downsized to perform the required tests such as sieve analysis and various quality testing. The sampling technician may also need to reduce samples into equal halves for correlation testing. Correlation testing is done between two technicians using separate testing equipment. This chapter, along with Materials I.M. 336, will discuss the approved sample reduction methods.

Importance of Sample Reduction

The technician reducing a field sample of aggregate must keep in mind the ultimate goal; the end result should be a smaller sample with the same characteristics of the original field sample.

Sample reduction should be regarded in the same way as obtaining the original field sample. The resulting smaller samples should be random, representative and the end result of the reduction process.

Size of Sample

Sample sizes are normally determined based on the largest particle sizes represented in the product. The required sample size is also dependent on the test to be performed.

Field and test sample sizes to determine a sieve analysis are detailed in Materials IM 301.

Methods

Splitting:
Fine, coarse or combined fine and coarse aggregate samples may be reduced using a riffle chute splitter. The material must be in an air dry condition, with basically no visible free moisture on the particle surfaces. The material should be dry enough to allow the aggregate to flow freely through the splitter chutes

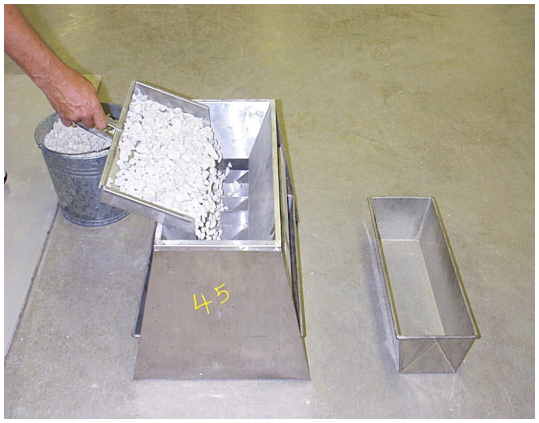
Note: A preliminary reduction of fine aggregate in a damp condition may be made using the 2 – inch riffle chute splitter. The resultant sample size shall be not less than 5,000 grams.

Aggregate samples with particles larger than ¾ inch should be reduced through a riffle chute splitter with 2 inch openings. When the largest particles are ¾ inch and smaller, the 1 inch splitter is preferred.

Riffle Chute splitter

The sample needs to be well-blended, placed in an appropriate sized pan no wider than the width of the row of chutes in the splitter, and poured across the center of the chutes in a manner to allow free-flow of the aggregate. 'Dumping' of the aggregate into the splitter tends to cause segregation of the material, resulting in inaccurate and non-correlating test results.

The entire field sample must be reduced, resulting in two approximately equal increments.



Splitting the sample

Quartering:
The preferred method of reducing a fine aggregate field sample into approximately equal halves is the Quartering method. The aggregate must be damp enough to stand in a vertical face.

The field sample of damp, fine aggregate is placed on a flat, non-absorbent surface, thoroughly mixed and flattened to an approximate 2 – 3 inch depth. Using a 'quartering device' or straight edge of appropriate size, quarter the flattened pile of fine aggregate into approximately equal quarters.

When reducing the sample into halves, the diagonal quarters are selected for each half, being sure to include all fine material.

This method may also be used to reduce a field sample to test sample size by continuing to reduce diagonal quarters until the desired sample size is achieved.

Note: The Quartering method should be avoided when reducing coarse or combined aggregates due to segregation problems.

Quartering using straight edge.

Select diagonal quarters.

IM 204

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

IM 209

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]

Notes:

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).

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.).

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.

Proportioned aggregates need to be produced allowing adequate time for new aggregate to be delivered to the project if the originally supplied aggregates to do not meet the quality requirements at the time of incorporation in a project (see Article 1106.01 and 1106.04 of the Standard Specifications for clarification).

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.

- Non-Proportioned Aggregate Acceptance Supplemented by Producer Gradations
    - If the Producer/Supplier QC test results are used by a District in the acceptance decision for non-proportioned aggregates, the Producer shall supply a Certified Gradation Test Report (Form #821278) to the RCE and DME using.
    - When Agency only test results are used in the acceptance decision of for non-proportioned aggregate, the Producer shall supply a Certified Gradation Test Report (Form #821278) to the RCE and DME, but the results will be used for Producer/Agency correlation and not acceptance.
- If necessary, The District Materials Engineer will provide test reports to the Project Engineer.

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 213

TECHNICAL TRAINING & CERTIFICATION PROGRAM

GENERAL

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

This Instructional Memorandum (IM) explains the requirements to become certified and to remain certified to perform inspection and testing in the State of Iowa. This IM also describes the duties, responsibilities and the authority of persons assigned the position of Certified Technician in any of the above areas for construction or maintenance projects. 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.

IM 301

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.

IM T-203

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

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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	DUR PCC 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 T100NR05W									
			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	
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' BED 27	A B C D E	
								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	
											1-5	D	

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**		
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	D	
											DOWN		
			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	1B-10		
								4	4	L	6-10	A B C D E	
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				
					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	L2 ROCK BEDS	REVETMENT CLASS	NOTES
7	**BLACK HAWK**	**DIST 2**	**SAND AND GRAVEL**								**CONTINUED**		
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	DWU	3iB		4	4	D	1-6	A B C D E	
						3iB		4	4	D	1-4		
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 FLR	D	
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									
A10042	BRUENING ROCK PRODUCTS INC		BRANDON I-380	E2 23 T87N R10W									

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
10	**BUCHANAN**	**DIST 6**	**CRUSHED STONE**								**CONTINUED**		
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 BED 10	D	
											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						
A13506	MOHR SAND, GRAVEL, & CONST LLC		MOHR	NW 23 T86N R34W	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	L2 ROCK BEDS	REVETMENT CLASS	NOTES
13	**CALHOUN DIST 3**	**SAND AND GRAVEL**								**CONTINUED**		
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	
							4	4	L	8-9		

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	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						