LEVEL I & II AGGREGATE INSTRUCTION MANUAL

2001/2002

TECHNICAL TRAINING
AND
CERTIFICATION
PROGRAM

HIGHWAY DIVISION

Iowa Department of Transportation

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TECHNICAL TRAINING AND CERTIFICATION PROGRAM
(General Rewrite)

GENERAL

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

This Instructional Memorandum (I.M.) explains the requirements to become certified and to remain certified to perform inspection and testing in the state of Iowa. This I.M. 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 I.M. 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 testing and inspection will be performed by certified personnel and documented in accordance with the I.M's.

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 and Certification Program will be carried out in accordance with general policy guidelines established or approved by the Highway Division Director. The Director will be advised by a Board of Certification composed of the following members:

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

** Appointed by Program Director

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

Appeals on actions taken in this program shall be submitted to the Program Director. Unresolved appeals will be submitted to the Certification Board.

TRAINING

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

CERTIFICATION REQUIREMENTS

1. A candidate must attend instruction and pass the examination(s) for all levels of certification prepared and presented by the Program Director or someone designated by the Program Director. If the new candidate fails the examination, they will have one opportunity to retake the examination. The retake must be completed within 6 months of the original exam. If they fail the retake of the examination, they will need to attend the training again before taking the examination the third time. If an individual is recertifying they will have only one opportunity to take the examination. If they fail the examination they must take the applicable training before retaking the examination.
2. All prerequisites shall be met before the applicant may attend the next level of training for the certification desired. A listing of certification levels and prerequisites is located in Appendix A.
3. Once the candidate has met all the criteria and has received certification, it is recommended the Certified Technician work under the supervision of an experienced technician until they become efficient in the inspection and testing methods they will be performing.
   An individual requesting to become certified as a Precast/Prestress Concrete Technician is required to obtain forty hours of experience assisting in quality control inspection at an approved plant before certification will be issued. The experience must be documented and shall be approved by the District Materials Engineer. This experience must be completed within two years from the date the individual attended the training.
4. Registered professional engineers, engineering graduates, and geology graduates from accredited institutions will be exempt from the training requirement in the areas they have had instruction. In order to obtain certification for any technical level, these persons must pass all applicable tests for the level of certification they wish to obtain. All certificates issued in accordance with these requirements will be subject to the same regulations concerning expiration, recertification, etc., as applies to certificates obtained via training and examinations.

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

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

Out-of-state applications should be submitted to the Iowa DOT Materials Office in Ames, Iowa to schedule test dates. Copies of all the applicant's certifications must accompany the application.

CERTIFICATION

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

CERTIFICATION IDENTIFICATION

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

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

RENEWAL OF CERTIFICATION

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

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

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

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

The Certified Technician will not receive credit for the following:

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

PERFORMANCE REQUIREMENTS

A written notice may be issued to the Certified Technician for any inadequacies performed during their duties. Upon receipt of two such notices, the Certified Technician may be given a three-month suspension. After receiving three notices, the Certified Technician is subject to decertification. An example of this notice is shown in Appendix B.

DECERTIFICATION

The certificate will become invalid for the following reasons:

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

FUNCTIONS AND 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, AND DOCUMENTATION

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

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

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

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

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

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

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

ACCEPTANCE

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

CERTIFICATION LEVELS

CERTIFECATION LEVEL	TITLE	PRE-REQUISITES
AGGREGATE		
Level I Aggregate	Certified Sampling Technician	None
Level II Aggregate	Certified Aggregate Technician	Level I Aggregate
PORTLAND CEMENT CONCRETE		
Level I PCC**	PCC Testing Technician	None
Level II PCC	PCC Plant Technician	Level II Aggregate & Level I PCC
Level III PCC	PCC Mix Design Technician	Level II PCC

** American Concrete Institute (ACI) Grade I certification will be acceptable as a portion of the Level I PCC training.

CERTIFECATION LEVEL	TITLE	PRE-REQUISITES
HOT MIX ASPHALT		
Level I HMA	HMA Technician	Level II Aggregate
Level II HMA	HMA Mix Design Technician	Level I HMA
PROFILOGRAPH		
Profilograph	Profilograph Technician	None
PRESTRESS		
Prestress	Prestress Technician	Level I PCC or ACI Grade I *If the technician will be performing gradations, they will need to be Aggregate Level II certified.*

UNSATISFACTORY PERFORMANCE NOTICE

Issued To: ____________________________ Date: ____________________

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This notice is to inform you that your performance as a Certified Inspector/Technician was unsatisfactory for the reason(s) listed below. After receipt of two such notices you may be give a three-month suspension. After three notices, you are subject to decertification

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

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

Unsatisfactory Performance:

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District Materials Engineer

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

CERTIFIED TECHNICIANS QUALIFICATIONS

Tests and Procedures the Certified Technician is qualified to perform for each Level of Certification.

LEVEL I AGGREGATE

I.M. 204 – Inspection of Construction Projects Sampling and Testing (when material is incorporated)
I.M. 209 Appendix C – Aggregate Specification Limits and Sampling and Testing Guide (when material is produced)
I.M. 301 – Aggregate Sampling Methods

LEVEL II AGGREGATE

I.M. 216 - Guidelines for Verifying Certified Test Results
I.M. 302 – Method of Test Sieve Analysis of Aggregates
I.M. 306 – Method of Test to Determine the Amount of Materials Finer Than the #200 Sieve in Aggregate
I.M. 307 – Method of Test Specific Gravity of Aggregates
I.M. 308 – Method of Test Determination of Free Moisture and Absorption of Aggregates
I.M. 336 – Methods of Reducing Aggregate Field Samples to Test Samples
I.M. 344 – Method of Test for Determination of the Amount of Shale in Fine Aggregate
I.M. 345 – Method of Test for Determination of the Amount of Shale in Coarse Aggregate

LEVEL I PCC

I.M. 204 – Inspection of Construction Projects Sampling and Testing
I.M. 208 – Materials Laboratory Qualification Program
I.M. 216 - Guidelines for Verifying Certified Test Results
I.M. 315 – Making and Testing Concrete Cylinders
I.M. 316 – Flexural Strength of Concrete
I.M. 317 – Slump of Portland Cement Concrete
I.M. 318 – Air Content of Mixed Concrete by Pressure
I.M. 327 – Sampling Concrete for Slump, Air, and Strength
I.M. 328 – Making, Protecting, and Curing Concrete Flexural Specimens
I.M. 340 – Weight Per Cubic Foot, Yield, and Air Content of Concrete
I.M. 383 – Testing the Strength of PCC Using the Maturity Method
I.M. 385 – Temperature of Freshly Mixed Concrete
I.M. 525 – Method of Designing Flowable Mortar
Iowa 410-B – Method of Test for Flow of Grout Mixtures
AASHTO T 97 – Third Point Loading

LEVEL II PCC

I.M. 527 – Paving Plant Inspection
I.M. 528 – Structural Concrete Plant Inspection
I.M. 529 – P.C. Concrete Proportions

LEVEL III PCC

I.M. 530 – Quality Management and Acceptance of PC Concrete Pavement
I.M. 531 – Test Method, Combining Aggregate Gradations
I.M. 532 – Aggregate Proportioning Guide for Portland Cement Concrete Pavement

LEVEL I HMA

I.M. 204 – Inspection of Construction Projects Sampling and Testing
I.M. 208 – Materials Laboratory Qualification Program
I.M. 216 - Guidelines for Verifying Certified Test Results
I.M. 320 – Method of Sampling Compacted Pavement Layers
I.M. 321 – Method of Test for Compacted Density of Asphaltic Concrete (Displacement Method)
I.M. 322 – Methods of Sampling Uncompacted Asphaltic Concrete
I.M. 323 – Method of Sampling Asphaltic Materials
I.M. 325 – Compacting Asphalt Concrete by the Marshall Method
I.M. 325G – Method of Test for Determining the Density of Hot Mix Asphalt by Means of the Superpave Gyratory Compactor
I.M. 337 – Determining Thickness of Completed Courses of Base, Sub-base, and Asphaltic Concrete
I.M. 350 – Maximum Specific Gravity of Asphaltic Paving Mixtures Field Procedure for Central Laboratory Test Method
I.M. 357 – Method of Preparation of Bituminous Mix Samples for Test Specimens
I.M. 501 – Asphaltic Terminology, Equations, and Example Calculations
I.M. 508 – Asphaltic Concrete Plant Inspection
I.M. 509 – Tank Measurement and Asphalt Cement Content Determination
I.M. 511 – Control of Asphaltic Concrete Mixtures
I.M. 514 – Verification of Field Density for Asphalt Concrete Paving

LEVEL II HMA

I.M. 380 – Method of Test for Vacuum Saturated Specific Gravity and Absorption of Combined or Individual Aggregate Sources
I.M. 510 – Method of Design of Asphaltic Concrete Mixes
AASHTO T 176 – Plastic Fines in Graded Aggregate and Soils by use of the Sand Equivalent Test
AASHTO T 304 – Uncompacted Void Content of Fine Aggregate

ASTM D 4791 – Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

PROFILOGRAPH

I.M. 341 – Method of Test Determining Pavement Profiles with the 25 Foot Profilograph

PRESTRESS

I.M. 570 – Inspection and Acceptance Precast and Prestressed Concrete Bridge Units

AGGREGATE TECHNICIAN DUTIES

Duties of the Aggregate Technician are detailed in Materials I.M. 209 and I.M. 300 series and consist of, but are not limited to, the following:

A. Sampling

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

B. Gradation testing

  1. Follow appropriate gradation testing methods.
  2. Maintain current applicable specifications.
  3. Post test results within 24 hours of sampling.

C. Other testing as required (specific gravity, moisture, deleterious material, etc.)

  1. Follow appropriate testing methods.
  2. Maintain current applicable specifications.
  3. Complete required reports.

D. Sampling and testing equipment

  1. Clean and check testing sieves for defects.
  2. Assure scale accuracy.
  3. Maintain sampling and testing equipment.

E. Communication

  1. Notify Materials Department for production start-up or changes.

2. Relay test results to appropriate production or supervisory personnel.

3. Report failing test results immediately to appropriate personnel (including Materials Department) and assure remedial actions are taken.

F. General

1. Monitor stockpiling procedures to avoid contamination and excess segregation.

2. Assure proper identification of stockpiles

3. Assure specification requirements for intended use are met before shipment.

4. Assure sampling locations are safe.

5. Assure proper bedding planes or production depths are maintained.

G. Documentation

1. Report all production test results of certified aggregates on form #821278 and distribute as required.

2. Assure "plant production log" is maintained.

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

The Quality Control Technician shall have no other duties while performing certified inspection duties. The District Materials Engineer may approve all Quality Control activities be performed by a single Certified Technician for low production situations.

Many of the duties of the PCC Level II Technician are detailed in I.M. 527 (Paving) and I.M. 528 (Structural) and consist of, but are not limited to, the following:

A. Stockpiles

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

B. Plant Facilities

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

C. Calibration

1. Be present during calibration (paving).
2. Check plant calibration (structural).
3. Assure proper batch weights.

D. Cement (Fly Ash) and Aggregate Delivery

1. Check for proper sources and certification.
2. Document quantities delivered.
3. Monitor condition of shipments.

E. Plant Sampling

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

2. Check aggregate moistures and specific gravity.

F. Proportion Control

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

G. Concrete Tests

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

H. Test Equipment

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

I. Documentation

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

HOT MIX ASPHALT (HMA) TECHNCIAN INSPECTION DUTIES

The Quality Control Technician shall have no other duties while performing certified inspection duties. The District Materials Engineer may approve all Quality Control activities be performed by a single Certified Technician for low production situations.
Many of the duties of the Hot Mix Asphalt Technician are detailed in I.M. 508 and 511. These duties consist of, but are not limited to, the following:

A. Stockpiles

1. Assure proper stockpiling
2. Prevent intermingling of aggregates.
3. Prevent contamination.
4. Prevent segregation.
5. Document certified aggregate deliveries.

B. Plant Erection

1. Assure safe sampling locations.
2. Check specification compliance.
2. Check for proper laboratory location.

C. Calibration

1. Be in possession of appropriate mix design data.
2. Be present at the calibration.
3. Assure proper procedures being followed.
4. Obtain and/or record calibration data.
5. Check for proper gate settings.

D. Asphalt Delivery

1. Check for proper source and certification
2. Document deliveries.
3. Document quantities by tank stick, weighing, or metering.
4. Monitor Temperature

E. Plant Sampling

1. Check cold-feed gradation by obtaining, splitting, and testing samples.

2. Obtain asphalt binder samples.

3. Test aggregate moisture.

F. Mix Control

1. Monitor coating of aggregates.

2. Monitor and record mix temperature.

3. Monitor and record asphalt binder temperature.

4. Check trucks for proper loading and possible segregation.

5. Monitor mixing time.

6. Monitor recycle proportions.

G. Weights

1. Observe scale calibrations.

2. Check for specification compliance.

3. Regularly check calibrations.

H. Testing

1. Core testing*.

    a. Determine field density and percent voids of compacted mix.

    b. Calculate quality index for density and thickness when required.

2. Uncompacted mix.

    a. Bulk specific gravity of laboratory-compacted specimen.

    b. Maximum specific gravity.

    c. Calculate voids, VMA, film thickness.

I. Documentation

1. Prepare Daily Plant Inspection Report.

2. Document all checks and test results in field book.

3. Maintain a daily diary of work activity.

4. Moving averages.

5. Control Charts.

*On projects where the contractor is not responsible for the quality control testing, then the agency is responsible for core testing functions.

PRESTRESS TECHNICIAN DUTIES

Duties of the Prestress Technician are detailed in Materials I.M. 570 and consist of, but are not limited to, the following:

A. Pre-pour

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

B. Concrete Placement

1. Check on use of an approved mix design and batching operations (sequence).

2. Assure appropriate placement and proper vibration techniques.
3. Measure and record concrete temperature.
4. Assure test cylinders are properly made.
5. Assure appropriate finish.
6. Assure appropriate curing operations.

C. Post-pour

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

PROFILOGRAPH TECHNCIAN DUTIES

Duties of the Profilograph Technician are detailed in Materials I.M. 341 and consist of, but are not limited to, the following:

A. Test pavement for smoothness criteria

B. Evaluate and certify test results

    1. Certified person that reduces trace must sign certified test report
    2. Profilograms become part of permanent project record

C. Documentation

    1. Certified Profilograph test report must include following statement:

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

NOTES

CERTIFIED AGGREGATES APPROVED PRODUCER PROGRAM

GENERAL

This I.M. deals with requirements for furnishing certified aggregate and the approved producer program.

In order to furnish certified aggregates to projects, an aggregate producer shall be on the approved aggregate producer listing (Appendix B, attached). The specific requirements, including the details of the required quality control program are in Appendix A (attached).

Specification Limits for aggregates being produced, and certified gradation sampling and testing frequency requirements are found in Appendix C. 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 noncompliance will be considered sufficient grounds to remove the producer from the Approved Producer List.

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 Materials Engineer
- The Chief Materials Geologist

The prime contractor or a contractor-authorized representative (the producer) shall be responsible for source product Quality Control.

Aggregate source gradation testing will be performed and documented in accordance with this Instructional Memorandum by persons qualified in accordance with the provisions of I.M. 210.

The gradation tests will be called certified gradation tests and the aggregate represented will be called certified aggregate.

Source gradation tests will be considered advisory when the aggregate acceptance is determined by sampling and testing, on the project, in accordance with I.M. 204. The advisory tested group will hereinafter be called proportioned aggregates. For all other aggregates, source gradation tests may be considered the basis of acceptance.

Sampling and testing duties described in this Instructional Memorandum shall not be delegated to non-certified technicians.

SAMPLING, TESTING AND DOCUMENTATION

Gradation sampling, testing, and documentation of certified aggregates, at the source, shall be the responsibility of the aggregate producer or supplier. Quality sampling, testing, and documentation of certified aggregates shall be the responsibility of the IDOT Area Inspector.

Certified source testing shall be performed at frequencies as outlined in Appendix C of this I.M. utilizing the procedures contained in Materials I.M. Series 300. Additional certified gradation testing may be required at the time material is shipped to a project, for a stockpiled material carried through a winter season, or if there is evidence of segregation, contamination, or degradation. When additional certified testing of stockpiled material is required, the testing shall be at a frequency of at least one per 6000 Mg (tons). Bins or other means of securing representative samples shall be furnished for the sampling of stockpiled material.

Source 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.

The quality of the material produced shall be determined before shipment to a project.

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.

All producer gradation test results performed on certified aggregates, whether compliant or non-compliant, shall be promptly reported 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 A.C.C. or P.C.C. mix designs are generated by the contractor and supplied to the aggregate producer on forms 955 and 955QMC respectively.

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 mass (weight), the certified truck tickets shall be numbered and include signatures or initials in accordance with Article 2001.07.
- 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 mass (weight) 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, 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:

P.C.C. Aggregate: Type or size, quantity, source name or T-203 A number, production beds (for quarried stones) and the delivery date.

Note: For aggregate being delivered for use in a contractor mix design (CMD), the product size is required in lieu of the Iowa DOT gradation number.

A.C.C. Aggregate: Product size, quantity, source name or T-203 A number, production beds (for quarried stones), the delivery date and project number.

Note: The project number is preferred when practical, as in the case of shipping to a paving plant site, but not required when shipping to a plant or ready mixed concrete plant supplying material to multiple projects.

Non-proportioned Aggregate

Iowa DOT gradation number, project number, quantity, source name or T-203 A number and the delivery date.

Note: Documentation for revetment stones shall include production beds.

Note: No gradation number is required for chock stone or revetment.

MONITORING OF CERTIFIED AGGREGATES

The District Materials Office will be responsible for monitoring of sampling and testing of aggregates for gradation by the certified technician.

Monitor inspection samples are secured from aggregate being produced for a project, reserved stockpiles or stockpiles for intermittent project usage.

Monitor Sampling for Quality Testing shall be performed at the following minimum frequency:

- One per 12,000 Mg (tons)
  or
- If monthly production is greater than 12,000 Mg (tons), the minimum sampling frequency is one per month.

Monitor sampling for Gradation Testing may be independent samples or proficiency (split-bucket) samples for comparison testing in accord with I.M. 216. Sampling shall be performed at the following minimum frequency:

- Proportioned aggregates: one per 18,000 Mg (tons) representing the various products made.
- Non-proportioned aggregates: one per 36,000 Mg (tons) representing the various products made.

Note: These sampling frequencies may be adjusted by the District Materials Engineer. Monitoring of certified gradation testing may be waived when a product quantity is less than 2000 Mg (tons).

Periodic evaluation of certified technicians will be performed by the District Materials Representative and kept on file. Correlation (split-bucket) sample results will be compared per I.M. 216.

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.

REHANDLING OF CERTIFIED AGGREGATES

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

For the purpose of this I.M., 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. Re-handled certified aggregates may be required to be re-tested, with or without re-weighing, and re-certified on a numbered shipment ticket with proper identification and certification statement.

ACCEPTANCE

In the case of proportioned aggregates, acceptance tests will be performed on samples obtained at the proportioning plant in accordance with Construction Procedures and

Instructions Manual Section 3.22 and Materials Instructional Memorandums 204 and 513.

Certified 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). When the material represented is non-proportioned aggregate, the project number must be on the certified document and a copy furnished for project inspection personnel. When the aggregate represented is proportioned aggregate, the project number is preferred when practical, as in the case when shipping to a paving plant site, and not required when impractical, as in the case when shipping into warehouse stock at a ready mix plant. A file of certified shipment or transfer documents for 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.

Documentation procedures for asphalt and concrete paving plants that have **multiple** project and commercial mix responsibilities would function in the same manner as described above for ready mix plants.

Acceptance of non-proportioned aggregates will be based on proper certification and on visual examination by the contracting authority to ensure against obvious contamination or segregation.

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.

APPENDIX A
GUIDELINES FOR AGGREGATE PRODUCER QUALITY CONTROL PROGRAM

GENERAL

This appendix contains the minimum requirements for the producer Quality Control Program in order to become an approved aggregate producer.

Each producer must submit a written application to their District Materials Engineer for review and approval. **Note:** Producers with operations in more than one District shall apply to each District Materials Engineer where certified material production exists or is anticipated. The applications are available from the DME Offices and the Iowa Limestone Producers Association (ILPA) office. (A sample application is attached.)

DEFINITIONS

The following definitions apply to the Quality Control Program guidelines:

Source - Any location aggregate is produced at or shipped from on a certified basis (e.g., quarries, pits, project sites, terminal locations, portable production operation, etc.).

Conditional Status - This is a written notice from the District Materials Engineer to a producer that certified aggregates will no longer be accepted from a particular source. Application of Conditional Status may vary depending upon situation or specific circumstances. The Conditional Status may apply only to a production operation and aggregate produced by that operation. In other situations, when the deficiency is more widespread, the Conditional Status may apply to an entire company or division within a company until the problem is resolved. In the case of portable production operations, Conditional Status shall apply to the specific production operation regardless of source location, and shipment of aggregate previously produced by the affected production operation may be placed on Conditional Status when warranted.

GUIDELINES FOR AGGREGATE PRODUCER QUALITY CONTROL PROGRAM

1. Aggregate Certification

   The producer has the overall responsibility of certifying that material being placed in the certified stockpile is produced under and conforms to the Aggregate Certification Program, and the producer Quality Control (QC) Program. The Iowa DOT, through its monitoring activities (sampling/testing, visual observation, etc.), will verify the continued compliance to the program.

2. Knowledge of Current Specifications

The producer Quality Control representative(s) must maintain up-to-date knowledge of the specifications that apply to aggregate products currently being produced at the source. The producer representative shall have available, at the testing lab, a copy of the current Standard Specifications, all applicable Supplemental Specifications and all applicable Instructional Memorandums (I.M.s) for aggregate inspection, as well as a current geological section, if applicable. The producer shall be aware of any Special Provisions, which change current aggregate specifications. This applies to both quality and gradation requirements. The producer shall be responsible for providing these up-to-date publications to their QC representative.

3. Plant Production Log

The producer is required to maintain a plant production log when producing under the program. This production log shall detail, on a daily basis, samples taken, pass/fail results, corrective actions, plant/ledge changes, etc. The log must be kept at a designated location and be readily available to the Iowa DOT representative for review.

4. Visual Inspection

The producer is responsible for visually inspecting the aggregate source process on a frequent basis. Visual inspection can be defined as observing the processing or production area, as well as the condition of the aggregate in the flow stream or stockpiles. This visual inspection does not take away from actual testing, but enhances the inspection to ensure quality aggregates. It is the responsibility of the producer Quality Control representative to observe the overall operation to detect segregation, degradation, and contamination that are detrimental to the quality of the product.

5. Quality Requirements

Any certified stockpile must meet the designated quality before shipment. The producer is responsible for supplying material meeting all quality requirements. Intentional shipment of untested or out of specification material shall constitute grounds for immediate rejection of material and placement of the source and/or the producer on conditional status. The producer Quality Control representative shall obtain and maintain quality information on specific ledges, production methods, and certified stockpiles for each source.

6. Production Notification

Twenty-four hours before startup or as soon as possible for production change, the appropriate Area Materials Coordinator (AMC) or District Materials Engineer (DME) shall be notified. Failure to notify may result in material rejection or resampling of the stockpile. Notification shall include the estimated intended tonnage to be produced, estimated daily production rate, intended use (e.g., project information or warehouse stock), and if applicable, production ledges, and responsible person(s).

7. Production

A. The producer shall establish gradation production limits for each material to be certified to help ensure a product that is uniformly graded and meets specifications at the time of use.

1. Gradation production limits shall apply to individual products within each source and be maintained for each stockpile.

2. Gradation production limits are subject to review, only, by the AMC or DME.

3. Repeated non-adherence to the producer established gradation production limits will require stockpile sampling and testing by the producer.

B. Testing and Reporting

1. Minimum test frequencies as per I.M. 209, Appendix C

2. Test results shall be known before delivery when the product is being shipped to a project.

3. All test results shall be available at a designated location within 24 hours of sampling when the material is being placed into a certified stockpile.

4. Report gradation test results to DME and contractor, when applicable, on Form #821278.

C. Maintaining Ongoing Quality Control Procedures

1. Proper ledge control

2. Equipment (production and testing)

3. Stockpiling procedures

4. Proper stockpile identification (signing, stockpile maps, etc., as required).

8. Delivery

A. Stockpile identification to ensure delivery from proper stockpiles.

B. Visual inspection for contamination, segregation, etc.

C. Stockpile gradation resampling may be required.

D. Proper identification and certification of delivered aggregate as per I.M. 209.

E. Maintain ongoing QC procedures.

F. Report tonnage to the AMC when requested.

9. Quality Control Structure

In order to ensure quality as a priority, the producer Quality Control personnel shall have a line of communication directly to their management, as well as their production operation.

AGGREGATE PRODUCER APPROVAL APPLICATION

Company Name______________________________
Address ______________________________
(IF MORE THAN ONE; i.e., Regional Offices, etc., PLEASE ATTACH LIST AND AREA COVERED.)

1. Are copies of current applicable specifications, aggregate testing I.M.s and source information data such as geologic sections available at the respective sources or testing facilities?(Yes or No) If No, explain______________________________

2. Is a plant production log maintained on a daily basis and available for inspection? (Yes or No) If No, explain______________________________

3. Who (position) is responsible for production notification to the Area Materials Coordinator?______________________________

4. Which company representative (position) is normally responsible for daily overall Quality Control processes at the source?______________________________

5. Describe the certified stockpile identification system in place at each source (Map, signing, etc.)______________________________

6. Please attach a detailed summary of your Quality Control Program. (**Note:** Please refer to Guidelines for Required Aggregate Producer Quality Control Program)

7. Please attach a flow chart of your current Quality Control structure (Include names, addresses, phone numbers of appropriate management personnel, chain of command, etc., for problem resolution).

Indicate the District(s) for which you are seeking approval.

1 2 3 4 5 6

AUTHORIZED SIGNATURE ____________________ DATE______________

DME RECOMMENDATIONS______________________________
____

DME SIGNATURE ____________________ DATE______________
APPROVAL (YES or NO) REMARKS ______________________________
____

MATLS. ENGINEER SIGNATURE ____________________ DATE______________

APPENDIX B
APPROVED AGGREGATE PRODUCERS

This appendix lists the approved aggregate producers and the Districts to which the producer has applied.

Producer	**Approved Districts**
Acme Fuel & Materials Company Muscatine, IA	DISTRICT 5
Aggregate Materials Company Dubuque, IA	DISTRICT 6
Aggregates, Inc. Cedar Rapids, IA	DISTRICT 6
Anderson Sand & Gravel Company De Witt, IA	DISTRICT 6
Arcadia Limestone Company Arcadia, IA	DISTRICT 1
Bard Concrete Dyersville, IA	DISTRICT 6
Basic Materials Corporation Waterloo, IA	DISTRICT 2
Becker Gravel Company, Inc. Stratford, IA	DISTRICT 1, DISTRICT 2, DISTRICT 3, DISTRICT 4
Bedrock Gravel Company Auburn, IA	DISTRICT 3
Bellco of Nebraska, Inc. Council Bluffs, IA	DISTRICT 4
Bellevue Sand & Gravel Company Bellevue, IA	DISTRICT 6
Blazek Corporation Lawler, IA	DISTRICT 2
Boggess Construction Company Estherville, IA	DISTRICT 3

Producer	**Approved Districts**
Boyer Sand & Rock, Inc. Hawarden, IA	DISTRICT 3
Brockman Mgt., LLC, dba Brockman Sand Co. Ft. Madison, IA	DISTRICT 5
Bruening Rock Products, Inc./Skyline Const., Inc. Decorah, IA	DISTRICT 2, DISTRICT 5, DISTRICT 6
Builders Sand & Cement Company Davenport, IA	DISTRICT 6
Central Stone Company #1 Hannibal, MO	DISTRICT 5
Cessford Construction Company Burlington, IA	DISTRICT 5
Cessford Construction Company Le Grand, IA	DISTRICT 1
Cohrs Construction, Inc. Spirit Lake, IA	DISTRICT 3
Concrete, Inc. Gifford, IA	DISTRICT 1
Concrete Materials Sioux Falls, SD	DISTRICT 3
Conreco, Inc. Omaha, NE	DISTRICT 4
Coots Materials Company Vinton, IA	DISTRICT 6
Corell Recycling - A Div. of Corell Contractor, Inc. Des Moines, IA	DISTRICT 1
Crawford Quarry Company Cedar Rapids, IA	DISTRICT 6
Croell Redi Mix Sumner, IA	DISTRICT 2

Producer	**Approved Districts**
Dave's Sand & Gravel, Inc. Everly, IA	DISTRICT 3
Douds Stone, Inc. Ottumwa, IA	DISTRICT 5
Estherville Sand & Gravel Company Estherville, IA	DISTRICT 3
Falk, L. R. Construction Company St. Ansgar, IA	DISTRICT 2
Flewelling Sand & Gravel Moville, IA	DISTRICT 3
Fred Carlson Company, Inc. Decorah, IA	DISTRICT 1, DISTRICT 2
Ft. Calhoun Stone Company Blair, NE	DISTRICT 3, DISTRICT 4
Fort Dodge Asphalt Company Fort Dodge, IA	DISTRICT 1
Gray Quarry, Inc. Hamilton, IL	DISTRICT 5
Greene Limestone Company Charles City, IA	DISTRICT 2
Hahn Ready Mix Muscatine, IA	DISTRICT 5
Hallett Materials Des Moines, IA	DISTRICT 1, DISTRICT 3, DISTRICT 4
"Hank" Stalp Gravel Company West Point, NE	DISTRICT 3
Heartland Asphalt, Inc. Mason City, IA 50401	DISTRICT 2
Heckett MultiServ Wilton, IA	DISTRICT 5

Producer	**Approved Districts**
Heckett MultiServ West Sterling, IL	DISTRICT 6
Higman Sand & Gravel Akron, IA	DISTRICT 3
Ideal Sand Co. aka Ideal Ready Mix Co., Inc. West Burlington, IA	DISTRICT 5
Iron Mountain Trap Rock Company Iron Mountain, MO	DISTRICT 5
J. W. Ready Mix & Construction Sac City, IA	DISTRICT 3
Kerford Limestone Company Weeping Water, NE	DISTRICT 4
Knocks' Building Supplies Parkersburg, IA	DISTRICT 2
Kruse Paving, Inc. Lakefield, MN	DISTRICT 3
Kruse Rock & Gravel Milford, IA	DISTRICT 3
Kuhlman Construction Company Colesburg, IA	DISTRICT 6, DISTRICT 2
L. G. Everist, Inc. Sioux Falls, SD	DISTRICT 3
L & M Sand & Gravel, Inc. LeMars, IA	DISTRICT 3
L & W Quarries Centerville, IA	DISTRICT 5
LaHARV Construction Company, Inc. Forest City, IA	DISTRICT 2, DISTRICT 3
Linwood Mining & Minerals Corporation Davenport, IA	DISTRICT 5, DISTRICT 6

Lyman-Richey Sand & Gravel Company Omaha, NE	DISTRICT 3, DISTRICT 4
Producer	**Approved Districts**
Mallard Sand & Gravel Company Valley, NE	DISTRICT 3, DISTRICT 4
Manatts, Inc. Brooklyn, IA	DISTRICT 1, DISTRICT 2, DISTRICT 3, DISTRICT 4, DISTRICT 5, DISTRICT 6
Manatts Sand & Gravel, Inc. Tama, IA	DISTRICT 1, DISTRICT 2, DISTRICT 6
Marengo Ready Mix, Inc. Marengo, IA	DISTRICT 6
Martin Marietta Aggregates Des Moines, IA	DISTRICT 1, DISTRICT 2, DISTRICT 3, DISTRICT 4 DISTRICT 5, DISTRICT 6
Martin Marietta Aggregates Valley, NE	DISTRICT 4, DISTRICT 5
MatX, Inc. Colorado Springs, CO	DISTRICT 6
Moberly Stone Company Moberly, MO	DISTRICT 5
Moline Consumers Company Moline, IL	DISTRICT 6
Molo Sand & Gravel Dubuque, IA	DISTRICT 6
Myrl & Roy's Paving, Inc. Sioux Falls, SD	DISTRICT 3
New Ulm Quartzite Quarries, Inc. New Ulm, MN	DISTRICT 2
North Iowa Sand & Gravel, Inc. Mason City, IA	DISTRICT 2
Northwest Materials Fort Dodge, IA	DISTRICT 1

Ortonville Stone Company Ortonville, MN	DISTRICT 3

Producer	**Approved Districts**
Paul Niemann Construction Company Sumner, IA	DISTRICT 2, DISTRICT 6
Pederson Brothers, Inc. Harmony, MN	DISTRICT 2
Pella Construction Company Ltd. Pella, IA	DISTRICT 1, DISTRICT 5
Persinger Sand & Gravel Smithland, IA	DISTRICT 3
Peterson Contractors, Inc. Reinbeck, IA	DISTRICT 1, DISTRICT 2 DISTRICT 3, DISTRICT 4 DISTRICT 5, DISTRICT 6
Prairie Sand & Gravel Prairie Du Chhien, WI	DISTRICT 2
Preston Ready Mix Corporation Preston, IA	DISTRICT 6
Quality Concrete Company Clinton, IA	DISTRICT 6
Randall Transit Mix Company Northwood, IA	DISTRICT 2
Recycled Aggregate Products Company Sioux City, IA	DISTRICT 3
Rehms-Stewart, Inc. Ocheyedan, IA	DISTRICT 3
Reilly Construction Company, Inc. Ossian, IA	DISTRICT 1, DISTRICT 2, DISTRICT 3, DISTRICT 4 DISTRICT 5, DISTRICT 6
River Bend Enterprises Nashua, IA	DISTRICT 2
River City Stone - Div. of Mathy	DISTRICT 6

Dubuque, IA

Producer	Approved Districts
River Products Company, Inc., The Iowa City, IA	DISTRICT 1, DISTRICT 5

Producer	**Approved Districts**
Rohlin Construction Company, Inc. Estherville, IA	DISTRICT 1, DISTRICT 2, DISTRICT 3
Roverud Construction, Inc. Spring Grove, MN	DISTRICT 2
RVBT aka Rock Valley Sand & Gravel Rock Valley, IA	DISTRICT 3
S & A Construction, LTD Allendale, MO	DISTRICT 4
S & G Materials Iowa City, IA	DISTRICT 6
Schildberg Construction Company, Inc. Greenfield, IA	DISTRICT 4
Sieh Sand and Gravel Spencer, IA	DISTRICT 3
Shell Rock Products Shell Rock, IA	DISTRICT 2
Spencer Quarries Spencer, SD	DISTRICT 3
Stoner Sand Ridgeway, MO	DISTRICT 5
Tiefenthaler Ag-Lime Inc. Breda, IA	DISTRICT 3
Ulland Brothers, Inc. Albert Lea, MN	DISTRICT 2
W. Hodgman & Sons, Inc. Fairmont, MN	DISTRICT 2, DISTRICT 3
Wayne T. Hansen Corporation Algona, IA	DISTRICT 2, DISTRICT 3

Weber Stone Company, Inc. Anamosa, IA	DISTRICT 6
Welden Aggregates, Inc. Iowa Falls, IA	DISTRICT 1
Producer	**Approved Districts**
Wendling Quarries, Inc. De Witt, IA	DISTRICT 1, DISTRICT 5, DISTRICT 6
West Des Moines Sand Des Moines, IA	DISTRICT 1
Western Iowa Limestone Harlan, IA	DISTRICT 4
Wetherell Excavating & Trucking, Inc. Storm Lake, IA	DISTRICT 3
Wiltgen Construction Company Calmar, IA	DISTRICT 2
Winn Corporation Sand & Gravel Ollie, IA	DISTRICT 5
Wright Materials Company Belmond, IA	DISTRICT 2
Zupke Sand & Gravel Randalia, IA	DISTRICT 2

AGGREGATE SPECIFICATION LIMITS AND SAMPLING AND TESTING REFERENCE GUIDE

(See Specifications for complete Details)

October 3, 2000
Supersedes April 25, 2000

Matls. I.M. 209, Appendix C
New Issue

TEST LIMITS October 2000	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Mud Balls	Mortar Strength	Al_2O_3 Limit	Pore Index	Gradation Number	Certified Inspection
Fine Aggregate for PCC															**Gradations**
PCC	4110.00						2				1.5			1	1/1500
		Note: Maximum 40% between sieves If the gradation is 80% or less passing the #16 sieve and 50% or less passing the #30 sieve, no mortar strength is required. Annual test requiring mortar strength of more than 1.5 and a fineness modulus of more than 2.75 for continued approval.													
PCC, Class L	4111.00						2				1.3			1	1/1500
		Note: Maximum 45% between sieves													
Mortar	4112.00						2				0.9			2	1/1500
		Note: Shale + coal not to exceed 2%													
Class V	4117.03													8	1/1500
		Note: Only from sources acceptable as coarse aggregate PCC.													
Coarse Aggregate for PCC															
Crushed Stone	4115.00														
		Note: Chert particles are those retained on the 3/8" sieve, except for 4115.06 which uses the #4 sieve. Note: Chert refers to unsound chert on 3/8" sieve which break into 3 or more pieces when subjected to freeze/thaw tests.													
Structural		6		50		2	1	0.5				0.5		3-5	1/1500
Nonstructural		6		50		3	1	0.5				0.5		3-5	1/1500
Gravel	4115.00														
Structural		6		35		2	1	0.5						3-5	1/1500
Nonstructural		6		35		3	1	0.5						3-5	1/1500
Deck Overlay	4115.00	4		40	2.5	0.5						0.4		6	1/1500
							Note:Chert+Shale+Coal+Iron not to exceed 1%.								
Class V Aggregate	4117.00													7	1/1500
	Note: Course Aggregate as in 4115 and Fine Aggregate as in 4110 and 4111.														

AGGREGATE SPECIFICATION LIMITS AND SAMPLING AND TESTING REFERENCE GUIDE
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Granular Surfacing															
Agg. for Granular Shoulders	4120.02														1/3000
		Note: Requirements are equivalent to 4120.04, 4120.05, or 4120.06.													
Class C Gravel	4120.03		15				10			15				10	1/3000
Class A Crushed Stone	4120.04		15	45						4				11	1/3000
	For shoulders only; If "A" Freeze does not exceed 10, an abrasion of 55% will be allowed.														
Class B Crushed Stone	4120.05		20	55						4				11	1/3000
		Note: "C" Freeze + Abrasion not to exceed 65%													
Class D Crushed Stone	4120.06														1/3000
		Note: "C" Freeze, Abrasion, and Gradation to be determined by Contract Documents.													
Paved Shoulders Fillets	4120.07		15	45						4				16	1/3000
Granular Subbase															
	4121.00	25		45								1.5		12	1/3000
		Note: Crushed PCC, sand, gravel, or crushed stone, or combinations. See specifications for details. The following are virgin materials:													

Iowa Department of Transportation

Office of Materials

AGGREGATE SPECIFICATION LIMITS AND SAMPLING AND TESTING REFERENCE GUIDE

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TEST LIMITS October 2000	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Mud Balls	Mortar Strength	Al_2O_3 Limit	Pore Index	Gradation Number	Certified Inspection
Crushed Stone-Base															
Macadam Stone	4122.02		10	45										13	1/1500
Modified Subbase															
	4123.00		15	45								4.7(-#40)		14	1/3000
Note: Material with Al_2O_3 less than 0.7 (+4) may have an abrasion maximum of 55.															
Note: If gravel only, 75% of +3/8" must be crushed with a minimum of one fractured face.															
Cover Aggregate															
Cover Aggregate for Bituminous Seal Coats	4125.01A		10	40			5							1,19-21	1/1500
Note: Friction Type 4D or better, Shale on Sand Cover Aggregate shall not exceed 2%.															
Aggregate for Slurry Mixture	4125.01B	10		40			5							23	1/1500
Note: Friction Type 4 or better, Sand Equivalent of not less than 45.															
Fine Aggregate for ACC															
Type A	4127.03						2	0% on 1.5"						22,24-27	1/1500
Type B	4126.00													24-27	1/1500
Note: Crushed fine aggregate shall be produced from sources meeting freeze/thaw and abrasion loss requirements for coarse aggregates for ACC.															
Coarse Aggregate for ACC															
Type A	4127.00	10		45	6.0							0.7		24-27	1/1500
Note: Mudballs + Clay Lumps not to exceed 0.5%															
Note: The fine portion of combined materials shall not exceed 2% shale retained on the #16 sieve.															
Type B															
Note: The fine portion of combined materials shall not exceed 5% shale retained on the #16 sieve.															
Primary	4126.02	25	10	45	6.0							1.5		24-27	1/1500
Non-Primary	4126.02	45	10	45	6.0							2.5		24-27	1/1500
Composite Aggregate for ACC															
	4126.04								4					24-27	1/1500
Note: This gradation only applies to Marshall mixtures.															

AGGREGATE SPECIFICATION LIMITS AND SAMPLING AND TESTING REFERENCE GUIDE

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TEST LIMITS October 2000	Spec #	F & T A	F & T C	LA Abrasion	Absorption	Chert	Shale	Clay Lumps	Plastic Index	Mud Balls	Mortar Strength	Al_2O_3 Limit	Pore Index	Gradation Number	Certified Inspection
Revetment Stone															
Class A	4130.02	10		50								0.7	25		N/A
Class B	4130.03	10		50								0.7	25		N/A
Class D	4130.04		10	50											N/A
Class E	4130.04	10		50								0.7	25		N/A
Erosion Stone	4130.05		15	50						5				34	N/A
		Note: Minimum of 50% layers greater than 5" thick. A minimum of 10% with the greatest dimension not more than 2 times the smallest.													
Porous Backfill	4131.00	10		45								0.7		29	1/1500
						Note: Shall not exceed 5% shale on the #16 sieve.									
Special Backfill															
Crushed Stone/Concrete	4132.02													30,31	1/3000
Gravel	4132.03											10		31	1/3000
		Note: Carbon of no more than 1% on fraction passing to #40 sieve.													
Granular Backfill	4133.00									4				32	1/3000
		Note: "C" Freeze and Abrasion requirements are equivalent to those of either 4120.04 or4120.05.													
Recycled PCC				Note: Recycled PCC must meet gradation and sampling frequency of the intended product.											
Recycled Composite Pavement				Recycled composite pavement must meet gradation and sampling frequency of the intended product.											

AGGREGATE GRADATION TABLE – ENGLISH

OCTOBER, 2001

Percent Passing

Grad .No.	Section No.	Intended Use	1.5"	1.0"	¾"	½"	⅜"	#4	#8	#30	#50	#100	#200	**Notes**
1	4110,4111,4125	PCC FA, Cover Agg.					100	90-100	70-100	10-60			0-1.5	1
2	4112	Mortar Sand						100	95-100	40-75	10-40	0-30	0-3	
3	4115 (57,2-8)	PCC CA	100	95-100		25-60		0-10	0-5				0-1.5	2
4	4115 (2-8)	PCC CA	100	50-100	30-100	20-75	5-55	0-10	0-5				0-1.5	
5	4115 (67, 2-8)	PCC CA		100	90-100		20-55	0-10	0-5				0-1.5	
6	4115.06 (Repair & Overlay)	PCC CA			100	97-100	40-90	0-30					0-1.5	
7	4117 (Class V)	PCC FA & CA	100					80-92	60-75	20-40				
8	4117.03 (Class V)	Fine Limestone					100	90-100					0-30	
10	4120.03 (C Gravel)	Granular Surface			100			50-80	25-60					3
11	4120.04, 4120.05 A, B Cr. St.)	Granular Surface & Shoulder		100	95-100	70-90		30-55	15-40				6-16	4,5
12	4121	Granular Subbase	100						10-20		0-15		0-6	6
13	4122.02 (Cr. St.)	Mac. St. Base	3" nominal maximum size – screen over ¾"or 1.0" screen.											
14	4123	Modified Subbase	100		70-90				10-40				3-10	5
16	4120.07 (Cr. St.)	Paved Shoulder Fillet	100			0-50		0-10						7
19	4125 (0.500" Cr. Gr. Or Cr. St.)	Cover Aggregate			100	97-100	40-90	0-30	0-15				0-2	
20	4125(0.500" Scr. Gr.)	Cover Aggregate			100	95-100	40-80	0-15	0-7				0-1.5	
21	4125 (⅜")	Cover Aggregate				100	90-100	10-55	0-20	0-7			0-1.5	
23	4125.01B (Cr. St.)	Slurry Treatment					100	70-90	45-70	19-34	12-25	7-18	5-15	
29	4131	Porous Backfill			100	95-100	50-100	10-50	0-8					
30	4132.02 (Cr. St.)	Special Backfill	100						15-45				0-10	5
31	4132.03 (Gravel)	Special Backfill		100	90-100	75-90			30-55				3-7	
32	4133 (Sand/Gr./ Cr. St.)	Granular Backfill	100 % passing the 3" screen						20-100				0-10	8,9
34	4130.05 (6" Cr. St.)	Erosion Stone	100% passing the 9" screen – 100% retained on the 3" screen											

Notes: (Gradations No. 9, 15, 17, 18, 22, 24, 25, 26, 27, 28, and 33 have been deleted.

1. When the fine aggregate is sieved through the following number sieves – 4, 8, 16, 30, 50 and 100 – not more than 40% shall pass one sieve with the next higher number, for section 4110, nor 45% for section 4111

2. When used in precast and prestressed concrete bridge beams, 100% shall pass the 1.0" sieve.

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

4. See specification for combination of gravel and limestone screenings.

5. Unwashed air dry samples of crushed composite material shall be tested for gradation compliance except that no gradation determination will be made for the material passing the No. 200 sieve.

6. For granular subbase made from crushed concrete, it may be necessary to scalp or screen to attain the specified gradation. The gradation requirements for granular subbase, not made from crushed concrete and without blending sand, shall be 8% to 30% passing the No. 8 sieve.

7. Gradation 3 or 4 may be substituted, at the contractor's option.

8. Crushed stone shall have 100% passing the 1.0" sieve.

9. When granular backfill is used under flowable mortar, one of the following alternative materials shall be used: natural sand complying with Section 4110, except the % passing the No. 200 sieve shall not exceed 4%; gravel, crushed stone, or crushed concrete meeting gradation requirements of Section 4121.

NOTES

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.

AGGREGATES DEFINED

Generally, aggregates are granular construction materials composed of hard mineral particles, crushed or uncrushed, 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 75 µm (#200) sieve.

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

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 4.75 mm (#4) sieve as the sieve size with which to make this separation. All particles which will pass through a 4.75 mm (#4) sieve, and be

Aggregate Classification

Coarse Aggregate: *Any aggregate that does not pass the 4.75 mm (no. 4 sieve).*

Fine Aggregate: *Any aggregate that passes the 4.75 mm (no. 4 sieve).*

predominately retained on the 75 µm (#200) sieve, are referred to as "fine aggregates." All particles which are retained on 4.75 mm (#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 or gravels as opposed to manufactured sands or gravels. Consequently, sand made by crushing quartzite or limestone is a natural aggregate but not a natural sand. The specifications required fine aggregates for concrete floors and pavements to be natural sands.

Aggregate Uses

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

NOTES

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 I.M. Volume II prepared by the Materials Office of the Highway Division.

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, appendix C. 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 listed 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 2 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 produced 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 directly by the Transportation Center 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.

To obtain an off-the-belt sample, stop the belt, insert a template at three or more separate locations along the belt, remove all material within the template, and combine it into the field 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. All material within each

Methods for Obtaining Aggregate Samples:
***Off the Belt Sampling*
***Streamflow Sampling*
***Stockpile Sampling*
(fine aggregate only)

1. Conveyor Belt Sampling

2. Streamflow Sampling

increment is removed from all three or more increments and mixed back together to make one field sample. When obtaining field sample by interception of 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.

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 not to sample at the bottom of the stockpile. Stockpile sampling of coarse 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.

Sampling Records

It is the responsibility of the aggregate sampler to get all the necessary information to fill out report headings. This includes type of material, intended use, location of producer, source, 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

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

3a. Stockpile Sampling: Sand Tube

3b. Stockpile Sampling: Shovel

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.

and securely tied to prevent loss of material during shipping. Appropriate Form 82003 should be filled out completely and placed <u>inside</u> the sample sack. Other identification tags should be attached to the tie for shipping information.

use square headed shovels for sand sampling

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?
5. Do you know the proper action to take if the sample fails to meet specification requirements?

NOTES

MATERIALS LABORATORY QUALIFICATION PROGRAM

GENERAL

The FHWA has outlined a Laboratory Qualification Program in the Federal-Aid Policy Guide update published as 23 CFR 637 on June 29, 1995. The updated guide has requirements for laboratories performing testing on Federal-Aid highway projects on the National Highway System (NHS). The Iowa DOT must implement the program for laboratory qualification by June 29, 2000.

LABORATORIES TO BE QUALIFIED

The following laboratories will be included in the qualification program for all projects on Interstate and primary routes:

Central Materials Laboratory
6 Transportation Center (TC) Laboratories
TC Area Laboratories
Resident Construction Laboratories
Aggregate Producer Laboratories
Ready Mix Laboratories
PCC Contractor Laboratories
ACC Contractor Laboratories
Consultant and Commercial Laboratories *
City Laboratories *

* May be qualified at the time of a project.

LABORATORY QUALIFICATION PROCESS

A two-level qualification system is required by the FHWA. Laboratories are either accredited or qualified. The accreditation process is more rigorous than the qualification process.

Accredited Laboratory Process

The Central Materials Laboratory and the six TC Laboratories will be accredited as outlined in the 23 CFR 637 guide. The Central Materials Laboratory is accredited through the AASHTO Materials Reference Laboratory Program. The TC Materials Laboratories will be accredited by using the Central Materials Staff and equipment to check testing and testing procedures and by using the same calibration and training documentation process. Laboratories will be accredited for a two-year period. In addition, an annual review will be made by the Central Office Staff. Appendix A contains the procedures for accrediting the Transportation Center Materials Laboratories.

Qualified Laboratory Process

The remaining laboratories will be qualified as outlined below:

The Transportation Center Materials Offices will qualify laboratories. Laboratories will be qualified for a two-year period. In addition, an annual review will be made by TC Staff. Appendix B contains the procedures for qualifying materials laboratories.

Three laboratory types will be qualified, aggregate laboratories, PC Concrete laboratories and asphalt mix laboratories.

Qualified laboratories will have the following:

1. Current manuals and test methods to perform the qualified testing available.
2. A technician certified by the Iowa DOT to perform the qualified testing.
3. Proper equipment to perform the qualified testing (calibrated or checked annually according to Appendix B).
4. Satisfactory correlation and proficiency test results.
5. Documentation of equipment calibrations, equipment checks, and correlation results.

ADMINISTRATION OF THE PROCESS

The Central Materials Laboratory will be responsible for implementation and operation of the Laboratory Qualification Program. The Central Materials Laboratory will accredit the TC Laboratories. The Transportation Center Materials Offices will qualify laboratories.

NON-COMPLIANCE/DISPUTE RESOLUTION

A laboratory that does not meet the requirements of the I.M. is subject to elimination from the qualification program.

Disputes concerning calibration and correlation of equipment will be resolved by the office responsible for the qualification. For disputes that cannot be resolved at the Transportation Center, the Central Materials Laboratory will be the final authority.

******GENERAL RE-WRITE – PLEASE READ CARERFULLY******

APPENDIX A
TC LABORATORY ACCREDITATION PROGRAM

The Central Materials Laboratory (CML) will accredit the Transportation Center Materials Laboratories and maintain records of the accreditation for five years. The CML Staff will check the following prior to accrediting a laboratory:

1. Check for current manuals and test procedures covering the accredited testing.
2. Check the certification and training records of the testing personnel.
3. Document that proper equipment is available to perform qualified testing.
4. Check documentation system.

Scheduling of the annual accreditation review will be discussed with the laboratories needing accreditation.

Table 1 is the list of items to be reviewed.

An oral close out on any deficiencies will be held with the testing personnel. Written notice will be sent within two months of the inspection. CML personnel will re-inspect if necessary after correction of any deficiencies.

A report showing the laboratory, the date accredited, and the expiration date will be issued by the Materials Testing Engineer.

NON-COMPLIANCE/ DISPUTE RESOLUTION

A laboratory that does not meet the requirements of the I.M. is subject to elimination from the qualification program.

The CML and the Transportation Center Materials Engineer will resolve disputes concerning calibration and correlation of equipment.

Table 1. Laboratory Accreditation Checklist

	√	**Minimum Calib./Verif. Interval**	**Calib./Verif. Procedure**
Tester Qualifications-Proper Iowa DOT certifications			
Current Written Test Procedures			
Current Calibration Procedures & Records			
Documentation of correlation results and corrective actions taken for previous construction season			
Balances		12 months	Iowa 917-A
Ovens		4 months	In-House Procedure #1
Mechanical Shakers		12 months	In-House Procedure #2
Marshall Compactor T-245		12 months	In-House Procedure #4
Gyratory Compactor TP-4		6 months	In-House Procedure #22
Marshall Molds T-245		12 months	In-House Procedure #23
Comp. Test Machine T-245		12 months	In-House Procedure #5
Sieves		6 months	In-House Procedure #6
Thermometers - Test		6 months	In-House Procedure #7
Thermometers - Ref.		12 months	In-House Procedure #7
Timers T-201, T-202		6 months	In-House Procedure #8
Sand Equivalent T-176		12 months	In-House Procedure #9
Gyratory Compactor Molds TP - 4		12 months	In-House Procedure #24
Vacuum Systems T-209		12 months	In-House Procedure #10
Pycnometers T-228, T209		12 months	In-House Procedure #18
Fine Aggregate Anularity TP33		12 months	In-House Procedure #25
Dynamic Shear Rheometer TP5-97		6 months	In-House Procedure #12
Balance Weights		12 months	In-House Procedure #30
Sample Splitters		12 months	

APPENDIX B
LABORATORY QUALIFICATION PROGRAM

The District (DISTRICT) Materials Office will qualify the other laboratories and maintain records of the qualification for three years. The District Staff will check the following prior to qualifying a laboratory:

1. Establish the type of laboratory (Aggregate, Asphalt Mix, PC Concrete).
2. Check for current manuals and test procedures covering the qualified testing.
3. Check the certification of the testing personnel.
4. Document that proper equipment is available to perform qualified testing.
5. Check documentation system.

Scheduling of the qualification review will be discussed with the laboratories seeking qualification. The District Materials Engineer should be contacted for laboratories that have been qualified in other states. The District Materials Office may qualify a laboratory based on an acceptable qualification report and qualification program from another state transportation agency.

Table 1 and the pages following cover the list of items to be reviewed.

An oral close out on any deficiencies will be held with the testing personnel. Written notice will be sent within two weeks of the inspection. District personnel will re-inspect after correction of any deficiencies.

A form showing the laboratory type, the date qualified, and the expiration date will be issued by the District Materials Engineer.

The list of Qualified Laboratories will be maintained on a database accessible by authorized Materials Personnel.

NON-COMPLIANCE/ DISPUTE RESOLUTION

A laboratory that does not meet the requirements of the I.M. is subject to elimination from the qualification program.

The office responsible for the qualification will resolve disputes concerning calibration and correlation of equipment. For disputes that cannot be resolved at the District level, the Central Materials Laboratory will be the final authority.

Table 1. Laboratory Qualification Checklist

		Calib./Verif. Interval	**Calib./Verif. Procedure**
Tester Qualifications-Proper Iowa DOT certifications			
Current Written Test Procedures			
Current Calibration Procedures & Records			
Documentation of correlation results and corrective actions taken for previous construction season.			
Aggregate Laboratory			
Balances		12 months	Iowa 917-B
Sieves- wear, tear, size, and opening size		12 months	
Splitter- condition		12 months	
Mechanical Shakers- condition (if used)		12 months	
ACC Laboratory			
Balances- and water bath		12 months	Iowa 917-B
Sieves- wear, tear, size, and opening size		12 months	
Splitter- condition		12 months	
Mechanical Shakers- condition (if used)		12 months	
Rice equipment- vacuum and flask		12 months	IM 350
Thermometers		12 months	
Ovens- temperatures		12 months	
Gyratory Compactor and molds		12 months	Manufacturer Rec.
Marshall Hammer and molds		12 months	Correlation Checks
PCC Laboratory			
Balances		12 months	Iowa 917-B
Sieves- wear, tear, size, and opening size		12 months	
Splitter- condition		12 months	
Mechanical Shakers- condition (if used)		12 months	
Air Meter		12 months	IM 318
Slump Cone and equipment-condition		12 months	
Beam Breaker		12 months	Central Lab

Iowa Department of Transportation

MATERIALS LABORATORY QUALIFICATION PROGRAM
Laboratory Inspection - per Materials Instructional Memorandum 208

Company Name: ______________________________

Laboratory name: ______________________________

Laboratory type: Aggregate ACC PCC (Circle one)

Laboratory location: ______________________________

Laboratory contact person: ______________________________

Laboratory technician:	Certification number:	Expires:

Current manuals and written test procedures available? ______________________________

Current calibration procedures and records? ______________________________

Documentation of correlation results and corrective actions taken for previous construction season? __________

Proper equipment available to perform qualified testing? ______________________________

Other remarks: ______________________________

Date of inspection: ______________ Qualification expiration date: ______________

Inspection performed by: ______________________________
print name

____
sign name

Inspection received by: ______________________________
print name

____
sign name

District Number __________

cc: Materials Engineer, Contractor/Producer, Ames, File

Iowa Department of Transportation

AGGREGATE LABORATORY INSPECTION QUALITY CONTROL CHECKLIST

Contractor/Producer: ____________________ Location: ____________________
Certified Technician: ____________________ Certification No.: ____________________

Balances (Iowa Test Method 917-B) **Yes** **No**

	Yes	No
Updated balance calibration records available?	___	___
Check balance using 500 gm & 1000 gm calibrated weights?	___	___
Is balance accurate to 0.1%?	___	___

Sieves

	Yes	No
Is there adequate correlation history to qualify?	___	___
Were go no-go gauges used to check accuracy?	___	___
Are the sieves in good condition (no loose frames, holes, or tears.)	___	___

Splitter

	Yes	No
Is the splitter in good condition? (i.e..., missing chutes, cracked welds, or leaking seams)	___	___

Shaker

	Yes	No
Is shaker apparatus secure and level?	___	___

Comments: ____
____
____
____

cc: Materials Engineer
Contractor/Producer
Ames
File

Inspected By: ____________________

Date Inspected: ____________________

Iowa Department of Transportation

ACC LABORATORY INSPECTION QUALITY CONTROL CHECKLIST

Contractor/Producer: ____________________ Location: ____________________

Certified Technician: ____________________ Certification No.: ____________________

		Yes	No
Thermometers	(I. M. 350)		
Thermometer Calibration and Documentation available?		____	____
Temperature of check:	________ (25 deg C. or 135 deg C.)		
state reference thermometer	________		
contractor reference thermometer	________		
difference	________		
Calibration Chart?		____	____
Rice Pycnometer	(I.M. 350)		
Calibration documentation available?		____	____
Equipment achieves less then 30mm of mercury vacuum?		____	____
Mercury is free of bubbles?		____	____
Gyratory/Marshall Compactor	(AASHTO TP - 4)/(I. M. 325)		
Calibration documentation available?		____	____
Is equipment generally clean?		____	____
Documentation of annual mold measurements?		____	____
Ovens	(I.M. 325)		
Documentation of temperature checks?		____	____
General condition satisfactory?		____	____
Do all parts work as intended?		____	____
Water Bath	(I.M. 321)		
Temperature?	________		
Correlation			
Lab Chief advised correlation results needed for following year?		____	____

Comments: ____

____

____

____

NOTE: ACC labs must also qualify as an aggregate Lab.

cc: Materials Engineer
Contractor/Producer
Ames
File

Inspected By: ____________________

Date Inspected: ____________________

Iowa Department of Transportation

READY MIX/PCC PAVING LABS
QUALITY CONTROL CHECKLIST

Contractor/Producer : ______________________ Location: ______________

Certified Technician : ______________________ Certification No : ________

Inspection Checklist Items:

	Yes	No
Air Meter (I.M. 318)		
Check meter using approved 5% pugs. (**optional**)	____	____
Is air meter clean?	____	____
Proper rod and mallet.	____	____
Slump Cone (I.M. 317)		
Interior of cone free of dents or projections.	____	____
5/8" by 24" tamping rod.	____	____
Rigid, nonabsorbent base.	____	____
Equipment clean and free of hardened concrete.	____	____
Beam Breaker (I.M. 316)		
Current annual calibration sheet	____	____
Equipment clean.	____	____
Beam Molds (I.M. 328)		
Molds clean and free of dents	____	____
General condition of molds good.	____	____

Comments ____

NOTE: PCC labs must also qualify as an aggregate Lab.

cc: Materials Engineer
Contractor/Producer
Ames
File

Inspected By: ______________

Date Inspected: ______________

APPENDIX C
INTERLABORATORY CORRELATION TESTING

GENERAL

Each Transportation Center Laboratory shall establish and maintain their testing credibility by following the correlation-testing program described herein. The testing precision data listed in this I.M. shall apply to correlation of test results between the Iowa DOT and a contractor's laboratory.

CORRELATION SAMPLE

The remaining portion of a project control sample may be submitted to the Central Laboratory for testing. This sample shall be re-identified showing the intended use to be: Correlation testing, project number, and department information.

CORRELATION FREQUENCY

Each Transportation Center Laboratory shall correlate the following tests at a frequency of at least once per month. The frequency may be increased for problem situations at the discretion of the Transportation Center Materials Engineer.

1. Asphalt Cement
   a. DSR Stiffness G*/sin delta
   b. Specific Gravity @ 15.6°C (60°F)
2. Emulsified Asphalt
   a. Percent Residue
3. Asphalt Mixtures
   a. Gyratory Density
   b. Gyratory Slope
   c. Marshall Density
   d. Maximum Specific Gravity

4. Aggregate

   a. Gradation of Combined Aggregate

   b. Specific Gravity of Aggregate for Mix Design

   c. Absorption of Aggregate for Mix Design

   d. Fine Aggregate Angularity

TESTING PRECISION

1. Asphalt Cement

   a. Penetration. The two results shall not differ from their mean by more than 8 percent of their mean.

   b. Absolute Viscosity. The two results shall not differ from their mean by more than 10 percent of their mean.

   c. Specific Gravity. The two results shall not vary by more than 0.005.

   d. DSR Stiffness. The two results shall not differ from their mean by more than 10 percent of their mean.

2. Emulsified Asphalt

   a. Percent Residue. The two results shall not differ by more than 2 percent.

3. Cut-Back Asphalt

   The two results shall not differ from their mean by more than 3 percent of their mean for material having a viscosity of less than 800 cst and 9 percent of their mean for material having viscosity between 800 to 6000 cst.

4. Asphalt Mixture

   a. Asphalt Content by Extraction. The two results shall not differ by more than 0.3 percent.

   b. Gradation of Extracted Aggregate. The two results shall meet the precision parameters prescribed in I.M. 216.

   c. Asphalt Content by Nuclear Gauge. The two results shall not differ by more than 0.3 percent.
   d. Marshall and Gyratory Density The two results shall not differ by more than 0.02.

   e. Maximum Specific Gravity. The two results shall not differ by more than 0.01.

5. Aggregate

   a. Gradation of Combined Aggregate. The two results shall meet the precision parameters prescribed in I.M. 216.

   b. Bulk Dry Specific Gravity for Mix Design. The difference between the two results shall not be more than 0.028.

   c. Absorption of Aggregate for Mix Design. The difference between the two results shall not be more than 0.37 percent.

   d. Apparent Specific Gravity for Mix Design. The difference between the two results shall not be more than 0.01.

   e. Fine Aggregate Angularity. The difference between the two results shall not be more than 0.5.

Other tests such as kinematic viscosity, specific gravity of asphalt cement and penetration of emulsion residue may be correlated at the discretion of the Transportation Center Materials Engineer.

NOTES

GENERAL AGGREGATE SOURCE INFORMATION

GENERAL

Generally, 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 asphalt construction, and a durability class for coarse aggregates used in Portland Cement Concrete construction. Upon request, new sources or different combinations of beds within an existing source can be evaluated for classification for either type of use. These rankings do not in any way waive the normal quality requirements for the particular types of aggregates indicated in contract documents.

PORTLAND CEMENT CONCRETE AGGREGATES

Aggregates shall be produced from sources approved in accordance with the requirements of Office of Materials I.M. 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 may have ½ in. Bridge Deck Overlay/Repair material available.

ASPHALTIC CONCRETE AGGREGATES

Aggregates for asphaltic construction have been classified into six 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.

When aggregates of friction Type 1 through Type 4 are specified for construction, a source approval including bed limitations is required for each project. 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 calcinated 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 granites. 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.

Type 3: Natural aggregates in this class are crushed traprocks, and/or crushed gravels. The crushed gravels shall not contain more than 60 percent total carbonate. 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 4D: A subgroup of the Type 4 category comprised of those aggregates near, but exceeding, the 20-micron minimal grain size. Type 4D aggregates are not acceptable for use in any asphalt cement concrete surface courses requiring the use of Type 4 or better material.

Type 5: Aggregates crushed from dolomitic or limestone ledges in which 20 percent or more of the grains are 30 microns or smaller.

SOURCE LISTINGS - Explanation

The use of Xs in the PCC or AC columns indicates use where no classification is required or, if required, has not been made.

NOTE: - indicates top size limitation.

Bed numbers shown for PCC aggregate are those on the formal source approval letter. Beds shown for AC sources are those which have been used or have potential for use and are of the designated friction type.

Frictional Classification - as indicated on page 2
Asphaltic Concrete - Type A and B

Durability Class for Portland Cement Concrete
Coarse Aggregate Fine Aggregate
("B" indicates acceptability for Bridge Deck Overlay/Repair)

Source Code Number - Used to identify sources on test requests and for data storage.

Specific Gravity
(DWU-Determine When Used)

```
                                                                        DUR     FRICT
                                                                   SP   PCC      AC
CODE    OPERATOR                 SOURCE NAME           LOCATION    GR   CA  FA  A  B   BEDS
*******************************************************************************************
 04    APPANOOSE       SEITC     ---CRUSHED STONE---                    :     :      :     :
A04004 L&W QUARRIES INC          MARTIN #3          E2 20 T070  R19W 2.70 : 2     : 4D 4D: 1 - 3 :1
*******************************************************************************************
 54    KEOKUK          SEITC     ---CRUSHED STONE---                    :     :      :     :
A54002 KASER CORP                KESWICK            NW 21 T077  R12W 2.61 : 2     : 4  4 :13 -15 :2
*******************************************************************************************
 55    KOSSUTH         NEITC     ---SAND & GRAVEL---                    :     :      :     :
A55520 GIESE CONST CO            CONN               SE 35 T095  R29W DWU  :    X :      :     :3
*******************************************************************************************
 56    LEE             SEITC     ---CRUSHED STONE---                    :     :      :     :
A56004 CESSFORD CONST CO         FRANKLIN           NE 25 T068  R06W 2.49 : 2     :      :    12 :2
*******************************************************************************************
NOTES: 1 - AASHTO D-67, GRADATION #5, 40% MAXIMUM
       2 - AASHTO 57 GRADATION MAXIMUM
       3 - APPROVED ONLY FOR L-MIX PC CONCRETE
```

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
01	ADAIR DIST. 4	---CRUSHED STONE---								
A01002	SCHILDBERG CONST CO INC	MENLO	SE 17 TO77 R31W				5	5	15 -16	
								4	14	
A01004	SCHILDBERG CONST CO INC	JEFFERSON	NW 17 TO77 R31W					5	20	
								4D	25	
A01006	SCHILDBERG CONST CO INC	HOWE	SW 01 TO76 R31W					5	25	
02	ADAMS DIST. 4	---CRUSHED STONE---								
A02002	SCHILDBERG CONST CO INC	MT ETNA	SW 23 TO73 R34W					4	11 -13	
A02004	SCHILDBERG CONST CO INC	CORNING	10 TO71 R34W					4	3 - 5	
		---SAND & GRAVEL---								
A02502	SCHILDBERG CONST CO INC	MT ETNA	NW 23 TO73 R34W	2.67	2		4	4		
				2.67		X				
03	ALLAMAKEE DIST. 2	---CRUSHED STONE---								
A03002	BRUENING ROCK PROD INC	WEXFORD	NE 36 TO98 R03W	2.70	3i				1C- 5	
							4	4	1 - 8	
A03008	BRUENING ROCK PROD INC	MCCABE	NE 06 TO97 R05W					4	1 - 6	
A03014	BRUENING ROCK PROD INC	HAMMELL-BOONIES	SW 02 TO99 R06W		X		4	4	5 - 6	
A03022	ROVERUD CONST INC	LIVINGOOD	SW 07 TO96 R06W				4	4	4 - 7	
								4	2 - 7	
A03028	ROVERUD CONST INC	WELPER-JOHNSON	SW 35 TO99 R04W							
A03034	BRUENING ROCK PROD INC	WILDE	SE 13 TO99 R05W		X		4	4	1 - 5	
A03038	BRUENING ROCK PROD INC	RHEIM	SE 07 T100 R04W	DWU	3i		4	4	1 - 4	
A03040	BRUENING ROCK PROD INC	DEE	SE 21 TO99 R04W	DWU	3iB		4	4	5A- 5D	
A03042	NIEMANN CONST CO	CHURCHTOWN	SW 29 TO99 R04W					4	1 - 3	
							4	4	3	
A03046	BRUENING ROCK PROD INC	MOHS	SW 29 TO96 R04W	DWU	2		5	5	1 - 2	
								5	1 - 4	
A03048	BRUENING ROCK PROD INC	POSTVILLE	SW 16 TO96 R06W					4	2 - 5	
A03050	BRUENING ROCK PROD INC	GREEN	NW 16 TO96 R06W	2.63	3		4	4	2 - 3	
A03052	BRUENING ROCK PROD INC	ROSSVILLE	NE 35 TO97 R05W	DWU			4	4	1 - 5	
A03054	BRUENING ROCK PROD INC	WEST RIDGE	NE 08 TO98 R06W							
A03056	NIEMANN CONST CO	WAUKON	SW 05 TO97 R05W							
A03060	NIEMANN CONST CO	HANOVER	NE 36 TO99 R06W							
A03064	WILTGEN CONST CO	RAINBOW ACRES	SE 26 TO97 R02W							
A03066	WILTGEN CONST CO	ELSBERN	NW 29 TO97 R06W							
		---SAND & GRAVEL---								
A03502	CARLSON MATERIALS CO	HARPERS FERRY	SW 07 TO97 R02W	2.67	3iB		3	3		
				2.67		X				
A03506	BRUENING ROCK PROD INC	HAMMELL-BOONIES	SW 02 TO99 R06W				4	4		
A03510	CARLSON MATERIALS CO	LONNING	SE 02 TO99 R06W				4	4		
				DWU		X				
A03512	ROVERUD CONST INC	ZEZULKA	NE 11 T100 R04W				3	3		
				2.66		X				
04	APPANOOSE DIST. 5	---CRUSHED STONE---								
A04004	L&W QUARRIES INC	MARTIN #3	E2 20 TO70 R19W	2.70	2		4D	4D	1 - 3	1
								5	6	
A04016	L&W QUARRIES INC	LEMLEY EAST #5	CT 35 TO70 R19W	2.70	2		4D	4D	1 - 3	1
								5	6	
A04018	L&W QUARRIES INC	CLARKDALE #8	SE 15 TO69 R18W					5	4	

NOTE:
1 - AASHTO 67, GRADATION #5, 40% MAXIMUM; RESTRICTION DOES NOT APPLY TO STRUCTURAL CONCRETE

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
05	AUDUBON DIST. 4	SAND & GRAVEL							
A05506	HALLETT MATERIALS CO	EXIRA	SW 08 TO78 R35W	2.64	3		4	4	
				2.66		X			
06	BENTON DIST. 6	CRUSHED STONE							
A06002	BASIC MATERIALS CORP	SMITH	NW 19 TO86 R12W	2.65	2		4	4	21 -26
A06004	WENDLING QUARRIES INC	GARRISON A	SE 28 TO85 R11W	2.67	2		4	4	6 -16
A06006	WENDLING QUARRIES INC	GARRISON B	NE 33 TO85 R11W	2.64	2		4	4	6 -16
A06008	WENDLING QUARRIES INC	BALLHEIM	NE 17 TO86 R12W					X	
A06012	COOTS MATERIALS CO INC	JABENS	SW 07 TO85 R11W	DWU	2				6 -11
				2.63	2		4	4	12
							4	4	10 -12
A06014	WENDLING QUARRIES INC	VINTON-MILROY	S2 10 TO85 R10W					4	
A06016	COOTS MATERIALS CO INC	COOTS	SW 36 TO86 R11W					X	
A06018	WENDLING QUARRIES INC	PORK CHOP-EAST	NW 11 TO85 R09W					X	
A06020	WENDLING QUARRIES INC	PORK CHOP-WEST	NE 10 TO85 R09W						
A06022	WENDLING QUARRIES INC	LONG	SE 13 TO84 R09W					X	
		SAND & GRAVEL							
A06502	WENDLING QUARRIES INC	VINTON-MILROY	S2 10 TO85 R10W				4	4	
				2.65		X			
A06504	COOTS MATERIALS CO INC	MT AUBURN	SW 31 TO86 R10W				4	4	
				2.65		X			
A06506	WENDLING QUARRIES INC	PORK CHOP	CT 11 TO85 R09W				4	4	
				DWU		X			
07	BLACK HAWK DIST. 2	CRUSHED STONE							
A07004	BASIC MATERIALS CORP	WATERLOO SOUTH	NW 18 TO87 R12W				4	4	17 -23
							4	4	32 -36
								4	1 -16
A07006	BASIC MATERIALS CORP	YOKUM	NE 05 TO90 R14W					5	11 -21
A07008	BASIC MATERIALS CORP	MORGAN	NE 15 TO89 R12W					5	1 - 3
								5	4A- 4B
A07014	NIEMANN CONST CO	GLORY	NE 36 TO87 R11W					4	3 - 4
								5	1 - 4
A07018	BASIC MATERIALS CORP	RAYMOND-PESKE	SW 01 TO88 R12W	2.66	2		4	4	1B- 5
							4	4	6 -10
A07020	BASIC MATERIALS CORP	STEINBRON	SE 01 TO88 R11W	2.62	3i		X	X	1
		SAND & GRAVEL							
A07504	BASIC MATERIALS CORP	WATERLOO SAND	SW 09 TO89 R13W				4	4	
				2.65		X			
A07506	MANATTS INC	ASPRO	NW 01 TO88 R13W				4	4	
				2.65		X			
A07508	BASIC MATERIALS CORP	GILBERTVILLE	16 TO88 R12W				4	4	
				2.65		X			
A07512	ZEIEN S&G	ZEIEN	NW 23 TO87 R12W						
A07518	NIEMANN CONST CO	JANESVILLE	NE 14 TO90 R14W				3	3	
				2.66		X			
08	BOONE DIST. 1	SAND & GRAVEL							
A08520	MARTIN MARIETTA	LAUBE	36 TO85 R27W				4	4	
A08524	HALLETT MATERIALS CO	JENKINS-STURTZ	W2 36 TO84 R27W	2.69	2		3	3	
				2.66		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
09	BREMER DIST. 2	---CRUSHED STONE---							
A09002	BASIC MATERIALS CORP	FREDERIKA	NE 12 T093 R13W					5	2 - 8
A09004	NIEMANN CONST CO	DENVER-FOELSKE	NE 29 T091 R13W				4	4	4 - 9
A09006	NIEMANN CONST CO	TRIPOLI-PLATTE	SW 36 T093 R13W	2.65	3i		4	4	1 - 3
A09008	NIEMANN CONST CO	DENVER #2	NE 29 T091 R13W						
		---SAND & GRAVEL---							
A09504	NIEMANN CONST CO	NOLTE	SE 31 T092 R11W				4	4	
				2.65		X			
A09508	NIEMANN CONST CO	TRIPOLI-PLATTE	SW 36 T093 R13W						
A09510	NIEMANN CONST CO	PLAINFIELD/ADAMS	NE 32 T093 R14W	2.66		X			
10	BUCHANAN DIST. 6	---CRUSHED STONE---							
A10002	NIEMANN CONST CO	WESTON-LAMONT	NW 14 T090 R07W	2.61	3iB				1 - 6
							4	4	1 - 7
A10004	NIEMANN CONST CO	BLOOM-JESUP	SW 32 T089 R10W	2.63	3				2 - 5
							4	4	1 - 7
A10008	BRUENING ROCK PROD INC	OELWEIN	NW 02 T090 R09W	2.65	3i		4	4	4 - 5
							4	4	4 - 6
A10010	NIEMANN CONST CO	HAZELTON	NW 11 T090 R09W	2.65	3iB		4	4	4
A10012	NIEMANN CONST CO	INDEPENDENCE	NW 14 T088 R09W					5	
A10014	NIEMANN CONST CO	OELWEIN #1	SW 02 T090 R09W				5	5	1 -12
A10016	NIEMANN CONST CO	OELWEIN #2	SE 03 T090 R09W	DWU	3i		4	4	13 -16
A10018	NIEMANN CONST CO	EAST AURORA	SE 17 T090 R07W				4	4	1 - 5
A10022	BRUENING ROCK PROD INC	BROOKS	NW 02 T088 R09W	2.55	3i		4	4	7
								5	1 - 6
A10024	NIEMANN CONST CO	RASMUSSEN #2	SE 21 T088 R08W					5	
A10026	NIEMANN CONST CO	BRANDON	SE 27 T087 R10W					5	
A10028	NIEMANN CONST CO	HERTZBERGER	NE 36 T087 R10W					5	
A10030	NIEMANN CONST CO	SOUTH AURORA	NW 19 T090 R07W	2.65	3iB			4	1 - 3
A10032	NIEMANN CONST CO	SELLS	NW 25 T088 R09W					5	
A10034	NIEMANN CONST CO	TROY MILLS	SE 30 T087 R07W						
A10036	WENDLING QUARRIES INC	KILER	NW 34 T087 R10W					4	
A10038	BASIC MATERIALS CORP	WIDGER	SW 07 T088 R10W	2.61	3i				1B
							4	4	1A- 1B
		---SAND & GRAVEL---							
A10502	MARTIN MARIETTA	COOK	SE 21 T088 R07W				4	4	
A10504	NIEMANN CONST CO	WARD	NE 14 T090 R07W				4	4	
				2.65		X			
A10506	MANATTS INC	GREENLEY	SE 29 T089 R09W				4	4	
				2.64		X			
A10510	NIEMANN CONST CO	HUFFMAN	SE 02 T089 R08W				4	4	
				2.65		X			
A10514	NIEMANN CONST CO	HOLLERMAN	SE 26 T090 R07W				4	4	
A10516	NIEMANN CONST CO	MILLER	NW 14 T088 R09W	2.65		X			
A10518	MANATTS INC	YEAROUS	SE 19 T089 R10W	2.65		X			
11	BUENA VISTA DIST. 3	---SAND & GRAVEL---							
A11502	ROHLIN CONST CO INC	ROHLIN	SW 02 T093 R38W				4	4	
A11504	MARTIN MARIETTA	RAILROAD	NE 03 T093 R37W				3	3	
A11506	MARTIN MARIETTA	LINN GROVE	NW 25 T093 R38W				4	4	
A11508	WETHERALL CONST CO	NEWELL	NW 01 T090 R36W				4	4	
A11510	MARTIN MARIETTA	SIOUX RAPIDS	05 T093 R36W				3	3	
A11512	BUENA VISTA COUNTY	MARATHON	SE 19 T093 R35W				4	4	
A11514	WETHERALL CONST CO	STORM LAKE	SW 18 T090 R36W				4	4	
A11516	ROHLIN CONST CO INC	WERNIMONT	W2 12 T093 R37W				3	3	

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
12	BUTLER DIST. 2	---CRUSHED STONE---							
A12004	GREENE LS CO	LUBBEN	NW 25 TO93 R17W					5	1 -21
A12008	GREENE LS CO	FLORRY-STEERE	CT 08 TO93 R17W					5	1 -11
A12010	CARLSON/BRUENING	CLARKSVILLE-ENGLE	NE 16 TO92 R15W						
A12014	NIEMANN CONST CO	OLTMANN	SE 08 TO91 R16W					X	
A12016	GREENE LS CO	WIEGMANN-BRISTOW	SE 23 TO92 R18W				X	X	1 -11
A12018	GREENE LS CO	NEYMEYER	SW 28 TO90 R18W						
A12020	GREENE LS CO	BRUNS #2	NW 21 TO91 R18W						
		---SAND & GRAVEL---							
A12502	KNOCKS BLDG SUPPLY	CLARKSVILLE-KNOCKS	NW 01 TO92 R16W	2.67	2		4	4	
				2.67		X			
A12504	SHELL ROCK S&G	BROOKS	NE 02 TO91 R15W	2.66	X		4	4	
				2.67		X			
A12508	GREENE LS CO	AUSTINVILLE	NW 23 TO90 R18W						
A12514	GREENE LS CO	DE VRIES	SW 28 TO90 R18W				4	4	
				2.63		X			
A12516	GREENE LS CO	JENSEN	S2 18 TO93 R16W				4	4	
A12518	NIEMANN CONST CO	SHELL ROCK-ADAMS	NE 03 TO91 R15W				3	3	
				2.66		X			
13	CALHOUN DIST. 3	---SAND & GRAVEL---							
A13502	BECKER GRAVEL CO.	LAKE CITY	NW 23 TO86 R34W				4	4	
14	CARROLL DIST. 3	---SAND & GRAVEL---							
A14506	MARTIN MARIETTA	POUND	SE 18 TO85 R33W				4	4	
A14510	TIEFENTHALER INC	LANESBORO	NW 17 TO85 R33W	2.72	2		4	4	
				2.68		X			
A14512	MARTIN MARIETTA	OPEN	SE 15 TO84 R34W				4	4	
A14514	TIEFENTHALER INC	MACKE	06 TO85 R33W	2.69	2		4	4	
				2.66		X			
15	CASS DIST. 4	---CRUSHED STONE---							
A15004	SCHILDBERG CONST CO INC	LEWIS	SE 17 TO75 R37W					4	10 -11
A15008	SCHILDBERG CONST CO INC	ATLANTIC MINE	NE 13 TO79 R37W						
		---SAND & GRAVEL---							
A15502	SCHILDBERG CONST CO INC	LYMAN	NW 33 TO75 R36W				4	4	
A15504	HALLETT MATERIALS CO	ATLANTIC	NE 06 TO76 R36W	2.67	2		4	4	
				2.65		X			
A15508	HALLETT MATERIALS CO	VALLEY	SW 01 TO77 R36W	2.66	3		4	4	
				2.66		X			
16	CEDAR DIST. 6	---CRUSHED STONE---							
A16002	WENDLING QUARRIES INC	HUNT	SW 10 TO81 R04W	DWU	3iB		4	4	1
A16004	WENDLING QUARRIES INC	LOWDEN-SCHNECKLOTH	NW 04 TO81 R01W	DWU	3i				1
							4	4	1 - 3
A16006	WENDLING QUARRIES INC	STONEMILL	SE 14 TO80 R03W	DWU	3iB		4	4	4
A16008	WENDLING QUARRIES INC	LIME CITY	NE 16 TO79 R02W	DWU	3i		4	4	2
A16010	WENDLING QUARRIES INC	PEDEN	NE 10 TO79 R03W				5	5	
A16012	WEBER STONE CO INC	ONION GROVE	SE 14 TO82 R02W	2.61	3i		4	4	1 - 7
A16014	WENDLING QUARRIES INC	TOWNSEND	NW 02 TO79 R02W						
A16016	WENDLING QUARRIES INC	GAUL	NW 13 TO81 R04W						
A16018	WENDLING QUARRIES INC	LOWDEN-MASSILLON	NW 23 TO82 R01W						
A16020	WENDLING QUARRIES INC	ATALISSA	NE 34 TO79 R03W						
A16022	WENDLING QUARRIES INC	TRICON	N2 09 TO82 R04W	DWU	3i		4	4	1
A16024	WENDLING QUARRIES INC	THOMSEN	SW 05 TO79 R02W						
		---SAND & GRAVEL---							
A16502	WENDLING QUARRIES INC	SHARPLISS	NW 12 TO79 R03W				4	4	
				2.65		X			
A16506	WEBER STONE CO INC	ONION GROVE	SE 14 TO82 R02W	2.65		X			
A16508	WENDLING QUARRIES INC	MASSILLON	CT 11 TO82 R01W	2.65		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
17	CERRO GORDO DIST. 2	---CRUSHED STONE---							
A17008	MARTIN MARIETTA	PORTLAND WEST	NE 19 TO96 R19W	2.75	3iB		4	4	1 - 8
A17012	MARTIN MARIETTA	LILLYBRIDGE-UBBEN	SW 26 TO94 R20W	2.68	2				3
							5	5	1 - 3
A17020	MARTIN MARIETTA	MASON CITY	NE 29 TO97 R20W	DWU	3i				7
				2.73	3				7 - 9
							X	X	1 - 6
A17022	HOLNAM	HOLNAM	NE 19 TO97 R20W	DWU	2				1 - 4
				DWU	2				11 -13
A17024	HEARTLAND ASPHALT	RIVERVIEW	NE 29 TO96 R19W				4	4	1 - 2
		---SAND & GRAVEL---							
A17506	BECKER GRAVEL CO	NELSON-FORBES	SW 27 TO96 R19W				4	4	
A17512	NORTH IOWA S&G INC	WEPKING	NE 15 TO97 R21W	DWU		X			
A17514	HOLNAM, INC	HOLNAM SAND	NE 19 TO97 R20W	DWU	2				
				2.65		X			
A17516	MARTIN MARIETTA	RIPPEN	SE 20 TO96 R19W	2.66		X			
18	CHEROKEE DIST. 3	---SAND & GRAVEL---							
A18506	HALLETT MATERIALS CO	CHEROKEE SOUTH	NE 16 TO91 R40W	2.70	2		3	3	
				2.69		X			
A18512	FABER & SON CONST CO	KILLIAM	SW 20 TO93 R39W				4	4	
A18514	MARTIN MARIETTA	LARABEE	SE 20 TO93 R39W				4	4	
A18516	MARTIN MARIETTA	WASHTA #1	NE 30 TO90 R41W				3	3	
A18518	MARTIN MARIETTA	QUIMBY	SW 15 TO90 R41W				3	3	
A18520	MARTIN MARIETTA	QUIMBY-EAST	NW 06 TO90 R40W				3	3	
A18526	HALLETT MATERIALS CO	CHEROKEE NORTH	SW 23 TO92 R40W	2.70	2		3	3	
				2.67		X			
A18528	BEDROCK GRAVEL	BEAZLEY	SW 31 TO90 R41W	DWU		X	4	4	
A18530	BEDROCK GRAVEL	PATTERSON	32 TO91 R40W	2.69	2				
				DWU		X			
A18532	HODGEMAN & SONS INC	WALKER	31 TO90 R41W						
A18534	HALLETT MATERIALS CO	NELSON	CT 23 TO92 R40W	DWU	2				
				DWU		X			
19	CHICKASAW DIST. 2	---CRUSHED STONE---							
A19002	GREENE LS CO	TRACY	SE 29 TO94 R14W	2.55	2		4	4	9 -10
A19004	BRUENING ROCK PROD INC	DEERFIELD-MAHONEY	SE 33 TO97 R14W					X	
A19006	GREENE LS CO	HUNT	NE 29 TO94 R14W	2.57	2		4	4	9 -10
A19008	GREENE LS CO	BOICE	NE 16 TO95 R14W					5	
		---SAND & GRAVEL---							
A19504	GREENE LS CO	HUNT	NW 29 TO94 R14W				4	4	
A19506	BLAZEK S&G CO	BLAZEK	NW 32 TO96 R11W				4	4	
				2.66		X			
A19508	ROVERUD CONST INC	BUSTA	SE 23 TO96 R11W				4	4	
				2.65		X			
A19510	RIVER BEND ENTERPRISES	NASHUA	NE 31 TO94 R14W				X	X	
				2.66		X			
A19512	GREENE LS CO	PEARL ROCK	SE 31 TO94 R14W				4	4	
				2.65		X			
A19514	BRUENING ROCK PROD INC	NASHUA	SW 33 TO95 R14W	DWU		X			
A19516	NIEMANN CONST CO	REWOLDT	NE 25 TO94 R13W	DWU		X			
A19518	CARLSON MATERIALS CO	AGGLAND	31 TO96 R12W						
20	CLARKE DIST. 5	---CRUSHED STONE---							
A20002	MARTIN MARIETTA	OSCEOLA	NW 12 TO72 R26W					5	1 -10
								X	1 - 4 :1

NOTE:
1 - FRICTION TYPE TO BE DETERMINED WHEN USED ON WINTERSET BEDS 1-4

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
21	CLAY DIST. 3	---SAND & GRAVEL---							
A21504	HUMMEL S&G	ECKLEY	NW 16 TO95 R35W	DWU	2		4	4	
				DWU		X			
A21506	DAVE'S S&G	EVERLY	SW 31 TO97 R38W	2.70	2		3	3	
				2.68		X			
A21508	MARTIN MARIETTA	SCHARNBURG	NE 11 TO96 R38W				4	4	
A21510	NORGAARD S&G	DICKENS	NW 20 TO96 R35W				3	3	
				2.70		X			
A21514	MARTIN MARIETTA	CORNELL	SW 27 TO94 R36W				4	4	
A21516	SIEH S&G	SPENCER #1	SW 24 TO96 R36W	2.69	2		3	3	
				2.66		X			
A21518	HALLETT MATERIALS CO	SPENCER #2	SW 05 TO97 R37W				4	4	
A21520	MARTIN MARIETTA	EVERLY	SE 06 TO96 R38W				4	4	
A21522	BECKER GRAVEL CO	STAINS	30 TO97 R38W				4	4	

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
22	CLAYTON DIST. 2	---CRUSHED STONE---							
A22002	KUHLMAN CONST CO	TWIN ROCK-SCHRADER	NW 14 TO94 R05W				4	4	3 -11
							4	4	1 -11
A22004	ROVERUD CONST INC	BENTE-ELKADER-WATSON	SW 12 TO93 R05W	2.66	2				6 - 9
							4	4	1 - 9
A22006	BRUENING ROCK PROD INC	MARQUETTE	NW 16 TO95 R03W	DWU	3i		4	4	1 - 3
A22008	KUHLMAN CONST CO	ANDEREGG	SE 32 TO92 R02W	DWU			4	4	2 - 8
A22010	KUHLMAN CONST CO	OSTERDOCK	SE 02 TO91 R03W	2.67	2				3 - 5
							4	4	1 - 8
A22012	KUHLMAN CONST CO	SCHMIDT	NE 33 TO91 R01W	2.66	3i				4B- 6
							4	4	2 - 6
A22014	ROVERUD CONST INC	BLUME	NE 09 TO93 R03W	2.64	3i				1 - 7
							4	4	1 -12
A22016	KUHLMAN CONST CO	GISLESON	NW 06 TO95 R04W	2.66	3i		4	4	1 - 8
							4	4	1 -15
A22018	ROVERUD CONST INC	ZURCHER	SE 01 TO94 R05W				4	4	
A22020	KUHLMAN CONST CO	MUELLER	NE 30 TO94 R03W	DWU	3i		4	4	1 - 8
A22024	BRUENING ROCK PROD INC	SPOOK CAVE	NE 21 TO95 R04W				4	4	1 - 2
A22026	KUHLMAN CONST CO	DOERRING-LUANA	SE 05 TO95 R05W					4	
A22030	KUHLMAN CONST CO	EBERHARDT	NW 27 TO93 R05W	2.72	3		4	4	1 - 5
								4	1 - 8
A22032	KUHLMAN CONST CO	WELLMAN	NW 25 TO92 R06W		X		X	4	1 - 6
A22034	KUHLMAN CONST CO	KRUSE	NW 17 TO92 R04W	2.70	3B		4	4	5 -11
				2.70	2B		4	4	5 -12
							4	4	2 -12
A22038	KUHLMAN CONST CO	FASSBINDER	SW 09 TO92 R03W	2.67	3i		4	4	2B- 6
A22040	KUHLMAN CONST CO	HARTMAN	NW 29 TO91 R06W	2.68	3i		4	4	1 - 4
A22042	ROVERUD CONST INC	MORAREND	CT 35 TO92 R03W	2.67	X				1 - 8
							4	4	1 -10
A22044	KUHLMAN CONST CO	BOGE	SW 18 TO91 R02W						
A22046	KUHLMAN CONST CO	JOY SPRINGS-BURRACK	NW 19 TO91 R06W	2.65	3i		4	4	1
A22056	ROVERUD CONST INC	MCGREGOR	NE 34 TO95 R03W					4	
A22058	ROVERUD CONST INC	ST OLAF	SE 25 TO94 R05W						
A22060	ROVERUD CONST INC	JOHNSON	NW 26 TO93 R04W	2.64	3i		4	4	2 - 5
							4	4	1 - 5
A22062	ROVERUD CONST INC	SNY MAGILL	SE 22 TO94 R03W	DWU	3i		4	4	6 -10
A22066	ROVERUD CONST INC	PETERSON	NW 09 TO94 R06W						
A22068	RIVER CITY STONE INC	MILLVILLE	NW 10 TO91 R02W	DWU	3i				1 - 8
A22070	ROVERUD CONST INC	BERNHARD	NW 35 TO95 R04W				4	4	1 - 3
A22072	PATTISON BROS.	CLAYTON TERMINAL	07 TO93 R02W				4	4	1
							4	4	3 - 4
A22074	RIVER CITY STONE INC	STRAWBERRY POINT	NE 19 TO91 R06W	DWU	3i				1 - 2
A22076	ROVERUD CONST INC	LARSON	NW 08 TO93 R05W						
A22078	ROVERUD CONST INC	SMITH	07 TO93 R06W						
A22080	KUHLMAN CONST CO	HILINE	NW 08 TO91 R03W						
		---SAND & GRAVEL---							
A22510	ROVERUD CONST INC	BENTE	SE 15 TO93 R05W	2.66	X		4	4	
				2.66		X			
A22512	KUHLMAN CONST CO	FAIRGROUND	NE 26 TO93 R05W				4	4	
				2.66		X			
A22514	KUHLMAN CONST CO	JOY SPRINGS	SW 19 TO91 R06W				X	X	
A22518	KUHLMAN CONST CO	THURN	CT 25 TO92 R05W				3	3	
				2.65		X			
A22520	KUHLMAN CONST CO	WELTERLEN	SE 32 TO91 R05W	2.65		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
23	CLINTON DIST. 6	---CRUSHED STONE---							
A23002	WENDLING QUARRIES INC	BLOORE-ELWOOD	NW 08 TO83 R02E	DWU	3i		4	4	1 - 2
A23004	WENDLING QUARRIES INC	BEHR	SW 02 TO81 R03E	2.61	3i		4	4	1 - 2
A23006	WENDLING QUARRIES INC	SHAFFTON	NE 11 TO80 R05E	DWU	3i		4	4	16 -17
				DWU	3		4	4	3 -14
A23010	WENDLING QUARRIES INC	GOOSE LAKE	SW 22 TO83 R05E				4	4	1 -10
A23012	WENDLING QUARRIES INC	TEEDS GROVE	SW 03 TO83 R06E					4	
A23014	WENDLING QUARRIES INC	TORONTO	NW 29 TO82 R01E					4	
A23016	WENDLING QUARRIES INC	LYONS	NW 18 TO82 R07E					4	
A23018	WENDLING QUARRIES INC	KINGS	NW 06 TO80 R03E					4	
A23026	WENDLING QUARRIES INC	MILL CREEK	NE 22 TO82 R06E					4	
A23028	WENDLING QUARRIES INC	DELMAR	SE 06 TO83 R04E						
A23030	WENDLING QUARRIES INC	EDON VALLEY	04 TO83 R01E						
A23032	ANDERSON S&G	ANDERSON	23 TO81 R03E						
		---SAND & GRAVEL---							
A23502	WENDLING QUARRIES INC	DOYLE	NE 30 TO83 R07E				4	4	
				2.67		X			
A23504	WENDLING QUARRIES INC	BEHR	SW 02 TO81 R03E	2.68	2		4	4	
				2.68		X			
A23506	WENDLING QUARRIES INC	SCHNECKLOTH	S2 10 TO80 R05E				4	4	
				2.67		X			
A23508	QUALITY READY MIX	GATEWAY	NE 27 TO81 R06E				4	4	
				2.66		X			
A23510	WENDLING QUARRIES INC	SHAFFTON	N2 11 TO80 R05E				4	4	
				2.66		X			
A23514	ANDERSON S&G	ANDERSON	NW 23 TO81 R03E	2.68		X			
24	CRAWFORD DIST. 3	---SAND & GRAVEL---							
A24512	HALLETT MATERIALS CO	DUNLAP	SE 27 TO82 R41W	2.70	2		3	3	
				2.66		X			
25	DALLAS DIST. 4	---CRUSHED STONE---							
A25004	SCHILDBERG CONST CO INC	I-80	SW 33 TO78 R28W					5	
		---SAND & GRAVEL---							
A25502	HALLETT MATERIALS CO	MESSERSCHMIDT	NW 28 TO79 R27W	2.70	2		4	4	
				2.67		X			
A25504	BOONEVILLE GRAVEL CO	BOONEVILLE	NW 30 TO78 R26W	2.66	2		4	4	
				2.66		X			
A25506	MARTIN MARIETTA	CROFT	NE 16 TO81 R27W				4	4	
A25508	MARTIN MARIETTA	DUDLEY	NW 05 TO78 R29W				4	4	
A25510	HALLETT MATERIALS CO	PERRY	NW 01 TO81 R29W	2.70	2		4	4	
				2.67		X			
A25512	HALLETT MATERIALS CO	VAN METER	SE 16 TO78 R27W	2.68	2		3	3	
				2.66		X			
26	DAVIS DIST. 5	---CRUSHED STONE---							
A26004	DOUDS STONE INC	LEWIS	W2 02 TO69 R12W	2.60	3		4	4	1
								5	3 - 5
							4	4	6 - 7
A26006	DOUDS STONE INC	BROWN	SW NW 02 TO69 R12W						
27	DECATUR DIST. 5	---CRUSHED STONE---							
A27002	MARTIN MARIETTA	GRAND RIVER	NW 22 TO70 R27W					5	12 -14
A27008	MARTIN MARIETTA	DECATUR	SE 32 TO69 R26W					X	7 :1
								5	9 -15

NOTE:
1 - FRICTION TYPE TO BE DETERMINED WHEN USED

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
28	DELAWARE DIST. 6	---CRUSHED STONE---							
A28002	KUHLMAN CONST CO	SEDGEWICK #2	SW 36 TO90 R06W	2.66	3iB		4	4	3
A28006	KUHLMAN CONST CO	SEDGEWICK #1	SW 36 TO90 R06W				4	4	1 - 3
A28008	KUHLMAN CONST CO	EDGEWOOD WEST	CT 04 TO90 R05W	2.67	3i				2 - 7
							4	4	1 - 7
A28010	KUHLMAN CONST CO	TIBBOTT	SW 23 TO90 R04W	2.70	3i				1 - 5
							4	4	1 - 7
A28012	KUHLMAN CONST CO	BAUL	SE 22 TO89 R06W	2.69	3i		4	4	1 - 4
A28014	KUHLMAN CONST CO	LOGAN	SW 10 TO88 R05W	2.69	3				2 - 8
							4	4	1 - 8
A28016	KUHLMAN CONST CO	WHITE	NW 02 TO88 R04W	2.72	3i		4	4	1 - 2
A28020	BARD CONCRETE CO	DEUTMEYER	SW 13 TO88 R03W	DWU	3i		4	4	2 - 6
A28030	KUHLMAN CONST CO	GRIEF	NE 18 TO87 R03W					4	
A28032	RIVER CITY STONE INC	SCHNITTJER-DELHI	NE 35 TO88 R04W						
A28038	KUHLMAN CONST CO	KUHLMAN	NW 06 TO90 R04W	2.70	3i		4	4	1B- 5
A28040	BARD CONCRETE CO	KRAPFL	SE 23 TO89 R03W	2.69	3i		4	4	4
A28042	KUHLMAN CONST CO	WALSTON-MASONVILLE	SE 21 TO89 R06W	2.69	3i				1 - 4
							4	4	1 - 6
A28044	NIEMANN CONST CO	DUNDEE	NE 20 TO90 R06W					4	
A28046	KUHLMAN CONST CO	PINS	NW 27 TO88 R03W						
A28050	KUHLMAN CONST CO	BUCK CREEK	NW 20 TO87 R04W						
A28052	RIVER CITY STONE INC	MANCHESTER	SW 09 TO88 R05W	DWU	3				5 - 8
A28054	RIVER CITY STONE INC	WINCH	NW SW 02 TO87 R04W						
A28056	RIVER CITY STONE INC	THORPE	NW 33 TO90 R05W						
		---SAND & GRAVEL---							
A28502	KUHLMAN CONST CO	SEDGEWICK	SW 36 TO90 R06W				4	4	
				2.65		X			
A28504	BARD CONCRETE CO	TEGLER	NE 36 TO89 R03W				4	4	
				2.65		X			
A28506	BARD CONCRETE CO	DYERSVILLE	NW 26 TO89 R03W				4	4	
				2.65		X			
A28510	KUHLMAN CONST CO	LOGAN	SW 10 TO88 R05W	2.65		X			
A28514	KUHLMAN CONST CO	FERGESEN	NE 32 TO89 R06W				4	4	
				DWU		X			
A28520	RIVER CITY STONE INC	MANCHESTER	SW 10 TO88 R05W	2.65		X			
29	DES MOINES DIST. 5	---CRUSHED STONE---							
A29002	L&W QUARRIES INC	MEDIAPOLIS-LEONARD	SE 01 TO71 R04W	2.65	3				15 :1
							4	4	15 -18
							5	5	20
A29008	CESSFORD CONST CO	NELSON	NE 26 TO72 R02W	2.62	3				21 -24
							4	4	7 -20
								4	15 -24
							5	5	24 -27
A29012	CESSFORD CONST CO	GEODE	NE 01 TO69 R05W				4	4	11 -12
							5	5	9 -13
		---SAND & GRAVEL---							
A29502	CESSFORD CONST CO	SPRING GROVE	SW 36 TO69 R03W				4	4	
				2.66		X			
A29504	SHIPLEY CONST CO	SHIPLEY	26 TO69 R03W	2.68		X			
30	DICKINSON DIST. 3	---SAND & GRAVEL---							
A30502	CONCRETE SAND & MATERIALS	MILFORD	12 TO98 R37W	2.70	2		3	3	
				2.66		X			
A30504	ROHLIN CONST CO INC	ROHLIN	NE 06 TO98 R36W				3	3	
A30506	HUMMEL S&G	FOSTORIA	NE 26 TO98 R37W				4	4	
A30508	ROHLIN CONST CO INC	LOST	32 TO98 R37W	2.71	3		3	3	
				2.67		X			
A30510	CEMSTONE S&G	EAST	NE 07 TO98 R36W	2.71	2		3	3	
				2.66		X			
A30512	DICKINSON CO	WESTPORT	NE 17 TO98 R38W				4	4	
A30514	ROHLIN CONST CO INC	LEITH	NE 04 TO98 R37W						

NOTE:
1 - AASHTO 57 GRADATION MAXIMUM

RECENTLY ACTIVE

AGGREGATE SOURCES

Aggregate → 0- limestone
5- gravel or sand

Bridge deck mat'l

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
31	DUBUQUE DIST. 6	---CRUSHED STONE---								
A31002	RIVER CITY STONE INC	ROSE SPUR	27 TO90 R02E	2.66	3i				1 - 8	
							4	4	1 -15	
A31006	KUHLMAN CONST CO	DYERSVILLE-SUNDHEIM	SE 32 TO89 R02W	2.66	3i				4 -12	
							4	4	1 - 8	
A31008	RIVER CITY STONE INC	KLEIN-RICHARDSVILLE	NW 33 TO90 R01E	DWU	3i				3A- 4B	
							4	4	1 - 4	
A31010	RIVER CITY STONE INC	BROWN	NW 33 TO89 R02E	2.68	3i		4	4	3 - 9A	
							4	4	2 - 9	
A31014	BARD CONCRETE CO	KURT	N2 35 TO87 R02W	2.70	3iB		4	4	1 - 2	
A31018	RIVER CITY STONE INC	MELOY	NW 23 TO87 R01E	DWU	3i		4	4	1 - 3	
A31020	RIVER CITY STONE INC	SCHLITCHE	SE 11 TO89 R02W	DWU	3i		4	4	1 - 4	
A31022	RIVER CITY STONE INC	SIMPSON FURNACE-ASBURY	SW 07 TO89 R02E	2.67	3i			4	3B- 9	
A31024	KUHLMAN CONST CO	JOHNS CREEK	SW 36 TO88 R02W	2.69	3i				3 - 4	
							4	4	1 - 4	
A31026	WENDLING QUARRIES INC	ARNSDORF	SE 25 TO87 R02E	DWU	3i		4	4	1 - 2	
A31028	RIVER CITY STONE INC	THOLE	NW 21 TO87 R02E	DWU	3i			4	1 - 2	1
A31030	RIVER CITY STONE INC	KEMP	NE 09 TO89 R01W					4		
A31034	RIVER CITY STONE INC	HERMSEN	NE 33 TO90 R02W					4		
A31036	RIVER CITY STONE INC	BALLTOWN	SE 05 TO90 R01E							
A31038	RIVER CITY STONE INC	HARTBECKE	SW 21 TO88 R01W					4		
A31040	RIVER CITY STONE INC	KENNEDY	NW 03 TO88 R01W					4		
A31042	RIVER CITY STONE INC	GANSEN	NW 09 TO87 R02E					4		
A31044	RIVER CITY STONE INC	GASSMAN	SE 07 TO88 R03E	2.67	3i		4	4	5 - 9	
A31046	WENDLING QUARRIES INC	DECKER	SE 24 TO87 R02E	DWU	3i		4	4	1 - 5	
A31048	RIVER CITY STONE INC	MCDERMOTT	NE 35 TO88 R01W	2.65	3i		4	4	2	
A31050	RIVER CITY STONE INC	PLOESSEL-DYERSVILLE	N2 07 TO88 R02W	2.74	3i		4	4	3 - 5	
A31052	KUHLMAN CONST	EPWORTH-KIDDER	SW 02 TO88 R01W							
A31054	RIVER CITY STONE INC	MERRITT	SE 05 TO89 R02E							
A31056	RIVER CITY STONE INC	RUBIE	SE 06 TO88 R03E							
A31058	RIVER CITY STONE INC	HOLY CROSS	SW 12 TO90 R02W							
A31060	BARD CONCRETE CO	EAST CASCADE	SE 22 TO87 R01W	2.71	3i		4	4	2 - 5	
A31064	RIVER CITY STONE INC	WEBER	NW 32 TO89 R02E	2.64	3i		4	4	3 - 9A	
A31066	RIVER CITY STONE INC	FILLMORE	SW 26 TO87 R01W	2.70	3i		4	4	2 - 4	
		---SAND & GRAVEL---								
A31502	AGGREGATE MATERIALS-FLYNN	NINE MILE ISLAND	NE 24 TO88 R03E	2.66	3i		3	3		
				2.66		X				
A31504	BARD CONCRETE CO	SAUSER PROPERTY	NW 36 TO87 R02W				4	4		
				2.66		X				
A31512	MOLO S&G CO	BURKLE-MOLO	SW 19 TO89 R02W	2.66		X				
A31514	RIVER CITY STONE INC	FILLMORE	CT 26 TO87 R01W	2.66		X				
32	EMMET DIST. 3	---SAND & GRAVEL---								
A32502	ESTHERVILLE ROCK&GRAVEL	ESTHERVILLE	N2 03 TO99 R34W	2.70	2		3	3		
				DWU		X				
A32506	EMMET COUNTY	FREY	NW 21 T100 R34W				4	4		
A32514	BOGGESS CONST	WALLINGFORD	07 TO98 R33W					4		
				DWU		X				
A32518	ROHLIN CONST CO INC	EGELAND	20 TO98 R33W				4	4		
A32520	ROHLIN CONST CO INC	YOUNG	NE 19 TO98 R32W				4	4		
A32522	ESTHERVILLE ROCK&GRAVEL	OLD ESTHERVILLE S&G	30 TO99 R33W							
A32524	EMMET COUNTY	PETERSON	SW 34 T100 R34W							
A32526	ROHLIN CONST CO INC	DAVID YOUNG	NE 29 TO98 R33W				4	4		
A32530	L.C. KRUSE & SONS	WHITE	SW 16 T100 R34W	DWU	2		4	4		
				DWU		X				
A32534	ROHLIN CONST CO INC	ENERSON	28 T100 R34W				4	4		
A32538	ESTHERVILLE ROCK&GRAVEL	JENSEN	NW 03 T099 R34W	DWU	2					
				DWU		X				

NOTE:
1 - TOP 17.O' ONLY OF BED 2

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
33	FAYETTE DIST. 2	---CRUSHED STONE---							
A33002	NIEMANN CONST CO	ELDORADO-JACOBSEN	SW 17 TO95 R08W	2.69	3iB		5	5	4 - 6B
A33004	NIEMANN CONST CO	HOUG	SW 11 TO94 R08W				5	5	1 - 9
A33006	NIEMANN CONST CO	MARYVILLE	SE 24 TO91 R07W	2.69	3i		4	4	1 - 2
A33010	NIEMANN CONST CO	VOSHELL	NW 21 TO93 R07W				X	X	1 - 4
A33016	NIEMANN CONST CO	MAYNARD	NE 23 TO92 R09W					X	
A33018	NIEMANN CONST CO	FAIRBANK	SW 28 TO91 R10W		X		4	4	5
								4	1 - 5
A33020	NIEMANN CONST CO	YEAROUS	SW 19 TO93 R08W				4	4	1 -10
A33022	NIEMANN CONST CO	MILLER	SW 35 TO95 R10W				4	4	1 - 8
A33024	NIEMANN CONST CO	WAUCOMA	NW 25 TO95 R10W	2.69	3iB		5	5	2 - 4
A33026	WILTGEN CONST CO	LYNCH	NW 05 TO95 R10W				4	4	1 - 5
A33030	NIEMANN CONST CO	SCHWEMMAN-ST LUCAS	NE 29 TO95 R09W				X	X	
A33032	BRUENING ROCK PROD INC	LANDIS	SE 12 TO93 R08W		X		4	4	1 - 5
A33034	NIEMANN CONST CO	MCDONOUGH	SE 36 TO94 R08W						
A33036	NIEMANN CONST CO	GRAHAM-HAWKEYE	SW 06 TO94 R09W		X		4	4	1 - 4
A33038	NIEMANN CONST CO	PAPE	NE 28 TO95 R08W	DWU	3i		5	5	3 - 5
		---SAND & GRAVEL---							
A33506	NIEMANN CONST CO	ALPHA	NW 03 TO94 R10W	2.64	X		4	4	
				2.64		X			
A33508	CARLSON MATERIALS CO	DURSCHER	NW 03 TO94 R07W					4	
A33510	ZUPKE S&G	RANDALIA	NW 29 TO93 R09W				4	4	
				2.66		X			
A33512	NIEMANN CONST CO	WADENA	NE 25 TO93 R07W				4	4	
				2.66		X			
A33518	KUHLMAN CONST CO	BASSETT	SE 11 TO91 R07W				4	4	
				2.65		X			
A33520	BRUENING ROCK PROD INC	OELWEIN SAND	NE 09 TO91 R09W	2.65		X			
A33522	BRUENING ROCK PROD INC	PAPE	SE 08 TO95 R08W	2.65		X			
A33524	CROELL REDI-MIX	ROGERS	04 TO94 R07W	2.66		X			
34	FLOYD DIST. 2	---CRUSHED STONE---							
A34002	GREENE LS CO	CARVILLE-BUNN	SW 23 TO95 R15W	2.63	2		4	4	1 - 4
A34004	GREENE LS CO	MAXON	SE 07 TO94 R17W	2.68	2				4C-19
							5	5	1 -17
A34006	GREENE LS CO	JOHLAS	SW 07 TO94 R15W					X	
A34008	GREENE LS CO	WARNHOLTZ	SW 09 TO96 R16W	2.70	3i		5	5	1 - 4
				2.68	2		4	4	17 -18
								X	1 -18
A34010	GREENE LS CO	LACOSTA	SE 25 TO97 R17W	DWU	3i		5	5	1 - 4
							5	5	1 - 8
							4	4	9 -14
A34012	GREENE LS CO	WILLIAMS	NW 29 TO96 R18W						
A34014	BRUENING ROCK PROD INC	HANNMANN	NE 20 TO94 R15W						
		---SAND & GRAVEL---							
A34502	GREENE LS CO	ROCKFORD	SE 15 TO95 R18W	2.68	2		3	3	
				2.65		X			
A34506	GREENE LS CO	LENT	NE 08 TO96 R16W				4	4	
A34510	GREENE LS CO	BRACKEL	NE 17 TO94 R17W				4	4	
A34514	GREENE LS CO	LITTLE CEDAR	NW 01 TO95 R15W	2.65		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
35	FRANKLIN DIST. 2	---CRUSHED STONE---							
A35002	MARTIN MARIETTA	DOWS	NE 30 TO91 R22W				4	4	1 - 4
							5	5	5 - 6
							4	4	7 -12
A35006	MARTIN MARIETTA	HIBNESS	SE 22 TO91 R20W	2.58	3				1 - 4A
							4	4	1 -12
A35010	GREENE LS CO	MILLER	NE 13 TO91 R19W					4	1 - 5
A35016	GREENE LS CO	AYRES	01 TO92 R19W						
		---SAND & GRAVEL---							
A35502	CARLSON MATERIALS CO	GENEVA	SW 07 TO91 R19W	2.68	2		3	3	
				2.66		X			
A35508	MARTIN MARIETTA	STUCK	SW 30 TO91 R22W				4	4	
A35512	MARTIN MARIETTA	ANDERSON-POPEJOY	NW 27 TO90 R22W	2.68		X	3	3	
A35514	CARLSON MATERIALS CO	KOCH	SW 08 TO91 R19W				4	4	
				2.69		X			
A35516	BECKER GRAVEL CO	PETERS	SW 04 TO92 R20W				3	3	
				2.65		X			
A35518	BECKER GRAVEL CO	REINKE	SW 22 TO91 R20W				4	4	
A35520	BECKER GRAVEL CO	BRANDT	N2 34 TO90 R19W				4	4	
				2.68		X			
36	FREMONT DIST. 4	---CRUSHED STONE---							
A36002	SCHILDBERG CONST CO INC	THURMAN	NW 23 TO70 R43W					4	
37	GREENE DIST. 1	---SAND & GRAVEL---							
A37502	HALLETT MATERIALS CO	BEAZOR	SW 02 TO83 R31W	2.69	2		4	4	
				2.68		X			
A37504	HALLETT MATERIALS CO	JEFFERSON	SW 04 TO83 R31W	2.66	2		4	4	
				2.64		X			
A37510	MARTIN MARIETTA	POUND	NW 20 TO84 R29W				4	4	
A37514	ARCADIA LIMESTONE CO	WRIGHT	NW 05 TO84 R32W				4	4	
				2.66		X			
A37516	GREENE CO. REDI MIX	SHADE TREE	NW 20 TO83 R30W				4	4	
				2.67		X			
A37518	BECKER GRAVEL CO	P&M	30 TO82 R32W	2.69		X			
38	GRUNDY DIST. 1	---CRUSHED STONE---							
A38002	GREENE LS CO	REIKEN	NE 15 TO89 R18W				4	4	2 - 5
		---SAND & GRAVEL---							
A38504	CARLSON MATERIALS CO	HERONIMOUS	SE 35 TO88 R17W	2.65		X			
39	GUTHRIE DIST. 4	---SAND & GRAVEL---							
A39502	MARTIN MARIETTA	MONTEITH	SW 29 TO79 R30W				4	4	
A39504	SCHILDBERG CONST CO INC	SMITH	NW 34 TO79 R30W				4	4	
A39506	BUTTLER CONST CO	BAYARD	NE 22 TO81 R32W				4	4	
40	HAMILTON DIST. 1	---CRUSHED STONE---							
A40004	MARTIN MARIETTA	COUNTY LINE	SE 34 TO86 R23W				4	4	
A40006	MARTIN MARIETTA	GRAND GEORGE	SE 18 TO89 R25W						
		---SAND & GRAVEL---							
A40508	MARTIN MARIETTA	GRAND GEORGE	SE 18 TO89 R25W					4	
A40510	BECKER GRAVEL CO	MORTVEDT	SW 24 TO86 R24W	2.67		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
41	HANCOCK DIST. 2	---CRUSHED STONE---							
A41002	BASIC MATERIALS CORP	GARNER NORTH	SE 11 TO95 R24W	2.77	3iB		4	4	1 - 4
				2.77	3i		4	4	6
A41004	BASIC MATERIALS CORP	GARNER SOUTH-WIELAND	NW 13 TO95 R24W	2.77	3iB		4	4	1 - 4
				2.77	3i		4	4	6
		---SAND & GRAVEL---							
A41502	MARTIN MARIETTA	MEZVINSKI	SW 07 TO97 R24W				4	4	
A41504	HANCOCK COUNTY	HUTCHINS	E2 27 TO96 R26W					4	
A41506	HANCOCK COUNTY	KLEMME	26 TO95 R24W					4	
A41508	MARTIN MARIETTA	KIRSHBAUM	SW 18 TO97 R24W					4	
A41510	NUCKOLL'S CONCRETE SERVICES INC	BRITT	34 TO96 R26W	DWU	2		3	3	
				DWU		X			
A41512	WINNEBAGO COUNTY	CRYSTAL LAKE	SW 01 TO97 R25W				4	4	
A41518	LAHARV CONST CO INC	AUSTIN	NE 11 TO97 R25W						
42	HARDIN DIST. 1	---CRUSHED STONE---							
A42002	MARTIN MARIETTA	ALDEN	NW 20 TO89 R21W	2.58	3i		4	4	0,1,3
				DWU	3				0,1
A42004	GERHKE, INC.	GIFFORD	NW 04 TO86 R19W					5	
A42006	RIEKENA	RIEKENA	NW 03 TO88 R20W						
		---SAND & GRAVEL---							
A42502	WELDON BROS CONST CO	IOWA FALLS	NW 20 TO89 R20W	2.65	2		4	4	
				2.68		X			
A42504		LYMAN	NE 28 TO89 R20W				4	4	
A42508	MARTIN MARIETTA	MCCORMICK	27 TO87 R20W				4	4	
A42510	MARTIN MARIETTA	JANSSEN	SE 34 TO89 R20W				4	4	
				2.65		X			
A42512	HARDIN AGGREGATES INC	GIFFORD	SW 31 TO87 R19W				4	4	
				2.66		X			
A42514	MARTIN MARIETTA	NERHING	NW 28 TO87 R20W				4	4	
A42516		IOWA FALLS	NW 17 TO89 R20W				4	4	
A42518	MARTIN MARIETTA	KLEIN	SW 35 TO89 R20W				4	4	
A42520	MARTIN MARIETTA	PETERSON	NW 32 TO88 R22W				4	4	
A42522	MARTIN MARIETTA	OBER	NW 32 TO88 R22W	2.67		X			
A42524	BECKER GRAVEL CO	GRIFFEL	SE 31 TO89 R19W				3	3	
A42526	BECKER GRAVEL CO	MEIER	NE 31 TO87 R21W						
A42528	BECKER GRAVEL CO	LLOYD	04 TO86 R19W	DWU			4	4	
A42530	BECKER GRAVEL CO	BLOME	SE 32 TO87 R21W						
43	HARRISON DIST. 4	---CRUSHED STONE---							
A43002	SCHILDBERG CONST CO INC	LOGAN	19 TO79 R42W				4D	4D	25E
							5	5	25C-25E
								4	26
A43004	WESTERN IOWA LIMESTONE	LOGAN	17 TO79 R42W				4D	4D	25E
							5	5	25C-25E
								4	26
		---SAND & GRAVEL---							
A43502	CLARK LS CO	WOODBINE	NW 23 TO80 R42W	DWU	3		3	3	
				DWU		X			
A43504	CLARK LS CO	PISGAH	NW 23 TO81 R44W				4	4	
				DWU		X			
A43506	SCHEMMER LS INC	LOGAN	SE 08 TO79 R42W				3	3	
				DWU		X			
A43510	HALLETT MATERIALS CO	WOODBINE	NE 31 TO81 R41W	2.69	3		3	3	
A43512	HALLETT MATERIALS CO	WOODBINE-MCCANN	SW 29 TO81 R41W	DWU	3		3	3	
				DWU		X			
44	HENRY DIST. 5	---CRUSHED STONE---							
A44002	COOTS MATERIALS CO INC	SMITH	SE 17 TO71 R06W						
A44006	HENRY COUNTY	LEEPER	NE 18 TO71 R06W	DWU	2				8 -11
A44008	DOUDS STONE INC	TWEEDY	SW 36 TO71 R06W				4	4	13 -14
		---SAND & GRAVEL---							
A44502	CESSFORD CONST CO	NORTH ROME	SW 29 TO72 R07W				4	4	
				2.66		X			
A44504	IDEAL SAND CO	ENSMINGER-ROME	NE NW 32 TO72 R07W	2.67		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
45	HOWARD DIST. 2	---CRUSHED STONE---							
A45002	ROVERUD CONST INC	ECKERMAN	NW 33 T100 R11W	2.61	2		X	X	8 - 9
A45006	BRUENING ROCK PROD INC	NELSON	NE 33 TO99 R13W	2.54	2		4	4	1 - 3
				2.54	2		4	4	8 - 9
A45008	BRUENING ROCK PROD INC	DOTZLER	NE 23 TO99 R12W	2.56	3		4	4	7 -10A
A45010	BRUENING ROCK PROD INC	DALEY	NE 11 TO98 R11W	2.59	3		4	4	9 -11
A45014	FALK CONST CO	CECELIA	SE 08 TO97 R14W					5	
A45018	BRUENING ROCK PROD INC	LE ROY	NW 10 T100 R14W					X	
A45020	BRUENING ROCK PROD INC	RIECKS	NW 24 T100 R11W						
A45022	BRUENING ROCK PROD INC	MAUER	SE 13 T100 R13W						
A45024	BRUENING ROCK PROD INC	MAPLE LEAF	SE 04 TO98 R13W						
A45026	BRUENING ROCK PROD INC	BRUENING BROTHERS #1	SE 22 T100 R11W						1 - 3
A45028	BRUENING ROCK PROD INC	ELMA	NW 06 TO97 R13W	DWU	3		4	4	2 - 3B
A45030	BRUENING ROCK PROD INC	DIEKEN-TANK	SE 24 T100 R13W						
A45032	BILL KEIM	GANSEN	13 T100 R12W						
		---SAND & GRAVEL---							
A45502	BRUENING ROCK PROD INC	MAPLE LEAF-POTTER	SE 04 TO98 R13W				4	4	
A45504	ROVERUD CONST INC	ECKERMAN	NW 33 T100 R11W	DWU	3		4	4	
				2.65		X			
A45508	CARLSON MATERIALS CO	SOVEREIGN	SW 01 TO98 R12W	DWU	3		3	3	
				2.65		X			
A45514	CARLSON MATERIALS CO	EASTLAND	NE 26 T100 R14W				3	3	
A45516	CARLSON MATERIALS CO	FREIDERICH	NE 15 TO98 R14W				3	3	
				2.67		X			
A45518	BRUENING ROCK PROD INC	ELMA	NW 06 TO97 R13W	2.67		X			
46	HUMBOLDT DIST. 2	---CRUSHED STONE---							
A46004	MARTIN MARIETTA	GRIFFITH	SW 24 TO91 R30W				X	X	
A46006	MARTIN MARIETTA	HODGES	NE 32 TO92 R28W	2.60	3i		4	4	10 -18
				DWU	3i		5	5	4 - 8
A46014	MARTIN MARIETTA	PEDERSON	SW 28 TO92 R28W	DWU	3i				4 -10
A46016	BECKER GRAVEL CO	ERICKSON	30 TO94 R28W						
		---SAND & GRAVEL---							
A46504	MARTIN MARIETTA	PETERSON	SW 27 TO92 R29W				4	4	
A46512	NORTHWEST MATERIALS	WARREN	SW 08 TO92 R30W	DWU			X	X	
A46516	BECKER GRAVEL CO	ERICKSON	30 TO94 R28W						
A46518	MARTIN MARIETTA	PEDERSON	SW 28 TO92 R28W						
47	IDA DIST. 3	---SAND & GRAVEL---							
A47502	HALLETT MATERIALS CO	BATTLE CREEK	05 TO86 R41W				3	3	
48	IOWA DIST. 6	---SAND & GRAVEL---							
A48502	MARENGO READY MIX	KIMMICH	SE 24 TO81 R11W				4	4	
				2.66		X			
A48506	WENDLING QUARRIES INC	MARENGO	NW 22 TO81 R11W	2.66		X			
A48508	MARENGO READY MIX	DISTERHOFF	SE 34 TO81 R10W	2.66		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
49	JACKSON DIST. 6	---CRUSHED STONE---							
A49002	BELLEVUE S&G CO	BELLEVUE	SW 25 TO87 R04E	2.67	3i		4	4	1 - 3
A49004	BELLEVUE S&G CO	LAMOTT	NW 02 TO86 R03E				4	4	
A49008	WEBER STONE CO INC	IRON HILL	SW 16 TO85 R02E	DWU	3i		4	4	3 - 6
							4	4	1 - 6
A49010	WENDLING QUARRIES INC	ANDREW	NW 21 TO85 R03E	2.70	3iB		4	4	1B- 3
							4	4	1 - 7
A49012	WENDLING QUARRIES INC	FROST	SE 16 TO84 R03E	DWU	3iB		4	4	1A- 1D
							4	4	1 - 2
A49014	WENDLING QUARRIES INC	MAQUOKETA WEST	NE 13 TO84 R02E	DWU	3i		4	4	7 - 8
							4	4	1 - 5
A49016	WENDLING QUARRIES INC	WEIS	SE 22 TO85 R04E					4	
A49018	WENDLING QUARRIES INC	PATASKA	NW 23 TO85 R05E					4	
A49020	WENDLING QUARRIES INC	PRESTON	SW 26 TO84 R05E	2.67	3i		4	4	7 -10
							4	4	1 -10
A49021	PRESTON READY MIX	PRESTON R/M	SW 26 TO84 R05E	2.67	3i		4	4	7 -10
							4	4	1 -10
A49022	WENDLING QUARRIES INC	BELLEVUE	SE 23 TO86 R04E				4	4	
A49024	WENDLING QUARRIES INC	MAQUOKETA EAST	SW 07 TO84 R03E	2.70	3i		4	4	7 - 8
A49026	WENDLING QUARRIES INC	MILES	SW 20 TO84 R06E					4	
A49028	WENDLING QUARRIES INC	FULTON	SW 25 TO85 R02E	DWU	3i		4	4	2
							4	4	1 - 2
A49030	BELLEVUE S&G INC	SPRINGBROOK	15 TO85 R04E				4	4	
A49032	WENDLING QUARRIES INC	OTTER CREEK-GLAHN	CT 21 TO86 R02E						
A49034	WENDLING QUARRIES INC	KILBURG	NW 21 TO85 R05E						
A49036	WENDLING QUARRIES INC	ST DONATUS	SE 17 TO87 R04E						
A49040	WENDLING QUARRIES INC	JOINERVILLE-HAMANN	SE 20 TO84 R02E				4	4	1 - 3
A49042	WENDLING QUARRIES INC	PETERSON	24 TO84 R06E				4	4	1 - 2
A49044	WENDLING QUARRIES INC	FRANK	NW 14 TO87 R04E						
A49046	WENDLING QUARRIES INC	ROWAN	NE 25 TO86 R03E						
A49048	PRESTON READY MIX	DRURY	CT 32 TO85 R06E						
A49050	RIVER CITY STONE INC	MARSHALL	NW 01 TO84 R06E						
A49052	WENDLING QUARRIES INC	STILLMUNKES	10 TO85 R05E						
A49054	DUANE KUNDE	KUNDE	E2 33 TO84 R05E						
A49058	WENDLING QUARRIES INC	61 ROAD CUT	N2 31 TO84 R03E	2.67	3i		4	4	1
A49060	BELLEVUE S&G INC	ST DONATUS- BUSCH	18 TO87 R04E						
A49062	PRESTON READY MIX	JOHNSON	31 TO84 R04E						
A49064	BELLEVUE S&G CO	VEACH	01 TO85 R02E						
		---SAND & GRAVEL---							
A49504	WENDLING QUARRIES INC	KNIPELMEYER	NE 36 TO87 R04E				4	4	
				2.64		X			
A49506	BELLEVUE S&G CO	BELLEVUE	E2 01 TO86 R04E	2.64	3iB		3	3	
				2.68		X			
A49510	WENDLING QUARRIES INC	MAQUOKETA	NE 13 TO84 R02E				4	4	
				2.65		X			
A49516	WENDLING QUARRIES INC	TURNER	NE 07 TO84 R07E	2.63	3iB		3	3	
				2.65		X			
A49520	WENDLING QUARRIES INC	BALDWIN	SW 28 TO84 R01E	2.66		X			
A49522	CENTURY READY MIX	EWING	NW 02 TO84 R01E	DWU		X			
A49524	BELLEVUE S&G CO	GRIEBEL	SE 25 TO87 R04E	DWU	3B		4	4	
				2.67		X			
A49526	BELLEVUE S&G CO	BELLEVUE FARM	SE 25 TO87 R04E	DWU	3i				
				DWU		X			
A49528	AGGREGATE MATERIALS CO	STEVENS	NW 02 TO84 R01E	2.65		X			
A49530	PRESTON READY MIX	PETERSEN	SW 18 TO84 R07E	DWU	3iB		4	4	
				DWU		X			
A49532	WEBER STONE CO INC	IRON HILL	NE 16 TO85 R02E	2.65		X			
A49534	PRESTON READY MIX	MARBURGER	SE 13 TO84 R07E			X			
50	JASPER DIST. 1	---CRUSHED STONE---							
A50002	MARTIN MARIETTA	SULLY MINE	SE 16 TO79 R17W	2.54	3i		4	4	36 -41
								4	10 -19
		---SAND & GRAVEL---							
A50502	MARTIN MARIETTA	COLFAX	NE 01 TO79 R21W	2.68	2		3	3	
				2.66		X			
A50504	MARTIN MARIETTA	REASNOR	NE 10 TO78 R19W				4	4	
				2.66		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS	
52	JOHNSON DIST. 6	---CRUSHED STONE---								
A52002	WENDLING QUARRIES INC	FOUR CO.	NW 04 TO81 R08W					X		
A52004	RIVER PRODUCTS CO	CONKLIN	NW 33 TO80 R06W	2.66	3iB		4	4	3 -10	
				DWU	3i		5	5	23 -24	1
							4	4	21	
A52006	RIVER PRODUCTS CO	KLEIN	NW 02 TO79 R07W	2.66	3iB		4	4	3 -10	
				DWU	3i		5	5	23 -24	1
							4	4	21	
A52008	WENDLING QUARRIES INC	ERNST	SW 20 TO80 R05W					X		
		---SAND & GRAVEL---								
A52502	S&G MATERIALS INC	SHOWERS	NE 27 TO79 R06W				4	4		
				2.65		X				
A52506	S&G MATERIALS INC	BUTLER	SW 33 TO79 R06W	DWU		X				
A52508	S&G MATERIALS INC	WILLIAMS	NW 34 TO79 R06W	DWU		X				
53	JONES DIST. 6	---CRUSHED STONE---								
A53002	BARD CONCRETE CO	FARMERS-BEHRENDS	NE 14 TO86 R03W	2.64	3i		4	4	1 - 5	
A53004	WENDLING QUARRIES INC	MONTICELLO	NE 24 TO86 R04W	2.66	3i		4	4	1	
A53006	WENDLING QUARRIES INC	ANAMOSA	SE 13 TO84 R04W	DWU	3i				1 - 5	
							4	4	1 - 6	
A53010	WENDLING QUARRIES INC	BALLOU-OLIN	NE 24 TO83 R03W	DWU	3iB				3	
							4	4	1 - 3	
A53012	WENDLING QUARRIES INC	WYOMING	33 TO84 R01W	2.69	3iB		4	4	1 - 2C	
A53014	WEBER STONE CO INC	JACOBS-SCOTCH GROVE	SW 07 TO85 R02W					5		
A53016	WEBER STONE CO INC	STONE CITY	5&6 TO84 R04W	DWU	3i		4	4	2B- 3	
A53018	RIVER CITY STONE INC	FINN	NE 06 TO85 R01W	DWU	3i		4	4	2 - 5	
A53020	WENDLING QUARRIES INC	CANTON	NE 24 TO85 R01W					X		
A53024	RIVER CITY STONE INC	SULLIVAN	NW 14 TO86 R03W							
A53026	RIVER CITY STONE INC	ANAMOSA	SW 15 TO84 R04W							
		---SAND & GRAVEL---								
A53502	WENDLING QUARRIES INC	MONTICELLO	SE 07 TO86 R03W				4	4		
				2.66		X				
A53506	RIVER CITY STONE INC	FINN	N2 06 TO85 R01W				4	4		
				2.65		X				
A53508	WENDLING QUARRIES INC	ANAMOSA-VERNON	SW 13 TO84 R04W				4	4		
				2.66		X				
A53510	WENDLING QUARRIES INC	KNAPP	SE 27 TO84 R03W				4	4		
				2.65		X				
A53514	WENDLING QUARRIES INC	FLEMING	NE 12 TO83 R03W				4	4		
				2.66		X				
A53516	WENDLING QUARRIES INC	OXFORD MILLS	SE 21 TO83 R01W				4	4		
				2.65		X				
A53522	WEBER STONE CO INC	WEBER	SE SW 05 TO84 R04W	2.66		X				
A53526	BARD CONCRETE CO	STEPHENS	NW 34 TO86 R03W				4	4		
				2.66		X				
A53528	WEBER STONE CO INC	ANAMOSA	NE 14 TO84 R04W	2.65		X				
A53530	RIVER CITY STONE INC	ANAMOSA-WOOD'S	CT 15 TO84 R04W	2.66		X				
54	KEOKUK DIST. 5	---CRUSHED STONE---								
A54002	MARTIN MARIETTA	KESWICK	NW 21 TO77 R12W	2.61	2		4	4	13 -15	1
							4	4	13 -18	
A54004	MARTIN MARIETTA	OLLIE	SW 01 TO74 R11W	2.66	3		4	4	13 -18	
				2.60	3				27 -29	1
							4	4	13 -19	
							4	4	27 -30	
A54008	MARTIN MARIETTA	HARPER	SE 11 TO76 R11W				4	4	15 -24	
							4	4	32 -37	
							4	4	38 -40	
A54010	DOUDS STONE INC	LYLE	NW 13 TO74 R13W	DWU	3		4	4	36	
				DWU	2		5	5	11	
								X	9 -13	
							4		36 -38	
		---SAND & GRAVEL---								
A54502	WINN S&G	WINN	SE 06 TO74 R10W	2.66		X				

NOTE: 1 - 1.25 INCH MAXIMUM TOP SIZE

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS	
55	KOSSUTH DIST. 2	---SAND & GRAVEL---								
A55506	KOSSUTH COUNTY	WHITTEMORE	NW 16 TO95 R30W				4	4		
A55508	KOSSUTH COUNTY	IRVINGTON	NW 36 TO95 R29W				4	4		
A55510	HODGEMAN & SONS INC	SENECA	SE 08 TO98 R30W				4	4		
A55518	REDING S&G	REDING	02 TO94 R29W							
A55520	GIESE CONST CO	CONN	SE 35 TO95 R29W				4	4		
				DWU		X				1
56	LEE DIST. 5	---CRUSHED STONE---								
A56002	CESSFORD CONST CO	HAWKEYE	NE 10 TO68 R06W					5	1 -21	
							4	4	22 -27	
A56004	CESSFORD CONST CO	FRANKLIN	NE 25 TO68 R06W	2.49	2				12	2
							4	4	12 -14	
A56006	CESSFORD CONST CO	ARGYLE	SE 18 TO66 R06W					5	4 -12	
							4	4	13 -17	
A56008	CESSFORD CONST CO	DONNELLSON	SE 05 TO67 R06W				4	4	10 -15	
A56012	CESSFORD CONST CO	VINCENNES	NW 19 TO66 R06W							
		---SAND & GRAVEL---								
A56504	CESSFORD CONST CO	VINCENNES	SE 32 TO66 R06W				4	4		
				2.67		X				
A56506	BROCKMAN SAND CO	FT MADISON	SW 11 TO67 R05W				4	4		
				2.67		X				
57	LINN DIST. 6	---CRUSHED STONE---								
A57002	WENDLING QUARRIES INC	BETENBENDER-COGGON	SW 03 TO86 R06W	DWU	3i				8 - 9	
				DWU	2				8 -10	
A57004	WENDLING QUARRIES INC	PLOWER	SE 36 TO86 R06W	2.62	3				9 -11	
							4	4	1 -10	
A57006	WENDLING QUARRIES INC	ROBINS	NE 21 TO84 R07W	2.57	3i		4	4	3	3
A57008	WENDLING QUARRIES INC	BOWSER-SPRINGVILLE	SW 29 TO84 R05W	DWU	3i		4	4	6 - 7	
A57010	WENDLING QUARRIES INC	TROY MILLS	SE 09 TO86 R07W				X	X		
A57012	WENDLING QUARRIES INC	MORGAN CREEK	SE 22 TO83 R08W				X	X		
A57014	WENDLING QUARRIES INC	SWEETING	NW 18 TO85 R08W					4		
A57016	WENDLING QUARRIES INC	ALICE	NW 08 TO85 R07W					4		
A57018	MARTIN MARIETTA	CEDAR RAPIDS	NE 15 TO82 R06W	2.64	3i				2 - 9	3
							4	4	2 -14	
A57020	WENDLING QUARRIES INC	LISBON	NW 24 TO82 R05W	DWU	3iB		4	4	1	
A57022	CRAWFORD QUARRY CO	LEE CRAWFORD	NW 23 TO83 R08W	2.55	3i		4	4	8	
A57026	NIEMANN CONST CO	COOK	NW 10 TO86 R07W							
A57028	WENDLING QUARRIES INC	BEVERLY	NW 07 TO82 R07W	DWU	3i		4	4	6	
A57030	BRUENING ROCK PROD INC	HENNESSEY	NE 01 TO82 R07W	DWU	3i		4	4	4 - 5	
A57032	WENDLING QUARRIES INC	BOWSER SOUTH	SW 29 TO84 R05W	DWU	3i		4	4	6 - 7	
		---SAND & GRAVEL---								
A57502	WENDLING QUARRIES INC	SWEETING	NE 18 TO85 R08W				4	4		
				2.64		X				
A57506	WENDLING QUARRIES INC	CEDAR RAPIDS	NE 27 TO84 R08W				4	4		
				2.65		X				
A57508	WENDLING QUARRIES INC	EAST MARION	NE 36 TO84 R06W				3	3		
				2.65		X				
A57516	MARTIN MARIETTA	CEDAR RAPIDS SAND	SW 35 TO83 R07W	2.65		X				
A57520	WENDLING QUARRIES INC	IVANHOE	NW 29 TO82 R05W				4	4		
				2.66		X				
A57522	WENDLING QUARRIES INC	CENTRAL CITY	NE 10 TO85 R06W				4	4		
				2.65		X				
A57524	WENDLING QUARRIES INC	COGGON	NW 11 TO86 R06W				4	4		
				2.65		X				
A57526	WENDLING QUARRIES INC	TROY MILLS	SE 09 TO86 R07W	2.65		X				
A57528	AGGREGATES INC	AGGREGATES INC	SW 26 TO84 R08W	DWU	2B					
				2.65		X				
A57530	WENDLING QUARRIES INC	HESS	SW 04 TO82 R06W	DWU		X				

NOTE: 1 - APPROVED ONLY FOR L-MIX PC CONCRETE
2 - AASHTO 57 GRADATION MAXIMUM
3 - 1.25 INCH MAXIMUM TOP SIZE

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
58	LOUISA DIST. 5	---CRUSHED STONE---							
A58002	RIVER PRODUCTS CO	COLUMBUS JCT.	NW 03 TO74 R05W	2.55	3				16 -19 :1
							4	4	15 -19
		---SAND & GRAVEL---							
A58504	RIVER PRODUCTS CO	FREDONIA A INLAND PUMPING	SW 17 TO75 R04W				4	4	
				2.66		X			
		FREDONIA B RIVER PUMPING	SW 17 TO75 R04W				4	4	
				2.66		X			
60	LYON DIST. 3	---SAND & GRAVEL---							
A60502	PETTENGILL CONC & GRAVEL	ROCK RAPIDS #1	NW 33 T100 R45W	2.69	2		3	3	
				2.67		X			
A60504	PETTENGILL CONC & GRAVEL	ROCK RAPIDS #2	NE 09 TO99 R45W				3	3	
A60506	PETTENGILL CONC & GRAVEL	ROCK VALLEY	17 T100 R45W				4	4	
A60508	DIETER PIT	DIETER	SE 24 T100 R49W				4	4	
A60510	HODGEMAN & SONS INC	EGEBO	NW 21 TO99 R48W				4	4	
A60512	JOE'S READY MIX INC	LITTLE ROCK	NW 03 TO99 R43W				4	4	
				2.66		X			
A60514	MARTIN MARIETTA	DOON	21 TO98 R45W				3	3	
A60516	MARTIN MARIETTA	OPEN	SW 24 TO98 R46W				3	3	
A60518	ROCK VALLEY GRAVEL CO	OPEN	NW 17 TO99 R48W				4	4	
A60520	HOGAN	WINTER	SE 18 TO99 R43W				4	4	
A60522	HYMANS CONST CO	OPEN	17 TO98 R44W				4	4	
A60524	MARTIN MARIETTA	OPEN	29 TO98 R45W				4	4	
A60528	HYMANS CONST CO	RUDD	20 T100 R45W				4	4	
A60530	HODGEMAN & SONS INC	KOOIKER	28 TO99 R45W				4	4	
A60532	HODGEMAN & SONS INC	LEMS	24 TO98 R49W				4	4	
A60534	HODGEMAN & SONS INC	HORN	16 TO99 R48W				4	4	
A60536	ROHLIN CONST CO	VAN ENGEN	SW 35 TO98 R46W						
A60538	HODGEMAN & SONS INC	HARMSON	SE 04 TO99 R45W						
A60540	HODGEMAN & SONS INC	KANANGEITER	SE 04 TO99 R43W						
61	MADISON DIST. 4	---CRUSHED STONE---							
A61002	SCHILDBERG CONST CO INC	EARLY CHAPEL-DAGGETT	NW 10 TO76 R29W				5	5	15
								4D	12
								4	14B
A61006	SCHILDBERG CONST CO INC	STANZEL	SW 05 TO75 R29W				5	5	15
A61010	MARTIN MARIETTA	EARLHAM	N2 09 TO77 R28W					4D	25E
A61012	MARTIN MARIETTA	WINTERSET NORTH	SE 27 TO76 R27W					5	25
A61013	SCHILDBERG CONST CO INC	WINTERSET WEST	SW 28 TO76 R27W					5	25
A61014	SCHILDBERG CONST CO INC	92 QUARRY	NW 34 TO76 R27W					5	25
A61016	MARTIN MARIETTA	JONES CREEK	NE 27 TO75 R27W					5	25
A61018	MARTIN MARIETTA	PAMMEL	08 TO75 R28W				5	5	15
A61020	MARTIN MARIETTA	PERU	NW 10 TO74 R27W					5	25
A61022	SCHILDBERG CONST CO INC	GARDNER	NW 34 TO76 R27W					5	25
A61024	MARTIN MARIETTA	PENN-DIXIE	SW 32 TO76 R27W					5	25
A61026	MARTIN MARIETTA	MASON	SW 16 TO77 R28W					4	20
								5	25
A61028	GRIMES ASPHALT & PAVING	GRIMES ASPHALT & PAVING	SE 04 TO74 R27W					5	25
A61030	MARTIN MARIETTA	WINTERSET SOUTH	NW 34 TO76 R27W					5	25
62	MAHASKA DIST. 5	---CRUSHED STONE---							
A62008	MARTIN MARIETTA	GIVEN #2	SE 14 TO74 R16W						
		---SAND & GRAVEL---							
A62502	SKYLINE CONST CO	G71	SW 15 TO74 R16W	2.67		X			

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 AC A	FRICT AC B	BEDS	
63	MARION DIST. 5	---CRUSHED STONE---								
A63002	MARTIN MARIETTA	DURHAM MINE	NE 08 T075 R18W	2.51	3i		4	4	101	
				2.62	2		4	4	88 -95	1
							4	4	95 -96	2
A63010	BRUENING ROCK PROD INC	S&S	SE 25 T075 R20W					4		
		---SAND & GRAVEL---								
A63502	PELLA CONST CO LTD	BEAN PROPERTY	NE 02 T075 R18W				4	4		
				2.67		X				
A63506	MARTIN MARIETTA	KAMMERICK	NE 03 T075 R18W				4	4		
				2.67		X				
A63512	MARTIN MARIETTA	NEW HARVEY	NW 12 T075 R18W	2.67		X				
64	MARSHALL DIST. 1	---CRUSHED STONE---								
A64002	MARTIN MARIETTA	FERGUSON	SW 05 T082 R17W	2.66	3		4	4	8 -21	
				DWU	2		4	4	2 -17	
							4	4	1 -18	
A64004	CESSFORD CONST CO	LE GRAND	SW 36 T084 R17W	2.58	3i		5	5	1 - 7	
							4	4	8 -27	
		---SAND & GRAVEL---								
A64502	MARTIN MARIETTA	MARSHALLTOWN	SW 29 T084 R17W	2.66	2		4	4		
				2.65		X				
A64504	HALLETT MATERIALS CO	BROMLEY-CLEMONS	NE 02 T084 R20W	2.65	2		4	4		
				2.65		X				
65	MILLS DIST. 4	---CRUSHED STONE---								
A65002	SCHILDBERG CONST CO INC	FOLSOM-GLENWOOD	NW 29 T073 R43W					5		
66	MITCHELL DIST. 2	---CRUSHED STONE---								
A66002	FALK CONST CO	DUENOW	SE 08 T099 R17W	2.77	3iB				5	
							4	4	1 - 5	
							4	4	7 -13	
A66006	FALK CONST CO	WILDE	NE 07 T098 R18W					5		
A66014	FALK CONST CO	STAFF	NE 17 T097 R17W	DWU	3i				3	
A66016	FALK CONST CO	LESCH	SW 12 T097 R17W				5	5	1 - 8	
							4	4	9 -14	
A66018	FALK CONST CO	DYNES	SW 30 T099 R15W							
A66020	FALK CONST CO	ASPEL	NE 03 T099 R15W							
A66022	FALK CONST CO	WAGNER	NW 29 T098 R16W		X		X	X		
		---SAND & GRAVEL---								
A66502	FALK CONST CO	OSAGE-SCHMIDT	NW 01 T097 R17W				4	4		
				2.63		X				
A66504	FALK CONST CO	ST ANSGAR-BLAZEK	SW 36 T099 R18W				3	3		
A66510	FALK CONST CO	NEWBURG	NW 26 T099 R18W				3	3		
A66512	FALK CONST CO	KLAAHSEN	SW 36 T099 R18W							
A66514	FALK CONST CO	LOVIK	SE SW 12 T097 R17W	DWU		X				
67	MONONA DIST. 3	---SAND & GRAVEL---								
A67506	HARGRAVE	HARGRAVE	NE 31 T085 R46W				4	4		
A67508	MIDWEST PAVING CO	ONAWA	SW 09 T082 R45W				4	4		
68	MONROE DIST. 5	---CRUSHED STONE---								
A68002	MARTIN MARIETTA	EDDYVILLE NORTH	NE 02 T073 R16W					5	2 - 4	
A68004	MARTIN MARIETTA	EDDYVILLE SOUTH	SW 02 T073 R16W							
69	MONTGOMERY DIST. 4	---CRUSHED STONE---								
A69002	SCHILDBERG CONST CO INC	STENNETT	NE 27 T073 R38W					4	16 -17	
		---SAND & GRAVEL---								
A69504	HALLETT MATERIALS CO	ELLIOT	13 T073 R38W				4	4		

NOTES: 1 - TOP 6.0' ONLY OF BED 95
2 - BOTTOM 5.0' ONLY OF BED 95

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	FA	FRICT AC A	B	BEDS
70	MUSCATINE DIST. 5	---CRUSHED STONE---							
A70002	WENDLING QUARRIES INC	MOSCOW	NW 08 TO78 R02W	2.66	3i		5	5	11 -17
				2.67	3iB		4	4	21A-24
								5	1 - 9
A70006	HARSCO CORP/HECKETT DIV	WILTON	SE 02 TO78 R02W				2	2	
A70008	HARSCO CORP/HECKETT DIV	MONTPELIER	SE 11 TO77 R01E				2	2	
		---SAND & GRAVEL---							
A70504	WENDLING QUARRIES INC	ATALISSA-MCKILLIP	NW 20 TO78 R02W				4	4	
				2.66		X			
A70506	ACME FUEL AND MATERIALS	ACME	SE 22 TO76 R02W	2.65		X			
A70508	HAHN S&G	HAHN	SE 16 TO76 R02W						
A70510	NORTHERN GRAVEL CO	NORTHERN	15 TO76 R02W						
71	O'BRIEN DIST. 3	---SAND & GRAVEL---							
A71508	MARTIN MARIETTA	SHELDON	SW 16 TO97 R42W				4	4	
A71510	MARTIN MARIETTA	OPEN	SE 29 TO97 R42W				4	4	
A71512	MARTIN MARIETTA	SANBORN	SW 04 TO96 R41W				4	4	
A71514	MARTIN MARIETTA	PAULLINA	SE 23 TO95 R41W				4	4	
A71516	MARTIN MARIETTA	OPEN	SE 01 TO94 R41W				4	4	
A71518	MARTIN MARIETTA	OPEN	17 TO95 R39W				4	4	
A71520	MARTIN MARIETTA	PRIMGHAR	NW 04 TO95 R39W				4	4	
A71522	FABER & SON CONST CO	SHELDON	SE 19 TO97 R42W				4	4	
A71524	FLOYD RIVER S&G INC	RITTER	SE 11 TO97 R42W	2.69	2		3	3	
				2.66		X			
A71526	MARTIN MARIETTA	OPEN	SE 20 TO97 R42W				4	4	
A71528	O'BRIEN COUNTY	COUNTY	NW 27 TO95 R39W				4	4	
A71530	ROHLIN CONST CO	ROHLIN	14 TO97 R42W				4	4	
A71532	BECKER GRAVEL CO	DOUMA	SE 05 TO96 R41W						
72	OSCEOLA DIST. 3	---SAND & GRAVEL---							
A72504	NORTHWEST R/M CONCRETE INC	OCHEYEDAN	SE 15 SW 14 TO99 R40W	2.71	2		3	3	
				2.68		X			
A72506	HALLETT MATERIALS CO	ASHTON	SW 28 TO98 R42W	2.69	2		3	3	
				2.69		X			
A72508	MARTIN MARIETTA	THOMAS	NW 36 TO99 R40W				4	4	
A72514	MARTIN MARIETTA	OPEN	NW 31 T100 R40W				4	4	
A72518	FABER & SON CONST CO	VASS	19 T100 R42W				4	4	
A72520	NORTHWEST R/M CONCRETE INC	OCHEYEDAN NORTH	NE 23 TO99 R40W				4	4	
A72522	MARTIN MARIETTA	KAPPES	NE 11 TO98 R42W						
A72524	BECKER GRAVEL CO	BOERHAVE	SE 21 TO98 R42W						
A72526	NORTHWEST R/M CONCRETE INC	OCHEYEDAN SOUTH	19 TO99 R39W						
A72528	BECKER GRAVEL CO	DIRKS	SW 36 TO99 R40W						
A72530	NORHTWEST R/M CONCRETE INC	BOYD	NW 36 TO99 R40W	DWU	2				
				DWU		X			
73	PAGE DIST. 4	---CRUSHED STONE---							
A73002	SCHILDBERG CONST CO INC	BRADDYVILLE	NE 15 TO67 R36W					4	
A73004	SCHILDBERG CONST CO INC	SHAMBAUGH	SW 20 TO67 R36W						
		---SAND & GRAVEL---							
A73504	HALLETT MATERIALS CO	SHENANDOAH	NW 17 TO69 R39W	2.63	2		3	3	
				2.63		X			
74	PALO ALTO DIST. 3	---SAND & GRAVEL---							
A74502	MARTIN MARIETTA	EMMETSBURG S&G	36 TO96 R33W	2.71	2		3	3	
				2.64		X			
A74504	MARTIN MARIETTA	DORWEILLER	SW 05 TO94 R31W				3	3	
				2.67		X			
A74506	MARTIN MARIETTA	WEST BEND	NW 08 TO94 R31W				3	3	
A74508	MARTIN MARIETTA	OPEN	NW 10 TO97 R33W				4	4	
A74509	HOFFERT S&G	EMMETSBURG	NW 22 TO96 R33W	2.69	2		4	4	
				2.66		X			
A74512	ROHLIN CONST CO INC	KAY	SW 20 TO96 R31W						

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
75	PLYMOUTH DIST. 3	---SAND & GRAVEL---							
A75502	HIGMAN S&G	AKRON	NW 01 T092 R49W	2.70	2		3	3	
				2.67		X			
A75503	EVERIST INC	AKRON	NE 01 T092 R49W	2.69	2		3	3	
				2.67		X			
A75506	MARTIN MARIETTA	REMSEN	SE 03 T092 R44W				4	4	
A75508	MARTIN MARIETTA	ASPEN	NE 11 T092 R49W				3	3	
A75510	MARTIN MARIETTA	KINGSLEY	NE 35 T090 R44W				4	4	
A75512	HYMANS CONST CO	KINGSLEY	NE 13 T090 R44W				4	4	
A75514	WALKERS EXCAVATING CO	OYENS	05 T092 R44W				3	3	
A75516	HALLETT MATERIALS CO	BRUNSVILLE	03 T092 R46W				4	4	
A75518	HALLETT MATERIALS CO	HINTON	NW 16 T090 R46W	DWU	3		3	3	
A75520	HALLETT MATERIALS CO	MERRILL	02 T091 R46W				4	4	
A75522	ROHLIN CONST CO INC	THOMS	26 T092 R46W						
A75524	L&M SAND & GRAVEL INC	G DIRKSEN #2	31 T093 R44W	DWU		X			
76	POCAHONTAS DIST. 3	---CRUSHED STONE---							
A76002	MARTIN MARIETTA	GILMORE CITY	NE 36 T092 R31W	2.64	3iB		5	5	1A- 3
							4	4	1B- 3
A76004	MARTIN MARIETTA	MOORE	SW 25 T092 R31W	2.65	3iB		5	5	1A- 3
							4	4	1B- 3
							4	4	4 -10
							5	5	4 -12
		---SAND & GRAVEL---							
A76506	MARTIN MARIETTA	EGLE	NE 02 T090 R31W				4	4	
A76508	MARTIN MARIETTA	OPEN	NE 07 T091 R33W				4	4	
A76510	MARTIN MARIETTA	ZEAMAN	SE 13 T092 R31W				4	4	
A76512	MARTIN MARIETTA	LIZARD CREEK	13 T090 R31W				4	4	
A76514	ROHLIN CONST CO INC	MILLER	12 T093 R31W						
77	POLK DIST. 1	---SAND & GRAVEL---							
A77502	MARTIN MARIETTA	JOHNSTON	NW 17 T079 R24W	DWU	2		3	3	
				2.66		X			
A77504	HALLETT MATERIALS CO	DENNY-JOHNSTON	08 T079 R24W	2.70	2		3	3	
				2.67		X			
A77514	WEST DES MOINES SAND CO	FLINT	SE 29 T078 R25W	2.65	2		4	4	
				2.66		X			
A77518	HALLETT MATERIALS CO	ARMY POST ROAD	SE 30 T078 R25W	2.69	2		3	3	
				2.67		X			
A77520	MARTIN MARIETTA	ARMY POST ROAD	SW 29 T078 R25W	2.65	2		3	3	
				2.65		X			
A77522	HALLETT MATERIALS CO	EDM #2-VANDALIA	NE 07 NW 08 T078 R23W	2.69	2		3	3	
				2.65		X			
A77524	HALLETT MATERIALS CO	UNIVERSITY PLANT	SE 33 T079 R23W	2.69	2		3	3	
				2.65		X			
A77526	HALLETT MATERIALS CO	ARMY POST EAST	SE 29 T078 R25W	2.66	2		3	3	
				2.65		X			
A77528	HALLETT MATERIALS CO	PLEASANT HILL	08 T078 R23W	2.68	2		3	3	
				2.66		X			
A77530	HALLETT MATERIALS CO	NORTH DES MOINES	NE 16 T079 R24W	2.67	2				
				2.66		X			
78	POTTAWATTAMIE DIST. 4	---CRUSHED STONE---							
A78002	SCHILDBERG CONST CO INC	CRESCENT	35 T076 R44W				4	4	25B-25E
								4	25A-25C
								4D	25F
								4	26A-26E
								4	27A-27B
A78004	SCHILDBERG CONST CO INC	SILVER CITY	SE 31 T074 R41W					4	
A78006	SCHILDBERG CONST CO INC	MACEDONIA-K&S	NE 28 T074 R40W					4	
		---SAND & GRAVEL---							
A78502	HALLETT MATERIALS CO	AVOCA	29 T077 R39W	2.65	3		3	3	
				2.65		X			
A78504	HALLETT MATERIALS CO	OAKLAND	SW 23 T075 R40W	2.65	3		4	4	
				2.65		X			
A78506	SCHILDBERG CONST CO INC	CRESCENT	NE 34 T076 R44W				4	4	

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
79	POWESHIEK DIST. 1	---CRUSHED STONE---								
A79002	MALCOM STONE CO	MALCOM MINE	SE 04 TO80 R15W	2.60	2		4	4	10 -13	
80	RINGGOLD DIST. 4	---CRUSHED STONE---								
A80002	MARTIN MARIETTA	WATTERSON	SE 19 TO67 R29W					5	5 - 7	
81	SAC DIST. 3	---SAND & GRAVEL---								
A81502	HALLETT MATERIALS CO	SACTON-LAKEVIEW	S2 08 TO86 R36W	2.72	3		3	3		
				2.67		X				
A81504	MARTIN MARIETTA	AUBURN	NW 02 TO86 R35W	2.68	2		4	4		
				2.64		X				
A81506	WIRTJERS TRUCKING	SAC CITY	NW 36 TO88 R36W				4	4		
				DWU		X				
A81508	LAKE VIEW CONCRETE PROD	LAKEVIEW	SE 05 TO86 R36W				4	4		
A81514	TIEFENTHALER INC	CARNARVON S&G	NE 16 TO86 R36W	2.68	2		3	3		
				2.66		X				
A81520	BECKER GRAVEL CO	UREN	SE 11 TO87 R36W				3	3		
				2.67		X				
A81522	HALLETT MATERIALS CO	ULMER	SW 28 TO87 R35W				4	4		
A81524	BECKER GRAVEL CO	NO NAME	SE 04 TO87 R37W				4	4		
A81526	MARTIN MARIETTA	BETTIN	19 TO87 R36W				4	4		
A81528	BEDROCK GRAVEL	WALL LAKE	NW 18 TO86 R36W	2.70	3					
				2.67		X				
A81530	J.W. READY MIX & CONST	LEITZ NORTH	SE 29 TO87 R35W	DWU		X				
A81532	MARTIN MARIETTA	EARLY-THORPE	22 TO89 R37W	DWU	2		4	4		
				2.66		X				
A81534	MARTIN MARIETTA	SAC COUNTY S&G	SE SE 22 TO89 R37W	2.68		X				
A81536	TIEFENTHALER INC	DAIKER	NE 12 TO86 R35W	DWU		X				
A81538	BEDROCK GRAVEL CO	HEIM	SE 12 TO86 R35W							
82	SCOTT DIST. 6	---CRUSHED STONE---								
A82002	MOLINE CONSUMERS CO	MCCAUSLAND	W2 17 TO80 R04E	DWU	3i		4	4	17 -19	1
					3		4	4	1 -16	1
A82004	MOLINE CONSUMERS CO	NEW LIBERTY	NE 33 TO80 R01E	DWU	3iB		4	4	1 - 2	1
A82006	MOLINE CONSUMERS CO	LECLAIRE	NW 35 TO79 R05E	2.71	3i				14- 27	
				DWU	3i				28 -29	
				DWU	3				2 -13	
							4	4	1 -28	
A82008	LINWOOD MINING & MINERALS	LINWOOD MINE	SW 13 TO77 R02E	2.67	3i		5	5	20 -25	
				2.69	3i		5	5	27 -30B	
				DWU	3i		4	4	33 -41	
				DWU	3		5	5	19	
							4	4	24 -25	
		---SAND & GRAVEL---								
A82502	MOLINE CONSUMERS CO	MCCAUSLAND	SW 17 TO80 R05E				4	4		
				2.66		X				
83	SHELBY DIST. 4	---SAND & GRAVEL---								
A83504	HALLETT MATERIALS CO	HARLAN	NE 36 TO79 R39W	2.67	3		3	3		
				2.65		X				
84	SIOUX DIST. 3	---SAND & GRAVEL---								
A84502	ROCK VALLEY GRAVEL CO	VANZEE	NW 20 TO97 R46W	2.69	2		3	3		
				2.67		X				
A84504	HYMANS CONST CO	VANDERESCH	SW 20 TO96 R47W	DWU	2		3	3		
A84506	JOE'S READY MIX INC	HUDSON-OSTERCAMP	SE 07 TO96 R47W				3	3		
				2.69		X				
A84508	JOE'S READY MIX INC	SIOUX CENTER	NW 33 TO95 R45W				4	4		
				DWU		X				
A84510	EVERIST INC	HAWARDEN-NORTH	S2 NW 22 TO95 R48W	2.70	2		3	3		
				2.67		X				
A84511	HYMANS CONST CO	HAWARDEN	NE 01 TO95 R48W	DWU	2		3	3		
A84514	BOYDEN	COUNTY	35 TO97 R44W				4	4		
A84516	MARTIN MARIETTA	NO NAME	25 TO97 R48W							
A84518	MARTIN MARIETTA	ALTON	SE 15 TO94 R44W				4	4		
A84520	COUNTY PIT	CHATSWORTH	SW 28 TO94 R48W				4	4		
A84522	HYMANS CONST CO	HYMAN	SW 31 TO96 R47W							
A84524	VAN ZEE	FAIRVIEW	NW 36 TO97 R48W				4	4		
A84526	BEDROCK GRAVEL	JONAS	NE 36 TO94 R44W	DWU		X	4	4		
A84528	HIGMAN S&G	HIGMAN-CHATSWORTH	W2 28 TO94 R48W	2.69	2		4	4		
				DWU		X				
A84530	ROCK VALLEY BLOCK & TILE	GROENWEG	NW 15 TO97 R46W	DWU	2		3	3		
				DWU		X				

NOTE: 1 - 1.25 INCH MAXIMUM TOP SIZE

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
85	STORY DIST. 1	---CRUSHED STONE---								
A85006	MARTIN MARIETTA	AMES MINE	SW 24 T084 R24W	2.57	3i		5	5	19 -25	
				2.68			4	4	26,28 -39	1
		---SAND & GRAVEL---								
A85502	HALLETT MATERIALS CO	CHRISTENSEN	SE 22 T084 R24W				4	4		
				2.68		X				
A85510	HALLETT MATERIALS CO	AMES SOUTH	18 T083 R23W	2.66	2		3	3		
				2.65		X				
86	TAMA DIST. 1	---CRUSHED STONE---								
A86002	WENDLING QUARRIES INC	MONTOUR	NW 09 T083 R16W	2.63	3i		5	5	1 - 7	
				2.63	3i		4	4	13 -20	
							4	4	8 -12	
		---SAND & GRAVEL---								
A86502	MANATTS INC	FLINT	NW 03 T082 R15W				3	3		
				2.65		X				
A86504	MARTIN MARIETTA	LE GRAND	NE 16 T083 R16W				4	4		
87	TAYLOR DIST. 4	---CRUSHED STONE---								
A87004	SCHILDBERG CONST CO INC	102 QUARRY	NE 32 T068 R34W					4		
88	UNION DIST. 4	---CRUSHED STONE---								
A88002	SCHILDBERG CONST CO INC	THAYER	NE 35 T072 R28W					5	25A-25E	
								4D	25E	
89	VAN BUREN DIST. 5	---CRUSHED STONE---								
A89002	DOUDS STONE INC	DOUDS MINE	SE 25 T070 R11W	2.51	2		4	4	6- 13	
A89006	CESSFORD CONST CO	FARMINGTON-COMANCHE	NE 05 T067 R08W	2.69	3i		5	5	3	
				2.52	2		4	4	16 -17	
								4	18 -22	
							5	5	5 -12	
A89008	DOUDS STONE INC	SELMA-GARDNER	NW 16 T070 R11W	2.69	3		4	4	11	
								5	7 -11	
							4	4	14 -21	
							4	4	22 -31	
90	WAPELLO DIST. 5	---SAND & GRAVEL---								
A90504	MARTIN MARIETTA	HOFFMAN	SE 10 T072 R14W				4	4		
				2.67		X				
92	WASHINGTON DIST. 5	---CRUSHED STONE---								
A92002	MARTIN MARIETTA	WEST CHESTER	NE 19 T076 R08W	2.64	3		4	4	5 - 7	
A92006	MARTIN MARIETTA	COPPOCK	NE 30 T074 R07W				5	5	3 - 4	
A92008	RIVER PRODUCTS CO	PEPPER-KEOTA FIELD	SW 31 T076 R09W							
		---SAND & GRAVEL---								
A92502	RIVER PRODUCTS CO	RIVERSIDE	NE 10 T077 R06W				4	4		
				2.65		X				
94	WEBSTER DIST. 1	---CRUSHED STONE---								
A94002	MARTIN MARIETTA	FT DODGE MINE	SW 24 T089 R29W	2.66	3iB		4	4	36 -42	
A94006	MARTIN MARIETTA	YATES	SW 01 T089 R29W					5		
		---SAND & GRAVEL---								
A94502	NORTHWEST MATERIALS	YATES	SW 01 T089 R29W				4	4		
				2.66		X				
A94506	MARTIN MARIETTA	GILPIN	NW 02 T089 R30W				4	4		
A94514	MARTIN MARIETTA	HUDSON-OTHO	SW 14 T088 R28W				4	4		
A94520	MARTIN MARIETTA	WREDE	NE 05 T086 R27W				4	4		
A94522	AUTOMATED S&G	CROFT	NW 14 T089 R29W	2.65		X				
A94526	BECKER GRAVEL CO	BUSKE	SE 36 T090 R29W				3	3		
				2.67		X				
A94528	BECKER GRAVEL CO	CONDON	NW 19 T090 R30W							

NOTE:
1 - THE CONTENT OF BED 26 SHALL NOT BE MORE THAN 25% IN THE OVERALL PRODUCT.

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
96	WINNESHIEK DIST. 2	---CRUSHED STONE---							
A96002	ROVERUD CONST INC	KENDALLVILLE	NE 33 T100 R10W	2.68	3B		4	4	3 - 7
								4	1 - 7
A96003	WILTGEN CONST CO	BROWN	NW 08 TO99 R10W						
A96004	ROVERUD CONST INC	HOVEY	SW 28 TO98 R08W	DWU	3B		5	5	1 - 4
							4	4	1 - 6
A96005	BRUENING ROCK PROD INC	MCGEE	NW 19 TO99 R10W						
A96008	BRUENING ROCK PROD INC	WELKEN	SW 04 TO98 R07W	2.71	3i		4	4	4 - 8
A96010	ROVERUD CONST INC	ANDERSON	SW 22 T100 R10W	2.65	3B		5	5	1 - 4
A96014	NIEMANN CONST CO	FESTINA	SW 26 TO96 R09W		X		5	5	1 - 3
A96016	BRUENING ROCK PROD INC	SKYLINE A	SE 10 TO98 R08W	2.66	3B		5	5	1 - 3
							4	4	4 - 8
A96017	BRUENING ROCK PROD INC	SKYLINE B	CT 10 TO98 R08W		3B		5	5	1 - 3
							4	4	4 -11
A96022	WILTGEN CONST CO	MADISON #2	NE 18 TO98 R08W					5	
A96025	WILTGEN CONST CO	MADISON #1	NW 17 TO98 R08W					4	
A96030	ROVERUD CONST INC	ASK	NE 27 TO98 R07W					4	
A96032	ROVERUD CONST INC	BRUVOLD	NW 20 TO98 R07W					X	
A96034	BRUENING ROCK PROD INC	THOMPSON	SE 29 TO98 R09W						
A96038	ROVERUD CONST INC	NORDNESS	SE 09 TO97 R08W					X	
A96040	ROVERUD CONST INC	LOCUST	NE 11 TO99 R08W					X	
A96046	BRUENING ROCK PROD INC	SERSLAND-SMORSTAD	SE 09 TO97 R07W				X	X	
A96048	NIEMANN CONST CO	LOVE #1	NW 30 TO96 R10W					X	
A96049	NIEMANN CONST CO	LOVE #2	SW 30 TO96 R10W					X	1 -10
A96050	BRUENING ROCK PROD INC	BULLERMAN-FESTINA	SE 14 TO96 R09W					4	1 - 3
A96052	ROVERUD CONST INC	ESTREM	SW 04 TO97 R07W	2.63	3B				1 - 6
							5	5	1 - 8
A96054	ROVERUD CONST INC	HORSESHOE BEND	SW 20 TO97 R09W					X	
A96058	BRUENING ROCK PROD INC	BROGHAMMER	SE 26 TO99 R08W					X	
A96060	ROVERUD CONST INC	BURR OAK	SE 23 T100 R09W				4	4	
A96062	ROVERUD CONST INC	HOLT HAUS	SE 28 TO98 R08W					X	
A96064	ROVERUD CONST INC	STIKA	NW 15 TO97 R10W		3i		4	4	1 - 4A
A96066	BRUENING ROCK PROD INC	KROSHUS	SW 13 T100 R07W					X	
A96068	BRUENING ROCK PROD INC	HOLKESVIK	SW 01 TO99 R08W						
A96070	WILTGEN CONST CO	KUHN	NW 33 TO96 R08W						
A96072	BRUENING ROCK PROD INC	MCKENNA NORTH	SW 34 T100 R09W						
A96074	WILTGEN CONST CO	BUSHMAN	SW 21 TO96 R08W						
A96076	ROVERUD CONST INC	PRASKA	NE 19 TO97 R10W						
A96078	BRUENING ROCK PROD INC	BUSTA	NW 30 TO96 R10W						
A96082	WILTGEN CONST CO	CROW	SW 17 TO97 R10W						
A96084	WILTGEN CONST CO	YOUNG	SE 28 T100 R08W						
A96086	BRUENING ROCK PROD INC	BRUVOLD	NE 29 TO98 R07W						
A96090	BRUENING ROCK PROD INC	MCKENNA SOUTH	SE 28 TO99 R09W	DWU	3		5	5	1 - 5
A96092	ROVERUD CONST INC	HANSON	SE 26 T100 R08W						
A96094	ROVERUD CONST INC	CAROLAN	SE 27 TO99 R09W						
A96100	WILTGEN CONST CO	YOUNG	NE 05 TO98 R07W						
		---SAND & GRAVEL---							
A96502	CARLSON MATERIALS CO	DECORAH	NE 22 TO98 R08W				4	4	
				2.63		X			
A96506	ROVERUD CONST INC	FREEPORT	NE 07 TO98 R07W	2.65		X			
A96514	ROVERUD CONST INC	ELSBERND	NE 16 TO96 R09W				4	4	
				2.66		X			
A96520	CARLSON MATERIALS CO	SWEDES BOTTOM	NE 06 TO98 R08W	2.63		X	4	4	
A96522	BRUENING ROCK PROD INC	WOHLSEORS	NW 17 TO98 R10W						
A96526	ROVERUD CONST INC	STIKA	NW 15 TO98 R08W						
A96528	BRUENING ROCK PROD INC	GJETLEY	NE 08 TO98 R07W				4	4	
A96530	CARLSON MATERIALS CO	CARLSON-FREEPORT	NE 13 TO98 R08W	2.63		X			
A96532	WILTGEN CONST CO	SCHMITT	NE 34 TO96 R09W	DWU		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
97	WOODBURY DIST. 3	---SAND & GRAVEL---							
A97502	HALLETT MATERIALS CO	CORRECTIONVILLE-BUCK	NW 13 TO89 R42W				3	3	
				DWU		X			
A97508	MARTIN MARIETTA	CORRECTIONVILLE #2	NW 35 TO89 R42W				3	3	
A97510	HALLETT MATERIALS CO	CORRECTIONVILLE-COCKBURN	SE 11 TO88 R43W				3	3	
A97514	PERSINGER S&G	SMITHLAND	NW 25 TO86 R44W				3	3	
				DWU		X			
A97516	HALLETT MATERIALS CO	ANTHON	05 TO87 R43W	2.72	3		3	3	
				2.67		X			
A97518	HALLETT MATERIALS CO	SMITHLAND	35 TO86 R44W	2.69	3		3	3	
				2.67		X			
A97520	HALLETT MATERIALS CO	CORRECTIONVILLE-BREESIE	01 TO88 R43W				4	4	
A97526	FLEWELLING S&G	FLEWELLING	NW 10 TO89 R44W	2.67		X			
A97528	HALLETT MATERIALS CO	EDWARD	SE 23 TO89 R42W						
98	WORTH DIST. 2	---CRUSHED STONE---							
A98002	MARTIN MARIETTA	HARRIS	SW 29 T100 R20W	DWU	3i		4	4	10
				2.73	3B		4	4	6 - 7
				DWU	3		4	4	8 -11
							4	4	2 -10
A98010	BASIC MATERIALS CORP	FERTILE	SW 36 TO98 R22W	2.75	3B				15 -20
							4	4	5 -20
A98014	FALK CONST CO	STEVENS	NW 01 TO98 R20W	2.77	3				8 -11B
								5	1 - 3
							4	4	4 - 7
A98016	ULLAND BROS CONST	EMIL OLSON-BOLTON	SW 10 TO99 R20W		2				2 -5A
					X		4	4	3 - 7
								5	1 - 7
		---SAND & GRAVEL---							
A98502	RANDALL TRANSIT MIX	RANDALL TRANSIT MIX	NW 31 T100 R20W				4	4	
				2.66		X			
A98504	BASIC MATERIALS CORP	FERTILE	NW 36 TO98 R22W				3	3	
				2.65		X			
A98506	MARTIN MARIETTA	KNUTSON	SW 30 T100 R20W				4	4	
A98516	LAHARV CONST CO INC	BANG	SE 30 TO98 R22W				X	X	
A98518	FALK CONST CO	COOPER	NE 12 TO98 R20W					4	
A98520	LAHARV CONST CO INC	WADDINGTON	SE 26 TO98 R22W				X	X	
A98522	ULLAND BROS CONST	EMIL OLSON-BOLTON	SW 10 TO99 R20W						
99	WRIGHT DIST. 2	---CRUSHED STONE---							
A99002	BECKER GRAVEL	VOSS	36 TO90 R26W						
		---SAND & GRAVEL---							
A99502	WRIGHT MATERIALS	WRIGHT	NW 12 TO93 R24W	2.70	2		3	3	
				2.66		X			
A99510	MARTIN MARIETTA	MEINEKE	NE 14 TO90 R23W				4	4	
A99512	MARTIN MARIETTA	JACOBSON	SW 01 TO90 R25W						
A99514	BECKER GRAVEL	VOSS	36 TO90 R26W						
A99516	GIESE CONST CO	McALPINE	24 TO92 R24W						
A99518	BECKER GRAVEL	REICHTER	SE 06 TO92 R26W						

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
IL	ILLINOIS	---CRUSHED STONE---								
AIL002	CESSFORD CONST CO	BIGGSVILLE, HENDERSON CO.	17 TO10 R04W				4	4		
AIL004	RIVER CITY STONE INC	MCCARTHY, JO DAVIESS CO.	NW 34 TO29 R02W	2.68	3i		4	4	1 - 5	
AIL006	MOLINE CONSUMERS CO	MIDWAY, ROCK ISLAND CO.	SW 16 TO18 R02E	DWU	3iB		4	4	1 - 5	
AIL008	MOLINE CONSUMERS CO	MCMAHON, WHITESIDE CO.	NE 11 TO20 R02E							
AIL010	MOLINE CONSUMERS CO	MILAN, ROCK ISLAND CO.	14 TO17 R02W	DWU	3i		4	4	18	
				2.69	3		5	5	7 -13	
				DWU	3				14	
				2.72	3		4	4	16 -17	
AIL012	MATERIAL SERVICES	OTTAWA-LIGHTWEIGHT					4	4		
AIL014	CESSFORD CONST CO	DALLAS CITY, HENDERSON CO.	SW 36 TO08 R07W	2.63	3i		4	4	5B	1
								4	2 - 3	
AIL016	MOLINE CONSUMERS CO	CLEVELAND, HENRY CO.	SW 31 TO17 R02E	DWU	3i		4	4		
AIL018	MEDUSA AGGREGATES	KANKAKEE, KANKAKEE CO.	NW 07 TO30 R14W	DWU	2					
AIL020	GRAY QUARRIES/W.L. MILLER	HAMILTON, HANCOCK CO.	NE 31 TO05 R08W	2.65	3		4	4	2	1
					3		4		4	
AIL026	REIN SCHULTZ & DAHL	EMERSON	SE 13 TO21 R06E					4		
AIL028	WENDLING QUARRIES INC	TURNBAUGH-MT CARROLL, ILL.	SW 10 TO24 R04E	DWU	3		4	4	3 - 7	
AIL030	WENDLING QUARRIES INC	HUIZENGA	NW 21 TO21 R03E					4		
AIL032	GALENA STONE CO	EUSTICE, JO DAVIESS CO.	NE 16 TO27 R02E							
AIL034	GALENA STONE CO	VIRTUE, JO DAVIESS CO.	W2 24 TO28 R02W							
AIL036	HARSCO CORP/HECKETT DIV	STERLING, WHITESIDE CO.					2	2		
AIL038	COOTS MATERIALS CO INC	ROTH, JO DAVIESS CO.	SW 35 TO29 R02W							
		---SAND & GRAVEL---								
AIL502	MOLINE CONSUMERS CO	ALBANY, ROCK ISLAND CO.	SW 34 TO20 R02E	2.65	3i		3	3		
				2.67		X				
AIL504	GENERAL S&G CO	MILAN-BIG ISLAND, ROCK IS. CO.	16 TO17 R02W	2.67	3		3	3		
				2.67		X				
AIL506	ILLINOIS-WISCONSIN S&G	SOUTH BELOIT	NW 08 TO16 R02E				4	4		
AIL508	GENERAL S&G CO	BARSTOW, ROCK ISLAND CO.	NE 34 TO18 R01E				4	4		
AIL510	NELSON S&G CO	WHITESIDE COUNTY-SAND	SW 29 TO21 R07E				4	4		
AIL514	MIDWEST S&G	HENRY PIT, MARSHALL CO.	NW 03 TO13 R10E	DWU		X				
AIL516	BUILDERS S&G	CORDOVA, ROCK ISLAND CO.	SE 33 TO21 R02E	DWU	3i		4	4		
				DWU		X				
AIL518	WENDLING QUARRIES INC	THOMPSON	SE 02 TO23 R03E	DWU		X				
AIL520	MOLINE CONSUMERS CO	CORDOVA, ROCK ISLAND CO.	S2 05 TO20 R02E	DWU		X				
KS	KANSAS	---CRUSHED STONE---								
AKS002	BINGHAM S&G	BAXTER SPRINGS, CHEROKEE CO.	22 TO29 R23E							

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 AC A	FRICT AC B	BEDS
MN	MINNESOTA	---CRUSHED STONE---							
AMN002	HECTOR CONST CO	NEW ALBIN, HOUSTON CO.	NW 09 T101 R04W		X		X	X	
AMN004	ROVERUD CONST INC	POOL HILL, HOUSTON CO.	SW 33 T101 R04W		X		X	X	
AMN006	ROVERUD CONST INC	OTTERNESS, FILLMORE CO.	E2 11 T101 R08W	2.75	3i		X	X	1 - 2
AMN008	NEW ULM QUARTZITE QUARRY	QUARTZITE, BROWN CO.	SW 35 T110 R31W				2	2	
AMN012	ROVERUD CONST INC	NEWBURG, FILLMORE CO.	NE 08 T101 R08W		X		X	X	
AMN014	PEDERSEN BROS	BIG SPRINGS, FILLMORE CO.	SW 09 T101 R10W					4	1 - 6
AMN016	ROVERUD CONST INC	EITZEN, HOUSTON CO.	SE 20 T101 R05W		X		X	X	
AMN018	OSMUNDSON BROS CONST	GRAND MEADOW, MOWER CO.	NE 09 T103 R14W				X	X	
AMN020	ED BUNNE	LEROY, MOWER CO.	NE 27 T101 R14W				X	X	
AMN022	ROVERUD CONST INC	UNDERPASS	NE 20 T101 R07W						
AMN024	MERIDIAN AGGREGATE CO	GRANITE FALLS, YLW MED CO.	SW 28 T116 R39W				2	2	
AMN026	ORTONVILLE STONE CO	BIG STONE, BIG STONE CO.	26 T121 R46W	DWU	3i		2	2	
AMN030	ROVERUD CONST INC	GENGLER, HOUSTON CO.	SW 16 T102 R05W	DWU	3B		4	4	1 - 2
AMN032	SIOUX ROCK PRODUCTS	COTTONWOOD, COTTONWOOD CO.	SE 08 T107 R35W	DWU	3i		2	2	
AMN034	ROVERUD CONST INC	ENGRAV, HOUSTON CO.	NE 24 T101 R08W						
AMN036	MATHY CONST CO INC	GOLDBERG, OLMSTEAD CO.	SW 36 T108 R14W				4	4	
AMN038	MATHY CONST CO INC	RIFLE HILL, FILLMORE CO.	NW 35 T102 R12W						
		---SAND & GRAVEL---							
AMN504	BRUENING ROCK PROD INC	NEW ALBIN, HOUSTON CO.	09 T101 R04W				4	4	
AMN506	HECTOR CONST CO	LUTTCHENS, HOUSTON CO.	NW 23 T101 R04W	2.63	2B		4	4	
				2.68		X			
AMN508	HODGEMAN & SONS INC	HODGEMAN, JACKSON CO.	NE 34 T101 R34W				4	4	
AMN510	WILLETT	WILLET, JACKSON CO.	SW 25 T102 R35W				4	4	
AMN512	MARTIN MARIETTA	MAUDLIN, NOBLES CO.	SE 26 T101 R42W				4	4	
AMN516	ULLAND BROS	OLSON, FREEBORN CO.	NW 31 T102 R20W	DWU		X			
AMN518	CARLSON MATERIALS CO	LANESBORO, FILLMORE CO.	SE 07 T104 R10W	DWU		X			
AMN520	BUNNE & RANNELL	BUNNE & RANNELL, FILLMORE CO.	SE 33 T101 R13W	DWU		X			
AMN522	HOLST EXCAVATING	PRAIRIE ISLAND #3, GOODHUE CO.	23 T114 R15W						
AMN524	HOLST EXCAVATING	HASTINGS #2, DAKOTA CO.	02 T114 R17W						
AMN526	NORTHWESTERN AGGREGATES	LAKEVILLE, DAKOTA CO.	01 T114 R20W						
AMN528	HANCOCK CONCRETE CO	POPE, POPE CO.	NW 08 T125 R37W						
AMN532	ULLAND BROS	LARSON, FREEBORN CO.	25 T102 R21W						
MO	MISSOURI	---CRUSHED STONE---							
AMO002	L&W QUARRIES INC	KAHOKA, CLARK CO.	NE 17 TO65 R07W	DWU	2		4	4	2A- 3B
							4	4	14 -16
AMO004	MARTIN MARIETTA	MERCER, MERCER CO.	SE 22 TO66 R23W					5	3 - 5
AMO006	GREENE LS CO	TURNER PROP, NODAWAY CO.	SW 31 TO67 R34W					5	
AMO008	MARTIN MARIETTA	ALLENDALE-LAMB, WORTH CO.	NW 03 TO66 R30W					5	
AMO010	MARTIN MARIETTA	ALLENDALE-KING, WORTH CO.	SE 34 TO66 R30W					5	
AMO012	MARTIN MARIETTA	DR. JEFFERIES, HARRISON CO.	NW 03 TO66 R26W				5	5	2 - 8
AMO014	CARTER-WATERS CORP	EXPANDED SHALE,NEW MARKET MO.		DWU	2		3	3	
AMO016	MARTIN MARIETTA	BETHANY, HARRISON CO.	SW 09 TO63 R28W				5	5	
AMO018	MARTIN MARIETTA	ROUTE C, DAVIESS CO.	NE 30 TO61 R28W				5	5	2 - 5
AMO020	MARTIN MARIETTA	RIDGEWAY, HARRISON CO.	NE 01 TO64 R27W				5	5	
AMO022	IRON MT TRAP ROCK CO	IRON MT-ST FRANCOIS CO.					3	3	
AMO024	CENTRAL STONE CO	HUNTINGTON, RALLS CO.	NE 17 TO56 R06W	2.68	3i				6 - 9
				2.68	3		4	4	6 -11
AMO026	MISSOURI PORTABLE STONE	WARRENTON, WARREN CO.	15 TO46 R02W				3	3	
AMO027	ST JOE LEAD	PEA RIDGE MINE, WASH. CO.					3	3	
AMO028	PLATTIN MTRLS CO	PLATTIN, ST GENEVIEVE CO.	09 TO39 R07W						
AMO030	KNOX COUNTY STONE CO	EDINA, KNOX CO.	NE 25 TO62 R12W				4	4	1 - 9
AMO032	SCHILDBERG CONST CO INC	GRAHAM, NODAWAY CO.	NW 36 TO63 R37W				4	4	2 - 3
AMO038	CENTRAL STONE CO	GREENSBURG, SCOTLAND CO.	22 TO64 R12W						
AMO040	S&A CONSTRUCTION	SOUTH ALLENDALE, WORTH CO.	NW SW 17 TO65 R30W						
AMO042	TRAGER	GALLATIN, DAVIESS CO.	13 TO58 R28W						
		---SAND & GRAVEL---							
AMO502	IDEAL SAND CO	WAYLAND, CLARK CO.	SW 21 TO65 R06W				4	4	
				2.66		X			
AMO504	MEDUSA AGGREGATES	ALBANY, GENTRY CO.	27 TO63 R31W				4	4	
AMO506	MILBURN CO	GALLITIN, DAVIESS CO.	CT 16 TO59 R27W				4	4	
AMO510	TURNER QUARRIES	CLEARMONT, NODAWAY CO.	SW 34 TO66 R37W				4	4	
AMO516	STONER SAND CO	MOUNT MORIAH, HARRISON CO.	12 TO64 R26W	2.65		X			

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
NE	NEBRASKA	---CRUSHED STONE---							
ANE002	MARTIN MARIETTA	WEEPING WATER MINE, CASS CO.	03 T010 R11E	2.69	3iB		5	5	10
ANE004	KERFORD LS CO	WEEPING WATER MINE, CASS CO.	SE 32 T011 R11E	2.69	3iB		5	5	10
ANE010	FORT CALHOUN STONE CO	FT CALHOUN, WASHINGTON CO.	SE 01 T017 R12E				4D	4D	25C-25E
								4D	25A-25C
								4D	25F
								4D	26A-26E
								4D	27A-27B
ANE012	CITY WIDE S&G	WHITNEY, SARPY CO.	28 T013 R12E						
		---SAND & GRAVEL---							
ANE512	LYMAN-RICHEY S&G	WATERLOO #14, DOUGLAS CO.	NE 20 T015 R20E				4	4	
				2.62		X			
		---CLASS V AGGREGATE FOR CONCRETE---							
ANE502	LYMAN-RICHEY S&G	CULLOM #5, CASS CO.	SW 26 T013 R12E	2.62	3		4	4	
				2.62		X			
ANE504	LYMAN-RICHEY S&G	WATERLOO #10, DOUGLAS CO.	SE 17 T015 R10E	2.62	3		4	4	
				2.62		X			
ANE506	HARTFORD S&G	VALLEY, DOUGLAS CO.	NW 18 T015 R10E	2.62	3		4	4	
				2.62		X			
ANE508	LYMAN-RICHEY S&G	VALLEY #11, DOUGLAS CO.	SE 35 T016 R09E	2.62	3		4	4	
				2.62		X			
ANE510	HARTFORD S&G	VALLEY, DOUGLAS CO.	SW 22 T016 R09E	2.62	3		4	4	
				2.62		X			
ANE514	LYMAN-RICHEY S&G	OREAPOLIS #8, CASS CO.	SE 34 T013 R13E	2.62	3		4	4	
				2.62		X			
ANE526	WESTERN S&G	FREMONT, DODGE CO.	36 T008 R17E	2.62	3		4	4	
				2.62		X			
ANE530	WESTERN S&G	SOUTH BEND, CASS CO.	SW 13 T012 R10E	2.62	3		4	4	
				2.62		X			
ANE532	WESTERN S&G	ABEL SPUR, SAUNDERS CO.	SW 30 T013 R09E	2.62	3		4	4	
				2.62		X			
ANE534	MALLARD S&G	SPRINGFIELD #3, SARPY CO.	32 T013 R12E	2.62	3		4	4	
				2.62		X			
ANE536	MARTIN MARIETTA	GRETNA, SARPY CO.	17 T013 R10E	2.62	3		4	4	
				2.62		X			
ANE538	STALP S&G	WEST POINT, CUMING CO.	SE 28 T022 R06E	2.62	3		4	4	
				2.62		X			
ANE540	ALL SPEC S&G	ALL SPEC S&G, DOUGLAS CO.	SW 14 T015 R10E	2.62	3		4	4	
				2.62		X			
ANE542	LYMAN-RICHEY S&G	PLANT #47, DODGE CO.	35 T016 R09E	2.64	3		4	4	
				2.64		X			
ANE544	MALLARD S&G	VALLEY, DOUGLAS CO.	NE 06 T015 R10E	2.62	3		4	4	
				2.62		X			
SD	SOUTH DAKOTA	---CRUSHED STONE---							
ASD002	EVERIST INC	DELL RAPIDS EAST MINNEHAHA CO	SW 10 T104 R49W	2.64	3iB		2	2	
ASD004	CONCRETE MATERIALS CO	SIOUX FALLS QUARTZITE	13 T101 R50W	2.64	3iB		2	2	
ASD006	MYRL & ROY'S PAVING INC	EAST SIOUX, MINNEHAHA CO.	SE 27 T101 R48W	DWU	3i		2	2	1
ASD008	SPENCER QUARRIES INC	SPENCER, HANSON CO.	24 T103 R57W				2	2	
ASD010	EVERIST INC	DELL RAPIDS WEST MINNEHAHA CO	NW 16 T104 R49W	2.64	3iB		2	2	
		---SAND & GRAVEL---							
ASD502	BOYER MATERIALS	BOYER, UNION CO.	10 T095 R48W	DWU	2		4	4	
ASD504	MIDWEST PAVING CO	HAWARDEN, UNION CO.	SW 15 T095 R48W				4	4	
ASD506	MIDWEST PAVING CO	RICHLAND, UNION CO.	SW 20 T092 R49W				4	4	
ASD508	CONCRETE MATERIALS CO	CANTON, LINCOLN CO.	17 T089 R48W				4	4	
				2.68		X			
ASD510	CONCRETE MATERIALS CO	MINNEHAHA CO.	02 T101 R49W						
ASD514	HIGMAN S&G	HUDSON, UNION CO.	02 T095 R48W	DWU	2		4	4	
ASD516	HIGMAN S&G	VOLIN, CLAY CO.	12 T094 R54W						

RECENTLY ACTIVE

AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	BULK SSD SpGr	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
WI	WISCONSIN	---CRUSHED STONE---							
AWI002	BRYAN DRESSER TRAP ROCK	DRESSER-TRAPROCK					3	3	
AWI004	MARTIN MARIETTA	CNWRR-ROCK SPRINGS					2	2	
AWI006	KIELER KOWALSKI	TENNYSON, GRANT CO.		DWU	3i		4	4	
AWI008	QUALITY STONE INC	WETZEL, CRAWFORD CO.	NE 31 TO07 R06W	DWU	3i		4	4	7
AWI010	ED KRAEMER & SONS INC	RICHARDS, GRANT CO.	SW 21 TO01 R02W	DWU	3i		4	4	
AWI012	SCARPELLI MATERIALS	WATERLOO QRTZ,DODGE CO.	27,28,33,34 TO08 R13E				2	2	
AWI018	RIVER CITY STONE INC	FREESE, GRANT CO.	NW 28 TO01 R02W						
AWI020	MATHY CONST CO INC	MEDARY, LA CROSSE CO.	NW 27 TO16 R07W				4	4	
AWI022	MATHY CONST CO INC	KINGS BLUFF, LA CROSSE CO.	NE 25 TO18 R08W	DWU	3		4	4	2 - 4
AWI030	HAVERLAND STONE CO	HAVERLAND, GRANT CO.	NW 26 TO02 R02W						
AWI034	ED KRAEMER & SONS INC	HOUSEHOLDER, RICHLAND CO.							
		---SAND & GRAVEL---							
AWI502	PRAIRIE S&G CO	PRAIRIE DU CHIEN, CRAWFORD CO.	24 TO07 R07W	2.67	3i		4	4	
				2.67		X			
AWI504	DUBUQUE S&G CO	VOGT FARM, GRANT CO.	17 TO90 R03E	2.67	3i		3	3	
				2.67		X			
AWI506	PRAIRIE S&G CO	KRAMER, CRAWFORD CO.	NE 12 TO07 R07W	DWU	X		3	3	
				2.68		X			
AWI508	PRAIRIE S&G CO	BARN	SE 12 TO07 R07W	2.68	X				
				2.69		X			
AWI510	RIVER CITY STONE INC	KRUG, GRANT CO.	SW 17 TO01 R02W	DWU		X			
AWI514	HOLST EXCAVATING	REDWING #7	NE 33 TO25 R18W						

REVETMENT STONE
SOURCE APPROVAL

CODE	OPERATOR	SOURCE NAME	LOCATION	BEDS	REVETMENT CLASS
DIST. 1					
A40006	MARTIN MARIETTA	GRAND GEORGE	SW 18 TO89 R25W	3-5	D
A42002	MARTIN MARIETTA	ALDEN	NW 20 TO89 R21W	3	D,E
A50002	MARTIN MARIETTA	SULLY	SE 16 TO79 R17W	36-41	E
				42-47	E
A64002	MARTIN MARIETTA	FERGUSON	SW 05 TO82 R17W	8-21	E
A86002	WENDLING QUARRIES INC	MONTOUR	NW 09 TO83 R06W	8-12	D,E
A94002	MARTIN MARIETTA	FORT DODGE MINE	SW 24 TO89 R29W	36-42	D,E
DIST. 2					
A03002	BRUENING ROCK PROD INC	WEXFORD	NE 36 TO98 R03W	1B-8	A,B,D,E
A03028	ROVERUD CONST CO	WELPER-JOHNSON	SW 35 TO99 R04W	FULL FACE	A,B,D,E
A03040	BRUENING ROCK PROD INC	DEE	SE 21 TO99 R04W	5A-5D	A,B,D,E
A03050	BRUENING ROCK PROD INC	GREEN	NW 16 TO96 R06W	1-3	A,B,D,E
A07004	BASIC MATERIALS CORP	WATERLOO SOUTH	NW 18 TO87 R12W	1-23	A,B,D,E
				17-23	A,B,D,E
A07014	NIEMANN CONST CO	GLORY	NE 36 TO87 R11W	1-TOP 5'OF BED4	D
A07018	BASIC MATERIALS CORP	RAYMOND-PESKE	SW 01 TO88 R12W	1B- 5	A,B,D,E
				1B-10	A,B,D,E
				6-10	A,B,D,E
A09004	NIEMANN CONST CO	DENVER-FOELSKE	NE 29 TO91 R13W	BOTTOM 8'	A,B,D,E
				BED 12-TOP 9'	
				BED 13	
A12014	NIEMANN CONST CO	OLTMANN	SE 08 TO91 R16W	1-TOP	D
				½ BED 10	
A22002	KUHLMAN CONST CO	TWIN ROCK-SCHRADER	NW 14 TO94 R05W	3-11	A,B,D,E
A22004	ROVERUD CONST CO	BENTE/ELKADER/WATSON	SW 12 TO93 R05W	5-9	A,B,D,E
A22008	KUHLMAN CONST CO	ANDEREGG	SE 32 TO92 R02W	2-8	A,B,D,E
A22010	KUHLMAN CONST CO	OSTERDOCK	SE 02 TO91 R03W	3-8	A,B,D,E
A22012	KUHLMAN CONST CO	SCHMIDT	NE 33 TO91 R01W	2-6	A,B,D,E
A22014	ROVERUD CONST CO	BLUME	NE 09 TO93 R03W	1-12	A,B,D,E
A22016	KUHLMAN CONST CO	GISLESON	NW 06 TO95 R04W	1-15	A,B,D,E
A22020	KUHLMAN CONST CO	MUELLER	NE 30 TO94 R03W	1-8	A,B,D,E
A22026	KUHLMAN CONST CO	DOERRING-LUANA	SE 05 TO95 R05W	3-5	D
A22030	KUHLMAN CONST CO	EBERHARDT	NW 27 TO93 R05W	1-6	A,B,D,E
A22034	KUHLMAN CONST CO	KRUSE	NW 17 TO92 R04W	5-12	A,B,D,E
A22040	KUHLMAN CONST CO	HARTMAN	NW 29 TO91 R06W	1-4	A,B,D,E
A22042	ROVERUD CONST CO	MORAREND	CT 35 TO92 R03W	1-9	A,B,D,E
A22046	KUHLMAN CONST CO	JOY SPRINGS-BURRACK	NW 19 TO91 R06W	1-2	A,B,D,E
A22048	ROVERUD CONST CO	TUCKER	SW 18 TO91 R05W	1-3	D
A22060	ROVERUD CONST CO	JOHNSON	NW 26 TO93 R04W	2-5	A,B,D,E
A22062	ROVERUD CONST CO	SNY MAGILL	SE 22 TO94 R03W	6-10	A,B,D,E
A22070	ROVERUD CONST CO	BERNHARD/GIARD	NW 35 TO95 R04W	1-3	A,B,D,E
A22074	RIVER CITY STONE CO	STRAWBERRY POINT	NE 19 TO91 R06W	1-2	A,B,D,E
A33026	WILTGEN CONST CO	LYNCH	NW 05 TO95 R10W	6-8	A,B,D,E
A33032	BRUENING ROCK PROD INC	LANDIS	SE 12 TO93 R08W	1-5	A,B,D,E
A34004	GREENE LIMESTONE CO	MAXON	SE 07 TO94 R17W	4C-19	A,B,D,E
A34008	GREENE LIMESTONE CO	WARNHOLTZ	SW 09 TO96 R16W	5-16	D
				17-18	A,B,D,E
A35002	MARTIN MARIETTA	DOWS	NE 30 TO91 R22W	1-12	A,B,D,E
A35006	MARTIN MARIETTA	HIBNESS	SE 22 TO91 R20W	1-12A	A,B,D,E
A41002	BASIC MATERIALS CORP	GARNER NORTH	SE 11 TO95 R24W	6	A,B,D,E
A41004	BASIC MATERIALS CORP	GARNER SOUTH-WIELAND	NW 13 TO95 R24W	6	A,B,D,E
A45002	ROVERUD CONST CO	ECKERMAN	NW 33 TO100 R11W	7-9	A,B,D,E
A45006	BRUENING ROCK PROD INC	NELSON	NE 33 TO99 R13W	8-9	A,B,D,E
A45010	BRUENING ROCK PROD INC	DALEY	NE 11 TO98 R11W	9-10	A,B,D,E
A46006	MARTIN MARIETTA	HODGES	NE 32 TO92 R28W	4-18	D
A76002	MARTIN MARIETTA	GILMORE CITY	NE 36 TO92 R31W	1A-3	A,B,D,E
A76004	MARTIN MARIETTA	MOORE	SW 25 TO92 R31W	1A-3	A,B,D,E
A96002	ROVERUD CONST CO	KENDALLVILLE	NE 33 TO100 R10W	2-9	A,B,D,E
A96004	ROVERUD CONST CO	HOVEY	SW 28 TO98 R08W	2-6	A,B,D,E
A96017	BRUENING ROCK PROD INC	SKYLINE B	CT 10 TO98 R08W	4-11	A,B,D,E
A96052	ROVERUD CONST CO	ESTREM	SW 04 TO97 R07W	2-8	A,B,D,E
A96064	ROVERUD CONST CO	STIKA	NW 15 TO97 R10W	5A-8B	A,B,D,E
A96017	BRUENING ROCK PROD INC	SKYLINE B	CT 10 TO98 R08W	4-11	A,B,D,E
A98002	MARTIN MARIETTA	HARRIS	SW 29 TO100 R20W	6-11	A,B,D,E
A98010	BASIC MATERIALS	FERTILE	SW 36 TO98 R22W	15-20	A,B,D,E
AMN004	ROVERUD CONST CO	POOL HILL	SW 33 TO101 R04W	1-8	A,B,D,E
AMN030	ROVERUD CONST CO	GENGLER	SW 16 TO102 R05W	1-4	A,B,D,E

REVETMENT STONE
SOURCE APPROVAL

CODE	OPERATOR	SOURCE NAME	LOCATION	BEDS	REVETMENT CLASS
DIST. 3					
AMN032	SIOUX ROCK PRODUCTS	COTTONWOOD, COTTONWOOD CO.	SE 08 T107 R35W	Entire ledge*	A,B,D,E
ASD002	EVERIST INC	DELL RAPIDS, MINNEHAHA CO.	SW 10 T104 R49W	Entire ledge*	A,B,D,E
ASD004	CONCRETE MATERIALS CO	SIOUX FALLS QUARTZITE	13 T101 R50W	Entire ledge*	A,B,D,E
ASD006	MYRL & ROY'S PAVING INC	EAST SIOUX, MINNEHAHA CO.	SE 27 T101 R48W	Entire ledge*	A,B,D,E
ASD008	SPENCER QUARRIES INC	SPENCER, HANSON CO.	24 T103 R57W	Entire ledge*	A,B,D,E

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*Isolated pockets of sandstone may be cause to reject all or portions of a shot, also, the pipestone deposits will define the lower limits of ledge. In both instances a visual examination will reveal the presence of either unconsolidated sandstone or pipestone material.

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CODE	OPERATOR	SOURCE NAME	LOCATION	BEDS	REVETMENT CLASS
DIST. 4					
A01002	SCHILDBERG CONST CO INC	MENLO	SE 17 T077 R31W	15A-15C	D,E
A61002	SCHILDBERG CONST CO INC	EARLY CHAPEL-DAGGETT	NW 10 T076 R29W	14B	D,E
A61024	MARTIN MARIETTA	PENN-DIXIE	SW 32 T076 R27W	20A	D,E
A78002	SCHILDBERG CONST	CRESCENT	35 T076 R24W	25B-25E	D,E
A88002	SCHILDBERG CONST	THAYER	NE 35 T072 R28W	20B	D,E
				25B-25E	E
ANE002	MARTIN MARIETTA	WEEPING WATER NE	03 T010 R11E	10A-10B	E
ANE004	KERFORD LIMESTONE	WEEPING WATER NE	SE 32 T011 R11E	10A-10B	D,E
ANE010	FORT CALHOUN STONE	FORT CALHOUN NE	SE 01 T017 R12E	26B-26E	D,E
DIST. 5					
A04004	L&W QUARRIES	MARTIN #3	E2 20 T070 R19W	1-3	D
				6	D,E
A04016	L&W QUARRIES	LEMLEY EAST #5	CT 35 T070 R19W	1-3	D
				6	D,E
A04018	L&W QUARRIES	CLARKDALE #8	SE 15 T069 R18W	1A	D,E
				1C	D,E
				4	D
A20002	MARTIN MARIETTA	OSCEOLA	NW 12 T072 R26W	1-10	D
				20A	D
A26004	DOUDS STONE INC	LEWIS	W2 02 T069 R12W	3-5	D
				6-7	D,E
A27002	MARTIN MARIETTA	GRAND RIVER	NW 22 T070 R27W	17	D
A27008	MARTIN MARIETTA	DECATUR	SE 32 T069 R27W	7	D
				13-14	D
A29002	L&W QUARRIES	MEDIAPOLIS	SE 01 T071 R04W	15-18	D,E
A29008	CESSFORD CONST CO	NELSON	NE 26 T072 R02W	7-14	D,E
				7-20	D,E
				15-20	D
				15-24	D
				21-24	D,E
				25-27	D
A29012	CESSFORD CONST CO	GEODE	NE 01 T069 R05W	1-5	D,E
				9-13	D,E
A44008	DOUDS STONE INC	NELSON-TWEEDY	SW 36 T071 R06W	9-14	D,E
				13-14	D,E
A54002	MARTIN MARIETTA	KESWICK	NW 21 T077 R12W	13-15	D,E
				13-17	D
A54004	MARTIN MARIETTA	OLLIE	SW 01 T074 R11W	9-13	D
				13-18	D,E
				19-27	D
				27-30	D,E
				30-33	D
A54008	MARTIN MARIETTA	HARPER	SE 11 T076 R11W	13-22	D,E
				32-37	D,E
				38-40	D,E
A54010	DOUDS STONE INC	LYLE	NW 13 T074 R13W	2-11	D
				9-13	D,E
				36-38	E
				40	E
A56002	CESSFORD CONST CO	HAWKEYE	NE 10 T068 R06W	1-21	D
				22-27	D,E
A56008	CESSFORD CONST CO	DONNELLSON	SE 05 T067 R06W	10-13	D,E
A62008	MARTIN MARIETTA	GIVEN #2	SE 14 T074 R16W	2-6	D
A63002	MARTIN MARIETTA	DURHAM MINE	NE 08 T075 R18W	88-95	D,E
				95-96	D,E
A63010	BRUENING ROCK PROD INC	S&S	SE 25 T075 R20W	MASSIVE BEDS	D

REVETMENT STONE
SOURCE APPROVAL

CODE	OPERATOR	SOURCE NAME	LOCATION	BEDS	REVETMENT CLASS
DIST. 5					
A89002	DOUDS STONE INC	DOUDS MINE	SE 25 T070 R11W	5-13	D,E
A89006	CESSFORD CONST CO	FARMINGTON-COMANCHE	NE 05 T067 R08W	5-12	D
				14-15	D
				16-17	D,E
				18-23	D
A89008	DOUDS STONE INC	SELMA-GARDNER	NW 16 T070 R11W	14-31	D,E
				22-31	D,E
A92002	MARTIN MARIETTA	WESTCHESTER	NE 19 T076 R08W	15-16	D,E
A92008	RIVER PRODUCTS CO	PEPPER-KEOTA FIELD	SW 31 T076 R09W	2-20	D
				22-28	D
				29-36	D
AIL014	CESSFORD CONST CO	DALLAS CITY	SW 36 T008 R07W	5-6	D,E
AIL020	GRAY QUARRY, INC	GRAY	NE 31 T005 R08W	2	D,E
AMO002	L&W QUARRIES	KAHOKA	NE 17 T065 R07W	2A-3B	D,E
AMO012	MARTIN MARIETTA	JEFFERIES	NW 03 T066 R26W	25C-25D	D,E
AMO024	CENTRAL STONE	HUNTINGTON	NE 17 T056 R06W	6-11	D,E
DIST. 6					
A06006	WENDLING QUARRIES INC	GARRISON B	NE 33 T085 R11W	6-23	A,B,D,E
A06012	COOTS MATERIALS CO INC	JABENS	SW 07 T085 R11W	6-11,12	A,B,D,E
A06016	COOTS MATERIALS CO INC	COOTS	SW 36 T086 R11W	2A ON DOWN	D
A16004	WENDLING QUARRIES INC	LOWDEN-SCHNECKLOTH	NW 04 T081 R01W	1	A,B,D,E
A16006	WENDLING QUARRIES INC	MCGUIRE	SE 14 T080 R03W	4A-4D	A,B,D,E
A16008	WENDLING QUARRIES INC	LIME CITY	NE 16 T079 R02W	2	A,B,D,E
A16012	WEBER STONE CO	ONION GROVE	SE 14 T082 R02W	1-7	A,B,D,E
A16014	WENDLING QUARRIES INC	TOWNSEND	NW 02 T079 R02W	2-10	A,B,D,E
A16022	WENDLING QUARRIES INC	TRICON	N2 09 T082 R04W	1	A,B,D,E
A23002	WENDLING QUARRIES INC	BLOORE-ELWOOD	NW 08 T083 R02E	1-2	A,B,D,E
A23004	WENDLING QUARRIES INC	BEHR	SW 02 T081 R03E	1-2	A,B,D,E
A23006	WENDLING QUARRIES INC	SHAFFTON	NE 11 T080 R05E	16-17	A,B,D,E
				3-14	D
A23010	WENDLING QUARRIES INC	GOOSE LAKE	SW 22 T083 R05E	2-4	E
A23012	WENDLING QUARRIES INC	TEEDS GROVE	SW 03 T083 R06E	2-4	A,B,D,E
A23016	WENDLING QUARRIES INC	LYONS	NW 18 T082 R07E	UPPER OR LOWER LEDGE	E
A23018	WENDLING QUARRIES INC	KINGS	NW 06 T080 R03E	FULL FACE	E
A28008	KUHLMAN CONST	EDGEWOOD WEST	CT 04 T090 R05W	2-7	A,B,D,E
A28010	KUHLMAN CONST	TIBBOTT	SW 23 T090 R04W	1-5	A,B,D,E
A28014	KUHLMAN CONST	LOGAN	SW 10 T088 R05W	2-8	A,B,D,E
A28016	KUHLMAN CONST	WHITE	NW 02 T088 R04W	1-2	A,B,D,E
A28020	BARD CONCRETE	DEUTMEYER	SW 13 T088 R03W	1-6	A,B,D
A28030	KUHLMAN CONST	GRIEF	NE 18 T087 R03W	1-2	A,B,D,E
A28038	KUHLMAN CONST	EDGEWOOD EAST	NW 06 T090 R04W	1B-5	A,B,D,E
				2-6	E
A28040	BARD CONCRETE	KRAPFL	SE 23 T089 R03W	1-5	A,B,D
				4	E
A28052	RIVER CITY STONE CO	MANCHESTER	SW 09 T088 R05W	6-8	A,B,E
				TOP LEDGES-NORTH	D
A28056	RIVER CITY STONE CO	THORPE	NW 33 T090 R05W	FULL FACE	A,B,D,E
A31006	KUHLMAN CONST	DYERSVILLE	SE 32 T089 R02W	4-12	A,B,D,E
A31008	RIVER CITY STONE CO	KLEIN-RICHARDSVILLE	NW 33 T090 R01E	2-4B	A,B,D
				3A-4B	E
A31010	RIVER CITY STONE CO	BROWN	NW 33 T089 R02E	FULL FACE	D
				3-9	A,B,E
A31014	BARD CONCRETE	KURT	N2 T087 R02W	1-2	A,B,D,E
A31018	RIVER CITY STONE CO	MELOY	NW 23 T087 R01E	FULL FACE	A,B,D
				1-3	E
A31020	RIVER CITY STONE CO	SCHLITCHE	SE 11 T089 R02W	1-4	A,B,D,E
A31026	WENDLING QUARRIES INC	ARNSDORF	SE 25 T087 R02E	1-2	A,B,D,E
A31028	RIVER CITY STONE CO	THOLE	NW 21 T087 R02E	2-3	A,B
				3	D,E
A31034	RIVER CITY STONE CO	HERMSEN	NE 33 T090 R02W	1-2	A,B,D,E
A31036	RIVER CITY STONE CO	BALLTOWN	SE 05 T090 R01E	1-7	A,B,D,E
A31040	RIVER CITY STONE CO	KENNEDY	NW 03 T088 R01W	FULL FACE	A,B,D,E

REVETMENT STONE
SOURCE APPROVAL

CODE	OPERATOR	SOURCE NAME	LOCATION	BEDS	REVETMENT CLASS
DIST. 6					
A31044	RIVER CITY STONE CO	GASSMAN	SE 07 T088 R03E	2-9	A
				2-10	B,D
				5-9	E
A31050	RIVER CITY STONE CO	PLOESSEL-DYERSVILLE	N2 07 T088 R02W	2-5	A,B,D
				3-5	E
A31052	WEBER STONE CO	EPWORTH-KIDDER	SW 02 T088 R01W	FULL FACE	A,B,D,E
A31056	RIVER CITY STONE CO	RUBIE	SE 06 T088 R03E	5-9	A,B,E
				FULL FACE	D
A31058	RIVER CITY STONE CO	HOLY CROSS	SW 12 T090 R02W	FULL FACE	A,B,D,E
A31060	BARD CONCRETE	CASCADE EAST	SE 22 T087 R01W	2-5	A,B,D,E
A31064	RIVER CITY STONE CO	WEBER	NE 32 T089 R02E	3-9A	A,B,D,E
A31066	RIVER CITY STONE CO	FILLMORE	SW 26 T087 R01W	FULL FACE	A,B,D
				2-4	E
A49008	WEBER STONE CO	IRON HILL	SW 16 T085 R02E	1-6	A,B,D,E
A49010	WENDLING QUARRIES INC	ANDREW	NW 21 T085 R03E	1B-5B	E
A49012	WENDLING QUARRIES INC	FROST	SE 16 T084 R03E	1A-1E	A,B,D,E
A49016	WENDLING QUARRIES INC	WEIS	SE 22 T085 R04E	7	A,B,D,E
A49018	WENDLING QUARRIES INC	PATASKA	NW 23 T085 R05E	1	A,B,D,E
A49020	WENDLING QUARRIES INC	PRESTON	SW 26 T084 R05E	1-10	E
A49022	WENDLING QUARRIES INC	BELLEVUE	SE 23 T086 R04E	1B-3	E
A49024	WENDLING QUARRIES INC	MAQUOKETA EAST	SW 07 T084 R03E	4-8	A,B,D,E
A49040	WENDLING QUARRIES INC	JOINERVILLE	SE 20 T084 R02E	1-3	A,B,D,E
A52002	WENDLING QUARRIES INC	FOUR COUNTY	NW 04 T081 R08W	9-16	D
A53002	BARD CONCRETE	FARMERS-BEHRENDS	NE 14 T086 R03W	1-5	A,B,D,E
A53004	WENDLING QUARRIES INC	MONTICELLO	NE 24 T086 R04W	FULL FACE	A,B,D,E
A53010	WENDLING QUARRIES INC	BALLOU-OLIN	NE 24 T083 R03W	FULL FACE	A,B,D,E
A53012	WENDLING QUARRIES INC	WYOMING	33 T084 R01W	1-2C	A,B,D,E
A53014	WEBER STONE CO	JACOBS-SCOTCH GROVE	SW 07 T085 R02W	FULL FACE	A,B,D,E
A53016	WEBER STONE CO	STONE CITY	E2 06 T084 R04W	1,3	A,B,D,E
A53018	RIVER CITY STONE CO	FINN	NE 06 T085 R01W	2-5	A,B,E
				FULL FACE	D
A53024	RIVER CITY STONE CO	SULLIVAN	NW 14 T086 R03W	FULL FACE	A,B,D,E
A53026	RIVER CITY STONE CO	ANAMOSA	SW 15 T084 R04W	REEF MATERIAL	A,B,D,E
A57002	WENDLING QUARRIES INC	BETENBENDER-COGGON	SW 03 T086 R06W	1-10	A,B,D,E
A57010	WENDLING QUARRIES INC	TROY MILLS	SE 09 T086 R07W	FULL FACE	D
A57014	WENDLING QUARRIES INC	SWEETING	NW 18 T085 R08W	1-4	D
A57028	WENDLING QUARRIES INC	CEDAR RAPIDS	NW 07 T082 R07W	6	A,B,D,E
A70002	WENDLING QUARRIES INC	MOSCOW	NW 08 T078 R02W	11-17	D,E
				21A-24	D,E

APPROVED PRODUCERS

WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP		PHONE/FAX NUMBER
A				
ACME FUEL & MATERIALS CO.	2544 PETTIBONE AVE.	MUSCATINE, IA 52761		(319) 263-1105
AGGREGATE MATERIALS CO.	1400 E 12th STREET	DUBUQUE, IA 52001		(319) 583-6642
AGGREGATES, INC.	6101 BLAIRS FERRY ROAD NE	CEDAR RAPIDS, IA 52411		(319) 395-0050
ANDERSON SAND & GRAVEL CO.	2578 270th AVE	DEWITT, IA 52742		(319) 659-5506
ARCADIA LIMESTONE CO.	19011 CRYSTAL AVE.	ARCADIA, IA 51430		(712) 689-2299
B				
BARD CONCRETE	2021 325th AVE	DYERSVILLE, IA 52040		(319) 875-7145
			Fax	(319) 875-7860
BASIC MATERIALS CORP.	2625 W. AIRLINE HWY, BOX 2277	WATERLOO, IA 50704		(319) 235-6583
			Fax	(319) 235-7065
BECKER GRAVEL CO., INC	515 WILLOW ST, BOX 229	STRATFORD, IA 50249		(515) 838-2475
			Fax	(515) 838-2472
BEDROCK GRAVEL CO.	3527 320th STREET	AUBURN, IA 514333		(712) 688-2418
BELLCO OF NEBRASKA, INC.	2826 SOUTH AVE	COUNCIL BLUFFS, IA 51503		(712) 322-8501
			Fax	(712) 322-8526
BELLEVUE SAND & GRAVEL CO.	29427 HWY 52	BELLEVUE, IA 52031		(319) 872-3886
BLAZEK CORPORATION	1830 RIDGEWAY BLVD.	LAWLER, IA 52154		(319) 238-7150
BOGGESS CONSTRUCTION CO.	321 NORTH 17th COURT	ESTHERVILLE, IA 51334		(712) 867-4516
BOYER SAND & ROCK INC.	4162 BIRCH AVE	HAWARDEN, IA 51023		(712) 552-2308
			Fax	(712) 552-2677
BROCKMAN SAND CO.	2397 263rd AVE, BOX 312	FORT MADISON, IA 52627		(319) 372-7138
BRUENING ROCK PRODUCTS INC.	325 WASHINGTON ST., BOX 127	DECORAH, IA 52101		(319) 382-2933
/SKYLINE CONSTRUCTION, INC.			Fax	(319) 382-8375
BUILDERS SAND & CEMENT CO.	104 WESTERN AVENUE	DAVENPORT, IA 52801		(319) 322-1757
C				
CENTRAL STONE CO. #1	RR 1, BOX 236	HANNIBAL, MO 63401-9622		(573) 735-4525
CESSFORD CONST. CO.-SE DIV.	3808 OLD HWY 61	BURLINGTON, IA 52601		(319) 753-2297
			Fax	(319) 753-0926
CESSFORD CONST. CO.	2320 ZELLER AVE	LE GRAND, IA 50142		(641) 479-2695
			Fax	(641) 479-2003
COHRS CONSTRUCTION, INC.	15700 NORTH TRADEWIND DR	SPIRIT LAKE, IA 51360		(712) 832-3714
CONCRETE, INC.	BOX 54	GIFFORD, IA 50259		(641) 858-3637
CONCRETE MATERIALS	1201 WEST RUSSELL	SIOUX FALLS, SD		(605) 357-6000
CONRECO, INC.	4901 G STREET	OMAHA, NE 68117		(402) 733-4100
			Fax	(402) 733-5774
COOTS MATERIALS CO.	1700 WEST D STREET	VINTON, IA 52349		(319) 472-4480
			Fax	(319) 472-4485
CORELL RECYCLING	200 SOUTH 13TH STREET	WEST DES MOINES, IA 50265		(515) 223-8010
CRAWFORD QUARRY CO.	HWY 94 NORTHWEST, BOX 1027	CEDAR RAPIDS, IA 52046		(319) 396-5705
CROELL REDI MIX	P.O. BOX 146	SUMNER, IA 50674		(319) 578-3393
D				
DAVE'S SAND & GRAVEL, INC.	RR 2, BOX 58A	HARTLEY, IA 51346		(712) 834-2515
DOUDS STONE, INC.	13133 ANGLE ROAD, SUITE B, BOX 187	OTTUMWA, IA 52501		(641) 683-1671
			Fax	(641) 683-1673
E				
ESTHERVILLE SAND&GRAVEL CO.	P.O. BOX 97	ESTHERVILLE, IA 51344-0097		(712) 362-3506
			T-F	1-800-379-7263

APPROVED PRODUCERS

WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP		PHONE/FAX NUMBER
F				
FALK, L.R. CONSTRUCTION CO.	227 W. 4th ST., P.O. BOX 189	ST. ANSGAR, IA 50472-0189		(641) 736-4569
FLEWELLING SAND & GRAVEL	1157 HWY. 140	MOVILLE, IA 51039		(712) 873-3174
FRED CARLSON COMPANY	P.O. BOX 48	DECORAH, IA 52101		(319) 382-4249
FT. CALHOUN STONE CO.	1255 SOUTH STREET, PO BOX 284	BLAIR, NE 68008		(402) 426-4254
				(402) 468-5666
			Fax	(402) 426-4306
FORT DODGE ASPHALT CO.	2516 7th AVE. SOUTH	FORT DODGE, IA 50501		(515) 573-3124
G				
GEHRKE QUARRIES, INC.	32215 290th ST.	GIFFORD, IA 50259		(641) 858-3821
			Fax	(641) 858-2564
GRAY QUARRY INC.	P.O. BOX 386	HAMILTON, IL 62341		(217) 847-2712
GREENE LIMESTONE CO.	1211 SOUTH MAIN ST.	CHARLES CITY, IA 50616		(641) 228-4256
			Shop	(641) 228-4061
H				
HAHN READY MIX	P.O. BOX 1107	MUSCATINE, IA 52761		(319) 263-6467
HALLETT MATERIALS CO.	5550 NE 22nd ST., BOX 3365	DES MOINES, IA 50316		(515) 266-9928
			Fax	(515) 266-9857
			WIA	1-800-838-2615
"HANK" STALP GRAVEL COMPANY	1598 RIVER ROAD	WEST POINT, NE 68788		(402) 372-5491
			T-F	1-800-372-5491
			Fax	(402) 372-5477
HECKETT-MULTISERV	C/O N.S.S., HWY 38 & GREENS RD.	WILTON, IA 52778		(319) 732-4010
			Fax	(319) 732-4011
HECKETT-MULTISERV WEST	P.O. BOX 474, C/O N.S.W.	STERLING, IL 61081		(815) 626-3316
			Fax	(815) 626-9306
HEARTLAND ASPHALT, INC.	2601 S. FEDERAL AVE.	MASON CITY, IA 50401		(641) 424-1733
HIGMAN SAND & GRAVEL INC.	16485 HWY 12, BOX 109	AKRON, IA 51001		(712) 568-2181
I				
IDEAL SAND CO.	P.O. BOX 416, 3902 MT PLEASANT ST.	W. BURLINGTON, IA 52655		(319) 754-4747
IRON MOUNTAIN TRAP ROCK CO.	P.O. BOX 9137	IRON MOUNTAIN, MO 63650-9137		(573) 734-6106
J				
J.W. READY MIX & CONST.	3111 270th ST.	SAC CITY, IA 50583		(712) 662-4239
K				
KERFORD LIMESTONE CO.	36110 FLETCHER ST.	WEEPING WATER, NE 68463		(402) 267-2415
			Fax	(402) 267-5240
KNOCKS BUILDING SUPPLIES	302 NORTH SIDE	PARKERSBURG, IA 50665		(319) 278-4868
KRUSE PAVING, INC.	P.O. BOX 899	LAKEFIELD, MN 56150		(507) 662-5205
			Fax	(507) 662-6725
KRUSE ROCK & GRAVEL	1401 T AVENUE, P.O. BOX 466	MILFORD, IA 51351		(712) 338-9084
			T-F	1-888-808-7625
			Fax	(712) 338-2031
KUHLMAN CONSTRUCTION CO.	325 MAIN, BOX 126	COLESBURG, IA 52035		(319) 856-3535
			T-F	1-800-772-1731
			Fax	(319) 856-5505
L				
LESSARD COTRACTING INC.	P.O. BOX 705	SERGEANT BLUFF, IA 51054		(712) 252-4131
L.G. EVERIST INC.	P.O. BOX 9	DELL RAPIDS, SD 57022		(605) 428-5419
			Fax	(605) 428-3012
L&M SAND & GRAVEL INC.	426 2nd AVENUE N.E.	LE MARS, IA 51031		(712) 546-5359
L&W QUARRIES INC.	P.O. BOX 335	CENTERVILLE, IA 52544		(641) 437-4830

APPROVED PRODUCERS

WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP		PHONE/FAX NUMBER
			Fax	(641) 437-4837
L				
LA HARV CONST. CO. INC.	P.O. BOX 267	FOREST CITY, IA 50436		(641) 581-3643
LINWOOD MINING&MINERALS CORP	4321 EAST 60th ST.	DAVENPORT, IA 52807-9744		(319) 359-8251
			T-F	1-800-798-8251
			Fax	(319) 359-8787
LYMAN-RICHEY SAND&GRAVEL CO.	4315 CUMING ST.	OMAHA, NE 68131		(402) 558-2727
M				
MALLARD SAND & GRAVEL	P.O. BOX 638,	VALLEY, NE 68064		(402) 359-5287
MANATTS INC.	P.O. BOX 535, 1755 OLD 6 ROAD	BROOKLYN, IA 52211		(641) 522-9206
			Fax	(641) 522-9407
			Fax	(641) 522-5594
MANATTS SAND & GRAVEL	1928 340th ST., BOX 87	TAMA, IA 52339		(641) 484-4022
MARENGO READY MIX INC.	P.O. BOX 121	MARENGO, IA 52301-0121		(319) 642-3811
MARTIN MARIETTA AGGREGATES	11252 AURORA AVENUE	DES MOINES, IA 50322		(515) 254-0030
			T-F	1-800-332-5433
			Fax	(515) 254-0035
MARTIN MARIETTA AGGREGATES	P.O. BOX 629	VALLEY, NE 68064		(402) 359-4088
MATX, INC.	110 CLUBRIDGE PLACE	COLORADO SPRINGS, CO 80906		
MOBERLY STONE CO.	P.O. BOX 582	MOBERLY, MO 65270		(660) 277-4419
			Fax	(660) 277-4790
MOLINE CONSUMERS CO.	1701 5th AVENUE	MOLINE, IL 61265		(309) 757-8250
			Fax	(309) 757-8257
MOLO SAND & GRAVEL CO.	123 SOUTHERN AVENUE	DUBUQUE, IA 52001		(319) 557-7540
MYRL & ROY'S PAVING INC.	1300 N. BAHNSON AVENUE	SIOUX FALLS, SD 57103		(605) 334-3204
			Fax	(605) 334-0468
N				
NEW ULM QUARTZITE QUARRY	ROUTE 5, BOX 21	NEW ULM, MN 56073		(507) 354-2925
			Fax	(507) 359-7870
NORTH IOWA SAND&GRAVEL INC.	18237 KILLDEER AVENUE	MASON CITY, IA 50401		(641) 424-5591
			Fax	(641) 423-1894
NORTHWEST MATERIALS	1648 LAINSON AVENUE	FORT DODGE, IA 50501		(515) 573-8921
NORTHWEST R/M CONCRETE, INC.	6340 180th ST.	OCHEYEDAN, IA 51354		(712) 758-3683
O				
ORTONVILLE STONE CO.	P.O. BOX 67	ORTONVILLE, MN 56278		(612) 839-6131
P				
PAUL NIEMANN CONST. CO.	24541 150th ST., BOX 128	SUMNER, IA 50674-0128		(319) 578-3261
			Fax	(319) 578-3263
PEDERSON BROTHERS	P.O. BOX 606	HARMONY, MN 55939-0606		(507) 498-3377
PELLA CONST. CO. LTD.	BOX 25	PELLA, IA 50219		(641) 628-3840
PERSINGER SAND & GRAVEL	3281 LUCAS AVE.	SMITHLAND, IA 51056		(712) 889-2258
PETERSON CONTRACTORS, INC.	104 BLACKHAWK P.O. BOX A	REINBECK, IA 50669		(319) 345-2713
PETTENGILL CONCRETE&GRAVEL,INC	800 N. BOONE	ROCK RAPIDS, IA 51246		(712) 472-2571
PRESTON READY MIX CORP.	P.O. BOX 399	PRESTON, IA 52069		(319) 689-3381
PRAIRIE SAND & GRAVEL	P.O. BOX 210	PRAIRIE DU CHIEN, WI 53821		(608) 326-6471
Q				
QUALITY CONCRETE CO.	327 17th AVENUE S.	CLINTON, IA 52732		(319) 242-3524
R				
RANDALL TRANSIT MIX CO.	1343 HWY 105, P.O. BOX 153	NORTHWOOD, IA 50459-0153		(641) 324-1063
RECYCLED AGGREGATE PROD. CO.	2131 18th ST.	SIOUX CITY, IA 51105		(712) 252-7732
REILLY CONSTRUCTION CO.	110 MAIN ST., BOX 99	OSSIAN, IA 52161		(319) 532-9211
			Fax	(319) 532-9759

APPROVED PRODUCERS

WITH QC PROGRAMS

PRODUCER	STREET ADDRESS	CITY, STATE, ZIP		PHONE/FAX NUMBER
R				
RIVER BEND ENTERPRISES	3000 ASHERTON AVE	NASHUA, IA 50658		(641) 435-2436
RIVER CITY STONE INC.	P.O. BOX 1430	DUBUQUE, IA 52001-1430		(608) 568-3433
			Fax	(608) 568-3472
RIVER PRODUCTS CO. INC.	103 E COLLEGE, SUITE 220	IOWA CITY, IA 52240-4086		(319) 338-1184
			Fax	(319) 338-8510
ROHLIN CONST. CO. INC.	P.O. BOX 137	ESTHERVILLE, IA 51344-0137		(712) 362-3549
ROVERUD CONST. CO. INC.	601 HWY. 44 EAST, BOX 606	SPRING GROVE, MN 55974		(507) 498-3376
				(507) 498-3377
			T-F	1-800-622-7625
			Fax	(507) 498-5835
RVBT-aka-ROCK VALLEY S & G	1315 17th AVENUE, BOX 9	ROCK VALLEY, IA 51247		(712) 476-2063
S				
S&A CONSTRUCTION LTD.	P.O.BOX 20	ALLENDALE, MO 64420		(660) 786-2233
S&G MATERIALS	4213 SAND ROAD SE	IOWA CITY, IA 52240		(319) 354-1667
SCHILDBERG CONSTRUCTION CO.	BOX 358	GREENFIELD, IA 50849		(641) 743-2131
SCHMILLEN CONSTRUCTION, INC	4772 C AVENUE	MARCUS, IA 51035-0488		(712) 376-2249
SIEH SAND&GRAVEL	101 W. 18th ST., BOX 1503	SPENCER, IA 51301		(712) 836-2244
				(712) 262-4580
SHELL ROCK PRODUCTS	22281 WALNUT AVENUE	SHELL ROCK, IA 50670		(319) 885-4302
SPENCER QUARRIES	25341 430TH AVENUE	SPENCER, SD 57374		(605) 246-2344
STONER SAND	RR2	RIDGEWAY, MO 64481		(660) 824-4211
T				
TIEFENTHALER AG-LIME INC.	P.O. BOX 157, 11975 HAWTHORNE AVE.	BREDA, IA 51436		(712) 673-2686
U				
ULLAND BROTHERS, INC.	2400 MYERS ROAD	ALBERT LEE, MN 56007		(507) 373-1960
				(507) 433-1819
W				
W. HODGEMAN & SONS INC.	1100 MARCUS ST., BOX 1100	FAIRMONT, MN 56031-1100		(507) 235-3321
WAYNE T. HANSEN CORP.	13 COUNTRY ESTATES	ALGONA, IA 50511		(515) 295-5573
WEBER STONE CO., INC.	12791 STONE CITY ROAD	ANAMOSA, IA 52205		(319) 462-3581
			Fax	(319) 462-3585
WELDEN AGGREGATES, INC.	P.O. BOX 832	IOWA FALLS, IA 50126		(641) 648-5142
			Fax	(641) 648-5142
WENDLING QUARRIES, INC.	P.O. BOX 120	DEWITT, IA 52742		(319) 659-9181
			Fax	(319) 659-3393
WEST DES MOINES SAND CO.	10500 SW 52nd ST.	DES MOINES, IA 50265		(515) 287-2340
WESTERN IOWA LIMESTONE	P.O. BOX 430	HARLAN, IA 51537		(712) 755-2563
			Fax	(712) 755-5344
WETHERELL EXCAVATING&TRUCKING	P.O. BOX 582	STORM LAKE, IA 50588		(712) 732-4059
				(712) 732-2839
WILTGEN CONSTRUCTION CO.	113 E. MAIN ST., BOX 303	CALMAR, IA 52132		(319) 562-3301
			T-F	1-800-365-3301
WINN CORP. SAND & GRAVEL	28825 290th ST.	OLLIE, IA 52576		(641) 667-3471
WRIGHT MATERIALS CO.	P.O. BOX 244, 1127 HWY 69	BELMOND, IA 50421		(641) 444-3920
Z				
ZUPKE SAND & GRAVEL	17963 150th ST.	RANDALIA, IA 52164		(319) 428-4444

NOTES

INSPECTION OF CONSTRUCTION PROJECT SAMPLING AND TESTING

PURPOSE

The purpose of this memorandum is to prescribe general objectives, policies, procedures, and guide schedules for sampling and testing materials and construction. Sampling and testing guides for certain types of construction are attached as appendices to this memorandum.

OBJECTIVES

The objectives of sampling and testing are:

A. To determine through process control, verification and/or acceptance sampling and testing whether the construction operations controlled by sampling and testing and materials used or proposed for use in the construction work are in reasonably close conformity with approved plans and specifications (including approved changes).

B. To provide checks or reliability of acceptance sampling and testing through independent assurance sampling and testing by personnel not normally responsible for process control or acceptance.

C. To provide opportunity for timely remedial action when results of sampling and testing indicate materials used or proposed for use and the construction work accomplished or in progress are not in reasonably close conformity with the approved plans and specifications (including approved changes).

PROCESS CONTROL, VERIFICATION, AND/OR ACCEPTANCE SAMPLING AND TESTING

Process control, verification, and/or acceptance sampling and testing are required to ascertain whether the quality of materials being incorporated into the construction and the quality of construction work in progress are in reasonably close conformity with the plans and specifications. Results of these tests constitute the principal means of determining daily if materials and construction are satisfactory, or whether corrective action should be taken before work proceeds further. They serve as the principal basis for determining the acceptability of completed construction.

Materials Inspection and Acceptance

In order to provide the contractor the opportunity to construct a project with minimal sampling and testing delays, inspection is performed at the source. 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. Supplemental monitor samples secured by project personnel of source-inspected, certified or project processed materials are also required for some materials in order to secure satisfactory evidence for acceptance.

Source Inspection

Materials with characteristics, which do not easily change, will normally be accepted at the time of incorporation into the work on the basis of compliant source inspection test reports or certifications. This also applies to materials in which the packaging or form of shipment ensures proper identification of the materials and the original material characteristics.

Supplemental sampling and testing of source inspected material are required for some materials which are subject to change during delivery. This also applies to some materials, which are difficult to identify with source inspection test reports. Except for unusual situations, the contractor may, on the contractor's responsibility and at the contractor's risk, incorporate these materials into the work before completion of the required supplemental tests. Acceptance of these materials will be based on source inspection tests and tests of the supplemental samples.

In the case of aggregate quality, production from an approved source is required. The source approval includes the Quality Control operation and processing procedures established, and the ledges suitable for the production of crushed stone for the various quality requirements. Random source inspection is performed to detect any significant change in characteristics of a source and any variations of the established Quality Control and on processing procedures. Random sampling and testing is performed to monitor the quality of aggregate being produced from each source. For certain major types of construction, supplemental construction site verification and assurance sampling and laboratory testing for quality are required in addition to the above Quality Control inspection and testing prior to acceptance. The contractor may, on the contractor's responsibility and at the contractor's risk, incorporate these aggregates into the work before completion of supplemental tests. Acceptance for quality will be based on source monitoring and the test results on verification, assurance and/or project samples. Source approval and monitor inspections and tests will be the basis for acceptance of other aggregates.

Certified aggregate gradation tests by a certified aggregate technician in accordance with the requirements of Materials I.M. 209 and 210, are required by paragraph 1106.01 of the Standard Specification.

Certified source aggregate gradation tests will be considered advisory when the aggregate acceptance is determined by sampling and testing on the project in accordance with the appended sampling and testing guides. The advisory tested group is called **proportioned aggregate**. Source gradation tests may be considered the basis of acceptance for all other aggregates. The gradation tests are called certified gradation tests and the aggregates represented are called certified aggregates.

Certification Procedures

In the case of many materials it is more economical, efficient, and practical to require certification procedures in lieu of source inspection. Certified test results are required for some materials and only a certificate of compliance is required for other materials. The acceptance of some proprietary materials is on an approved source or brand basis.

For many of the materials for which certification procedures are required, supplemental testing of samples secured by contractor process control personnel or project monitoring personnel and verification and/or assurance samples secured by District personnel are also required as part of the basis of 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 supplemental samples. When supplemental samples are not required, acceptance will be based on satisfactory certification.

The certificate of compliance shall be signed by an authorized representative of the company.

Small Quantities of Materials

When small quantities of construction materials are involved and the cost of sampling and testing would be excessive, or the performance of the material is not critical, visual inspection or compliance certificates may be the basis for acceptance.

Sampling & Testing Guides

The appended sampling & testing guides schedule indicates the minimum inspection, sampling and testing procedures required within the guide policy and procedures for the process control, acceptance, verification and assurance of materials and construction work. **NOTE:** There are two sets of sampling & testing guides - One in S.I. units (metric) and one in U.S. units (in./lb.).

PROJECT PLANT, FIELD LABORATORY AND GRADE INSPECTION AND ACCEPTANCE

The project inspectors and/or the contractor process control technicians shall identify and inspect all materials received on the project before the materials are incorporated into the work. They shall ascertain that proper inspection reports or certifications are on hand and there have been no unusual alterations in the characteristics of the materials due to handling or other causes. In the event they are unable to properly identify the materials delivered or that materials were not inspected before delivery, the District Materials Office shall be notified. Project plant, field laboratory, and grade control sampling and/or testing shall be performed by the contractor process control personnel or the contract authority personnel as outlined in the sampling and testing guides and all other applicable instructions. When certified plant inspection or sampling and testing are provided by the contractor, those tests shall be known as process control tests. The acceptance testing will be the responsibility of the contract authority. With documented and satisfactory correlation test results, a contractor's process control test results may be used as acceptance. Test results determined by the District or Central laboratories, which indicate specification noncompliance, will be promptly reported to the project engineer office by telephone or Fax.

When certified plant inspection is required, the contractor's process control test results for aggregate gradation shall be the basis of acceptance. This acceptance will be dependent on satisfactory correlation with the contract authority's test results, in accordance with I.M. 216. The minimum frequency, for acceptance testing, shall be in accordance with I.M. 204.

Acceptance sampling and testing shall be performed by personnel that are certified by the Iowa

Department of Transportation, Office of Materials. When contractor process control sampling and testing are used as part of the acceptance decision, the sampling and testing shall be performed in laboratories, and by personnel, that are qualified by the Iowa DOT Office of Materials. This will be accomplished by a certified technician training program, an independent assurance (IA) program, and by a satisfactory correlation program with regional and/or Central Materials laboratories.

A Non-compliance Notice (Form #830245) will be immediately delivered to the acting representative of the contractor for the area of construction involved whenever project or laboratory test results indicate noncompliance with the specifications and/or plans. Appropriate action in accordance with specifications and instructional memorandums shall be taken.

VERIFICATION AND ASSURANCE SAMPLING AND TESTING

Independent verification sampling and testing will be performed to validate the quality of a material (e.g. freeze-thaw durability, abrasion, specific gravity, etc.) or a product (e.g. AC content, voids, density, smoothness, etc.). Those verification tests will be performed on the individual materials and/or the products considered to be the most critical and are identified in the attached guides. Independent assurance inspection will be performed as a check on the reliability of a material and the process control and acceptance sampling and testing. It is the responsibility of the District Materials Engineer to provide the verification and assurance inspection as outlined herein and designated in the sampling and testing guides. Personnel assigned to either of these activities shall be certified by the Iowa Department of Transportation, Office of Materials and not have any direct responsibility for project process control or acceptance sampling and testing.

Assurance samples of materials are required in some cases for testing to secure supplemental data for acceptance of source inspected or certified materials. The majority of the assurance samples are for validating process control and acceptance sampling and testing.

Verification and assurance sampling and testing shall be performed using test equipment other than that assigned to the project. Occasionally, for expedient situations, the project test equipment may be used. When specified in the appendices or when small quantities of materials are involved, the assurance sampling and testing may be accomplished by observation of the acceptance sampling and testing performed by contract authority personnel. When similar material is being incorporated into the work and processed through the same plant for more than one project, one verification or one assurance sample may be taken to represent those projects. Test results on the sample are to be reported to all projects represented by the sample.

Assurance Sampling and Testing for Incidental Concrete, as described in I.M. 528, is not required.

Assurance samples of materials for which project personnel are performing acceptance sampling and testing will normally be taken at approximately the same time and location as the project acceptance samples. Verification samples will be taken at random and will not be part of a split sample.

Samples of other materials, which require laboratory testing, are to be taken in accordance with the sampling and testing guides and appropriate instructions.

A report of the assurance tests, and the companion project acceptance tests will be made by the individual performing the assurance tests. If there are any significant discrepancies between the test results, the report shall document the procedures used to evaluate and reconcile the differences and be signed by the District Materials Engineer. Generally, the report of the verification testing will be signed by the Central Laboratory Testing Engineer. The documentation to evaluate and reconcile any significant differences between process control and verification test results will be signed by the District Materials Engineer.

The frequency of assurance sampling should be increased when it appears that the average values of the test results are approaching either an upper or lower specification limit. If the test results on assurance samples, or verification samples, do not reflect the indicated quality of the material or if they are outside specification requirements, the District Materials Engineer should be consulted promptly concerning the cause, degree, and necessity for correction. Additional samples may be necessary to determine the cause of the deviations. Should there be any dispute over a discrepancy between contractor process control test results and verification or acceptance test results, the central office Materials Laboratory's test results will be considered as being the correct value.

The location, frequency, and responsibility for assurance and verification samples are designated in the attached sampling and testing guides.

It is not always possible to coordinate the assurance sampling from projects where small quantities of materials are incorporated in a short period of time. In such cases, assurance samples may be waived by the District Materials Engineer. However, assurance sampling is encouraged when possible. Quantities below which assurance samples are not required are shown in the appropriate appendixes.

The District Materials Engineer may opt to use a system basis for conducting the independent assurance responsibility. The frequency of sampling and testing will be based on quantity of production, a unit of time, or a combination of the two rather than a project basis. When a system basis is used, an annual report will be made to document the performance of the program.

SAMPLING AND TESTING GUIDE SCHEDULES

The following guides prescribe the minimum frequency for sampling and testing, the indicated inspection locations and the size for each sample type. The guide frequencies are considered to be the minimum required for proper project documentation under normal construction conditions and procedures. More frequent sampling may be required by special conditions such as low or intermittent production, or widely varying test results, and must be initiated at the discretion of and by contractor process control and project inspection personnel. Test results reported via computer terminal may not be identified by a report form number.

NOTE: Currently only asphaltic concrete projects follow the Quality Control/Quality Assurance (QC/QA) guidelines. The sampling and testing frequencies are described, in detail, in the specifications for these Quality Management-Asphalt (QM-A) projects and are not included in the attached guides.

<u>In order to maintain as much clarity as possible in the Guide Schedules, the changes from the last issue are not marked. The Schedules should be checked carefully for changes.</u>

I.M. 204 Appendixes

Appendix A	Roadway and Borrow Excavation and Embankments
Appendix B	Deleted
Appendix C	Modified Subbase
Appendix D	Granular Subbase
Appendix E	Portland Cement Conc. Pavement, Pavement Widening, Base Widening, Curb and Gutter & Class 1 Shoulders
Appendix F	Type A Asphaltic Concrete
Appendix G	Type B Asphalt Concrete, Type B Asphaltic Concrete Base Subbase and Base Widening
Appendix H	Structure Concrete, Reinforcement, Foundations & Substructures, Conc. Struct., Conc. Floors, & Conc. Box, Arch & Circular Culverts
Appendix I	Soil Aggregate Subbase
Appendix J	Deleted
Appendix K	Cold-In-Place Asphalt Cement Concrete Recycling
Appendix L	Granular Surfacing/Driveway Surfacing
Appendix M	Concrete Bridge Floor Repair & Overlay & Surfacing
Appendix P	Bituminous Seal Coat
Appendix Q	Deleted
Appendix R	Deleted
Appendix T	Base Repair 2212, Concrete Pavement Repair 2529 & 2530
Appendix U	Granular Shoulders
Appendix V	Subdrains

I.M. 204 SUPPLEMENTAL GUIDE
BASIS OF ACCEPTANCE

TEST REPORT

The Office of Materials has the responsibility to sample and/or inspect the material for compliance. They will issue a test report after the necessary testing and/or inspection. The inspector must have this report before the material is incorporated into the project. The report number and amount approved must be recorded in accordance with the Office of Construction documentation procedures.

CERTIFICATION OF COMPLIANCE

Material to be incorporated into the project must be tested and approved. Testing and approval may include test report, certification, or visual approval. 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 cement; 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, clay tile, and corrugated plastic subdrain; in the form of a guaranteed analysis as with seed labels. The inspector shall verify that the certification has been received by documenting it in the project materials book. Certifications shall be Type A, Type B, Type C, Type D or other type as required by the engineer for specific products. A copy of the test report or certification verifying compliance with the applicable specifications will accompany all materials supplied to a project by a jobber unless acceptance is by brand name or approved source. Examples of typical certifications are attached.

These types of certification shall be used by project personnel for acceptance and incorporation of materials into the projects. However, other types of certification from approved manufacturers or producers, as required by appropriate Instructional Memorandums, may also be furnished to the District Materials or Central Materials Offices to ensure compliance with Quality Control testing required for an approved source.

TYPE A

The manufacturer or producer shall prepare a Type A certification. It shall consist of a certified copy of a laboratory report, which lists results of specified tests and shall certify that the materials furnished comply with the specifications. The tests may be conducted in the laboratory of the manufacturer or in another qualified laboratory. Such tests shall have been conducted on samples obtained from the lot or lots of material identifiable in the shipment.

Examples:
Steel H-piles
Structural steel materials
Reinforcing steel
ASTM A36, anchor bolts
Seven-wire strand for prestressed concrete
Seeds

TYPE B

The manufacturer or producer shall prepare a Type B certification. It shall include the maximum and minimum results for the specified tests and shall certify that the lot of materials furnished complies with the specifications. The applicable specification shall be referred to in the certification. The tests may be conducted in the laboratory of the manufacturer or in another qualified laboratory.

Examples: Aluminum pipes and sheets
Aluminum grating

TYPE C

A Type C certification shall be prepared by the manufacturer or producer and shall certify that the materials furnished are in accordance with the specifications. The applicable specification or Materials I.M. shall be referred to in the certification.

Examples: Structural plate pipe
Latex emulsion
Packaged PC premix
Clay tile

TYPE D

A Type D certification shall be in the form of a letter or statement of compliance from the approved manufacturer. The letter or statement of compliance shall state that the materials furnished comply with the applicable specifications of Iowa Department of Transportation.

Examples: PE tubing
Cement
Fly Ash
Paint
CMP
Asphalt Cement
Aggregate
Plastic pipe (PVC, PE, ABS)

APPROVED BRAND

The material must be listed in the appropriate Office of Materials I.M. in order to be used on a project. The project inspector shall document information about this material such as product name, source, date, producer, lot number, in the project materials book.

Certification of compliance is not needed when material is accepted by approved brand.

APPROVED SHOP DRAWING & APPROVED CATALOG CUT

This information must be submitted to, and reviewed by the Iowa DOT Central Design Offices before the material can be incorporated in the project.

TEST REPORT BY AN APPROVED INSPECTION AGENCY

All treated and untreated timber products, including posts, piling, and lumber, must be tested by an approved inspection agency. A certified report will show the results of the tests. If the supplier is furnishing material from stored stock, a certification statement shall be included with each shipment stating that the material has been inspected by an approved agency.

AS PER PLAN & ENGINEER, VISUAL APPROVAL BY PROJECT ENGINEER, APPROVED BY RCE, & MANUFACTURER RECOMMENDATIONS

The inspector must document information about this material such as product name, source, producer, lot number, date produced in the project materials book. The inspector shall 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 generally complies with the specifications. Visual approval is appropriate for non-critical items such as mulch or sod stakes, where general compliance can be readily determined by visual means. If there are questions on specification compliance, samples will be taken for testing.

APPROVED SOURCE

Material furnished must be from a manufacturer or distributor listed in the appropriate I.M. to be used on a project. The project inspector shall document pertinent information such as product name, source, date of production, distributor, etc, in the project materials book.

LOT ACCEPTANCE

Material furnished on a lot accepted basis must be from an approved brand and lot on a list maintained and provided by Central Materials. Materials on the list have been sampled, tested, and determined to comply with applicable specifications and I.M.'s. If a product from a lot is not listed, it must be sampled and tested prior to incorporation in the project. If the sample complies with specifications, it will be added to the list of accepted lots and may be used on the project.

FABRICATION REPORT

The project inspector must have a copy of the final fabrication report prior to incorporating the component into the project. Contents of the report will vary depending on the requirements of the appropriate Materials I.M. for the component being fabrication. Final acceptance is by construction personnel at the project site, and is based on proper documentation and the condition of the component.

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Abrasives for Blast Cleaning	482.03			Approved Brand	
Admixture - Air Entraining	403	4103	0.5 L/Lot	Approved Brand/Lot Accept	
Admixture - Latex Emulsion		2413.02b		Certification	C
Admixture - Retarder	403		0.5 L/Lot	Approved Brand/Lot Accept	
Admixture - Water Reducer	403		0.5 L/Lot	Approved Brand/Lot Accept	
Aggregates - General	209 409 T-203 T-204	4110 to 4133		Approved Source	
Aggregates - Gradation	301 to 306, 209	4109	I.M. 301	Certification	D
Aluminum, Structural		4190.01		Approved Shop Drawing and Fabrication Report	
Anchor Bolts			1 Bolt, Nut & Washer	Approved Shop Drawing & Test Report (Steel Mill Certifications)	A
Anchors, Concrete	453.09			Approved Brand	
Anti-Strip Agent	491.16			Approved Brand	
Arrow Panels, Solar Assisted	486.12	2528.06		Approved Brand	
Asphalt Cement	437	4137	1 L	Approved Source/Cert./Test Report	D
Asphalt, Cutback	437	4138	1 L	Approved Source/Cert./Test Report	D
Asphalt, Emulsified	437	4140	1 L	Approved Source/Cert./Test Report	D
Asphalt, Polymer Modified	437		1 L	Test Report (Approved Batch)	
Backer Rod for Cold Pour Joint Seal	436.04	4136.02c		Approved Brand	
Backer Rod for Hot Pour Joint Seal	436.04	4136.02c		Approved Brand	
Barrier Rail, Precast Concrete	571			Source Approval/DOT Stamp/Fabrication Report	
Beads, Glass		4184	1 L/Lot	Cert./ Lot Accept	D
Bearing, Bronze		4190.03	1/Project	Test Report	
Bearing, Lead		4195.01		Certification	D
Bearing, Neoprene	495.03	4195.02	1 Pad	Source Approval/Fab Report	A

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Bolts, Nuts & Washers, Structural	453.06b	4153.06	Per I.M.	Test Report by Central Lab	
Calcium Chloride Solution	373	4194.01	2 kg or 1 L	Test By RCE	
Caulking Compound		4192		As per Plan & Engineer	
Concrete & Special Sections	445	4145 4149.02b		Certification	D
Concrete, Pre-Stressed, Precast Units	570	2407		Iowa DOT Stamp/Fabrication Report	
Concrete Sealer	491.12a 491.12b	4139		Approved Brand	
Conduit - See Lighting Material					
Curing Materials - Burlap		4104		Test Report When New	
Curing Materials - Clear	405.07	4105.07		Approved Brand	
Curing Materials - Dark Colored		4105.06	1 L/Lot	Test Report	
Curing Materials - Plastic Film		4106.02		Visual approval	
Curing Materials - White Pigmented		4105.05	1 L/Lot	Approved brand/lot accept	
Delineators - See Signing Materials.					
Dowel - See Steel Reinforcement.					
Drains, Floor		2406.05		Approved Shop Drawing and Fabrication Report	
Drums, Channelizing	488.02	4188.02		Approved Brand	
Epoxy-Coated Steel - See Steel Reinforcement.					
Epoxy Injection Resin	491.19a 491.19b			Approved Brand	
Erosion Control, Fertilizer	469.03	4169.03	2 kg or 1 L	Approved Source	
Erosion Control, Fungicide		4169.05		Seed Manufacturing Recommendation	
Erosion Control, Inoculant		4169.04		Seed Manufact. recommendation	
Erosion Control, Jute Mesh		4169.10a	Visual	Visual Approval by Project Engineer	
Erosion Control, Mulch		4169.07	Visual	Visual Approval by Project Engineer	
Erosion Control, Silt Fence Fabric	496.01	4196.01		Approved Brand	
Erosion Control, Silt Fence Wire and		Std. Road		Visual Approval by Project	

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Posts		Plan RC-16 Series	Visual	Engineer	
Erosion Control, Sod		4169.07	Visual	Visual Approval by Project Engineer	
Erosion Control, Sod Stakes		4169.09	Visual	Visual Approval by Project Engineer	
Erosion Control, Sticking Agent		4169.06		Seed Manufacturing Recommendation	
Erosion Control, Wire Staples		4169.10b	Visual	Visual Approval by Project Engineer	
Erosion Control, Wood Excelsior Mat	469.10	4169.10c		Approved Brand	
Expansion Device, Steel		4152.02	Visual	Approved Shop Drawing and Fabrication Report	
Expansion Tube		4191.01b		Visual Approval by Project Engineer	
Fabric, Engineering	496.01	4196.01		Approved Brand	
Fasteners, Aluminum	486	4190.02		Fabrication Report	
Fence, Barbed Wire		4154.04	Visual	Visual Approval By Project Engineer	
Fence, Brace for Field Fence		4154.08	Visual	Visual Approval By Project Engineer	
Fence, Brace, Tie and Tension Wire		4154.05	Visual	Visual Approval By Project Engineer	
Fence, Chain Link Fabric	454.1	4154.03	1 m	Test Report	
Fence, Chain Link Fittings		4154.11	Visual	Visual Approval By Project Engineer	
Fence, Chain Link Posts, Braces, and Rails	454.10a 454.10b 454.10c	4154.10	150 mm	Test Report	
Fence, Field Fence Fabric		4154.02	Visual	Visual Approval By Project Engineer	
Fence, Gate		4154.12	Visual	Visual Approval By Project Engineer	
Fence, Miscellaneous Hardware			Visual	Visual Approval By Project Engineer	
Fence, Orange Mesh Safety	488.03	4188.03		Approved Brand	
Fence, Silt - See Erosion Control					
Fence, Staples		4154.06	Visual	Visual Approval By Project Engineer	

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Fence, Steel Line Posts		4154.09	1 Post	Test Report	
Fence, Wood Fence Post	462	4154.07		Special Test by Approved Inspection Agency or Certification	D
Fertilizer - See Erosion Control					
Fly Ash	491.17	4108		Certification	D
Galvanized Items		4100.07		Test Report by District Materials	
Grating (Aluminum)		4187.01a5		Approved Shop Drawing and Fab Report	
Grout, Hydraulic Cement	491.13a 491.13b			Approved Brand	
Grout, Polymer	491.11a 491.11b 491.11c			Approved Brand	
Guardrail, Attenuators				As per Plan	
Guardrail, Box-beam Median Barrier		4155.06		Approved Shop Drawing and Fabrication Report	
Guardrail, Cable		4155.03	2 m	Test Report by Central Lab	
Guardrail, Formed Steel Beam	455.02	4155.02		Approved Brand	
Guardrail, Steel Posts		4155.05		Mill Test Report	A
Guardrail, Wood Posts	462	4155.04		Test Report by Approved Inspection Agency or Cert	D
Iron Castings, Manhole Covers, etc		4153.04		Approved Shop Drawing & Test Report by District Materials	
Bridge Rockers		4153.04		Approved Shop Drawing & Fabrication Report	
Joint Filler, Flexible Foam - Type CF and EF Joints	436.05a 436.05b	4136.03b 4136.03d		Approved Brand	
Joint Filler, Type E Joint	436.03	4136.03a		Approved Brand	
Joint Filler, Bituminous Type	436.03	4136.03a		Approved Brand	
Joint Sealer for Concrete Sewer Pipes	491.09	4149.08		Approved Brand	
Joint Sealer, Elastomeric Neoprene)	436.02	4136.0		Approved Brand	
Joint Sealer, Poured	436.01	4136.02a	5 kg/Lot	Cert./Test Report/Approved Lot	D

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Keyway		4191.01a		Visual by PE	
Lighting Material, Aluminum Poles		4185.02d		Approved Shop Drawing and Fabrication Report	
Lighting Material, Circuit Test		2523.21		Test Report (Contractor)	
Lighting Material, Connectors		4185.11		Approved Catalog Cut	
Lighting Material, Contractors		4185.05		Approved Catalog Cut	
Lighting Material, Control Cabinet		4185.07		Approved Shop Drawing and Catalog Cut	
Lighting Material, Conduit and Fittings		4185.10	1 m-Steel 2 m-Plastic	Test Report	
Lighting Material, Ground Rods and Clamps		4185.04	1 piece	Test Report	
Lighting Material, Handholes	445	4185.08		Certification	D
Lighting Material, Junction Boxes		4185.09		Approved Catalog Cut	
Lighting Material, Lighting Tower		2522.04		Approved Shop Drawing and Fabrication Report	
Lighting Material, Lowering Device		2522.06		Approved Shop Drawing and Fabrication Report	
Lighting Material, Luminaries		4185.03		Approved Catalog Cut	
Lighting Material, Photoelectric Control		4185.06		Approved Catalog Cut	
Lighting Material, Sealant for Traffic Loop Detectors	491.18			Approved Brand	
Lighting Material, Steel Poles		4185.02d		Approved Shop Drawing and Fabrication Report	
Lighting Material, Underground Warning Tape		2523.13		Visual/approval	
Lighting Material, Wire and Cable		4185.12	1 m	Test Report and Approved Catalog Cut	
Lighting Material, Wood Poles	462	4185.02f		Test Report by Approved Inspection Agency or Certification	D
Lighting Materials, Fasteners for Poles		4185.02a	1 Each Type	Test Report and Approved Shop Drawing	

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Lighting Materials, Mastarms		4185.02b		Approved Shop Drawing and Fabrication Report	
Lighting Materials, Slip Base		4185.02		Approved Shop Drawing and Fabrication Report	
Lighting Materials, Transformer Base		4185.02c		Approved Shop Drawing and Fabrication Report	
Markers (reflective) for Guard Rail and Concrete Barrier Rail	486.08	4186.08		Approved Brand	
Markers, Raised Pavement	483.07	2527.02e		Approved Brand	
Mastarms - See Lighting Materials					
Paint, Epoxy Aluminum	482.04			Approved Brand	
Paint, Traffic - VOC Compliant Solvent Borne	483.03	4183.03		Approved Brand/Lot Number in Field Book	
Paint, Traffic - Waterborne	483.03	4183.04		Approved Brand/Lot Number in Field Book	
Paint, Waterborne Acrylic Finish (Bridge Paint)	482.03	4182.03		Approved Source/Cert.	
Paint, Zinc-Rich Epoxy	482.02	4182.02		Approved Brand	
Paint, Zinc-silicate Solvent Borne	482.02	4182.02		Approved Brand	
Paint, Zinc-Silicate Waterborne	482.02	4182.02		Approved Brand	
Patch Material, Rapid-Set Concrete	491.20			Approved Brand	
Piling, Concrete		4166		DOT Stamp/Fabrication Report	
Piling, Steel	467	4167	2'	Mill Certification/District Materials Monitor	A
Pipe, ABS Sewer/PVC	443 446	4146.04 4146.05		Approved Source/Certification	D
Pipe, Clay Sewer		4149.02a	2 Each	Test Report	
Pipe, Concrete	445	4145		Certification	D
Pipe, Corrugated Aluminum		4142	0.3 m	Test Report	
Pipe, Corrugated Polyethylene 3-10 in.	443	4146.02 4143.02	3 pieces 1.5 m each	Approved Source/ Certification/Test Report	D
Pipe, Corrugated Polyethylene 12-36 in.	446	4146.02		Approved Source/Certification	D

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Pipe, Corrugated Steel	441	4141		Certification	D
Pipe, Ductile Iron Sewer		4149.02c		Certification	A
Pipe, Polyethylene Sewer	443 446	4146.03		Approved Source/Certification	D
Pipe, Rodent Guard for PE pipe	443.01A	4143.01B		Approved Brand	
Pipe, Rodent Guard for CMP Pipe	443.01B	4143.01B		Approved Brand	
Plant Material, Fertilizer	469.03	4170.09b	2 kg or 1 L	Approved Source	
Plant Material, Mulch	470	4170.09d	Visual	Field Review Report	
Plant Material, Plants	470	4170.01 - 4170.08		Field Review Report	
Portland Cement Concrete Premix Pack	447			Approved Source/Certification	C
Portland Cement Type II	401	4101		Certification	D
Portland Cement Type III	401	4101		Certification	D
Railing, Bridge				Approved Shop Drawing and Fabrication Report	
Reflective Sheeting - See Signing Material.					
Release Agent	491.15			Approved Brand	
Sealant, Traffic Loop - See Lighting Material.					
Seed		4169.02		Certification	A
Signing Material, Delineator Posts		4186.10c	1 Each	Test Report	
Signing Material, Delineators	486.07	4186.07		Approved Brand	
Signing Material, Finished Sign	486	4186		Fabrication Report/ Approved Source/Certification	D
Signing Material, Fasteners		4186.06		Fabrication Report	
Signing Material, Reflective Sheeting	486.03	4186.03		Approved Brand	
Signing Material, Sign Panels		4186.02		Approved Shop Drawing and Fabrication Report	
Signing Material, Sign Support Structures		4187		Approved Shop Drawing and Fabrication Report	

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Signing Material, Steel Posts		4186.10		Approved Shop Drawing and Fabrication Report	
Signing Material, Wood Posts	462	4186.10		Test Report by Inspection Agency or Certification	D
Signing Materials, Galvanized Items		4100.07		Test Report by District Matls.	
Sod - See Erosion Control					
Steel Castings		4153.03		Approved Shop Drawing & Fabrication Report	
Steel Masonry Plates		4152.02		Mill Certification	A
Steel Pile, Welded		4153.05		Approved Shop Drawing & Fabrication Report	
Steel, Pins/Rollers, Cold Finished		4153.02		Approved Shop Drawing & Fabrication Report	
Steel, Pins/Rollers, Forged		4153.01		Approved Shop Drawing & Fabrication Report	
Steel Reinforcement, Basket Assemblies	451	4151.02		Approved Source/Certification	D
Steel Reinforcement, Epoxy-Coated	451.03B	4151.03b	1.5 m of Largest Size in Each Shipment	Mill Certifications & Epoxy Certification/Test Report	A
Steel Reinforcement, Epoxy-Coated Tie Bars	451.03B	4151.02a		Certification	D
Steel Reinforcement, Epoxy-Coated Dowels	451.03b	4151.02		Certification	D
Steel Reinforcement, Galvanized	451	4151.03A	1 m	Mill Certifications & Test Report for Galvanizing	A
Steel Reinforcement, Uncoated	451	4151		Mill Certification	A
Steel Reinforcement, Wire Mesh	451	4151.04	1 m X 1 m	Test Report or Certification	A
Steel Mechanical Splicers for Reinforcement	451			Approved Brand	
Steel, Structural	561 to 565	2408 4152		Appr. Shop Drawing/Fabrication Report/Mill Certifications	A
Step Irons for Utility Access		4149.06		Fabrication Report	
Structural Items, Other				Approved Shop Drawing and Fabrication Report	

Material	I.M.	Spec.	Sample Size	Basis of Acceptance	Cert. Type
Structural Plate (Arches)	444	4144		Certification	C
Studs, Shear	453.10			Approved Source/Cert.	A
Subdrain, Concrete Drain Tile	448	4148	6 Tile	Certification	C
Subdrain, Corrugated Metal Pipe Outlet	441	4141		Approved Source/Cert	D
Subdrain, Corrugated Polyethylene	443	4143.01b		Source Approval/Certification/ Test Report	D
Subdrain, Horizontal		4143.01a	2 m	Test Report	
Surface Finish, Special	491.10	2403.21c		Approved Brand	
Tape, Pavement Marking	483.06	2527.02a		Approved Brand	
Torque Calibration Machine (skidmore)		2408.38c	Calibrate Every 6 Months	Test Report	
Torque Wrench		2408.38c	Calibrate Every 6 Months	Test Report	
Water		4102	1 L/Source	Test Report or City Water Supply	
Wire and Cable - See Lighting Material.					
Wood, Hardware for Timber Structure		4153.07	1 Each Type	Test Report	
Wood, Timber Piles	462	4165		Test Report by Approved Inspection Agency or Certification	D
Wood, Treated Posts	462	4164		Test Report by Approved Inspection Agency or Certification	D
Wood, Treated Timber and Lumber	462	4162		Test Report by Approved Inspection Agency or Certification	D
Wood, Untreated Timber and Lumber	462	4162		Test Report by Approved Inspection Agency or Certification	D

GUIDE FOR THE ACCEPTANCE OF SMALL QUANTITIES OF MATERIALS

Material	Maximum Quantity	Specifications	Alternate Acceptance Method
Beads, Glass	0.5 km application	4184	Visual
Dowel Baskets, Epoxy-Coated	25		Visual & Field Check
Fly Ash	5 metric ton		Approved Source & Type
Hardware for Timber	50 kg	4153.07	Visual
Joint Filler, Preformed	15 m	4136.03	Visual & Dimension
Lighting Material - Conduit & Fittings	30 m	4185.10	Visual & Brand Name
Paint, Bridge	20 L	4182	Visual & Brand Name
Pipe, Welded Steel	30 m	4153.05	Letter of Compliance

(USS) ...ION OF USX CORPORATION
01.000.0772 (REV. 4/87)

Metallurgical
Test Report

CO. JOB. CONTRACT NO.	P.O. DATE	PURCHASE ORDER NO.		
	11/05/90	640350		
	SHIPPERS NO.		MILL ORDER NO.	INVOICE NO.
	B89864	01 04 91	UM12235	187-097245
	VEHICLE IDENTITY 1658	IA		60296

VENDOR: SOUTH WORKS
CHICAGO, ILL. 60617

SOLD TO: SKYLINE STEEL CORP
17 W 705-C BUTTERFIELD RD
OAK BROOK IL 60181

SHIP TO: SKYLINE STEEL CORP
17 W 705-C BUTTERFIELD RD
OAK BROOK IL 60181

EXAMPLE: TYPE "A" CERT

BEING DULY SWORN ACCORDING T LAW, DEPOSES AND SAYS PRODU DESCRIBED HEREIN WAS MFGD. SAMPLED, TESTED AND/OR INSP IN ACCORDANCE WITH THE SPECIFICATION AND FULFILLS REQUIREMENTS IN SUCH RESPECTS

PREPARED BY THE OFFICE OF:
J. J. HARRINGTON G A MG

BY: ____________________

DATE

SPEC. & INSP. H-PILES CARBON ASTM A36-87

BRF-13-2 (23)--38-26
Delaware County
Contract No 32280
Guetzko Construction, Ltd

INSP 01 MILL SWORN T/R

STATE OF INDIANA
COUNTY OF LAKE
SUBSCRIBED AND SWORN TO BEFORE ME
THIS 04TH DAY OF JANUARY A. D. 19
NOTARY PUBLIC
MY COMMISSION EXPIRES Feb 15, 1993

ITEM NO.	THICKNESS OR SECTION	WIDTH, DIA. OR FT. WT.	LENGTH	QUANTITY	WEIGHT	HEAT NO.	TEST OR PIECE IDENTITY	YIELD PT. KSI	TENSILE STR KSI	ELONGATION % IN 8"	ELONGATION % IN 2"	% RED. OF AREA	BEN
05	.4150	HP10X042	42'	07	12348	1R7508	294	49.7 49.3	72.0 72.5	21.0 27.0	40.0 48.0		
05	.4150	HP10X042	42'	06	10584	1R7509	252	53.5 51.5	71.5 73.0	27.0 26.0	48.0 48.0		
06	.4150	HP10X042	48'	08	16128	2R0055	384 930 L.F.	61.5 50.0	74.5 69.5	25.0 27.0	46.0 48.0		

"USS, A DIVISION OF USX, HEREBY CERTIFIES THAT ALL MANUFACTURING PROCESSES, INCLUDING MELTING, INVOLVED IN THE PRODUCTION OF USS STEEL MILL PRODUCTS OCCUR ENTIRELY IN THE UNITED STATES."
END OF DATA

OK
2/6/91
BB

HEAT NO.	TYPE	C	MN	P	S	SI	CU	NI	CR	MO	SN	AL	N	V	B	TI	CB	CR
1R7508	HEAT	21	078	009	030	035												
1R7509	HEAT	22	075	009	031	040												
2R0055	HEAT	18	057	008	028	039												

END OF DATA

CERTIFIED INSPECTION REPORT

ALCOA ALUMINUM COMPANY OF AMERICA PITTSBURGH, PA.
SHIPPED FROM: DAVENPORT, IOWA

CUSTOMER P.O. NO./GOVT. CONTRACT NO.
07-88937

PAGE 003

INVOICE TO
A. M. CASTLE AND COMPANY
P. O. BOX 419809
KANSAS CITY, MO 64141

SHIP TO
A M CASTLE AND COMPANY
6100 STILWELL
KANSAS CITY, MO 64120

24-095

We hereby certify that the material covered by this report has been inspected in accordance with, and has been found to meet, the applicable requirements described herein, including any specifications forming a part of the description and that samples representative of the material met the composition limits and had the mechanical properties shown on the face of this sheet. Per

QUALITY ASSURANCE MANAGER

INVOICE NO.	INVOICE DATE	CODE
22544982	91/01/29	120 170302

ALCOA NO.	SHIP DATE	VIA
US 52849	91/01/29	MASON DIXON

PRODUCT DESCRIPTION	B/L NO.	GROSS WEIGHT
PLATE	76702	4140
	ALLOY-TEMPER: 6061 T651	

ITEM DESCRIPTION	QUANTITY SHIPPED PCS., FT., ETC.	POUNDS	NO. OF TESTS & DIR		TEST	TEST	TEST
					UTS1	TYS1	EL4D
& EXCEPT MARKING ASME-SB-209 REV	LOT-397996	T651	3 L.T	MAX	44.6	39.6	14.0
83 ((MARKED)) INTERLEAVED	2PC			MIN	44.4	39.2	14.0
SKID WGT: 4500 LB							
QUAN TOL +/-10 %	LOT-397982	T651	3 L.T	MAX	47.4	42.4	15.0
COR D124403 REV 09 ORR 000881	4PC			MIN	47.2	42.2	13.0
PACKAGE LOT NO							
440159 398027							
440159 398024							
444406 397996							
444406 397982							
ITEM 4		8400					
1.5000 IN TK X 48.500 IN W X 144.500 IN LN CAT D 124410 (N)	LOT-230747	T651	3 L.T	MAX	47.0	42.5	15.0
A/T 6061-T651 TYPE 200 WROUGHT	3PC			MIN	46.4	42.1	12.0
TOOLING PLATE MILL FINISH, SAWED							
IAC 8631 PER QQ-A-250/11 REV F	LOT-230744	T651	3 L.T	MAX	45.7	40.7	17.5
& EXCEPT MARKING AMS4027 REV K	1PC			MIN	44.8	40.1	13.5
& EXCEPT MARKING ASTMB209 REV 89							
& EXCEPT MARKING ASME-SB-209 REV	LOT-230741	T651	3 L.T	MAX	47.7	43.3	14.5
83 ((MARKED)) INTERLEAVED	3PC			MIN	46.8	42.5	13.5
SKID WGT: 4500 LB							

EXAMPLE: TYPE "B" CERT.

CASTLE METALS-KC
DATE REC'D 1-31-91
REC'D FROM
APPROVED BY

Chemical Composition	SI	FE	CU	MN	MG	CR	ZN	TI	OTHER EACH	OTHER TOTAL	ALUMINUM
Alloy 6061 Max.	0.8	0.7	0.40	0.15	1.2	0.35	0.25	0.15	0.05	0.15	REMAINDER
Min.	0.40		0.15		0.8	0.04					

Chemical Composition
Max.
Min.

WHERE ... TESTS PER LOT ARE MADE, THE HIGHEST AND LOWEST VALUES ARE REPORTED FOR ... DEVIATION EXPLANATION ON THE BACK OF THIS SHEET. ... DETERMINED.

CONTECH
CONSTRUCTION PRODUCTS INC

SHIP TO: PETIT CONSTRUCTION CO.
BOX 428
BATTLE CREEK, IA 51006

DATE: 4/19/91
PROJECT: IDA COUNTY L-90T (1)
CONTRACTOR:

CERTIFICATE OF COMPLIANCE

The material covered by this certification was manufactured to comply in full with the specifications of AASHTO M-167.

Based on mill test results, it is certified that the listed materials have been tested and that the test results conform to the requirements of this specification.

SHIPMENT IDENTIFICATION: ORDER NUMBER: 17-9160

SALES NUMBER: 26-0770-00

ITEM NO.	QUANTITY	MATERIAL DESCRIPTION
001	1 PIPE	GALVANIZED MULTI-PLATE ROUND PIPE: 10 ga., 102 Pi, 96'0" MANUFACTURED FROM THE FOLLOWING HEAT NUMBERS: 101A91A 149P90A 475A90A 2A91A 108A91A EXAMPLE: TYPE "C" CERT AVERAGE WEIGHT OF COATING: 3 OZ. MIN.

PREPARED BY: Judy A. Yost
WINCHESTER PLANT

Davenport Cement Company

STRAIGHT BILL OF LADING - SHORT FORM

RECEIVED, subject to the classifications and tariffs in effect on the date of issue of this Bill of Lading,

HEADQUARTERS ADDRESS:
220 EMERSON PLACE, SUITE 300, DAVENPORT, IOWA 52801 - 319/323-2751

This short form is issued in lieu of the Uniform Bill of Lading and is subject to its terms and Conditions:

CAUTION:
MAY CAUSE EYE OR SKIN INJURY
SEE NOTICE ON REVERSE SIDE

R E P R I N T Wed Apr 24 09:40:33 1991

AT: ATt West DesMoines Terminal

CUSTOMER NO.	CONTRACT/P.O. NUMBER	TERR. NO./SALESMAN	SHIPPING DATE	BILL OF LADING NO.
2075-1392			4/24/91	[illegible]
				FREIGHT

SHIP TO
FRED CARLSON CO./WILLIAMS
RP-520-4(26)--16-40
JCT R-77 & 520 NEAR
WILLIAMS / HAMILTON CO. IA

SOLD TO
FRED CARLSON CO
PO Box 40
Decorah IA 52101

COUNTY

TEST/SILO # 46

CARRIER
CARRIER NO.
RUAN TRANSPORT CORP.
255 Truck: 56255

PROJECT
110 PORTLAND TYPE I

Gross Weight [illegible]
Tare Weight [illegible]
Net Weight [illegible]
26.07

[illegible]

SIGNED
TRAILER NO.

TRANS NO. 11303
DRIVER: NITTAC

EXAMPLE:
TYPE "D" CERT.

[illegible]

Signed
CONSIGNEE'S SIGNATURE

EXTRA COPY

COPY

MARTIN MARIETTA
AGGREGATES COMPANY

4626448

SOLD TO:
MANATTS INC
SN-3478(2)--51-08
BOONE COUNTY

SOLD FROM:
121
AMES MINE
RR2, AMES, IOWA
(515)232-3363

DATE: 06/28/91 TIME: 03:08 PM TRK. NO. MA63P HAULER NO. 0174 TICKET NO.: 4626448

PROD NO. 0816 DESCRIPTION: 1/2 TYPE A CUST NO. 524504 P.O. NO. SCN. 527

TONS GROSS: 39.64
TONS TARE: 16.41
TONS NET: 23.23

CASH SALE		
MATERIAL	$	PER TON
TAX	$	
HAUL	$	PER TON
TOTAL	$	PAYMENT REC. BY.

LOADS TODAY: 82
QUANTITY TODAY: 1755.98
QUANTITY TO DATE: 3448.96

WEIGHPERSON: SHORT D

STATE SECRETARY OF AGRICULTURE CERTIFIED. EFFECTIVE $CaCO_3$ EQUIVALENT PER TON OF AGLIME. ________ LBS

GH
DRIVER

CUSTOMER

CERTIFICATION BELOW VALIDONLY WITH AUTHORIZED SIGNATURE. THIS IS TO CERTIFY THAT THE MATERIAL HEREIN DESCRIBED MEETS THE APP. CONTRACT SPECIFICATIONS & REQUIREMENTS

EXAMPLE:
TYPE "D" CERT

CARRIER MUST SHOW THIS NUMBER ON FREIGHT BILLS

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading

FROM

CONTECH
CONSTRUCTION PRODUCTS INC.

CONSTRUCTION PRODUCTS INC.

AT: DES MOINES PLANT

PAGE 1 B/L STOP 01

72-4594 FIN

ORDER NUMBERS

PLANT: 72-0030-0

SALES 26-3876-0

BUYER:

DATE 07/13/91 L3H-0770

CARRIER/ROUTE VAN WYK TRUCKING

CAR/VEHICLE NO

DEST. CODE

CONSIGNED TO: (MAIL OR STREET ADDRESS OF CONSIGNEE - FOR PURPOSES OF NOTIFICATION ONLY)

HOLLAND CONST. CO.

EXAMPLE: TYPE "D" CERT.

IF CHARGES ARE TO BE PREPAID WRITE OR STAMP HERE, "PPD"

ORGN, FRGT PREPAID

TO EXPEDITE PAYMENT, MAIL A COPY OF THIS BILL OF LADING WITH FREIGHT BILL. FREIGHT BILLS RECEIVED WITHOUT THIS COPY WILL BE RETURNED. MAIL TO COMPUTREX, INC., P.O. BOX 13020, LEXINGTON, KY. 40583.

001	1	H/C PIPE 2 2/3x1/2 GALV WS 16GA 24" 8.00FT ROLL ONE END	129
002	1	H/C PIPE 2 2/3x1/2 GALV WS 16GA 24" 14.00FT	226
003	2	CSP BAND 10"HUGGER GALV 16GA 24" 1PC W/BAR BOLT & STRAP.	39
004	1	H/C PIPE 2 2/3x1/2 GALV WS 16GA 18" 20.00FT	243
005	1	CSP BAND 10"HUGGER GALV 16GA 18" 1PC W/BAR BOLT & STRAP.	16
006	6	BAND ACC FASTENER STEEL BOLT 1/2"x6"	3
007	6	BAND ACC FASTENER STEEL NUT	

1. STATE CERTIFIED ...
PROJ # ...
2. STA ...
3. BRING BACK 1 - ...
1 - 14' & 1 - ...

H/M This is to certify that the named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

The material covered by this fabricator's certification statement are manufactured in compliance with the Iowa Department of Transportation's specifications based upon mill certificates and quality control tests. It is certified that representative samples of the listed material have been tested and that the test results conform to the requirements of those specifications. Material description and project identification are as shown.

Authorized Signature

Date 7-15-91

Item # 1-7

637 LBS

PER

CONTECH CONSTRUCTION PRODUCTS INC. SHIPPER

Per

Permanent post-office address of shipper:

Agent

Per

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix A (U.S.) Units

ROADWAY AND BORROW EXCAVATION AND EMBANKMENTS
Section 2102 and 2107

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Special Backfill														
Crushed Stone (4132.02)		AS 209												
Crushed Concrete (4132.02)		209												
RAP(2303.02)														
Gravel (4132.03)		AS 209												
Granular Backfill		AS 209												
Engineering Fabric (4196)	Quality	AB 496.01												
GRADE INSPECTION														
Special & Select Backfill Compaction Control	Moisture	309, 310	RCE	1/lift/ 1500 ft.	1 lb	RCE	Field Book							
Moisture & Density Compaction Control	Density (Proctor) Moisture	309, 310	RCE	1/soil class 1/lift/1500 ft.	25 lb 1lb	RCE	Field Book							
Compacted Materials	Density	311,312, 326, 334	RCE	1/lift/mile or 1/1500 cy		RCE	Field Book							Unless otherwise specified or directed

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

Cert A-Type A Certification
Cert B-Type B Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

ASSUR-Independent Assurance
VERIF-Verification
CORR-Correlation
MON-Monitor

Sampling and Testing Guide-Minimum Frequency

ROADWAY AND BORROW EXCAVATION AND EMBANKMENTS
Section 2102 and 2107

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Special Backfill														
Crushed Stone (4132.02)		AS 209												
Crushed Concrete (4132.02)		209												
RAP(2303.02) Gravel (4132.03)		AS 209												
Granular Backfill		AS 209												
Engineering Fabric (4196)	Quality	AB 496.01												
GRADE INSPECTION														
Special & Select Backfill Compaction Control	Moisture	309, 310	RCE	1/lift/ 450 m	0.5 kg	RCE	Field Book							
Moisture & Density Compaction Control	Density (Proctor) Moisture	309, 310	RCE	1/soil class 1/lift/450 m	12 kg 0.5 kg	RCE	Field Book							
Compacted Materials	Density	311,312, 326, 334	RCE	1/lift/1.5 km or 1/1150 m³ ➡		RCE	Field Book							Unless otherwise specified or directed

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

Cert A-Type A Certification
Cert B-Type B Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

ASSUR-Independent Assurance
VERIF-Verification
CORR-Correlation
MON-Monitor

Matls. I.M. 204
Appendix C (US) Units

MODIFIED SUBBASE
Section 2115

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Natural Aggregate	Quality Gradation	AS 209												
Recycled Products														
Composite	Gradation	*As Per Spec.												
PCC Pavement	Gradation	*As Per Spec.												
Rap		*As Per Spec.												
GRADE INSPECTION														
Compacted Subbase	Density	*As Per Spec.	RCE			RCE	Field Book							
Dimensions	Thickness Width	337	RCE	3/2 lane mi.		RCE	Field Book							
	Cross Section (Primary)	Stringline	RCE	10/mi.		RCE	Field Book							
	Cross Section (Other)	Template	RCE	3/mi.		RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

* Use Current Specification for Modified Subbase

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix C (Metric) Units

MODIFIED SUBBASE
Section 2115

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Natural Aggregate	Quality Gradation	AS 209												
Recycled Products														
Composite	Gradation	*As Per Spec.												
PCC Pavement	Gradation	*As Per Spec.												
Rap		*As Per Spec.												
GRADE INSPECTION														
Compacted Subbase	Density	*As Per Spec.	RCE			RCE	Field Book							
Dimensions	Thickness Width	337	RCE	2/2 lane km		RCE	Field Book							
	Cross Section (Primary)	Stringline	RCE	6/km		RCE	Field Book							
	Cross Section (Other)	Template	RCE	2/km		RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

* Use Current Specification for Modified Subbase

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix D (U.S.) Units

GRANULAR SUBBASE
Section 2111

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Natural Aggregate (4121)	Quality Gradation	AS 209												
PCC Pavement	Gradation	209												
GRADE INSPECTION														
Compacted Subbase (2111)	Density	By Specification	RCE			RCE	Field Book							
Dimensions	Thickness Width	337	RCE	3 / 2 lane mi.		RCE	Field Book							
	Cross Section (Primary)	stringline	RCE	10/ mi.		RCE	Field Book							
	Cross Section (Others)	template	RCE	3/mi		RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

GRANULAR SUBBASE
Section 2111

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Natural Aggregate (4121)	Quality Gradation	AS 209												
PCC Pavement	Gradation	209												
GRADE INSPECTION														
Compacted Subbase (2111)	Density	By Specification	RCE			RCE	Field Book							
Dimensions	Thickness Width	337	RCE	2/2 lane km		RCE	Field Book							
	Cross Section (Primary)	stringline	RCE	6/km		RCE	Field Book							
	Cross Section (Others)	template	RCE	2/km		RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix E (U.S.) Units

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING CURB & GUTTER, AND PAVED SHOULDERS
Section 2122, 2201, 2213, 2301, and 2302

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Fine (4110)		AS 209					Refer to IM 527 for report number							
Aggregate-Coarse (4115)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Curing Compounds (4105)	Lab-Tested													
Clear Curing Compounds (4105)		AB 405.07												
Air Entraining Admixture (4103)	Quality	AB 403												
Water Reducing Admixture (4103	Quality	AB 403												
Retarding Admixture (4103)	Quality	AB 403												
Joint Sealer (4136.02)	Lab Tested	436.01, 436.02,436.03												
Backer Rod (4136.02)	Lab Tested	AB 436.04												
Mixing Water (4102)	Lab Tested		RCE	➽ 1/source	1 qt	CTRL								Not required for potable water from municipal supply

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

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

Section 2122, 2201, 2213, 2301, and 2302

Matls. I.M. 204
Appendix E (U.S.) Units

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Reinforcement (4151)							Refer to IM 527 for report number							
Dowels	Quality	AS 451												
Tie Bars	Quality	AS 451												
Continuous Reinforcement	Quality	AS 451												
General Use	Quality	AS 451												
PLANT INSPECTION														
Aggregates-Fine (4110/4111)	Grad *	302, 306 336	CONTR	3/lot	IM 301	CONTR	Refer to IM 527 for report number	ASSUR CORR V	DME CONTR DME	1/100,000 sy 1st day + 10% 1/QM-C project	IM 301 IM 301 IM 301	DME RCE CTRL		See Notes See I.M. 214
	Moist ➠	308,527	CONTR	1 / half day	1000 gm	CONTR								Not applicable with probe
	Sp. Gr.	307	CONTR	I.M. 527	1000 gm	CONTR								
	Quality	AS 209												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

* A system approach may be applied, at the discretion of the DME

Note 1: When Certified Plant Inspection is not provided, the Engineer is responsible for performing sampling and testing.

Note 2: When the project engineer does the acceptance gradation testing, the assurance sample is to be split with the project engineer. This split sample is for correlation purposes, and if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Note 3: If a third aggregate is used on a QM-C project, individual verification samples of the third aggregate must be obtained by the DME at a rate of 1/QM-C project for gradation and quality testing by CTRL.

Sampling and Testing Guide-Minimum Frequency

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

Section 2122, 2201, 2213, 2301, and 2302

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregates- Coarse (4115)	Grad *	302, 306 336	CONTR	3/lot	I.M. 301	CONTR	Refer to IM 527 for report number	ASSUR CORR V	DME CONTR DME	1/100,000 sy 1st day + 10% 1/QM-C project	IM 301 IM 301 IM 301	DME RCE CTRL		See Notes
	Moist	308	CONTR	1 / half day	2000 gm	CONTR								1000gm may be used (IM 301)
	Sp. Gr.	307	CONTR	I.M. 527	2000 gm	CONTR								1000gm may be used (IM 301)
	Quality	AS 209						V	DME	1/ 100,000 sy	50 lb	CTRL		
Portland Cement (4101)	Quality	AS Cert D		Each Load				V	DME	1/100,000 sy	15 lb	CTRL		
	Cement Yield		CONTR	1/10,000 cy		CONTR								
Fly Ash	Quality	AS Cert D		Each Load				V	DME	1/100,000 sy	15 lb	CTRL		
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Each Load				V	DME	1/100,000 sy	15 lb	CTRL		
Air Admixture	Quality	AB 403	DME	1/lot	1 pint	CTRL								
Water Reducer	Quality	AB 403	DME	1/lot	1 pint	CTRL								
Retarding Admixture	Quality	AB 403	DME	1/lot	1 pint	CTRL								

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

*A - System approach may be applied at the discretion of the DME

Note 1: When Certified Plant Inspection is not provided, the Engineer is responsible for performing sampling and testing.

Note 2: When the project engineer does the acceptance gradation testing, the assurance sample is to be split with the project engineer. This split sample is for correlation purposes, and if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Note 3: If a third aggregate is used on a QM-C project, individual verification samples of the third aggregate must be obtained by the DME at a rate of 1/QM-C project for gradation and quality testing by CTRL.

Verification/Assurance samples not required when mix quantity is less than 2000 sq. yds.

Sampling and Testing Guide-Minimum Frequency

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

Matls. I.M. 204
Appendix E (U.S.) Units

Section 2122, 2201, 2213, 2301, and 2302

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Chloride Solution	Concentration	373	RCE	1/day			Refer to IM 527 for report number							
Wire Mesh		AS CERT A						V	DME	1/Project/YR	2 ft X 2 ft	CTRL		
Steel Reinforcement:														
Dowels	Quality	AS 451						V ➠	DME	1/District/YR	2 ft	CTRL		Steel sampling
Tie Bars	Quality	AS 451						V ➠	DME	1/District/YR	2 ft	CTRL		Frequency
General Use	Quality	AS 451						V ➠	DME	1/District/YR	48 in	CTRL		Minimum of one per District per year
Continuous Reinforcement	Quality	AS 451						V ➠	DME	1/District/YR	2 - 2 ft pcs.	CTRL		
Plastic Concrete	Air	318 327	RCE	➠ 1/1000 cy		RCE		ASSUR	DME	1/100,000 sy		DME		1/100 cy for transit mixer min 1 per day
	Grade Yield		RCE	1/1000 cy		RCE								
	Beams**	316, 327, 328	RCE	2/day		RCE								
Hardened Concrete	Thickness*➠	346, 347	CONTR	1/2000 sy	I.M. 346	RCE		ASSUR	CONTR		10%	DME		Monitor Sampling
	Smoothness	341 Cert. Test Report	CONTR		100%	CONTR		CORR	DME		10%	DME		

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

* Thickness cores sent to Central lab for additional project information testing **None required when maturity is used

Verification/Assurance samples not required when mix quantity is less than 2000 sq. yds.

Sampling and Testing Guide-Minimum Frequency

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

Matls. I.M. 204
Appendix E (Metric) Units

Section <u>2122</u>, <u>2201</u>, <u>2213</u>, <u>2301</u>, and <u>2302</u>

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➔➔
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Fine (<u>4110</u>)		AS <u>209</u>					Refer to IM 527 for report form							
Aggregate-Coarse (<u>4115</u>)		AS <u>209</u>												
Portland Cement (<u>4101</u>)	Quality	AS <u>401</u>												
Fly Ash (<u>4108</u>)	Quality	AS <u>491.17</u>												
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS <u>491.14</u>												
Curing Compounds (<u>4105</u>)	Lab-Tested													
Clear Curing Compounds (<u>4105</u>)		AB <u>405.07</u>												
Air Entraining Admixture (<u>4103</u>)	Quality	AB <u>403</u>												
Water Reducing Admixture (<u>4103</u>	Quality	AB <u>403</u>												
Retarding Admixture (<u>4103</u>)	Quality	AB <u>403</u>												
Joint Sealer (<u>4136.02</u>)	Lab Tested	<u>436.01</u>, <u>436.02</u>,<u>436.03</u>												
Backer Rod (<u>4136.02</u>)	Lab Tested	AB <u>436.04</u>												
Mixing Water (<u>4102</u>)	Lab Tested		RCE	➔➔ 1/source	1 L	CTRL								Not required for potable water from municipal supply

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING
CURB & GUTTER, AND PAVED SHOULDERS
Section 2122, 2201, 2213, 2301, and 2302

Matls. I.M. 204
Appendix E (Metric) Units

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Reinforcement (4151)							Refer to IM 527 for report form							
Dowels	Quality	AS 451												
Tie Bars	Quality	AS 451												
Continuous Reinforcement	Quality	AS 451												
General Use	Quality	AS 451												
PLANT INSPECTION														
Aggregates-Fine (4110/4111)	Grad *	302, 306 336	CONTR	3/lot	IM 301	CONTR	Refer to IM 527 for report form	ASSUR CORR V	DME CONTR DME	1/100,000 m² 1st day + 10% 1/QM-C project	IM 301 IM 301 IM 301	DME RCE CTRL		See Notes See I.M. 214
	Moist ➠	308,527	CONTR	1 / half day	1000 gm	CONTR								Not applicable w probe
	Sp. Gr.	307	CONTR	I.M. 527	1000 gm	CONTR								
	Quality	AS 209												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

* A system approach may be applied, at the discretion of the DME

Note 1: When Certified Plant Inspection is not provided, the Engineer is responsible for performing sampling and testing.

Note 2: When the project engineer does the acceptance gradation testing, the assurance sample is to be split with the project engineer. This split sample is for correlation purposes, and if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Note 3: If a third aggregate is used on a QM-C project individual verification samples of the third aggregate must be obtained by the DME at a rate of 1/QM-C project for gradation and quality testing by CTRL.

Matls. I.M. 204
Appendix E (Metric) Units

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

Section 2122, 2201, 2213, 2301, and 2302

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➸
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregates- Coarse (4115)	Grad *	302, 306 336	CONTR	3/lot	I.M. 301	CONTR	Refer to IM 527 for report form	ASSUR CORR V	DME CONTR DME	1/100,000 m^2 1st day + 10% 1/QM-C project	IM 301 IM 301 IM 301	DME RCE CTRL		See Notes
	Moist	308	CONTR	1 / half day	1000 gm	CONTR								
	Sp. Gr.	307	CONTR	I.M. 527	1000 gm	CONTR								
	Quality	AS 209						V	DME	1/ 100,000 m^2	22 kg	CTRL		
Portland Cement (4101)	Quality	AS Cert D		Each Load				V	DME	1/100,000 m^2	7 kg	CTRL		
	Cement Yield		CONTR	1/7500 m^3		CONTR								
Fly Ash	Quality	AS Cert D		Each Load				V	DME	1/100,000 m^2	7 kg	CTRL		
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Each Load				V	DME	1/100,000 m^2	7 kg	CTRL		
Air Admixture	Quality	AB 403	DME	1/lot	0.5 L	CTRL								
Water Reducer	Quality	AB 403	DME	1/lot	0.5 L	CTRL								
Retarding Admixture	Quality	AB 403	DME	1/lot	0.5 L	CTRL								

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

*A - System approach may be applied at the discretion of the DME

Note 1: When Certified Plant Inspection is not provided, the Engineer is responsible for performing sampling and testing.

Note 2: When the project engineer does the acceptance gradation testing, the assurance sample is to be split with the project engineer. This split sample is for correlation purposes, and if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Note 3: If a third aggregate is used on a QM-C project, individual verification samples of the third aggregate must be obtained by the DME at a rate of 1/QM-C project for gradation and quality testing by CTRL.

Verification/Assurance samples not required when mix quantity is less than 2000 m^2.

Sampling and Testing Guide-Minimum Frequency

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

Matls. I.M. 204
Appendix E (Metric) Units

Section 2122, 2201, 2213, 2301, and 2302

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Chloride Solution	Concentration	373	RCE	1/day			Refer to IM 527 for report form							
Wire Mesh		AS CERT A						V	DME	1/Project/YR	0.5 m X 0.5 m	CTRL		
Steel Reinforcement: Dowels	Quality	AS 451						V ➠	DME	1/District/YR	0.5 m	CTRL		Steel sampling
Tie Bars	Quality	AS 451						V ➠	DME	1/District/YR	0.5 m	CTRL		Frequency
General Use	Quality	AS 451						V ➠	DME	1/District/YR	1 m	CTRL		Minimum of one per District per year
Continuous Reinforcement	Quality	AS 451						V ➠	DME	1/District/YR	2 - 0.5 m pcs.	CTRL		
Plastic Concrete	Air	318 327	RCE	➠ 1/750 m^3		RCE		ASSUR	DME	1/100,000 m^2		DME		1/75 m^3 for transit mixer minim 1 per day
	Grade Yield		RCE	1/750 m^3		RCE								
	Beams**	316, 327, 328	RCE	2/day		RCE								
Hardened Concrete	Thickness*➠	346, 347	CONTR	1/2000 m^2	I.M. 346	RCE		ASSUR	CONTR		10%	DME		Monitor Sampling
	Smoothness	341 Cert. Test Report	CONTR		100%	CONTR		CORR	DME		10%	DME		

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

* Thickness cores sent to Central lab for additional project information testing **None required when maturity is used

Verification/Assurance samples not required when mix quantity is less than 2000 m^2.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix F (U.S.) Units

TYPE A & B ASPHALT CONCRETE (QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4126/4127)		AS 491.04												
Asphalt Cement		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
PLANT INSPECTION														
Aggregates (2303)	Quality							V	DME	1/20,000 Ton	50 lb.	CTRL		
Combined Aggregate (4126, 4127)	Gradation		CONTR	3/lot	I.M. 301	CONTR		CORR. ASSUR	CONTR DME	1st day + 10% 1/20,000 T.	I.M. 301	DME/RCE DME	I.M. 216 I.M. 216	
	Moisture ➠		CONTR	1 / half day	1000 gm	CONTR								Dryer Drum Plants Only

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Note: Sample Frequencies based on Tons of Mix

Matls. I.M. 204
Appendix F (U.S.) Units

TYPE A & B ASPHALT CONCRETE (QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Notes	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler			DME	1/proj.	50 gm	DME	821278							
Asphalt Cement	DSR Quality	AS Cert D	CONTR	1/40 T	3 oz. Tin	DME➡		V	DME	1/20,000 T of Mix	1 qt	CTRL		log all shipments Test 1st 3days then 1/week
Cutback	Quality Viscosity	AS 329	RCE	1/proj	1 qt	DME								log all shipments
Emulsion	Residue	AS 360	RCE	1/proj	1 qt	DME								Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density	321, 325	CONTR	As per 2303	50 lb	CONTR		CORR	CONTR	1/day ➡	50 lb	DME		May be adjusted by DME as per 2303
	Lab Voids	350, 510	CONTR	As per 2303	50 lb	CONTR		CORR V	CONTR DME	1/day ➡ 1/20,000 T of Mix	50 lb 40 lb	DME CTRL		May be adjusted by DME as per 2303
Compacted Mixture	Density Thickness Voids	320, 321 337 321	CONTR➡ CONTR➡ CONTR➡	lot lot lot	7/lot 7/lot 7/lot	CONTR CONTR CONTR		CORR CORR CORR	CONTR CONTR	1st day+10% 1st day+10% 1st day+10%		DME DME DME		Witness by RCE Witness by RCE Witness by RCE
	Smoothness	341	CONTR	100%	100%	CONTR		CORR	DME	10%		DME		

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

Cert A-Type A Certification
Cert B-Type B Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

ASSUR-Independent Assurance
VERIF-Verification
CORR-Correlation
MON-Monitor

Note: Verif/Assur/Corr not required under 2000 Tons of Mix.
Note: Sample Frequency based on Tons of Mix.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix F (Metric) Units

TYPE A & B ASPHALT CONCRETE (QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4126/4127)		AS 491.04												
Asphalt Cement		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
PLANT INSPECTION														
Aggregates (2303)	Quality							V	DME	1/20,000 Mg	22 kg	CTRL		
Combined Aggregate (4126, 4127)	Gradation		CONTR	3/lot	I.M. 301	CONTR		CORR. ASSUR	CONTR DME	1st day + 10% 1/20,000 Mg	I.M. 301	DME/RCE DME	I.M. 216 I.M. 216	
	Moisture ➡		CONTR	1 / half day	1000 gm	CONTR								Dryer Drum Plants Only

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Note: Sample Frequencies based on Mg of Mix

Matls. I.M. 204
Appendix F (Metric) Units

TYPE A & B ASPHALT CONCRETE (QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Notes	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler			DME	1/proj.	50 gm	DME	821278							
Asphalt Cement	DSR Quality	AS Cert D	CONTR	1/40 Mg	85 gm Tin	DME➡		V	DME	1/20,000 Mg of Mix	1 L	CTRL		log all shipments Test 1st 3days then 1/week
Cutback	Quality Viscosity	AS 329	RCE	1/proj	1 L	DME								log all shipments
Emulsion	Residue	AS 360	RCE	1/proj	1 L	DME								Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture:	Lab Density	321, 325	CONTR	As per 2303	22 kg	CONTR		CORR	CONTR	1/day ➡	22 kg	DME		May be adjusted by DME as per 2303
	Lab Voids	350, 510	CONTR	As per 2303	22 kg	CONTR		CORR V	CONTR DME	1/day ➡ 1/20,000 Mg of Mix	22 kg 18 kg	DME CTRL		May be adjusted by DME as per 2303
Compacted Mixture	Density Thickness Voids	320, 321 337 321	CONTR➡ CONTR➡ CONTR➡	lot lot lot	7/lot 7/lot 7/lot	CONTR CONTR CONTR		CORR CORR CORR	CONTR CONTR	1st day+10% 1st day+10% 1st day+10%		DME DME DME		Witness by RCE Witness by RCE Witness by RCE
	Smoothness	341	CONTR	100%	100%	CONTR		CORR	DME	10%		DME		

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Note: Verif/Assur/Corr not required under 2000 Mg of Mix.
Note: Sample Frequency based on Mg of Mix.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix G (U.S.) Units

TYPE A & B ASPHALT CONCRETE (Non QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4126/4127)		AS 491.04												
Asphalt Cement		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
PLANT INSPECTION *														
Aggregates (2303)	Quality							V	DME	1/20,000 Ton of Mix	50 lb.	CTRL		
Combined Aggregate (4126, 4127)	Gradation		RCE	3/lot	I.M. 301	RCE		ASSUR	DME	1/20,000 Ton of Mix	I.M. 301	DME	I.M. 216	
	Moisture ➡		RCE	1/ half day	1000 gm	RCE								Dryer Drum Plants Only

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

*For certified Plant Insp. on non-QMA projects. See QMA table for S & T guide.

Note 1: Sample frequency based on Tons of Mix.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix G (U.S.) Units

TYPE A & B ASPHALT CONCRETE (NonQMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler			DME	1/proj.	50 gm	DME	821278							
Asphalt Cement	DSR Quality	AS Cert D	RCE	1/40 T	3 oz. Tin	DME➠		V	DME	1/20,000 Tons of Mix	1 qt	CTRL		log all shipments Test 1st 3days/ then 1/week
Cutback	Quality Viscosity	AS 329	RCE➠	1/proj	1 qt	DME								log all shipments
Emulsion	Residue	AS 360	RCE	1/proj	1 qt ➠	DME								Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture	Lab Density	321, 325	RCE	3/Lot ➠	50 lb	DME								Tests 1/Lot
	Lab Voids	350, 510	RCE	As per 2303	50 lb	DME		V	DME	1/20,000 Ton of Mix	40 lb	CTRL		
Compacted Mixture	Density	320, 321	CONTR*	Lot	7/Lot	RCE		ASSUR	CONTR	1st day + 10%				
	Thickness	337	CONTR*	Lot	7/Lot	RCE		ASSUR	CONTR	1st day + 10%		DME		
	Voids	321	CONTR*	Lot	7/Lot	RCE								
	Smoothness	341	CONTR	100%	100%	CONTR		CORR	DME	10%		DME		

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

*Witness by RCE

Note: Verif/Assur/Corr not required under 2000 Tons of Mix.

Matls. I.M. 204
Appendix G (Metric) Units

TYPE A & B ASPHALT CONCRETE (Non QMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➼
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ. Note 1	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Coarse (4127)		AS 209												
Aggregates-Fine (4127)		AS 209												
Hydrated Lime (4126/4127)		AS 491.04												
Asphalt Cement		AS 437												
Emulsions & Cutbacks		AS 437												
Release Agent		AB 491.15												
PLANT INSPECTION *														
Aggregates (2303)	Quality							V	DME	1/20,000 Mg of Mix	22 kg	CTRL		
Combined Aggregate (4126, 4127)	Gradation		RCE	3/lot	I.M. 301	RCE		ASSUR	DME	1/20,000 Mg of Mix	I.M. 301	DME	I.M. 216	
	Moisture ➼		RCE	1/ half day	1000 gm	RCE								Dryer Drum Plants Only

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

*For certified Plant Insp. on non-QMA projects. See QMA table for S & T guide.
Note 1: Sample frequency based on Mg of Mix.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix G (Metric) Units

TYPE A & B ASPHALT CONCRETE (NonQMA)

Section 2303, 2213, and 2114

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Mineral Filler			DME	1/proj.	50 gm	DME	821278							
Asphalt Cement	DSR Quality	AS Cert D	RCE	1/40 Mg	85 gm Tin	DME➠		V	DME	1/20,000 Mg of Mix	1 L	CTRL		log all shipments Test 1st 3days then 1/week
Cutback	Quality Viscosity	AS 329	RCE➠	1/proj	1 L	DME								log all shipments
Emulsion	Residue	AS 360	RCE	1/proj	1 L ➠	DME								Plastic bottle required
GRADE INSPECTION														
Uncompacted Mixture	Lab Density	321, 325	RCE	3/Lot ➠	22 kg	DME								Tests 1/Lot
	Lab Voids	350, 510	RCE	As per 2303	22 kg	DME		V	DME	1/20,000 Mg of Mix	18 kg	CTRL		
Compacted Mixture	Density Thickness	320, 321 337	CONTR* CONTR*	Lot Lot	7/Lot 7/Lot	RCE RCE		ASSUR ASSUR	CONTR CONTR	1st day + 10% 1st day + 10%		DME		
	Voids	321	CONTR*	Lot	7/Lot	RCE								
	Smoothness	341	CONTR	100%	100%	CONTR		CORR	DME	10%		DME		

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

*Witness by RCE

Note: Verif/Assur/Corr not required under 2000 Mg of Mix.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix H (U.S.) Units

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregate-Fine (4110)		AS 209												
Aggregate-Coarse (4115)		AS 209												
Granular Backfill (4133)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
Mixing Water (4102)	Quality		RCE	➠ 1/project	1 L	CTRL	731							Not required for potable water from Municipal Supply
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Air Entraining Admixture	Quality	AB 403												
Retarding Admixture	Quality	AB 403												
Water reducing Admixture	Quality	AB 403												
Curing Compound (4105)	Lab Tested	AB 405 ➠	DME	1/lot	1 L	CTRL								Bridge Barrier Rails AASHTO, M148, Cert. by Manufacturer

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Pre-formed Joint Sealer (4136)	Lab-Tested	AB 436												
Reinforcing Steel Bars (4151)	Quality	AS 451												
Steel Pile (4167)	Quality	467												
Concrete Pile (4166)	Quality	AS 570												
Timber Pile (4165)	Quality	➠ 462		Each Shipment										Rpt. or Cert by Independent Insp. Agency
Timber & (4162) Lumber (4163)		➠ 462		Each Shipment										Rpt. or Cert by Independent Insp. Agency
Concrete Anchors	Quality	AB 453.09												
Epoxy Grout	Quality	AB 491.11												
Concrete Sealer	Quality	AB 491.12												
Subdrain Pipe (4143)	Quality	AS 443, 448												
Neoprene Bearing Pads (4195)		AS 495.03												
Bronze Bearing Plates (4190.03)		ASD/Cert A												

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Sampling and Testing Guide-Minimum Frequency

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➼
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Masonry Plate (4152)		ASDrawing/Cert A												
Precast Units (2407)	Quality	AS 570												
Anchor Bolts (lighting, signing, handrail) (4153)	Lab Tested	ASD												
Structural Steel (4152)	Quality	➼ Cert A												Monitor Sample According to plans or other instructions
Aluminum Bridge Rail & Anchor Assembly		ASD Cert B												
Conduit (Electrical) (4185.1)	Lab Tested		DME	1/ size	2' with coupling	CTRL								
Bentonite		AS Cert D												
Flowable Mortar	Lab Tested ➼	Approved Trial Mix 525, 375												Tested by DME

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Matls. I.M. 204
Appendix H (U.S.) Units

October 2, 2001
Supersedes April 3, 2001

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregate- Fine (4110)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	ASSUR CORR	DME CONTR	1/1000 cy➠ 1st day +10%	IM 301 IM 301	DME RCE		System Approach Applicable
	Moisture	➠ 308, 528	CONTR	1/lot	1000 gm	CONTR	830211							See IM 528 if Moisture Probe is used
	Sp. Gr.	307	CONTR	IM 528	1000 gm	CONTR	830211							
	Quality	AS 209												
Aggregate- Coarse (4115)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	ASSUR CORR	DME CONTR	➠ 1/1000 CY 1st day+10%	IM 301 IM 301	DME RCE		System Approach Applicable
	Moisture	308, 528	CONTR	1/lot	2000gm	CONTR	830211							
	Sp. Gr.	307	CONTR	IM 528	2000gm	CONTR	830211							
	Quality	AS 209						V	DME	1/1000 cy	50 lb	CTRL		
Portland Cement	w/c ratio	528	CONTR	1/pour		CONTR	830211							
	Quality	AS Cert D					830211	V	DME	1/1000 cy	15 lb	CTRL		

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix H (U.S.) Units

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Fly Ash	Quality	AS Cert		Ea Load			830211							
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Ea Load			830211							
Air Entraing Admixture (4103)		AB 403	RCE	1/lot➠	0.5 L	CTRL								Sample lots not previously reported or as required by DME
Retarding Admixture		AB 403	RCE	1/lot➠	0.5 L	CTRL								
Water Reducing Admixture (4103)		AB 403	RCE	1/lot➠	0.5 L	CTRL								
GRADE INSPECTION														
Plastic Concrete	Air Content	316, 327	RCE	1/30 cy➠		RCE	830211	ASSUR	DME	1/1000 cy		DME		DME may adjust
	Slump	317, 327	RCE	1/30 cy ➠		RCE	830211	ASSUR	DME	1/1000 cy		Witness Only		DME may adjust
.	Beams	316, 327, 328	RCE	2/placement ➠		RCE	830211							As per 2403.18 & 2403.18
	Cylinders								DME	➠ 3/project		DME		Primary Projects Only (Information only)

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Matls. I.M. 204
Appendix H (U.S.) Units

October 2, 2001
Supersedes April 3, 2001

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Reinforcing Steel (4151)	Quality	AS Cert A		Each Shipment			Field Book	V	DME	IM 451	6 ft	CTRL		
Reinforcing Steel Epoxy Coated (4151)	Quality	AS Cert A		Each Shipment			Field Book	V ➡	DME	1 of largest bar in deck	6 ft	CTRL		Will be acceptance tested for coating
Steel Pile (4167)	Quality	AS Cert A		Each Heat			Field Book		DME	IM 467		CTRL		Monitor by CTRL Materials
Timber Pile (4165)	Quality	Cert D 462						MON						Test report by Independent Lab
Anchor Bolts (lighting, signing, handrail)	Lab Tested	ASD	DME	➡ 1/project	1 bolt w/nut & washer	CTRL								Sample only if not source inspected
Steel Masonry Plates (4152)		ASD Cert A		Each Shipment			Field Book							Approved by Materials Department
Bronze Bearing Plates (4190.03)	Lab Tested		DME	➡ 1/project	1 only	CTRL								Sample only if not source inspected
Neoprene Bearing Pads (4199)		AS 495.03		Each Shipment			820905							
Alum. Bridge Rail & Anchor Assembly		ASD		Each Shipment			Field Book							Approved By Materials Dept.
Drains (Std Steel Pipe)(as per plan)	Dimensions Galvanized	ASD Visual 332	DME	1/project		DME	Test Report							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Timber (4162) & Lumber (4163)	Quality	Cert D 4162		Each Shipment										
Subdarain Pipe (4143)	Quality	AS Cert D 443, 448		Each Shipment										
Flowable Mortar (2506) ➠	Flow Test	375	RCE	As needed for Project Control		RCE	830211							Mix Design approval by DME
Bentonite	Flow Test	Visual 375				RCE								
Smoothness (2317)	Profilometer	Cert. Test Report 341	CONTR	Each Project	Each Wheelpath	CONTR	821301	CORR	DME	10%				

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 50 cu. yd.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Matls. I.M. 204
Appendix H (Metric) Units

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregate-Fine (4110)		AS 209												
Aggregate-Coarse (4115)		AS 209												
Granular Backfill (4133)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
Mixing Water (4102)	Quality		RCE	➠ 1/project	1 L	CTRL	731							Not required for potable water from Municipal Supply
GGBFS (Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Air Entraining Admixture	Quality	AB 403												
Retarding Admixture	Quality	AB 403												
Water reducing Admixture	Quality	AB 403												
Curing Compound (4105)	Lab Tested	AB 405 ➠	DME	1/lot	1 L	CTRL								Bridge Barrier Rails AASHTO, M148, Cert. by Manufacturer

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3.

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix H (Metric) Units

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Pre-formed Joint Sealer (4136)	Lab-Tested	AB 436												
Reinforcing Steel Bars (4151)	Quality	AS 451												
Steel Pile (4167)	Quality	467												
Concrete Pile (4166)	Quality	AS 570												
Timber Pile (4165)	Quality	➡ 462		Each Shipment										Rpt. or Cert by Independent Insp. Agency
Timber & (4162) Lumber (4163)		➡ 462		Each Shipment										Rpt. or Cert by Independent Insp. Agency
Concrete Anchors	Quality	AB 453.09												
Epoxy Grout	Quality	AB 491.11												
Concrete Sealer	Quality	AB 491.12												
Subdrain Pipe (4143)	Quality	AS 443, 448												
Neoprene Bearing Pads (4195)		AS 495.03												
Bronze Bearing Plates (4190.03)		ASD/Cert A												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3.

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

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Appendix H (Metric) Units

October 2, 2001
Supersedes April 3, 2001

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Steel Masonry Plate (4152)		ASDrawing/Cert A												
Precast Units (2407)	Quality	AS 570												
Anchor Bolts (lighting, signing, handrail) (4153)	Lab Tested	ASD												
Structural Steel (4152)	Quality	➠ Cert A												Monitor Sample According to plans or other instructions
Aluminum Bridge Rail & Anchor Assembly		ASD Cert B												
Conduit (Electrical) (4185.1)	Lab Tested		DME	1/ size	0.5 m with coupling	CTRL								
Bentonite		AS Cert D												
Flowable Mortar	Lab Tested ➠	Approved Trial Mix 525, 375												Tested by DME

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPL E SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregate- Fine (4110)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	ASSUR CORR	DME CONTR	1/750 m^3 1st day +10%	IM 301	DME RCE		System Approach Applicable
	Moisture	308, 528	CONTR	1/lot	1000 gm	CONTR	830211							See IM 528 if Moisture Probe is used
	Sp. Gr.	307	CONTR	IM 528	1000 gm	CONTR	830211							
	Quality	AS 209												
Aggregate- Coarse (4115)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	ASSUR CORR	DME CONTR	1/750 m^3 1st day+10%	IM 301	DME RCE		System Approach Applicable
	Moisture	308, 528	CONTR	1/lot	2000gm	CONTR	830211							
	Sp. Gr.	307	CONTR	IM 528	2000gm	CONTR	830211							
	Quality	AS 209						V	DME	1/750 m^3	22 kg	CTRL		
Portland Cement	w/c ratio	528	CONTR	1/pour		CONTR	830211							
	Quality	AS Cert D					830211	V	DME	1/750 m^3	7 kg	CTRL		

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Matls. I.M. 204
Appendix H (Metric) Units

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

October 2, 2001
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MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Fly Ash	Quality	AS Cert		Ea Load			830211							
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS Cert		Ea Load			830211							
Air Entraing Admixture (4103)		AB 403	RCE	1/lot➠	0.5 L	CTRL								Sample lots not previously reported or as required by DME
Retarding Admixture		AB 403	RCE	1/lot➠	0.5 L	CTRL								
Water Reducing Admixture (4103)		AB 403	RCE	1/lot➠	0.5 L	CTRL								
GRADE INSPECTION														
Plastic Concrete	Air Content	316, 327	RCE	1/25 m³➠		RCE	830211	ASSUR	DME	1/750 m³		DME		DME may adjust
	Slump	317, 327	RCE	1/25 m³ ➠		RCE	830211	ASSUR	DME	1/750m³		Witness Only		DME may adjust
	Beams	316, 327, 328	RCE	2/placement ➠		RCE	830211							As per 2403.18 & 2403.19
	Cylinders								DME	➠ 3/project		DME		Primary Projects Only (Information only)

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m³.

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Sampling and Testing Guide-Minimum Frequency

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Reinforcing Steel (4151)	Quality	AS Cert A		Each Shipment			Field Book	V	DME	IM 451	2 m	CTRL		
Reinforcing Steel Epoxy Coated (4151)	Quality	AS Cert A		Each Shipment			Field Book	V ➽	DME	1 of largest bar in deck	2 m	CTRL		Will be acceptance tested for coating
Steel Pile (4167)	Quality	AS Cert A		Each Heat			Field Book		DME	IM 467		CTRL		Monitor by CTRL Materials
Timber Pile (4165)	Quality	Cert D 462						MON						Test report by Independent Lab
Anchor Bolts (lighting, signing, handrail)	Lab Tested	ASD	DME	➽ 1/project	1 bolt w/nut & washer	CTRL								Sample only if not source inspected
Steel Masonry Plates (4152)		ASD Cert A		Each Shipment			Field Book							Approved by Materials Department
Bronze Bearing Plates (4190.03)	Lab Tested		DME	➽ 1/project	1 only	CTRL								Sample only if not source inspected
Neoprene Bearing Pads (4199)		AS 495.03		Each Shipment			820905							
Alum. Bridge Rail & Anchor Assembly		ASD		Each Shipment			Field Book							Approved By Materials Dept.
Drains (Std Steel Pipe)(as per plan)	Dimensions Galvanized	ASD Visual 332	DME	1/project		DME	Test Report							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3

Note: When the Project Engineer does the acceptance gradation testing, the assurance samples is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Sampling and Testing Guide-Minimum Frequency

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

Sections 2403, 2404, 2405, 2406, 2412, & 2415

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Timber (4162) & Lumber (4163)	Quality	Cert D 4162		Each Shipment										
Subdarain Pipe (4143)	Quality	AS Cert D 443, 448		Each Shipment										
Flowable Mortar (2506) ➠	Flow Test	375	RCE	As needed for Project Control		RCE	830211							Mix Design approval by DME
Bentonite	Flow Test	Visual 375				RCE								
Smoothness (2317)	Profilometer	Cert. Test Report 341	CONTR	Each Project	Each Wheelpath	CONTR	821301	CORR	DME	10%				

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Verification/Assurance samples not required when mix quantity is less than 40 m^3

Note: When the Project Engineer does the acceptance gradation testing, the assurance sample is to be split with the Project Engineer. This split sample is for correlation purposes and , if it is not a routine lot sample, should not be used for determining specification compliance of a lot. However, any non-compliant test result is to be resolved.

Matls. I.M. 204
Appendix I (U.S.) Units

SOIL AGGREGATE SUBBASE

Section 2110

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Granular Surfacing Material (4120)		AS 209												
GRADE INSPECTION														
Mixed Materials (2110)	Density➽ (Proctor)	I.M. 309	RCE	2/ mile (min 2/project)	5000 gm	RCE	Field Book							Change of Soil type requires additional Proctors
Uncompacted Mixture	Pulverization Moisture	2" Sieve Visual	RCE	2/2 lane mile		RCE	Field Book							
Compacted Mixture (2110)	Density Thickness Width	311, 312, 334 337	RCE	2/2 lane mile		RCE	Field Book							
Finished Subbase	Cross Section	Stringline ➽	RCE	10/ mi		RCE	Field Book							Template for secondary park and institutional roads

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix I (Metric) Units

SOIL AGGREGATE SUBBASE

Section 2110

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Granular Surfacing Material (4120)		AS 209												
GRADE INSPECTION														
Mixed Materials (2110)	Density➠ (Proctor)	I.M. 309	RCE	2/ km (min 2/project)	5000 gm	RCE	Field Book							Change of Soil type requires additional Proctors
Uncompacted Mixture	Pulverization Moisture	50.8 mm Sieve Visual	RCE	2/2 lane km		RCE	Field Book							
Compacted Mixture (2110)	Density Thickness Width	311, 312, 334 337	RCE	2/2 lane km		RCE	Field Book							
Finished Subbase	Cross Section	Stringline ➠	RCE	6/km		RCE	Field Book							Template for secondary park and institutional roads

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix K (U.S.) Units

COLD-IN-PLACE ASPHALT CEMENT CONCRETE RECYCLING(NEW)

Section 2318

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➡
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Emulsion (Rej. Agent) (2318.02)	Quality	AS 437												
GRADE INSPECTION														
RAP (2318.02)	Max Size		RCE	1st day + 1/ week	10 lb	RCE								
Emulsion (Rej. Agent)	Quality Residue	Cert D 360	RCE	1/10,000 gal.	1 qt ➡	DME								Must use plastic bottle
Uncompacted Mixture (2318.04)	Moisture Density	504 504	RCE RCE	1/lot 1/lot	30 lb ➡ 30 lb	DME DME								Sealed Container
Compacted Mixture (2318.04)	Moisture* Density	504 504	CONTR CONTR	7/day 7/day		CONTR CONTR➡								Witnessed by RCE

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

*See I.M. 504 for Day 1 moisture correction factor.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix K (Metric) Units

COLD-IN-PLACE ASPHALT CEMENT CONCRETE RECYCLING(NEW)

Section 2318

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Emulsion (Rej. Agent) (2318.02)	Quality	AS 437												
GRADE INSPECTION														
RAP (2318.02)	Max Size		RCE	1st day + 1/ week	5 kg	RCE								
Emulsion (Rej. Agent)	Quality Residue	Cert D 360	RCE	1/38,000 L	1 L ➠	DME								Must use plastic bottle
Uncompacted Mixture (2318.04)	Moisture Density	504 504	RCE RCE	1/lot 1/lot	14 kg ➠ 14 kg	DME DME								Sealed Container
Compacted Mixture (2318.04)	Moisture* Density	504 504	CONTR CONTR	7/day 7/day		CONTR CONTR➠								Witnessed by RCE

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

*See I.M. 504 for Day 1 moisture correction factor.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix L (U.S.) Units

GRANULAR SURFACING/DRIVEWAY SURFACING
Section 2312 & 2315

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Class C Gravel (4120.03)	Gradation Quality	AS 209												
Class A Crushed Stone (4120.04)	Gradation Quality	AS 209												
Class B Crushed Stone (4120.05)	Gradation Quality	AS 209												
Class D Crushed Stone (4120.06)	Gradation Quality	AS 209												
Aggregate for Type B, AC or cold laid Bituminous Concrete (for driveways only)	Gradation Quality	AS 209												
Crushed Stone Base (for driveways only) (4122)	Gradation Quality	AS 209												
GRADE INSPECTION														
Dimensions	Thickness Width Cross Slope		RCE	3/ mi.			Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix L (Metric) Units

GRANULAR SURFACING/DRIVEWAY SURFACING
Section 2312 & 2315

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Class C Gravel (4120.03)	Gradation Quality	AS 209												
Class A Crushed Stone (4120.04)	Gradation Quality	AS 209												
Class B Crushed Stone (4120.05)	Gradation Quality	AS 209												
Class D Crushed Stone (4120.06)	Gradation Quality	AS 209												
Aggregate for Type B, AC or cold laid Bituminous Concrete (for driveways only)	Gradation Quality	AS 209												
Crushed Stone Base (for driveways only) (4122)	Gradation Quality	AS 209												
GRADE INSPECTION														
Dimensions	Thickness Width Cross Slope		RCE	2/km			Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix M (U.S.) Units

April 25, 2001
Supersedes October 3, 2000

CONCRETE BRIDGE FLOOR REPAIR & OVERLAY AND SURFACING
Section 2413

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➔
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Fine (4110)		AS 209												
Aggregates-Coarse (4115)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Mixing Water (4102)	Quality	Lab Tested	RCE	➔ 1/source	1 qt.	CTRL								Not needed for potable Municipal Water
Air Entraining Admixture (4103)	Quality	AB 403												
Water Reducing Admixture (4103)	Quality	AB 403												
Retarding Admixture (4103)		AS 403												
Curing Compound (4105)	Lab Tested	405	DME 1/lot	1/lot ➔	1 pt	CTRL								Sample lots not previously reported
PLANT INSPECTION														
Aggregate-Fine (4110)		AS CERT												
Aggregate-Coarse (4115)	Quality	AS CERT						V	DME	1/project ➔	50 lb	CTRL		DME may adjust frequency
Portland Cement (4101)	Quality	AS CERT						V	DME	1/project	15 lb	CTRL		
Air Entraining Admixture (4103)		AB 403	RCE	Each ➔ Lot	1 pt	CTRL								Sample if not previously reported
Water Reducing Admixture (4103)		AB 403	RCE	Each ➔ Lot	1 pt	CTRL								Sample if not previously reported
Retarding Admixture (4103)		AB 403	RCE	Each ➔ Lot	1 pt	CTRL								Sample if not previously reported
Latex Emulsion		Certification		Each Lot										

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix M (U.S.) Units

CONCRETE BRIDGE FLOOR REPAIR & OVERLAY AND SURFACING
Section 2413

April 25, 2001
Supersedes October 3, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Plastic Concrete (2413)	Air	318, 327	RCE	1/100 sy		RCE	830211	ASSUR	DME	1/project		DME		
	Slump	317, 327	RCE	1/100 sy		RCE	830211	ASSUR	DME	1/project		Witness Only		
	Density	358	RCE	➠ 6/bridge		RCE	1297							Minimum of 1 per placement and witness by DME
	Thickness		RCE	3/50 sy		RCE	Field Book							
	Cylinders								DME	3/project		DME		Primary Projects only (Information Only)
Concrete Sealer (2413.09)	Quality	AB 491.12												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix M (Metric) Units

CONCRETE BRIDGE FLOOR REPAIR & OVERLAY AND SURFACING
Section 2413

April 25, 2001
Supersedes October 3, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates-Fine (4110)		AS 209												
Aggregates-Coarse (4115)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Mixing Water (4102)	Quality	Lab Tested	RCE	➠ 1/source	1 L	CTRL								Not needed for potable Municipal Water
Air Entraining Admixture (4103)	Quality	AB 403												
Water Reducing Admixture (4103)	Quality	AB 403												
Retarding Admixture (4103)		AS 403												
Curing Compound (4105)	Lab Tested	405	DME 1/lot	1/lot ➠	0.5 L	CTRL								Sample lots not previously reported
PLANT INSPECTION														
Aggregate-Fine (4110)		AS CERT												
Aggregate-Coarse (4115)	Quality	AS CERT						[redacted]	DME	1/project ➠	22 kg	CTRL		DME may adjust frequency
Portland Cement (4101)	Quality	AS CERT						[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Air Entraining Admixture (4103)		AB 403	RCE	Each ➠ Lot	0.5 L	CTRL								Sample if not previously reported
Water Reducing Admixture (4103)		AB 403	RCE	Each ➠ Lot	0.5 L	CTRL								Sample if not previously reported
Retarding Admixture (4103)		AB 403	RCE	Each ➠ Lot	0.5 L	CTRL								Sample if not previously reported
Latex Emulsion		Certification		Each Lot										

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix M (Metric) Units

CONCRETE BRIDGE FLOOR REPAIR & OVERLAY AND SURFACING
Section 2413

April 25, 2001
Supersedes October 3, 2000

MATERIAL OR CONSTRUCTION ITEM	**TESTS**	**METHOD OF ACCEPTANCE AND RELATED IMS**	**QC/ACCEPTANCE S&T**					**ASSURANCE, CORRELATION AND VERIFICATION S&T**						**REMARKS** ➤
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Plastic Concrete (2413)	Air	318, 327	RCE	1/100 m^2		RCE	830211	ASSUR	DME	1/project		DME		
	Slump	317, 327	RCE	1/100 m^2		RCE	830211	ASSUR	DME	1/project		Witness Only		
	Density	358	RCE	➤ 6/bridge		RCE	1297							Minimum of 1 per placement and witness by RCE
	Thickness		RCE	3/50 m^2		RCE	Field Book							
	Cylinders								DME	3/project		DME		Primary Projects only (Information Only)
Concrete Sealer (2413.09)	Quality	AB 491.12												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix P (U.S.) Units

BITUMINOUS SEAL COAT

Section 2307

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates (4125)	Quality	AS 209												
Emulsions/Cutbacks	Quality	AS												
Emulsion & Aggregate	Compatibility	349	DME	1/ source	1 qt & 10lb	DME/ CTRL								
GRADE INSPECTION														
Aggregate	Quality Gradation	301 Cert D						V	DME	1/proj.	50 lb	CTRL		
Emulsion (1)	Quality Residue Compatibility	Cert D 323, 360 349	RCE ➽ RCE	1/20,000 gal 1st Day + 1/ week	1 qt 1 qt & 10 lb	DME DME		V	DME	1/proj.	1 gal.	CTRL		Log all shipments Plastic bottle only
Cutback	Quality Viscosity Anit-Strip	Cert D 323, 329 AB 323, 374	 RCE	1/20,000 gal	1 qt	DME		V	DME	1/proj	1 qt	CTRL		

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Note: (1) Poymer-modified emulsions are not normally accepted on the basis of certification; prior approval must be obtained from the DME before beginning shipments to a project.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix P (Metric) Units

BITUMINOUS SEAL COAT
Section 2307

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➔
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates (4125)	Quality	AS 209												
Emulsions/Cutbacks	Quality	AS												
Emulsion & Aggregate	Compatibility	349	DME	1/ source	1 L & 5 kg	DME/ CTRL								
GRADE INSPECTION														
Aggregate	Quality Gradation	301 Cert D						V	DME	1/proj.	22 kg	CTRL		
Emulsion [1]	Quality Residue Compatibility	Cert D 323, 360 349	RCE ➔ RCE	1/75000 L 1st Day + 1/ week	1 L 1 L & 5 kg	DME DME		V	DME	1/proj.	4 L	CTRL		Log all shipments Plastic bottle only
Cutback	Quality Viscosity Anit-Strip	Cert D 323, 329 AB 323, 374	 RCE	1/75000 L	1 L	DME		V	DME	1/proj	1 L	CTRL		

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Note: (1) Poymer-modified emulsions are not normally accepted on the basis of certification; prior approval must be obtained from the DME before beginning shipments to a project.

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix T (U.S.) Units

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates Fine (4110)		AS 209												
Aggregates Coarse (4115)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Curing Compound (4105)	Lab Tested	405												
Air Entraining Admixture (4103)	Quality	AB 403												
Granular Backfill	Gradation Quality	AS CERT AS CERT												
Drain Tubing	Quality	AS 443												
Epoxy Grout		AB 491.11												
Joint Seal (4136.02)	Lab Tested	436.01 AB 436.02												
Backer Rod (4136.02)		AB 436.04												
Steel Reinforcing	Quality	AS 451												

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregates-Coarse (4115)	Grad	302 306 336	CONTR	3/lot	I.M. 301	CONTR		CORR	CONTR	1st day +10%	IM 301	RCE		
	Moist	308	CONTR	1 / half day	1000 gm	CONTR								
	Sp. Gr.	307	CONTR	I.M. 527	1000 gm	CONTR								
	Quality	AS 209												
Aggregate- Fine (4110)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	CORR	CONTR	1st day+10%	IM 301 IM 301	RCE		
	Moisture	➠ 308, 528	CONTR	1/lot	1000 gm	CONTR	830211							See IM 528 if Moisture Probe is used
	Sp. Gr.	307	CONTR	IM 528	1000 gm	CONTR	830211							
	Quality	AS 209												
Portland Cement (4101)	Quality	AS CERT D		Each Load										
Fly Ash	Quality	AS CERT D		Each Load										
Air Entraining Admixture		AB 403	➠ DME	1/lot	1 pt	CTRL								Sample lots not previously reported or as directed by DME
Water Reducing Admixture		AB 403	➠ DME	1/lot	1 pt	CTRL								
Retarding Admixture		AB 403	➠ DME	1/lot	1 pt	CTRL								

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

Cert A-Type A Certification
Cert B-Type B Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

ASSUR-Independent Assurance
VERIF-Verification
CORR-Correlation
MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix T (U.S.) Units

October 2, 2001
Supersedes April 3, 2001

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Plastic Concrete	Air Slump	318 327 318 327	RCE RCE	2/half day 2/half day		RCE RCE	830224 830224							
Reinforcing Steel Epoxy-Coated Steel	Quality Quality	AS 451 AS 451		Each Shipment										
Calcium Chloride	Concentr.	373	RCE	1/lot		RCE								
Asphalt Mixes Hardened Conc. Smoothness	➽ ➽												➽	Approval by DME See Plans/Specs for exclusions

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Matls. I.M. 204
Appendix T (Metric) Units

October 2, 2001
Supersedes April 3, 2001

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregates Fine (4110)		AS 209												
Aggregates Coarse (4115)		AS 209												
Portland Cement (4101)	Quality	AS 401												
Fly Ash (4108)	Quality	AS 491.17												
GGBFS(Ground Granulated Blast Furnace Slag)	Quality	AS 491.14												
Curing Compound (4105)	Lab Tested	405												
Air Entraining Admixture (4103)	Quality	AB 403												
Granular Backfill	Gradation Quality	AS CERT AS CERT												
Drain Tubing	Quality	AS 443												
Epoxy Grout		AB 491.11												
Joint Seal (4136.02)	Lab Tested	436.01 AB 436.02												
Backer Rod (4136.02)		AB 436.04												
Steel Reinforcing	Quality	AS 451												

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Matls. I.M. 204
Appendix T (Metric) Units

October 2, 2001
Supersedes April 3, 2001

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
PLANT INSPECTION														
Aggregates-Coarse (4115)	Grad	302 306 336	CONTR	3/lot	I.M. 301	CONTR		CORR	CONTR	1st day +10%	IM 301	RCE		
	Moist	308	CONTR	1 / half day	1000 gm	CONTR								
	Sp. Gr.	307	CONTR	I.M. 527	1000 gm	CONTR								
	Quality	AS 209												
Aggregate- Fine (4110)	Gradation	302, 306 336	CONTR	3/lot	IM 301	CONTR	830211	CORR	CONTR	1st day+10%	IM 301 IM 301	RCE		
	Moisture	➽ 308, 528	CONTR	1/lot	1000 gm	CONTR	830211							See IM 528 if Moisture Probe is used
	Sp. Gr.	307	CONTR	IM 528	1000 gm	CONTR	830211							
	Quality	AS 209												
Portland Cement (4101)	Quality	AS CERT D		Each Load										
Fly Ash	Quality	AS CERT D		Each Load										
Air Entraining Admixture		AB 403	➽ DME	1/lot	0.5 L	CTRL								Sample lots not previously reported or as directed by DME
Water Reducing Admixture		AB 403	➽ DME	1/lot	0.5 L	CTRL								
Retarding Admixture		AB 403	➽ DME	1/lot	0.5 L	CTRL								

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix T (Metric) Units

BASE REPAIR (2212)
PAVEMENT REPAIR (Patches)
Sections 2529 and 2530

October 2, 2001
Supersedes April 3, 2001

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➻
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Plastic Concrete	Air Slump	318 327 318 327	RCE RCE	2/half day 2/half day		RCE RCE	830224 830224							
Reinforcing Steel Epoxy-Coated Steel	Quality Quality	AS 451 AS 451		Each Shipment										
Calcium Chloride	Concentr.	373	RCE	1/lot		RCE								
Asphalt Mixes Hardened Conc. Smoothness	➻ ➻												➻	Approval by DME See Plans/Specs for exclusions

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix U (U.S.) Units

GRANULAR SHOULDERS
Section 2121

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➠
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregate (4120.02)	Gradation Quality	AS 209												
Aggregate (Paved Shoulder Fillets) (4120.07)	Gradation Quality	AS 209												
GRADE INSPECTION														
Dimensions	Thickness Width Cross Section	Template	RCE	3/mile 3/mile 3/mile		RCE	Field Book							
Aggregate (Paved Shoulder Fillets)	Gradation	Certification												

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix U (Metric) Units

GRANULAR SHOULDERS
Section 2121

October 3, 2000
Supersedes April 25, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Aggregate (4120.02)	Gradation Quality	AS 209												
Aggregate (Paved Shoulder Fillets) (4120.07)	Gradation Quality	AS 209												
GRADE INSPECTION														
Dimensions	Thickness Width Cross Section	Template	RCE	2/km 2/km 2/km		RCE	Field Book							
Aggregate (Paved Shoulder Fillets)	Gradation	Certification												

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Matls. I.M. 204
Appendix V (U.S.) Units

SUBDRAINS
Section 2502

April 25, 2001
Supersedes October 3, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➸
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Drain Tubing (4143)	Quality	AS 443												
Rodent Guard (4143.01)		AB 443.01												
Subdrain Outlet (4143)		AS												
Porous Backfill (4131)	Quality Gradation	AS 209												
Granular Backfill (4133)	Quality Gradation	AS 209												
Class A (Outlets) (4120.04)	Quality Gradation	AS 209												
GRADE INSPECTION														
Drain Tubing (4143)	Quality	AS Cert		Each Shipment			Field Book	MON ➸	RCE	1/project	3-5-foot pcs.	CTRL		Sample for projects over [redacted] ft. only
Engineering Fabric (4196)		AS 496.01												
Subdrain Outlet	Quality	AS Cert												
Porouis Backfill (4131)	Gradation	AS Cert		Each Shipment										
Granular Backfill (4133)	Gradation	AS Cert		Each Shipment										
Class A (Outlets) (4120.04)	Gradation	AS Cert		Each Shipment										
Metal Posts (4154.09)		Visual	RCE											

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

Cert A-Type A Certification
Cert B-Type B Certification
Cert C-Type C Certification
Cert D-Type D Certification

RCE-Resident Construction Engineer/Project Engineer
DME-District Materials Engineer
CTRL-Central Materials Office
CONTR-Contractor

ASSUR-Independent Assurance
VERIF-Verification
CORR-Correlation
MON-Monitor

Sampling and Testing Guide-Minimum Frequency

Matls. I.M. 204
Appendix V (Metric) Units

SUBDRAINS
Section 2502

April 25, 2001
Supersedes October 3, 2000

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION AND VERIFICATION S&T						REMARKS ➽
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
SOURCE INSPECTION														
Drain Tubing (4143)	Quality	AS 443												
Rodent Guard (4143.01)		AB 443.01												
Subdrain Outlet (4143)		AS												
Porous Backfill (4131)	Quality Gradation	AS 209												
Granular Backfill (4133)	Quality Gradation	AS 209												
Class A (Outlets) (4120.04)	Quality Gradation	AS 209												
GRADE INSPECTION														
Drain Tubing (4143)	Quality	AS Cert		Each Shipment			Field Book	MON ➽	RCE	1/project	3-2m pcs.	CTRL		Sample for projects over [redacted] ft. only
Engineering Fabric (4196)		AS 496.01												
Subdrain Outlet	Quality	AS Cert												
Porouis Backfill (4131)	Gradation	AS Cert		Each Shipment										
Granular Backfill (4133)	Gradation	AS Cert		Each Shipment										
Class A (Outlets) (4120.04)	Gradation	AS Cert		Each Shipment										
Metal Posts (4154.09)		Visual	RCE											

AS-Approved Source AB-Approved Brand ASD-Approved Shop Drawing S&T-Sampling & Testing	Cert A-Type A Certification Cert B-Type B Certification Cert C-Type C Certification Cert D-Type D Certification	RCE-Resident Construction Engineer/Project Engineer DME-District Materials Engineer CTRL-Central Materials Office CONTR-Contractor	ASSUR-Independent Assurance VERIF-Verification CORR-Correlation MON-Monitor

Matls. I.M. 204
Appendix W (U.S.) Units

April 25, 2001
Supersedes October 3, 2000

Sampling and Testing Guide-Minimum Frequency
WATER POLLUTION CONTROL
EROSION CONTROL **(New)**

Section 2525, 2601

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION) AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
GRADE INSPECTION														
Seeds 4169.02		Cert A												
Fertilizer 4169.03		AS 469.03												
Inoculant 4169.04		Seed Manufacturer Recommendation												
Sticking Agent		Manufacturer Recommendation												
Sod 4169.07		Visual				RCE	Field Book							
Mulch 4169.07		Visual				RCE	Field Book							
Stakes for Sod		Visual				RCE	Field Book							
[redacted] mesh 4169.10a		Visual				RCE	Field Book							
Wire Staples 4169.10b		Visual				RCE	Field Book							
[redacted] Excelsior Mat 4169.10c		Visual				RCE	Field Book							
Engineering Fabrics		Cert D I.M. 496.01					Field Book							
Silt Fence Wire and Posts (Std. Rd. Plan RC-16)		Visual				RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

Matls. I.M. 204
Appendix W (Metric) Units

April 25, 2001
Supersedes October 3, 2000

Sampling and Testing Guide-Minimum Frequency

WATER POLLUTION CONTROL

EROSION CONTROL **(New)**

Section 2525, 2601

MATERIAL OR CONSTRUCTION ITEM	TESTS	METHOD OF ACCEPTANCE AND RELATED IMS	QC/ACCEPTANCE S&T					ASSURANCE, CORRELATION) AND VERIFICATION S&T						REMARKS
			SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	S&T TYPE	SAMPLE BY	FREQ.	SAMPLE SIZE	TEST BY	REPORT	
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Inoculant 4169.04		Seed Manufacturer Recommendation												
Sticking Agent		Manufacturer Recommendation												
Sod 4169.07		Visual				RCE	Field Book							
Mulch 4169.07		Visual				RCE	Field Book							
Stakes for Sod		Visual				RCE	Field Book							
[redacted] mesh 4169.10a		Visual				RCE	Field Book							
Wire Staples 4169.10b		Visual				RCE	Field Book							
[redacted] Excelsior Mat 4169.10c		Visual				RCE	Field Book							
Engineering Fabrics		Cert D I.M. 496.01					Field Book							
Silt Fence Wire and Posts (Std. Rd. Plan RC-16)		Visual				RCE	Field Book							

AS-Approved Source	Cert A-Type A Certification	RCE-Resident Construction Engineer/Project Engineer	ASSUR-Independent Assurance
AB-Approved Brand	Cert B-Type B Certification	DME-District Materials Engineer	VERIF-Verification
ASD-Approved Shop Drawing	Cert C-Type C Certification	CTRL-Central Materials Office	CORR-Correlation
S&T-Sampling & Testing	Cert D-Type D Certification	CONTR-Contractor	MON-Monitor

NOTES

AGGREGATE SAMPLING METHODS AND DETERMINATION OF MINIMUM SIZE OF SAMPLES FOR SIEVE ANALYSIS

SCOPE

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

LOCATION FOR SAMPLING

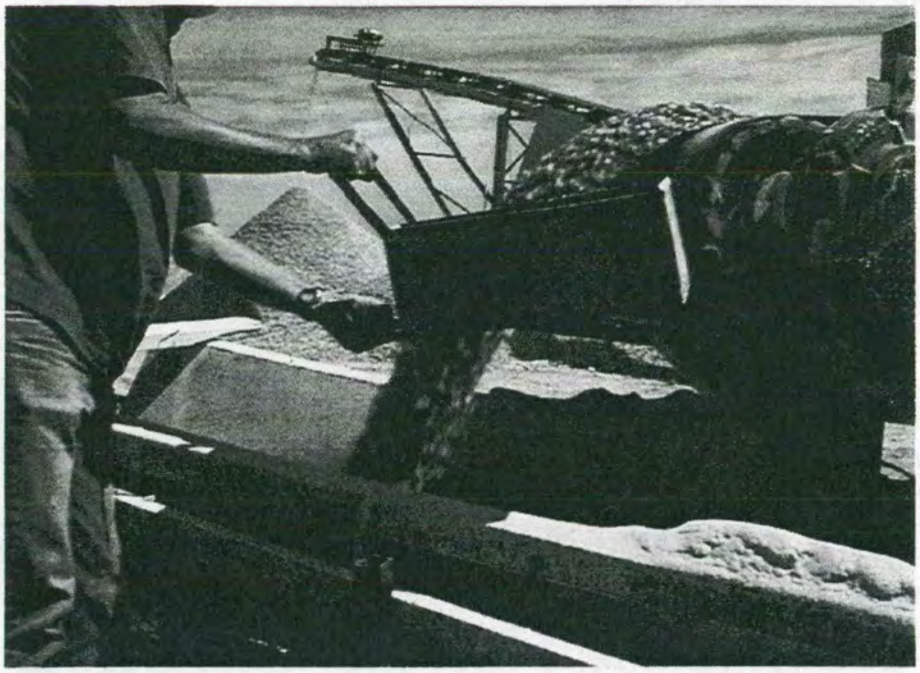
To help ensure representative samples are taken, one of the following methods will be used for obtaining aggregate samples:

1. Conveyor Belt/Template Method

To obtain an off-the-belt sample: stop the belt, insert a template (as illustrated in the pictures below) at three or more separate locations along the belt, remove all material within the template, and combine it into the sample. In belt sampling, the ends of the template should be spaced just far enough apart to get an increment approximately one-third the minimum mass (weight) of the sample. If the template does not yield the minimum size of sample in three locations, additional locations will be necessary. No less than three separate locations should be used in obtaining one 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 only, or as directed by the Transportation Center 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 aggregate should be avoided. If it becomes absolutely necessary to obtain a sample from a stockpile, consult the Transportation Center Materials Engineer to help devise an adequate and proper sampling plan.

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 maximum size of the product and the intended use. The following table lists the required minimum field sample and test sample sizes based on the smallest sieve through which at least 95% of the sample will pass.

SIEVE SIZE	FIELD SAMPLE (kg/lbs.)	TEST SAMPLE (kg/gms)
37.5 mm (1½ in.)	23.0/50	5.0/5,000(2)
25.0 mm (1 in.)	13.5/30	3.5/3,500
19.0 mm (¾ in.)	9.0/20	2.0/2,000
12.5 mm (½ in.)	9.0/20	1.5/1,500
9.5 mm (⅜ in.)	4.5/10	1.0/1,000(1)
4.75mm (#4 sieve)	4.5/10	.5/500
2.36mm (#8 sieve)	4.5/10	.2/200

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

(1) When testing fine aggregate for PC Concrete, the minimum test sample is 500 grams.
(2) When testing 1 1/2" aggregate for Special Backfill or Granular Subbase, the minimum test sample is 2500 grams.

NOTES

SECTION III
AGGREGATE PROPERTIES AND CHARACTERISTICS

Ideally, construction aggregates should be composed of durable, abrasion-resistant particles free of any deleterious or objectionable materials such as clay, shale, coal, organic matter, etc. Their specific gravities and absorptions are important when they are incorporated into Portland cement or asphaltic concrete mixes.

Aggregate Production Problems

Three common problems occur during the production phase and also at the time of use. These are SEGREGATION, DEGRADATION, and CONTAMINATION. When any of these conditions occur, it will affect the performance of the aggregate for its intended use and may lessen the design life of the project.

Stockpile segregation

Segregation will occur anytime an aggregate is handled, and is especially predominate during construction of the stockpile. When a stacker conveyor is used, the finer (smaller) material will normally congregate in the center of the pile. The larger particles will tend to roll to the outside of the pile. As material is fed out of the stockpile, gradation variation is likely to occur.

When using a stacker conveyor, a helpful technique is using a movable stacker capable of building the stockpile in lifts. If the stacker is set too high, segregation will still occur. Some materials, such as "recycled asphalt paving" (RAP), have specifications controlling the height of individual lifts during stockpile construction.

Truck dumping is another common method of stockpile construction. With some less critical aggregates, this is usually accomplished with trucks running on the stockpile to make additional lifts. This method can result in degradation (breakdown) of the material as the trucks drive across the stockpile. Also, as the height of the stockpile increases, aggregate dumped close to the edge will segregate, with the coarser material rolling down the outside of the stockpile. Multiple lift truck stockpile construction of more critical aggregates, such as aggregate intended for use in paving, should be avoided.

Using a dozer to construct a stockpile is not recommended, especially with an aggregate prone to degradation. When a dozer is used, it normally forms ramp areas that are used over and over, tending to grind the aggregate under the tracks.

When loading material from a stockpile using an end loader, it is best to work along the entire vertical face of the pile. Done properly, this tends to equalize the coarse and fine areas of the stockpile, minimizing the segregation.

Contamination can easily happen during stockpiling. Material of one type may mistakenly be dumped into the wrong stockpile, contaminating both products. Different materials stockpiled too close to each other tends to lead to contamination where the stockpiles adjoin. Stockpiles should be constructed on sound bases to help eliminate contamination during the load-out process. Sometimes loader operators get too low when loading-out, or the bases may soften during the spring thaw or wet periods, increasing the danger of contamination from mud or dirt.

A good inspector should be alert to segregation, degradation and contamination and take steps to correct the problem before the effected material can be incorporated into the project.

Deleterious Material

It is very important that the aggregate be kept clean and free from deleterious substances. For this reason, the specifications limit the amount of deleterious substances that can be present. Shale, coal, chert, and other lightweight particles tend to float in a PC concrete mix.

Im 344

Resistance to Abrasion

Abrasion is the mechanical wearing away of aggregate particles by friction and impact. Aggregates with low resistance to abrasion will readily wear away when used as surfacing materials or when exposed in pavement surfaces. They also degrade with handling. Excessive handling of aggregates with low resistance to abrasion can result in their containing relatively high percentages of fine material, often above the maximum level specified for the 75μm (#200) sieve for the particle aggregate involved.

Abrasion Test using steel balls

Los Angeles Abrasion Test

Resistance to abrasion is determined by the use of the Los Angeles Abrasion Machine, a cylindrical drum mounted on a horizontal shaft. A specified weight of coarse aggregate is placed in the machine along with a specified number of standard steel balls, the abrasive charge. After rotation at 30-33 rpm for 500 revolutions, the percentage of the aggregate sample that has been abraded to pass 1.70 mm (#12) sieve is reported as the loss due to abrasion, the percentage of wear.

Natural gravels will generally develop wear losses of 20% to 35% when tested for abrasion resistance. Crushed limestone aggregates will generally develop wear losses of 30% to 45%. Losses of 45% or more are commonly accepted to be indicative of aggregates with poor resistance to abrasion.

Durability and Soundness

These two terms are very similar in meaning and are often used interchangeably. The durability of an aggregate or other material is a measure of its ability to perform satisfactorily over an extended period of time. Soundness of an aggregate is a measure of its ability to resist the detrimental effects of exposure to natural forces.

Durability
Class 2
Class 3
Class 3i

Durability

Aggregate related deterioration can lead to the premature failure of our Portland Cement Concrete (PCC) highways. Durability is done only for **coarse aggregate** for use in PCC. The designations of Class 2, Class 3, and Class 3i durability are used. The best method to determine durability class is to observe the performance of a concrete pavement that was constructed with the coarse aggregate in question. If the pavement has performed satisfactorily for 20 years, it is a Class 3 durability. Class 3i durability aggregates must perform satisfactorily for up to 30 years in interstate class highways.

When a pavement performance history is not available, we have relied on ASTM Designation C666, Method B to make laboratory determination of the durability class. This consists of a series of 300 freeze and thaw test cycles on a concrete specimen and takes approximately 6 months to complete.

Much of an aggregate's ability to perform in PCC is a function of the pore spaces between the mineral grains. These voids can be thought of as both large pores connected to a smaller, or capillary, pore system. It has been determined that aggregates with extensive capillary pore systems are subject to durability problems due to failure after repeated freeze and thaw cycles.

Durability Test-Sound wave machine with prepared samples (concrete cubes with brass plugs on each end). Sound wave is transmitted through each cube before subjecting the sample to 300 F&T cycles and that reading is compared to first reading. If the coarse aggregate used in the sample tends to be susceptible it will crack during the process and the second sound wave will indicate how much aggregate was affected.

A unique apparatus was designed and constructed by the Iowa DOT Materials Laboratory personnel which measures the pore system of an aggregate particle in a relatively simple, quick and environmentally safe test. the test is referred to as the "Iowa Pore Index Test". This test, in conjunction with chemical analysis, has largely taken the place of the ASTM C666 test method in Iowa.

Chemical testing is a rapid way to evaluate the salt-susceptibility of carbonate aggregates by directly measuring aggregate properties that were being determined by indirect physical test. X-ray fluorescence (XRF), X-ray diffraction (XRD), and Thermongravimetric analysis (TGA), along with the Iowa pore index test, is used to generate an overall quality number.

•X-ray fluorescence (XRF) provides an elemental analysis used to calculate oxide percents.

•X-ray diffraction (XRD) determines mineralogy and is used primarily to determine purity of dolomite crystals.

•Thermogravimetric analysis (TGA) determines grain and crystallite size and some mineralogy.

The ASTM test takes approximately 6 months to complete. Chemical testing can normally be completed in one week, and through years of in-house research, has proven to be a more reliable method to predict the aggregate's durability.

Soundness

Through the chemical testing research, an alternative method of predicting a coarse, carbonate aggregate's resistance to freeze and thaw cycles has been developed. It is suspected that the principle cause of aggregate failure is due to the clay content of the stone. Because clays are aluminosilicate minerals, the amount of alumina in the

X-ray fluorescence

aggregate will be a measure of the clay content in the stone.

We use this test as a screening method for carbonate aggregates. If an aggregate sample fails the alumina content specification (Al_2O_3), the 'A' freeze and thaw test will be performed to determine compliance. The alumina test does not indicate other characteristics such as the presence of soft oolites, which could cause 'A' F & T non-compliance.

Method of Test for Determining the Soundness of Aggregates by Freezing and Thawing

Test samples of coarse aggregate are alternately frozen and thawed for a prescribed number of cycles-16 in Method "A" for higher quality requirements, and 25 cycles in Method "C" for lower quality requirements. In both methods, the percentage passing the 2.36 mm (#8) sieve, computed to a clean dry weight basis, is reported as the soundness loss.

how much clay in material

Method "A": 0.5% methyl alcohol is added to water in which the sample is immersed for thawing. This test is particularly severe on limestone aggregates that contain 5% or more of insoluble material in the clay or silt-size particle range. Generally, this is also the limestone that fails to perform well when the use of sound stone is required.

Method "C": Test samples are thawed in water only. Freezing and thawing in water is not particularly severe, hence 25 cycles are required on this test while only 16 cycles are required when the water-alcohol solution is used. Any reasonably clean, coarse aggregate will perform well in this test and it is used for all materials, which do not require high quality aggregates.

Freezer for Freeze-Thaw Test

Freeze-Thaw Test

Specific Gravity

Specific Gravity is a property that can be determined for all materials and is important for the aggregate inspector to understand. Simply defined, specific gravity is the relative density of a material to water, or the number of times heavier a material is than water.

The specific gravity of aggregate to be used in a Portland cement concrete (PCC) mix is determined, at time of use, by the Pycnometer Method in Iowa. This method is described in I.M. 307, included in this manual, and personnel performing this test must possess a Level II Aggregate Certification.

Specific Gravity Jars

PCC mix designs are based on volumetrics, which, for the aggregate portion of the mix, requires that the amount of each of the aggregates to be incorporated, per cubic yard of mix, be based on the "saturated surface-dry"(SSD) weight of the individual material.

SSD is defined as neither absorbing water from, nor contributing water to the concrete mix. The aggregate particles have all the moisture they can absorb with no "free" moisture on the particle surfaces.

The bulk SSD specific gravity of each aggregate must be known to determine the correct amount of each aggregate needed in the PCC mix. The specific gravity of the aggregate is normally determined from a series of tests performed on samples obtained during the production phase of each aggregate. Most aggregate sources have a uniform specific gravity as long as production practices stay consistent. Sources, which may have variable specific gravities, will usually be designated with a "DWU" (determined when used) in the T-203 source instructional memorandum.

The specific gravity test performed at time of use (the plant site) is for verification purposes and to figure moisture percentages. The specific gravity to be used in determining batch weights is the one listed in the T-203. When the source indicates it is a "DWU", the plant technician is to call the appropriate District Materials office for the current specific gravity.

The test results by the plant inspector at time of use should be within 0.020 of the intended specific gravity. If the result is not within this tolerance, the plant inspector should rerun the test. If the result is still not in conformance, the plant inspector is to notify the District Materials office for investigation.

Aggregate Moisture

The amount of individual aggregates used in a Portland cement concrete mix is determined in the design process based on the **Saturated-Surface-Dry** weight of the material. Terms used to describe the moisture content of aggregate are as follows:

- **Oven-dry (or constant-dry weight)** – containing no surface or internal moisture.
- **Air-dry** – dry at the particle surface but containing some internal moisture – this is somewhat absorbent.
- **Saturated-Surface-Dry** – an ideal condition in which the aggregate can neither absorb nor contribute water. In this condition, the interior has absorbed all the moisture it can hold, but the surface is dry.
- **Damp or Wet** – containing moisture on the particle surface.

The free moisture present in aggregates must be accounted for when used in a Portland Cement Concrete mix. Aggregates containing free moisture carry that moisture into the mix during the batching process. If corrections are not made, the weight of the individual aggregates containing this moisture will result in aggregate under yielding, that is, less aggregate in the mix than is required in the mix design. This "extra" water will also affect the water/cement ratio.

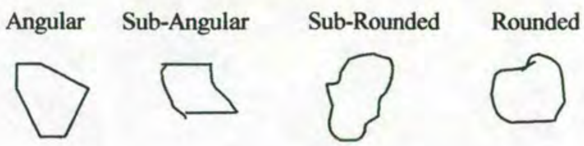
An aggregate particle's internal structure is made up of solid matter and voids that may or may not contain water. Sometimes the aggregates to be used may be in an "absorbent" condition, which means that during the batching process, the aggregates will actually absorb some of the mix water, resulting in a mix drier than intended, with more aggregate by weight than designed. Iowa specifies that a stockpile of <u>coarse</u> aggregate having absorption of 0.5% or more shall be wetted and allowed to drain for at least 1 hour before use in the PCC mix. Fine aggregate, which is normally washed during the production phase, must be allowed to drain at least 24 hours before use in the mix. Also, at the time of use, aggregates must be handled in a manner that sill prevent variations of more than 0.5 percent in moisture content of successive batches. The plant operator is responsible to devise remedial measures. The moisture content is normally determined in Iowa by the pycnometer method when tested at the time of use (I.M. 308, included in this manual). Personnel performing this test must have a valid Iowa Level II Aggregate certification. If water can be observed draining or dripping from any individual aggregate moisture sample, the moisture content cannot be measured successfully with the pycnometer, nor can it be uniformly controlled in the proportioning process. The moisture content must be allowed to stabilize (drain) before using the affected aggregate.

Unit Weight

Unit weight is a ratio of weight to volume, such as kilograms per cubic meter square. Unit weight is not a measure of quality, but it is useful in converting weights of material to volumes. See ASTM Designation C29.

Shape and Surface Texture

Particle shape of either coarse or fine aggregate may be angular, sub-angular, sub-rounded, or rounded.



Aggregate particles should ideally be equal dimensionally and free of excessive amounts of flat and elongated pieces. Long, slender aggregate pieces should be avoided. The shape of aggregate particles many times depends on the type of crusher used in the processing operation.

Particle shape and surface texture have a definite bearing on the quality of the finished product. Base courses composed of angular particles will compact and key together to form a dense, tight base, while elongated and rounded particles will slide and roll without compacting.

On the other hand, rounded particles tend to make plastic concrete. The texture of aggregate particles is normally defined in the following sequence: lithographic, sub-lithographic, fine-grained, medium grained, and coarse grained. Lithographic and fine-grained particles are polished quite easily by normal traffic wear and in time become a maintenance problem.

Gradation

Gradation is the particle size distribution of aggregates determined by using sieves with square openings. As an aggregate is moved or handled, there is tendency for the particle sizes to separate. This separation is known as segregation. Limits are usually specified for the percentage of material passing each sieve. There are several reasons for specifying grading limits and maximum aggregate size. Deviations from the grading limits seriously affect the uniformity of finished work.

Gradation-*Describes the various sizes of aggregate particles in terms of percentage passing or a percentage retained on a set of standardized square sieves.*

Dense Graded Aggregate:

Dense graded aggregates contain a proportion of material in each particle size present so as to minimize the void spaces between particles.

Gap Graded Aggregate:

Gap or open-graded aggregates contain too great an amount of particles of nearly the same size. This produces an open-type mixture with large void spaces. There are not enough of the smaller sizes to fill the voids between the larger sizes.

Plasticity Index:

The plasticity index of an aggregate is determined in order to determine the presence and relative activity of contained clay minerals. In Iowa, the Atterberg test (Iowa Test Method 109-A) is used to determine the Plasticity Index (P.I.) of a soil. The P.I. is directly related to the amount of clay in a material and is determined by subtracting the plastic limit from the liquid limit.

The Liquid Limit (L.L.) is that water content, expressed in percent dry weight, at which the material passes from a plastic to a liquid state. In general, it is determined by adding water to a portion of the minus 425 mm (#40) sieve size material until a certain consistency is reached.

After at least 15 minutes of aging in a humidity chamber, a small amount is transferred to a special pan on top of an L.L. machine. A groove is made through the middle of the sample on the pan, separating the two halves by a fraction of an inch. The number of "drops" needed to bring a portion of the two halves back together is used to determine if the proper amount of water was initially added. If the initial amount of water was wrong, the sample is re-mixed and re-ran. The final sample is then weighed, dried, and again added, as well as the weight of the original grooved samples.

The Plastic Limit (P.L.) is that water content expressed in percent dry weight, at which the material passes from a semi-solid state to a plastic state. Generally, it is determined by adding water to a portion of the minus 425 mm (#40) sieve size material and then rolling it between the palm of the hand and a clean dry table. If the "threads" reach 3.175 mm (1/8 in.) diameter without breaking, they are remade into balls and rolled again. When the balls cannot be made to reach the 3.175 mm (1/8 in.) diameter thread size without breaking, they are placed in a pan for weighing, drying, and re-weighing to determine the weight of the threads.

Summary-Aggregates

For the most purposes, aggregates must conform to certain requirements and should consist of clean, hard, strong, and durable particles free of chemicals, coatings of clay, or other fine materials that may affect construction.

Weak, friable, or freeze-thaw susceptible aggregate particles are undesirable for normal open highway construction. Aggregate containing natural shale or shale particles, soft and porous particles, and certain types of chert should be especially avoided since they have poor resistance to weathering. Visual inspection may often disclose weaknesses in coarse aggregates.

NOTES

Section IV

Sieve Analysis

General Requirements

Aggregate sieve analysis procedures are governed by the Standard Specifications of the Iowa Department of Transportation and the Materials Office Instructional Memorandum Manual. The applicable test methods in the Materials Manual are included primarily in the 300 series under the subsection "Aggregate."

Sieve analysis is nothing more than the separation of a material based on particle size. For example, material that passes a 38.1 mm (1 ½ in.) sieve and is retained on a 25.4 mm (1 in.) sieve would not contain any particle larger than 38.1 mm (1 ½ in.) nor smaller than 25.4 mm (1 in.). Sieves are normally arranged in a "nest" with the largest wire opening at the top of the nest and the smallest at the bottom.

Iowa Department of Transportation Standard Specifications normally set limits on the percent passing a given sieve. The percent of the total weight retained on each sieve must be found first.

Coarse Aggregate Sieves

SI Units	US Units
37.5 mm	1 ½ inch
25.0 mm	1 inch
19.0 mm	¾ inch
12.5 mm	½ inch
9.50 mm	3/8 inch
4.75 mm	No. 4 (0.187 inch)

Fine Aggregate Sieves

SI Units	US Units
4.75 mm	No. 4 (0.187 in.)
2.36 mm	No. 8 (0.0937 in.)
1.18 mm	No. 16 (0.0469 in.)
0.600 mm	No. 30 (0.0234 in.)
0.300 mm	No. 50 (0.0117 in.)
0.150 mm	No. 100(0.0059 in.)

To calculate percent retained on any sieve, merely divide the weight retained by the original dry weight of the sample and multiply by 100. The percent passing each sieve is then determined from the percent-retained column.

$$\textit{\textbf{Percent retained}} = \frac{\text{Weight retained}}{\text{Original Dry Weight}} \times 100$$

NOTES

METHODS OF REDUCING AGGREGATE FIELD SAMPLES TO TEST SAMPLES

SCOPE

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

PROCEDURE

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

I. SPLITTING METHOD

A. Apparatus

1. Sample splitter (conforming to equipment requirements of AASHTO T248-95).
2. Three catch pans
3. Wide, flat-edged scoop

B. Sample Preparation

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

C. Test Procedure

1. Place the field sample on a hard, clean surface, such as a counter-top, concrete floor, or in a large, flat pan.
2. Thoroughly mix the field sample until it appears homogenous.
3. Place a catch pan under the chutes on each side of the splitter.
4. Place increments of the field sample on the wide, flat-edged scoop and uniformly distribute it from edge to edge, so when it is introduced into the chutes, approximately equal amounts will flow through each chute.

METHOD OF TEST SIEVE ANALYSIS OF AGGREGATES

SCOPE

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

PROCEDURE

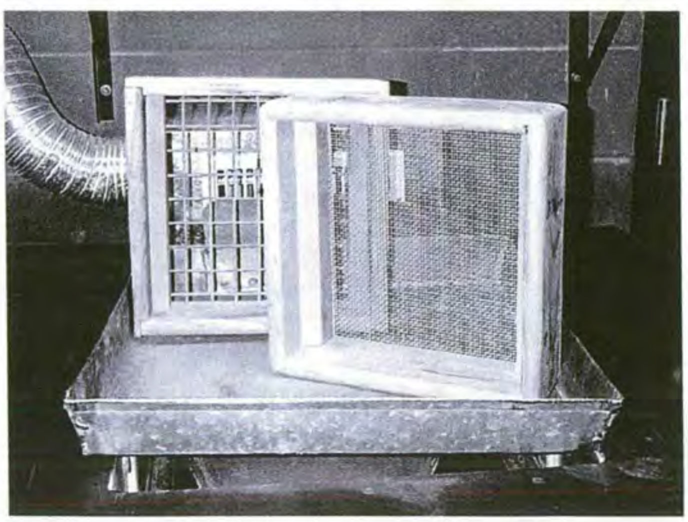
A. Apparatus

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

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

   Box Sieves for testing coarse aggregates consisting of the following sizes:

37.5 mm (1½-in.)	19 mm (¾-in.)	4.75 mm (#4)
25 mm (1-in.)	12.5 mm (½-in.)	2.36 mm (#8)
	9.5 mm (⅜-in.)	



203 mm (8 in.) Diameter Sieves for testing fine aggregates consisting of the following sizes:

4.75 mm (#4)	1.18 mm (#16)	150 µm (#100)
2.36 mm (#8)	600 µm (#30)	75 µm (#200)
	300 µm (#50)	Pan

A set of **305 mm (12 in.) Diameter Sieves** may be used for testing fine aggregate or aggregate containing both coarse and fine material.

3. Mechanical and hand-powered sieve shakers

4. Drying oven or stove

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

B. Test Sample

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

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

C. Preparation of Sample

1. When a determination of the amount of material passing the 75 µm (#200) sieve is required, the test sample must first be subjected to Materials I.M. 306, Method of Test for Determining the Amount of Material Finer Than the 75 µm (#200) Sieve. Coarse aggregates may have a *separate* "wash" sample of the appropriate size (per I.M. 306) *reduced* from the remaining portion of the field sample, per I.M. 336.

2. Coarse aggregates which have changes in moisture for different particle sizes must be dried to a constant mass (weight). When the absorbed moisture stays essentially the same for different particle sizes the sample may be sieved at a surface-dry condition (no free water present).

   NOTE: Material from crushed composite (AC/PC) pavements shall be sieved at a surface-dry condition using no artificial heat. No gradation determination will be made for material finer than the 2.36 mm (#8) sieve. In some instances, larger particles may be coated to the extent that dry sieving will not accurately reflect the true gradation of the material. In these instances, the air-dried sample must be washed over the 2.36 mm (#8) sieve and allowed to come to a surface-dry condition by air-drying. The total percent passing this sieve is the sum of the washing loss and pan after dry sieving divided by the original (air) dry/mass (weight). Coated particles may also be a problem with some virgin aggregate material (e.g., Class D crushed stone, etc.). When this condition exists, the material shall be dried to a constant mass (weight), washed over the smallest sieve for which there is a specification requirement, and dried again. The total percentage passing this sieve is a combination of the washing loss and the amount passing the sieve obtained by dry sieving the washed sample divided by the original dry mass (weight).

D. Test Procedure

1. Weigh and record the mass (weight) of the test sample as the Original Dry Mass.

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

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

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

a. On the 4.75 mm (#4) and larger sieves, limit the amount of material carried on the sieve to a single layer when determining sieving to completion.

b. Overloading of the 203 mm (8 in.) and 305 mm (12 in.) diameter sieves, 4.75 mm (#4) and smaller, must be avoided to allow for sieving to completion. The weights retained should not exceed the following:

203 mm (8 in.) diameter sieves		305mm (12 in.) diameter sieves	
4.75 mm (#4) and smaller	200 grams	4.75 mm (#4)	850 grams
		2.36mm (#8) and smaller	450 grams

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

c. When the aggregate being tested has a mixture of coarse and fine material, the portion of the sample finer than the 4.75 mm (#4) sieve may be distributed among two or more sets of sieves to prevent overloading of individual sieves. Alternately, the portion passing the 4.75 mm (#4) sieve may be reduced to a minimum of 500 grams using a mechanical splitter according to I.M. 336. If this procedure is followed, compute the mass (weight) of each size increment of the original sample as follows:

#4 to 4 places

$$A = \frac{W1}{W2} \times B$$

W1/W2 =

Where:

A = calculated mass (weight) of the material retained on each sieve based on the total sample mass (weight).

W1= mass (weight) of the total amount of material passing the 4.75 mm (#4) sieve.

W2= mass (weight) of the reduced, minus 4.75 mm (#4) sieve material.

B = mass (weight) of the reduced sample material retained on each sieve.

NOTE: This method is recommended when using 203 mm (8 in.) diameter sieves to test the fine aggregate portion of a sample when overload is anticipated. If using 305 mm (12 in.) sieves and the original test sample is reasonably close to the required mass (weight), overload should not occur. When sieve overload is anticipated on the 2.36 mm (#8) sieve only, sieve the original sample through the 2.36 mm (#8) box sieve before placing the fine portion in the nest of 203 mm (8 in.) round sieves.

3. Clean the retained material from each sieve for weighing. Remove as much material as practical without damaging the wire cloth. Particles may be removed most readily from a sieve by inverting the sieve over a pan and tapping the sieve by hand and/or pushing (without force) the particles out of the mesh into the pan. Care must be taken while cleaning the sieves, so no damage occurs to the wire mesh by bending or breaking the wires. A fiber-bristle brush should be used for cleaning the 1.18 mm (#16), 600 µm (#30), and 300 µm (#50) sieves. Do not use a brush or any external force on the wire cloth to attempt cleaning the 150 µm (#100), or 75 µm (#200) sieves. If clogging of the mesh occurs on these finer sieves, they should be sent to the District Materials Laboratory for cleaning.

4. Weight the fraction of material retained on each sieve and in the pan, to at least the nearest 0.5 gram and record. Total the mass (weight) of the material retained on the sieves and in the pan.

5. An accuracy check must be made comparing the mass (weight) of the material before sieving to the total mass (weight) after sieving. The total of the weights retained on the sieves and in the pan must be within 0.5 percent of the Original Dry Mass by washing.

When the percent finer than the 75µm (#200) sieve is not determined:

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

When the percent finer than the 75 µm (#200) sieve is determined by washing (IM 306):

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

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

E. Calculations

1. Divide the mass (weight) of the material retained on each sieve, and in the pan, by the Original Dry Mass (Weight) of the sample. When computing the percent retained of a **washed** sample the sum of the washing loss and pan mass

(weight) shall be divided by the Original Dry Mass (Weight). Computation shall be carried out to the nearest 0.1 percent when determining percent retained and the consequent percent passing.

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

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

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

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

EXAMPLE #1, COARSE AGGREGATE

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

Original Dry Mass:	5793	Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)				100.0	
25mm (1)		577	10.0	90.0	
19mm (¾)		1066	18.4	71.6	
12.5mm (½)		1446	25.0	46.6	
9.5mm (3/8)		1383	23.9	22.7	
4.75mm (4)		1082	18.7	4.0	
2.36mm (8)	(B)	141 (A)	2.4	1.6	
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)		0.8	
Wash		(A)	1.6		
Pan	(B)	93 (A)			
Total		5790	100.0		
Tolerance		99.9			

Wash Sample

Original Dry Mass:	2571.0
Dry Mass Washed:	2555.0
Washing Loss:	16.0

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)			0.8	
Wash	16.0	0.8		
Pan	4.0			

Date Reported:	Cert. No.:	
Tested By:		

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ______________________________

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:	Cert. No.:	
Tested By:		

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ______________________________

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

EXAMPLE #2, FINE AGGREGATE

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

Original Dry Mass:	594.0	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	591.5	Reduced Minus 4.75 mm (W2):	
Washing Loss:	2.5	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)				100.0	
4.75mm (4)		29.0	4.9	95.1	
2.36mm (8)	(B)	64.5 (A)	10.9	84.2	
1.18mm (16)	(B)	102.0 (A)	17.2	67.0	
600µm (30)	(B)	181.5 (A)	30.6 (30.7)	36.3	
300µm (50)	(B)	154.5 (A)	26.0 (26.1)	10.2	
150µm (100)	(B)	51.0 (A)	8.6	1.6	
75µm (200)	(B)	6.0 (A)	1.0	0.6	
Wash		2.5	0.6		
Pan	(B)	1.0 (A)			
Total		592.0	99.6 (100.0)		
Tolerance		99.7			

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ____________________

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ____________________

Fineness Modulus Calculation
for Concrete Sand (Grad. #1 – 4110)
AASHTO T27-93

Add the **cumulative** percents retained, starting with the largest sieve retaining any material thru the #100 (150µm) sieve. Divide this total by 100 and report the result to the nearest 0.01.

Example:

	Percent Retained	Cumulative Percent Retained
⅜" (9.5mm)	0	0
#4 (4.75mm)	3.6	3.6
#8 (2.36mm)	16.9	20.5
#16 (1.18mm)	19.6	40.1
#30 (600µm)	23.4	63.5
#50 (300µm)	26.1	89.6
#100 (150µm)	9.5	99.1

Total Accumulative Percent Retained = 316.4

316.4 ÷ 100 = 3.16 Fineness Modulus

3.9384

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

EXAMPLE #3, COMBINED AGGREGATE, 8" AND BOX SIEVES

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

4 places

Original Dry Mass:	2457.2	Total Minus 4.75 mm (W1):	2115.7
Dry Mass Washed:	2410.5	Reduced Minus 4.75 mm (W2):	537.2
Washing Loss:	46.7	Conversion Factor: W1 / W2	3.9384
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)				100.0	
19mm (¾)		14.6	0.6	99.4	
12.5mm (½)		45.9	1.9	97.5	
9.5mm (3/8)		81.0	3.3	94.2	
4.75mm (4)		154.0	6.3	87.9	
2.36mm (8)	57.6 (B)	226.9 (A)	9.2	78.7	
1.18mm (16)	93.0 (B)	366.3 (A)	14.9	63.8	
600µm (30)	176.3 (B)	694.3 (A)	28.3 (28.4)	35.4	
300µm (50)	172.5 (B)	679.4 (A)	27.6	7.8	
150µm (100)	32.7 (B)	128.8 (A)	5.2	2.6	
75µm (200)	3.9 (B)	15.4 (A)	0.6	2.0	
Wash		46.7	2.0		
Pan	0.8 (B)	3.2 (A)			
Total	536.8	2456.5	99.9 (100.0)		
Tolerance	99.9	100.0			

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:	Cert. No.:
Tested By:	

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ______________________________

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:	Cert. No.:
Tested By:	

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: ______________________________

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

EXAMPLE #4, COMBINED AGGREGATE, 12" SIEVES

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

Original Dry Mass:	2061.2	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	2011.4	Reduced Minus 4.75 mm (W2):	
Washing Loss:	39.8	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)				100.0	
19mm (¾)		26.8	1.3	98.7	
12.5mm (½)		80.7	3.9	94.8	
9.5mm (3/8)		55.1	2.7	92.1	
4.75mm (4)		182.7	8.9	83.2	
2.36mm (8)	(B)	229.7 (A)	11.2	72.0	
1.18mm (16)	(B)	362.8 (A)	17.7	54.3	
600µm (30)	(B)	610.5* (A)	29.8	24.5	
300µm (50)	(B)	377.1 (A)	18.4	6.1	
150µm (100)	(B)	72.2 (A)	3.5	2.6	
75µm (200)	(B)	10.2 (A)	0.5	2.1	
Wash		39.8	2.1		
Pan	(B)	3.4 (A)			
Total		2051.0	100.0		
Tolerance		100.0			

Wash Sample	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:	Cert. No.:
Tested By:	

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments: *The 600µm (30) sieve was overloaded. Sieving to completion was verified by hand sieving.

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:	Cert. No.:
Tested By:	

Note: For the 4.75mm (#4) sieve and smaller, a 203mm (8") sieve should retain no more than 200 grams, and a 305mm (12") sieve no more than 450 grams

Comments:

NOTES

METHOD OF TEST TO DETERMINE THE AMOUNT OF MATERIAL FINER THAN THE 75 µm (#200) SIEVE IN AGGREGATE

SCOPE

This test method outlines the procedure for determining the quantity of material finer than a 75 µm (#200) sieve by washing and dry sieving.

PROCEDURE

A. Apparatus

1. A 75 µm (#200) sieve (wash sieve)
2. A wash pan large enough to prevent loss of water and material
3. Oven or drying stove
4. Balance accurate to 0.1 percent of the sample mass (weight)
5. A set of 203 mm (8 in.) or 305 mm (12 in.) sieves for dry sieving

B. Test Sample

1. Select the test sample from the material to be tested by an appropriate method as outlined in Materials I.M. 336.
2. When determination of specification compliance is needed on each or any of the following sieves: 1.18 mm (#16), 600 µm (#30), 300 µm (#50), or 150 µm (#100), subject the entire sample to this test procedure.
3. When determination of specification compliance is needed for only the amount of material finer than the 75 µm (#200) sieve, reduce the remaining portion of the field sample from which the original test sample was selected, by the appropriate method as outlined in I.M. 336. A representative sample, sufficient to yield not less than the appropriate mass of dried material, as shown in the following table shall be selected:

Sieve Analysis Sample Mass (weight) kg (See Materials I.M. 301.)	Appropriate Minimum Mass (Weight) kg of Sample
5.0 kg	2.5 kg
3.5 kg	2.5 kg
2.0 kg	1.0 kg
1.5 kg	*
1.0 kg	*
0.5 kg	*
0.2 kg	*

*Use entire sample.

C. Test Procedure

1. Place the sample in the oven at 110°C (230°F) or on the stove and dry to a constant mass (weight). Care must be taken in drying the sample to avoid overheating causing the sample to "pop" or "sputter."

2. Allow the sample to cool, weigh and record as the Original Dry Mass (Weight).

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

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

5. Pour off the water through the 75 µm (#200) wash sieve. When washing samples with a high silt content, it may be necessary to vibrate or lightly tap the wash sieve in order to keep the mesh open so the water and the minus 75 µm (#200) sieve material may pass through freely. Repeat this operation until the wash water appears almost clear.

6. Rinse the material retained on the 75 µm (#200) sieve back into the sample and decant as much water as possible by carefully pouring the water through the 75 µm (#200) sieve.

7. Dry the washed sample, allow to cool, weigh and record as the Dry Mass (Weight) of the washed sample.

8. When determining only the amount passing the 75 µm (#200) sieve, screen the sample over the 2.36 mm (#8) sieve and discard the retained material. Place the portion of material passing the 2.36 mm (#8) sieve on a nest of sieves including the 300 µm (#50), 150 µm (#100), and 75 µm (#200) sieves and the pan. The sieves larger than the 75 µm (#200) sieve is included for protection of the 75 µm (#200) sieve. Place the nest of sieves in the mechanical sieve shaker and sieve to completion (normally five minutes or less). Weigh and record only the material retained in the pan.

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

D. Calculations

$$\text{\% Passing 75 µm (\#200) sieve} = \frac{\text{Washing Loss} + \text{Pan}}{\text{Original Dry Mass (Weight)}} \times 100$$

NOTES

GUIDELINES FOR VERIFYING CERTIFIED TESTING RESULTS

GENERAL

Agency field personnel monitor certified testing by contractor personnel on a regular basis. Tolerances given herein are for use as guides to flag test result variations that indicate a possible discrepancy.

TOLERANCES

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

TEST NAME	TEST METHOD	TOLERANCE
Slump of PC Concrete	IM 327	6 mm (¼ in.)
Air Content of PC Concrete	IM 318	0.4%
Length of Concrete Cores	IM 347	2 mm (0.10 in.)
Free Moisture in Aggregate, By Pycnometer	IM 308	0.2%
Specific Gravity of Aggregate, by Pycnometer	IM 307	0.02
Moisture in Aggregate or Recycled Asphalt Paving, By Hot Plate		0.3%
Density of AC Concrete, by Displacement	IM 321	0.02
Pavement Profile, by 7.6 m (25 foot) Profilograph, Profile Index, mm/km (in/mi):	IM 341	
Less than 93 mm/km (6 in./mi.)	16 mm/km (1 in./mi)	
93 to 311 mm/km (6 to 20 in./mi.)	31 mm/km (2 in./mi.)	
311 to 622 mm/km (20 to 40 in./mi.)	47 mm/km (3 in./mi.)	
More than 622 mm/km (40 in./mi.)	78 mm/km (5 in./mi.)	

TOLERANCES FOR AGGREGATE GRADATIONS

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

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

Note: Comparisons of aggregate gradations are only valid if the two tests were made on a split sample.

Table 1 gives tolerances for the coarse portion (#4 sieve size material and larger) and the fine portion (material smaller than the #4 sieve) of aggregates. For analysis of combined aggregate for HMA, table 2 will be used for all sieve sizes.

Table 1 Tolerances for all aggregates except HMA combined aggregate

	Size Fraction Between Consecutive Sieves, %*	Tolerance, %
Coarse Portion #4 Sieve and larger	0.0 to 3.0	2
	3.1 to 10.0	3
	10.1 to 20.0	5
	20.1 to 30.0	6
	30.1 to 40.0	7
	40.1 to 50.0	9
Fine portion: #8 Sieve and smaller	0.0 to 3.0	1
	3.1 to 10.0	2
	10.1 to 20.0	3
	20.1 to 30.0	4
	30.1 to 40.0	4

Table 2 Tolerances for all HMA combined aggregate

Size Fraction Between Consecutive Sieves, %*	Tolerances
0.0 to 3.0	2
3.1 to 10.0	3
10.1 to 20.0	5
20.1 to 30.0	6
30.1 to 40.0	7
40.1 to 50.0	9

*The monitoring analysis fraction is used to find the proper tolerance. Use of these tolerances is explained in the following examples. Gradation results are reported in two significant figures. Fraction differences between two sieves, one of which is reported to one decimal place, should be calculated to one decimal place.

EXAMPLE #1 - 57 CONCRETE STONE

Sieve Size	Gradation Percent PSG Monitor	Gradation Percent PSG Certified	Percent Retained Monitor Fraction	Percent Retained Certified Fraction	Fraction Diff.	Applicable Tolerance	Disposition
37.5 mm (1.5 in.)	100	100					
25 mm (1.0 in.)	97	99	3	1	2	2	OK
19 mm (3/4 in.)	72	65	25	34	9	(+4) 6	Suspect
12.5 mm (0.5 in.)	38	35	34	30	4	7	OK
9.5 mm (3/8 in.)	12	8.8	26	26.2	0.2	6	OK
4.75 mm (#4)	0.6	0.2	11.4	8.6	2.8	5	OK
2.36 mm (#8)	0.5	0.2	0.1	0.0	0.1	1	OK
75 μm (#200)	0.5	0.2	0.0	0.0	0.0	(-4) 1	OK
Pan	0	0	0.5	0.2	0.3	1	OK

The size fraction between consecutive sieves is found by calculating the difference between the % PSG reported for the two sieves. For example, the fraction between the 37.5 mm (1.5 in.) and 25 mm (1 in.) sieves for the above monitor test is 100 minus 97 equaling 3%. Between the 12.5 mm (½ in.) and 9.5mm (⅜ in.) sieves it is 38 minus 12 equaling 26%. Since nothing passes the pan, the size fraction between the 75 µm (#200) sieve and the pan is equal to the percent passing the 75 µm (#200).

The example shows the fraction between each pair of consecutive sieve sizes for both tests and the difference between these fractions for both tests. The difference is compared with the applicable tolerance to determine a disposition. In this example, a suspect result is found in the fraction between the 25 mm (1 in.) and 19 mm (¾ in.) sieves. Since the suspect difference is due primarily to the % PSG results on the 19 mm (¾ in.) sieves, it is these results that should at least be investigated first. Only further investigation can determine which 19 mm (¾ in.) sieve, if any is faulty.

<u>**Note:**</u> The applicable tolerance changes between +4.75-mm/#4 and -4.75-mm/#4 size fractions. Note in the following example the applicable tolerance change as it applies to a Fine Aggregate gradation.

EXAMPLE #2 - CONCRETE SAND

Sieve Size	Gradation Percent PSG Monitor	Gradation Percent PSG Certified	Percent Retained Monitor Fraction	Percent Retained Certified Fraction	Fraction Diff.	Applicable Tolerance	Disposition
9.5 mm (3/8 in.)	100	100					
4.75 mm (#4)	95	95	5	5	0	(+4) 3	OK
2.36 mm (#8)	88	86	7	9	2	2	OK
1.18 mm (#16)	72	71	16	15	1	3	OK
600 μm (#30)	44	44	28	27	1	(-4) 4	OK
300 μm (#50)	12	13	32	31	1	4	OK
150 μm (#100)	1.5	1.3	10.5	11.7	1.2	3	OK
75 μm (#200)	0.4	0.4	1.1	0.9	0.2	1	OK
Pan	0.0	0.0	0.4	0.4	0	1	OK

EXAMPLE #3 - 13.2 mm (1/2 in) ACC STONE - COMBINED AGGREGATE

Sieve Size	Gradation Percent PSG Monitor	Gradation Percent PSG Certified	Percent Retained Monitor Fraction	Percent Retained Certified Fraction	Fraction Diff.	+4.75 mm Applicable Tolerance	Disposition
19 mm (3/4 in.)	100	100					
12.5 mm (0.5 in.)	99	99	1	1	0	2	OK
9.5 mm (3/8 in.)	87	86	12	13	1	5	OK
4.75 mm (#4)	69	75	18	11	7	5	SUSPECT
2.36 mm (#8)	54	56	15	19	4	5	OK
1.18 mm (#16)	41	42	13	14	1	5	OK
600 μm (#30)	28	29	13	13	0	5	OK
300 μm (#50)	15	15	13	14	1	5	OK
150 μm (#100)	9.1	11	5.9	4	1.9	3	OK
75 μm (#200)	6.9	8.6	2.2	2.4	0.2	2	OK
Pan	0.0	0.0	6.9	8.6	1.7	3	OK

NOTE: The applicable tolerance for this combined aggregate sample is from the +4.75-mm/#4 table. In this example, the suspect fractions would indicate a possible problem for two pairs of consecutive sieve sizes involving the 4.75 mm (# 4) sieves. This evidence and the difference in the test values found for the 4.75 mm (# 4) sieves, strongly point to an error in one of the 4.75 mm (# 4) sieve results.

When RAP mixes are used the comparison data is of the composite gradation results and not of the cold feed.

Rev 08/99

Iowa Department Of Transportation

Form M201

Reported Gradations & I.M. 216 Comparison Report

Project No.: ______________________

Contract ID: ____________________ Intended Use: ____________________

County: ____________________

Cont. / Producer: ____________________

Mix Design No.: ______________

	Good	Fair	Poor
Care Of Equipment:	_____	_____	_____
Sampling Procedure:	_____	_____	_____
Splitting Procedure:	_____	_____	_____
Sieving To Completion:	_____	_____	_____
Computations:	_____	_____	_____
Reporting:	_____	_____	_____

Mix Change (Y/N): __________

Date Of Change: __________

Total, % AC: __________

Effective % AC: __________

Proper Equipment: __________

Applicable Specs.: __________

D.O.T. Tested By: ______________________ Cert. No.: __________ Date: __________

Prod. / C.P.I. Tested By: ______________________ Cert. No.: __________ Date: __________

			Sieve Sizes										
			25	19	12.5	9.5	4.75	2.36	1.18	600um	300um	150um	75um
		Specs.											
Sample ID		D.O.T.											
Sample ID		Prod. / C.P.I.											

D.O.T. FBR: 0.00

Sieves	D.O.T. % Retained	Prod. / C.P.I. % Retained	Diff.	Tol. %	Comply (Y/N)
25 - 19	NA	NA	0.0	2	Y
19 - 12.5	NA	NA	0.0	2	Y
12.5 - 9.5	NA	NA	0.0	2	Y
9.5 - 4.75	NA	NA	0.0	2	Y
4.75 - 2.36	NA	NA	0.0	2	Y
2.36 - 1.18	NA	NA	0.0	2	Y
1.18 - 600	NA	NA	0.0	2	Y
600 - 300	NA	NA	0.0	2	Y
300 - 150	NA	NA	0.0	2	Y
150 - 75	NA	NA	0.0	2	Y
75	NA	NA	0.0	2	Y

Sieve Fraction Between Consecutive Sieves, %			Tolerance, %
0.0	To	3.0	2
3.1	To	10.0	3
10.1	To	20.0	5
20.1	To	30.0	6
30.1	To	40.0	7
40.1	To	50.0	9

Remarks: ____

____

Distribution ____ Central Materials ____ TC Materials ____ Cont./Producer ____ Proj. Engineer ____ Technician

Rev 08/99

Iowa Department Of Transportation

Form M200

Reported Gradations & I.M. 216 Comparison Report

Project No.: ______________________

Contract ID.: ________________

County: ________________

Cont. / Producer: ________________

Design No.: ____________

Coarse Agg. T-203A No.: ________

Fine Agg. T-203A No.: ________

Proper Equipment: ________

Applicable Specification: ________

Intended Use: ________________

(Paving, Structure, Patching, Incidental)

	Good	Fair	Poor
Care Of Equipment:			
Sampling Procedure:			
Splitting Procedure:			
Sieving To Completion:			
Computations:			
Reporting:			

D.O.T. Tested By: ______________________ Cert. No.: __________ Date: __________

Prod. / C.P.I. Tested By: ______________________ Cert. No.: __________ Date: __________

Grad No.	Sample ID	Specs	Sieve Sizes 37.5	25	19	12.5	9.5	4.75	2.36	1.18	600um	300um	150um	75um
		D.O.T.												
		Prod. / C.P.I.												

Grad No.	Sample ID					Specs								
		D.O.T.												
		Prod. / C.P.I.												

Sieves	D.O.T. % Retained	Prod. / C.P.I. % Retained	Diff.	Tol. %	Comply (Y/N)
37.5 - 25	NA	NA	0.0	2	Y
25 - 19	NA	NA	0.0	2	Y
19 - 12.5	0.0	0.0	0.0	2	Y
12.5 - 9.5	0.0	0.0	0.0	2	Y
9.5 - 4.75	0.0	0.0	0.0	2	Y
4.75 - 2.36	0.0	0.0	0.0	2	Y
2.36 - 75	0.0	0.0	0.0	2	Y
75um	0.0	0.0	0.0	2	Y

Size Fraction Between Consecutive Sieves, %			Tolerance, %
Coarse Aggregate:			
0.0	to	3.0	2
3.1	to	10.0	3
10.1	to	20.0	5
20.1	to	30.0	6
30.1	to	40.0	7
40.1	to	50.0	9

9.5 - 4.75	0.0	0.0	0.0	2	Y
4.75 - 2.36	0.0	0.0	0.0	1	Y
2.36 - 1.18	0.0	0.0	0.0	1	Y
1.18 - 600	0.0	0.0	0.0	1	Y
600 - 300	0.0	0.0	0.0	1	Y
300 - 150	0.0	0.0	0.0	1	Y
150 - 75	0.0	0.0	0.0	1	Y
75um	0.0	0.0	0.0	1	Y

Fine Aggregate:			
0.0	to	3.0	1
3.1	to	10.0	2
10.1	to	20.0	3
20.1	to	30.0	4
30.1	to	40.0	4

Remarks: ____

Distribution: ____ Central Materials ____ TC Materials ____ Cont./Producer ____ Proj. Engineer ____ Technician

NOTES

METHOD OF TEST
SPECIFIC GRAVITY OF AGGREGATES
FIELD PROCEDURES FOR LABORATORY TEST METHOD 201

SCOPE

This method describes two procedures used for determining the bulk specific gravity of aggregates proposed for use in Portland Cement Concrete.

PROCEDURE A – SPECIFIC GRAVITY OF AGGREGATES USING A PYCNOMETER

A. Apparatus

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

2. Pycnometer – a fruit jar supplied with a gasket and conical pycnometer top. A two-quart pycnometer is used for coarse aggregates, and a one-quart pycnometer is used for fine aggregate. If a two-quart pycnometer cannot be obtained, a one-quart jar may be substituted(The engineer may require 2 samples be obtained and tested in separate 1-quart pycometers for some aggregates). The quantity of aggregate would be approximated 1100 grams for the one-quart pycnomter.

2. Thermometer – a thermometer with a range of at least 50°F (10°C) to 100°F (38°C)

3. Sieve – a No. 4 (4.75 mm) sieve

B. Field Sample

1. Obtain a field sample as prescribed in I.M. 301.

C. Preparation of Test Sample

1. Fine Aggregate

a. Obtain a test sample of approximately 1100 grams from the material to be tested by one of the following methods:

(1) Use of a sample splitter

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

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

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

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

2. Coarse aggregate

a. Obtain the test sample as prescribed in I.M. 336, Methods of Reducing Aggregate Field Samples To Test Samples (See sections on Quartering or Splitting).

b. Sieve the test sample over the No. 4 (4.75 mm) sieve. The sample should be of sufficient size to produce approximately 2100 grams of material retained on the No. 4 sieve. Discard the material that passes this sieve.

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

d. After soaking, pour off the free water and allow the sample to come to a saturated-surface-dry condition by spreading the sample on a flat, non-absorbent surface. The forced circulation of air by means of a fan, if available, may hasten this process. The sample should be stirred frequently to secure uniform drying. The predominance of free moisture may be removed initially by rolling the sample back and forth in a clean, dry, absorbent cloth.

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

D. Calibration of Pycnometers

1. Fill the pycnometer jar nearly full of water at the temperature to be used in the actual test, plus or minus 3°F (1.7°C). This may be done either before or after the actual test.

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

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

E. Test Procedure

1. Weigh the saturated-surface-dry sample to the nearest 0.5 gram. For ease in calculations, the fine aggregate sample may be brought to exactly 1000 grams weight, and the coarse aggregate sample may be brought to exactly 2000 grams weight.

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

3. Nearly fill the pycnometer jar with water at the same temperature plus or minus 3°F (1.7°C) as used in the calibration.

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

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

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

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

F. Calculations

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

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

Where:

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

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

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

Pycnometers for Coarse and Fine Aggregates

PROCEDURE B – SPECIFIC GRAVITY OF COARSE AGGREGATE (AASHTO T 85)

A. Apparatus

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

2. Sample Container – A wire basket of No. 6 (3.35 mm) or finer mesh, or a bucket of approximately equal breadth and height, with a capacity of 4 to 7 L.. The container shall be constructed so as to prevent trapping air when the container is submerged.

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

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

5. Sieve - A No. 4 (4.75 mm) sieve

6. Thermometer – a thermometer with a range of 50°F (10°C) to 100°F (38°C)

B. Field Sample

1. Obtain a field sample as prescribed in I.M. 301.

C. Preparation of Test Sample

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

D. Test Procedure

1. Weigh the saturated-surface-dry sample to the nearest 0.5 gram. For ease in calculations, the fine aggregate sample may be brought to exactly 1000 grams weight, and the coarse aggregate sample may be brought to exactly 2000 grams weight.

2. After weighing, immediately place the saturated-surface-dry sample in the sample container, remove all entrapped air by shaking the immersed container, and determine its mass in water at 73.4°F ± 3°F (23.0°C ± 1.7°C). Make sure the water is at a depth sufficient enough to cover the container and sample.

E. Calculations

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

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

Where:

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

Specific Gravity Problems

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

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

Where:

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

P = Mass in grams of the pycnometer filled with water

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

Given:

1. S = 2000 (C.A.) $\frac{2000}{4725.7 - 3945.2}$

P = 2725.7

Sp.Gr. (SSD) = 2.56

W= 3945.2

2. S = 1000 (F.A.) $\frac{1000}{378}$

P = 1524.6

Sp.Gr.(SSD) = 2.65

W= 2146.6

3. S = 1000

P = 1485.9

Sp.Gr. (SSD) = 2.64

W= 2107.1

4. S = 2000

P = 2739.9

Sp.Gr. (SSD) = 2.62

W= 3976.2

5. S = 2000

P = 2637.8

Sp.Gr. (SSD) = 2.62

W= 3874.8

NOTES

METHOD OF TEST
DETERMINATION OF FREE MOISTURE AND ABSORPTION OF AGGREGATES

SCOPE

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

PROCEDURE A - FREE MOISTURE IN AGGREGATES USING A PYCNOMETER

A. Apparatus

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

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

3. Thermometer - -35 Page of 5°C (-30°F) to 50°C (120°F) thermometer

4. Scoop

B. Field Sample

1. Obtain a field sample as prescribed in I.M. 301.

C. Preparation of Test Sample

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

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

2. Weigh to the nearest 0.5 gram, a 1000 gram sample of fine aggregate, or 2000 gram sample of coarse aggregate. To avoid moisture loss due to evaporation the weighing should be done immediately after obtaining the test sample. Also avoid any excessive manipulation of the aggregate, prior to weighing, which could cause a loss of moisture.

D. Calibration of Pycnometer

1. Calibrate the pycnometer by the procedure in I.M. 307.

E. Test Procedure

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

F. Calculation

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

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

Where:

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

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

Gs = Specific gravity of material in a saturated-surface-dry condition. (This is obtained from Method I.M. 307 or I.M. T203.)

s = Mass (Weight) in grams of wet sample

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

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

PROCEDURE B – FREE MOISTURE IN AGGREGATE BY MASS (WEIGHT) DIFFERENCE

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

A. Apparatus

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

B. Preparation of Sample

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

C. Test Procedure

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

D. Calculation

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

$$\text{Percent Moisture} = \frac{\text{Wt. as received - Wt. SSD}}{\text{Wt. as received}} \times 100$$

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

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

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

or

$$\text{Percent Moisture (SSD)} = \frac{\text{wet mass (weight) - saturated - surface - dry mass (weight)}}{\text{saturated - surface - dry mass (weight)}} \times 100$$

PROCEDURE C - WATER ABSORPTION IN AGGREGATE

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

A. Apparatus

1. Balance having the capacity of at least 5000 grams and accurate to 0.5 gram

2. Oven or hot plate

B. Preparation of Sample

1. Obtain a test sample of at least 1000 grams of fine aggregate and 2000 grams of coarse aggregate by following the appropriate procedure outlined in I.M. 307.

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

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

C. Test Procedure

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

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

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

D. Calculation

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

Percent Absorption =

$$\frac{\text{Saturated - surface - dry mass (weight) - oven dry mass (weight)}}{\text{oven dry mass (weight)}} \times 100$$

APPENDIX A
W-W1 TABLE FOR PYCNOMETER MOISTURE DETERMINATION

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

Moisture Tests (I.M. 308)

Calculate the percent of free moisture of each of the examples below by using the following formula:

$$\text{Percent Moisture} = \frac{(W - W1)(Gs)(100)}{(Gs - 1)(s)}$$

W= Mass in grams of the pycnomemter containing a saturated-surface-dry sample of the same mass as "s" and sufficient water to fill the remaining volume of the pycnometer as determined in I.M. 307.

W1= Mass in grams of the pycnometer containing the wet sample and sufficient amount of water to fill the remaning volume of the pycnometer.

Gs = Specific Gravity of material in a saturated-surface-dry condition (this is obtained from Method I.M. 307).

s = Mass in grams of wet sample

What is the percent of free moisture in the aggregate when:

$$\frac{\overset{9.5}{(3916.5-3907.0)}(2.61)(100)}{(2.61-1)(2000)}$$

1. W = 3916.5 W1 = 3907.0 Gs = 2.61 s = 2000.0

$\frac{2479.5}{3220} = 0.8\%$ 0.777

2. W = 2096.5 W1 = 2078.5 Gs = 2.66 s = 1000.0

$\frac{4788}{1660} = 2.88 = 2.9$

3. W = 3903.5 W1 = 3911.0 Gs = 2.70 s = 2000.0 $\frac{2025}{3400} = -0.6$ absorb 0.596

4. W = 2204.5 W1 = 2184.0 Gs = 2.60 s = 1000.0

$\frac{5333}{1600} = 3.33$

NOTES

Section V
Aggregate Source Inspection

Aggregate source inspection involves monitoring the quality of the material being produced from an approved source, preliminary testing or production will usually have occurred at the site to establish the potential quality of material obtainable. Although at times further assurance samples are required, most construction aggregates are delivered to a project with the only quality requirement being that they were obtained from an approved source. This can be done because the quality level of an aggregate as measured by soundness or abrasion tests remains essentially the same unless some significant change has occurred, either in the material or in the manner in which it was produced. It is the responsibility of the Aggregate Technician to recognize when any such change has occurred and to obtain such as necessary to establish the quality of aggregate being produced under the changed conditions. The factors causing change are somewhat different in quarries than in sand and gravel pits and each shall be covered separately.

Quarries

There are many reasons why an aggregate from a particular quarry can test differently with respect to quality than that previously produced. Most of these reasons fall into the following categories.

> ***Quarry-*** *A deposit of ledge rock from which the rock is excavated by cutting or blasting.*

a) Ledge Control: The quarry ledge has not been maintained in the same beds.
b) Lateral Variations: One or more beds in the quarry ledge have changed laterally in quality.
c) Faulted and Dipping Beds: The beds are offset along a fault or

have such an irregular surface that the quarrying operation cuts across beds to the extent that the same beds are not always being worked.

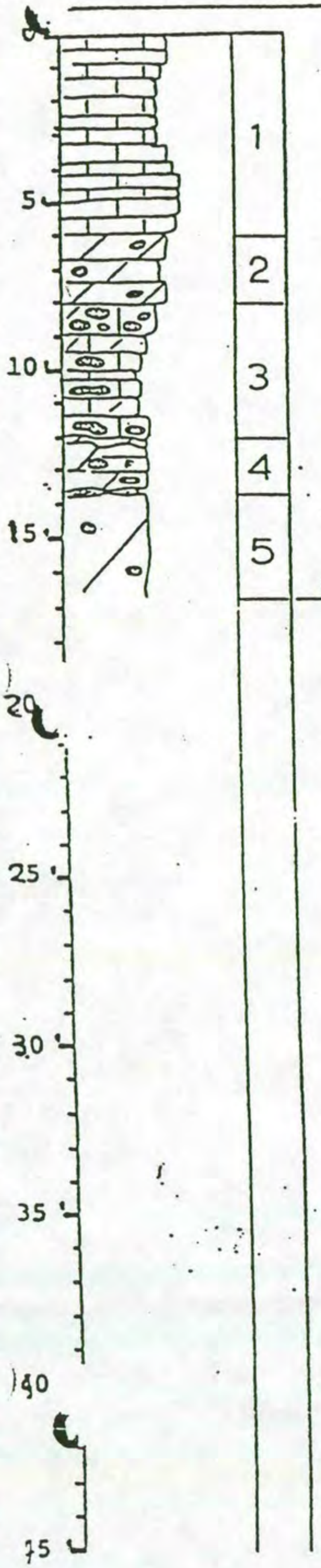
d) Deleterious Materials: The quarry ledge has become intruded with pockets or seams of clay and associated weathered material.
e) Production Changes: Production methods have changed to the extent that a similar product is not being obtained.

Ledge Control

As an aid identifying the various beds and/or quality units in quarry, geologic sections have been prepared for most (Figure 3.1). The various beds are identified be a number and a description. The geologic age of the source is also noted and the relative position of the source age-wise can be found on a time chart such as Figure 3.2. Every layer or bed of rock in a quarry can be quite different in quality while often times quite similar visibly. Consequently, when material is being produced on the basis of previously established quality, we must be sure that the quarry ledge is in the same beds as before, or if it isn't, that any of the new beds in the ledge are of a quality that will assure specification compliance of the final product.

In quarries where bedding planes are distinct and continuous, it is a simple matter for the producer to maintain a ledge in the same beds and for the inspector to ascertain which beds they are. When there are no good bedding planes, the producer can have difficulty remaining in the same beds and difficulty in knowing exactly which beds are being worked. Satisfactory ledge control can be maintained by

Peterson	5/6/75	SW¼ Sec. 23 T. 95 R. 15 Co. Floyd
		Carville Qr.
		Heckman-Reynolds



00: Overburden ±3.0'

CEDAR VALLEY FORMATION
(Coralville Member)

1. Limestone; light brown; medium crystalline; very petroliferous; carbonaceous laminations; thin to platy bedding. ±6.

2. Dolomite; light brown; coarse crystalline; a few small calcite-filled vugs- as 3 or 4 beds; very hard. 2.

3. Limestone; light, pinkish gray; medium crystalline; dolomitic; many large calcit-filled vugs in zones parallel to bedding; flaggy beds 0.3-0.6' thick; upper 1.0' is a distinctive zone of highly concentrated calcite-filled vugs. ±4.

4. Dolomite; light, pinkish gray; fine crystalline; many calcite-filled vugs and "birdseye" calcite; a few small pelecypod fragments; as 3 or 4 wavy beds; reddish brown shale parting at the base; irregular reddish brown shaley bed 0.2' thick at top; hard. ±1

5. Dolomite; light, pinkish gray; medium crystalline; has a few small calcite-filled vugs and "birdseye" calcite; massive but fractured; hard. ±3.

FIGURE 3.1

STRATIGRAPHIC COLUMN OF IOWA

SYSTEM	SERIES	GROUP	FORMATION	DESCRIPTION	THICKNESS (feet)	AGE (in millions of years before present)
Quaternary	Pleistocene		Wisconsin	loess, glacial till and interbedded sand and gravel	500'	
			Illinoian			
			Kansan			
			Nebraskan			2-3
Cretaceous		Colorado	Carlile	shale	350'	
			Greenhorn	limestone and shale		
			Graneros	shale		
		Dakota		sandstone and shale	200'	130
Jurassic			Fort Dodge beds	gypsum, red and green shales in Webster County only	50'	185
Pennsylvanian	Virgil	Wabaunsee	French Creek	shale	210'	
			Jim Creek	limestone		
			Friedrich	shale		
			Grandhaven	limestone		
			Dry	shale		
			Dover	limestone		
			Langdon includes (Nyman Coal)	shale		
			Maple Hill	limestone		
			Wamego	shale		
			Tarkio	limestone		
			Willard	shale		
			Elmont	limestone		
			Harveyville	shale		
			Reading	limestone		
			Auburn	shale		
			Wakarusa	limestone		
			Soldier Creek	shale		
			Burlingame	limestone		
			Silver Lake	shale		
			Rulo	limestone		
			Cedar Vale (includes Elmo bed at top)	shale		
			Happy Hollow	limestone		
			White Cloud	shale		
			Howard	limestone		
			Severy (includes Nodaway coal bed at base)	shale		
Pennsylvanian		Shawnee	Topeka	limestone	180'	
			Calhoun	shale		
			Deer Creek	limestone		
			Tecumseh	shale		
			Lecompton	limestone		
			Kanwaka	shale		
			Oread	limestone		
		Douglas	Lawrence	shale	110'	
			Stranger	shale		
			Iatan	limestone		
			Weston	shale		
	Missouri	Lansing	Stanton	limestone	50'	
			Vilas	shale		
			Plattsburg	limestone		
		Kansas City	Bonner Springs	shale	25'	
			Wyandotte	limestone and shale		
			Lane	shale		
			Iola	limestone and shale		
			Chanute	shale		
			Drum	limestone		
			Quivira	shale		
			Westerville	limestone		
			Cherryvale	shale		
			Dennis	limestone and shale		
			Galesburg	shale		
			Swope	limestone		
			Ladore	shale		
			Hertha	limestone		
		Pleasanton	undifferentiated	shale and sandstone, thin coal beds	40'	
	Des Moines	Marmaton	Lenapah	limestone	145'	
			Nowata	shale		
			Altamont	limestone and shale		
			Bandera	shale		
			Pawnee	limestone and shale		
			Labette	shale		
			Fort Scott	limestone		
		Cherokee	undifferentiated	shale, sandstone, thin limestones and coal	755'	310

FIG. 3.2

STRATIGRAPHIC COLUMN OF IOWA

SYSTEM	SERIES	GROUP	FORMATION	DESCRIPTION	THICKNESS (feet)	AGE (in millions of years before present)
Mississippian	Meramec		Ste. Genevieve	shale and limestone	140'	
			St. Louis	sandy limestone		
			Spergen	limestone		
	Osage		Warsaw	shale and dolomite	250'	
			Keokuk	cherty dolomite and limestone		
			Burlington	cherty dolomite and limestone		
	Kinderhook		Gilmore City	limestone, oolitic	300'	
			Hampton	limestone and dolomite		
		North Hill	Starrs Cave	limestone	100'	
			Prospect Hill	siltstone		
			McCraney	limestone		355
Devonian	Upper	Yellow Spring	English River	siltstone	300'	
			Maple Mill	shale		
			Aplington	dolomite		
			Sheffield	shale		
			Lime Creek	dolomite and shale	225'	
			Shell Rock	limestone and dolomite		
	Middle[*]		Cedar Valley	limestone and dolomite	270'	
			Wapsipinicon	limestone and dolomites, shales in middle		
	Lower		La Porte City	chert, limestone and dolomite	50 - 100'	410-415
Silurian	Niagaran		Gower	dolomite	300'	
			Hopkinton			
	Alexandrian		Kankakee	cherty dolomite	100'	
			Edgewood	sandy dolomite		425
Ordovician	Cincinnatian		Maquoketa	dolomite and shale	300'	
	Mohawkian		Galena	dolomite and chert	320'	
			Decorah	limestone and shale		
			Platteville	limestone, shale and sandstone	70'	
	Chazyan		St. Peter	sandstone	50 - 230'	
	Beekmantown		Prairie du Chien	sandy and cherty dolomite and sandstone	290'	475
Cambrian	St. Croixan	Trempealeau	Madison[a]	sandstone	185'	
			Jordan			
			Lodi[a]			
			St. Lawrence	dolomite		
			Franconia	glauconitic sandstone, siltstone, shale	160'	
		Dresbach	Galesville	sandstone	550'	
			Eau Claire	sandstone and shale, dolomite		
			Mt. Simon	sandstone		570
Precambrian				sediments (sandstones), igneous, and metamorphic rocks		

[*] recognized only in extreme northeast Iowa

FIG. 3.2

applying the answers to the following questions to the source being used.

Do specifications or special provisions require ledge control? Some materials do, such as course aggregate for portland cement concrete and graded stone base.

Does the production history indicate that the finished produce will be boarder line on quality or well within the requirements?

What is the quality level of the beds that might be added to the ledge?

Could additional beds improve a borderline product or cause it to fail?

Could the additional beds be of such poor quality that they should not be incorporated into the manufacture of any product?

Often, all that is necessary is a proper identification of the ledge being worked so as to compile a dependable production history for the source. When in doubt, always consult the appropriate supervisor.

Lateral Variations

Most lateral variations in bed quality are caused by the effects of weathering. Other lateral variations are due to the factors of deposition which were present when the bed was formed. Some geologic units characteristically show very little lateral variation (like the Galena Formation), others show a lot (like the St. Louis Formation). Lateral variations may or may not affect the quality of the bed. Each case has to be evaluated individually.

Lateral Variations Due to Weathering

These can be caused by actual compositional changes in a bed or by changes in a bed or by changes in thickness. A 60.7 mm (0.2 ft.) thick shale bed may increase to a very troublesome 304.8 mm (1 ft.) or more in thickness, requiring benching and removal (Figure 4.1). A limestone or dolomite bed may suddenly pinch out, becoming replaced by sandstone or some other type of rock. This happens frequently in the Meramecian Formations common in southeastern Iowa, but not too often elsewhere.

More common are compositional changes characteristic of those geologic formations which contain breccias, angular fragments of rock in generally shaly matrices (Figure 4.2). Breccia thickness can vary considerably within the same quarry, often affecting beds in the adjacent quarry ledges. At other times, beds will gradually change in composition, becoming more shaly, sandy, etc. Either type of change can affect the quality of the rock.

An inspector must learn and be alert to any changes that can occur that will affect the quality of the finished product.

Faulted and Dipping Beds

Frequently, the quarry beds are not flat lying. They may dip at a uniform angle (Figure 5.1), or they may roll up and down from 0.305 m to 0.607 m (1 ft. to 2 ft.) to commonly as much as 2.438 m (8 ft.) over a lateral distance of 30.48 m (100 ft.) (Figure 5.2). When either situation occurs, a flat lying quarry floor will cut across beds that may not be of the quality level required for the aggregate product becoming made. Proper ledge control might require that a quarry floor be raised, lowered, or worked

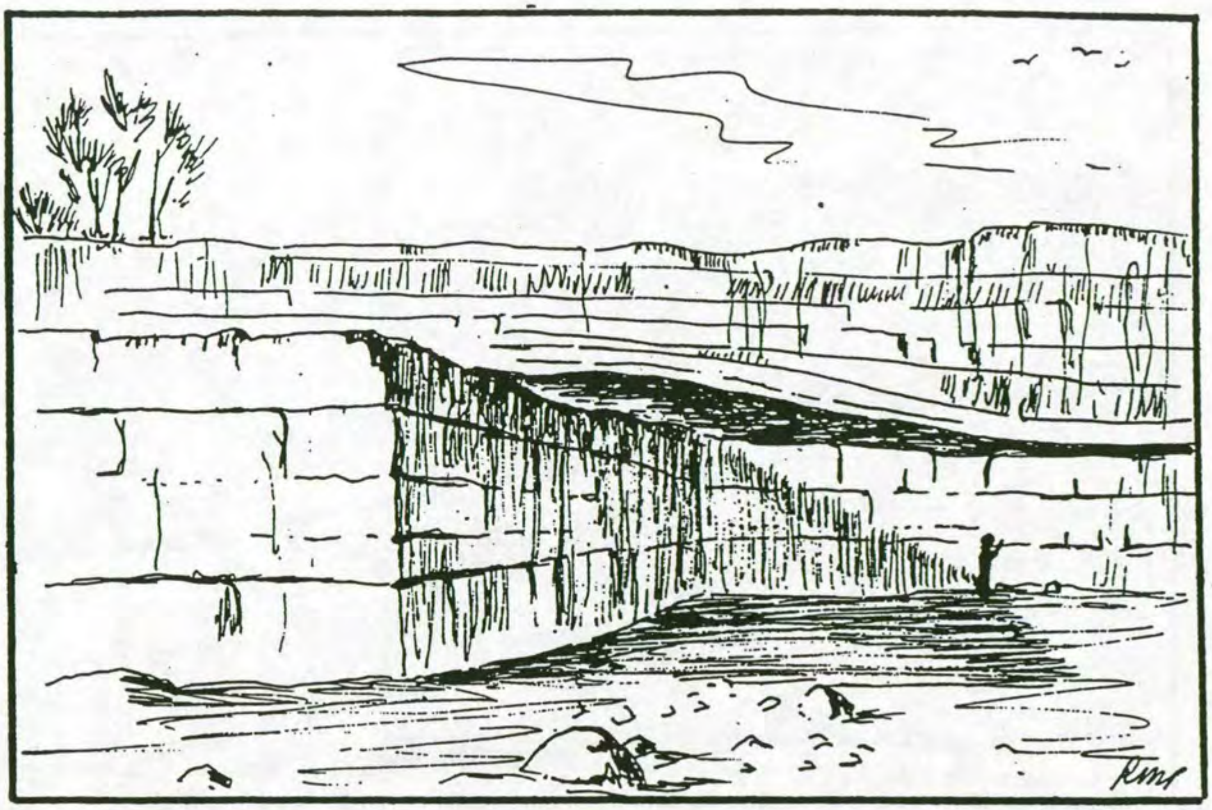


Figure 4.1

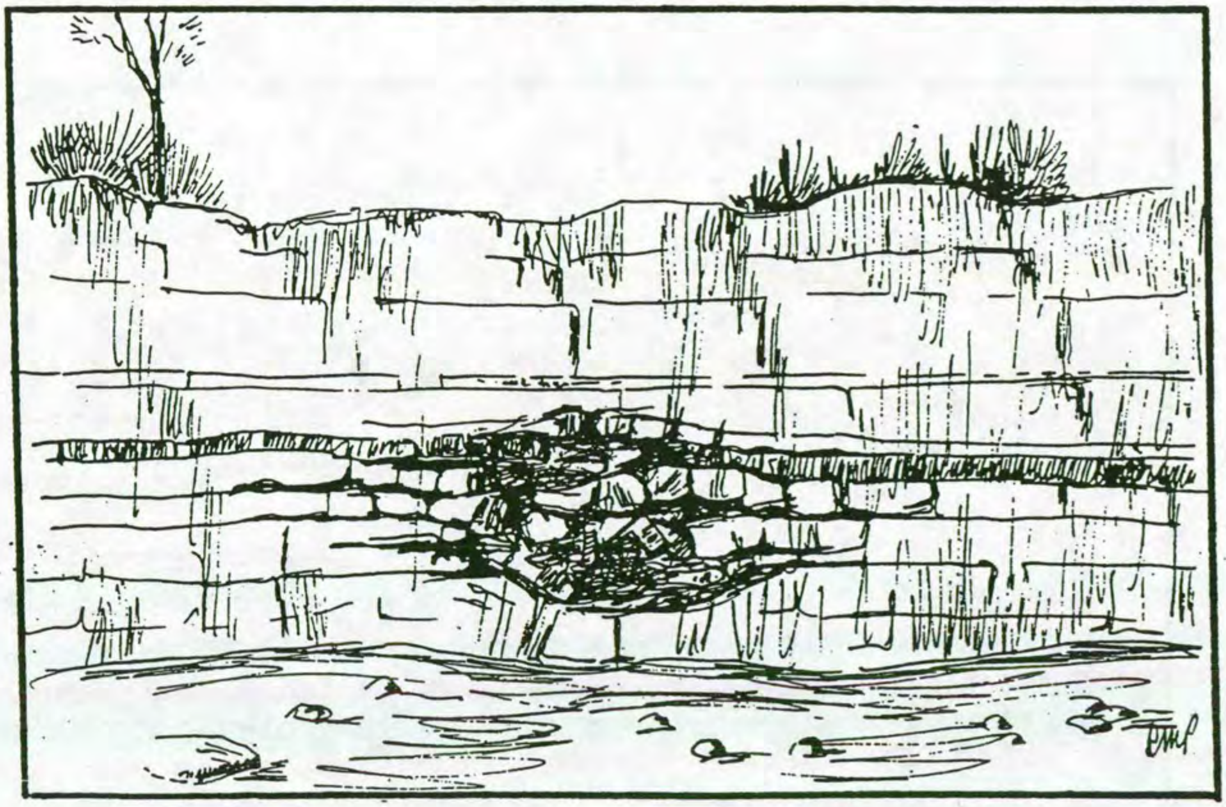


Figure 4.2

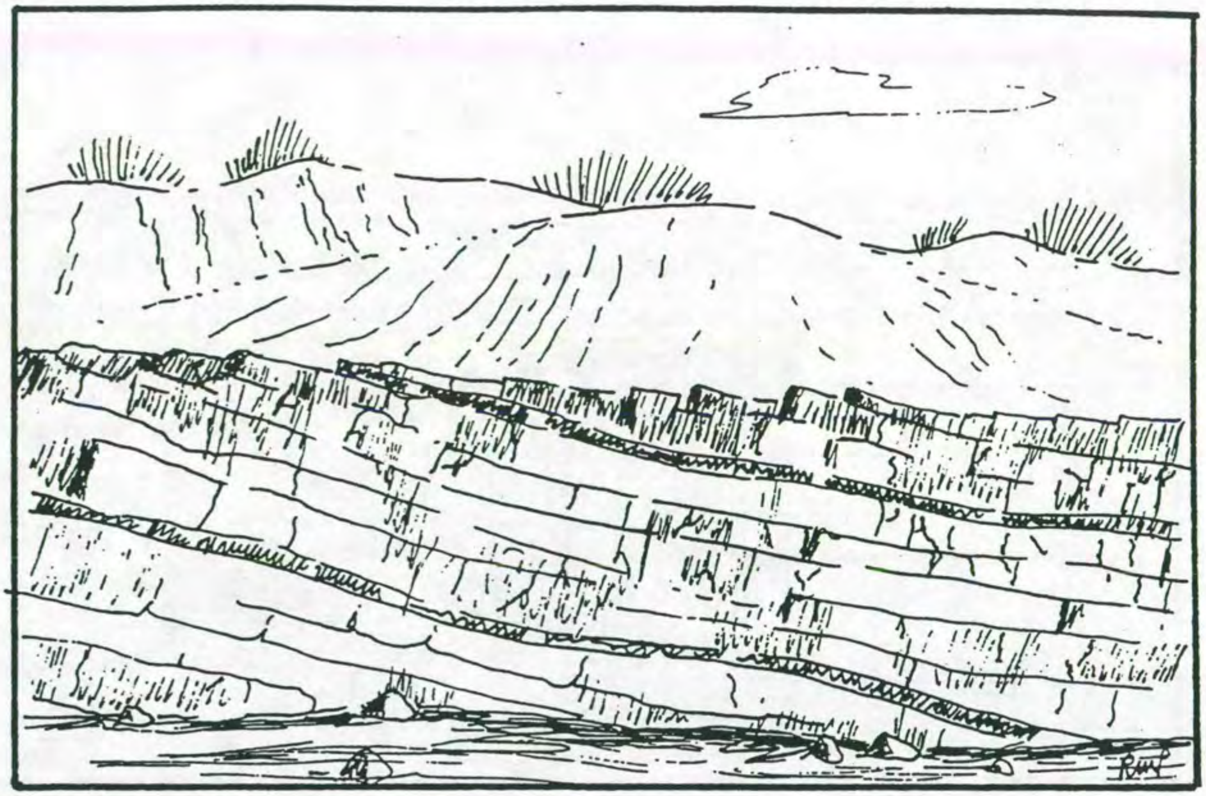


Figure 5.1

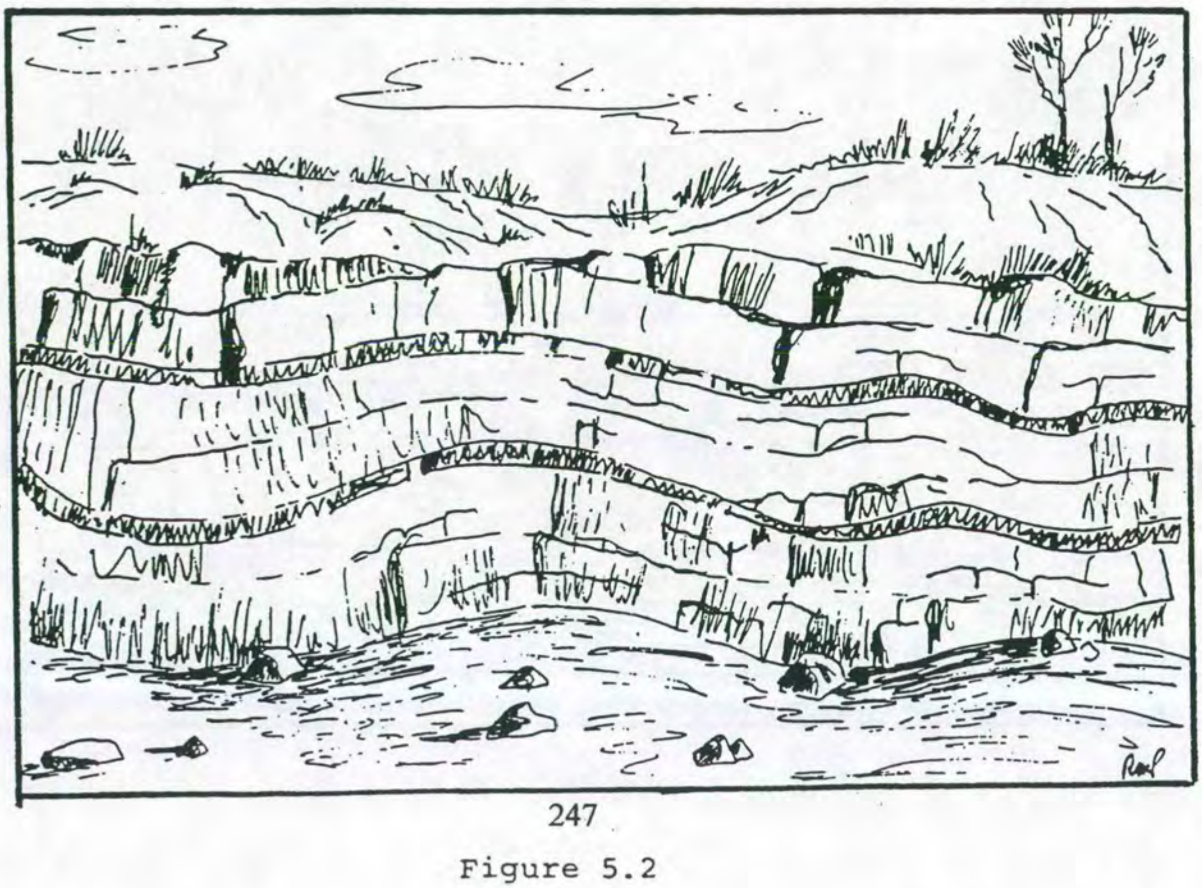


Figure 5.2

at an angle in order to insure the production of complying material.

True faults, fractures in bedded rock accompanied by differential movement in the fault zone, are not common, but there are a few. A quarry ledge transgressing a fault will suddenly be working different beds depending on the amount of movement that occurred along the fault (Figure 5.3). This can be a problem depending on the nature of new beds incorporated into the ledge. Often, large blocks will exhibit minor slippage along the vertical joints and appear as small faults in a quarry face. These are the most common in the Galena and Cedar Valley Formations, massive rock units with well developed joint systems.

Deleterious Materials

Ground water moving along vertical joints and horizontal bedding planes has often left large void spaces in the rock. These are frequently filled with clay or other materials that were available to the moving ground water (Figure 6.1). Occasionally so much foreign material will be in the rock that it cannot be used for aggregate purposes. Some rock became contaminated with clay or shale during deposition. This is the case with the Silurian reefs found in eastern Iowa. Ordinarily, the rock is of high quality, but the contained clay pockets can become very troublesome (Figure 6.2). The clay content of aggregate being produced from this type of rock should be monitored closely when there are limits placed on clay lumps, clay balls, etc.

Production Changes

Some products can be made at certain quarries only by beneficiating or treating the material in order to improve its properties during the manufacturing process. For instance, when a quarry ledge

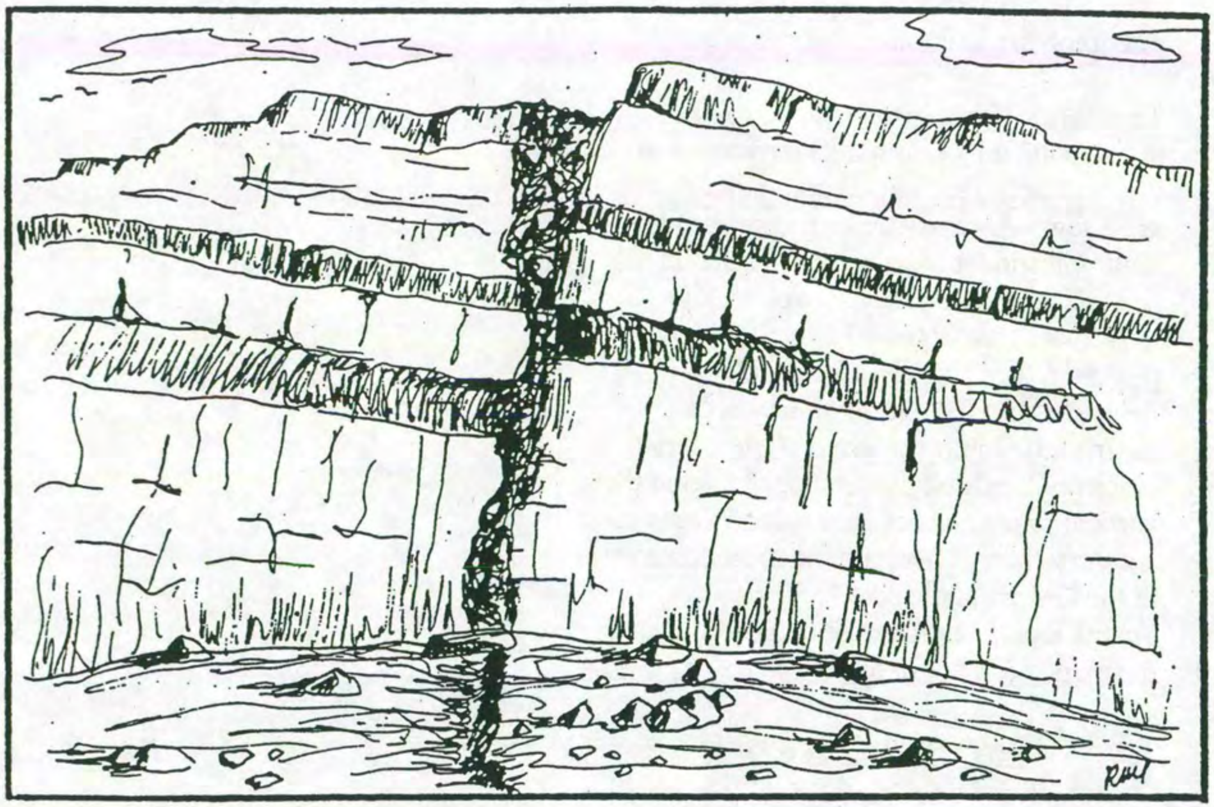


Figure 5.3

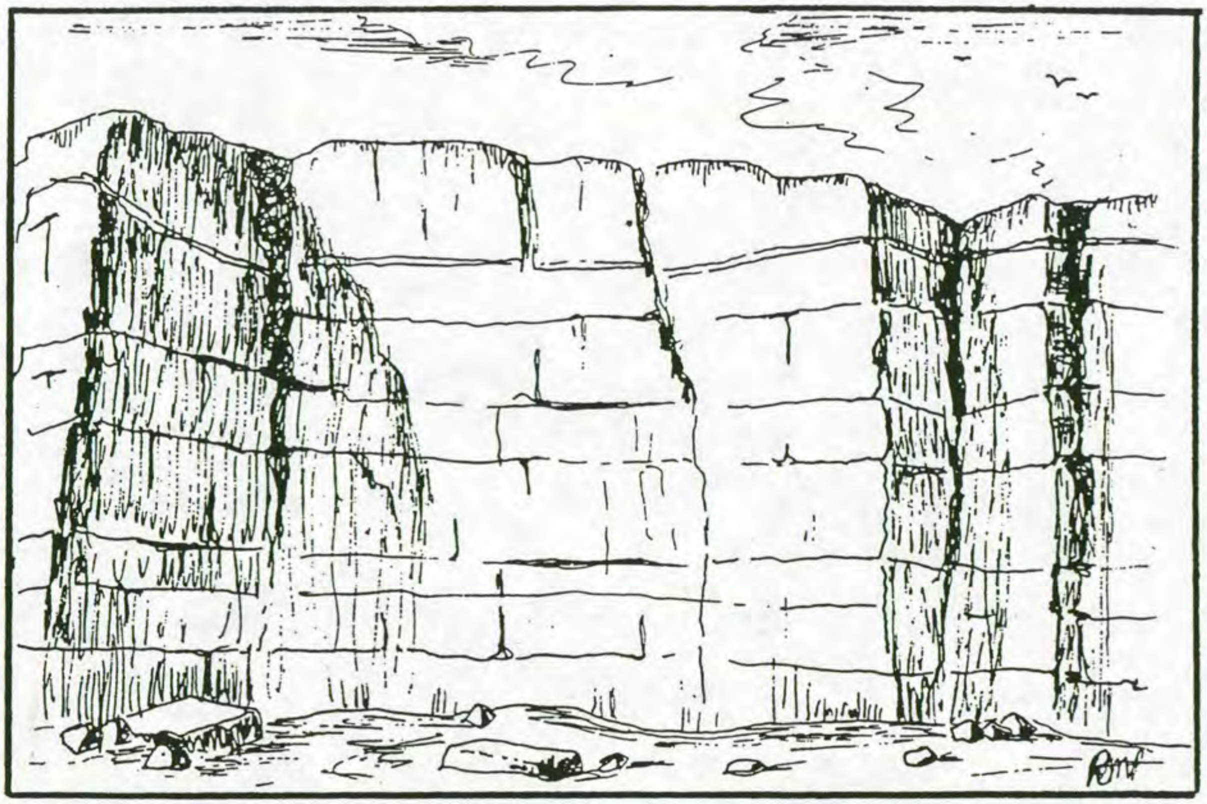


Figure 6.1

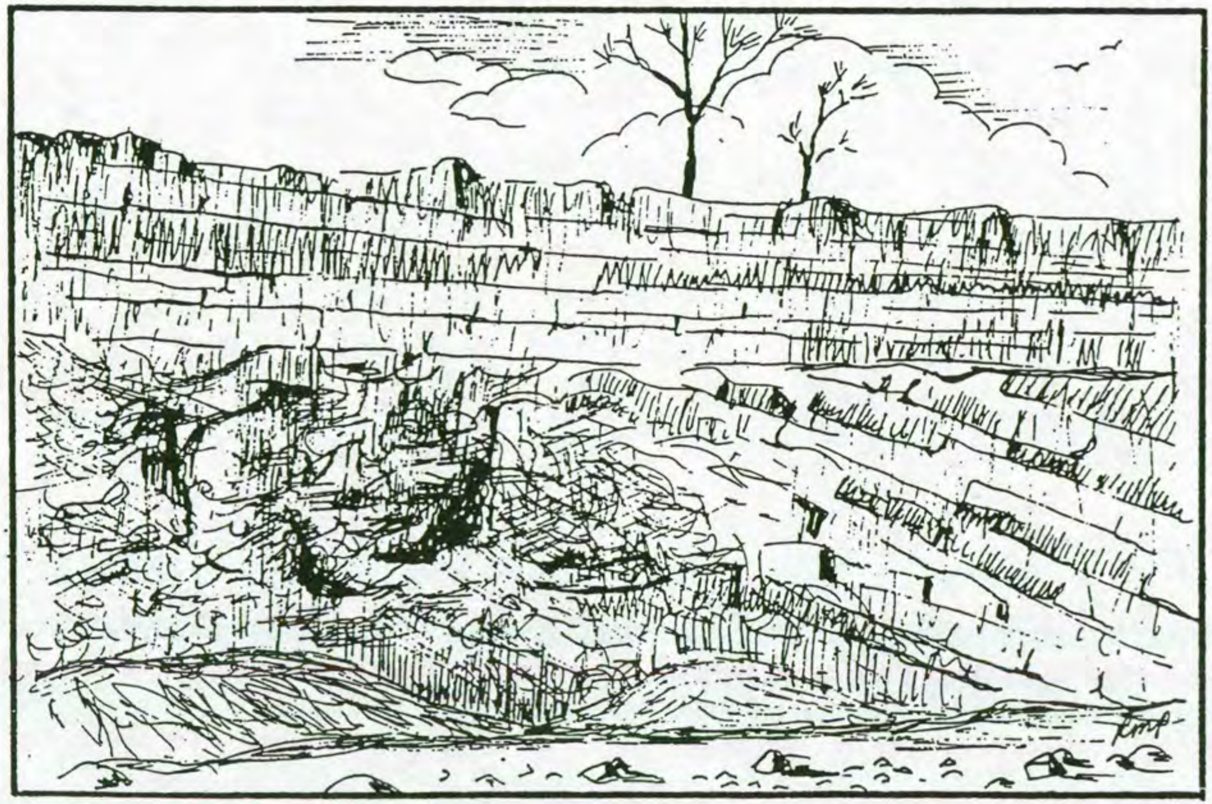


Figure 6.2

consists of beds with argillaceous partings on the bedding planes, the removing or scalping of the minus 19 mm (3/4 in.) from the primary crusher may remove enough of this material to substantially improve the soundness of the final product. These situations should be documented in the source files, so that any future production employs equal or better methods of product beneficfation.

Sand and Gravel Pits

Sand and gravel pits are granular deposits located in areas where moving water has concentrated the sand and gravel-size particles in sufficient quantity. They are generally in or adjacent to the many streams and rivers in Iowa or in glacial outwash deposits where the melting ice had generated the water flow necessary to form sand and gravel deposits. There are many factors which can cause quality changes in sand and gravel pits, but only the main points will be covered.

Sand- *Granular material almost entirely passing the No. 4 sieve and predominantly retained on the No. 200 sieve.*

Flowing water deposits material only in relation to the load it carries (always changing) and its velocity and direction. Most deposits are accumulations over long time periods under a variety of conditions. Consequently, the deposit can be alternately coarse or fine, dirty or clean. Thus a greater degree of dependence is placed on the production methods and equipment to give a uniform quality product than in the case of crushed stone. Any change in production equipment or methods, in the area or depth of working, or in the appearance of the product should be noted since any one could signal a changed quality level in the final product. Most gravel coarse aggregate perform only moderately well in pavement because, despite containing relatively high percentages of extremely durable igneous materials. They also contain significant

Gravel Pit Face: Note how the gravel is deposited in layers of coarse and fine with areas containing high shale, etc. Important for the producer to process this type of source properly to maintain consistent quality and gradation (i.e. using a dozer to work the entire exposed face to blend the material before it is processed at the plant.

percentages of good to poor quality limestone, and of course, the cherts, iron spalls, shale particles, and other objectionable materials that frequently cause gravel pavements to have a poor appearance. Held within the specified limits, the objectionable materials will not affect the durability of pavement.

The quality of the limestone fraction, however, can affect the durability of pavement. Consequently, very few gravel coarse aggregates comply with the durability requirements for use in pavements on the primary highway system. When necessary, gravel coarse aggregates can be separated and tested according to rock type using a modification of the ASTM Standard Recommended Practice for Petrographic Examination of Aggregates for Concrete. This can be extremely helpful in identifying the types and amounts of poor quality materials present.

NOTES

FIELD EQUIPMENT CLEANING, CALIBRATION, AND REPAIR
(General Rewrite)

GENERAL

Various items of field-testing equipment require periodic calibration to ensure reliable results. Specific items requiring calibration are balances and weights, concrete air meters, and concrete beam testing machines, etc.

The Central Materials Laboratory of the Iowa Department of Transportation will, when possible, calibrate and repair testing equipment for county and municipal governments and private organizations when certified technicians are required.

COUNTY & MUNICIPAL GOVERNMENTS

County owned equipment will be cleaned, calibrated and repaired as time permits. For any necessary repair parts, cleaning, etc., the county will be billed. If extensive repair or modification to equipment is required, the county will be billed for parts and labor. Prior to any extensive repair, the County Engineer will be notified with an estimate of the cost and his authorization to proceed must be received prior to the work.

Municipal governments that have projects involving state or federal funding may also have their equipment cleaned, calibrated, and repaired. Charges shall be the same as those imposed upon counties.

PRIVATE ORGANIZATIONS

Testing equipment owned by private organizations will be cleaned, calibrated, and repaired when the Department of Transportation requires that certified technicians be utilized. A charge will normally be made when calibrating or repairing this equipment. Extensive repairs will be billed at actual cost plus labor charges. Prior to extensive repairs the organization will be notified with an estimate of the cost and authorization to proceed must be received prior to the work.

NON-STANDARD EQUIPMENT

The Department of Transportation is not responsible for repairing equipment that is not normally used by the Department and for which replacement parts are not normally stocked by the Central Laboratory.

BILLING PROCEDURE

Upon written notification from, the Office of Materials, the Office of Accounting will bill the appropriate agency or organization.

CHARGES FOR CLEANING, CALIBRATION, AND REPAIR OF TESTING EQUIPMENT

<u>ACTIVITY</u>	<u>FEE</u>
Cleaning and Checking of Sieves	$4.50 each or $30.00 per set (8-inch) $9.00 each or $60.00 per set (12-inch)
Cleaning, Repair, and Checking of Balances	$30.00 each, plus cost of parts*
Repair and Calibration of Concrete Beam (Flexural Test) Machines	$50.00 each, plus cost of parts* Rental is $100 per month or any part thereof. Includes use by cities & counties, contractors, and consultants.
Cleaning and Repair of PCC Air Meters	$35.00 for sandblast cleaning, plus parts*
Calibration of Air Meters	$35.00
Cleaning of Slump Cones	$25.00 each

***NOTE:** The cost of parts includes an additional 7.5 percent for overhead.

NOTES

METHOD OF TEST
DETERMINATION OF THE AMOUNT OF SHALE IN FINE AGGREGATE
FIELD PROCEDURE OF IOWA TEST METHOD 209

SCOPE

This test method covers the procedure for the approximate determination of the shale content in fine aggregate.

PROCEDURE

A. Apparatus

1. Balance having a capacity of not less than 1000 g and sensitive to at least 0.1 g
2. A strainer with openings smaller than 1.18 mm (#16 sieve)
3. Two bowls of sufficient capacity
4. A solution of zinc chloride ($ZnCl_2$) having a specific gravity between 1.950 and 1.999 at 21°C (70°F)

   NOTE: To prepare one gallon of solution, slowly add 5670 g (12.5 lb.) of technical grade zinc chloride to 2248 g (4.75 pt.) of water with constant stirring. The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 21°C (70°F) and measure specific gravity with a hydrometer. If the sp. gr. is below 1.95, add zinc chloride in 227 g (0.5 lb.) increments until the sp. gr. of the solution is at least 1.95 at 21°C (70°F). It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

5. Drying oven or hot plate
6. Mixing spoon

B. Sample Preparation

1. Obtain a representative sample by appropriate methods detailed in Materials I.M. 301 and 336.
2. Dry the test sample to a constant weight, allow to cool, weigh, and record. When the material includes aggregate retained on and above the 4.75mm (#4) sieve, the representative sample shall be large enough to yield at least 500 grams of dry material passing the 4.75mm (#4) sieve.
3. Sieve the test sample over the 1.18mm (#16) sieve. Discard the material passing

this sieve and subject the test sample to the test procedure. The test sample for P.C. concrete fine aggregate is the total material retained on the 1.18 mm (#16) after the fine aggregate sieve analysis has been completed, which could include +4.75 mm (+#4) materials. The test sample for asphalt fine aggregate is the quantity of -4.75 mm (-#4) materials retained on the 1.18 mm (#316) sieve after sieve analysis.

C. Test Procedure

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

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

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

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

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

5. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant mass (weight) in an oven at a temperature of 110 ± 5°C (230 ± 9°F) or on a hot plate at a low heat setting. Weigh to the nearest 0.1 g.

D. Calculations

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

shale

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

whole sample

* This mass (weight) includes the material passing the 1.18 mm (#16 sieve) and represents the total sample mass (weight) of the fine aggregate.

.1 %

NOTES

METHOD OF TEST
DETERMINATION OF THE AMOUNT OF SHALE IN COARSE AGGREGATE
FIELD PROCEDURE OF IOWA TEST METHOD 210

SCOPE

This test method covers the procedure for the approximate determination of the shale content in coarse aggregate. This method separates, along with the shale, other particles of low specific gravity.

PROCEDURE

A. Apparatus

1. Balance having a capacity of at least 2500 g and sensitive to 0.1 g

2. A strainer with openings not larger than 2.36 mm (#8 sieve)

3. Two bowls of sufficient capacity

4. A solution of zinc chloride ($ZnCl_2$) having a specific gravity between 1.950 and 1.999 at 21°C (70°F).

   NOTE: To prepare one gallon of solution, slowly add 5670 g (12.5 lb.) of technical grade zinc chloride to 2248 g (4.75 pt.) of water with constant stirring. The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 21°C (70°F) and measure specific gravity with a hydrometer. If the sp. gr. is below 1.95, add zinc chloride in 227 g (0.5 lb.) increments until the sp. gr. of the solution is at least 1.95 at 21°C (70°F). It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

5. Drying oven or hot plate

6. Mixing spoon

B. Test Procedure

1. A sample of approximately 2500-grams of + 4.75 mm (+ #4) material shall be selected by quartering or splitting to insure representation.

2. Dry the sample to a constant mass (weight) in an oven at a temperature of 110 ± 5°C (230 ± 9°F) or on a hot plate at low heat setting with frequent stirring to avoid local overheating. Weigh to the nearest 0.1 g.

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

3. Place the dried sample of aggregate in the bowl and pour the solution of zinc chloride over the aggregate until the volume of the liquid is at least 3 times the absolute volume of the aggregate.

4. Agitate the aggregate by vigorously stirring with a large mixing spoon until no additional pieces float to the surface.

5. Skim off the floating particles within one minute.

6. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant mass (weight) in an oven at a temperature of 110 ± 5°C (230 ± 9°F) or on a hot plate at a low heat setting. Weigh to the nearest 0.1 g.

7. Particles of low specific gravity other than shale may be handpicked and removed prior to weighing.

C. Calculation

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

$$\%\,\text{Shale} = \frac{\text{Dry Mass (Weight) of Washed Decanted Particles}}{\text{* Dry Mass (Weight) of Sample}} \times 100$$

   * Mass (weight) of the + 4.75 mm (+ #4) material

NOTES

Appendix A:
Forms

Aggregate Sieve Analysis

(Coarse or fine using Box and 203 mm (8 in.) Sieves; or 305 mm (12 in.) Sieves)

1. Obtain a field sample (per I.M. 301)
2. Reduce the field sample (per I.M. 336) to the proper test sample size listed in I.M. 301.
3. When required to determine the percent passing the 75 μm (#200) sieve, or when testing a Fine Aggregate sample, dry the test sample to a constant mass (weight). (Note: A second (smaller) sample of coarse aggregate may be obtained (per I.M. 336) from the field sample to test for the percent passing the 75 μm sieve. See I.M. 306 for the appropriate sample size. In this case, the larger sample of coarse aggregate needs only to be in a "surface-dry" condition when sieving down through the 2.36 mm (#8) screen).
4. Cool the sample if dried to a constant mass, weigh and record as the Original Dry Mass.
   4a. When testing for the percent passing the 75 μm sieve, wash the entire sample over a 75 μm wash sieve per I.M. 306.
   4b. Dry the washed sample to a constant mass, cool, weigh, and record as Dry Mass Washed.
   4c. Determine washing loss and record in both places on worksheet.
5. Place the sample in the appropriate sieves and sieve to completion:
   - Coarse Aggregate in box sieves, 37.5 mm through 2.36 mm (1 ½ in. through #8)
   - Fine Aggregate in 203 mm or 305 mm round sieves, 9.5 mm through 75 μm (3/8 in. through #200)
   - Combined or Fine Aggregate in 305 mm sieves, 25 mm through 75 μm (1 in. through #200)

   (Note the largest sieve size needed in any case is dependent on the maximum particle size in the sample).
6. Clean the retained material from each sieve, weigh, and record each increment to the nearest 0.5 gram saving each increment individually until the entire test procedure is completed.

7. Add the mass retained column, including the washing loss and pan if the sample was washed. Check weighing accuracy by dividing the total by the original mass x 100 (and/or the total minus the washing loss divided by the dry mass washed x 100 if the sample was washed).
8. Calculate the percent retained for each sieve by dividing the mass retained on each sieve by the Original Dry Mass x 100. Remember to combine the washing loss and pan for this calculation if sample was washed.
9. Add the percent retained column, prorating as needed, to equal 100 %.
10. Determine the percent passing each sieve by consequently subtracting the percents retained starting with the sieve that had 100 % passing (the smallest sieve used which had no material retained).

Coarse Aggregate Wash Sample
(Percent passing 75 µm sieve only)

1. Dry the sample to a constant mass, cool, weigh, and record as Original Dry Mass (at the bottom of the worksheet).
2. Wash the sample over the 75 mm sieve per I.M. 306.
3. Dry the washed sample to a constant mass, cool, weigh and record as Dry Mass Washed.
4. Determine the Washing Loss and record in appropriate places on worksheet.
5. Screen the sample over a box 2.36 mm sieve, discarding the material retained on the 2.36 mm sieve.
6. Place the minus 2.36 mm material in a nest of round sieves (300 µm, 150 µm, and 75 µm) and pan.
7. Place the nest of sieves in a mechanical shaker (or sieve by hand) until sieving to completion is achieved (usually 5 minutes in a mechanical shaker).
8. Weigh and record only the material retained in the pan.
9. Combine the Washing Loss and Pan masses and divide by the Original Dry Mass x 100.
10. Record as percent passing the 75 µm sieve.

(Now it is safe to discard your sample increments)

Combined Aggregate Sieve Analysis

(With Box and Round 203 mm (8 in.) diameter sieves)

Phase 1

1. Obtain a field sample (per I.M. 301).
2. Reduce the field sample (per I.M. 336) to the proper test sample size listed in I.M. 301.
3. Dry the test sample to a constant mass (weight), allow to cool, weigh to nearest 0.5 gram and record as Original Dry Mass.
4. Wash the sample over the 75 μm wash sieve (per I.M. 306).
5. Dry the washed sample to a constant mass, cool, weigh and record the mass as the Dry Mass of Washed Sample.
6. Determine the Washing Loss and record in both locations on worksheet.
7. Sieve the sample through the required box sieves finishing with the 4.75 mm (#4) or 2.36 mm (#8).
8. Clean the retained material from each sieve; weigh and record each increment (record in the second column of worksheet), saving each increment individually until the entire test procedure is completed.

Note: At this point technician must decide if the amount of material passing the 4.75 μm or 2.36 μm box sieve will create an overload situation on any of the 203 mm sieves (over 200 grams on a sieve).

Phase 2 (Overload not anticipated)

1. Place the minus 4.75 mm (or 2.36 mm) material in the nest of 203 mm round sieves and sieve in the mechanical shaker for a period long enough to obtain sieving to completion (usually 10 minutes).
2. Clean the retained material from each sieve; weigh and record each increment (record in the second column of worksheet), saving each increment individually until the entire test procedure is completed.
3. Add the entire mass retained column including the pan and washing loss
4. Determine the weighing accuracy (± 0.5%)

5. Calculate the percent retained on each sieve (individual mass ÷ dry mass x 100) to nearest 0.1%. (Remember to combine the washing loss and pan for this calculation)
6. Total the percent retained column, prorating as necessary, to equal 100%.
7. Calculate the percent passing each sieve by consecutively subtracting the percent retained, starting with the sieve that had 100% passing (the smallest sieve used which had no material retained).
8. The percent passing the 75 μm (#200) sieve must equal the last result obtained in the percent retained column.

Phase 2 (overload on 203 mm sieves anticipated)

1. Weigh and record the material passing the 4.75 mm box sieve as the total minus 4.75 mm mass (W1).
2. Reduce the material passing the 4.75 mm box sieve using the 25 mm (1 in.) sample splitter (a smaller splitter may be used if available). **The minimum mass of the reduced sample is 500 grams.**
3. Weigh and record the reduced minus 4.75 mm material as the reduced minus 4.75 mm mass (W2).
4. Divide W1 by W2 and record as conversion factor (four places to the right of the decimal point).
5. Place the reduced sample into the nest of 203 mm sieves (starting with the 2.36 mm sieve) and sieve in the mechanical sieve shaker for a period long enough to obtain sieving to completion (usually 10 minutes).
6. Clean the retained material from each sieve; weigh and record each increment (record in first column on worksheet), saving each increment individually until the entire test procedure is completed.
7. Add the column including the pan (excluding the washing loss) and check weighing accuracy by dividing the column total by the W2 weight (±0.5% tolerance).
8. Multiply each mass retained (B) including the pan by the conversion factor and record the result in the second column (A) to the nearest 0.1%.
9. Add the entire second column (including the masses retained on the +4.75 mm sieves and washing loss).

10. Divide this total by the Original Dry Mass of Sample x 100. The result must be within ± 0.5%.
11. Divide each mass retained in this column (second column) by the Original Dry Mass of Sample x 100 and record in the percent retained to the nearest 0.1%.
12. Add the percent retained column, prorating as needed to equal 100%.
13. Determine percent passing each sieve by consecutively subtracting the percents retained starting with the sieve that had 100% passing.
14. The percent passing the 75 μm sieve must equal the last result obtained in the percent retained column.

(Now it is safe to discard your sample increments)

Form 821278
12/92

IOWA DEPARTMENT OF TRANSPORTATION

CERTIFIED GRADATION TEST REPORT

☐ Certified Sample

☒ Monitor Sample

☐ Verification Sample

County: Delaware
Project: WHS
Contractor:
Contract #:
Design:
Date: Oct. 27,2000 Report No.: 3

Source Name Tegler Pit T-203A No. A28504 Source Location NE Sec 36 Twp 89 Range w2 County Delaware

Material Concrete Sand Class Gradation No 1 Beds

Material Producer BARD Concrete Company Destination Stockpile Sampled At Pit 10-5,13,19

Date Sampled	Sample Identification	Sampled By	Tested By	Sieve Analysis 37.5mm (1 1/2in)	26.5mm (1.00in)	19mm (3/4in)	13.2mm (0.50in)	9.5mm (3/8in)	4.75mm (No.4)	2.36mm (No.8)	1.18mm (No.16)	Percent Passing 600µm (No.30)	300µm (No.50)	150µm (No100)	75µm (No200)	Other Test Results			Comp	Tons
	* Production Limits		Max.					100	100	100		54			1.5					
			Min.						90	70					0					
Oct. 5	DL-192-00	DOT	Like					100	97	85	68	44	15	1.7	0.4					
Oct. 5	T18-00	Producer	S.L.					100	94	83	64	42	15	1.3	0.2					
Oct.13	DL-197-00	DOT	Like					100	97	86	68	45	16	1.9	0.4					
Oct. 13	T21-00	Producer	L.M.					100	96	84	67	44	15	1.2	0.2					
Oct. 19	DL-202-00	DOT	Like					100	97	90	76	49	15	1.5	0.4					
Oct. 20	T23-00	Producer	S.L.					100	96	86	70	46	16	1.5	0.4					

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Note to County and Resident Engineers- If County or Project Number is Incorrect, please notify inspector and Ames Office Promptly. Corrected Reports will be issued.

Comments Bard Concrete Company
Roger Boulet

File

District 6 personnel have made a comparison of gradations. No significant difference exists between these results.

*AGREED by the Contractor/producer

Distribution: Materials Engr.; Project Engr.; Certified Technician; Area Inspector

ESTIMATED QUANTITY 0 TONS

TOTAL PREVIOUSLY CERTIFIED 30,000 TONS

TOTAL CERTIFIED TO DATE 42,000 TONS

CERTIFICATION NUMBER EC222

Reported By Don Like

Representing Iowa DOT

Form 821278
12/92

IOWA DEPARTMENT OF TRANSPORTATION

CERTIFIED GRADATION TEST REPORT

[✓] Certified Sample

[ ] Monitor Sample

[ ] Verification Sample

County: Jasper
Project: IM-80-5(184)160--13-5
Contractor: Manatt's
Contract #:
Design:
Date: 7/24/00 Report No.: 36

Source Name #552 Colfax T-203A No. A50502 Source Location NE Sec 01 Twp 79 Range 21W County 50

Material Concrete Sand Class Gradation No 1 Beds

Material Producer Van Dusseldorp S&G Destination Sampled At Colfax Plant

Date Sampled	Sample Identification	Sampled By	Tested By		37.5mm (1 1/2in)	26.5mm (1.00in)	19mm (3/4in)	13.2mm (0.50in)	9.5mm (3/8in)	4.75mm (No.4)	2.36mm (No.8)	1.18mm (No.16)	600µm (No.30)	300µm (No.50)	150µm (No100)	75µm (No200)	Other Test Results			Comp	Tons
* Production Limits				Max.						100	100		50			1.0					
				Min.					100	90	70		10			0					
7/17/00	CCC00-0258	CC	CC		Load		Area		100	99	91	75	46	12	1.7	0.4					1500
7/18/00	CCC00-0267	CC	CC		"		"		100	99	91	75	46	12	1.2	0.3					1500

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Note to County and Resident Engineers- If County or Project Number is Incorrect, please notify inspector and Ames Office Promptly. Corrected Reports will be issued.

Comments Copies: Materials Eng.
Van Dusseldorp
Manatt's
File Des Moines Lab
CC.

ESTIMATED QUANTITY 3000 0 TONS

TOTAL PREVIOUSLY CERTIFIED 33,750 0 TONS

TOTAL CERTIFIED TO DATE 36,750 0 TONS

CERTIFICATION NUMBER CI 906

*AGREED by the Contractor/producer

Reported By Charlotte Cunningham

Representing Van Dusseldorp Sand & Gravel

Distribution: Materials Engr.; Project Engr.; Certified Technician; Area Inspector

800240E - 01/98

PCC Plant Report

Project No.:	STPN-3-6(29)--2J-09	Contract ID.:	09-0036-029
Plant Name:	Croell - Waverly	County:	Bremer
Contractor / Sub:	PCI/CFI	Temp.(°F) Min.:	65
Weather:	Sunny-Cool	Temp.(°F) Max.:	75

Report No.:	1
Date This Report:	Aug. 31,00
Date Of Last Report:	Aug. 30,00
Design No.:	

Check Mix (x)		Check Type (x)		
Central		Paving	X	(Send Daily or End of Lot)
Ready	X	Structure		(Send Weekly or End of Lot)
		Incidental		(Send Weekly or End of Lot)
		Patching		(Send Weekly or End of Lot)

Date	Mix	Time		Batched	% of Est.	Fine Aggregate			Coarse Aggregate			Actual Quantities Used Per CY (in pounds)							Avg.	Max.
						Moist.	T-203	Dry Wt.	Moist.	T-203	Dry Wt.					Water			W/C	W/C
Mo / Day	Number	Start	Stop	(CY)	Used	(%)	Sp. G.	(lbs)	(%)	Sp. G.	(lbs)	Cement	Fly Ash	Fine	Coarse	In Agg.	Plant	Grade	Ratio	Ratio
31-Aug	C4WRC20	07:26	02:49	506.00	101.2	2.6	2.66	1510.0	0.2	2.65	1500.0	474.0	119.0	1550.0	1503.0	43.0	207.0	3.0	0.427	0.489
																			0.000	
																			0.000	
																			0.000	
																			0.000	
																			0.000	
																			0.000	

COARSE SAMPLE

	Sieve Accuracy= 99.8%				Sieve Accuracy= 0.0%				Sieve Accuracy= 0.0%					
	Orig. Dry Weight (OD Wt.):			6924.2	Orig. Dry Weight (OD Wt.):				Orig. Dry Weight (OD Wt.):					
	Dry Wt. Washed (D Wt. W):				Dry Wt. Washed (D Wt. W):				Dry Wt. Washed (D Wt. W):					
Sieve Size	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Specs.	Avg.
1 1/2"		0.0		100.0		0.0		0.0		0.0		0.0	100	0
1"		0.0		100.0		0.0		0.0		0.0		0.0	95-100	0
3/4"	1731.4	25.0		75.0		0.0		0.0		0.0		0.0		0
1/2"	1710.0	24.7		50.3		0.0		0.0		0.0		0.0	25-60	0
3/8"	1798.9	26.1		24.2		0.0		0.0		0.0		0.0		0
#4	1251.2	18.1		6.1		0.0		0.0		0.0		0.0	0-10	0
#8	317.4	4.6		1.5		0.0		0.0		0.0		0.0	0-5	0
Pan	103.8	1.5				0.0				0.0				
Total	6910.7	100.0			0.0	0.0			0.0	0.0				
#200				0.9				0.0				0.0	0-1.5	0

Wash

Wash Loss	15.3	OD Wt.:	3020.6	0.0	OD Wt.:	0.0	OD Wt.:
Pan	10.5	D Wt. W.:	3005.3		D Wt. W.:		D Wt. W.:
Total	25.8			0.0		0.0	

FINE SAMPLE

	Sieve Accuracy= 100.0%				Sieve Accuracy= 0.0%				Sieve Accuracy= 0.0%					
		Orig. Dry Weight:		617.3		Orig. Dry Weight:				Orig. Dry Weight:				
		Dry Wt. Washed:		615.7		Dry Wt. Washed:				Dry Wt. Washed:				
		Washing Loss:		1.6		Washing Loss:		0.0		Washing Loss:		0.0		
Sieve Size	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Specs.	Avg.
3/8"		0.0		100.0		0.0				0.0			100	0
#4	13.7	2.2		97.8		0.0		0.0		0.0		0.0	90-100	0
#8	50.7	8.2		89.6		0.0		0.0		0.0		0.0	70-100	0
#16	109.5	17.7		71.9		0.0		0.0		0.0		0.0		0
#30	172.4	27.9		44.0		0.0		0.0		0.0		0.0	10--60	0
#50	197.0	32.0		12.0		0.0		0.0		0.0		0.0		0
#100	66.8	10.8		1.2		0.0		0.0		0.0		0.0		0
#200	5.2	0.8		0.4		0.0		0.0		0.0		0.0	0-1.5	0
Wash	1.6	0.4			0.0	0.0			0.0	0.0				
Pan	0.7													
Total	617.6	100.0			0.0	0.0			0.0	0.0				
Sample ID:		BC2700			(ID):				(ID):					
Tested By / Cert. No.:		Bill Croell NE463			(TB/CN):				(TB/CN):					

Batched			
Check One (x):	Today	Week	To Date Total
Concrete (CY):	506.00		506.00
Cement (Tons):	119.65		119.65

	Brand / Source	Rate	Lot No.
Air Ent:	DV1000		CF06-183-22
Wat. Red:	WRDA82		CF05-A178-40
Retarder:			
Cal Chlor:			
Superplas:			

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Concrete Treatment (x)		lbs / CY
Ice		
Heated Water		
Heated Materials		

	Type	Sp. Gr.	Source
Cement:			
Fly Ash:			

	T-203 A - #	Grad. #
Rock:		
Sand:		

Remarks

		Cert. No.
C.P.I.:	Bill Croell	NE463
Monitor:	Lee Dahlin	NE113

Distribution: ____ Central Materials ____ TC Materials ____ Res. Engineer ____ Contractor ____ Plant

800241 - 07/00 ver. 1.1

DAILY ACC PLANT REPORT

Project No.: NHS-6-3(41)--12-77
Contract ID: 77-0006-41
Mix Design No.: ABD8-1007

Contractor: Quality Asphalt, Inc.
County: POLK
Recycle Source:

Class:
Size: 19 mm
Mix Type: A Superpave

Report No.: 1
Design Blows:
Design Gyrations: 109

Hot Box I.D. No.:		SU6-18A	SU6-18B	SU6-18C	SU6-18D	
Date Sampled:		06/18/98	06/18/98	06/18/98	06/18/98	
Gradation ID:	Specs	GRAD 1-A	GRAD 1-B			
1 in. (25mm) Sieve	100	100	100			
3/4 in. (19mm) Sieve	90-100	99	100			
1/2 in. (12.5mm) Sieve	83-90	89	89			
3/8 in. (9.5mm) Sieve	76-90	76	77			
* #4 (4.75mm) Sieve	43-57	47	48			
* Moving Average						
* #8 (2.36mm) Sieve	23-35	29	30			
* Moving Average						
#16 (1.18mm) Sieve		19	19			
* #30 (600um) Sieve	7-15	13	12			
* Moving Average						
#50 (300um) Sieve		7.6	7.3			
#100 (150um) Sieve		5.4	4.7			
* #200 (75um) Sieve	2.0-5.3	4.2	3.6			
* Moving Average						
Compliance (Y/N)						
Intended Added, % AC	5.40					
Actual Added, % AC		5.28				
Intended Total, % AC	5.40					
Actual Total, % AC		5.28				
Gmb:		2.373	2.365	2.375	2.371	
Gmm:		2.469	2.477	2.480	2.478	
Pa:		3.9	4.5	4.2	4.3	
Moving Average	3.5-5.0					
Time		7:05 AM	8:35 AM	1:30 PM	4:55 PM	This
Station		112+55	134+22	189+98	244+55	Column
Side		WB	WB	WB	WB	Is For
Sample Mg's		118.00	504.00	2,374.00	3,160.00	Dist. Lab
Sublot Mg's		500.00	1,100.00	1,100.00	1,105.24	Test
Mg's to Date						Results
Fines / Bitumen Ratio	0.6-1.4	1.13				

Gsb: 2.577 Gb: 1.0240 Effective % AC: 3.71

Mix Change Information:

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. °C	14	17	21	22	22	20	20
A.C. Temp. °C	150	152	151	153	155	150	150
Mix Temp. °C	145	155	159	151	145	148	150

Date Placed: 06/18/98 Date Tested: 06/19/98

Course Placed: surface Tested By: John Rayson

Density Record

Core No.:	1	2	3	4	5	6	7
Station	110+66	144+35	166+81	198+45	212+16	238+77	254+75
CL Reference	1.0 RT	1.0 LT	2.8 LT	1.9 RT	2.8 LT	1.0 RT	2.8 RT
W 1 Dry	1,205.5	1,236.6	1,388.5	1,279.4	1,145.5	1,401.2	1,215.8
W 2 in H20	685.9	701.6	799.6	736.1	648.2	795.5	696.1
W 3 Wet	1,206.6	1,238.1	1,389.6	1,280.9	1,147.0	1,402.5	1,217.1
Difference	520.7	536.5	590.0	544.8	498.8	607.0	521.0
Field Density	2.315	2.305	2.353	2.348	2.297	2.308	2.334
% Density	97.638	97.216	99.241	99.030	96.879	97.343	98.439
% Voids	6.5	6.9	5.0	5.2	7.2	6.8	5.7
Thickness (mm)	40	45	50	45	35	50	45

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Gmb (Lot Avg.): **2.371** Avg. Field Density: **2.323**
Gmm (Lot Avg.): **2.476** Avg. % Density: **97.969**
Dist. Labs Pa: Avg. % Field Voids: **6.2**
Target % RAP: **NA** Specified % Density: 95

$$\text{Q.I.} = \frac{2.323 - 2.252}{0.022} = \mathbf{3.21}$$

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): **9.2** VMA: **12.9** D.O.T. Results Used:

Remarks:

Certified Tech: Ray Johnson c1213 Cert. No.
Certified Tech: John Rayson c1312 Cert. No.

Distribution: ____ Central Materials ____ TC Materials ____ Proj. Engineer ____ Contractor ____ Plant

Notes

Notes

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:	1		
Material:	FINE AGGREGATE-PCC	Grad. No.:	1
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	511.3	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	509.0	Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)		19.1			
2.36mm (8)	(B)	98.3 (A)			
1.18mm (16)	(B)	124.0 (A)			
600µm (30)	(B)	160.9 (A)			
300µm (50)	(B)	77.2 (A)			
150µm (100)	(B)	22.6 (A)			
75µm (200)	(B)	7.3 (A)			
Wash		2.3			
Pan	(B)	0.4 (A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

Lab. No.:	2		
Material:	FINE AGGREGATE-PCC	Grad. No.:	1
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	542.0	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	539.6	Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	101.3 (A)			
1.18mm (16)	(B)	160.7 (A)			
600µm (30)	(B)	179.0 (A)			
300µm (50)	(B)	80.0 (A)			
150µm (100)	(B)	10.9 (A)			
75µm (200)	(B)	5.8 (A)			
Wash		2.4			
Pan	(B)	0.3 (A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

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IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:	1		
Material:	FINE AGGREGATE-PCC	Grad. No.:	1
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	511.3	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	509.0	Reduced Minus 4.75 mm (W2):	
Washing Loss:	2.3	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)				100.0	100
4.75mm (4)		19.1	3.7	96.3	90-100
2.36mm (8)	(B)	98.3 (A)	19.2	77.1	70-100
1.18mm (16)	(B)	124.0 (A)	24.3	52.8	
600µm (30)	(B)	160.9 (A)	31.5 (31.4)	21.4	10-60
300µm (50)	(B)	77.2 (A)	15.1	6.3	
150µm (100)	(B)	22.6 (A)	4.4	1.9	
75µm (200)	(B)	7.3 (A)	1.4	0.5	0-1.5
Wash		2.3	0.5		
Pan	(B)	0.4 (A)			
Total		512.1	100.1 (100.0)		
Tolerance		100.2			

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments:

Lab. No.:	2		
Material:	FINE AGGREGATE-PCC	Grad. No.:	1
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	542.0	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	539.6	Reduced Minus 4.75 mm (W2):	
Washing Loss:	2.4	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					100
4.75mm (4)				100.0	90-100
2.36mm (8)	(B)	101.3 (A)	18.7 (18.8)	81.2	70-100
1.18mm (16)	(B)	160.7 (A)	29.6 (29.7)	51.5	
600µm (30)	(B)	179.0 (A)	33.0 (33.1)	18.4	10-60
300µm (50)	(B)	80.0 (A)	14.8	3.6	
150µm (100)	(B)	10.9 (A)	2.0	1.6	
75µm (200)	(B)	5.8 (A)	1.1	0.5	0-1.5
Wash		2.4	0.5		
Pan	(B)	0.3 (A)			
Total		540.4	99.7 (100.0)		
Tolerance		99.7			

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments:

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IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:	1		
Material:	COARSE AGGREGATE-PCC	Grad. No.:	3
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	3759.4	Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)		23.0			
19mm (¾)		381.2			
12.5mm (½)		1476.8			
9.5mm (3/8)		1243.5			
4.75mm (4)		501.0			
2.36mm (8)	(B)	100.7 (A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash		(A)			
Pan	(B)	30.8 (A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	2603.3
Dry Mass Washed:	2590.4
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan	1.1			

Date Reported:		Cert. No.:	
Tested By:			

Comments:

Lab. No.:	2		
Material:	COARSE AGGREGATE-PCC	Grad. No.:	4
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	5348.7	Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)		169.0			
19mm (¾)		516.7			
12.5mm (½)		1817.0			
9.5mm (3/8)		1798.3			
4.75mm (4)		713.9			
2.36mm (8)	(B)	307.1 (A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash		(A)			
Pan	(B)	24.6 (A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	2582.8
Dry Mass Washed:	2561.9
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan	0.9			

Date Reported:		Cert. No.:	
Tested By:			

Comments:

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IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:	1		
Material:	COARSE AGGREGATE-PCC	Grad. No.:	3
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	3759.4	Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)				100.0	100
25mm (1)		23.0	0.6	99.4	95-100
19mm (¾)		381.2	10.1	89.3	
12.5mm (½)		1476.8	39.3 (39.4)	49.9	25-60
9.5mm (3/8)		1243.5	33.1	16.8	
4.75mm (4)		501.0	13.3	3.5	0-10
2.36mm (8)	(B)	100.7 (A)	2.7	0.8	0-5
1.18mm (16)	(B)	(A)			
600μm (30)	(B)	(A)			
300μm (50)	(B)	(A)			
150μm (100)	(B)	(A)			
75μm (200)	(B)	(A)			
Wash		(A)	0.8		
Pan	(B)	30.8 (A)			
Total		3757.0	99.9 (100.0)		
Tolerance		99.9			

Wash Sample		
	Original Dry Mass:	2603.3
	Dry Mass Washed:	2590.4
	Washing Loss:	12.9

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)			0.5	0-1.5
Wash	12.9	0.5		
Pan	1.1			

Date Reported:	Cert. No.:	
Tested By:		

Comments:

Lab. No.:	2		
Material:	COARSE AGGREGATE-PCC	Grad. No.:	4
Co. & Proj. #:			
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	5348.7	Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)				100.0	100
25mm (1)		169.0	3.2	96.8	
19mm (¾)		516.7	9.7	87.1	
12.5mm (½)		1817.0	34.0	53.1	
9.5mm (3/8)		1798.3	33.6	19.5	
4.75mm (4)		713.9	13.3	6.2	0-10
2.36mm (8)	(B)	307.1 (A)	5.7	0.5	0-5
1.18mm (16)	(B)	(A)			
600μm (30)	(B)	(A)			
300μm (50)	(B)	(A)			
150μm (100)	(B)	(A)			
75μm (200)	(B)	(A)			
Wash		(A)	0.5		
Pan	(B)	24.6 (A)			
Total		5346.6	100.0		
Tolerance		99.96			

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Wash Sample		
	Original Dry Mass:	2582.8
	Dry Mass Washed:	2561.9
	Washing Loss:	20.9

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)			0.8	0-1.5
Wash	20.9	0.8		
Pan	0.9			

Date Reported:	Cert. No.:	
Tested By:		

Comments:

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:			
Material:	1" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using Box and 203mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	3581.0	Total Minus 4.75 mm (W1):	2262.9
Dry Mass Washed:	3393.7	Reduced Minus 4.75 mm (W2):	563.1
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)		76.5			
19mm (¾)		178.4			
12.5mm (½)		202.0			
9.5mm (3/8)		296.1			
4.75mm (4)		377.8			
2.36mm (8)	103.1 (B)	(A)			
1.18mm (16)	167.6 (B)	(A)			
600µm (30)	186.3 (B)	(A)			
300µm (50)	62.1 (B)	(A)			
150µm (100)	20.3 (B)	(A)			
75µm (200)	14.8 (B)	(A)			
Wash					
Pan	6.9 (B)	(A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments: ______________________________

Lab. No.:			
Material:	3/4" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using Box and 203mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	2296.0	Total Minus 4.75 mm (W1):	1023.9
Dry Mass Washed:	2201.9	Reduced Minus 4.75 mm (W2):	512.0
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)		15.0			
12.5mm (½)		196.0			
9.5mm (3/8)		477.3			
4.75mm (4)		489.7			
2.36mm (8)	163.2 (B)	(A)			
1.18mm (16)	101.0 (B)	(A)			
600µm (30)	97.6 (B)	(A)			
300µm (50)	80.0 (B)	(A)			
150µm (100)	41.3 (B)	(A)			
75µm (200)	26.0 (B)	(A)			
Wash					
Pan	2.4 (B)	(A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments: ______________________________

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:			
Material:	1" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using Box and 203mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	3581.0	Total Minus 4.75 mm (W1):	2262.9
Dry Mass Washed:	3393.7	Reduced Minus 4.75 mm (W2):	563.1
Washing Loss:	187.3	Conversion Factor: W1 / W2	4.0186
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)				100.0	
25mm (1)		76.5	2.1	97.9	
19mm (¾)		178.4	5.0	92.9	
12.5mm (½)		202.0	5.6	87.3	
9.5mm (3/8)		296.1	8.3	79.0	
4.75mm (4)		377.8	10.6	68.4	
2.36mm (8)	103.1 (B)	414.3 (A)	11.6	56.8	
1.18mm (16)	167.6 (B)	673.5 (A)	18.8	38.0	
600μm (30)	186.3 (B)	748.7 (A)	20.9 (21.0)	17.0	
300μm (50)	62.1 (B)	249.6 (A)	7.0	10.0	
150μm (100)	20.3 (B)	81.6 (A)	2.3	7.7	
75μm (200)	14.8 (B)	59.5 (A)	1.7	6.0	
Wash		187.3	6.0		
Pan	6.9 (B)	27.7 (A)			
Total	561.1	3573.0	99.9 (100.0)		
Tolerance	99.6	99.8			

Wash Sample	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

Lab. No.:			
Material:	3/4" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using Box and 203mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	2296.0	Total Minus 4.75 mm (W1):	1023.9
Dry Mass Washed:	2201.9	Reduced Minus 4.75 mm (W2):	512.0
Washing Loss:	94.1	Conversion Factor: W1 / W2	1.9998
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)				100.0	
19mm (¾)		15.0	0.7	99.3	
12.5mm (½)		196.0	8.5	90.8	
9.5mm (3/8)		477.3	20.8	70.0	
4.75mm (4)		489.7	21.3	48.7	
2.36mm (8)	163.2 (B)	326.4 (A)	14.2	34.5	
1.18mm (16)	101.0 (B)	202.0 (A)	8.8	25.7	
600μm (30)	97.6 (B)	195.2 (A)	8.5	17.2	
300μm (50)	80.0 (B)	160.0 (A)	7.0	10.2	
150μm (100)	41.3 (B)	82.6 (A)	3.6	6.6	
75μm (200)	26.0 (B)	52.0 (A)	2.3	4.3	
Wash		94.1	4.3		
Pan	2.4 (B)	4.8 (A)			
Total	511.5	2295.1	100.0		
Tolerance	99.9	100.0			

Wash Sample	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:			
Material:	3/4" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using 305mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	2247.5	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	2091.9	Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)		27.0			
12.5mm (½)		243.3			
9.5mm (3/8)		301.1			
4.75mm (4)		511.8			
2.36mm (8)	(B)	432.0 (A)			
1.18mm (16)	(B)	211.6 (A)			
600μm (30)	(B)	116.9 (A)			
300μm (50)	(B)	100.4 (A)			
150μm (100)	(B)	83.0 (A)			
75μm (200)	(B)	54.0 (A)			
Wash					
Pan	(B)	8.3 (A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

Lab. No.:			
Material:	1/2" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using 305mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	1631.0	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	1526.5	Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)		13.1			
9.5mm (3/8)		295.4			
4.75mm (4)		383.7			
2.36mm (8)	(B)	396.0 (A)			
1.18mm (16)	(B)	167.7 (A)			
600μm (30)	(B)	86.6 (A)			
300μm (50)	(B)	77.0 (A)			
150μm (100)	(B)	62.3 (A)			
75μm (200)	(B)	39.1 (A)			
Wash					
Pan	(B)	6.6 (A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75μm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments:

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

Lab. No.:			
Material:	3/4" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using 305mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	2247.5	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	2091.9	Reduced Minus 4.75 mm (W2):	
Washing Loss:	155.6	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)				100.0	
19mm (¾)		27.0	1.2	98.8	
12.5mm (½)		243.3	10.8	88.0	
9.5mm (3/8)		301.1	13.4	74.6	
4.75mm (4)		511.8	22.8 (22.9)	51.7	
2.36mm (8)	(B)	432.0 (A)	19.2	32.5	
1.18mm (16)	(B)	211.6 (A)	9.4	23.1	
600µm (30)	(B)	116.9 (A)	5.2	17.9	
300µm (50)	(B)	100.4 (A)	4.5	13.4	
150µm (100)	(B)	83.0 (A)	3.7	9.7	
75µm (200)	(B)	54.0 (A)	2.4	7.3	
Wash		155.6	7.3		
Pan	(B)	8.3 (A)			
Total		2245.0	99.9 (100.0)		
Tolerance		99.9			

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments:

Lab. No.:			
Material:	1/2" COMBINED AGGREGATE	Grad. No.:	
Co. & Proj. #:	(Using 305mm sieves)		
Producer:			
Contractor:			
Sampled By:		Date:	
Sample Loc.:			

Original Dry Mass:	1631.0	Total Minus 4.75 mm (W1):	
Dry Mass Washed:	1526.5	Reduced Minus 4.75 mm (W2):	
Washing Loss:	104.5	Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)				100.0	
12.5mm (½)		13.1	0.8	99.2	
9.5mm (3/8)		295.4	18.1	81.1	
4.75mm (4)		383.7	23.5	57.6	
2.36mm (8)	(B)	396.0 (A)	24.3	33.3	
1.18mm (16)	(B)	167.7 (A)	10.3	23.0	
600µm (30)	(B)	86.6 (A)	5.3	17.7	
300µm (50)	(B)	77.0 (A)	4.7	13.0	
150µm (100)	(B)	62.3 (A)	3.8	9.2	
75µm (200)	(B)	39.1 (A)	2.4	6.8	
Wash		104.5	6.8		
Pan	(B)	6.6 (A)			
Total		1632.0	100.0		
Tolerance		100.1			

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments:

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments: ______________________________

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample

Original Dry Mass:	
Dry Mass Washed:	
Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:
Tested By:		

Comments: ______________________________

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments: ____________________

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash Sample		
	Original Dry Mass:	
	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

Comments: ____________________

IOWA DEPARTMENT OF TRANSPORTATION
SIEVE ANALYSIS WORKSHEET

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash	Original Dry Mass:	
Sample	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

Date Reported:		Cert. No.:	
Tested By:			

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

Original Dry Mass:		Total Minus 4.75 mm (W1):	
Dry Mass Washed:		Reduced Minus 4.75 mm (W2):	
Washing Loss:		Conversion Factor: W1 / W2	
		Calculated Weight (A)=Conversion Factor x (B)	

Sieve Size	Reduced Minus 4.75mm	Total or Calc. Weight Retd	% Retd.	% Passing	Specs.
37.5mm (1½)					
25mm (1)					
19mm (¾)					
12.5mm (½)					
9.5mm (3/8)					
4.75mm (4)					
2.36mm (8)	(B)	(A)			
1.18mm (16)	(B)	(A)			
600µm (30)	(B)	(A)			
300µm (50)	(B)	(A)			
150µm (100)	(B)	(A)			
75µm (200)	(B)	(A)			
Wash					
Pan	(B)	(A)			
Total					
Tolerance					

Wash	Original Dry Mass:	
Sample	Dry Mass Washed:	
	Washing Loss:	

Sieve Size	Mass Retd.	% Retd.	% Passing	Specs.
75µm (200)				
Wash				
Pan				

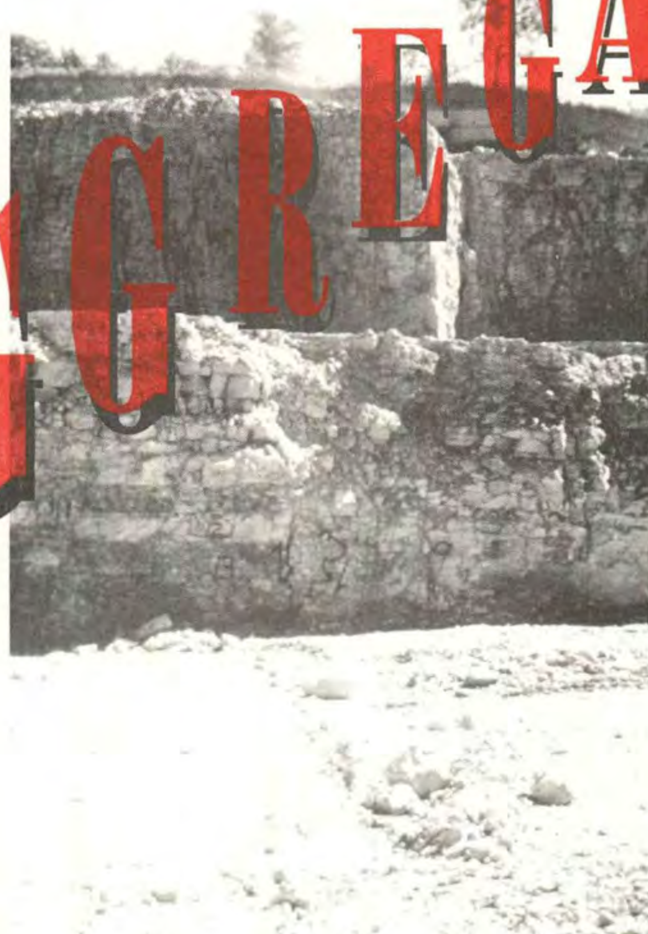
Date Reported:		Cert. No.:	
Tested By:			

Comments: ______________________

TTCP

Technical Training and Certification Program

AGGREGATE



LEVEL I & LEVEL II

INSTRUCTION TEXT

1996-1997

Iowa Department of Transportation

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AGGREGATE TECHNICIAN CERTIFICATION PROGRAM

GENERAL

The purpose of the Aggregate Technician Certification Program (ATCP) is to ensure quality sampling and testing of aggregate for gradation by certification of industry and contracting authority personnel.

Through a cooperative program of training, study and examination, technicians will be able to better ensure satisfactory gradation control, identification of aggregates, and documentation.

Sampling shall be done by either a Level I or Level II Certified Aggregate Technician. Testing of aggregate for gradation, in accordance with 1106.01 of the Standard Specifications, shall be by a Level II Certified Aggregate Technician. The technician cannot delegate the sampling or testing responsibility to a non-certified person.

ADMINISTRATION

The ATCP will be carried out in accordance with general policy guidelines established or approved by the Director of the Division of Project Development. The Director will be advised by a Board of Certification composed of the following members:

Engineer - Office of Materials
Engineer - Office of Construction
Representative of the Transportation Center Materials Engineers**
Representative of the Association of General Contractors (AGC of Iowa)
Representative of the Iowa Limestone Producers Association (ILPA)
Representative of the County Engineers

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

Appeals on actions taken in this program shall be submitted to the Program Director. Unresolved appeals will be submitted to the Certification Board.

** Appointed by the Program Director.

REQUIREMENTS

Certification as a Level I or Level II Aggregate Technician can be obtained by successfully passing written and demonstration examinations conducted in accordance with this memorandum.

Certified Technicians may represent any company or agency for which they have been formally authorized as representatives.

Registered Professional Engineers and engineering and geology graduates from accredited institutions will be exempt from taking examinations. In order to obtain certification, these persons must meet all of the following conditions:

A. Be a registered Engineer in the State of Iowa or submit satisfactory evidence of a degree in engineering or geology.

B. Shall have had work assignments in the area of highway construction, aggregate production, distribution and/or use. Shall be intimately connected with the scope of activity defined in the areas of certification.

In requesting certification, a statement of the above information must be submitted to the Iowa DOT Materials Office in Ames. Certificates issued in accordance with these requirements will be subject to the same regulations concerning expiration, etc. that apply to certificates obtained by examinations.

OUT-OF-STATE APPLICANTS

Requests for certification from persons for Level I or Level II Aggregate Technicians from another state will be issued when the following criteria is met:

1. The person must be a certified Aggregate Technician in another state or shall have received equivalent training if the state does not have a certification program.

2. The applicant shall pass an examination, or examinations, administered by the Iowa DOT to obtain the certification level desired.

Out-of-state applications should be submitted to the Iowa DOT Materials Office in Ames to schedule test dates. Copies of all certifications must accompany the application.

CERTIFICATION INFORMATION

Certification information is available in the Iowa Technical Training Booklet. The booklet contains information on the Technical Training Program and a description of all classes offered.

Class schedules for all technical training classes statewide and applications are also included. The booklets are available from any of the Iowa DOT Transportation Center Material Offices. They may also be obtained from the ICPA, IRMCA, ILPA, and APAI.

The fees for the schools and examinations are indicated in the booklet.

INSTRUCTIONAL SCHOOLS AND EXAMINATIONS

The Transportation Center Office of Materials will conduct schools and provide the study materials. Producers/contractors are encouraged to conduct their own pre-training programs. All new applicants must attend an Iowa DOT school and pass the applicable exams to become certified. All examinations will be conducted by the Materials Offices.

The locations and dates of examinations are found in the Technical Training and Certification Registration Booklet. The Level I examination will cover the fundamentals of sampling. The Level II examination will cover the fundamentals of sampling, testing, reporting and proper inspection control as well as a hands-on practical demonstration.

Both the Level I and Level II exams will be open book. Each applicant will have the opportunity to retake any part of the examination failed. If, over a six month period, an applicant fails to successfully complete both portions of the Level II examination, the applicant must retake and successfully pass both portions of the examination.

CERTIFICATION

Upon successfully completing the requirements for certification, the Program Director will issue a certificate and a pocket certification card. This certification is not transferable.

PERFORMANCE REQUIREMENTS

A written notice may be issued to the certified technician for any inadequacies in performing his/her duties. Upon receipt of two such notices, the certified technician may be given a three month suspension. After three written notices, the certified technician is subject to decertification.

DECERTIFICATION

The certificate will become invalid for reasons such as:

1. Failure of the certificate holder to renew the certificate prior to regular expiration described above.
2. False or fraudulent information being used to secure or renew the certificate.
3. False or fraudulent actions or documentation by the certificate holder.

RENEWAL OF CERTIFICATION

Certifications will remain valid for five (5) years (a three month 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 from the date of decertification, they must retake all applicable schools and pass the examinations. **The responsibility for applying for recertification shall rest with the certified individual.**

It shall be the responsibility of the individual to inform the Office of Materials of any address change.

Note: The new program will be implemented at the expiration date of an individual's current certification.

Retesting will be required every five years regardless of work experience or performance. Failure of any level shall require the applicant to retake the applicable school and pass the test.

FUNCTIONS AND RESPONSIBILITIES

The specification requirement for source gradation testing by Certified Technicians does not change the supplier's responsibilities to furnish materials complying with the specification requirements.

The sampling and testing of aggregates for gradation at each source shall be performed by a Certified Technician. The technician shall sample and test in accordance with specified frequencies and promptly submit designated reports.

The Transportation Center Materials Engineer will be responsible for monitoring product quality control and the sampling and testing of aggregates for gradation by the Certified Technician. It is the responsibility of the aggregate producer to maintain the quality of the product delivered to the project.

Samples for abrasion, freeze and thaw, and other tests as needed to monitor the quality control of aggregates will be obtained by Transportation Center Materials Engineers' Offices. Copies of this test data will be made available to the producer by the Transportation Center Materials Office for their records.

The Transportation Center Materials Office will have the authority and responsibility to question and, where necessary, require any changes in production or quality control to ensure the production of material which consistently complies with specification requirements.

Iowa Department of Transportation

HIGHWAY DIVISION - OFFICE OF MATERIALS
INSTRUCTIONAL MEMORANDUM

CERTIFIED AGGREGATE TESTING AND CERTIFIED AGGREGATES
General Rewrite

GENERAL

The prime contractor or a contractor's authorized representative (the producer) shall be responsible for source product quality control.

Aggregate source gradation testing will be performed and documented in accordance with this Instructional Memorandum by persons qualified in accordance with the provisions of I.M. 210.

Source gradation tests will be considered advisory when the aggregate is used for portland cement concrete, asphaltic concrete, asphalt treated base, bituminous treated base, and cement treated granular base and may be considered the basis of acceptance for all other aggregates. The advisory tested group will hereinafter be called "proportioned aggregates." The gradation tests will be called certified gradation tests and the aggregate represented will be called certified aggregate.

Sampling and testing duties described in this Instructional Memorandum shall not be delegated to noncertified technicians.

SAMPLING, TESTING AND DOCUMENTATION

Certified source testing shall be performed as outlined in Materials I.M. 204 utilizing the procedures contained in Materials I.M. Series 300. This testing shall be performed at the required frequency (I.M. 204) during production. Additional certified gradation testing may be required at the time material is shipped to a project or for a stockpiled material carried through a winter season. When additional certified testing of stockpiled material is required, the testing shall be at a frequency of at least one per 6000 Mg (tons). Bins or other means of securing representative samples shall be furnished for the sampling of stockpiled material.

The quality of the material produced shall be verified by testing before shipment to a project. Quality samples will be secured by Transportation Center Materials Office personnel.

All producer gradation tests, complying or non-complying, performed on certified aggregates shall be transmitted promptly by the aggregate producers to the Transportation Center Materials Office on Form 821278. The certified test reports shall identify whether the material is being produced for direct delivery or stockpiling for a specific project or for advance warehouse stock.

Source information and production limits shall be documented on Form 955 for aggregate used in all asphalt mixtures whether the aggregate is being produced directly for project mix designs or secured from acceptable warehouse stockpiles. For other aggregates, the production limits selected need be documented only on the certified gradation test report (Form 821278).

To insure proper identification of delivered aggregates each truck load of certified aggregate shall be identified by a numbered truck ticket showing aggregate description (which shall include the Iowa DOT gradation number if appropriate, the product size if being used for an asphalt mixture, etc.), quantity, source (the pit or quarry name), delivery date and the following certification statement:

This is to certify the material herein described meets applicable contract specification and requirements.

Note: This certification statement shall be signed or initialled by an authorized representative of the Producer.

Note: For aggregates as bid items measured by mass (weight), certified tickets shall include signatures or initials in accordance with Article 2001.07. For aggregates as bid items not measured by weight, a shipment statement or a copy of the certified gradation test report (Form 821278), (which shall include the Iowa DOT gradation number if appropriate, the product size if being used for an asphalt mixture, etc., quantity, source [the pit or quarry name], delivery date and the above certification statement) shall be furnished to project inspection personnel. A certified truck ticket may also be furnished.

When aggregate is shipped by rail or barge each shipment must be identified by a bill of lading or shipment listing which includes rail car or barge number, aggregate description (which shall include the Iowa DOT gradation number if appropriate), quantity, and source and the above statement of certification. A copy of the bill of lading or shipment listing shall be sent to the project engineer and receiving contractor or ready mix operator no later than the same day as shipment source departure.

When aggregate is transferred to a paving plant or ready mix plant without being weighed the estimated quantity transferred shall be shown on a transfer listing furnished to the contractor or ready mix operator. This transfer listing shall include estimated quantity, aggregate description (which shall include the Iowa DOT gradation number), and source and the above statement of certification. An example of this situation is when aggregate moves from the source into a paving plant or ready mix plant without changing ownership.

Certified 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). When the material represented is nonproportioned aggregate the project number must show on the certified document and a copy furnished for project inspection personnel. When the aggregate represented is proportioned aggregate the project number is preferred when practical as in the case when shipping to a paving plant site and not required when impractical as in the case when shipping into warehouse stock at a ready mix plant. A file of certified shipment or transfer documents for 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.

Documentation procedures for asphalt and concrete paving plants which have multi project and commercial mix responsibilities would function in the same manner as described above for ready mix plants.

MONITORING OF CERTIFIED AGGREGATES

The Transportation Center Materials Office will be responsible for monitoring of sampling and testing of aggregates for gradation by the certified technician.

Sampling for monitor inspection of aggregate being produced for a project, for reserved stockpiles, or for stockpiles for intermittent project usage, will be secured at a minimum rate of one per 12,000 Mg (tons) for quality and one per 6,000 Mg (tons) to verify that the gradation testing is being performed in accordance with requirements. Note: These sampling frequencies may be adjusted by the Transportation Center Materials Engineer. The monitoring of certified gradation testing may be waived when the quantities required are approximately 2,000 Mg (tons) or less.

A notice of intent to start production of certified aggregates shall be given to the appropriate Transportation Center Materials representative to afford the opportunity to verify proper ledge control.

Periodic evaluation of certified technicians will be performed by the Transportation Center Materials Representative and kept on file. Correlation (split-bucket) sample results will be compared per I.M. 216.

At no time will the Transportation Center 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.

REHANDLING OF CERTIFIED AGGREGATES

When certified aggregates are rehandled the Transportation Center Materials Engineer shall be notified and afforded the opportunity to monitor the rehandling procedure.

For the purpose of this I.M., rehandling 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 retested with or without reweighing and recertified on a numbered shipment ticket with proper identification and certification statement.

ACCEPTANCE

In the case of proportioned aggregates acceptance tests will be performed on samples obtained at the proportioning plant in accordance with Construction Procedures and Instructions Manual Section 3.22 and Materials Instructional Memorandums 204 and 513.

Acceptance of nonproportioned aggregates will be based on certified gradation tests and on visual examination by the contracting authority to ensure against obvious contamination, segregation or similar unsatisfactory features.

Minor quantities of noncritical aggregates may be visually inspected by the contracting authority and recorded in the project field book. Monitor tests will not be required. Quantities less than 200 Mg (ton) are considered minor. An example of a noncritical aggregate is a nonproportioned aggregate such as granular backfill material for bridge abutments.

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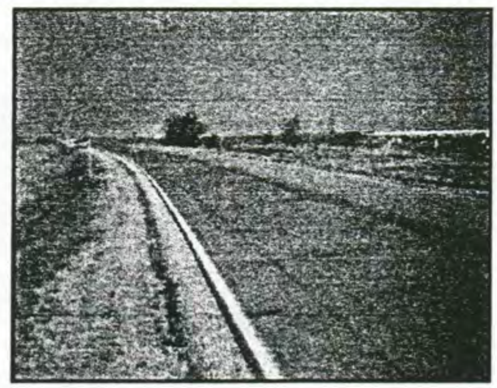
SECTION I
AGGREGATES

Today's highways must have the strength and durability to sustain high volumes of traffic for many years. Since the 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 which have been determined through experience to be the best measure of their quality.



Iowa has come close to eliminating the D-Cracking problem in primary pavements with the classification of coarse aggregates used in concrete.

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, crushed or uncrushed, which are or can be properly sized for the use intended. Glacial clay is composed of minute granular mineral particles and can be used as construction material. However, the term "aggregate" as used in this booklet will be referring to granular materials which contain, at most, only a few percent of particles which will pass through a 75 μm (#200) sieve.

AGGREGATE CLASSIFICATION

COARSE AGGREGATE: *Any aggregate that does not pass the 4.75mm (No. 4) sieve.*

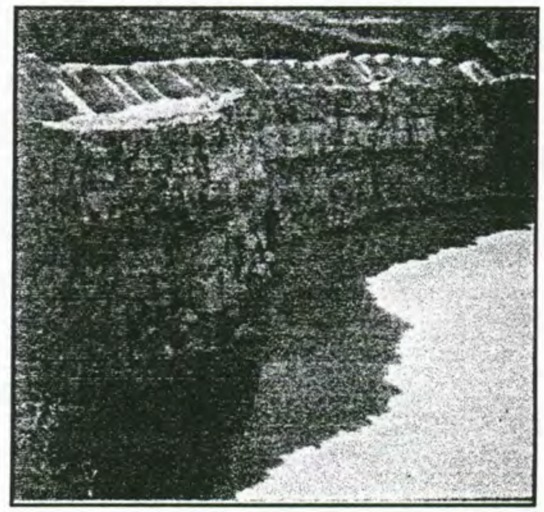
FINE AGGREGATE: *Any aggregate that passes the 4.75mm (No. 4) sieve.*

Coarse and Fine Aggregates: Aggregates are frequently referred to as "fine" or "coarse." There is no universally accepted particle size which separates fine aggregate from coarse aggregate. We have chosen the 4.75 mm (#4) sieve as the sieve size with which to make this separation. All particles which will pass through a 4.75 mm (#4) sieve, and be predominately retained on the 75 μm (#200) sieve, are referred to as "fine aggregate." All particles which are retained on 4.75 mm (#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 which 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.



Aggregate sources are generally gravels and crushed stone from rock sources such as quarries.

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<u>**Natural Sands and Gravels**</u>: 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 or gravels as opposed to manufactured sands or gravels. Consequently, sand made by crushing quartzite or limestone is a natural aggregate but not a natural sand. The specifications require fine aggregates for concrete floors and pavements to be natural sands.

AGGREGATE USES

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

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SECTION II

SAMPLING METHODS AND EQUIPMENT

INTRODUCTION

This chapter deals with the different sampling methods and equipment. Before beginning to study, be sure you have a copy of the current I.M. Volume II prepared by the Materials Office of the Project Development Division.

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 <u>must</u> know how to obtain a proper sample. Without

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

NOTES

this knowledge, it is useless to proceed further into the areas of test procedure.

SAMPLING FREQUENCY

Refer to Materials I.M. 204 in the Field Testing Manual. In the Appendixes A through V of I.M. 204 are listed the minimum sampling frequencies of each material for various types of projects. More frequent sampling may be required for low or intermittent production or for widely varying test results.

SIZE OF SAMPLE

Refer to Materials I.M. 301 in the Field Testing Manual. You will note on Page 2 of I.M. 301 a list of the various construction materials. Immediately to the right of each material listed is a minimum sample size which must be secured for each field sample.

RANDOM SAMPLING

Test samples should represent the total of the material being produced. This is normally accomplished by random sampling. The random sample should not be obtained because of any particular reason or notion. All material produced 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 judgment 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 run to establish crusher settings, etc. Some days will have a combination of random and check samples.

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METHODS FOR OBTAINING AGGREGATE SAMPLES:

* *Off -the-Belt Sampling*
* *Streamflow Sampling*
* *Stockpile Sampling* *(Fine Aggregate only)*

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 Transportation Center Materials Engineer). The preferred method of coarse aggregate sampling is the streamflow method.

To obtain an off-the-belt sample; stop the belt, insert a template at three or more separate locations along the belt, remove all material within the template, and combine it into the field sample. In belt sampling, the ends of the template should be spaced just far 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. All material within each increment is removed from all three or more increments and mixed back together to make one field sample.

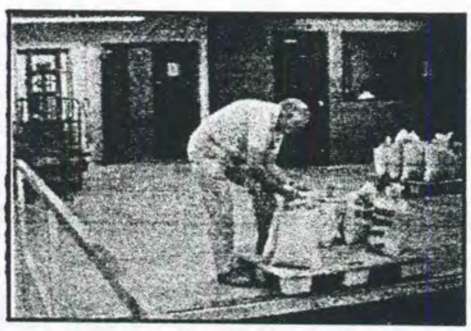
No less than three separate locations or passes should be used in obtaining one field sample.

When obtaining field sample by interception of 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.

Aggregate technician obtaining streamflow sample.

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 not to sample at the bottom of the stockpile.

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



Materials Technician checking in aggregate samples at the Central Lab of the Iowa DOT.

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

SAMPLE RECORDS

It is the responsibility of the aggregate sampler to get all the necessary information to fill out reports properly. Some of this information is general and is used to fill out report headings. This includes type of material, intended use, location of producer, source, 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. Appropriate Form 820003 should be filled out completely and placed <u>inside</u> the sample sack. Other identification tags should be attached to the tie for shipping information.

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?
5. Do you know the proper action to take if the sample fails to meet specification requirements?

NOTES

GENERAL AGGREGATE SOURCE INFORMATION

GENERAL

Generally, 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 asphalt construction, and a durability class for coarse aggregates used in portland cement concrete construction. Upon request, new sources or different combinations of beds within an existing source can be evaluated for classification for either type of use. These rankings do not in any way waive the normal quality requirements for the particular types of aggregates indicated in contract documents.

PORTLAND CEMENT CONCRETE AGGREGATES

Aggregates shall be produced from sources approved in accordance with the requirements of Materials I.M. 409. Scalping of some portion of the coarser fraction may be approved by the Engineer.

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 are those which are associated with no deterioration of pavements in less than 10 years and only minimal deterioration in pavements of 10 to 20 years of age. When performance records are unavailable the aggregates, when tested, must have durability factors of 80 or more.

Class 3 durability aggregates are those which are associated with little or no deterioration of pavements more than 20 years of age. When performance records of 20 years or more are unavailable the aggregates, when tested, must have durability factors of 90 or more.

Class 3i durability aggregates are those which are associated with only minimal deterioration on interstate system pavements from 20 to 30 years of age. When performance records are unavailable the aggregates , when tested, must possess the same properties as aggregates with acceptable performance histories.

Note: Those sources with a 'B' in their durability class designation may have 1/2" Bridge Deck Overlay/Repair material available.

ASPHALTIC CONCRETE AGGREGATES

Aggregates for asphaltic construction have been classified into six 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.

When aggregates of friction Type 1 through Type 4 are specified for construction, a source approval including bed limitations, is required for each project. 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 granites. 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.

Type 3 Natural aggregates in this class are crushed traprocks, and/or crushed gravels. The crushed gravels shall not contain more than 60 percent total carbonate. 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 noncarbonate particles by more than 20 percent.

Type 4D A subgroup of the Type 4 category comprised of those aggregates near but exceeding the 20 micron minimal grain size. Type 4D aggregates are not acceptable for use in sprinkle treatment or in any asphalt cement concrete surface courses requiring the use of Type 4 or better material.

Type 5 Aggregates crushed from dolomitic or limestone ledges in which 20 percent or more of the grains are 30 microns or smaller. This classification also includes natural gravels where the number of lithographic and sublithographic carbonate particles, expressed as a fraction of the total material, exceeds the noncarbonate particles by more than 20 percent.

SOURCE LISTINGS - Explanation

The use of X's in the PCC or AC columns indicates use where no classification is required or, if required, has not been made.

Note - indicates top size limitation.

Bed numbers shown for PCC aggregate are those on the formal source approval letter. Beds shown for AC sources are those which have been used or have potential for use and are of the designated friction type.

Frictional Classification - as indicated on page 2
Asphaltic Concrete - Type A and B

Durability Class for Portland Cement Concrete
Coarse Aggregate Fine Aggregate
('B' indicates acceptability for Bridge Deck Overlay/Repair)

Source Code Number - Used to identify sources on test requests and for data storage.

Specific Gravity
(DWU-Determine When Used)

CODE	OPERATOR		SOURCE NAME	LOCATION	SP GR	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS	
04	APPANOOSE	SEITC	---CRUSHED STONE---								
A04004	L&W QUARRIES INC		MARTIN #3	E2 20 T070 R19W	2.70	2		4D	4D	1 - 3	1
54	KEOKUK	SEITC	---CRUSHED STONE---								
A54002	KASER CORP		KESWICK	NW 21 T077 R12W	2.61	2		4	4	13 -15	2
55	KOSSUTH	NEITC	---SAND & GRAVEL---								
A55520	GIESE CONST CO		CONN	SE 35 T095 R29W	DWU		X				3
56	LEE	SEITC	---CRUSHED STONE---								
A56004	CESSFORD CONST CO		FRANKLIN	NE 25 T068 R06W	2.49	2				12	2

NOTES: 1 - AASHTO D-67, GRADATION #5, 40% MAXIMUM
2 - AASHTO 57 GRADATION MAXIMUM
3 - APPROVED ONLY FOR L-MIX PC CONCRETE

RECENTLY ACTIVE
AGGREGATE SOURCES

CODE	OPERATOR	SOURCE NAME	LOCATION	SP GR	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
01	ADAIR DIST 4	---CRUSHED STONE---							
A01002	SCHILDBERG CONST CO INC	MENLO	SE 17 T077 R31W				5	5	15 -16
								4	14
A01004	SCHILDBERG CONST CO INC	JEFFERSON	NW 17 T077 R31W					5	20
								4D	25
A01006	SCHILDBERG CONST CO INC	HOWE	SW 01 T076 R31W					5	25
02	ADAMS DIST 4	---CRUSHED STONE---							
A02002	SCHILDBERG CONST CO INC	MT ETNA	SW 23 T073 R34W					4	11 -13
A02004	SCHILDBERG CONST CO INC	CORNING	10 T071 R34W					4	3 - 5
		---SAND & GRAVEL---							
A02502	SCHILDBERG CONST CO INC	MT ETNA	NW 23 T073 R34W	2.67	2		4	4	
				2.67		X			
03	ALLAMAKEE DIST 2	---CRUSHED STONE---							
A03002	BRUENING ROCK PROD INC	WEXFORD	NE 36 T098 R03W	2.70	31				1C- 5
							4	4	1 - 8
A03008	BRUENING ROCK PROD INC	MCCABE	NE 06 T097 R05W					4	1 - 6
A03014	BRUENING ROCK PROD INC	HAMMELL-BOONIES	SW 02 T099 R06W		X		X	X	
A03022	ROVERUD CONST INC	LIVINGOOD	SW 07 T096 R06W				4	4	4 - 7
								4	2 - 7
A03034	BRUENING ROCK PROD INC	WILDE	SE 13 T099 R05W		X		4	4	1 - 5
A03038	BRUENING ROCK PROD INC	RHEIM	SE 07 T100 R04W	DWU	31		4	4	1 - 4
A03040	BRUENING ROCK PROD INC	DEE	SE 21 T099 R04W	DWU	31B		4	4	5A- 5D
A03042	BRESNAHAN CONST CO	CHURCHTOWN	SW 29 T099 R04W					4	1 - 3
							4	4	3
A03046	BRUENING ROCK PROD INC	MOHS	SW 29 T096 R04W	DWU	2		5	5	1 - 2
								5	1 - 4
A03048	BRUENING ROCK PROD INC	POSTVILLE	SW 16 T096 R06W					4	2 - 5
A03050	BRUENING ROCK PROD INC	GREEN	NW 16 T096 R06W	2.63	3		4	4	2 - 3
A03052	BRUENING ROCK PROD INC	ROSSVILLE	NW 36 T097 R05W				X	X	1 - 5
A03054	BRUENING ROCK PROD INC	WEST RIDGE	NE 08 T098 R06W						
A03056	BRESNAHAN CONST CO	WAUKON	SW 05 T097 R05W						
		---SAND & GRAVEL---							
A03502	CARLSON MATERIALS CO	HARPERS FERRY	SW 07 T097 R02W	2.67	31B		3	3	
				2.67		X			
A03506	BRUENING ROCK PROD INC	HAMMELL-BOONIES	SW 02 T099 R06W				4	4	
A03510	CARLSON MATERIALS CO	LONNING	SE 02 T099 R06W				4	4	
				DWU		X			
A03512	ROVERUD CONST INC	ZEZULKA	NE 11 T100 R04W				3	3	
				2.66		X			
04	APPANOOSE DIST 5	---CRUSHED STONE---							
A04004	L&W QUARRIES, INC	LEMLEY WEST #3	E2 20 T070 R19W	2.70	2		4D	4D	1 - 3 :1
								5	6
A04016	L&W QUARRIES, INC	LEMLEY EAST #5	CT 35 T070 R19W	2.70	2		4D	4D	1 - 3 :1
								5	6
A04018	L&W QUARRIES, INC	CLARKDALE #8	SE 15 T069 R18W					5	4
		---SAND & GRAVEL---							
A04502	MARTIN MARIETTA	CINCINNATI	NE 13 T067 R19W				4	4	
				2.68		X			

NOTE:

1 - AASHTO D-67, GRADATION #5, 40% MAXIMUM
RESTRICTION DOES NOT APPLY TO STRUCTURAL CONCRETE

CODE	OPERATOR	SOURCE NAME	LOCATION	SP GR	DUR PCC CA	DUR PCC FA	FRICT AC A	FRICT AC B	BEDS
05	AUDUBON DIST 4	---SAND & GRAVEL---							
A05506	HALLETT MATERIALS CO	EXIRA	NE 07 T078 R35W						
06	BENTON DIST 6	---CRUSHED STONE---							
A06002	BASIC MATERIALS CORP	SMITH	NW 19 T086 R12W	2.65	2		4	4	21 -26
A06004	VULCAN MATERIALS CO	GARRISON A	SE 28 T085 R11W	2.67	2		4	4	6 -16
A06006	VULCAN MATERIALS CO	GARRISON B	NE 33 T085 R11W	2.64	2		4	4	6 -16
A06008	VULCAN MATERIALS CO	BALLHEIM	NE 17 T086 R12W					X	
A06012	COOTS MATERIALS CO INC	JABENS	SW 07 T085 R11W	2.64	2		4	4	12
							4	4	10 -12
A06014	VULCAN MATERIALS CO	VINTON-MILROY	S2 10 T085 R10W					4	
A06016	COOTS MATERIALS CO INC	COOTS	SW 36 T086 R11W					X	
A06018	VULCAN MATERIALS CO	PORK CHOP-EAST	NW 11 T085 R09W					X	
A06020	VULCAN MATERIALS CO	PORK CHOP-WEST	NE 10 T085 R09W						
A06022	VULCAN MATERIALS CO	LONG	SE 13 T084 R09W					X	
		---SAND & GRAVEL---							
A06502	VULCAN MATERIALS CO	VINTON-MILROY	S2 10 T085 R10W				4	4	
				2.65		X			
A06504	COOTS MATERIALS CO INC	MT AUBURN	SW 31 T086 R10W				4	4	
				2.65		X			
A06506	VULCAN MATERIALS CO	PORK CHOP	CT 11 T085 R09W				4	4	
				DWU		X			
07	BLACK HAWK DIST 2	---CRUSHED STONE---							
A07002	BASIC MATERIALS CORP	RAYMOND-PINTS	SW 36 T089 R12W				4	4	5 -10
							4	4	20 -23
							4	4	18 -27
								4	11 -17
A07004	BASIC MATERIALS CORP	WATERLOO SOUTH	NW 18 T087 R12W				4	4	17 -23
							4	4	32 -36
								4	1 -16
A07006	BASIC MATERIALS CORP	YOKUM	NE 05 T090 R14W					5	11 -21
A07008	BASIC MATERIALS CORP	MORGAN	NE 15 T089 R12W					5	1 - 3
								5	4A- 4B
A07014	NIEMANN CONST CO	GLORY	NE 36 T087 R11W					4	3 - 4
								5	1 - 4
A07016	BASIC MATERIALS CORP	AHLES	NE 13 T088 R11W	2.60	3i		4	4	1A- 1B
A07018	BASIC MATERIALS CORP	RAYMOND-PESKE	SW 01 T088 R12W	2.65	2		4	4	1B- 5
							4	4	6 -10
A07020	BASIC MATERIALS CORP	STEINBRON	SE 01 T088 R11W	DWU	3i		X	X	1
		---SAND & GRAVEL---							
A07504	BASIC MATERIALS CORP	WATERLOO SAND	SW 09 T089 R13W				4	4	
				2.65		X			
A07506	MANATTS INC	ASPRO	NW 01 T088 R13W				4	4	
				2.65		X			
A07508	HAWKEYE MATERIALS	LIVINGSTON	16 T088 R12W				4	4	
				2.65		X			
A07510	BAGENSTOS S&G	BAGENSTOS & SON	SE 19 T087 R11W				4	4	
				2.65		X			
08	BOONE DIST 1	---SAND & GRAVEL---							
A08520	MARTIN MARIETTA	LAUBE	36 T085 R27W				4	4	
A08524	HALLETT MATERIALS CO	JENKINS-STURTZ	W2 36 T084 R27W	2.70	2		3	3	
				2.67		X			

NOTES

INSPECTION OF CONSTRUCTION PROJECT SAMPLING AND TESTING

PURPOSE

The purpose of this memorandum is to prescribe general objectives, policies, procedures, and guide schedules for sampling and testing materials and construction. Sampling and testing guides for certain types of construction are attached as appendices to this memorandum.

OBJECTIVES

The objectives of sampling and testing are:

A. To determine through process control and/or acceptance sampling and testing whether the construction operations controlled by sampling and testing and materials used or proposed for use in the construction work are in reasonably close conformity with approved plans and specifications (including approved changes).

B. To provide checks or reliability of acceptance sampling and testing through independent assurance sampling and testing by personnel not normally responsible for process control or acceptance.

C. To provide opportunity for timely remedial action when results of sampling and testing indicate materials used or proposed for use and the construction work accomplished or in progress are not in reasonably close conformity with the approved plans and specifications (including approved changes).

PROCESS CONTROL AND/OR ACCEPTANCE SAMPLING AND TESTING

Process control and/or acceptance sampling and testing are required to ascertain on a day to day basis whether the quality of materials being incorporated into the construction and the quality of construction work in progress are in reasonably close conformity with the plans and specifications. Results of these tests constitute the principal means of determining daily if materials and construction are satisfactory, or whether corrective action should be taken before work proceeds further. They serve as the principal basis for determining the acceptability of completed construction.

Materials Inspection and Acceptance

In order to provide the contractor the opportunity to construct a project with minimal sampling and testing delays, inspection is performed at the source. 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. Supplemental monitor samples secured by project personnel of source inspected, certified or project processed materials are also required for some materials in order to secure satisfactory evidence for acceptance.

Source Inspection

Materials with characteristics which do not easily change will normally be accepted at the time of incorporation into the work on the basis of complying source inspection test reports. This also applies to materials in which the packaging or form of shipment ensures proper identification of the materials and the original material characteristics.

Supplemental sampling and testing of source inspected material are required for some materials which are subject to change during delivery. This also applies to some materials which are difficult to identify with source inspection test reports. Except for unusual situations, the Contractor may, on the Contractor's responsibility and at the Contractor's risk, incorporate these materials into the work before completion of the required supplemental tests. Acceptance of these materials will be based on source inspection tests and tests of the supplemental samples.

In the case of aggregate quality, production from an approved source is required. The source approval includes the quality control operation and processing procedures established, and the ledges suitable for the production of crushed stone for the various quality requirements. Random source inspection is performed to detect any significant change in characteristics of a source and any variations of the established quality control and on processing procedures. Random sampling and testing are performed to monitor the quality of aggregate being produced from each source. For certain major types of construction, supplemental construction site assurance sampling and laboratory testing for quality are required in addition to the above quality control inspection and testing prior to acceptance. The Contractor may, on the Contractor's responsibility and at the Contractor's risk, incorporate these aggregates into the work before completion of supplemental tests. Acceptance for quality will be based on source monitoring and the test results on assurance and/or project samples. Source approval and monitor inspections and tests will be the basis for acceptance of other aggregates.

Certified aggregate gradation tests by a certified aggregate technician in accordance with the requirements of Materials I.M. 209 and 210, are required by paragraph 1106.01 of the Standard Specification.

Certified source aggregate gradation tests will be considered advisory when the aggregate is used for portland cement concrete, asphalt concrete, bituminous treated base, and cement treated granular base and will be considered the basis of acceptance for all other aggregates. The advisory tested group are called "proportioned aggregates" and the remaining groups are called "nonproportioned aggregates." The gradation tests are called certified gradation tests and the aggregates represented are called certified aggregates.

Certification Procedures

In the case of many materials it is more economical, efficient, and practical to require certification procedures in lieu of source inspection. Certified test results are required for some methods and only a certificate of compliance is required for other materials. The acceptance of some proprietary materials is on an approved source or brand basis.

For many of the materials for which certification procedures are required, supplemental testing of samples secured by project personnel and assurance samples secured by Transportation Center personnel are also required as part of the basis of 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 supplemental samples. When supplemental samples are not required, acceptance will be based on satisfactory certification.

The certificate of compliance shall be signed by an authorized representative of the company.

Small Quantities of Materials

When small quantities of construction materials are involved and the cost of sampling and testing would be excessive, or the performance of the material is not critical, visual inspection or compliance certificates may be the basis for acceptance.

Sampling & Testing Guides

The appended sampling & testing guides schedule indicates the minimum inspection, sampling and testing procedures required within the guide policy and procedures for the acceptance of materials and construction work. Note: There are two sets of sampling & testing guides - One in S.I. units (metric) and one in U.S. units (in./lb.).

PROJECT PLANT, FIELD LABORATORY AND GRADE INSPECTION AND ACCEPTANCE

The project inspectors shall identify and inspect all materials received on the project before the materials are incorporated into the work. They shall ascertain that proper inspection reports or certifications are on hand and that there have been no unusual alterations in the characteristics of the materials due to handling or other causes. In the event they are unable to properly identify the materials delivered or that materials were not inspected before delivery, the Transportation Center Materials Office shall be notified.

Project plant, field laboratory, and grade control acceptance sampling and/or testing will be performed by project personnel as outlined in the sampling and testing guides and all other applicable instructions. When certified plant inspection or Quality Management-Asphalt (QM-A) testing are provided by the Contractor, those gradation tests, and the asphalt mixture tests, shall be known as process control tests. The acceptance testing will be performed by the contract authority. Test results determined by the Transportation Center or Central laboratories which indicate specification non-compliance will be promptly reported to the Project Engineer's Office by telephone.

Acceptance gradation testing on projects with contractor provided certified plant inspection will be performed on samples split from process control samples. The sampling and splitting will be randomly witnessed by the contract authority.

A Noncompliance Notice (Form 830245) will be immediately delivered to the acting representative of the Contractor for the area of construction involved whenever project or laboratory test results indicate noncompliance with the specifications and/or plans. Appropriate action in accordance with specifications and instructional memorandums shall be taken.

ASSURANCE SAMPLING AND TESTING

Independent assurance inspection will be performed as a check on the reliability of material and project control acceptance sampling and testing. It is the responsibility of the Transportation Center Materials Engineer to provide this inspection as outlined herein and designated in the sampling and testing guides. In no case shall personnel assigned to this work have any direct responsibility for project process control.

Assurance samples of materials are required in some cases for testing to secure supplemental data for acceptance of source inspected or certified materials. The majority of the assurance samples are for validating project control sampling and testing.

Assurance sampling and testing required for project control testing shall be performed using test equipment other than that assigned to the project. Occasionally, for expedient situations, the project test equipment may be used. When specified in the appendices or when small quantities of materials are involved, the assurance sampling and testing may be accomplished by observation of the acceptance sampling and testing performed by personnel. When similar material is being incorporated into the work and processed through the same plant for more than one project, one assurance sample may be taken to represent those projects. Test results on the sample are to be reported to all projects represented by the sample.

Assurance Sampling and Testing for Incidental Concrete, as described in I.M. 528, is not required.

Assurance samples of materials for which project personnel are performing acceptance sampling and testing will normally be taken at approximately the same time and location as the project acceptance samples.

Samples of other materials which require laboratory testing are to be taken in accordance with the sampling and testing guides and appropriate instructions.

A report of the assurance tests, and the companion project acceptance, tests will be made by the individual performing the assurance tests and signed by the Transportation Center Materials Engineer. If there are any significant discrepancies between the test results, the report shall document the procedures used to evaluate and reconcile the differences.

The frequency of assurance sampling should be increased when it appears that the average values of the test results are approaching either an upper or lower specification limit. If the test results on assurance samples do not reflect the indicated quality of the material or if they are outside specification requirements, the Transportation Center Materials Engineer should be consulted promptly concerning the cause, degree, and necessity for correction. Additional samples may be necessary to determine the cause of the deviations.

The location and frequency of assurance samples are prescribed in the attached sampling and testing guides.

It is not always possible to coordinate the assurance sampling from projects where small quantities of materials are incorporated in a short period of time. In such cases, assurance samples may be waived by the Transportation Center Materials Engineer. However assurance sampling is encouraged when possible. Quantities below which assurance samples are not required are shown in the appropriate appendixes.

SAMPLING AND TESTING GUIDE SCHEDULES

The following guides prescribe the minimum frequency for sampling and testing, the indicated inspection locations and the size for each sample type. The guide frequencies are considered to be the minimum required for proper project documentation under normal construction conditions and procedures. More frequent sampling may be required by special conditions such as low or intermittent production, or widely varying test results, and must be initiated at the discretion of and by project inspection personnel. Test results reported via computer terminal may not be identified by a report form number.

> Note: In order to maintain as much clarity as possible in the Guide Schedules, the changes from the last issue are not marked. The Schedules should be checked carefully for changes.

I.M. 204 Appendixes

Appendix A	Roadway and Borrow Excavation and Embankments
Appendix B	Deleted
Appendix C	Deleted
Appendix D	Granular Subbase
Appendix E-1, E-2	Portland Cement Conc. Pavement, Pavement Widening, Base Widening, Curb and Gutter & Class 1 Shoulders
Appendix F-1, F-2	Type A Asphaltic Concrete
Appendix G-1, G-2	Type B Asphalt Concrete, Type B Asphaltic Concrete Base Subbase and Base Widening
Appendix H-1,	Structure Concrete, Reinforcement, Foundations. & H-2, H-3 Substructures, Conc. Struct., Conc. Floors & Conc. Box, Arch & Circular Culverts
Appendix I	Soil Aggregate Subbase
Appendix J	Soil Lime Subbase
Appendix K	Deleted
Appendix L	Granular Surfacing/Driveway Surfacing
Appendix M-1, M-2	Concrete Bridge Floor Repair & Overlay & Surfacing
Appendix P	Bituminous Seal Coat
Appendix Q	Deleted
Appendix R	Deleted
Appendix T-1, T-2	Base Repair 2212, Concrete Pavement Repair 2529 & 2530
Appendix U	Granular Shoulders
Appendix V	Subdrains

C - Central Laboratory
D - Dist. Laboratory
ASD - Approved Shop Drawings
AS - Approved Source
AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING, CURB AND GUTTER, AND CLASS 1 SHOULDERS
Section 2201, 2213, 2301 and 2302

U.S. Units

Materials Inst. Memorandums
Assurance Sample Secured by District Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING: FIELD SAMPLING AND TESTING			PROJECT ACCEPTANCE SAMPLING AND TESTING: FIELD SAMPLING AND LAB TESTING				ASSURANCE SAMPLES AND TESTS			REMARKS
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
SOURCE INSP.														
Aggregates Fine (4110) (4111) Sp. Grav.	Gradation Delt. Matls. Mortar St.	 AS AS AS	302-306 410 307 410	1/1500T Variable	IM 301	821278								
Coarse (4115)	Gradation Obj.Matls. F & T Abrasion Sp. Gravity	 AS AS AS AS	303-306 415 209-415 209-415 307	1/1500 T	IM 301	821278								
Port. Cement (4101)	Quality	AS	401											
Fly Ash	Quality	AS	491.17											
Curing Compounds A. (4105)	Lab Tested						1/lot (1)	1 qt.	C					A. Barrier Rails ASTM 309 Cert. by Manuf.
Burlap (4104)	Lab Tested						1/shipment	1 sq. yd.	C					
Plastic Film (4106)	Lab. Tested						1/lot	3 ft. full width	C					
Mixing Water (4102)	Lab Tested						1/source	1 qt.	C					
Air Ent. Admix.(4103)	Quality	AB	403											
Water Reducing Admixture	Quality	AB	403											
Joint Sealer(4136.02) Subgrade Film(4107)	Lab Tested Lab Tested						1/lot (1) 1/lot (1)	10 lbs. 3 ft. full width	C C					
Steel Reinf. (4151): Dowels Tie Bars Cont. Reinf. General Use	 Quality Quality Quality Quality	 AS AS AS AS	 451 451 451 451											
Wire Mesh(4151)	Lab Tested	AS	451											
Engineering Fabric. (4196)	Quality	AB	496.01											
PLANT INSP.														
Aggregates Fine	Gradation Moisture Sp. Gravity Quality	 AS	302-306 308 307 410	3/lot 1/½ day variable	IM 301 1000 grams 1000 grams	830224 830224 830224					1/100,000 sq.yds.	IM 301	D	
Coarse	Gradation Moisture Sp.Gravity Quality		303-306 308	3/lot 1/½ day variable	IM 301 2000 grams 2000 grams	830224 830224 830224					1/100,000 sq.yds. 1/100,000 sq.yds.	IM 301 50 lbs.	D C	
Port.Cement	Quality W/C Ratio Delivery Check	AS	Cert.	Each Load 1/1000 cy* 1/10,000 cy		830224 830224 820912					1/100,000 sq.yds.	15 lbs.	C	*Min-1/day
Fly Ash	Quality	AS	Cert.	Each Load		830224					1/100,000 sq.yds.	15 lbs.	C	
Air Entraining Admixture (4103)*		AB	403				1/lot (1)	1 pt.	C	820259				Monitor Sample
Water Red. Admix.		AB	403				1/lot (1)	1 pt.	C					Monitor Sample

(1) Sample lots not previously reported or as required by Dist. Matl's Engr.

C - Central Laboratory
TC - Trans. Center. Laboratory
ASD - Approved Shop Drawings
AS - Approved Source
AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING, CURB AND GUTTER, AND CLASS 1 SHOULDERS
Section 2201, 2213, 2301 and 2302

Metric Units

Materials Inst. Memorandums
Assurance Sample Secured by Trans. Center Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
SOURCE INSP.														
Aggregates Fine (4110) (4111) Sp. Grav.	Gradation Delt. Matls. Mortar St.	 AS AS AS	302-306 410 307 410	1/1500 Mg Variable	IM 301	821278								
Coarse (4115)	Gradation Obj.Matls. F & T Abrasion Sp. Gravity	 AS AS AS AS	303-306 415 209-415 209-415 307	1/1500 Mg	IM 301	821278								
Port. Cement (4101)	Quality	AS	401											
Fly Ash	Quality	AS	491.17											
Curing Compounds A. (4105)	Lab Tested						1/lot (1)	1 L	C					A. Barrier Rails ASTM. 309 Cert. by Manul
Burlap (4104)	Lab Tested						1/shipment	1 m²	C					
Plastic Film (4106)	Lab. Tested						1/lot	1 m full width	C					
Mixing Water (4102)	Lab Tested						1/source	1 L	C					
Air Ent. Admix.(4103)	Quality	AB	403											
Water Reducing Admixture	Quality	AB	403											
Joint Sealer(4136.02) Subgrade Film(4107)	Lab Tested Lab Tested						1/lot (1) 1/lot (1)	4.5 kg 1 m full width	C C					
Steel Reinf. (4151): Dowels Tie Bars Cont. Reinf. General Use	 Quality Quality Quality Quality	 AS AS AS AS	 451 451 451 451											
Wire Mesh(4151)	Lab Tested	AS	451											
Engineering Fabric. (4196)	Quality	AB	496.01											
PLANT INSP.														
Aggregates Fine	Gradation Moisture Sp. Gravity Quality	 AS	302-306 308 307 410	3/lot 1/½ day variable	IM 301 1000 grams 1000 grams	830224 830224 830224					1/100,000 m²	IM 301	TC	
Coarse	Gradation Moisture Sp.Gravity Quality		303-306 308	3/lot 1/½ day variable	IM 301 2000 grams 2000 grams	830224 830224 830224					1/100,000 m² 1/100,000 m²	IM 301 22 kg	TC C	
Port.Cement	Quality W/C Ratio Delivery Check	AS	Cert.	Each Load 1/1000 m³* 1/10,000 m³		830224 830224 820912					1/100,000 m²	7 kg	C	*Min-1/day
Fly Ash	Quality	AS	Cert.	Each Load		830224					1/100,000 m²	7 kg	C	
Air Entraining Admixture (4103)*		AB	403				1/lot (1)	0.5 L	C					Monitor Sample
Water Red. Admix.		AB	403				1/lot (1)	0.5 L	C					Monitor Sample

(1) Sample lots not previously reported or as required by Dist. Matl's Engr.

C - Central Laboratory
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AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING,
CURB AND GUTTER, AND CLASS 1 SHOULDERS
Section 2201, 2213, 2301 and 2302

U.S. Units

Materials Inst. Memorandums
Assurance Sample Secured by District Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
GRADE INSP.	[illegible]													
Chloride Solution	Concentration		373	1/day		830224								
Wire mesh	Quality	AS	451	Each ship. Cert.							IM 451	2 ft. x 2 ft.	C	
Steel Reinf.(4151):														
Dowels	Quality	AS	451	Each ship. Cert.							IM 451	2-18 in. pc.	C	
Tie Bars	Quality	AS	451	Each ship. Cert.							IM 451	2-18 in.pc.	C	
General Use	Quality	AS	451	Each ship. Cert.							IM 451	42 in.pc.	C	
Plastic Conc.	Air Content Slump Grade Yield Beams Thickness		318-327 317-327 316-327-328	1/1000 cy*(1) 1/1000 cy*(1) 1/1000 cy 1/2000 cy** As needed		830224 830224 830224 830224					1/100,000 sq.yds. 1/100,000 sq.yds.		D D	(1) 1/100 c.y. for Transit Mix *Min - 1/day **Min - 2/day
Hardened Conc.	Thickness Width Smoothness**	 •	346-347 Cert	1/2000 s.y.* 1/day		1263 Diary				 1263	10% proj 10% proj		D D	*See specifications for variations **Qualified operator and equipment
	Comp. Strength Air content		346				1/2000 sy		C		1/2000 sy 1/4000 sy		C	

Note: When certified plant inspection is provided by the contractor, the frequency of acceptance gradation testing shall be as follows: Test the first three (3) split samples of each aggregate tested for process control on each project ,each mix on a.c. projects). Test at least ten percent (10%) of the split samples thereafter.

Note: The assurance gradation sample is to be split with the project engineer. This split sample is for correlation purposes and, if it's not a routine lot sample, should not be used for determining specification compliance of a lot. However, any noncomplying test result is to be resolved.

Assurance samples not required when mix quantity is less than 2,000 sq. yds.

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AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
PORTLAND CEMENT CONCRETE PAVEMENT, PAVEMENT WIDENING, BASE WIDENING, CURB AND GUTTER, AND CLASS 1 SHOULDERS
Section 2201, 2213, 2301 and 2302

Metric Units

Materials Inst. Memorandums
Assurance Sample Secured by Trans. Center Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
GRADE INSP.														
Chloride Solution	Concentration		373	1/day		830224								
Wire mesh	Quality	AS	451	Each ship: Cert.							IM 451	0.5 m x 0.5 m	C	
Steel Reinf.(4151):														
Dowels	Quality	AS	451	Each ship. Cert.							IM 451	2-450 mm pc.	C	
Tie Bars	Quality	AS	451	Each ship. Cert.							IM 451	2-450 mm pc.	C	
General Use	Quality	AS	451	Each ship. Cert.							IM 451	2 m pc.	C	
Plastic Conc.	Air Content		318-327	1/1000 m^3*(1)		830224					1/100,000 m^2		TC	(1) 1/100 m^3 for Transit Mix
	Slump		317-327	1/1000 m^3*(1)		830224					1/100,000 m^2		TC	
	Grade Yield			1/1000 m^3		830224								*Min - 1/day
	Beams		316-327-328	1/2000 m^3**		830224								**Min - 2/day
	Thickness			As needed										
Hardened Conc.	Thickness		346-347	1/2000 m^2*		1263					10% proj		TC	*See specifications for variations
	Width			1/day		Diary								
	Smoothness**		Cert.							1263	10% proj		D	**Qualified operator and equipment
	Comp. Strength		346				1/2000 m^2		C		1/2000 m^2		C	
	Air content										1/4000 m^2			

Note: When certified plant inspection is provided by the contractor, the frequency of acceptance gradation testing shall be as follows: Test the first three (3) split samples of each aggregate tested for process control on each project (each mix on a.c. projects). Test at least ten percent (10%) of the split samples thereafter.

Note: The assurance gradation sample is to be split with the project engineer. This split sample is for correlation purposes and, if it's not a routine lot sample, should not be used for determining specification compliance of a lot. However, any noncomplying test result is to be resolved.

Assurance samples not required when mix quantity is less than 2,000m^3

C - Central Laboratory
D - Dist. Laboratory
ASD - Approved Shop Drawings
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AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
TYPE A ASPHALTIC CONCRETE
Section 2303

U.S. Units

Materials Inst. Memorandums
Assurance Sample Secured by District Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
SOURCE INSP.														
Aggregates Coarse (4127)	Gradation Delt. Mtls. F & T Abrasion Absorption	 AS AS AS AS	303-304 308	1/1000T	IM 301	821278								
Fine (4127)	Gradation Clay & Silt Shale F & T (Lmst) Abr. (Lmst) Absorption	 AS AS AS AS	302 308	1/1000 T	IM 301	821278 821278								
Mineral Filler (4127)	AASHTO M-17 Gradation			1/lot	50 grams	821278								
Anti Strip Additive Hydratel Lime		AS	491.04											
Asph. Cement (4137)	Quality	AS	437											
Liquid Asphalt (4138) (4140)	Quality	AS	437											
Release Agent	Quality	AB	491.15											
PLANT INSP.														
Aggregates Combined Aggr. Moisture*	Quality Gradation	 308	 304 1/½ day	 3/Lot* 1 kg.	 IM 301 820007	 820007					1/20,000 T 1/20,000 T	50 lbs. IM 301	C D	*Ref. to IM 508 page 35 (Lot) *Dryer Drum Plants
Sand Cover	Gradation	AS	302											
Asph. Cement	Quality Viscosity	AS	Cert. 323-361	Each Load	Log all shipments on Form	820007	 1/40 T*	 3 oz.	 D D		1/20,000 T	1 qt.	C	 *Test 1 sample/day
Cutback Emulsion	Quality Viscosity Emulsion Residue	AS	Cert. 323-329 323-360	Each Load	Log all shipments on Form	820007	 1/10,000 gal. 1/10,000 gal.	 1 qt. 1 qt.	 D D		1/20,000 gal.	1 qt.	C	
Asph. Content %	Computed			Daily*	IM 509	820007								*As req. to det. pay quantities

C - Central Laboratory
TC - Trans. Center. Laboratory
ASD - Approved Shop Drawings
AS - Approved Source
AB - Approved Brand

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
TYPE A ASPHALTIC CONCRETE
Section 2303

Metric Units

Materials Inst. Memorandums
Assurance Sample Secured by Trans. Center Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
SOURCE INSP.														
Aggregates Coarse (4127)	Gradation Delt. Mtls. F & T Abrasion Absorption	 AS AS AS AS	303-304 308	1/1000 Mg	IM 301	821278								
Fine (4127)	Gradation Clay & Silt Shale F & T (Lmst) Abr. (Lmst) Absorption	 AS AS AS AS	302 308	1/1000 Mg	IM 301	821278 821278								
Mineral Filler (4127)	AASHTO M-17 Gradation			1/lot	50 grams	821278								
Anti Strip Additive Hydratel Lime		AS	491.04											
Asph. Cement (4137)	Quality	AS	437											
Liquid Asphalt (4138) (4140)	Quality	AS	437											
Release Agent	Quality	AB	491.15											
PLANT INSP.														
Aggregates Combined Aggr. Moisture*	Quality Gradation		304	3/Lot* 1/½ day	IM 301 1 kg.	820007 820007					1/20,000 Mg 1/20,000 Mg	22 Kg IM 301	C TC	*Ref. to IM 508 page 33 (Lot) *Dryer Drum Plants
Sand Cover	Gradation	AS	302											
Asph. Cement	Quality Viscosity	AS	Cert. 323-361	Each Load	Log all shipments on Form	820007	1/40 Mg*	85 g	TC		1/20,000 Mg	1 L	C	*Test 1 sample day
Cutback	Quality Viscosity	AS	Cert. 323-329	Each Load	Log all shipments on Form	820007	1/38,000 L	1 L	TC		1/76,000 L	1 L	C	
Emulsion	Emulsion Residue		323-360				1/38,000 L	1 L	TC					
Asph. Content %	Computed			Daily*	IM 509	820007								*As req. to det. pay quantities

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5001 10/ F1

C - Central Laboratory
D - Dist. Laboratory
ASD - Approved Shop Drawings
AS - Approved Source
AB - Approved Brand

SAMPLING . . TESTING GUIDE
MINIMUM FREQUENCIES
TYPE A ASPHALTIC CONCRETE
Section 2303

U.S. Units

Materials Inst. Memorandums
Assurance Sample Secured by District Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
GRADE INSP.														
Uncompacted Mixture	AC Content		322-335				3/lot*	40 lbs	D	820975	1/20,000 T/mix	40 lbs.	C	*1/Lot less than 200 tons
	Gradation (1)		331								1/20,000 T/mix		C	
	Stability										1/20,000 T/mix		C	
	Lab. Density (Marshall)		321-325				1/day		D	820975	1/20,000 T/mix		C	
Compacted Mixture	Density		320-321	As spec.		820007					1/week			Test one set of cores IM 514
	Thickness		337	same		820007					1/proj.			
	Voids		321	same		820007					1/proj.			
	Width			same		Diary								
	Smoothness	*	Cert.								10%/proj.			*Qualified operator and equipment.
Reclaimed Asphalt Pavement	Extraction and Gradation		301 330 331				(1)							

(1) As required by District Materials Engineer

Note: When certified plant inspection is provided by the contractor, the frequency of acceptance gradation testing shall be as follows: Test the first three (3) split samples of each aggregate tested for process control on each project (each mix on • c. projects). Test at least ten percent (10%) of the split samples thereafter.

Note: The assurance gradation sample is to be split with the project engineer. This split sample is for correlation purposes and, if it's not a routine lot sample, should not be used for determining specification compliance of a lot. However, any noncomplying test result is to be resolved.

Assurance samples not required when mix quantity is less than 1,000 tons.

APPENDIX F-2

Pub. 300-US-F2
5601 09/09/93

SAMPLING AND TESTING GUIDE
MINIMUM FREQUENCIES
TYPE A ASPHALTIC CONCRETE
Section 2303

Metric Units

Materials Inst. Memorandums
Assurance Sample Secured by Trans. Center Personnel at Project Site

MATERIAL OR CONSTRUCTION ITEM	TESTS	AS or AB	METHOD OF ACCEPTANCE OR SAMPLING & TESTING	PROJECT ACCEPTANCE SAMPLING AND TESTING							ASSURANCE SAMPLES AND TESTS			REMARKS
				FIELD SAMPLING AND TESTING			FIELD SAMPLING AND LAB TESTING							
				FREQUENCY	SAMPLE SIZE	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB.	RPT. NO.	FREQUENCY	SAMPLE SIZE	LAB	
GRADE INSP.														
Uncompacted Mixture	AC Content		322-335				3/lot (1) (2)*	18 kg	TC	820975	1/20,000 Mg/mix	18 kg	C	*1/Lot less than 200 Mg
	Gradation (1)		331								1/20,000 Mg/mix		C	
	Stability										1/20,000 Mg/mix		C	
	Lab. Density (Marshall)		321-325				3/lot (2)*		TC	820975	1/20,000 Mg/mix		C	
	Lab Voids		350-510				3/lot (2)*		820975				C	
Compacted Mixture	Density		320-321	As spec.		820007					1/week			Test one set of cores IM 514
	Thickness		337	same		820007					1/proj.			
	Voids		321	same		820007					1/proj.			
	Width			same		Diary								
	Smoothness	•	Cert.								10%/proj.			*Qualified operator and equipment
Reclaimed Asphalt Pavement	Extraction and Gradation		301 330 331				(1)							

(1) As required by Transportation Center

Note: When certified plant inspection is provided by the contractor, the frequency of acceptance gradation testing shall be as follows: Test the first three (3) split samples of each aggregate tested for process control on each project (each mix on a.c. projects). Test at least ten percent (10%) of the split samples thereafter.

(2) Sample three per lot, test one per lot. On QMA projects the sampling rate is normally four per day. See I.M. 511 (QMA) for additional information on sampling and testing frequencies for QMA projects.

Note: The assurance gradation sample is to be split with the project engineer. This split sample is for correlation purposes and, if it's not a routine lot sample, should not be used for determining specification compliance of a lot. However, any noncomplying test result is to be resolved.

Assurance samples not required when mix quantity is less than 1,000 Mg.

DETERMINATION OF MINIMUM SIZE OF SAMPLES FOR SIEVE ANALYSIS

SCOPE

This I.M. sets forth the minimum amount of dry materials necessary for the determination of particle size distribution.

LOCATION FOR SAMPLING

To help ensure 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) intercepting the complete material stream flow from the end of a conveyor belt or from overhead bin discharge, or 3) sampling from the production stockpile (for fine aggregate only or as directed by the Transportation Center Materials Engineer).

To obtain an off-the-belt sample: stop the belt, insert a template (as illustrated in Fig. 1) at three or more separate locations along the belt, remove <u>all</u> material within the template, and combine it into the sample. In belt sampling, the ends of the template should be spaced just far enough apart to get an increment that is approximately one-third the minimum mass (weight) of the sample. If the template does not yield the minimum size of sample in three locations, additional locations will be necessary. No less than three separate locations should be used in obtaining one sample.

When obtaining a sample by interception of the aggregate stream flow, care must be exercised so that the sampling device (see Fig. 2) 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.

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 stockpile shall be taken. Care should be used not to sample at the bottom of the stockpile.

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

SHIPPING SAMPLES

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

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

SAMPLE SIZE & TEST METHODS

The sample size and test methods for the various materials shall be in accordance with the following schedule:

Gradation Number & Reference	Intended Use	Min. Field Sample lbs.	Min. Field Sample kg	Sample kg.	Min. Test Matls. I.M.'s Required
1. 4110, 4111, 4125	PCC FA, Cover Agg.	10	4.5	0.5	302, 306, 336
2. 4112.	Mort Sand	10	4.5	0.1	302, 306, 336
3. 4115 (57,2-8)	PCC CA	30	13.5	5.0	303, 306, 336
4. 4115 (2-8)*	PCC CA	50	23.0	10.0	303, 306, 336
5. 4115 (67,2-8)	PCC CA	20	9.0	2.5	303, 306, 336
6. 4115.08 (repair & overlay)	PCC CA	20	9.0	2.5	303, 306, 336
7. 4117. (Class V)	FA & CA	10	4.5	1.0	302, 306, 336
8. 4117.03 (Class V add.)	Fine Lmst.	10	4.5	0.1	302, 306, 336
9. DELETED					
10. 4120 (C gravel)	Gran. Surf.	20	9.0	2.5	303, 306, 336
11. 4120, 4122.03 (A, B Cr. S)	Gran. Surf.& Shldrs.	20	9.0	2.5	303, 306, 336
12. 4121. **	Gran. Sub.	30	13.5	5.0	303,304,305,306,336
13. 4122.02 (Cr. Stone)	Mac. St. Base	35	16.0	15.0	303
14. DELETED					
15. DELETED					
16. 4122.04 (Cr. Stone)	Pvd. Shldr. File	50	22.5	10.0	303, 336
17. DELETED					
18. DELETED					
19. 4125. [13.2 mm (1/2" Cr.S)]	Cover Agg.	20	9.0	2.0	303, 306, 336
20. 4125. [13.2 mm (1/2" Gr.)]	Cover Agg.	20	9.0	2.0	303, 306, 336
21. 4125. [9.5 mm (3/8")]	Cover Agg.	10	4.5	1.0	303, 306, 336
22. 4127	ACC	20	9.0	2.5	303,304,305,306,336
23. 4125.01B (Cr. Stone)	Slurry Tr.				
24. 4126, 4127, 4128 [26.5 mm (1")] **	ACC	30	13.5	5.0	303,304,305,306,336
25. 4126, 4127, 4128 [19.0 mm (3/4") mix size] **	ACC	20	9.0	2.5	303,304,305,306,336
26. 4126, 4127 [13.2 mm (1/2") mix size] **	ACC	20	9.0	2.0	303,304,305,306,336
27. 4126,4127 [9.5 mm (3/8")]	ACC	10	4.5	1.0	302, 306, 336
28. 4129	Asph. Sand Surf.				
29. 4131	Porous Backfill	20	9.0	2.0	303, 336
30. 4132 (Cr. S) **	Spc. Backfill	20	9.0	2.5	303,304,305,306,336
31. 4132 (Gr.)	Spc. Backfill	20	9.0	2.5	303,304,305,306,336
32. 4133 (Sand/gravel/Cr. St.)	Gran. Backfill	20	9.0	2.0	303, 306, 336
33. DELETED					
34. 4130.05 [150.0 mm (6") Cr. St.]	Erosion Stone	Visual Inspection			

*If the amount of material passing the 1" sieve is 95% or greater the field sample and test sample sizes may be reduced to minimums of 30 lbs. and 5.0 kg. respectively.

** When the amount of material passing the 4.75 mm (#4) sieve is approximately 30% or less, use test method described in I.M. 303 in lieu of the method of I.M. 304.

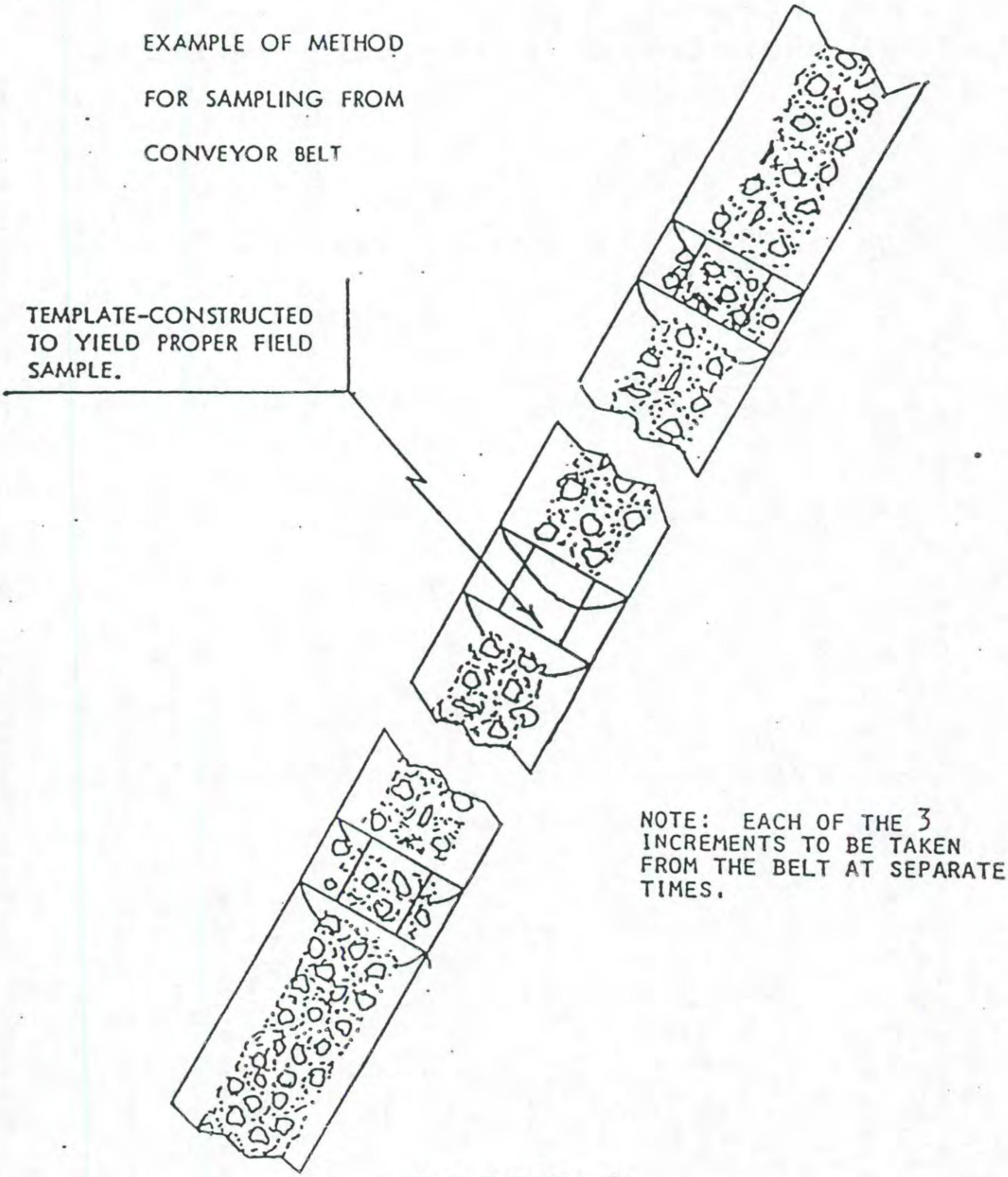
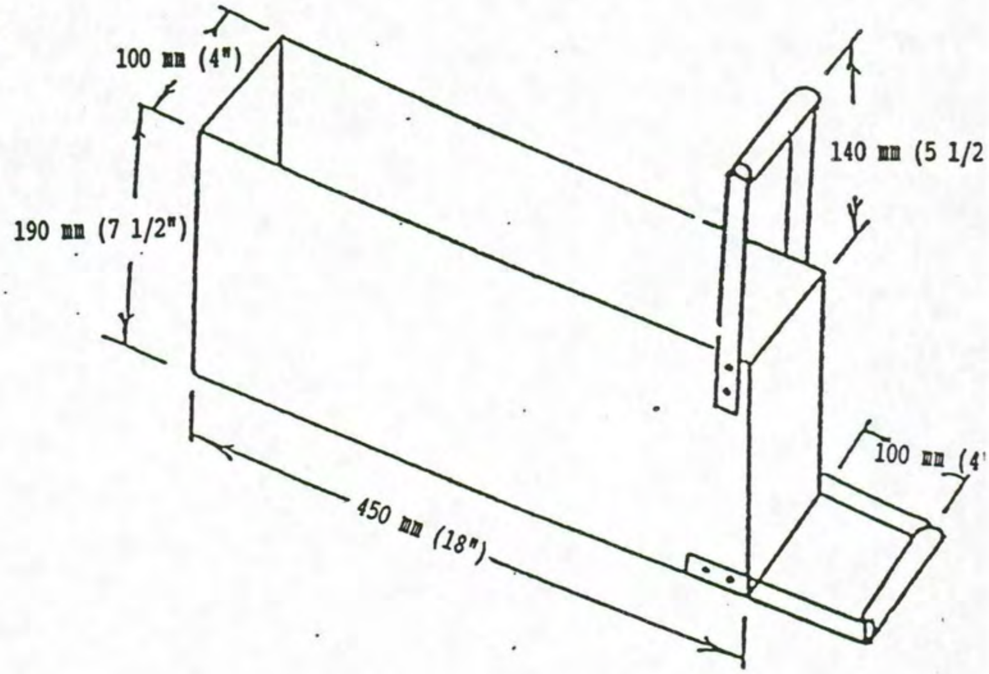

EXAMPLE OF METHOD
FOR SAMPLING FROM
CONVEYOR BELT
TEMPLATE-CONSTRUCTED
TO YIELD PROPER FIELD
SAMPLE.
NOTE: EACH OF THE 3
INCREMENTS TO BE TAKEN
FROM THE BELT AT SEPARATE
TIMES.

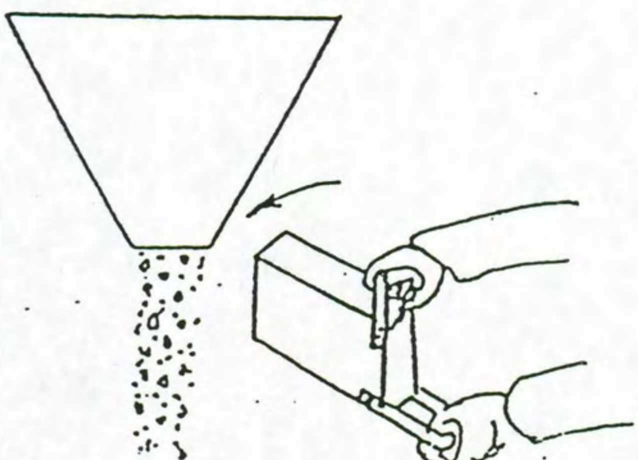
FIGURE 1

ILLUSTRATION OF

SAMPLING DEVICE

WITH HANDLES





NOTE: PASS THE SAMPLING DEVICE QUICKLY THRU THE ENTIRE STREAM FLOW OF AGGREGATE.

FIGURE 2

NOTES

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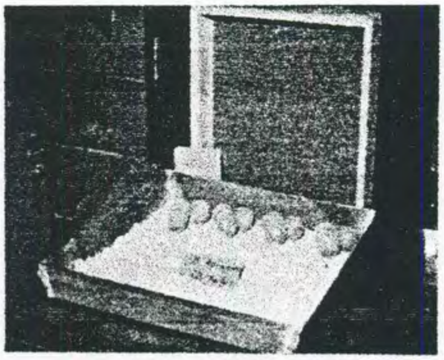
SECTION III

SAMPLING METHODS AND EQUIPMENT

Ideally, construction aggregates should be composed of durable, abrasion-resistant particles free of any deleterious or objectionable materials such as clay, shale, coal, organic matter, etc. Their specific gravities and absorptions are important when they are incorporated into portland cement or asphaltic concrete mixes.

RESISTANCE TO ABRASION

Abrasion is the mechanical wearing away of aggregate particles by friction and impact. Aggregates with low resistance to abrasion will readily wear away when used as surfacing materials or when exposed in pavement surfaces. They also degrade with handling. Excessive handling of aggregates with low resistance to abrasion can result in their containing relatively high percentages of fine material, often above the maximum level specified for the 75 μm (#200) sieve for the particular aggregate involved.


Abrasion test using 12 steel balls

LOS ANGELES ABRASION TEST

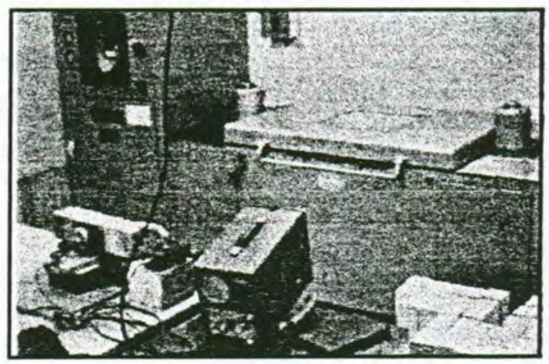
Resistance to abrasion is determined by use of the Los Angeles Abrasion Machine, a cylindrical drum mounted on a horizontal shaft. A specified weight of coarse aggregate is placed in the machine along with a specified number of standard steel balls, the abrasive charge. After rotation at 30-33 rpm for 500 revolutions, the percentage of the aggregate sample which has been abraded to pass a 1.70 mm (#12) sieve is reported as the loss due to abrasion, the percent of wear.

Natural gravels will generally develop wear losses of 20% to 35% when tested for abrasion resistance. Crushed limestone aggregates will generally develop wear losses of 30% to 45%. Losses of 45% or more are commonly accepted to be indicative of aggregates with poor resistance to abrasion.

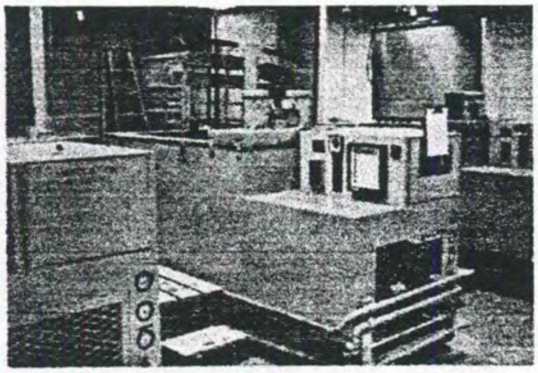
DURABILITY AND SOUNDNESS

These two terms are very similar in meaning and are often used interchangeably. The durability of an aggregate or other material is a measure of its ability to perform satisfactorily over an extended period of time. Soundness of an aggregate is a measure of its ability to resist the detrimental effects of exposure to natural forces. Durability is tested only for coarse aggregate for portland cement concrete. The designations of Class 2, Class 3 and 3i durability are used. The best method to determine durability class is to observe the performance of a concrete pavement that was constructed with the coarse aggregate in question. If the pavement has performed satisfactorily for only 20 years, it is Class 3 durability. Class 3i durability aggregates must perform satisfactorily for up to 30 years in interstate class highways. If the coarse aggregate, or a similar aggregate, has not been used in portland cement concrete pavements, we primarily rely on ASTM Designation C666, Method B to make a laboratory determination of durability class. This consists of a series of 300 freeze and thaw test cycles on a concrete specimen.

DURABILITY
CLASS 2
CLASS 3
CLASS 3i



Durability Test - Soundwave machine with prepared samples (concrete cubes with brass plugs on each end). Soundwave is transmitted through each cube before subjecting the sample to 300 F&T cycles. Soundwave is transmitted through each sample after F&T cycles and that reading is compared to first reading. If the coarse aggregate used in the sample tends to be susceptible it will crack during the process and the second soundwave will indicate how much aggregate was affected.



Freezers for Freeze-Thaw Test

METHOD OF TEST FOR DETERMINING THE SOUNDNESS OF AGGREGATES BY FREEZING AND THAWING

Test samples of coarse aggregate are alternately frozen and thawed for a prescribed number of cycles - 16 cycles in Method "A" for higher quality requirements, and 25 cycles in Method "C" for lower quality requirements. In both methods, the percentage passing the 2.36 mm (#8) sieve, computed to a clean dry weight basis, is reported as the soundness loss.

16 cycle

Method "A": 0.5 percent methyl alcohol is added to water in which the sample is immersed for thawing. This test is particularly severe on limestone aggregates which contain 5 percent or more of insoluble material in the clay or silt-size particle range. Generally, these are also the limestones which fail to perform well when the use of sound stone is required.

25 cycle

Method "C": Test Samples are thawed in water only. Freezing and thawing in water is not particularly severe, hence 25 cycles are required on this test while only 16 cycles are required when the water-alcohol solution is used. Any reasonably clean, coarse aggregate will perform well in this test and it is used for all materials which do not require high-quality aggregates.

NOTES

ABSORPTION AND SURFACE MOISTURE

Absorption and surface moisture may need to be determined (Iowa Test Method 201-A or ASTM Designation C127 & C128), so that the water content can be controlled. An aggregate particle's internal structure is made up of solid matter and voids that may or may not contain water. Terms used to describe the moisture content of aggregate are as follows:

Oven-dry - with no surface or internal moisture.

Air-dry - dry at the particle surface but containing some interior moisture - this is somewhat absorbent.

Saturated Surface-dry - an ideal condition in which the aggregate can neither absorb water nor contribute water. In this condition the interior has absorbed all the moisture it can hold, but the surface is dry.

Damp or Wet - containing moisture on the particle surface. Portland cement concrete batch weights of material must be adjusted for moisture conditions of the aggregates.

NOTES

SPECIFIC GRAVITY

Specific Gravity is a property which can be determined for all materials. Specific Gravity of a material is used in some calculations and tests for highway construction materials and is an important property for the aggregate inspector to understand. It is not a measure of aggregate quality.

Simply defined, specific gravity is the number of times heavier a material is than water. Stated another way, it is the ratio of the weight of a material to the weight of an equal volume of water. Even another way of stating the definition would be to say that specific gravity is the relative density of a material to water. If it were not for tradition, perhaps the term "relative density" would be more applicable than "specific gravity" as gravity has little to do with the matter except to provide the force which contributes to weight.

Test methods for determining specific gravity for fine and coarse aggregates are described in ASTM C128 and C127 or Iowa Test Method 201-A. In portland cement concrete calculations, the specific gravities of saturated-surface-dry aggregates are ordinarily used, that is, all the pores in each aggregate particle should be filled with moisture, but there should be no excess moisture on the particular surface at time of test.

NOTES

DELETERIOUS MATERIAL

It is very important that the aggregate be kept clean and free from deleterious substances. For this reason, the specifications limit the amount of deleterious substances that can be present. Shale, Coal, Chert and other lightweight particles tend to float in a P.C. concrete mix.

UNIT WEIGHT

Unit weight is a ratio of weight to volume, such as kilograms per cubic meter. Unit weight is not a measure of quality, but is useful in converting weights of material to volumes. See ASTM Designation: C29.

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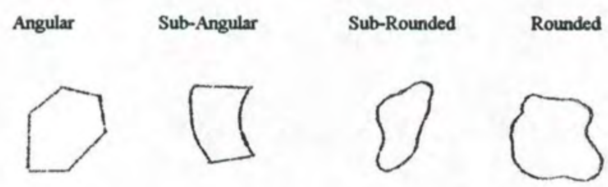
SHAPE AND SURFACE TEXTURE

Particle shape of either coarse or fine aggregate may be angular, sub-angular, sub-rounded, or rounded.



Aggregate particles should ideally be equa-dimensional and free of excessive amounts of flat and elongated pieces. Long, silvery aggregate pieces should be avoided. The shape of aggregate particles many times depends on the type of crusher used in the processing operation.

Particle shape and surface texture have a definite bearing on the quality of the finished product. Base courses composed of angular particles will compact and key together to form a dense, tight base, while elongated and rounded particles will slide and roll without compacting.

On the other hand, rounded particles tend to make plastic concrete more workable without a detrimental effect on the hardened concrete.

The texture of aggregate particles are normally defined in the following sequence: lithographic, sublithographic, fine grained, medium grained, and coarse grained. Lithographic and fine grained particles are polished quite easily by normal traffic wear and in time become a maintenance problem.

GRADATION

Gradation is the particle size distribution of aggregates determined by using sieves with square openings. As an aggregate is moved or handled, there is a tendency for the particle sizes to separate. This separation is known as segregation. Limits are usually specified for the percentage of material passing each sieve. There are several reasons for specifying grading limits and maximum aggregate size. Deviations from the grading limits seriously affect the uniformity of finished work.

GRADATION* - *Describes the various sizes of aggregate particles in terms of percentage passing or a percentage retained on a set of standardized square sieves.

<u>**Dense Graded Aggregate:**</u> Dense graded aggregates contain a proportion of material in each particle size present such as to minimize the void spaces between particles.

NOTES

<u>Gap Graded Aggregate</u>: Gap or open-graded aggregates contain too great an amount of particles of nearly the same size. This produces an open-type mixture with large void spaces. There are not enough of the smaller sizes to fill the voids between the larger sizes. See Figure 2 for comparison of dense and gap or open gradations of aggregates.

<u>Plasticity Index:</u> The plasticity index of an aggregate is determined in order to determine the presence and relative activity of contained clay minerals. In Iowa, the Atterberg test (Iowa Test Method 109-A) is used to determine the <u>Plasticity Index</u> (P.I.) of a soil. The P.I. is directly related to the amount of clay in a material and is determined by subtracting the plastic limit from the liquid limit.

The <u>Liquid Limit</u> (L.L.) Is that water content, expressed in percent dry weight, at which the material passes from a plastic to a liquid state. In general, it is determined by adding water to a portion of the minus 425 mm (#40) sieve size material until a certain consistency is reached.

After at least 15 minutes of aging in a humidity chamber, a small amount is transferred to a special pan on top of a L.L. machine. A groove is made through the middle of the sample on the pan, separating the two halves by a fraction of an inch. The number of "drops" needed to bring a portion of the two halves back together is used to determine if the proper amount of water was initially added. If the initial amount of water was wrong, the sample is remixed and rerun. The final sample is then weighed, dried, and again weighed to determine the amount of water added, as well as the weight of the original grooved samples.

The Plastic Limit (P.L.) is that water content, expressed in percent dry weight, at which the material passes from a semi-solid state to a plastic state. Generally, it is determined by adding water to a portion of the minus 425 mm (#40) sieve size material and then rolling it between the palm of the hand and a clean dry table. If the "threads" reach 3.175 mm (1/8 in.) diameter without breaking, they are remade into balls and rolled again. When the

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balls cannot be made to reach the 3.175 mm (1/8 in.) diameter thread size without breaking, they are placed in a pan for weighing, drying and reweighing to determine the weight of water, as well as the weight of the "threads."

SUMMARY - (Aggregates)

For most purposes, aggregates must conform to certain requirements and should consist of clean, hard, strong and durable particles free of chemicals, coatings of clay or other fine materials that may affect construction.

Weak, friable or freeze-thaw susceptible aggregate particles are undesirable for normal open highway construction. Aggregates containing natural shale or shaly particles, soft and porous particles, and certain types of chert should be especially avoided since they have poor resistance to weathering. Visual inspection may often disclose weaknesses in coarse aggregates.

MATERIAL - SPEC.	F&T C	F&T A	ABRASION	ABSPTION	P.I.	COAL/ SHALE	MUD/ CLAY	CHERT	COMMENTS
Conc. Sand - 4110						2			1.5 Mortar Strength
Conc. Stone - 4115		6	50			0.5	0.5	*	*2-Strc, 3-non Strc
Overlay - 4115.08		4	40	2.5		*	*	*/0.5	*Total of 1%
CL. "C" Gravel - 4120	15					*10	*15		*Total of 20
CL. "A" Crushed - 4120	15*		45*				4		*Shoulders only 55 Abrasion if 10 A-Freeze Max.
CL. A Gran. Shldr - 4120	15		45				4		
CL. "B" - 4120	20*		55*				4		*Total of 65%
CL. "D" - 4120	CONTRACT								
Gran. Subbase - 4121		25	45		5*				*Each Indv. Source
Macadam - 4122	10		45						
Soil Agg. Subbgr - 4123	15				**				**4-Gravel, 6-Cr. Stone
Cover Aggr. - 4125	10		40			(X)			(X)-2 on #16,.5 on #4
Slurry Aggr. - 4125		10	40						
"B" A.C. Stone - 4126	*	*	45	6	4**	5			*Primary 10 "C" & 25 "A" *Other 10 "C" & 45 "A" ** Composite
"A" A.C. Coarse - 4127		10	45	6			0.5		
"A" A.C. Fine - 4127						2	*0	*0	*1.5 Screen
Revetment - 4130		10	50						Primary Cl. - A &B
Revetment - 4130	5		50						Non-Primary - CL. A & B
Revetment - 4130	10		50						All Proj. - CL. D
Revetment - 4130		10	50						All Proj. - CL. E
Erosion Stone - 4130	15		50				5		
Porous Backfill - 4131		10	45			5			
Spec. Backfill - 4132					10				Gravel
Spec. Backfill - 4132									Crushed Concrete
Spec. Backfill - 4132									Crushed Stone
Gran. Backfill - 4133	15		45						

NOTES

SECTION IV
SIEVE ANALYSIS

GENERAL REQUIREMENTS

Aggregate sieve analysis procedures are governed by the Standard Specifications of the Iowa Department of Transportation and the Materials Office Instructional Memorandum Manual. The applicable test methods in the Materials Manual are included primarily in the 300 series section under the subsection "Aggregate."

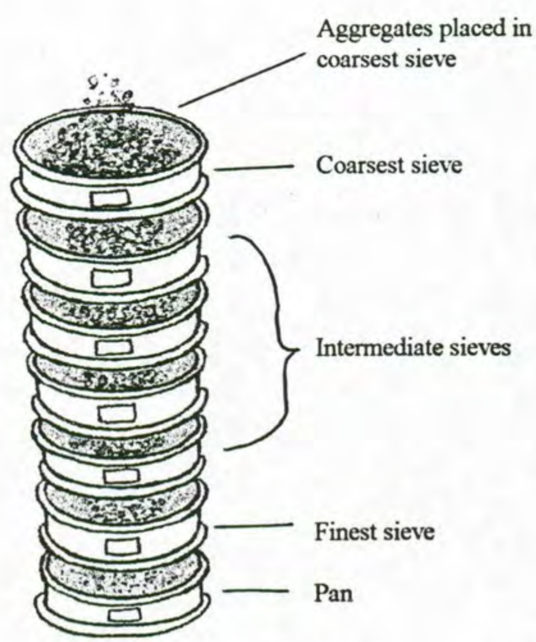
Sieve analysis is nothing more than the separation of a material based on particle size. For example, material which passes a 38.1 mm (11/2 in.) sieve and is retained on a 25.4 mm (1 in.) sieve would not contain any particle larger than 38.1mm (11/2 in.) nor smaller than 25.4 mm (1 in.). Sieves are normally arranged in a "nest" with the largest wire openings at the top of the nest and the smallest at the bottom.

COARSE AGGREGATE SIEVES

SI UNITS	US UNITS
37.5 mm.	1 ½ inch
25.0 mm.	1 inch
19.0 mm	3/4 inch
12.5 mm.	½ inch
9.50 mm.	3/8 inch
4.75 mm.	No.4 (0.187 inch)

FINE AGGGREGATE SIEVES

SI UNITS	US UNITS
4.75 mm.	No. 4 (0.187 in.)
2.36 mm.	N0. 8 (0.0937 in.)
1.18 mm.	No. 16 (0.0469 in.)
0.600 mm.	No. 30 (0.0234 in.)
0.300 mm.	No. 50 (0.0117 in.)
O.150 mm.	No.100 (0.0059 in.)



$$\textit{Percent retained} = \frac{\textit{Weight retained}}{\textit{Original dry weight}} \times 100$$

Iowa Department of Transportation Standard Specifications normally set limits on the percent passing a given sieve. The percent of the total weight retained on each sieve must be found first.

To calculate percent retained on any sieve, merely divide the weight retained by the original dry weight of the sample and multiply by 100.

The percent passing each sieve is then determined from the percent retained column.

METHOD OF TEST
SIEVE ANALYSIS OF FINE AGGREGATE
Field Procedures for Test Method Iowa No. 205

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

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1 percent of mass (weight) of the sample to be tested.

2. Sieves - 203 mm or 305 mm (8" or 12") diameter sieves of suitable sizes to furnish the information required by the specifications covering the material to be tested. This will normally be a nest of sieves consisting of 4.75 mm (Nos. 4,) 2.36 mm (8), 1.18 mm (16), 600 μm (30), 300 μm (50), 150 μm (100), 75 μm (200) and pan. The woven wire cloth sieves must conform to AASHTO Designation M-92.

3. Mechanical sieve shaker.

4. Oven or drying stove.

5. Wash pan of sufficient size to prevent loss of water and material.

6. Fiber bristle sieve cleaning brush (similar to stencil brush or cropped paint brush).

B. Test Sample

1. Obtain the sample for sieve analysis from the material to be tested by one of the following methods:

   (a) Use of a sample splitter.

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

   (c) Place the field sample on a hard, clean, level, nonabsorbent surface. If the material is not damp add water to it. Thoroughly mix the sample and form a miniature stockpile. Obtain a test sample by selecting at least five increments of material at random locations from the miniature stockpile, using a small scoop or spoon.

2. The sample for test should be approximately of the mass (weight) desired and must be the end result of the sampling method. Do not attempt to select sample of an exact predetermined mass (weight).

3. Samples of fine aggregate for sieve analysis shall conform to the sample size for the applicable material as indicated by Matls. I.M. 301.

C. Balance

1. Balance should be tared each time it is used.

D. Preparation of Sample

1. First subject the sample to the "Method of Test for Determining the Amount of Material Finer Than the 75 μm (No. 200) Sieve in Aggregate by Washing" Matls. I.M. 306.

E. Test Procedure

1. Place the washed and dried sample on the nested sieves, then place the nest in the Mechanical Sieve Shaker. Secure the sieves in the shaker and begin the sieving operation. Generally it will require at least 10 minutes to sieve a fine aggregate sample to completion. In no case should particles of the sample be turned or manipulated through the sieves by hand. If the Mechanical Sieve Shaker's action is such that the sample is not sieved to completion in a reasonable time, the cause could be overloading of the sieves. A guide for determining an overloaded sieve is; The retained fractions should weigh less than 4 grams per 645 mm^2 of sieve surface. For a 203.2 mm (8 in.) diameter sieve this amount would be 200 grams. Continue sieving until not more than 0.5 by mass (weight) of the dry mass (weight) of the washed sample passes any sieve during one minute. If the overloading condition cannot be corrected by adjusting the sample size on future tests, the washed and dried sample should be divided for sieving and then recombined for weighing.

2. Clean the retained material out of the sieves for weighing, so that a minimum of material is retained in the sieve by clinging to the mesh. Particles may be removed most readily from a sieve by inverting the sieve over a pan and tapping the sieve by hand and/or pushing (without force) the particles out of the mesh into the pan. Care should be exercised in cleaning the sieves to not damage the wire mesh by bending or breaking the wires. A brush should be used for cleaning the 1.18 mm (No. 16), 600 μm (30), and 300 μm (50) sieves. Do not use a brush

or any external force to attempt to clean the 150 μm(No. 100) or 75 μm(No. 200) sieve. Gentle tapping of the sieve frame is recommended for these sieves. If clogging of the mesh occurs on these finer sieves, they should be returned to the central laboratory for cleaning.

3. Weigh the fraction of material retained on each sieve and in the pan and record. The combined mass (weight) of material retained on all the sieves and in the pan must equal the original mass (weight) after washing within 0.5 percent. The original dry mass (weight) of the sample must also be within 0.5 percent of the mass (weight) on each sieve and in the pan plus the washing loss. If the difference exceeds 0.5 percent check for a subtraction error in the washing loss.

4. The total amount of material finer than the No. 200 sieve is determined by adding the mass (weight) of material passing the No. 200 sieve by dry sieving to that lost by washing.

F. Calculations

1. Divide the mass (weight) of the material retained on each sieve (and in the Pan) by the total original dry mass (weight) of the sample, including all the minus No. 200 material, to determine the percentage retained on each sieve.

2. In computing the percentage retained and consequent percentage passing each sieve, the computations are carried out to the nearest 0.1 percent so that the percentages retained will add to a total of 100 percent. In reporting the sieve analysis, however, these results are shown only to two significant figures--i.e., to the nearest percent for percentages of 10.0 and larger and to the nearest tenth of a percent for lower results.

3. Because the mass (weight) of material retained on the sieves may not equal the dry mass (weight) after washing, the total of the percentages retained may not be exactly 100.0%. If this occurs, the percentages should be altered by prorating the percentages so that they do total 100.0% (see example).

Fine Aggregate Sieve Analysis Example:

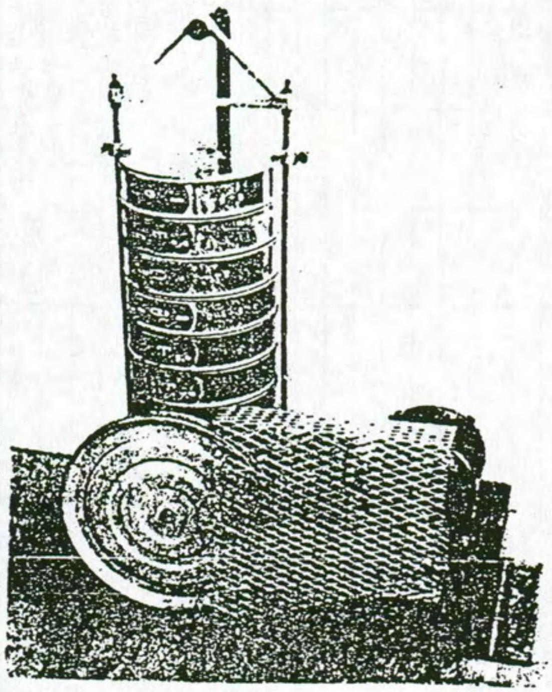
Original Dry Mass (Weight) of Sample = 594.0
Dry Sample Mass (Weight) After Washing = 591.5

Sieve Size	Mass (Weight) Retained (g)
9.50 mm (3/8)	0.0
4.75 mm (4)	29.0
2.36 mm (8)	64.5
1.18 mm (16)	102.0
600 μm (30)	181.5
300 μm (50)	154.5
150 μm (100)	51.0
75 μm (200)	6.0
Pan	1.0
Total	589.5

589.5 : 591.5 = 99.7%

Therefore this mass (weight) loss from sieving is within the 0.5% tolerance.

Sieve No.	%Retained	(Prorated)	Passing	(Reportable)
9.5 mm (3/8)	0.0 ÷ 594.0 = 0	0.0	100	100
4.75 mm (4)	29.0 ÷ 594.0 = 4.9	4.9	95.1	95
2.36 mm (8)	64.5 ÷ 594.0 = 10.9	10.9	84.2	84
1.18 mm (16)	102.0 ÷ 594.0 = 17.2	17.2	67.0	67
600 μm (30)	181.5 ÷ 594.0 = 30.6	30.7	36.3	36
300 μm (50)	154.5 ÷ 594.0 = 26.0	26.1	10.2	10
150 μm (100)	51.0 ÷ 594.0 = 8.6	8.6	1.6	1.6
75 μm (200)	6.0 ÷ 594.0 = 1.0	1.0	0.6	0.6
Pan & Wash	3.5 ÷ 594.0 = 0.6	0.6		
	99.8	100.0		



Mechanical Sieve Shaker and Sieves

Form 820180
10-95

FINE AGGREGATE

Iowa Department of Transportation
SIEVE ANALYSIS WORKSHEET

Lab. No.		Material		Material		Material
Co. & Proj.						
Producer						
Contractor						
Sampled by		Date		Date		Date
Sample Loc.						

Coarse Sample

	Coarse Sample					Coarse Sample					Coarse Sample				
	Split Diff.	Orig. Dry Mass (Weight)				Split Diff.	Orig. Dry Mass (Weight)				Split Diff.	Orig. Dry Mass (Weight)			
	Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.
37.5mm (1½)															
26.5mm (1.06)															
19mm (¾)															
13.2mm (0.530)															
9.5mm (⅜)															
4.75mm (4)															
2.36mm (8)															
Total 4.75mm (4)															
Pan															
Total															

Fine Sample

	Fine Sample					Fine Sample					Fine Sample				
		Orig. Dry Mass (Weight)		594.0			Orig. Dry Mass (Weight)					Orig. Dry Mass (Weight)			
	Tol. Check 99.7%	Dry Mass (Wt.) Washed Sample		591.5		Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
		Washing Loss		2.5			Washing Loss					Washing Loss			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.
9.5mm (⅜)	0.0	0.0		100.0	100										
4.75mm (4)	29.0	4.9		95.1	95-100										
2.36mm (8)	64.5	10.9		84.2	75-100										
1.18mm (16)	102.0	17.2		67.0											
600µm (30)	181.5	30.Ø7		36.3											
300µm (50)	154.5	26.Ø1		10.2											
150µm (100)	51.0	8.6		1.6											
75µm (200)	6.0	1.0		0.6	0-1.5										
Wash	2.5														
Pan	1.0	0.6													
Total	592.0	~~99.8~~100.0													
Less +4.75mm (4)															
Passing #4.75mm (4)															

Date Reptd.		Date Reptd.		Date Reptd.	
Tested by	Date	Tested by	Date	Tested by	Date

NOTES

NOTES

METHOD OF TEST
SIEVE ANALYSIS OF COARSE AGGREGATES*
Field Procedures for Lab. Test Method 204

SCOPE

This method of test covers a procedure for the determination of the particle size distribution of coarse aggregates, using sieves with square openings.

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1 percent of the mass (weight) of the sample to be tested.

2. Sieves - Sieves with square openings mounted on substantial frames that are constructed in such a manner that will prevent loss of material during sieving. Use suitable sieve sizes to furnish the information required by the specifications covering the material to be tested. The woven wire cloth shall conform to AASHTO M-92. This will normally be a set of sieves consisting of: 37.5 mm (1 1/2 in.), 26.5 mm (1.06 in.), 19 mm (3/4 in.), 13.2 mm (0.530 in.), 9.5 mm (3/8 in.), 4.75 mm (#4), and 2.36 mm (#8).

3. Mechanical or hand-powered sieve shaker.

4. Drying oven or stove.

5. Wash pan of sufficient size to prevent loss of water and material.

B. Sample Size

1. Reduce the sample by quartering or splitting as described in I.M. 336 to the size that will conform with the applicable material as shown in I.M. 301.

C. Sample Preparation

1. Aggregates that have changes in moisture for different particle sizes must be dried to a constant mass (weight).

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

*This procedure is used for gradation, numbers 12, 22, 24, 25, 26, and 30, and is applicable when the amount of material passing the 4.75 mm (No. 4) sieve is approximately 30% or less. All of the fine aggregate sieves shall be used [4.75 mm (No. 4), 2.36 mm (No. 8), 1.18 mm (No. 16), 600 μm (No. 30), 300 μm (No. 50), 150 μm (No. 100), and 75 μm (No. 200)].

D. Balance

1. Balance should be tared each time it is used.

E. Test Procedure

1. Sieve the sample over the required sieves. The sieving operation must be conducted by means of a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve. Do not attempt to turn or manipulate the sample through the sieve by hand. Continue sieving until not more than 0.5 percent by mass (weight) of the total sample passes any sieve during one minute of sieving. On that portion of the sample retained on the 4.75 mm (No. 4) sieve, the above described procedure for determining thoroughness of sieving is to be carried out with a single layer of material. When mechanical sieving is used the thoroughness of sieving is to be tested by using the hand method described above.

   Note: Normally the sieves that are required for this analysis are the 2.36 mm (No. 8) size and above. When specifications require a determination on a sieve finer than the 2.36 mm (No. 8) size, the material passing the 2.36 mm (No. 8) sieve is sieved through the appropriate size sieve or sieves.

2. If sieving to completion as described above is not accomplished, reduce the amount of material carried on the sieve and/or sieves for a longer period of time. If overloading a sieve is anticipated when using a mechanical sieve shaker, divide the sample for sieving and recombine it for weighing.

3. Determine and record the mass (weight) of material retained on each sieve and in the pan. The combined mass (weight) of material retained on all of the sieves and in the pan must equal the mass (weight) before sieving within 0.5 percent.

4. Divide the mass (weight) of the material retained on each sieve and in the pan by the total original mass (weight) of the sample to determine the percentage retained on each sieve. These percentages retained should total 100.0. If the total is not exactly 100.0, the percentages should be altered by prorating the difference so that they do total 100.0.

Note: In some instances (e.g. granular surfacing material, Class A & D crushed stone, etc.) particles are coated to the extent that dry sieving will not accurately reflect the true gradation of the material. In these instances, the sample must be washed over the smallest sieve for which there is a specification requirement. The total percentage passing this sieve is a combination of the washing loss and the amount passing the sieve obtained by dry sieving the washed sample.

5. When it is necessary to determine the amount of material finer than the 75 μm (No. 200) sieve, select the test and sample by one of the following methods:

(a) Splitting

(1) The sample to be tested may be selected by splitting as described in Matls. I.M. 336.

(2) If a sample splitter is used in reducing the field sample (Par. B), continue splitting the remaining portion until the test sample for washing will be of the size required in Matls. I.M. 306.

(b) Entire sample

(1) The sample obtained for determining the sieve analysis may also be used for the determination of the material finer than the minus 75 μm (No. 200) sieve by washing. This test is performed prior to the sieve analysis.

(c) Testing

(1) Subject the sample to the "Method of Test For Determining the Amount of Material Finer Than the 75 μm (No. 200) Sieve in Aggregate by Washing," Matls. I.M. 306.

(2) Only the total material finer than the 75 μm (No. 200) sieve is required from the wash sample. The Matls. I.M. 306 procedure provides only the portion that is lost in washing the sample. To this must be added the amount of minus 75 μm (No. 200) material obtained when dry sieving.

Therefore, upon completion of the procedure outlined in Matls. I.M. 305, sieve the washed and dried sample over a 4.75 mm (No. 4) or 2.36 mm (No. 8) sieve and discard the retained material. Place the portion of material passing the 4.75 mm (No. 4) or 2.36 mm (No. 8) sieve on a nest of sieves including 1.18 mm (No. 16), 600 μm (No. 30), 75 μm (No. 200) and pan, [the No. 1.18 mm (No. 16) and 600 μm (No. 30) sieves are included to protect the No. 75 μm (No. 200) sieve] and after a minimum time of 5 minutes on a mechanical shaker, determine only the mass (weight) of the material in the pan.

(3) Add the washing loss [minus 75 μm (No. 200)] to the dry sieving loss [minus 75 μm (No. 200)] to obtain the total minus 75 μm (No. 200). Divide this total by the dry mass (weight) of the sample (before washing) and record as percent passing the 75 μm (No. 200).

*The entire procedure in D-5 may be omitted provided the total amount of material finer than the 75 μm (No. 200) is not a specification requirement.

F. Calculations

1. In computing the percentages retained and the subsequent percentages passing each sieve, the computations are carried out to the nearest 0.1 percent so that the percentages retained will add to a total of 100.0 percent. In reporting the sieve analysis, however, these results are shown to only two significant figures, i.e., to the nearest percent for percentages above 10 and to the nearest tenth of a percent for lower results.

Coarse Aggregate Sieve Analysis
Example

Coarse Aggregate for Class C3 Concrete Mix. Minimum Sample Size Required (I.M. 301) = 10,000 g. Original Surface Dry Mass (Weight) of Sample = 11,548 g.

Sieve No.	Surface Dry Mass (Weight) Retained - Grams
37.5 mm(1.50")	0
26.5 mm(1.06")	1154
19.0 mm (3/4")	2136
13.2 mm (0.530")	2892
9.5 mm (3/8")	2766
4.75 mm (No. 4)	2164
2.36 mm (No. 8)	242
Pan	185
	Total 11,539

11,539 ÷ 11,548 = 99.9%

Therefore the mass loss from sieving is within the 0.5% tolerance.

Sieve Size		%Retained Prorated	%Psg.
37.5 mm (1.50")	(0÷11,548) X 100 = 0.0	0.0	100.0
26.5 mm (1.06")	(1154÷11,548) X 100 = 10.0	10.0	90.0
19 mm (3/4")	(2136÷11,548) X 100 = 18.5	18.5	71.5
13.2 mm (0.530)	(2892÷11,548) X 100 = 25.0	25.1	46.4
9.5 mm (3/8")	(2766÷11,548) X 100 = 24.0	24.0	22.4
4.75 mm (No. 4)	(2164÷11,548) X 100 = 18.7	18.7	3.7
2.36 mm (No. 8)	(242 ÷11,548) X 100 = 2.1	2.1	1.6
Pan	(185 ÷11,548) X 100 = 1.6	1.6	
	99.9	100.0	

11,539 ÷ 11,548 = 99.9%

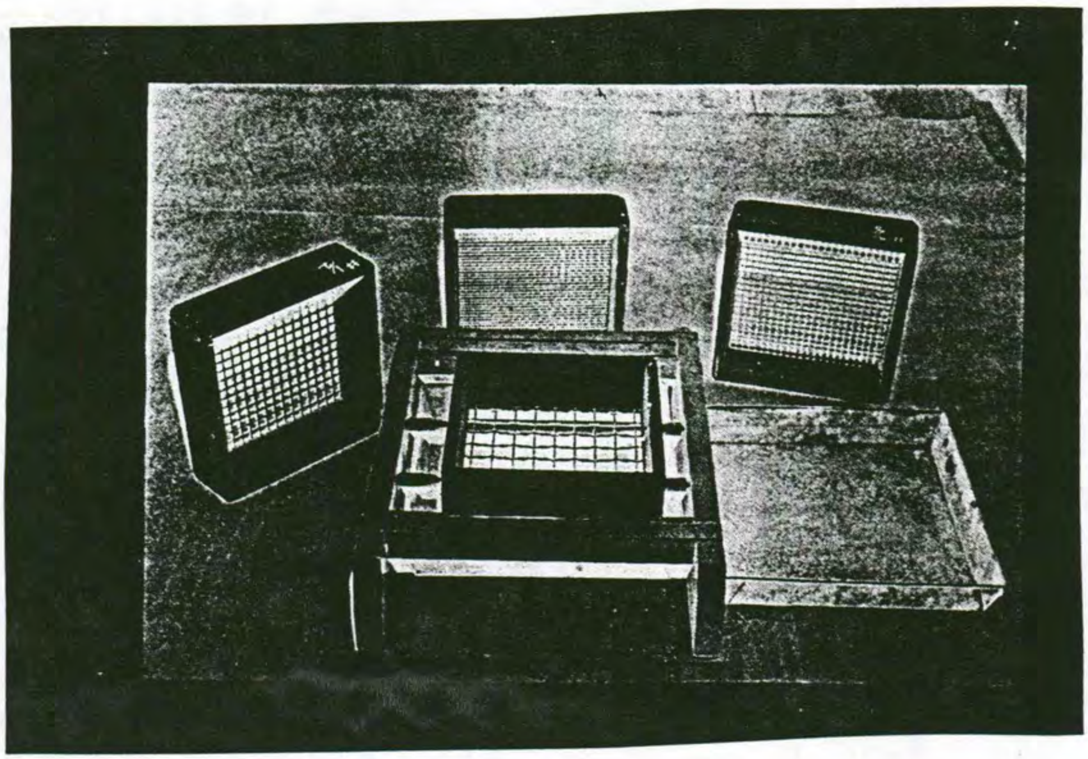
Therefore the mass loss from sieving is within the 0.5% tolerance.

Dry Mass (Weight) of Wash Sample =2571 g.
Dry Mass (Weight) of Washed Sample =2555 g.
Washing Loss [Minus 75 μm (No. 200)] = 16 g.
Dry Sieving Loss [Minus 75 μm (No. 200)] = 4 g.

$$\text{Total Minus No. 200} = \frac{20}{2571} \times 100 = 0.8\%$$

Sieve Analysis

Sieve	% Passing
37.5 mm (1.50")	100
26.5 mm (1.06")	90
19 mm (3/4")	72
13.2 mm (0.530")	46
9.5 mm (3/8")	22
4.75 mm (No. 4)	3.7
2.36 mm (No. 8)	1.6
75 μm (No.200)	0.8



BOX SCREENS

Form 820180
10-95

Iowa Department of Transportation
SIEVE ANALYSIS WORKSHEET

Lab. No.		Material		Material			Material	
Co. & Proj.								
Producer								
Contractor								
Sampled by		Date			Date			Date
Sample Loc.								

Coarse Sample / Coarse Sample / Coarse Sample

	Split Diff.	Orig. Dry Mass (Weight)		11548		Split Diff.	Orig. Dry Mass (Weight)				Split Diff.	Orig. Dry Mass (Weight)			
	Tol. Check 99.9%	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.
37.5mm (1½)	0	0.0		100.0											
26.5mm (1.06)	1154	10.0		90.0											
19mm (¾)	2136	18.5		71.5											
13.2mm (0.530)	2892	25.~~0~~1		46.4											
9.5mm (⅜)	2766	24.0		22.4											
4.75mm (4)	2164	18.7		3.7											
2.36mm (8)	242	2.1		1.6											
Total 4.75mm (4)															
Pan	185	1.6													
Total	11539	100.0													

Fine Sample / Fine Sample / Fine Sample

		Orig. Dry Mass (Weight)		2571			Orig. Dry Mass (Weight)					Orig. Dry Mass (Weight)			
	Tol. Check	Dry Mass (Wt.) Washed Sample		2555		Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
		Washing Loss		16			Washing Loss					Washing Loss			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.
9.5mm (⅜)															
4.75mm (4)															
2.36mm (8)															
1.18mm (16)															
600µm (30)															
300µm (50)															
150µm (100)															
75µm (200)				0.8											
Wash	16														
Pan	4														
Total															
Less +4.75mm (4)															
Passing #4.75mm (4)															

Date Reptd.		Date Reptd.		Date Reptd.	
Tested by	Date	Tested by	Date	Tested by	Date

DRAFT
METHOD OF TEST
SIEVE ANALYSIS OF CRUSHED COMPOSITE PAVEMENT MATERIALS FOR FIELD TESTING

SCOPE

This method of test covers a procedure for the determination of the particle size distribution of unwashed coarse material, using sieves with square openings.

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1 percent of the mass (weight) of the sample to be tested.

2. Sieves - sieves with square openings mounted on substantial frames that are constructed in such a manner that will prevent loss of material during sieving. Use suitable sieve sizes to furnish the information required by the specifications covering the material to be tested. The woven wire cloth shall conform to AASHTO M-92.

3. Mechanical or hand-powered sieve shaker.

4. Mechanical fan to aid in air drying material (optional).

5. Drying pan of sufficient size to prevent loss of material.

B. Sample Size

1. Reduce the sample by quartering or splitting as described in I.M. 336 to the size that will conform with the applicable material as shown in I.M. 301.

C. Sample Preparation

1. Material from crushed composite pavements shall be sieved at a surface-dry condition determined by visual examination.
Note: This procedure is used for testing crushed composite AC/PC pavement for gradation numbers 11 and 30 only. No artificial heat shall be used to air dry material.

D. Test Procedure

1. Sieve the sample over the sieves with openings of 2.36 mm (No. 8) size or greater. No gradation determination will be made for material finer than the 2.36 mm (No. 8) sieve. The sieving operation must be conducted by means of a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve. Do not attempt to turn or manipulate the sample through the sieve by hand. Continue sieving until not more than 0.5 percent by mass (weight) of the total sample passes any sieve during one minute of sieving. On that portion of the sample retained on the 4.75 mm (No. 4) sieve, the above described procedure for determining thoroughness of sieving is to be carried out with a single layer of material. When mechanical sieving is used, the thoroughness of sieving is to be tested by using the hand method described above.

2. If sieving to completion as described above is not accomplished, reduce the amount of material carried on the sieve and/or sieves for a longer period of time. If overloading a sieve is anticipated when using a mechanical sieve shaker, divide the sample for sieving and recombine it for weighing.

3. Determine and record the mass (weight) of material retained on each sieve and in the pan. The combined mass (weight) of material retained on all of the sieves and in the pan must equal the mass (weight) before sieving within 0.5 percent.

4. Divide the mass (weight) of the material retained on each sieve and in the pan by the total original mass (weight) of the sample to determine the percentage retained on each sieve. These percentages retained should total 100.0. If the total is not exactly 100.0, the percentages should be altered by prorating the difference so that they do total 100.0.

   Note: In some instances particles are coated to the extent that dry sieving will not accurately reflect the true gradation of the material. In these instances, the sample must be washed over the smallest sieve for which there is a specification requirement. The total percentage passing this sieve is a combination of the washing loss and the amount passing the sieve obtained by dry sieving the washed sample.

E. Calculations

1. In computing the percentages retained and the subsequent percentages passing each sieve, the computations are carried out to the nearest 0.1 percent so that the percentages retained will add to a total of 100.0 percent. In reporting the sieve analysis, however, these results are shown to only two significant figures, i.e.,

to the nearest percent for percentages above 10 and to the nearest tenth of a percent for lower results.

2. Rounding-off: When rounding off a number, always round five (5) or greater up and four (4) or less down. Examples are as follows:

Calculated Value	Rounded-Off Value
10.4%	10%
10.5%	11%
10.6%	11%
11.4%	11%
11.5%	12%
11.6%	12%
6.45%	6.5%
6.55%	6.6%
6.65%	6.7%

Coarse Material Sieve Analysis
Example

Coarse material for crushed composite pavement. Minimum Sample Size Required (I.M. 301) = 2,500 g. Original Surface Dry Mass (Weight) of Sample = 2,560 g.

Sieve No.	Surface Dry Mass (Weight) Retained - Grams
26.5 mm (1.06 in.)	0
19.0 mm (3/4 in.)	25.6
13.2 mm (0.530 in.)	335.5
9.5 mm (3/8 in.)	384.1
4.75 mm (No. 4)	645.4
2.36 mm (No. 8)	411.8
Pan	758.0
Total	2560.4

$$2560.4 \div 2561 \times 100 = 100\%$$

Therefore the mass loss from sieving is within the 0.5% tolerance.

Form 820180
10-92

Iowa Department of Transportation

SIEVE ANALYSIS WORKSHEET

Lab. No.	Crushed	Material Composite AC/PC Pavement		Material		Material
Co. & Proj.						
Producer	Gradation II (modified)					
Contractor						
Sampled by		Date		Date		Date
Sample Loc.						

Coarse Sample

	Coarse Sample	Coarse Sample	Coarse Sample
Orig. Dry Weight	2561.0		
Dry Wt. Washed Sample			

Sieve Size	Wt. Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Wt. Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Wt. Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.
37.5mm (1½)	0.0														
26.5mm (1.06)	0.0														
19mm (¾)	25.6	1.0	99.0	99	97-100										
13.2mm (0.530)	335.5	13.1	85.9	86											
9.5mm (⅜)	384.1	15.0	70.9	71											
4.75mm (4)	645.4	25.2	45.7	46	30-75										
2.36mm (8)	411.8	16.1	29.6	30	15-45										
Total 4.75mm (4)															
Pan	758.0	29.6													
Total	2560.4	100.0													

Fine Sample

	Fine Sample	Fine Sample	Fine Sample
Orig. Dry Weight			
Dry Wt. Washed Sample			
Washing Loss			

Sieve Size	Wt. Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Wt. Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Wt. Retd.	% Retd.	% Retd. Final	% Passing	Specs.
9.5mm (⅜)															
4.75mm (4)															
2.36mm (8)															
1.18mm (16)															
600μm (30)															
300μm (50)															
150μm (100)															
75μm (200)															
Wash															
Pan															
Total															
Less +4.75mm (4)															
Passing #4.75mm (4)															

Date Reptd.		Date Reptd.		Date Reptd.	
Tested by	Date	Tested by	Date	Tested by	Date

METHOD OF TEST
SIEVE ANALYSIS OF COMBINED AGGREGATES

SCOPE

This method of test covers a procedure for the determination of the particle size distribution of combined coarse and fine aggregates, using sieves with square openings.

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1 percent of the mass (weight) of the sample to be tested.

2. Sieves - The sieves with square openings shall be mounted on substantial frames such as wood or brass constructed in a manner that will prevent loss of material during sieving. Suitable sieve sizes shall be selected to furnish the information required by the specifications, covering the material to be tested. The woven wire cloth sieves shall conform to AASHTO M-92.

3. Oven or drying stove.

4. Mechanical sieve shaker.

5. Tub for washing sample.

6. Fiber bristle sieve cleaning brush (similar to a stencil brush or cropped paint brush).

B. Sample Size

1. Follow method I.M. 336 and select a coarse sample in accordance with Matls. I.M. 301 for the material to be tested.

2. From the remaining portion of the field sample, follow I.M. 336 and select a fine sample of sufficient size to ensure that it will contain a minimum of 500 grams of dry material passing the 4.75 mm (No. 4) screen.

3. To estimate the minimum sample size needed for 'fine sample', divide 500 grams by the estimated percent passing the 4.75 mm (No. 4) screen and multiply by 100.

$$\frac{500}{\text{est. \% psg. 4.75 mm (No.4)}} \times 100$$

4. Splitting - Compare the percent retained on the 4.75 mm (No. 4) screen of the coarse test fraction with the percent retained on the 4.75 mm (No. 4) of the fine test fraction. If a difference of more than 3 percent is found, the operator shall re-test the material. This is achieved by comparing the percent retained on the 4.75 mm (No.4) screen of the fine sample with the percent retained on the 4.75 mm (No.4) screen of the coarse sample.

C. Balance

1. Balance should be tared each time it is used.

D. Test Procedure

1. Coarse Sample

a. Place the sample in the oven at $110 \pm 5^{\circ}$C ($230 \pm 9^{\circ}$F). or on the stove and dry to a constant mass (weight).

When drying on the stove the sample must be stirred to prevent local overheating causing the sample to "pop" or "sputter".

b. Allow the sample to cool and determine the original dry mass (weight).

c. Sieve the sample on the 4.75 mm (No. 4) sieve.

d. Wash the material retained on the 4.75 mm (No.4) sieve by either; placing it on a 4.75 mm (No.4) sieve and agitate the sieve and its contents in a tub of water, or, place the material in a large pan, cover with water, agitate the pan of aggregate and decant the water from it. Repeat these steps until the decanted water appears clear. Any clay lumps present must be broken up and passed through this sieve in the washing process.

e. Place the washed sample in the oven or on the stove and dry to a constant mass (weight).

f. Allow the sample to cool and determine the washed dry mass (weight).

g. Sieve the washed and dried sample on the required coarse sieves, ending with the 4.75 mm (No.4) sieve. The sieving operation must be conducted by means of a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve. Do not attempt to turn or manipulate the sample through the sieve by hand. Continue sieving until not more than 0.5 percent by mass (weight) of the dry mass (weight) of the washed sample passes any sieve during one minute. The above described procedure for determining the thoroughness of sieving is to be carried out with a single layer of material. When mechanical sieving is used, the thoroughness of sieving is to be tested by using the hand method of sieving as described above.

h. Weigh the material retained on each sieve and in the pan, and record. The total must equal the dry mass (weight) of the washed sample as previously recorded within 0.5 percent.

2. Fine Sample

a. First subject the sample to the "Method of Test for Determining the Amount of Material Finer than the 75 μm (No. 200) Sieve in Aggregate by Washing". Matls. I.M. 306.

b. Separate the minus 4.75 mm (No.4) material by sieving the sample over a 4.75 mm (No.4) box sieve.

c. Place the minus 4.75 mm (No.4) material on the nested sieves and begin the sieving operation by means of a lateral and vertical motion of the sieves so as to keep the sample moving continuously over the surface of the sieves. In no case should the particles in the sample be turned or manipulated through the sieves by hand.

Continue sieving until not more than 0.5 percent by mass (weight) of the dry mass (weight) of the washed sample passes any sieve during one minute. A shaker provided with an electric motor should be run for a period of at least 10 minutes. When the sieve action is such that the particles are not sieved to completion in the time allowed, the cause may be overloading of the sieves. If this condition cannot be corrected by adjusting the sample size on future tests, the washed and dried sample should be divided for sieving and then recombined for weighing.

d. Clean the retained material out of the sieves for weighing, so that a minimum of material is retained in the sieve by clinging to the mesh. Particles may be removed most readily from a sieve by inverting the sieve over a pan and tapping the sieve and/or pushing (without force) the particles out of the mesh into the pan. Care should be exercised in cleaning the sieves to not damage the wire mesh by bending or breaking the wires. A brush should be used for cleaning the 1.18 mm (No.16), 600 μm (No.30), and 300 μm (No.50) sieves. Do not use a brush or any external force to attempt to clean the 150 μm (No.100) or 75 μm (No.200) sieve. Gentle tapping of the sieve frame is recommended for these sieves. If clogging of the mesh occurs on these finer sieves, they should be returned to the central laboratory for cleaning.

e. Weigh and record the fractions of material on each sieve and pan. Any material retained on the 4.75 mm (No.4) round sieve must be combined with material retained on the 2.36 mm (No.8) sieve for weighing. The combined mass (weight) of material retained on all the sieves and within the pan must equal the original mass (weight) after washing within 0.5 percent.

The original dry mass (weight) of the sample must also be within 0.5 percent of the mass (weights) on each sieve and in the pan plus the washing loss. If the difference exceeds 0.5 percent check for a subtraction error in the washing loss.

f. The total amount of material finer than the No. 75 μm (No. 200) sieve is determined by adding the mass (weight) of materials passing the No. 75 μm (No. 200) sieve by dry sieving to that lost by washing.

E. Calculations

1. The percentage of the coarse sample retained on each of the sieves is computed by dividing the mass (weight) retained on each sieve by the

original dry mass (weight) of the sample, and multiplying the result by 100. The computations should be checked by totaling the percentages retained on the various sieves. This figure should equal the result obtained by dividing the total plus 4.75 mm (No.4) material by the original dry mass (weight) and multiplying by 100. If a difference exists, the latter figure will be considered correct, and the difference prorated over the sieves.

2. Using the mass (weight) of material passing the 4.75 mm (No.4) sieve, as determined on the fine sample, compute the percentages retained by dividing the mass (weight) retained on each of the sieves by the weight passing the 4.75 mm (No.4) sieve, and multiplying by 100. (The percentage retained on the 4.75 mm (No.4) sieve is <u>not</u> computed for this sample.) These percentages retained should total 100.0. If the total is not exactly 100.0 the percentages should be altered by prorating the difference so they do total 100.0. It will be noted that the washing loss and the material in the pan are added together to compute the percentage retained in the pan.

3. The values determined in D-2 represent only the percentages retained as based on the material passing the 4.75 mm (No.4) sieve. To convert these percentages to the basis of total material, they must be multiplied by the percentage passing the 4.75 mm (No.4) sieve (as determined for the coarse sample) and divided by 100. The sum of these percentages must equal the percentage passing the 4.75 mm (No.4) sieve as determined on the coarse sample. These values are subtracted successively from the percentage passing the 4.75 mm (No.4) sieve to complete the sieve analysis.

4. In computing the percentage retained and subsequent percentage passing each sieve, the computations are carried out to the nearest 0.1 percent so that the percentages retained will add to a total of 100 percent. In reporting the sieve analysis, however, these results are shown only to two significant figures, i.e., to the nearest percent for percentages above 10.0, and to the nearest tenth of a percent for lower results.

Combined Aggregate Sieve Analysis
Example

Aggregate for 19 mm (3/4") Type A Asphaltic Concrete.
Minimum Size Sample Required (I.M. 301) = 2,500 g.
Estimated Percentage Passing 4.75 mm (No.4) Sieve = 50%
Estimated Percentage Passing 75 μm (No.200) Sieve = 10%
Approximate Wet Mass (Weight) of Fine Sample to obtain equals:

$$\frac{50 \times 100}{\%Psg\ 4.75\text{ mm (No.4)}} = \frac{550 \times 100}{50} = 1100\text{ g. (Approx.)}$$

Dry Mass (Coarse Sample) = 2800 g.
Dry Mass (Fine Sample) = 1045 g.
Dry Mass Washed Sample (Coarse) = 1306 g.
Dry Mass Washed Sample (Fine) = 965 g.

% Retained on Coarse Sample

19 mm (3/4")	= (0 X 100) ÷ 2800 = 0.0%
13.2 mm (0.530")	= (224 X 100) ÷ 2800 = 8.0%
9.5 mm (3/8")	= (490 X 100) ÷ 2800 = 17.5%
4.75 mm (No.4)	= (590 X 100) ÷ 2800 = 21.1%
Total 4.75 mm (No.4)	=(1304 X 100) ÷ 2800 = 46.6%

% Retained on Fine Sample

2.36 mm (No.8)	= (157 X 100) ÷ 554 = 28.3%	Prorate to 28.2
1.18 mm (No.16)	= (73 X 100) ÷ 554 = 13.2%	
600 μm (No.30)	= (94 X 100) ÷ 554 = 17.0%	
300 μm (No.50)	= (42 X 100) ÷ 554 = 7.6%	
150 μm (No.100)	= (52 X 100) ÷ 554 = 9.4%	
75 μm (No.200)	= (32 X 100) ÷ 554 = 5.8%	
Wash & Pan	= (80+24 X 100) ÷ 554 = 18.8%	

<u>% Retained Final</u>

2.36 mm (No.8) = (28.2 X 53.4) ÷ 100 = 15.1%
1.18 mm (No.16) = (13.2 X 53.4) ÷ 100 = 7.0%
600 μm (No.30) = (17.0 X 53.4) ÷ 100 = 9.1%
300 μm (No.50) = (7.6 X 53.4) ÷ 100 = 4.1%
150 μm (No.100) = (9.4 X 53.4) ÷ 100 = 5.0%
75 μm (No.200) = (5.8 X 53.4) ÷ 100 = 3.1%
Wash & Pan = (18.8 X 53.4) ÷ 100 = 10.0%

Form 820180
10-95

Iowa Department of Transportation
SIEVE ANALYSIS WORKSHEET

Lab. No.		Material		Material		Material
Co. & Proj.						
Producer						
Contractor						
Sampled by	Date		Date		Date	
Sample Loc.						

Coarse Sample

Coarse Sample					Coarse Sample					Coarse Sample					
	Split Diff. .4%	Orig. Dry Mass (Weight)		2800		Split Diff.	Orig. Dry Mass (Weight)				Split Diff.	Orig. Dry Mass (Weight)			
	Tol. Check 100%	Dry Mass (Wt.) Washed Sample		1306		Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	Specs.
37.5mm (1½)															
26.5mm (1.06)															
19mm (¾)	0	0.0		100.0											
13.2mm (0.530)	224	8.0		92.0											
9.5mm (⅜)	490	17.5		74.5											
4.75mm (4)	590	21.1		53.4											
2.36mm (8)															
Total 4.75mm (4)	1304	46.6													
Pan	2														
Total	1306														

Fine Sample

Fine Sample					Fine Sample					Fine Sample					
		Orig. Dry Mass (Weight)		1045			Orig. Dry Mass (Weight)					Orig. Dry Mass (Weight)			
	Tol. Check 100%	Dry Mass (Wt.) Washed Sample		965		Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
		Washing Loss		80			Washing Loss					Washing Loss			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	Specs.
9.5mm (⅜)															
4.75mm (4)	491	--													
2.36mm (8)	157	28.32	15.1	38.3											
1.18mm (16)	73	13.2	7.0	31.3											
600μm (30)	94	17.0	9.1	22.2											
300μm (50)	42	7.6	4.1	18.1											
150μm (100)	52	9.4	5.0	13.1											
75μm (200)	32	5.8	3.1	10.0											
Wash	80														
Pan	24	18.8	10.0												
Total	1045	100.0	53.4												
Less +4.75mm (4)	491														
Passing #4.75mm (4)	554														

Date Reptd.		Date Reptd.		Date Reptd.	
Tested by	Date	Tested by	Date	Tested by	Date

October 31, 1996
Supersedes April 30, 1996

METHOD OF TEST
SIEVE ANALYSIS OF COMBINED AGGREGATES
(LABORATORY METHOD)

SCOPE

This method of test describes a procedure for determining the particle size distribution of combined coarse and fine aggregates. This determination is performed with sieves having square openings.

This test method is for use only with 305 mm (12") diameter sieves.

PROCEDURE

A. Apparatus

1. Balance accurate to within 0.1% of the mass (weight) of the sample to be tested.

2. Sieves - The sieves with square openings shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. Suitable sieve sizes shall be selected to furnish the information required by the specifications covering the material to be tested. The woven wire cloth sieves shall conform to AASHTO M-92.

3. Oven or drying stove.

4. Mechanical sieve shaker.

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

B. Sample Size

1. Follow the method described in I.M. 336 and reduce the field sample to a test sample size that will conform with the following:

Nominal Maximum Aggregate Size	Minimum Sample Mass (Weight)
26.5 mm (1.06 in.)	2500 grams
19 mm (3/4 in.)	2000 grams
13.2 mm (0.530 in.)	1000 grams

C. Balance

1. Balance should be tared each time it is used.

D. Test Procedure

1. Place the sample in the oven at 110±5°C (230± 9°F), or on the stove and dry to a constant mass (weight).

2. Allow the sample to cool and determine the original sample mass (weight) to the nearest 0.5 gm.

3. Determine the amount of minus 75 µm (No. 200) sieve size, by washing the entire sieve analysis test sample as described in I.M. 306.

4. Place the washed sample in the oven or on the stove and dry to a constant mass (weight).

5. Allow the sample to cool and determine the washed dry mass (weight) to the nearest 0.5 gm.

6. Sieve the washed and dried sample on the required coarse sieves. This may be done by either hand sieving or using the mechanical sieve shaker. The sieving operation must be conducted by means of a lateral and vertical motion of the sieve, accompanied by a jarring action so as to keep the sample moving continuously over the surface of the sieve. Do not attempt to turn or manipulate the sample through the sieve by hand. Continue sieving until not more than 0.5 percent by mass (weight) of the dry mass (weight) of the washed sample passes any sieve during one minute. The above sieving is to be carried out with a single layer of material. When mechanical sieving is used, the thoroughness of sieving is to be tested by using the hand method of sieving as described above.

7. Sieve the portion of the sample that passed the coarse sieves on the nest of fine sieves with the mechanical shaker. This sieving is done in the same manner as described in C-6.

8. Clean the retained material out of the sieves for weighing, so that a minimum of material is retained in the sieve by clinging to the mesh. Particles may be removed most readily from the sieve by inverting the sieve over a pan and topping the sieve and/or pushing (without force) the particles out of the mesh into the pan. Care should be exercised in cleaning the sieves not to damage the wire mesh by bending or breaking the wires. A brush should be used for cleaning the 1.18 mm

(No. 16), 600 μm (No. 30) and 300 μm (No. 50) sieves. Do not use a brush or any external force to attempt to clean the 150 μm (No. 100) and 75 μm (No. 200) sieve. If clogging of the mesh occurs on these finer sieves they should be returned to either the Central or Transportation Center Laboratory for cleaning.

9. Record the mass (weight) of the material retained on each sieve and the pan. The combined mass (weight) of the material retained on all sieves and in the pan must equal the dried mass (weight) after washing to within 0.5 percent.

E. Calculation

1. Determine the mass (weight) of aggregate passing the 75 μm (No. 200) sieve by adding the mass (weight) of material retained in the pan by dry sieving to the mass (weight) loss by washing.

2. Record the percentages retained on each sieve to the nearest 0.1 percent. If this total does not add up to 100 percent, the sieves having the larger percentages retained must be prorated to due so.

3. Calculate the percent passing to the nearest 0.1 as follows:

   a. Subtract the percent retained on the largest sieve size used from 100 to determine percent passing this sieve.
   b. To determine the percent passing subsequent sieves, the percent retained on the sieve is subtracted from the percent passing the previous one.
   c. The amount of material passing the 75 μm (No. 200) sieve is the combined mass (weight) of the amounts washed through the 75 μm (No. 200) wash sieve and retained in the pan after dry sieving. Divide this combined mass (weight) by the original dry mass (weight) of the sample to determine the percent passing the 75 μm (No. 200) sieve. This must equal the calculated percent passing as determined in step D-2.

Note: Test results of "split samples" that do not correlate must be retested in accordance with I.M. 304.

I.M. 305 Test Method
Example

Original Dry Weight of Sample = 1747.5
Dry Sample Weight After Washing = 1540.1

Sieve Size	Weight Retained (g)
26.5 mm (1.06")	0.0
19 mm (3/4")	10.9
13.2 mm (0.530")	48.0
9.5 mm (3/8")	142.4
4.75 mm (4)	311.4
2.36 mm (8)	246.9
1.18 mm (16)	182.6
600 µm (30)	132.2
300 µm (50)	194.1
150 µm (100)	186.4
75 µm (200)	73.7
Pan	6.2

$1534.8 \div 1540.1 = 99.7\%$

Therefore this weight loss from sieving is within the 0.5% tolerance.

Sieve No.	%Retained	(Prorated)	Passing	(Reportable)
26.5 mm (1.06)	0.0 ÷ 1747.5 = 0	0.0	100	100
19 mm (3/4)	10.9 ÷ 1747.5 = 0.6	0.6	99.4	99
13.2 mm (0.530)	48.0 ÷ 1747.5 = 2.7	2.7	96.7	97
9.5 mm (3/8)	142.4 ÷ 1747.5 = 8.1	8.1	88.6	89
4.75 mm (4)	311.4 ÷ 1747.5 = 17.8	18.0	70.6	71
2.36 mm (8)	246.9 ÷ 1747.5 = 14.1	14.2	36.4	36
1.18 mm (16)	182.6 ÷ 1747.5 = 10.4	10.5	45.9	46
600 µm (30)	132.2 ÷ 1747.5 = 7.6	7.6	38.3	38
300 µm (50)	194.1 ÷ 1747.5 = 11.1	11.1	27.2	27
150 µm (100)	186.4 ÷ 1747.5 = 10.7	10.7	16.5	17
75 µm(200)	73.7 ÷ 1747.5 = 4.2	4.2	12.3	12
Pan & Wash	213.6 ÷ 1747.5 = 12.2			
	99.5			

Form 820180
10-95

Iowa Department of Transportation

SIEVE ANALYSIS WORKSHEET

Lab. No.		Material		Material			Material	
Co. & Proj.								
Producer								
Contractor								
Sampled by		Date			Date			Date
Sample Loc.								

	Coarse Sample					Coarse Sample					Coarse Sample				
	Split Diff.	Orig. Dry Mass (Weight)		1747.5		Split Diff.	Orig. Dry Mass (Weight)				Split Diff.	Orig. Dry Mass (Weight)			
	Tol. Check 99.7%	Dry Mass (Wt.) Washed Sample		1540.1		Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	**Specs.**	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	**Specs.**	Mass (Wt.) Retd.	% Retd.	% Retd. X-----	% Psg. Final	**Specs.**
37.5mm (1½)															
26.5mm (1.06)	0.0	0.0		100%											
19mm (¾)	10.9	0.6		99.4											
13.2mm (0.530)	48.0	2.7		96.7											
9.5mm (⅜)	142.4	8.1		88.6											
4.75mm (4)	311.4	17.8 18.0		70.6											
2.36mm (8)															
Total 4.75mm (4)															
Pan															
Total															

	Fine Sample					Fine Sample					Fine Sample				
		Orig. Dry Mass (Weight)					Orig. Dry Mass (Weight)					Orig. Dry Mass (Weight)			
	Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample				Tol. Check	Dry Mass (Wt.) Washed Sample			
		Washing Loss					Washing Loss					Washing Loss			
Sieve Size	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	**Specs.**	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	**Specs.**	Mass (Wt.) Retd.	% Retd.	% Retd. Final	% Passing	**Specs.**
9.5mm (⅜)															
4.75mm (4)															
2.36mm (8)	246.9	14.12		56.4											
1.18mm (16)	182.6	10.45		45.9											
600µm (30)	132.2	7.6		38.3											
300µm (50)	194.1	11.1		27.2											
150µm (100)	186.4	10.7		16.5											
75µm (200)	73.7	4.2		12.3											
Wash	207.4	12.23													
Pan	6.2														
Total	1742.2	99.9	100.0												
Less +4.75mm (4)															
Passing #4.75mm (4)															

Date Reptd.		Date Reptd.			Date Reptd.		
Tested by	Date	Tested by		Date	Tested by		Date

NOTES

Iowa Department of Transportation

HIGHWAY DIVISION - OFFICE OF MATERIALS
INSTRUCTIONAL MEMORANDUM

November 1993
Supersedes Nov. 1992

METHOD OF TEST
DETERMINING THE AMOUNT OF MATERIAL FINER THAN THE NO. 200 SIEVE IN AGGREGATE BY WASHING
Field Procedure for Lab. Test Method 206

SCOPE

This test method outlines the procedure for determining the quantity of material finer than a No. 75 µm (200) sieve by washing. This procedure may not determine the total amount of material finer than the No. 75 µm (200) sieve. Such a determination may be made by a combination of washing and dry sieving.

PROCEDURE

A. Apparatus

1. A No. 75 µm (200) sieve (wash sieve).
2. A wash pan large enough to prevent loss of water and material.
3. Oven or drying stove.
4. Balance accurate to 0.1 percent of the sample weight.

B. Test Sample

1. Select the test sample from material which has been thoroughly mixed and which contains sufficient moisture to prevent segregation. A representative sample, sufficient to yield not less than the appropriate weight of dried material, as show in the following table shall be selected:

Sieve Analysis Sample Weight kg. See matls. IM 301	Appropriate Minimum Weight of Sample kg.
10.0	2.5
5.0	2.5
2.5	1.0
1.0	*
0.5	*
0.1	*

*Use entire sample

C. Test Procedure

1. Place the damp sample in the oven at 110°C. (230°F.) or on the stove and allow it to come to a constant weight. Care must be taken in drying the sample to avoid over heating causing the sample to "pop" or "sputter".

2. Allow the sample to cool and determine the dry weight.

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

4. Agitate the sample vigorously by a rotary motion of the pan for 5 to 10 seconds.

5. Pour off the water through the No. 75 μm (200) wash sieve. In washing samples with a high silt content, it may be necessary to vibrate or lightly tap the No. 75 μm (200) sieve in order to keep the mesh open so that the water may pass through freely. Repeat this operation until the wash water appears almost clear.

6. Rinse the material retained on the No. 75 μm (200) sieve back into the sample and decant as much water as possible (by carefully pouring the water through the No. 75 μm (200) sieve).

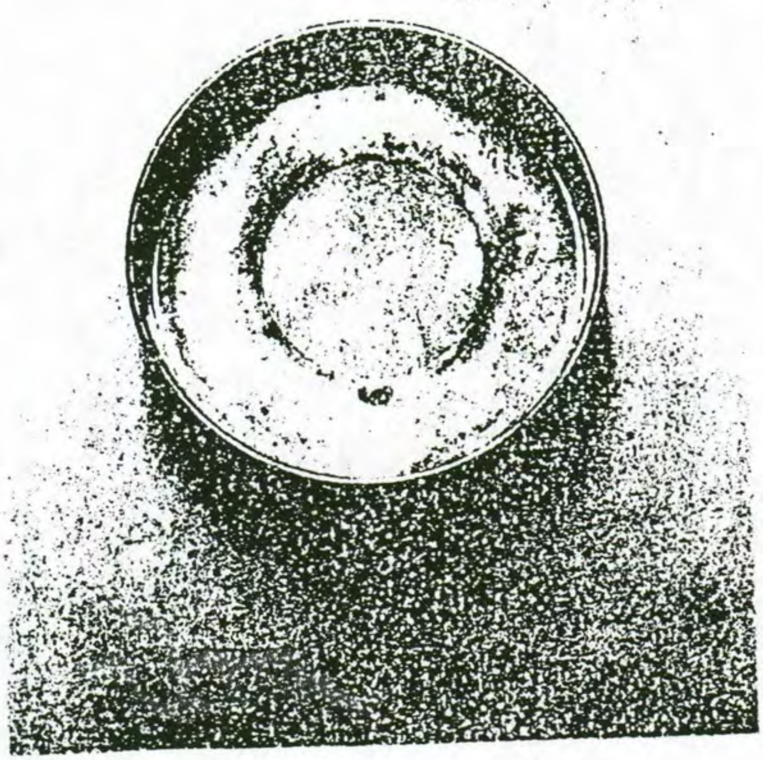
7. Dry the washed sample, allow to cool, and weigh.

D. Calculations

1. Calculate the results from the following formula:

% finer than No. 75 μm (200) =

$$\frac{\text{Orig. dry wt.} - \text{Washed dry wt.}}{\text{Original Dry Wt.}} \times 100$$



No. 75 µm (200) Wash Sieve

NOTES

METHOD OF REDUCING AGGREGATE SAMPLES BY QUARTERING OR SPLITTING

SCOPE

This method outlines the proper procedure for reducing an aggregate sample to the proper test size by the quartering or splitting methods.

QUARTERING METHOD

A. Apparatus

1. Shovel
2. Brush

B. Test Procedure

1. Place the sample on a hard, clean, smooth surface where there will be neither loss of material from the sample, nor the accidental addition of foreign material.
2. Mix the sample thoroughly by turning the entire lot over three times with a shovel. With the last turning, shovel the entire sample into a conical pile by depositing each shovelful on top of the preceding one.
3. Carefully flatten the conical pile to a uniform thickness and diameter by pressing down the apex with a shovel, so that each quarter will contain the amount of material originally in it.
4. Mark the flattened mass into quarters by two lines that intersect at right angles at the center of the pile.
5. Remove two diagonally opposite quarters and brush the cleared spaces clean.
6. Successively mix and quarter the remaining material as above, until the sample is reduced to the desired size, with the two remaining quarters giving the sample for test.

SPLITTING METHOD

A. Apparatus

1. Sample splitter
2. 3 catch pans
3. Wide, flat-edge scoop

B. Test Procedure

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

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

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

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

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

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

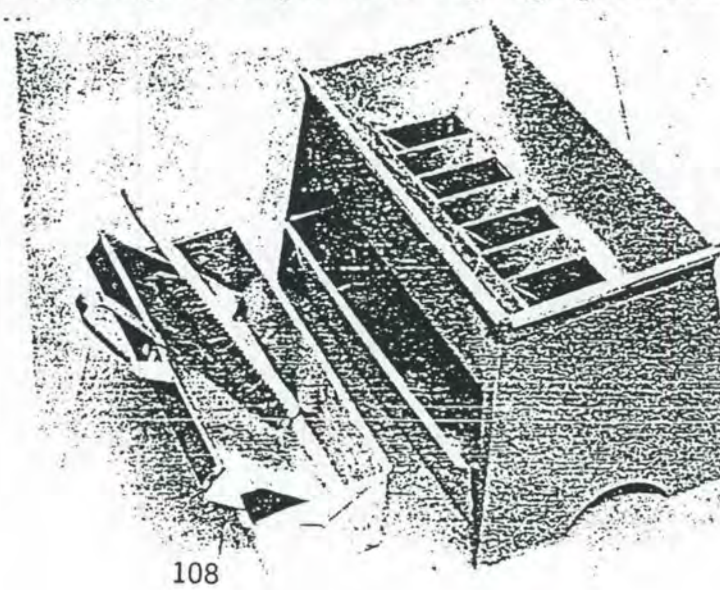
7. Use the material contained in one of the catch pans and repeat the previous steps (B-1, 2 and 3) until the sample is reduced to the desired size.

C. General

1. If the catch pans are equal to or slightly less than the total combined width of the riffle chutes, they may be used to place the material on the splitter in lieu of using the scoop. <u>Do not</u> use containers longer than the combined width of the riffle chutes, however, as this results in an over-loading of the end chutes.

2. Use the size of sample splitter best suited for the maximum particle size of the aggregate to be tested. Generally use the splitters with 25 mm (1 in) riffle openings for aggregates with a 19 mm (3/4 in) maximum particle size, and the splitters with 50 mm (2 in) openings for samples containing larger particle sizes.

Figure 1
50 mm (2 in) Sample Splitter



MECHANICAL SPLITTER METHOD

A. Apparatus

1. Mechanical Sample Splitter
2. 10 Catch Pans
3. Buckets
4. Shovel

B. Test Procedure

1. Place the ten small pans of the splitter in the appropriate area of splitter.
2. Place the entire field sample in buckets. Turn on splitter and pour material slowly into the top of hopper.
3. Complete pouring of entire field sample into hopper (catch pans will hold one bag without overflowing). If more than one bag is used, you will have to pour each catch pan into separate larger containers and then resume splitting. It may be necessary to use a brush to collect the fine material of the sample.
4. Use all the material contained in one or more of the catch pans to obtain the desired size.

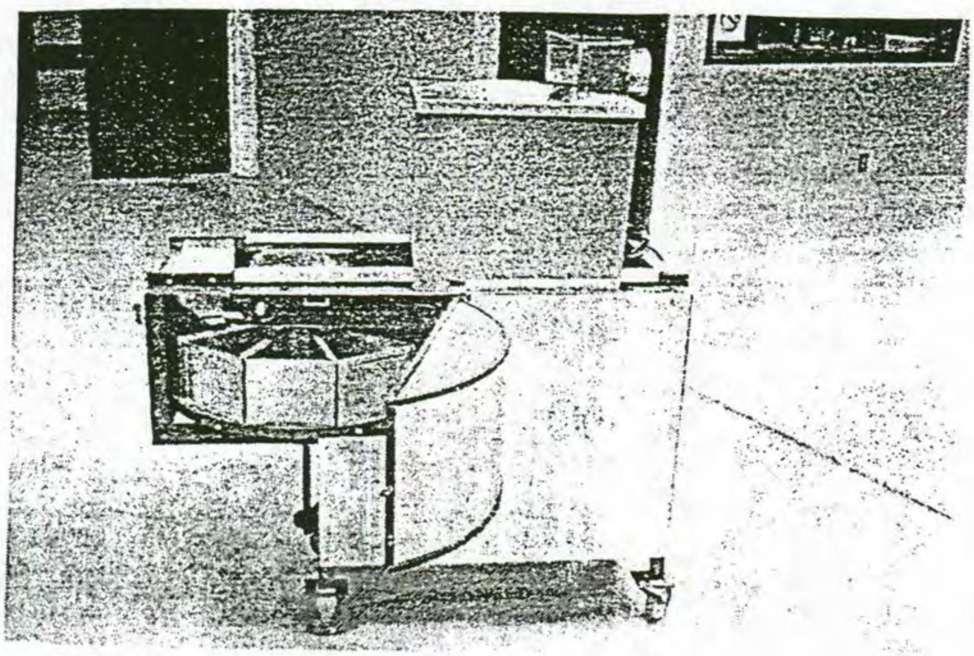


Figure 2
Mechanical Sample Splitter

NOTES

SECTION V

AGGREGATE SOURCE INSPECTION

Aggregate source inspection involves monitoring the quality of the material being produced from an approved source. Prior to being designated as an approved source, preliminary testing or production will usually have occurred at the site to establish the potential quality of material obtainable. Although at times further assurance samples are required, most construction aggregates are delivered to a project with the only quality requirement being that they were obtained from an approved source. This can be done because the quality level of an aggregate as measured by soundness or abrasion tests remains essentially the same unless some significant change has occurred, either in the material or in the manner in which it was produced. It is the responsibility of the Aggregate Technician to recognize when any such change has occurred and to obtain such samples as necessary to establish the quality of aggregate being produced under the changed conditions. The factors causing change are somewhat different in quarries than in sand and gravel pits and each shall be covered separately.

QUARRIES

There are many reasons why an aggregate from a particular quarry can test differently with respect to quality than that previously produced. Most of these reasons fall into the following categories:

QUARRY - A deposit of ledge rock from which the rock is excavated by cutting or blasting.

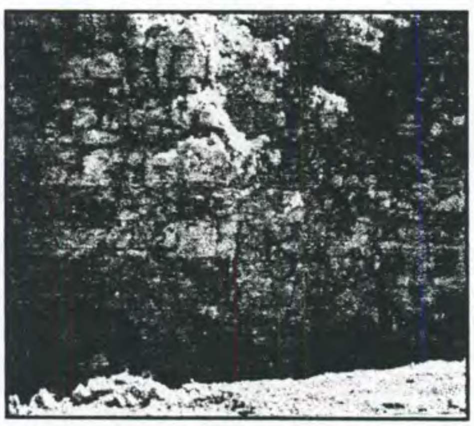
a) Ledge Control: The quarry ledge has not been maintained in the same beds.

b) Lateral Variations: One or more beds in the quarry ledge have changed laterally in quality.

c) Faulted and Dipping Beds: The beds are offset along a fault or have such an irregular surface that the quarrying operation cuts across beds to the extent that the same beds are not always being worked.

d) Deleterious Materials: The quarry ledge has become intruded with pockets or seams of clay or shale and associated weathered material.

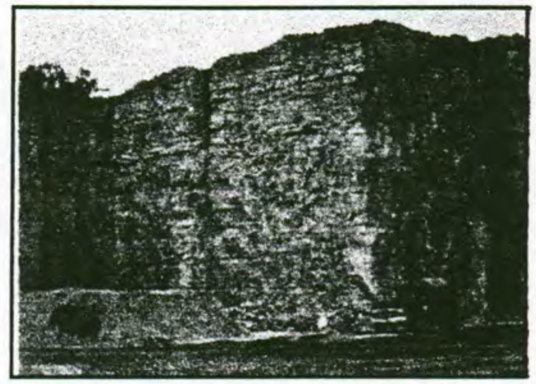
e) Production Changes: Production methods have changed to the extent that a similar product is not being obtainied.



Close-up of verticle fault. Note the different bedding planes as the fault zone is crossed and the possible overall quality changes that may be encountered.

LEDGE CONTROL

As an aid in identifying the various beds and/or quality units in a quarry, geologic sections have been prepared for most sources (Figure 3.1). The various beds are identified by a number and a description. The geologic age of the source is also noted and the relative position of the source age-wise can be found on a time chart such as Figure 3.2. Every layer or bed of rock in a quarry can be quite different in quality while often times quite similar visibly. Consequently, when material is being produced on the basis of previously established quality, we must be sure that the quarry ledge is in the same beds as before, or if it isn't, that any of the new beds in the ledge are of a quality that will assure specification compliance of the final product.

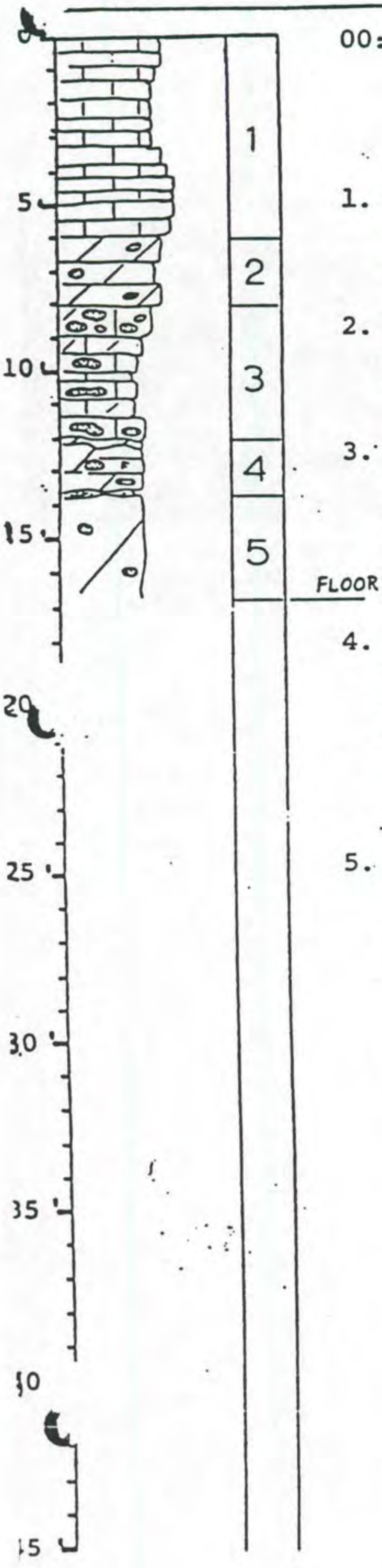


Skyline Quarry (Winneshiek Co.) - a quarry with good traceable bedding breaks and unique fossils to aid in maintaining proper ledges.

In quarries where bedding planes are distinct and continuous, it is a simple matter for the producer to maintain a ledge in the same beds and for the inspector to ascertain which beds they are. When there are no good bedding planes, the producer can have difficulty

4-3

Peterson 5/6/75	SW¼ Sec. 23 T. 95 R. 15 Co. Floyd
	Carville Qr.
	Heckman-Reynolds



00: Overburden ±3.0'

CEDAR VALLEY FORMATION
(Coralville Member)

1. Limestone; light brown; medium crystalline; very petroliferous; carbonaceous laminations; thin to platy bedding. ±6.0

2. Dolomite; light brown; coarse crystalline; a few small calcite-filled vugs- as 3 or 4 beds; very hard. 2.0

3. Limestone; light, pinkish gray; medium crystalline; dolomitic; many large calcit-filled vugs in zones parallel to bedding; flaggy beds 0.3-0.6' thick; upper 1.0' is a distinctive zone of highly concentrated calcite-filled vugs. ±4.0

4. Dolomite; light, pinkish gray; fine crystalline; many calcite-filled vugs and "birdseye" calcite; a few small pelecypod fragments; as 3 or 4 wavy beds; reddish brown shale parting at the base; irregular reddish brown shaley bed 0.2' thick at top; hard. ±1.

5. Dolomite; light, pinkish gray; medium crystalline; has a few small calcite-filled vugs and "birds-eye" calcite; massive but fractured; hard. ±3.

FIGURE 3.1

STRATIGRAPHIC COLUMN OF IOWA

SYSTEM	SERIES	GROUP	FORMATION	DESCRIPTION	THICKNESS (feet)	AGE (in millions of years before present)
Quaternary	Pleistocene		Wisconsin	loess, glacial till and interbedded sand and gravel	500'	
			Illinoian			
			Kansan			
			Nebraskan			2-3
Cretaceous		Colorado	Carlile	shale	350'	
			Greenhorn	limestone and shale		
			Graneros	shale		
		Dakota		sandstone and shale	200'	130
Jurassic			Fort Dodge beds	gypsum, red and green shales in Webster County only	50'	185
Pennsylvanian	Virgil	Wabaunsee	French Creek	shale	210'	
			Jim Creek	limestone		
			Friedrich	shale		
			Grandhaven	limestone		
			Dry	shale		
			Dover	limestone		
			Langdon includes (Nyman Coal)	shale		
			Maple Hill	limestone		
			Wamego	shale		
			Tarkio	limestone		
			Willard	shale		
			Elmont	limestone		
			Harveyville	shale		
			Reading	limestone		
			Auburn	shale		
			Wakarusa	limestone		
			Soldier Creek	shale		
			Burlingame	limestone		
			Silver Lake	shale		
			Rulo	limestone		
			Cedar Vale (includes Elmo bed at top)	shale		
			Happy Hollow	limestone		
			White Cloud	shale		
			Howard	limestone		
			Severy (includes Nodaway coal bed at base)	shale		
Pennsylvanian		Shawnee	Topeka	limestone	180'	
			Calhoun	shale		
			Deer Creek	limestone		
			Tecumseh	shale		
			Lecompton	limestone		
			Kanwaka	shale		
			Oread	limestone		
		Douglas	Lawrence	shale	110'	
			Stranger	shale		
			Iatan	limestone		
			Weston	shale		
	Missouri	Lansing	Stanton	limestone	50'	
			Vilas	shale		
			Plattsburg	limestone		
		Kansas City	Bonner Springs	shale	215'	
			Wyandotte	limestone and shale		
			Lane	shale		
			Iola	limestone and shale		
			Chanute	shale		
			Drum	limestone		
			Quivira	shale		
			Westerville	limestone		
			Cherryvale	shale		
			Dennis	limestone and shale		
			Galesburg	shale		
			Swope	limestone		
			Ladore	shale		
			Hertha	limestone		
		Pleasanton	undifferentiated	shale and sandstone, thin coal beds	40'	
	Des Moines	Marmaton	Lenapah	limestone	145'	
			Nowata	shale		
			Altamont	limestone and shale		
			Bandera	shale		
			Pawnee	limestone and shale		
			Labette	shale		
			Fort Scott	limestone		
		Cherokee	undifferentiated	shale, sandstone, thin limestones and coal	755'	310

FIG. 3.2

STRATIGRAPHIC COLUMN OF IOWA

SYSTEM	SERIES	GROUP	FORMATION	DESCRIPTION	THICKNESS (feet)	AGE (in millions of years before present)
Mississippian	Meramec		Ste. Genevieve	shale and limestone		
			St. Louis	sandy limestone	140'	
			Spergen	limestone		
	Osage		Warsaw	shale and dolomite		
			Keokuk	cherty dolomite and limestone	250'	
			Burlington	cherty dolomite and limestone		
	Kinderhook		Gilmore City	limestone, oolitic	300'	
			Hampton	limestone and dolomite		
		North Hill	Starrs Cave	limestone		
			Prospect Hill	siltstone	100'	
			McCraney	limestone		355
Devonian	Upper	Yellow Spring	English River	siltstone		
			Maple Mill	shale	300'	
			Aplington	dolomite		
			Sheffield	shale		
			Lime Creek	dolomite and shale	225'	
			Shell Rock	limestone and dolomite		
	Middle		Cedar Valley	limestone and dolomite		
			Wapsipinicon	limestone and dolomites, shales in middle	270'	
	Lower		La Porte City	chert, limestone and dolomite	50 - 100'	410-415
Silurian	Niagaran		Gower	dolomite	300'	
			Hopkinton			
	Alexandrian		Kankakee	cherty dolomite	100'	
			Edgewood	sandy dolomite		425
Ordovician	Cincinnatian		Maquoketa	dolomite and shale	300'	
	Mohawkian		Galena	dolomite and chert	320'	
			Decorah	limestone and shale		
			Platteville	limestone, shale and sandstone	70'	
	Chazyan		St. Peter	sandstone	50 - 230'	
	Beekmantown		Prairie du Chien	sandy and cherty dolomite and sandstone	290'	475
Cambrian	St. Croixan	Trempealeau	Madison[a]	sandstone		
			Jordan		185'	
			Lodi[a]			
			St. Lawrence	dolomite		
			Franconia	glauconitic sandstone, siltstone, shale	160'	
		Dresbach	Galesville	sandstone		
			Eau Claire	sandstone and shale, dolomite	550'	
			Mt. Simon	sandstone		570
Precambrian				sediments (sandstones), igneous, and metamorphic rocks		

[a] recognized only in extreme northeast Iowa

FIG. 3.2

NOTES

NOTES

remaining in the same beds and the difficulty in knowing exactly which beds are being worked. Satisfactory ledge control can be maintained by applying the answers to the following questions to the source being used.

Do specifications or special provisions require ledge control? Some materials do, such as coarse aggregate for portland cement concrete and graded stone base.

Does the production history indicate that the finished product will be borderline on quality or well within the requirements?

What is the quality level of the beds which might be added to the ledge?

Could the additional beds improve a borderline product or cause it to fail?

Could the additional beds be of such poor quality that they should not be incorporated into the manufacture of any product?

Often, all that is necessary is a proper identification of the ledge being worked so as to compile a dependable production history for the source. When in doubt, always consult the appropriate supervisor.

LATERAL VARIATIONS

Most lateral variations in bed quality are caused by the effects of weathering. Other lateral variations are due to the factors of deposition which were present when the bed was formed. Some geologic units characteristically show very little lateral variation (like the Galena Formation), others show a lot (like the St. Louis Formation). Lateral variations may or may not affect the quality of the bed. Each case has to be evaluated individually.

Lateral Variations Due to Weathering: Generally, the upper beds of any quarry that are above the ground water table will oxidize to a buff or brown color. They may have been partially dissolved and become quite friable and soft. This can lower the resistance to abrasion considerably but usually has little effect on soundness. Sometimes the clay overburden of a quarry has infiltrated the upper beds to the extent that they become undesirable. Both of these situations can usually be handled satisfactorily on a judgment basis. When uncertain, consult appropriate supervisor.

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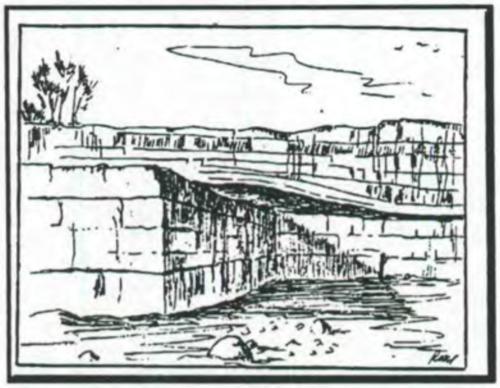

Figure 4.1

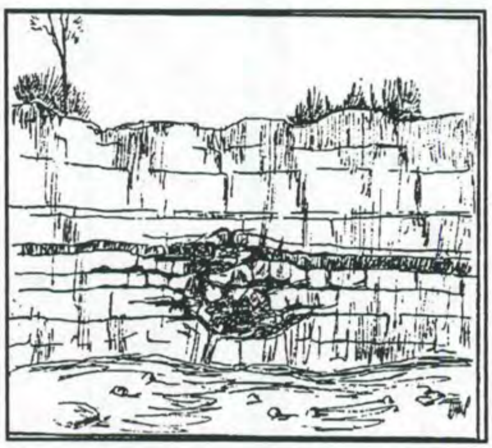

Figure 4.2

Lateral Variations Inherent to the Rock: These can be caused by actual compositional changes in a bed or by changes in thickness. A 60.7 mm (0.2 ft.) thick shale bed may increase to a very troublesome 304.8 mm (1 ft.) or more in thickness, requiring benching and removal (Figure 4.1). A limestone or dolomite bed may suddenly pinch out, becoming replaced by sandstone or some other type of rock. This happens frequently in the Meramecian Formations common in southeastern Iowa, but not too often elsewhere.

More common are compositional changes characteristic of those geologic formations which contain breccias, angular fragments of rock in generally shaly matrices (Figure 4.2). Breccia thicknesses can vary considerably within the same quarry, often affecting beds in the adjacent quarry ledges. At other times, beds will gradually change in composition, becoming more shaly, sandy, etc. Either type of change can affect the quality of the rock.

An inspector must learn and be alert to any changes that can occur that will affect the quality of the finished product.

FAULTED AND DIPPING BEDS

Frequently, the quarry beds are not flat lying. They may dip at a uniform angle (Figure 5.1), or they may roll up and down from 0.305 m to 0.607 m (1 ft. to 2 ft.) to commonly as much as 2.438 m (8 ft.) over a lateral distance of 30.48 m (100 ft.) (Figure 5.2). When either situation occurs, a flat-lying quarry floor will cut across beds that may not be of the quality level required for the aggregate product becoming made. Proper ledge control might require that a quarry floor be raised, lowered or worked at an angle in order to insure the production of complying material.

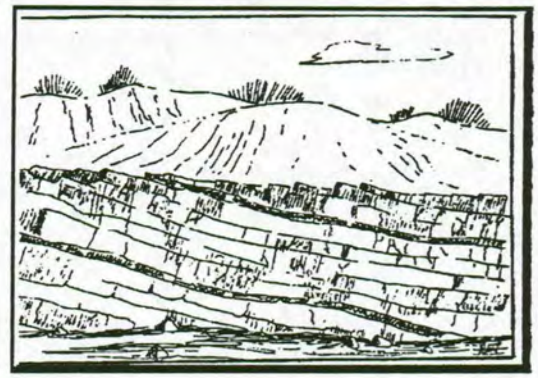

Figure 5.1

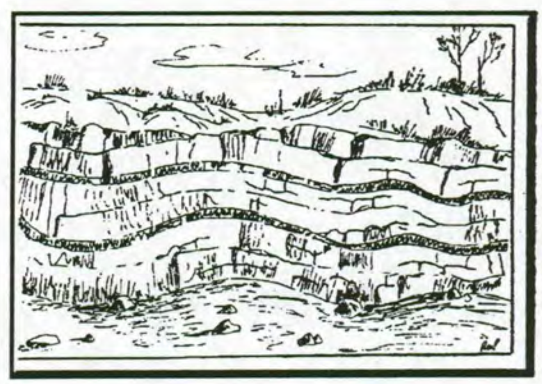

Figure 5.2

True faults, fractures in bedded rock accompanied by differential movement in the fault zone, are not common, but there are a few. A quarry ledge transgressing a fault will suddenly be working differentbeds depending on the amount of movement

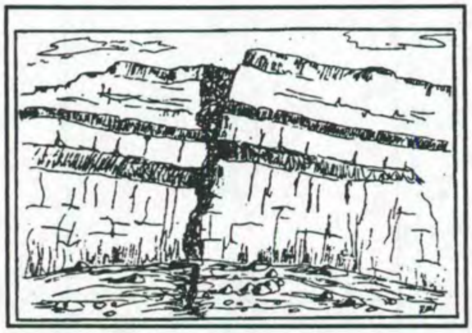
Figure 5.3

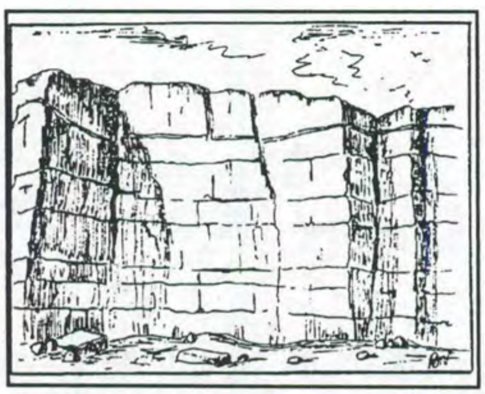
Figure 6.1

occurred along the fault (Figure 5.3). This can be a problem depending on the nature of new beds incorporated into the ledge. Often, large joint blocks will exhibit minor slippage along the vertical joints and appear as small faults in a quarry face. These are the most common in the Galena and Cedar Valley Formations, massive rock units with well developed joint systems.

DELETERIOUS MATERIALS

Ground water moving along vertical joints and horizontal bedding planes has often left large void spaces in the rock. These frequently are filled with clay or other materials that were available to the moving ground water (Figure 6.1). Occasionally so much foreign material will be in the rock that it cannot be used for aggregate purposes.

Some rock became contaminated with clay or shale during deposition. This is the case with the Silurian reefs found in eastern Iowa. Ordinarily, the rock is of high quality, but the contained clay pockets can quality but the contained clay pockets can become very troublesome (Figure 6.2). The clay content of aggregates being produced from this type of rock should be monitored closely when there are limits placed on clay lumps, clay balls, etc.

Figure 6.2

PRODUCTION CHANGES

Some products can be made at certain quarries only by beneficiating or treating the material in order to improve its properties during the manufacturing process. For instance, when a quarry ledge consists of beds with argillaceous partings on the bedding planes, the removing or scalping of the minus 19 mm (¾ in.) from the primary crusher may remove enough of this material to substantially improve the soundness of the final product. These situations should be documented in the source files, so that any future production employs equal or better methods of product benefication.

SAND AND GRAVEL PITS

Sand and gravel pits are granular deposits located in areas where moving water has concentrated the sand and gravel-size particles in sufficient quantity.

***SAND** - Granular material almost entirely passing the No. 4 sieve and predominantly retained on the No. 200 sieve.*

Gravel pit face - Note how the gravel is deposited in layers of coarse and fine with areas containing high shale etc.. Important for the producer to process this type of source properly to maintain consistent quality and gradation (i.e. using a dozer to work the entire exposed faceto blend the material before it is processed in the plant.

They are generally in or adjacent to the many streams and rivers in Iowa or in glacial outwash deposits where the melting glacier ice had generated the water flow necessary to form sand and gravel deposits. There are many factors which can cause quality changes in sand and gravel pits, but only the main points will be covered.

Flowing water deposits material only in relation to the load it carries (always changing) and its velocity and direction. Most deposits are accumulations over long time periods under a variety of conditions. Consequently, the deposit can be alternately coarse or fine, dirty or clean. Thus a greater degree of dependence is placed on the production methods and equipment to give a uniform quality product than in the case of crushed stone. Any change in production equipment or methods, in the area or depth of working, or in the appearance of the product should be noted since any one could signal a changed quality level in the final product.

Most gravel coarse aggregates perform only moderately well in pavements because, despite containing relatively high percentages of extremely durable igneous materials, they also contain significant percentages of good to poor quality limestones, and of course, the cherts, iron spalls, shale particles and other objectionable materials that frequently cause gravel pavements to have a poor appearance. Held within the specified limits, the objectionable materials will not affect the durability of pavement. The quality of the limestone fraction, however, can affect the durability of pavement. Consequently, very few gravel coarse aggregates comply with the durability requirements for use in pavements on the primary highway system. When necessary, gravel coarse aggregates can be separated and tested according to rock type using a modification of the ASTM Standard Recommended Practice for Petrographic Examination of Aggregates for Concrete. This can be extremely helpful in identifying the types and amounts of poor quality materials present.

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FIELD EQUIPMENT CLEANING, CALIBRATION, AND REPAIR

GENERAL

Various items of field testing equipment require periodic calibration to ensure reliable results. Specific items requiring calibration are balances and weights, concrete air meters, and concrete beam testing machines, etc.

The Central Materials Laboratory of the Iowa Department of Transportation will, when possible, calibrate and repair testing equipment for county and municipal government; and private organizations.

COUNTY & MUNICIPAL GOVERNMENTS

County owned equipment will be cleaned, calibrated and repaired as time permits. For any necessary repair parts, cleaning, etc., the county be billed. If extensive repair or modification to equipment is required, the county will be billed for parts and labor. Prior to any extensive repair, the County Engineer will be notified with an estimate of the cost and authorization to proceed must be received prior to the work.

Municipal governments that have projects involving state or federal funding may also have their equipment cleaned, calibrated, and repaired. Charges shall be the same as those imposed upon counties.

PRIVATE ORGANIZATIONS

Testing equipment owned by private organizations will be cleaned, calibrated, and repaired when the Department of Transportation requires certified technicians be utilized. A charge will normally be made when calibrating or repairing this equipment. Extensive repairs will be billed at actual cost plus labor charges. Prior to extensive repairs the organization will be notified with an estimate of the cost and authorization to proceed must be received prior to the work.

NONSTANDARD EQUIPMENT

The Department of Transportation is not responsible for repairing equipment that is not normally used by the Department and for which replacement parts are not normally stocked by the Central Laboratory.

BILLING PROCEDURE

Upon written notification of the Office of Materials, the Office of Accounting will bill the appropriate agency or organization.

NOTES

METHOD OF TEST FOR DETERMINATION OF THE AMOUNT OF SHALE IN FINE AGGREGATE (Field Procedure of Iowa Test Method 209)

SCOPE

This test method covers the procedure for the approximate determination of the shale content in fine aggregate.

PROCEDURE

A. Apparatus

1. Balance having a capacity of not less than 1000 gm. and sensitive to at least 0.1 gm.

2. A strainer with openings smaller than 1.18 mm(#16 sieve)

3. Two bowls of sufficient capacity

4. A solution of zinc chloride ($Zn\ Cl_2$) having a specific gravity between 1.950 and 1.999 at 21°C(70°F).
NOTE: To prepare one gallon of solution, slowly add 12.5 pounds of technical grade zinc chloride to 4.75 pints of water with constant stirring. CAUTION: - The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 21°C(70°F) and measure Specific Gravity with a hydrometer. If the Sp. G. is below 1.95, add zinc chloride in 0.5 pound increments until the Sp. G. of the solution is at least 1.95 at 21°C(70°F). It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

5. Drying oven or hot plate.

6. Mixing spoon.

B. Test Procedure

1. The test sample is the quantity of material retained on the 1.18 mm (No. 16) sieve after the sieve analysis on fine aggregate (I.M. 302) has been completed.

2. Pour the zinc chloride solution into a mixing bowl until the volume of the liquid is at least 3 times the absolute volume of aggregate.
NOTE: Caution - There is no particular hazard from the fumes of the zinc chloride solution but goggles and gloves should be worn to prevent contact with the eyes or skin.

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

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

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

6. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant weight in an oven at a temperature of 110±5°C (230±9°F) or on a hot plate at a low heat setting. Weigh to the nearest 0.1 gm.

C. Calculations

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

$$\%\text{Shale} = \frac{\text{Dry weight of washed decanted particles}}{\text{*Dry weight of original sieve analysis sample}} \times 100$$

*This weight includes the weight of the material passing the U.S. Std. No. 16 sieve.

Iowa Department of Transportation

HIGHWAY DIVISION - OFFICE OF MATERIALS
INSTRUCTIONAL MEMORANDUM

November 1992
Supersedes May 1986

METHOD OF TEST FOR DETERMINATION OF THE AMOUNT OF SHALE IN COARSE AGGREGATE (Field Procedure of Iowa Test Method 210)

SCOPE

This test method covers the procedure for the approximate determination of the shale content in coarse aggregate. This method separates, along with the shale, other particles of low specific gravity.

PROCEDURE

A. Apparatus

1. Balance having a capacity of at least 2500 gm. and sensitive to 0.1 gm.

2. A strainer with openings not larger than 2.36 mm. (U.S. Std. No. 8 sieve size).

3. Two bowls of sufficient capacity.

4. A solution of zinc chloride ($Zn\ Cl_2$) having a specific gravity between 1.950 and 1.999 at 21°C(70°F).
NOTE: To prepare one gallon of solution, slowly add 12.5 pounds of technical grade zinc chloride to 4.75 pints of water with constant stirring. CAUTION: - The zinc chloride is added slowly to all the needed water to avoid generating excessive heat during the dissolving process. When all zinc chloride is in solution, cool to 21°C(70°F) and measure specific gravity with a hydrometer. If the Sp. G. is below 1.95, add zinc chloride in 0.5 pound increments until the Sp. G. of the solution is at least 1.95 at 21°C(70°F). It may be necessary to heat the original solution slightly in order to dissolve additional zinc chloride in a reasonable time.

5. Drying oven or hot plate.

6. Mixing spoon.

B. Test Procedure

1. Build up a 2500-gram sample of coarse aggregate or select the sample by quartering or splitting to insure representation.

2. Dry the sample to a constant weight in an oven at a temperature of 110±5°C (230±9°F) or on a hot plate at low heat setting with frequent stirring to avoid local overheating. Weigh to the nearest 0.1 gm.

3. Place the dried sample of aggregate in the bowl and pour the solution of zinc chloride over the aggregate until the volume of the liquid is

at least 3 times the absolute volume of the aggregate.
NOTE: Caution - There is no particular hazard from the fumes of the zinc chloride solution but goggles and gloves should be worn to prevent contact with the eyes or skin.

4. Agitate the aggregate by vigorously stirring with a large mixing spoon until no additional pieces float to the surface.

5. Skim off the floating particles within one minute.

6. Thoroughly wash the removed particles in the strainer to remove the zinc chloride. Dry to a constant weight in an oven at a temperature of 110±5°C (230±9°F) or on a hot plate at a low heat setting. Weigh to the nearest 0.1 gm.

7. Particles of low specific gravity other than shale may be hand-picked and removed prior to weighing.

C. Calculation

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

$$\%\text{Shale} = \frac{\text{Dry weight of washed decanted particles}}{\text{Dry weight of sample}} \times 100$$

APPENDIX A
FORMS

I.M. 302 FINE AGGREGATE

1. Obtain a field sample.
2. Create a miniature stockpile (material wet enough?).
3. Obtain a minimum of 5 increments for the test sample (minimum of 500 grams).
4. Dry test sample to a constant mass and record the original dry mass.
5. Wash the test sample over a 75 μm (#200) sieve.
6. Dry to a constant mass, allow to cool, weigh and record the dry mass washed sample.
7. Calculate the washing loss.
8. Sieve for ten minutes in mechanical sieve shaker (9.525 mm thru 75 μm (3/8" thru #200) sieve).
9. Clean sieves and separate each increment.
10. Weigh each increment and record.
11. Add each increment and check weighing accuracy (total divided by original dry mass = 99.5% to 100.5%).
12. Divide the mass of each increment by the original dry mass and record as percent retained (make sure you add the pan and wash together for the total amount of material that passed the 75μm (#200) sieve).
13. Total the percentages retained--should be 100% (prorate if necessary).
14. Subtract consecutively, the percentages retained from 100% to obtain percent passing each sieve.
15. Check percent passing 75 μm (#200) sieve, it should be the same as percentage calculated by adding the pan and wash together and dividing by the original dry mass.

I.M. 303 COARSE AGGREGATE

1. Obtain a field sample.
2. Split two samples--1 test sample for sieving and 1 sample for wash. Refer to I.M. 301 for the size of test sample for sieving and I.M. 306 for the size of sample for washing. Make sure to split the entire field sample.
3. If sample for sieving is saturated surface dry, it may be tested as is. Drying it to a constant mass is not necessary if no "free moisture" is present.
4. Weigh the sample for sieving and record as original dry mass.
5. Screen the sample over box sieves--37.5 mm thru 2.36 mm (1½" thru #8) sieve.
6. Separate individual increments, weigh and record as mass retained. (Be sure to weigh material in the pan.)
7. Total the masses retained and check weighing accuracy (total divided by the original dry mass = 99.5% to 100.5%).
8. Calculate percent retained by dividing the masses retained by the original dry mass and record.
9. Total the percentages (should be 100%) and prorate if necessary.
10. Calculate percent passing by consecutively subtracting percentages retained on each sieve from 100%.
11. Check percent passing 2.36 mm (#8) sieve, it should be the same as percent retained in the pan.

WASH SAMPLE

12. Dry to constant mass, allow to cool, weigh and record original dry mass.
13. Wash the sample over the 75 μm (#200) sieve.
14. Dry to constant mass, allow to cool, weigh and record the dry mass washed sample.
15. Calculate the washing loss by subtracting the dry mass washed sample from the original dry mass.
16. Screen the material over a 2.36 mm (#8) sieve.
17. Take the material that passes the 2.36 mm (#8) sieve and screen that over a 1.18 mm (#16), 600 μm (#30), 75 μm (#200) sieve and pan, for a period of five minutes.
18. Weigh only the material in the pan.
19. Add the washing loss and the material in the pan.
20. Divide this total by the original dry mass and record as percent passing the 75 μm (#200) sieve.

I.M. 304 COMBINED AGGREGATE

1. Obtain a field sample.
2. Split out two separate samples, one for the coarse portion and one for the fine portion. Make sure to split the entire field sample.
3. Coarse sample should be as large as specified in I.M. 301 for the various sizes of material.
4. Fine sample should be large enough so that a minimum of 500 grams of dry material will pass the 4.75 mm (#4) sieve. (500 grams ÷ percent passing 4.75 mm (#4) sieve)

COARSE SAMPLE

5. Dry sample to a constant mass.
6. Weigh and record original dry mass.
7. Rough shake the sample over a 4.75 mm (#4) sieve.
8. Throw away any material that passes the 4.75 mm (#4) sieve.
9. Wash the coarse sample over a 4.75 mm (#4) sieve.
10. Dry to a constant mass, weigh and record as dry mass washed sample.
11. Screen over appropriate box sieves 37.5 mm thru 4.75 mm (1½" thru #4) sieve.
12. Weigh and record each increment (be sure to weigh material in the pan).
13. Add all the masses retained and record the TOTAL +4.75 mm (+#4) sieve, then continue by adding pan mass and record total.
14. Check weighing accuracy by dividing the total by the dry mass washed sample = 99.5% to 100.5%.
15. Calculate percent retained by dividing the masses retained, and TOTAL +4.75 mm (+#4) sieve by the original dry mass. (Do not calculate pan.)
16. Add each percentage retained to see if they add up to the number calculated when dividing the total +4.75 mm (+#4) sieve by the original dry mass. If the individual increments do not add up to that number, you must prorate the largest.
17. Calculate percent passing by consecutively subtracting the percentages retained from 100% - STOP AT THE 4.75 mm (#4) SIEVE!!!!!!
18. The percent retained on the total +4.75 mm (+#4) sieve when added to the percent passing the 4.75 mm (#4) sieve should equal 100%.

FINE SAMPLE

19. Dry sample to a constant mass.
20. Weigh and record original dry mass.
21. Wash the sample over a 75 μm (#200) sieve.
22. Dry to constant mass, allow to cool, weigh and record dry mass washed sample.
23. Calculate washing loss and record.
24. Thoroughly screen the sample over a 4.75 mm (#4) sieve saving the material that is retained on the 4.75 mm (#4) sieve.
    Splitting check: % retained on +4.75 mm (+#4) sieve on coarse sample has to be within 3% of % retained or +4.75 mm (+#4) sieve on fine sample.
25. Any material that has passed the 4.75 mm (#4) sieve will then be placed in the tyler screens to include the 2.36 mm thru the 75 μm (#8 thru the #200) sieve and sieved for a minimum of ten minutes.
26. Clean the sieves and separate each increment including the pan.
27. Weigh and record the +4.75 mm (+#4) sieve material (saved in step 24) and each increment from the 2.36 mm thru the 75 μm (#8 thru the #200) sieve and the pan.
28. Add each increment and check weighing accuracy (total divided by the original dry mass = 99.5% to 100.5%).
29. Calculate the amount of material that has passed the 4.75 mm (#4) sieve by subtracting the amount of material that was retained on the 4.75 mm (#4) sieve from the total. This number should be at least 500 grams.
30. SOMETHING DIFFERENT--calculate the percent retained on each sieve starting with THE 2.36 mm (#8) SIEVE by dividing the masses retained by the amount of material that has passed the 4.75 mm (#4) sieve. Add the pan and washing loss together before calculating.
31. Total these percentages--they should equal 100%. Prorate if necessary.
32. SOMETHING DIFFERENT--Calculate percent retained final by multiplying the percentages retained by the percent passing the 4.75 mm (#4) sieve in the coarse sample. Total these percentages--they should equal the percent that you multiplied by. Prorate as necessary.
33. Last step is to calculate the percent passing. This is done by consecutively subtracting the percent retained final, starting with the 2.36 mm (#8) sieve from the percent passing the 4.75 mm (#4) sieve obtained from the coarse sample.
34. Check percent passing 75 μm (#200) sieve. It should be the same as the percent retained final column calculated from the wash and pan.

I.M. 305 COMBINED AGGREGATE
(WITH 305 mm (12 in.) SIEVES)

1. Obtain a field sample.
2. Reduce the field sample (per I.M. 336) to the proper test sample size (refer to I.M. 305 for test sample size).
3. Dry test sample to a constant mass, allow sample to cool, weigh and record as Original Dry Mass.
4. Wash the test sample over the 75 μm (#200) sieve (I.M. 306).
5. Dry the washed sample to a constant mass, cool, weigh and record as Dry Mass of Washed Sample.
6. Calculate the washing loss.
7. Place the sample in the required coarse sieves and sieve in the mechanical shaker for ten minutes. (NOTE: The coarse portion may be sieved by hand over box or 305 mm (12 in.) sieves.)
8. Place the remaining fine portion -4.75 mm (-#4) sieve in the nest of 305 mm (12 in.) sieves and sieve for ten minutes in the mechanical shaker.
9. Clean the retained material from each sieve and the pan into individual containers.
10. Weigh and record each increment, including the pan.
11. Add the total mass and check the weighing accuracy (+ or -0.5%).
12. Calculate the percent retained on each sieve by dividing each mass by the Original Dry Mass (x 100). Remember to combine the washing loss and pan.
13. Total these percentages. They should equal 100. Prorate if necessary.
14. Calculate the percent passing by consecutively subtracting the percent retained, starting with the sieve that has 100% passing.
15. The percent passing the 75 μm (#200) sieve should be the same as the result obtained by adding the pan and washing loss and dividing by the Original Dry Mass in the percent retained column.

AGGREGATE GRADATION TABLE

Grad. No.	Section No.	Metric Sieve Sz. / Std. Sieve Sz. / Intended Use	37.5mm 1.5"	26.5mm 1.06"	19mm 3/4"	13.2mm 0.530"	9.5mm 3/8"	4.75mm 4	2.36mm 8	600µm 30	300µm 50	150µm 100	75µm 200	Notes
1.	4110, 4111, 4125	PCC FA, Cover Agg.					100	90-100	70-100	10-60			0-1.5	1
2.	4112	Mort. Sand						100	95-100	40-75	10-40	0-30	0-3	
3.	4115 (57,2-8)	PCC CA	100	95-100		25-60		0-10	0-5				0-1.5	14
4.	4115 (2-8)	PCC CA	100	50-100	30-100	20-75	5-55	0-10	0-5				0-1.5	
5.	4115 (67,2-8)	PCC CA		100	90-100		20-55	0-10	0-5				0-1.5	
6.	4115.06 (Repair & Overlay)	PCC CA			100	97-100	40-90	0-30					0-1.5	
7.	4117 (Class V)	FA & CA	100					80-92	60-75	20-40				
8.	4117.03 (Class V add.)	Fine Lmst.						90-100					0-30	
10.	4120.03 (C gravel)	Gran. Surf.			100			50-80	25-60					7
11.	4120.04,4120.05(A,B Cr.St.)	Gr.Surf.& Shldr.		100	97-100			30-75	15-45				6-16	8
12.	4121	Gran. Sub.	100						10-20		0-15		0-6	10
13.	4122.02 (Cr.St.)	Mac. St. Base	75mm(3") nom. max. size screen over 19mm(3/4") or 26.5mm(1.06") screen.											
14.	Deleted													
15.	Deleted													
16.	4120.07 (Cr.St.)	Pvd.Shldr.Fill	100			0-50		0-10						6
19.	4125 {13.2mm(.530") Gr. or Cr.St.}	Cover Agg.			100	97-100	40-90	0-30	0-15				0-2	
20.	4125 {13.2mm(.530")Scr.Gr.}	Cover Agg.			100	95-100	40-80	0-15	0-7				0-1.5	
21.	4125 {9.5mm(3/8")}	Cover Agg.				100	90-100	10-55	0-20	0-7			0-1.5	
22.	4127	ACC		100	98-100	85-91	65-80	45-60	25-44	10-24			3-7	11
23.	4125.01B (Cr.St.)	Slurry Tr.					100	70-90	45-70	19-34	12-25	7-18	5-15	
24.	4126, 4127 {26.5mm(1.06")}	ACC	100	92-100	77-92	60-80		34-55	20-39	7-20			2-7	3, 4
25.	4126,4127 {19mm(3/4")}	ACC		100	98-100	76-92	60-85	42-67	30-53	14-32			3-7	3, 4, 12, 15
26.	4126,4127 {26.5mm(.530")}	ACC			100	92-100	70-91	50-72	36-57	16-34			3-7	3, 4, 16
27.	4126,4127 {9.5mm(3/8")}	ACC				100	98-100	63-89	44-68	20-37			3-7	3, 4
29.	4131	Porous Backfill			100	95-100	50-100	15-50	0-8					
30.	4132.02 (Cr.St.)	Spec. Backfill	100						15-45				0-10	
31.	4132.03 (Gr.)	Spec. Backfill	Use Gradation No. 25 or No. 26 above, excluding Note 4.											
32.	4133 (Sand/Gr./Cr.St.)	Gran. Backfill	100% passing the 76.2mm(3") sieve.						20-100				0-10	9, 13
34.	4130.05 {152.4mm(6" Cr.St.)}	Erosion Stone	100% passing the 228.6mm(9") screen - 100% retained on the 76.2mm(3") sieve											

Notes: **(Gradations No. 9, 14, 15, 17, 18, and 33 have been deleted)**

1. When the fine aggregate is sieved through the following numbered sieves - 4.75mm(4), 2.36mm(8), 1.18mm(16), 600µm(30), 300µm(50), and 150µm(100) - not more than 40% shall pass one sieve and be retained on the sieve with the next higher number for 4110 and 45% for 4111.

2 and 5 deleted

3. Any operating tolerance allowed elsewhere in the specification does not apply to the largest sieve for which both a minimum and maximum are shown. The 2 percent for gradation numbers 22, 25, and 27 and the 8 percent for gradation number 24 and 26 are the tolerances for the sieve size designated.
4. The maximum amount of minus 75µm(200) sieve material for asphalt mixes shall be controlled by the filler/bitumen ratio specified for each particular class or type of mix.
6. Gradation 3 or 4 may be substituted, at the Contractor's option.
7. When compaction of material is a specification requirement, the minimum percent passing the 75µm(200) sieve is 6%.
8. See specifications for combination of gravel and limestone screenings.
9. Crushed stone shall have 100% passing the 26.5mm(1.06") sieve.
10. For granular subbase made from crushed concrete, it may be necessary to scalp or screen to attain the specified gradation. The gradation requirement for granular subbase, not made from crushed concrete and without blending sand, shall be 10 to 30 percent passing the 2.36 mm(8) sieve.
11. Gradation 22 is used for interstate main line paving.
12. Gradation 25 is used for other than interstate main line paving.
13. When granular backfill is used under flowable mortar, one of the following alternative materials shall be used: natural sand complying with gradatior 4110, except the % passing the 75µm(200) shall not exceed 4.0%. Gravel, crushed stone, or crushed concrete meeting gradation requirement of 4121.
14. When used in precast and prestressed concrete bridge beams, 100% shall pass the 26.5mm(1.06") sieve.
15. For mixes with 50 blow Marshall mix design the following percent passing shall be used with the corresponding sieve sizes: 0.530" use 76%-95%, 3/8" use 60%-88%, No. 4 use 42%-70%, and No. 8 use 30%-56%.
16. For mixes with 50 blow Marshall mix design the following percent passing shall be used with the corresponding sieve sizes: 3/8" use 70%-94%, No. 4 use 50%-75%, and No. 8 use 36%-60%.

Form 821278
12-92

Iowa Department of Transportation

CERTIFIED GRADATION TEST REPORT

County Delaware
Project WHS
Contractor
Contract No.
Design
Date 10-27-93 Report No. 3

- [ ] Certified Sample
- [x] Monitor Sample
- [ ] Verification Sample

Source Name Tegler Pit T-203A No. A28504 Source Location NE Sec. 36 Twp. 89 Range 2W County Delaware

Material Concrete Sand Class Gradation No. 1 Beds

Material Producer BARD Concrete Company Destination Stockpile Sampled At Pit 10-5,13,19

Date Sampled	Sample Identification	Sampled By	Tested By	Sieve Analysis — in.	26.5mm (1.06)	19mm (¾ in.)	13.2mm (0.530)	9.5mm (⅜ in.)	4.75mm (No. 4)	2.36mm (No. 8)	1.18mm (No. 16)	600µm (No. 30)	300µm (No. 50)	150µm (No. 100)	Percent Passing 75µm (No. 200)	Other Test Results			Comp.	Tons
*Production Limits			Max.					100	100	100		54			1.5					
			Min.						90	70					0					
10-5	DL-192-93	D.O.T.	Like					100	97	85	68	44	15	1.7	0.4					
10-5	18-93	Producer	S.L.					100	94	83	64	42	15	1.3	0.2					
10-13	DL-197-93	D.O.T.	Like					100	97	86	68	45	16	1.9	0.4					
10-13	21-93	Producer	L.M.					100	96	84	67	44	15	1.2	0.2					
10-19	DL-202-93	D.O.T.	Like					100	97	90	76	49	15	1.5	0.4					
10-20	23-93	Producer	S.L.					100	96	86	70	46	16	0.5	0.4					

Note to County and Resident Engineers—If County or Project Number is incorrect, please notify Inspector and Ames Office Promptly. Corrected Reports will be Issued.

Comments File BARD Concrete Company
Roger Boulet

District 6 Materials personnel have made a comparison of gradations. No significant difference exists between these results.

*AGREED by the contractor/producer

ESTIMATED QUANTITY ______ Tons
TOTAL PREVIOUSLY CERTIFIED 30000 Tons
TOTAL CERTIFIED TO DATE 42000 Tons
CERTIFICATION NUMBER 162
Reported By
Representing Iowa Department of Transportation

Distribution: White Copy - District Materials Engineer; Canary Copy - Project Consruction Engineer; Pink Copy - Certified Technician; Goldenrod Copy - Area Inspector

Form 821278
6-94

Iowa Department of Transportation

CERTIFIED GRADATION TEST REPORT

County Jasper
Project IM-80-5(184)160--13-5
Contractor Manatt's
Contract No.
Design
Date 7/24/95 Report No. 36

[✓] Certified Sample
[ ] Monitor Sample
[ ] Verification Sample

Source Name #552 Colfax T-203A No. A50502 Source Location NE Sec. 01 Twp. 79 Range 21W County 50
Material Concrete Sand Class Gradation No. 1 Beds
Material Producer Van Dusseldorp S&G Destination Sampled At Colfax Plant

Date Sampled	Sample Identification	Sampled By	Tested By	Sieve Analysis — Percent Passing												Other Test Results			Comp.	Tons
				—in.	26.5mm (1.06)	19mm (¾ in.)	13.2mm (0.530)	9.5mm (⅜ in.)	4.75mm (No. 4)	2.36mm (No. 8)	1.18mm (No. 16)	600µm (No. 30)	300µm (No. 50)	150µm (No. 100)	75µm (No. 200)					
*Production Limits			Max.						100	100		50			1.0					
			Min.					100	90	70		10			0					
7/17/95	CC95-0258	CC	CC	Load Area				100	99	91	75	46	12	1.7	0.4					1500
7/18/95	CC95-0267	CC	CC	"		"		100	99	91	75	46	12	1.2	0.3					1500

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Note to County and Resident Engineers—If County or Project Number is Incorrect, please notify Inspector and Ames Office Promptly. Corrected Reports will be Issued.

Comments Copies: C. Narotam
Van Dusseldorp
Manatt's
Des Moines Lab
CC

*AGREED by the contractor/producer

ESTIMATED QUANTITY 3,000 Tons
TOTAL PREVIOUSLY CERTIFIED 33,750 Tons
TOTAL CERTIFIED TO DATE 36,750 Tons
CERTIFICATION NUMBER CI 906
Reported By Charlotte Cunningham
Representing Van Dusseldorp [redacted] Sand [redacted] Gravel

Distribution: Whi[redacted] - Transportation Center Materials Engineer; Canary Copy - Project Construction Engineer; Pink Copy - Certi[redacted]nician; Gol[redacted]py - Area Inspector

9/96

DAILY ACC PLANT PAGE

Form E241

Project No.:	NHSN-63-9(19)--2R-45	Mix Design No.:	ABD6-74 R4	Mix Type:	A
County:	Howard	Contractor:	Carlson Construction	Class:	1
Contract ID.:	45-0639-019	Recycle Source:	None	Size:	3/4"

Page No.:
Report No.: 12
Design Marshall Blows: 75

Hot Box I.D. No.:		QMA-41	QMA-42	QMA-43	QMA-44	
Date Sampled:		08/02/96	08/02/96	08/02/96	08/02/96	
Target & Gradation ID:	Target	JH-13A				
1" Sieve	100	100				
3/4" Sieve	90-100	97				
1/2" Sieve	85-99	89				
3/8" Sieve	71-85	74				
* #4 Sieve	39-53	45				
Moving Average		45				
* #8 Sieve	22-32	26				
Moving Average		26				
#16 Sieve		17				
* #30 Sieve	7.0-15	11				
Moving Average		11				
#50 Sieve		4.8				
#100 Sieve		2.8				
* #200 Sieve	2.0-4.1	2.5				
Moving Average		2.7				
Compliance (Y/ N)		Y				
Intended Added, % AC	5.60					
Tank Meas., % AC		5.68				
Intended Total, % AC	5.60					
Total, % AC		5.68				
Marshall Sp. Grav.:		2.347	2.329	2.343	2.326	
Max. Sp. Grav.:		2.442	2.443	2.445	2.448	
Marshall Voids		3.9	4.7	4.2	5.0	
* Moving Avg. (N=4)	3.5-5.0	4.7	4.5	4.4	4.4	
Time		8:15	11:20	2:10	5:15	
Station		173+00	163+00	154+00	143+75	
Side		LT	LT	LT	LT	
Sample Ton		207.00	774.00	1307.00	1890.00	
Sublot Tons		500.00	533.33	533.33	550.88	
Tons to Date		25773.64	26306.97	26840.30	27391.18	
Fines / Bitumen Ratio	0.3-1.20	0.44			.	
QUALITY CONTROL ACTIONS: 1.) AC Changes 2.) Cold Feed Adjust. 3.) Moisture Adjust. 4.) Etc.		2				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. (°F)	61	72	79	82	84	84	
A.C. Temp. (°F)	300	300	300	300	300	300	
Mix Temp. (°F)	280	284	280	288	282	284	

Date Placed: 08/02/96 Date Tested: 08/03/96

Course Placed: Binder Tested By: Jay Haas

Density Record

Core No.:	1	2	3	4	5	6	7
Station	139+89	144+32	148+63	153+62	161+90	167+58	174+20
CL Reference	1.5' LT	2.0' LT	8.5' LT	10.0' LT	2.0' LT	6.5' LT	9.0' LT
W 1 Dry	827.8	831.1	822.8	827.0	810.9	858.0	818.9
W 2 in H20	465.0	466.8	460.2	463.9	458.3	483.3	464.7
W 3 Wet	829.0	832.8	823.9	828.2	811.8	858.8	819.7
Difference	364.0	366.0	363.7	364.3	353.5	375.5	355.0
Field Density	2.274	2.271	2.262	2.270	2.294	2.285	2.307
% Density	97.346	97.217	96.832	97.175	98.202	97.817	98.759
% Voids	7.0	7.1	7.5	7.2	6.2	6.5	5.6
Thickness	2.00	2.12	2.00	2.00	1.87	2.25	2.00

Avg. % Field Voids:	6.7	Avg. Field Density:	2.280
Marshall Sp. G (Lot Avg.):	2.336	Avg. % Density:	97.621
Max. Sp. G (Lot Avg.):	2.445	Specified Density %:	95

Q.I. = (97.621 – 95) / 0.675 = **3.88**

Low Outlier: High Outlier: New Q.I. =

Film Thickness (FT): 15.1 VMA: 13.2

Remarks: A 3% aggregate proportion change was made before plant production started today.

C.P.I.: Jay Haas NE-208 Cert. No.
QMA Tech: Al Forde NE-118 Cert. No.

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9/96

DAILY ACC PLANT PAGE

Form M241

Project No.: NHSN-63-9(19)--2R-45 | Mix Design No.: ABD6-74 R5 | Mix Type: A | Page No.:

County: Howard | Contractor: Fred Carlson Construction | Class: | Report No.: 14

Contract ID.: 45-0639-019 | Recycle Source: None | Size 19 mm | Design Marshall Blows: 75

Hot Box I.D. No.:		QMA-48	QMA-49	QMA-50	QMA-51	
Date Sampled:		08/06/96	08/06/96	08/06/96	08/06/96	
Target & Gradation ID:	Target	JH-15A	JH-15B	JH-15C	AVG.	
26.5mm Sieve	100	100	100	100	100	
19mm Sieve	90-100	99	99	100	99	
13.2mm Sieve	86-100	96	92	93	94	
9.5mm Sieve	73-87	85	79	78	81	
* 4.75mm Sieve	41-55	56	52	49	52	
Moving Average		48	50	52		
* 2.36mm Sieve	24-34	34	32	32	33	
Moving Average		28	30	32		
1.18mm Sieve		21	21	22	21	
* 600um Sieve	9.0-17	14	14	15	14	
Moving Average		12	13	14		
300um Sieve		6.0	7.0	7.2	6.7	
150um Sieve		3.8	4.4	4.1	4.1	
* 75um Sieve	3.0-5.5	3.5	4.0	3.7	3.7	
Moving Average		3.7	3.8	3.7		
Compliance (Y/N)		N	Y	Y	Y	
Intended Added, % AC	5.60					
Tank Meas., % AC		5.63				
Intended Total, % AC	5.60					
Total, % AC		5.63			5.63	
Marshall Sp. Grav.:		2.332	2.325	2.334	2.342	
Max. Sp. Grav.:		2.432	2.446	2.439	2.437	
Marshall Voids		4.1	4.9	4.3	3.9	
Moving Avg. (N=4)	3.5-5.0	4.6	4.6	4.4	4.3	
Time		09:30	12:00	02:45	05:00	
Station		127+25	115+00	107+50	97+75	
Side		LT	LT	LT	LT	
Sample Mg		420.00	1018.00	1429.00	1975.00	
Sublot Mg		500.00	633.33	633.33	540.66	
Mg to Date		500.00	1133.33	1766.66	2307.32	
Fines / Bitumen Ratio	0.3-1.20	0.62			0.66	
QUALITY CONTROL ACTIONS: 1.) AC Changes 2.) Cold Feed Adjust. 3.) Moisture Adjust. 4.) Etc.		2				

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. (°C)	22	25	28	31	32	32	
A.C. Temp. (°C)	149	149	149	149	149	149	
Mix Temp. (°C)	140	138	138	141	140	140	

Date Placed: 08/06/96 | Date Tested: 08/07/96

Course Placed: Binder | Tested By: Jay Haas

Density Record

Core No.:	1	2	3	4	5	6	7
Station	91+28	100+39	102+20	113+2	116+16	128+50	133+10
CL Reference	2.9 LT	2.0 LT	2.7 LT	0.5 LT	1.6 LT	2.8 LT	0.7 LT
W 1 Dry	754.2	860.0	860.9	906.2	840.2	855.4	907.8
W 2 in H20	422.9	483.3	537.1	506.9	473.6	482.5	511.0
W 3 Wet	755.0	860.9	962.6	907.4	841.3	856.3	908.5
Difference	332.1	377.6	425.5	400.5	367.7	373.8	397.5
Field Density	2.271	2.278	2.023	2.263	2.285	2.288	2.284
% Density	97.342	97.643	86.712	97.000	97.943	98.071	97.900
% Voids	6.9	6.6	17.1	7.2	6.3	6.2	6.4
Thickness (mm)	50	55	62	57	51	53	56

Avg. % Field Voids: 6.7 | Avg. Field Density: 2.275

Marshall Sp. G (Lot Avg.): 2.333 | Avg. % Density: 97.526

Max. Sp. G (Lot Avg.): 2.439 | Specified Density: 95

$$Q.I. = \frac{97.526 - 95.000}{0.497} = 5.08$$

Low Outlier: | High Outlier: | New Q.I. =

Film Thickness (FT): 11.2 | VMA: 13.2

Remarks: A 2 % aggregate proportion change was made at 8:22 am. with 312.54 Mg. mix produced. Gradations reflect new specifications.

C.P.I.: Jay Haas | NE-208 Cert. No.

QMA Tech: Al Forde | NE-118 Cert. No.

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9/96

DAILY ACC PLANT PAGE

Form M241

Project No.: NHSN-63-9(19)--2R-45 | Mix Design No.: ABD6-56 | Mix Type: A | Page No.:

County: Howard | Contractor: Mathy Construction | Class: | Report No.: 14

Contract ID.: 45-0639-019 | Recycle Source: None | Size 19 mm | Design Marshall Blows: 75

Hot Box I.D. No.:		HB-14				
Date Sampled:		08/06/96				
Target & Gradation ID:	Target	DS-3A	DS-3B	DS-3C	AVG.	
26.5mm Sieve	100	100	100	100	100	
19mm Sieve	90-100	99	99	100	99	
13.2mm Sieve	86-100	96	92	93	94	
9.5mm Sieve	73-87	85	79	78	81	
* 4.75mm Sieve	41-55	56	52	49	52	
Moving Average						
* 2.36mm Sieve	24-34	34	32	32	33	
Moving Average						
1.18mm Sieve		21	21	22	21	
* 600um Sieve	9.0-17	14	14	15	14	
Moving Average						
300um Sieve		6.0	7.0	7.2	6.7	
150um Sieve		3.8	4.4	4.1	4.1	
* 75um Sieve	3.0-5.5	3.5	4.0	3.7	3.7	
Moving Average						
Compliance (Y/N)		N	Y	Y	Y	
Intended Added, % AC	5.60					
Tank Meas., % AC		5.63				
Intended Total, % AC	5.60					
Total, % AC		5.63			5.63	
Marshall Sp. Grav.:		2.333				
Max. Sp. Grav.:		2.439				
Marshall Voids		4.1				
Moving Avg. (N=4)	3.5-6.0					
Time						
Station						
Side						
Sample Mg						
Sublot Mg						
Mg to Date						
Fines / Bitumen Ratio	0.3-1.20	0.62			0.66	
QUALITY CONTROL ACTIONS: 1.) AC Changes 2.) Cold Feed Adjust. 3.) Moisture Adjust. 4.) Etc.						

Time	7:00	9:00	11:00	1:00	3:00	5:00	7:00
Air Temp. (°C)	22	25	28	31	32	32	
A.C. Temp. (°C)	149	149	149	149	149	149	
Mix Temp. (°C)	140	138	138	141	140	140	

Date Placed: 08/06/96 | Date Tested: 08/07/96

Course Placed: Binder | Tested By: Jay Haas

Density Record

Core No.:	1	2	3	4	5	6	7
Station	91+28	100+39	102+20	113+2	116+16	128+50	133+10
CL Reference	2.9 LT	2.0 LT	2.7 LT	0.5 LT	1.6 LT	2.8 LT	0.7 LT
W 1 Dry	754.2	860.0	860.9	906.2	840.2	855.4	907.8
W 2 in H20	422.9	483.3	537.1	506.9	473.6	482.5	511.0
W 3 Wet	755.0	860.9	962.6	907.4	841.3	856.3	908.5
Difference	332.1	377.6	425.5	400.5	367.7	373.8	397.5
Field Density	2.271	2.278	2.023	2.263	2.285	2.288	2.284
% Density	97.342	97.643	86.712	97.000	97.943	98.071	97.900
% Voids	6.9	6.6	17.1	7.2	6.3	6.2	6.4
Thickness (mm)	50	55	62	57	51	53	56

Avg. % Field Voids: 6.7 | Avg. Field Density: 2.275

Marshall Sp. G (Lot Avg.): 2.333 | Avg. % Density: 97.526

Max. Sp. G (Lot Avg.): 2.439 | Specified Density: 95

$$Q.I. = \frac{97.526 - 95.000}{0.497} = 5.08$$

Low Outlier: | High Outlier: | New Q.I. =

Film Thickness (FT): | VMA:

Remarks: Example of Non QMA project.

C.P.I.: Jay Haas | NE-208 Cert. No.

QMA Tech: Al Forde | NE-118 Cert. No.

9/96

PCC Plant Page

Form E240

Page: ________

Project No.:	STPN-3-6(29)--2J-09	County:	Bremer	Report No.:	1
Plant Name:	Croell - Waverly	Weather:	Sunny - Cool	Date This Report:	08/31/96
Contractor / Sub:	PCI / CFI	Min. Temp. (°F):	65	Date Of Last Report:	08/30/96
Contract ID.:	09-0036-029	Max. Temp. (°F):	75	Design No.:	

Check One (x)		Check One (x)		
Central Mix		Paving	x	(Send Daily or End of Lot)
Ready Mix	x	Structure		(Send Weekly or End of Lot)
Mobile Mix				(Send Weekly or End of Lot)

Year 1996 Date	Mix Number	Time Start	Time Stop	Batched (CY)	% of Est. Used	Fine Aggregate Moist. (%)	Fine Aggregate T-203 Sp. G.	Fine Aggregate Dry Wt. (lbs)	Coarse Aggregate Moist. (%)	Coarse Aggregate T-203 Sp. G.	Coarse Aggregate Dry Wt. (lbs)	Cement	Fly Ash	Fine	Coarse	Water In Agg.	Water Plant	Grade	Avg. W/C Ratio	Max. W/C Ratio
08/31	C4WRC20	07:26	02:49	506.00	101.2	2.6	2.66	1510.0	0.2	2.65	1500.0	474.0	119.0	1550.0	1503.0	43.0	207.0	3.0	0.427	.489

Actual Quantities Used Per CY (in pounds): Cement through Grade.

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Sieve Accuracy= 99.8% — Orig. Dry Weight (OD Wt.): 6924.2 — Dry Wt. Washed (D Wt. W):

Sieve Accuracy= — Orig. Dry Weight (OD Wt.): — Dry Wt. Washed (D Wt. W):

Sieve Accuracy= — Orig. Dry Weight (OD Wt.): — Dry Wt. Washed (D Wt. W):

	Sieve Size	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Specs.	Avg.
C O A R S E	1 1/2"				100.0									100	
	1"				100.0									95-100	
	3/4"	1731.4	25.0		75.0										
S	1/2"	1710.0	24.7		50.3									25-60	
A	3/8"	1796.9	26.1		24.2										
M	#4	1251.2	18.1		6.1									0-10	
P	#8	317.4	4.6		1.5									0-5	
L	Pan	103.8	1.5												
E	Total	6910.7	100.0												
W	#200				0.9									0-1.5	
a	Wash Loss	15.3	OD Wt.:	3020.6			OD Wt.:				OD Wt.:				
s	Pan	10.5	D Wt. W.:	3005.3			D Wt. W.:				D Wt. W.:				
h	Total	25.8													

Check One (x):	Today	Week	Total
	x		
Concrete Batched(CY)	506.00		506.00
Cement Batched(Tons)	119.65		119.65

	Brand / Source	Rate	Lot No.
Air Entrain:	DV 1000		CF06-183-22
Wat. Red:	WRDA82	4.0	CF05-A178-40
Retarder:			
Cal. Chlor:			
Superplas:			

Concrete Treatment (x)		lbs / CY
Ice		
Heated Water		
Heated Materials		

Sieve Accuracy= 100.0% — Orig. Dry Weight: 617.3 — Dry Wt. Washed: 615.7 — Washing Loss: 1.6

Sieve Accuracy= — Orig. Dry Weight: — Dry Wt. Washed: — Washing Loss:

Sieve Accuracy= — Orig. Dry Weight: — Dry Wt. Washed: — Washing Loss:

	Sieve Size	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Specs.	Avg.
F I	3/8"				100.0									100	
N	#4	13.7	2.2		97.8									90-100	
E	#8	50.7	8.2		89.6									70-100	
	#16	109.5	17.7		71.9										
S	#30	172.4	27.9		44.0									10-60	
A	#50	197.0	32.0		12.0										
M	#100	66.8	10.8		1.2										
P	#200	5.2	0.8		0.4									0-1.5	
L	Wash	1.6	0.4												
E	Pan	0.7													
	Total	617.6	100.0												
	Less + #4														
	Date Reported (DR):	08/31/96				(DR):				(DR):					
	Tested By/Date (TB/D):	Bill Croell			NE-463	(TB/D):				(TB/D):					

Mobile Mixer	
Cement Meter	Water Meter

Remarks

		Cert. No.
C.P.I.:	Bill Croell	NE-463
Monitor:	Lee Dahlin	NE-113

9/96

PCC Plant Page

Form M240

Page: ________

Project No.:	NHSN-63-9(19)--2R-45	County:	Howard	Report No.:	6
Plant Name:	Croell R/M - Elma	Weather:		Date This Report:	07/13/96
Contractor / Sub:	Wicks Construction - Sub	Min. Temp. (°C):		Date Of Last Report:	07/06/96
Contract ID.:	45-0639-019	Max. Temp. (°C):		Design No.:	748

Check One (x)		Check One (x)		
Central Mix		Paving	x	(Send Daily or End of Lot)
Ready Mix	x	Structure	x	(Send Weekly or End of Lot)
Mobile Mix				(Send Weekly or End of Lot)

Year 1996	Mix	Time		Batched	% of Est.	Fine Aggregate			Coarse Aggregate			Actual Quantities Used Per m3 (in kilograms)				Water			Avg. W/C	Max. W/C
Date	Number	Start	Stop	(m3)	Used	Moist. (%)	T-203 Sp. G.	Dry Wt. (kg)	Moist. (%)	T-203 Sp. G.	Dry Wt. (kg)	Cement	Fly Ash	Fine	Coarse	In Agg.	Plant	Grade	Ratio	Ratio
07/09	D-57			5.73	101.1	3.6	2.65	832.0	0.4	2.54	798.0	421.0		863.0	801.0	34.0	149.0	1.0	0.437	0.450
07/10	M-4			1.91	100.0	3.6	2.65	827.0	0.4	2.54	790.0	490.0		858.0	793.0	34.0	147.0	1.0	0.371	
07/12	C-4			50.84	100.7	3.6	2.65	877.0	0.7	2.54	843.0	371.0		910.0	849.0	39.0	131.0		0.458	0.488

COARSE SAMPLE

	Sieve Accuracy= 100.0%				Sieve Accuracy=				Sieve Accuracy=					
	Orig. Dry Weight (OD Wt.):			6808.7	Orig. Dry Weight (OD Wt.):				Orig. Dry Weight (OD Wt.):					
	Dry Wt. Washed (D Wt. W):				Dry Wt. Washed (D Wt. W):				Dry Wt. Washed (D Wt. W):					
Sieve Size	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Wt. Retd.	% Retd.	% Retd.	% Psg.	Specs.	Avg.
37.5mm				100.0									100	
26.5mm	26.1	0.4		99.6									95-100	
19mm	1656.2	24.3		75.3										
13.2mm	2463.0	36.2		39.1									25-60	
9.5mm	1637.4	24.0		15.1										
4.75mm	999.8	14.7		0.4									0-10	
2.36mm	22.4	0.3		0.1									0-5	
Pan	5.0	0.1												
Total	6809.9	100.0												

Wash

75um				0.6									0-1.5	
Wash Loss	18.9	OD Wt.:	3294.4			OD Wt.:				OD Wt.:				
Pan	2.4	D Wt. W.:	3275.5			D Wt. W.:				D Wt. W.:				
Total	21.3													

Check One (x):	Today	Week x	Total
Concrete Batched(m3)		58.48	732.63
Cement Batched(Mg)		22.21	343.56

	Brand / Source	Rate	Lot No.
Air Entrain:	DV 1000 - WR Grace		CF03 A183-8
Wat. Red.:			
Retarder:			
Cal. Chlor:			
Superplas:			

Concrete Treatment (x)		kg / m3
Ice		
Heated Water		
Heated Materials		

FINE SAMPLE

	Sieve Accuracy= 100.0%				Sieve Accuracy=				Sieve Accuracy=					
		Orig. Dry Weight:		637.8		Orig. Dry Weight:				Orig. Dry Weight:				
		Dry Wt. Washed:		633.9		Dry Wt. Washed:				Dry Wt. Washed:				
		Washing Loss:		3.9		Washing Loss:				Washing Loss:				
Sieve Size	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Wt. Retd.	% Retained	Final	% Passing	Specs.	Avg.
9.5mm				100.0									100	
4.75mm	29.1	4.6		95.4									90-100	
2.36mm	55.1	8.6		86.8									70-100	
1.18mm	85.1	13.3		73.5										
600um	144.6	22.7		50.8									10-60	
300um	225.2	35.4		15.4										
150um	87.8	13.8		1.6										
75um	6.0	0.9		0.7									0-1.5	
Wash	3.9	0.7												
Pan	0.8													
Total	637.6	100.0												
Date Reported (DR):	07/09/96				(DR):				(DR):					
Tested By/Date (TB/D):	Doug Kronneman			NE-386	(TB/D):				(TB/D):					

Mobile Mixer	
Cement Meter	Water Meter

Remarks
C-4 mix was used for bridge approaches.
D-57 mix was used for barrier rails.

		Cert. No.
C.P.I.:	Doug Kronneman	795
Monitor:	Danny Steenhard	NE-386

NOTES

NOTES

NOTES

Iowa Department of Transportation
Technical Training and Certification Program

COURSE EVALUATION SHEET

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

Course: ______________________ Location: ______________________

Instructor: ____________________

1. What type of agency are you employed by?

   ____

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

   Facility : ___________________

   Material : __________________

   Instructors : ________________

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

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

   ____

   ____

REMARKS: