PREFACE

This Method was developed through a joint effort between New York State Department of Transportation, New York Construction Materials Association, Inc., American Concrete Pavement Association, and New York City Concrete Promotional Council. It is intended as a guide for quality control and quality assurance sampling and testing of aggregate for compliance with the Department’s friction aggregate specifications. The latest version may be found on the NYSDOT web site, www.DOT.NY.gov, “Business Center/ Publications & Guidance”. Sampling frequencies are provided for obtaining samples at the aggregate source, production facility and the constructed surface course. This Method includes procedures and requirements for hot mix asphalt (HMA), paver placed surface treatment (PPST), microsurfacing, slurry and portland cement concrete (PCC). Procedures are provided to identify and calculate the proportion of each aggregate type in a sample. Four methods for identifying aggregate types are included: visual analysis, reaction to hydrochloric acid, copper nitrate staining and acid-insoluble residue determination. Any method or combination of these methods may be used to identify the components of aggregate samples. Visual analysis is the most common method, but identification procedures that include all applicable methods will produce the most reliable results. Familiarity with aggregate types to be tested, their appearance and how they behave when subjected to the tests described herein is critical. The percent residue is used to classify aggregate types as high-residue carbonate, low-residue limestone, low-residue dolomite, or noncarbonate.

The sampling and analysis procedures given in this Method should be incorporated into a comprehensive friction aggregate quality control or monitoring plan. Many different aggregate types are used in New York State, and many properties will vary between aggregates of the same type. The use of reference samples and consultation with a geologist are essential for developing a reliable friction aggregate quality control or monitoring plan.

Note: This Materials Method may require the use of hazardous materials and safety sensitive procedures. This Method does not address any of the safety problems associated with its use. It is the responsibility of the user of this Method to establish appropriate safety and health practices and determine the applicability of regulatory limitations before use.
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I. SCOPE

All surface course (see page 2 for the definition of “surface course”) mixtures are required to contain aggregate from approved sources meeting the applicable specification for friction aggregate content. It is the Producer’s responsibility to use aggregates required by the job mix formula or mixture design. This Method covers the procedures for sampling aggregates, identifying the specific aggregate types, determining acid-insoluble residue content, and determining the percent noncarbonate particles in the appropriate size fractions. Any or all of the techniques provided or referenced in this Method to identify aggregates may be used.

II. BACKGROUND

NYSDOT began specifying friction coarse aggregates for surface course HMA mixtures in 1969. Initially, a statewide survey of pavement friction provided a database for the Department’s entire highway network. Since 1980, pavement friction inventory data has been used to evaluate the performance of various coarse aggregate types and blends in HMA surface courses. In 2003 a program for evaluating the friction performance of Portland Cement Concrete (PCC) surface course mixtures was initiated. In 2004 an Engineering Instruction (EI) was issued to revise the Standard Specifications for Portland Cement Concrete (PCC). This EI revised the friction requirements of coarse and fine aggregates used in PCC surface courses. Because the pavement friction inventory shows carbonate aggregates to be the most vulnerable to the polishing action of traffic, the greatest attention is focused on them.

The Department initiated the pavement friction inventory program, as required by FHWA, to monitor pavement friction performance, and started testing pavements in 1980, using a drag-force trailer, according to ASTM E 274. Pavement test sites are selected to represent a cross section of the aggregate types and traffic volumes encountered throughout the state. Because the Department has a long-standing commitment to the widest possible use of local materials, a large variety of aggregates is included in the inventory.

Detailed information on the Department’s investigations related to pavement friction can be found in the following reports.

- HRR 236, “Skid Resistance of Bituminous Surfaces.”
- HRR 396, “Development of Specifications for Skid Resistant Asphalt Concrete.”
- TR 92-1, “Performance of Dolomites as High Friction Aggregates - Interim Report.”
- TRR 1418, “Aggregate Type and Traffic Volume as Controlling Factors in Bituminous Pavement Friction.”
- TR 98-2, “Pavement Friction in Intersections.”
III. GENERAL

A. DOCUMENT AND PROCEDURAL OVERVIEW

Surface course mixtures are designed to provide adequate pavement friction when subjected to the traffic volumes anticipated for their design service lives. Aggregate used in surface course mixtures must meet the specified friction requirements for the designated mix type. The specification requirements may be met in three general ways: use of 100% noncarbonate aggregates, use of carbonate aggregate containing the minimum required percent acid-insoluble residue, or blends of noncarbonate and carbonate aggregates. Blends may occur naturally, as gravel, may be quarried selectively (i.e., cherty limestone), may be quarry-blended before being shipped to plants, or may be plant-blended during production. Aggregate used in surface courses must be identified to verify conformance to both the requirements of the job mix formula or mix design and the applicable friction specification. Most aggregates may be identified using one or more of the following tests: Visual Analysis, Reaction with Hydrochloric Acid, Copper Nitrate Staining, or Acid-insoluble Residue (A.I.R.). Each of these test procedures is contained in this Method.

After the aggregate components are identified, the percent of each type must be calculated for the specified size fractions. The procedures for calculating the proportions of noncarbonate or A.I.R. in each size fraction are contained in this Method. The proportions of noncarbonate particles or A.I.R. in each sample are then compared with the specification requirements, which can be found in the Contract documents.

B. DEFINITIONS

Failing Samples. Samples which do not contain at least the minimum specified proportions of noncarbonate particles or A.I.R.

Passing Samples. Samples containing at least the minimum specified proportions of noncarbonate particles or A.I.R.

Surface Course. The surface layer of pavement or structure - including structural slab with integral wearing surface - which is exposed to vehicle traffic.

C. OVERVIEW OF FAILURE INVESTIGATION PROCEDURES

If any failing samples are identified, the surface course constructed with the material represented by the failing samples must be evaluated for compliance with the specification requirements according to the procedures of this Method. The Department will evaluate all surface courses in question by testing retained production samples and/or pavement samples. Before the project will be accepted, all surface course sections represented by failing retained or pavement samples must be repaired to the satisfaction of the Engineer at no additional cost to the Department.
D. INFORMATION SOURCES

Personnel responsible for sampling aggregate, preparing samples, and performing aggregate identification testing must be fully aware of all specified requirements. The following is a list of reference documents.

<table>
<thead>
<tr>
<th>Source</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard and Special Specs. (including all addenda)</td>
<td>Material requirements; blending requirements</td>
</tr>
<tr>
<td>Approved List, Sources of Fine &amp; Coarse Aggregates</td>
<td>Aggregate source numbers; aggregate types; friction acceptability; gravel noncarbonate content</td>
</tr>
<tr>
<td>Materials Method 5</td>
<td>Appendix A - Sampling of Aggregates</td>
</tr>
<tr>
<td></td>
<td>Appendix B - Stockpile Gradation Test - Coarse Aggregate</td>
</tr>
<tr>
<td></td>
<td>Appendix C - Hot Bin Analysis</td>
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<tr>
<td></td>
<td>Appendix D - Composite Aggregate Gradation Analysis</td>
</tr>
<tr>
<td>Materials Method 5.16</td>
<td>Superpave Hot Mix Asphalt-Aggregate Selection Requirements</td>
</tr>
<tr>
<td>Materials Method 9.1</td>
<td>Portland Cement Concrete Plant Inspection</td>
</tr>
<tr>
<td>Materials Method 29</td>
<td>Aggregate Acceptance Procedures</td>
</tr>
<tr>
<td>AASHTO T 2</td>
<td>Sampling Aggregate</td>
</tr>
<tr>
<td>AASHTO T 248</td>
<td>Reducing Field Samples of Aggregate to Testing Size</td>
</tr>
<tr>
<td>ASTM C 294</td>
<td>Standard Descriptive Nomenclature for Constituents of Natural Mineral Aggregates</td>
</tr>
<tr>
<td>ASTM C 295</td>
<td>Standard Guide for Petrographic Examination of Aggregate for Concrete</td>
</tr>
<tr>
<td>ASTM C 457</td>
<td>Standard Test Method for Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete</td>
</tr>
<tr>
<td>ASTM C856</td>
<td>Standard Practice for Petrographic Examination of Hardened Concrete</td>
</tr>
</tbody>
</table>

E. AGGREGATE TYPES

The aggregates used to produce surface course mixtures on Department projects can be divided into four types, for the purposes of establishing their friction characteristics: noncarbonate, high-residue carbonate, low-residue limestone and low-residue dolomite.

Note: All acid-insoluble residue contents discussed in this Method are as determined according to Section VIII. - DETERMINATION OF PERCENT ACID-INSOLUBLE RESIDUE.

1. Carbonates

Three of the four aggregate types are carbonates, as defined in ASTM C 294. Most carbonate aggregates contain siliceous impurities in the form of sand-sized particles,
siliceous intergrowths, or chert, which are largely quartz. The amount of siliceous impurities that are contained in an aggregate sample is found by performing an acid-insoluble residue (A.I.R.) content determination. The A.I.R. content, expressed as a percentage by mass of the parent rock type (limestone, dolomite, or blends of the two) are used to distinguish high-residue limestone, high-residue dolomite, low-residue limestone, and low-residue dolomite. Department specifications provide the A.I.R. thresholds for each carbonate aggregate type.

2. Noncarbonates

Noncarbonates, including, but not limited to, sandstone, granite, traprock, quartzite, and chert, are not carbonate rocks, as defined in ASTM C 294.

IV. EVALUATING FRICTION AGGREGATE CONTENT BEFORE AND DURING PRODUCTION

A. QUALITY CONTROL

When aggregates are blended at the production facility (HMA or PCC), including RAP and RCA, the Producer’s quality control personnel shall determine the noncarbonate content or acid-insoluble residue of the final blend as appropriate. In all other cases the quality control personnel at the approved aggregate source shall determine the noncarbonate content or acid-insoluble residue of the aggregate supplied for the production facility (HMA or PCC).

Note: Although the HMA or PCC Producer is only required to perform quality control testing when aggregate is plant blended or when the mixture contains RAP or RCA, the Producer is always responsible for supplying material that meets all Department specifications. The Department recommends that every Producer follow an friction aggregate quality control program, no matter the type of friction aggregate used.

Friction aggregate quality control sampling and testing is required at the appropriate frequency specified in Table 1 - Minimum Quality Control Sampling and Testing Frequencies or as modified by the Department, if any material with specified friction requirements is produced during the specified time interval. Sample and test the aggregate used in surface course mixtures for compliance with all applicable specifications at the frequencies listed in Table 1, or as modified by the Department. Obtain all samples according to AASHTO T 2.

Acceptable sample types are given in Table 2a - Quality Control Sample Types (HMA), Table 2b – Quality Control Sample Types (PCC) and Table 2c – Quality Control Sample Types (Aggregate Supplier); all quality control samples must be one of the acceptable types listed in these tables for the appropriate mixture and aggregate type. These tables also list the appropriate calculation procedure for each sample type.

All quality control testing shall be performed using an appropriate identification procedure or combination of procedures included or referenced in this Method.
### Table 1 – Minimum Quality Control Sampling and Testing Frequencies

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Aggregates</th>
<th>Tester</th>
<th>Aggregate Supplier</th>
<th>Mix Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HMA and PPST</strong></td>
<td>All aggregates that are HMA Plant Blended to meet the specification requirements</td>
<td>None required</td>
<td>One per day $^{(2)(3)(4)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All RAP and Virgin Aggregate Blends</td>
<td>None required</td>
<td>One per day $^{(2)(3)(4)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unblended High-Residue Carbonates ($\geq$20%)</td>
<td>One per week</td>
<td>One per day $^{(2)(3)(4)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sand &amp; Gravel aggregates</td>
<td>One per week</td>
<td>Monitoring by the HMA Producer is recommended</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Naturally occurring blends, excluding gravel</td>
<td>One per day</td>
<td>Monitoring by the PCC Producer is recommended</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quarry-blended aggregates</td>
<td>One per day</td>
<td>Monitoring by the PCC Producer is recommended</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All other aggregates, including noncarbonates and low ($\leq$20%) insoluble residue dolomite</td>
<td>One per week</td>
<td>Monitoring by the HMA Producer is recommended</td>
<td></td>
</tr>
</tbody>
</table>

| **PCC**       | All aggregates that are PCC Plant Blended to meet the specification requirements as described in the mix design | None required | One per day $^{(5)}$ |
|               | Unblended High-Residue Carbonates ($\geq$20%)                              | One per week | Monitoring by the PCC Producer is recommended |
|               | Sand & Gravel aggregates                                                  | One per week | Monitoring by the PCC Producer is recommended |
|               | Naturally occurring blends, excluding sand & gravel                        | One per day | Monitoring by the PCC Producer is recommended |
|               | Quarry-blended aggregates                                                 | One per day | Monitoring by the PCC Producer is recommended |
|               | All other aggregates, including noncarbonates and low ($\leq$20%) insoluble residue dolomite | One per week | Monitoring by the PCC Producer is recommended |

1. Frequencies for specific facilities or aggregate types may be modified by the Department.
2. Sampling and testing is required for any production day in which production exceeds 150 ton.
3. Sampling is required for any production day in which production is at least 25 ton but less than 150 ton. Samples must be clearly marked and stored at the production facility for at least 10 days.
4. The HMA Producer may certify friction aggregate content based on automation recordation for any production day in which production is less than 25 ton.
5. The PCC Producer may certify friction aggregate content based on automation recordation for any production day in which production is less than 12 yd³.
6. Sampling required at the production facility for any production week or portion thereof. A production week is defined as a period from Sunday to Saturday, inclusive, in which material is produced.
# Table 2a – Quality Control Sample Types (HMA)

<table>
<thead>
<tr>
<th>Mixture Type</th>
<th>Facility Type</th>
<th>Aggregates</th>
<th>Sample Type</th>
<th>Calculation Section(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 or Type C PPST</td>
<td>Batch Plant</td>
<td>Coarse aggregate</td>
<td>No. 1 &amp; No. 1A hot bins</td>
<td>IX. A. 1.</td>
</tr>
<tr>
<td></td>
<td>Drum Plant</td>
<td>Coarse aggregate</td>
<td>Composite mixture</td>
<td>IX. B. 1.</td>
</tr>
<tr>
<td>9.5 or Type B PPST</td>
<td>Batch Plant</td>
<td>Coarse aggregate no larger than 1A</td>
<td>No. 1A hot bin</td>
<td>IX. A. 2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coarse aggregate containing No. 1A and No. 1 bins, but with no cold feed of aggregate larger than size No. 1A&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>No. 1 &amp; No. 1A hot bins</td>
<td>IX. A. 3.&lt;sup&gt;(3)&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Drum Plant</td>
<td>Composite aggregate of mixture</td>
<td>No. 1A hot bin&lt;sup&gt;(4)&lt;/sup&gt;</td>
<td>IX. A. 4.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coarse aggregate plant blended with cold feed(s) of aggregate larger than size No. 1A.</td>
<td>Composite mixture</td>
<td>IX. B. 2</td>
</tr>
<tr>
<td>6.3 or Type A PPST</td>
<td>Batch Plant</td>
<td>Coarse and fine aggregate</td>
<td>No. 1A and fines hot bins</td>
<td>IX. A. 5.</td>
</tr>
<tr>
<td></td>
<td>Drum Plant</td>
<td>Coarse and fine aggregate</td>
<td>Composite aggregate or mixture</td>
<td>IX. B. 3</td>
</tr>
<tr>
<td>Any</td>
<td>Any</td>
<td>RAP and virgin coarse aggregate blends</td>
<td>Composite mixture</td>
<td>IX. B.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All other coarse aggregate types</td>
<td>Stockpile</td>
<td>Note 5</td>
</tr>
</tbody>
</table>

# Table 2b – Quality Control Sample Types (PCC)

<table>
<thead>
<tr>
<th>Mixture Type</th>
<th>Facility Type</th>
<th>Aggregates</th>
<th>Sample Type</th>
<th>Calculation Section(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>PCC Central, Transit, or Truck Mixed</td>
<td>Coarse aggregates</td>
<td>Stockpile, bin or fresh mix&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td>X. A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hardened PCC</td>
<td>X. B.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fine aggregates</td>
<td>Stockpile or bin&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td>VIII.</td>
</tr>
</tbody>
</table>

# Table 2c – Quality Control Sample Types (Aggregate Supplier)

<table>
<thead>
<tr>
<th>Aggregate size</th>
<th>Facility Type</th>
<th>Aggregates</th>
<th>Sample Type</th>
<th>Calculation Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>All applicable</td>
<td>Aggregate Production Plant</td>
<td>Coarse Aggregate</td>
<td>Stockpile</td>
<td>Note 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fine Aggregate</td>
<td>Stockpile</td>
<td>Note 5</td>
</tr>
</tbody>
</table>

## Notes for Tables 2a, 2b and 2c

1. For aggregate blends accepted based on A.I.R. content use Section VIII.
2. The Department recommends using composite mixture samples when producing 9.5 mixtures at a batch plant and batching material from the No. 1 size hot bin.
3. Use BR 312 - Determination of Percent Noncarbonate Particles in Superpave 9.5 mixtures From Hot Bin Samples of No. 1 and No. 1A Stone.
4. For 9.5 mixtures with material batched from the No. 1 hot bin, quality control samples may be taken from...
only the No. 1A hot bin, with the Regional Materials Engineer’s permission, if the mixture is proportioned such that the material in the No. 1A hot bin contains enough noncarbonate material to meet all friction requirements when the material in the No. 1 hot bin is assumed to be 100% carbonate.

5. Determine noncarbonate or A.I.R. content as appropriate for each required size fraction (Table 7).

6. If plant blending, a sample is needed from each stockpile or bin. All samples should be of the same type.

B. QUALITY ASSURANCE

The Department or its appointed agent will perform the quality assurance sampling and testing. All quality assurance testing will be performed using an appropriate identification procedure or combination of procedures included or referenced in this Method.

Aggregate identification procedures performed for quality assurance are conducted on behalf of the Department for the Department’s purposes. The Department assumes no responsibility for the production of acceptable material. It is the Contractor’s responsibility to furnish material meeting all appropriate Department standards and specifications.

Table 3 - Minimum Quality Assurance Sampling and Testing Frequencies

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Sample Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMA and PPST</td>
<td>1 per week</td>
</tr>
<tr>
<td>PCC pavement</td>
<td>1 per week</td>
</tr>
<tr>
<td>PCC structural slabs (1)</td>
<td>1 per day</td>
</tr>
</tbody>
</table>

1. See page 14 for the definition of “structural slabs”.

1. Quality Assurance Sample Types

a. HMA

Quality assurance samples for HMA may be taken from hot bin or composite aggregate samples, HMA mixture samples, compacted HMA specimens, retained quality control samples or pavement samples. For all HMA mixtures containing recycled asphalt pavement (RAP) or 9.5 mixes produced at a batch plant using material from the No. 1 size hot bin, quality assurance samples must be mixture samples, compacted HMA specimens or pavement samples.

Table 4 – HMA Quality Assurance Sample Sizes

<table>
<thead>
<tr>
<th>Mix Type</th>
<th>Size</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hot Bin</td>
</tr>
<tr>
<td>12.5 or Type C PPST</td>
<td>No. 1 Stone</td>
<td>1 qt</td>
</tr>
<tr>
<td></td>
<td>No. 1A Stone</td>
<td>1 qt</td>
</tr>
<tr>
<td>9.5 or Type B PPST</td>
<td>No. 1A Stone</td>
<td>2 qt (1)(2)</td>
</tr>
<tr>
<td>6.3 or Type A PPST</td>
<td>No. 1A Stone</td>
<td>1 qt</td>
</tr>
<tr>
<td></td>
<td>No. 1B Stone</td>
<td>1 qt</td>
</tr>
<tr>
<td></td>
<td>Fines</td>
<td>1 qt</td>
</tr>
</tbody>
</table>

1. For 9.5 mixes, only allowed if no material is batched from the No. 1 size hot bin.
2. Package entire sample in a single container.
b. PCC

- Fine aggregate quality assurance samples must be taken from the stockpiles, bins or dry composite mixture from the plant.

- Coarse aggregate quality assurance samples must be taken at the plant, from the fresh composite mixture, either dry or wet. Samples recovered from fresh wet mixture must be prepared by washing the PCC over a 1/4" sieve. Additional quality assurance samples may also be taken from fresh concrete or hardened 6" x 12" cylinders prepared at the jobsite. No special curing or storage requirements are needed for cylinders fabricated for friction testing. Hardened concrete samples cannot be used to evaluate aggregates for acid-insoluble residue testing.

<table>
<thead>
<tr>
<th>Table 5 – PCC Quality Assurance Sample Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mix Type</strong></td>
</tr>
<tr>
<td>PCC</td>
</tr>
<tr>
<td>All</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

1. Package entire sample in a single container.

2. Quality Assurance Sampling Procedures

Notify the quality control personnel before taking the quality assurance sample. Obtain representative samples, according to AASHTO T2, and reduce the samples, according to AASHTO T248, to the appropriate size shown in Tables 4 and 5. Leave the remaining material in a location designated by the quality control personnel and acceptable to the quality assurance personnel.

Complete a Form BR 3 for each sample. For mixtures which contain multiple bin samples only one form is needed.

Clearly mark the corresponding BR 3 serial number on each sample container. Clearly indicate on the sample container(s) that the sample is for friction testing. Red stickers may be used to mark the container(s), and are available from the Materials Bureau.

Provide the following information in the appropriate fields of the BR 3 for each sample submitted for friction testing.

<table>
<thead>
<tr>
<th><strong>Field Name</strong></th>
<th><strong>Required Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>The Region in which the sample was taken.</td>
</tr>
<tr>
<td>Facility Code</td>
<td>The five digit facility code. Applicable only at production</td>
</tr>
</tbody>
</table>
Sample Location
Location in production from where the sample was obtained (i.e. hot bins, aggregate belt, storage silo).

Sample Description or Item Number
Specification item number.

D Number
The contract “D” number(s) for which the material was supplied, if applicable. Maintenance projects include project number when applicable, or leave blank.

Project Location
The route number and county in which the project is located.

Sizes Sampled
Mark (“x” or “✓”) the applicable boxes for the sample. For mixes using multiple bins, mark all applicable boxes on one BR 3. Do not use two separate forms.

Test Requested
Check the “Friction” box and indicate friction specification type.

Aggregate Producer*
Name of the aggregate producer supplying the material.

Source No.*
Source number of the aggregate producer’s site.

Town, County*
Town and county of the aggregate producer’s site.

Actual Batch Percentages
For HMA Batch Plants and all PCC Plants. The actual target batching percentages for each mix constituent, as percent of total aggregate, at the time of sampling. See Section IX. A. - HOT BIN SAMPLES (BATCH PLANTS), for calculation instructions.

For Drum Plants. The actual target percentage of mineral filler, obtained from the automation recordation, at the time of sampling.

Remarks
Any other notable information such as the production facility name and number, and Job Mix Formula (JMF) or concrete mix design.

Sampled By
Print the name of the individual taking the sample.

Date, Time
Date and time the sample was taken.

* Can be obtained from the JMF, concrete mix design or the Approved List of Sources of Fine and Coarse Aggregates.

The remaining spaces will be filled in by Materials Bureau personnel.
C. RETAINED SAMPLE TESTING

When possible, the Department will determine whether failing quality control or quality assurance samples represent in-place material by testing retained samples. Retained sample testing may be performed using retained mixture or aggregate samples. All retained samples will be tested by the Main Office Geology Laboratory using an identification procedure or combination of procedures included or referenced in this Method.

**Note:** It is recommended that all quality control samples (aggregate and mixture) taken at production facilities be labeled and retained until the surface course constructed with the materials represented by those samples has been accepted by the Department.

If quality control test results indicate that a section of in-place surface course does not meet the specification requirements, retained sample testing will be performed on material produced between the time of sampling for the last passing sample (quality control or quality assurance) and the time of sampling for the next subsequent passing sample (quality control or quality assurance).

If quality assurance test results indicate that a section of in-place surface course does not meet the specification requirements, and those results contradict quality control test results, retained sample testing will be performed on material produced between the time of sampling for the last passing quality assurance sample and the time of sampling for the next subsequent passing quality assurance sample.

The Department reserves the right to choose which retained samples will be tested and to test only the samples which it deems appropriate.

If retained sample testing confirms the failing original results, or if no retained samples are available for testing, the Contractor will be given the following options.

- Obtain and submit surface course samples, according to Section V. - EVALUATING THE FRICTION AGGREGATE CONTENT OF IN-PLACE SURFACE COURSES, to refine the area(s) requiring remediation.
- Remediate all surface course sections represented by failing samples as determined by the criteria of Section V. H. - DETERMINING ACCEPTANCE OR REJECTION OF SURFACE COURSE SECTIONS.

**Note:** At least one retained sample should be tested from each production subplot for HMA, or each day’s production for PCC under investigation before coring the surface course.

If retained sample testing shows the in-place material is likely to meet specification requirements, some or all surface course testing may be waived by the Regional Director.
V. EVALUATING THE FRICTION CONTENT OF IN-PLACE SURFACE COURSES

Surface course samples may be taken when failing samples are identified by: quality control, quality assurance, or retained sample testing.

A. ROLES AND RESPONSIBILITIES

All parties will adhere to the requirements of this manual in fulfilling the responsibilities outlined below.

The Engineer will: mark the locations of all samples, witness the collection of samples, take immediate possession of all samples from the contractor, complete a BR 3 form for each sample, and transport all samples to the Main Office Materials Geology Laboratory as soon as possible.

The contractor shall: determine the location of all samples except any extra samples located by the Regional Materials Engineer, obtain all samples, and backfill all core holes as soon as possible, using materials and procedures approved by the Engineer, at no cost to the Department.

The Materials Bureau Geology Laboratory will test all samples, and provide all test results to the Regional Materials Engineer.

The Regional Materials Engineer (RME) will: determine the limits of sampling, provide the Engineer with the locations of any necessary extra cores, and determine the limits of acceptable and unacceptable surface-course material.

B. REQUIRED SAMPLE SIZES

Surface course sample sizes are specified in Table 6 – Surface Course Samples below. When two cores are required for one sample, take the first core of each sample at the location marked by the Engineer and the second core at a longitudinal offset from the first of 1ft in the direction of traffic flow. If initial testing shows that sufficient test specimens can be recovered from a single core, any subsequent samples may consist of one core each, as ordered by the Department.

<table>
<thead>
<tr>
<th>Surface Course (1)</th>
<th>Evaluation Procedure</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 HMA</td>
<td>% Noncarbonate</td>
<td>Two 6” Cores</td>
</tr>
<tr>
<td></td>
<td>% Acid-Insoluble</td>
<td>One 6” Core</td>
</tr>
<tr>
<td>9.5 or finer HMA</td>
<td>Any</td>
<td>One 6” Core</td>
</tr>
<tr>
<td>PCC w/ C. A. 2 aggregate</td>
<td>Any</td>
<td>One 6” Core</td>
</tr>
<tr>
<td>PCC w/ C. A. 1 aggregate</td>
<td>Any</td>
<td>One 6” Core</td>
</tr>
</tbody>
</table>

1. For Type A or B PPST use sample size for 9.5 or finer HMA. For Type C PPST use sample size for 12.5 HMA.
C. SURFACE COURSE SAMPLING LIMITS

If the Contractor elects to take surface-course samples, the Regional Materials Engineer will set the limits of sampling to evaluate all areas of in-place surface course material represented by failing quality control, quality assurance or retained samples. The in-place area represented by any one quality control, quality assurance, or retained sample, will be defined as all surface course constructed with material produced from the time that the immediately preceding sample was taken until the time that the next subsequent sample was taken.

D. PAVEMENT SAMPLE EVALUATION PROCEDURE (SEE SECTION E FOR STRUCTURAL SLABS).

1. Pavement Sample Locations
   a. The Engineer will divide the pavement within the sampling limits into approximately equal lots as close as possible to 1250 feet long. Establish the lots to follow the procession of the paving operation. Considering paving passes instead of travel lanes may be necessary and prudent in some instances to reduce the number of samples necessary (e.g. three travel lanes paved in two paving passes).
   b. A minimum of two lots are required within the sampling limits.
   c. For each lot, the Contractor shall choose to have one sample taken at the lot’s longitudinal mid point or end point.
   d. The RME may designate extra sample locations, to evaluate areas that are not represented by samples located according to the above method.
   e. The Engineer will mark all sample locations at the longitudinal locations designated by the Contractor and RME in the center of the travel lane, between the wheelpaths.

2. Pavement Sample Testing
   The Materials Bureau will test the pavement samples for friction aggregate content using an appropriate method(s) included or referenced in this Method. After testing has been completed, the Contractor will be provided the opportunity to review the recovered aggregate or PCC cores and test results for informational purposes.

3. Determining the Need for Additional Pavement Samples
   After receiving notice of the Department’s test results, the Contractor will be given the following options.
   a. Obtain and submit additional samples, according to Section V. E. - ADDITIONAL PAVEMENT SAMPLE EVALUATION PROCEDURE, to refine the areas requiring remediation. This option is only available to the Contractor if the pavement samples include both passing and failing samples.
b. Accept the Department’s test results and remediate the required areas as determined in Section V. H. - DETERMINING ACCEPTANCE OR REJECTION OF SURFACE COURSE AREAS.

4. Additional Pavement Sample Evaluation Procedure

a. Additional Pavement Sample Limits

The Regional Materials Engineer will define the area(s) from which additional pavement samples will be taken, consisting of all pavement areas represented by failing pavement samples. These areas consist of the length of pavement from which failing pavement samples were obtained, spanning between locations where passing pavement samples were obtained. See Figure 1 below. No additional pavement samples will be taken outside of these areas.

![Figure 1 - Pavement Core Locations](image)

- Location of a passing sample
- Location of a failing sample
- Area to be evaluated with additional samples

b. Additional Pavement Sample Locations

- The Engineer will divide the pavement areas to be evaluated with additional pavement samples into approximately equal sublots as close to 625 feet long as possible.
- For each sublot, the Contractor shall choose to have one sample taken at the lot's longitudinal quarter, mid, three-quarter, or end point. In addition, the Contractor may designate one extra sample location per contract.
- The Regional Materials Engineer may designate extra sample locations within the sampling limits, to evaluate areas that are not represented by samples located according to the above method.
5. Additional Pavement Sample Testing

The Materials Bureau will test the pavement samples for friction aggregate content using an appropriate procedure(s) included in this Method. After testing has been completed, the Contractor will be provided the opportunity to review the recovered aggregate or PCC cores and test results for informational purposes.

6. Alternative Pavement Sample Procedure

This procedure is for use in high traffic areas where maintenance and protection of traffic (MPT) is difficult. This procedure may only be used with the approval of the Regional Materials Engineer.

7. Alternative Pavement Sample Locations

a. Alternative Pavement Sample Locations

- Divide the pavement within the coring limits into approximately equal sublots as close as possible to 625 feet long. Establish the sublots to follow the procession of the paving operation. Number the sublots in consecutive order. Considering paving passes instead of travel lanes may be necessary and prudent in some instances to reduce the number of samples necessary (e.g. three travel lanes paved in two paving passes).

- For each sublot, the Contractor shall choose to have one sample taken at the lot’s longitudinal quarter, mid, three-quarter, or end point. In addition, the Contractor may designate one extra sample location per contract.

- The Regional Materials Engineer may designate extra sample locations within the sampling limits, to evaluate areas that are not represented by samples located according to the above method.

b. Alternative Pavement Sample Testing

- The Materials Bureau will test all pavement samples from the odd numbered sublots for friction aggregate content using appropriate procedure(s) included or referenced in this Method.

- The Materials Bureau will test the samples from even numbered sublots that fall immediately between a passing sample and a failing sample. The Department will not test samples from even numbered sublots located immediately between two passing or two failing samples.

- After the Materials Bureau has completed its testing, the Contractor will be provided the opportunity to review the recovered aggregate and test results for informational purposes.

E. STRUCTURAL SLAB SAMPLE EVALUATION PROCEDURE

For the purposes of this manual the term “structural slab” includes all PCC wearing surfaces on structures and approach slabs, inclusive of Precast Structures.
1. **Structural Slab Sample Locations**

   a. The Engineer will divide the structural slab(s) within the sampling limits into approximately equal lots as close as possible to 150 square yards in area. Establish the lots to follow the procession of the placement operation. Number the lots in consecutive order. Considering placement operations instead of travel lanes may be necessary in some instances (i.e. phased placements with multiple travel lanes paved in two passes).

   b. A minimum of two lots will be required within the sampling limits.

   c. For each lot, the Contractor shall choose to have one sample taken at the lot’s quarter, mid, three-quarter or end point. In addition the Contractor may select one extra sample location per contract.

   d. The Regional Materials Engineer may designate additional sample locations, to evaluate areas that are not represented by samples located according to the above method.

   e. The Engineer will mark all sample locations at the longitudinal locations designated by the Contractor and Regional Materials Engineer. When the placement under evaluation consists of an odd number of adjacent lanes which were placed simultaneously, the core locations will be marked in the center of the center-most lane between wheelpaths of that lane. When the placement under evaluation consists of an even number of adjacent lanes which were placed simultaneously, the cores will be marked at the boundary between the two center-most lanes. See Figure 1 below.

![Diagram of core locations and pour direction](image)
2. **Structural Slab Sample Testing**

The Materials Bureau will test the structural slab samples for friction aggregate content using an appropriate method(s) included or referenced in this Method. After testing has been completed, the Contractor will be provided the opportunity to review the PCC cores and test results for informational purposes.

F. **DETERMINING ACCEPTANCE OR REJECTION OF SURFACE COURSE AREAS**

The Regional Materials Engineer will identify areas of surface course to be accepted according to the following criteria. The Department will give precedence to test results from surface course samples when making acceptance decisions.

1. **Acceptance Based on Evaluation of Pavement or Structural Slab Samples**

   Surface course areas that meet all of the following criteria will be accepted.
   - Between locations of passing samples, or between the location of a passing sample and the limits of the surface course material under evaluation;
   - From which at least one other passing sample was obtained;
   - From which no failing samples were obtained.

   All other surface course areas will be rejected.

2. **Acceptance Based on Results from Other Types of Samples**

   All surface course areas represented by failing samples, as described in Section V. C. – SURFACE COURSE SAMPLING LIMITS, as appropriate, will be rejected.

   All other surface course areas will be accepted.

G. **SURFACE COURSE REMEDIATION**

It is the Contractor’s responsibility to remediate all rejected surface course areas, as identified in Section V. H. - **DETERMINING ACCEPTANCE OR REJECTION OF SURFACE COURSE AREAS**, to meet the Department specifications. Remediation shall be at the Contractor’s expense and completed to the satisfaction of the Engineer before the Department will accept the surface course.

VI. **PREPARING SAMPLES FOR TESTING**

A. **PREPARING AGGREGATE SAMPLES**

*Note:* Chemical extraction or asphalt ignition may be used to recover aggregate from HMA mixture samples for testing.

*Note:* Washing and acid rinsing may be used to recover aggregate from fresh PCC samples.

Dry the sample to a constant mass, and then determine the mass to the nearest 0.1 g. Separate the sample into the size fractions given in Table 7 - Required Test Specimens.
Determine the percent retained on each sieve. Reduce the material in each size fraction to meet the test sample size requirements given in Table 7. The test specimen sizes given in Table 7 are approximated based on the typical mass of aggregate particles in each size fraction. For a test to be valid a minimum of 150 particles are needed for noncarbonate content determination and 100 particles are needed for A.I.R. content determination. Rinse each specimen with tap water to remove any dust or coatings before beginning identification testing.

The size fractions for testing HMA mixtures given in Table 7 were established to evaluate mixtures against the friction aggregate specification requirements. These requirements were developed assuming that mixture gradations do not deviate from the JMF control points. However, during production the mixture gradation can deviate from the JMF target by up to 5%. This can cause the assumed top size fraction to make up less than 10% of the total aggregate (as little as 5%). When this occurs with a 1/2” nominal maximum size mixture, retrieving a testable specimen of the top size fraction from the standard pavement sample size is not possible (two 6” pavement samples). When evaluating pavement samples of 12.5 mixtures, if the -3/4”, +3/8” size fraction makes up less than 10% of the total aggregate, the noncarbonate content requirement specified for that size fraction will instead be applied to the -3/4”, +1/4” size fraction. This only affects 12.5 mixtures being evaluated for noncarbonate content.

Note: When separating samples into the size fractions shown in Table 7, more material will be retained on the 1/8” sieve than on the top size sieve. Reducing the sample to a size such that the mass of material retained on the top size sieve will be the proper size for testing is advantageous. By doing this only the material retained on the 1/8” sieve will need to be reduced further.

<table>
<thead>
<tr>
<th>Subtable</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>7a</td>
<td>Quality Control Test Specimens for HMA Plants</td>
</tr>
<tr>
<td>7b</td>
<td>Quality Control Test Specimens for PCC Plants</td>
</tr>
<tr>
<td>7c</td>
<td>Quality Control Test Specimens for Aggregate Sources</td>
</tr>
<tr>
<td>7d</td>
<td>Quality Assurance Test Specimens for HMA Plants</td>
</tr>
<tr>
<td>7e</td>
<td>Quality Assurance Test Specimens for PCC Plants</td>
</tr>
</tbody>
</table>

Table 7 – Required Test Specimens
### Table 7a – Quality Control Test Specimens for HMA Plants

<table>
<thead>
<tr>
<th>Aggregate Type</th>
<th>Testing Organization</th>
<th>Mix Sample Type(1)</th>
<th>Required Sizes (in)</th>
<th>Specimen Size(2)</th>
<th>Required Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncarbonate Blends – Plant Blended or Containing RAP</td>
<td>HMA Producer</td>
<td>12.5 Composite</td>
<td>-3/4 +3/8</td>
<td>300 g(3)</td>
<td>Percent Noncarbonate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1 Hot Bin</td>
<td>-3/8 +1/8</td>
<td>150 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.5 Composite or Hot Bin(4)(5)</td>
<td>-3/4 +No.4</td>
<td>150 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1A Hot Bin</td>
<td>-No.4 +1/8</td>
<td>50 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.3 Composite</td>
<td>-3/8 +No.4</td>
<td>150 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1A Hot Bin</td>
<td>-No.4 +No.8</td>
<td>50 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fines Hot Bin</td>
<td>-No.4 +No.8</td>
<td>50 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High-residue and Cherty Carbonates – Naturally Occurring, Plant Blended or Containing RAP</td>
<td>12.5 Composite</td>
<td>-3/4 +1/8</td>
<td>250 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1 Hot Bin</td>
<td>-3/8 +1/8</td>
<td>200 g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.5 Composite or Hot Bin(4)(5)</td>
<td>-3/4 +1/8</td>
<td>50 g(6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.3 Composite or Hot Bin(4)(5)</td>
<td>-3/8 +No.8</td>
<td>50 g</td>
<td></td>
</tr>
</tbody>
</table>

See page 21 for notes.

### Table 7b – Quality Control Test Specimens for PCC Plants

<table>
<thead>
<tr>
<th>Aggregate Type</th>
<th>Testing Organization</th>
<th>Mix Size and Sample Type</th>
<th>Required Sizes (in)</th>
<th>Specimen Size(2)</th>
<th>Required Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncarbonate Blends – Plant Blended</td>
<td>PCC Producer</td>
<td>C.A. 2 Composite</td>
<td>-1 1/2 +1/2</td>
<td>1200 g(7)</td>
<td>Percent Noncarbonate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C.A. 2 / No. 2 Bin(s) or Stockpile(s)</td>
<td>-1 -1/2 +1/4</td>
<td>1200 g(7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1 Bin(s) or Stockpile(s)</td>
<td>-1 -1/2 +1/4</td>
<td>300 g(7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C.A. 1 Composite, Bin(s) or Stockpile(s)</td>
<td>-1 +1/4</td>
<td>300 g(7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All PCC Sand Bin(s) or Stockpile(s)</td>
<td>-3/8 +No.30</td>
<td>50 g(8)</td>
<td></td>
</tr>
</tbody>
</table>

High-residue and Cherty Carbonates – Naturally Occurring, Plant Blended(8) | PCC Producer | C.A. 2 Composite | -1 1/2 +1/4 | 800 g(10) | Percent Acid-insoluble(12) |
| | | C.A. 2 / No. 2 Bin(s) | -1 -1/2 +1/4 | 800 g(10) |
| | | No. 1 Bin(s) | -1 +1/4 | 200 g |
| | | C.A. 1 Composite or Bin(s) | -1 +1/4 | 200 g |
| | | All PCC Sand Bin(s) or Stockpile(s) | -3/8 +No.30 | 50 g |

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### Table 7c – Quality Control Test Specimens for Aggregate Sources

<table>
<thead>
<tr>
<th>Aggregate Type</th>
<th>Mix Size and Sample Type</th>
<th>Required Sizes (in)</th>
<th>Specimen Size</th>
<th>Required Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncarbonate Blends – Gravel, Quarry Blended, or All Others</td>
<td>HMA</td>
<td>All</td>
<td>-3/4, -3/8, -3/8</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1 Stockpile</td>
<td>+1/8</td>
<td>150 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1A Stockpile</td>
<td>+1/8, +No.4</td>
<td>150 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1B Stockpile</td>
<td>+1/8, +No.4, +No.8</td>
<td>150 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Noncarbonate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-residue and Cherty Carbonates – Naturally Occurring, Quarry Blended, or All Others</td>
<td>HMA</td>
<td>All</td>
<td>-3/4, -3/8, -1/8</td>
<td>200 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1 Stockpile</td>
<td>+1/8</td>
<td>50 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 1A Stockpile</td>
<td>+1/8</td>
<td>50 g</td>
</tr>
<tr>
<td>C. A. 2</td>
<td>PCC</td>
<td>C. A. 2 / No. 2 Stockpile</td>
<td>-1/2, -1/2, -1</td>
<td>1200 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. A. 1 / No. 1 Stockpile</td>
<td>+1/2, +1/4</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+1/4</td>
<td>150 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. A. 1 / No. 1 Stockpile</td>
<td>+1/2, +1/4</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCC Sand Stockpile</td>
<td>+1/4</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+No.30, +No.200</td>
<td>50 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 g</td>
</tr>
<tr>
<td>High-residue and Cherty Carbonates – Naturally Occurring, Quarry Blended, or All Others</td>
<td>PCC</td>
<td>All</td>
<td>-1/2, -1/2, -1</td>
<td>800 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. A. 2 / No. 2 Stockpile</td>
<td>+1/4</td>
<td>200 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C. A. 1 / No. 1 Stockpile</td>
<td>+1/4</td>
<td>200 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PCC Sand Stockpile</td>
<td>+No.30, +No.200</td>
<td>50 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50 g</td>
</tr>
</tbody>
</table>

See page 21 for notes.
Table 7d – Quality Assurance Test Specimens for HMA Plants

<table>
<thead>
<tr>
<th>Aggregate Type</th>
<th>Testing Organization</th>
<th>Mix and Sample Type(1)</th>
<th>Required Sizes (in)</th>
<th>Specimen Size(2)</th>
<th>Required Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncarbonate Blends – Plant Blended or Containing RAP</td>
<td>NYSDOT</td>
<td>12.5 Composite</td>
<td>-3/4</td>
<td>+3/8</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.5 Composite</td>
<td>-3/4</td>
<td>+3/8</td>
<td>300 g</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>-3/8</td>
<td>+1/8</td>
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<tr>
<td></td>
<td></td>
<td>No. 1A Hot Bin</td>
<td>-3/8</td>
<td>+1/8</td>
<td>50 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.5 Composite or Hot Bin(4)(5)</td>
<td>-3/4</td>
<td>+No.4</td>
<td>150 g</td>
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<td></td>
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<td>6.3 Composite</td>
<td>-3/4</td>
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<td></td>
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<td>+No.4</td>
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<tr>
<td></td>
<td></td>
<td>No. 1A Hot Bin</td>
<td>-3/4</td>
<td>+No.8</td>
<td>50 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fines Hot Bin</td>
<td>-No.4</td>
<td>+No.8</td>
<td>50 g</td>
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<td>High-residue and Cherty Carbonates – Naturally Occurring, Plant Blended or Containing RAP</td>
<td>NYSDOT</td>
<td>12.5 Composite</td>
<td>-3/4</td>
<td>+1/8</td>
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<td></td>
<td>12.5 Composite</td>
<td>-3/4</td>
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<td></td>
<td></td>
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<td>-3/8</td>
<td>+1/8</td>
<td>50 g</td>
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<td></td>
<td></td>
<td>No. 1A Hot Bin</td>
<td>-3/8</td>
<td>+1/8</td>
<td>50 g</td>
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<td></td>
<td></td>
<td>9.5 Composite or Hot Bin(4)(5)</td>
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<td>+1/8</td>
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<td></td>
<td>6.3 Composite or Hot Bin(4)(5)</td>
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<td>50 g</td>
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See page 21 for notes.
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<tr>
<th>Aggregate Type</th>
<th>Testing Organization</th>
<th>Mix Size and Sample Type</th>
<th>Required Sizes (in)</th>
<th>Specimen Size (g)</th>
<th>Required Test</th>
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<td>Noncarbonate Blends – Plant Blended</td>
<td>NYSDOT</td>
<td>C.A. 2 Composite</td>
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<td>Percent Noncarbonate</td>
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<td>C. A. 2 / No. 2 Bin(s) or Stockpile(s)</td>
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<td></td>
<td></td>
<td>No. 1 Bin(s) or Stockpile(s)</td>
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<td>300 g 150 g</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>C. A. 1 / No. 1 Composite, Bin(s) or Stockpile(s)</td>
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<td>300 g</td>
<td></td>
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<td></td>
<td></td>
<td>All PCC Sand Bin(s) or Stockpile(s)</td>
<td>-3/8 No. 30 +No. 30 +No. 200</td>
<td>50 g 50 g</td>
<td>Percent Acid-insoluble</td>
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<th>High-residue and Cherty Carbonates – Naturally Occurring or Plant Blended(8)</th>
<th>NYSDOT</th>
<th>C.A. 2 Composite</th>
<th>-1 1/2 +1/4</th>
<th>800 g(10)</th>
<th>Percent Acid-insoluble(12)</th>
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</thead>
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<td></td>
<td>C. A. 2 / No. 2 Bin(s)</td>
<td>-1 1/2 +1/4</td>
<td>800 g(10)</td>
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<td></td>
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<tr>
<td></td>
<td>No. 1 Bin(s)</td>
<td>-1 +1/4</td>
<td>200 g</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>C. A. 1 Composite or Bin(s)</td>
<td>-1 +1/4</td>
<td>200 g</td>
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<td></td>
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<tr>
<td></td>
<td>All PCC Sand Bins(s) or Stockpile(s)</td>
<td>-3/8 No. 30 +No. 30 +No. 200</td>
<td>50 g 50 g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7a to 7e - Notes

1. For Type A PPST use appropriate requirements for 6.3 HMA. For Type B PPST use appropriate requirements for 9.5 HMA. For Type C PPST use appropriate requirements for 12.5 HMA.
2. All Sample sizes are approximate, based on a sample size of 150 particles for percent noncarbonate determination, and 100 particles for percent acid insoluble residue determination.
3. When evaluating pavement samples of a 12.5 mixture that contains less than 10% -3/4" +3/8" material the specimen size for the -3/4" +1/4" size fraction will be 250 g.
4. See Table 2 for appropriate sample types.
5. When testing hot bin samples of 6.3 or 9.5 mixes, test separate specimens for each size fraction listed and each hot bin sampled.
6. Due to the wide variation of particle sizes in this size fraction when the mixture includes No. 1 stone, this sample size should be verified to ensure that at least 150 particles are provided for testing.
7. Specimen Sizes for 6.3 Superpave, and Type A PPST. See Appendix B for Preventive Maintenance Slurry.
8. Including stockpile blending performed by the PCC Producer.
9. Only required if plant is blending fines. Also see note 5.
10. May be split to a 200 g specimen, if particles are reduced in size to minus 1/2" prior to immersion.
11. Friction testing requirements may be modified with the approval of the Department. Friction testing details, including frequency, appear in the Operations Plan in the Geological Source Report.
12. For cherty carbonates, percent noncarbonate testing may be used as a surrogate for acid insoluble residue (AIR) testing. However, because the friction specification for carbonates is based on AIR testing, action may be taken only on the basis of the results of AIR testing.
B. PREPARING HARDENED PCC SAMPLES

Note: Minimum disk thickness may be modified (based on maximum particle size of the aggregate) by the Director, Material Bureau.

1. C.A. 1 Mixtures.

Refer to Figure 2 – Preparing Hardened PCC samples (C.A. 1). Saw cut the cylinder parallel to its base to create four disks per sample. The middle two disks must each be at least 5/8" tall. Use both faces of the second disk and the bottom face of the third disk for testing. The top and bottom disks may be discarded. If necessary polish the test faces according to ASTM C457 using silicon-carbide or diamond abrasive.

![Diagram of disk preparation](image)

Figure 2 – Preparing Hardened PCC Samples (C.A. 1)
2. C.A. 2 Mixtures.

Refer to Figure 3 – Preparing Hardened PCC samples (C.A. 2). Sawcut the cylinder parallel to its base to create five discs per sample. The middle three discs must each be at least 2” tall. Depths may vary to avoid reinforcing steel. Use the faces of the second and fourth discs for testing. Discs 1, 3, and 5 may be discarded. If the core height is less than 7” an additional core may be needed at each location. If necessary, polish the test faces according to ASTM C457 using silicon-carbide or diamond abrasive.

Figure 3 – Preparing Hardened PCC Samples (C.A. 2)
VII. TEST PROCEDURES FOR IDENTIFYING AGGREGATE TYPES

A. REFERENCE SAMPLES

Reference samples are essential for performing an accurate analysis. Persons making friction aggregate identifications must first become thoroughly familiar with the physical characteristics of all aggregates being used. These physical characteristics should include, but are not limited to:

- Color (both wet and dry)
- Shape (rounded, angular, flat, etc.)
- Texture (grain or crystal sizes, smooth or gritty)
- Reaction with hydrochloric acid (dilute 10% and concentrated) (Section VII.C.)
- Copper nitrate staining (Section VII. D.)
- Individual characteristics of note (fossils, laminations, color banding, etc.)
- Rock Type (ASTM C 294 and C 295)

These characteristics are recognized as identifiers, useful in accurately determining the identity of blend components. Component aggregates, such as gravels or manufactured blends, may contain several different aggregate types. Recognition of these characteristics is needed to distinguish blend components.

Obtain reference samples of each blend component from uncontaminated stockpiles, preferably at the source from which the material was produced. Prepare the samples as described in Section VI. – PREPARING SAMPLES FOR TESTING.

Questions, concerning the source of certain particles found in a blend sample that cannot be resolved by consulting reference samples, if those particles are plentiful enough to significantly affect the outcome of a test should be referred to a qualified geologist.

B. VISUAL ANALYSIS

Visual analysis should be the first method employed in identifying aggregate types. Not all aggregate types can be identified by visual analysis. However, visual analysis can be an efficient means of separating the aggregate types in a blend into groups to be tested by other methods.

1. After becoming familiar with the reference sample of each component of the blend, separate the particles into piles representing each blend component.

2. Identify particles that require further testing to determine their identity/source: physical, chemical (hydrochloric acid reaction), or stain (copper nitrate).

Note: A petrographic microscope or other magnifier can be used as an aid for visual analysis.
C. REACTION TO HYDROCHLORIC ACID

Hydrochloric acid (HCL in aqueous solution) reacts with carbonate minerals to release carbon dioxide gas. The vigorous reaction is called effervescence and indicates that the reaction is taking place.

The main constituent of carbonate aggregates is calcium carbonate or a mixture of calcium and magnesium carbonate. Calcium carbonate reacts very vigorously with dilute hydrochloric acid and magnesium carbonate reacts only weakly with concentrated acid. Limestone is impure calcium carbonate (mineral calcite) that may contain some magnesium carbonate. It will react vigorously with dilute hydrochloric acid. Dolomite is impure calcium and magnesium carbonate (mineral dolomite) that averages a one to one ratio of calcium to magnesium. It will react slowly with concentrated acid. Sometimes dolomite must be powdered (by scratching with a knife), to increase the surface area available to react, to obtain noticeable reaction. This difference in reaction to acid is a rapid method for distinguishing between limestone and dolomite.

1. Test Solutions
   - Hydrochloric acid (HCl), 33-37% concentrate.
   - Hydrochloric acid (HCl), 10% dilute: dilute 227 ml of 33 - 37% HCl with 773 ml of distilled water.

2. Procedure and Identification
   a. Apply a small quantity of dilute HCl to the surface of a particle suspected of being a carbonate. If the particle reacts vigorously, it is likely limestone. If the particle reacts weakly, or not at all, go on to b.
   b. Apply a small quantity of concentrated HCl to the surface of the particle found not to be limestone. If a reaction occurs with the acid, it is likely a dolomite; if no reaction occurs, go on to c.
   c. Scratch the surface of the particle with a steel blade so that a small quantity of the particle is powdered. Apply a small quantity of concentrated HCl to the powdered material. If a reaction occurs, the particle is likely a dolomite. If no reaction occurs, it is likely a noncarbonate particle.

Note: Aggregate that has been through the copper nitrate staining method may require more than one drop of HCL to check for reaction.

Note: Some sandstone, siltstone, and mudstone, is composed of silica grains cemented with a carbonate (lime). This cement will react with acid. An insoluble residue content determination will resolve this identification (See Section VIII. - DETERMINATION OF PERCENT ACID-INSOLUBLE RESIDUE).
D. Copper Nitrate Staining

Copper nitrate (cupric nitrate) will attach itself to calcium carbonate, staining the surface blue. This color is affixed and intensified by the application of ammonium hydroxide solution.

Limestone will take an intense blue stain, because it contains a high proportion of calcium carbonate. Limestone that contains a high proportion of impurities (siliceous or argillaceous limestone) or contains a significant amount of magnesium carbonate (dolomitic limestone), may stain a pale blue or not stain at all. Dolomite will generally take a weak blue-green stain or none at all.

Some aggregates contain lime cement (see Note in Section VII. C. 2. - Procedure and Identification) and the cement will stain. Chert derived from carbonate aggregates may retain some carbonate matrix that will stain. If the majority of the particle is carbonate, the whole particle is considered carbonate.

1. Test Solutions
   - Cupric nitrate solution is made by dissolving cupric nitrate \((\text{Cu (NO}_3\text{)_2} \cdot 2 \frac{1}{2} (\text{H}_2\text{O}))\) in distilled water in sufficient quantity so the solution has a specific gravity of 1.160 ± 0.005.
   - Ammonium hydroxide \((\text{NH}_4\text{OH})\) concentrated.
   - Ammonium hydroxide \((\text{NH}_4\text{OH}) \cdot \text{H}_2\text{O}\) diluted. Because a wide range of ammonium hydroxide concentrations will produce the desired effect, no particular concentration is specified.

2. Procedure
   a. Place the sample in a glass or polyethylene beaker and completely cover with copper nitrate solution.

      **Note:** Some gravel particles may have coatings or weathered surfaces that will prevent the copper nitrate from staining the aggregate. A quick rinse (10 seconds or less) with a 10% HCL solution immediately followed by rinsing in tap water will help to expose fresh surfaces for staining.

   b. Place the beaker on a hot plate or in an oven at 140°F for approximately ½ hour or let the beaker remain at room temperature for 16 hours.

      **Note:** Extended periods of exposure to cupric nitrate may intensify the stain color on some aggregates, but care must be taken in interpreting the results after extended staining times.

   c. Decant the cupric nitrate solution.

      **Note:** The cupric nitrate solution can be filtered and reused, after the specific gravity is adjusted by adding fresh solution.

   d. Wash the sample thoroughly with water.
e. Cover the sample with dilute ammonium hydroxide. Allow the sample to be completely immersed for at least 10 seconds. In practice, ammonium hydroxide is used in any concentration that produces a marked enhancement of the blue color. If the concentration is too high, the blue color will be stripped from the carbonate particles; if too low, the color will not be enhanced.

f. Decant the ammonium hydroxide and carefully wash the sample with potable water.

Note: The ammonium hydroxide may be reused so long as it has a noticeable odor. Fresh ammonium hydroxide can be added to the solution to increase the concentration.

g. Dry the sample to a constant mass.

3. **Identification**

Limestone is stained blue and dolomitic limestone or siliceous limestone is stained pale blue. Dolomite, siliceous or argillaceous limestone and noncarbonate aggregates, such as chert or sandstone, may be stained slightly or not at all. Their identity must be confirmed independently using reaction with hydrochloric acid (Section VII. C. - REACTION TO HYDROCHLORIC ACID).

VIII. **DETERMINATION OF PERCENT ACID-INSOLUBLE RESIDUE**

A. **OVERVIEW**

This test method describes the procedure to determine the percentage of insoluble residue in carbonate aggregates containing sand-sized silica, siliceous particles, and chert using hydrochloric acid to react the carbonate materials. This method may be used to determine compliance with friction aggregate specifications or as an aid to the identification and characterization of aggregate materials. Both fine and coarse aggregates are covered in this method.

B. **SOLUTIONS**

- Hydrochloric Acid (HCL), 33-37% concentrate
- Hydrochloric Acid (HCL), 10% dilute (The 10% solution can be made by diluting 227 ml of 33-37% HCL with 773 ml of distilled water.)

C. **SAMPLE SIZES**

As required in Table 7 - Required Test Specimens

D. **SAMPLE PREPARATION**

1. Sieve the sample into the appropriate size fractions, as listed in Table 7.
2. Reduce each size fraction to the appropriate size, as listed in Table 7.
3. When testing is for quality control or quality assurance purposes, remove any materials not specified in the mix design for that size. Oversized or undersized material of a different type than the aggregate being tested and materials that have been identified as deleterious (Standard Specifications, Section 703, Table 703-3 Physical Requirements - Deleterious Materials) must be excluded.

4. Thoroughly clean the sample with potable tap water. Dry the sample to a constant mass.

   **Note:** When evaluating aggregates samples from pavement cores any oversized sand particles are included as part of the sample.

**E. Test Procedure**

1. Determine and record the sample’s mass to the nearest 0.1 g. If the tester wishes to reduce the particle size prior to immersion, follow the procedure below:
   - First crush the sample to reduce particle size.
   - Thoroughly clean the sample with potable tap water. Dry the sample to a constant mass.
   - Reduce the sample size to an appropriate mass to provide at least 100 particles of the reduced size.
   - Finally, determine the new reduced-particle-size sample’s mass to the nearest 0.1 g.

2. Place the sample in a beaker and immerse the sample with the 10% HCL solution. Periodically add more solution as needed to increase the rate of reaction.

   **Note:** If the sample is in danger of overflowing the container, add small amounts of water with a wash bottle until the reaction slows.

3. When the addition of solution no longer increases the rate of reaction, slowly add a small amount of the concentrated HCL. Periodically add more concentrated HCL as needed to increase the rate of reaction.

4. When the addition of concentrated HCL does not increase the rate of reaction, place the sample on the hot plate at a low heat. Do not boil the sample.

5. Decant and add fresh concentrated HCL solution periodically until there is no further reaction. The most common source of error in running this test is not letting the reaction go to completion. When all bubbling has ceased and the solution is not cloudy, the reaction should be complete. This can be checked by removing a particle that has retained its shape, carefully breaking it open, and placing a drop of concentrated acid on its center. If there is any bubbling, the reaction is not complete (return this particle to the beaker).

6. Determine and record the mass of a No. 200 sieve and screen.

7. Decant the acid and transfer the residue to the sieve.

8. Wash the residue thoroughly.
9. Dry the residue to a constant mass. If yellow staining appears on the residue during the drying process, the residue requires further rinsing.

10. Determine the mass of the sieve, screen, and residue.

11. Subtract the previously recorded mass of the sieve and screen. This is the mass of the residue.

F. Calculations

Calculate the percent acid-insoluble residue (AIR) using the following equation. Round all results according to Appendix C.

\[
\% \text{AIR} = \frac{\text{mass of insoluble residue}}{\text{original mass of sample}} \times 100
\]

G. Report

Form BR 54 can be used to report all measurements and results. Report the percent AIR to the nearest 0.1 percent.

IX. Calculating Percent Noncarbonate Particles of HMA Mixtures

Use the appropriate form, to record the noncarbonate calculations. Form BR 330 is the standard form and is used for most calculations. Other forms exist for specialized cases. Each calculation section references the appropriate calculation form. For a complete list of forms, see Appendix F. Sample calculations are provided in Appendix D and corresponding example forms are provided in Appendix E.

If uncrushed oversized sand particles are found, the Regional Materials Engineer will assess the effect of those particles on the quality of the HMA mixture. Note the amount of oversized sand on the appropriate form.

Round all results according to Appendix C.

Note: When the specific gravity of the carbonate particles (SG_{cp}) is substantially different from that of the noncarbonate particles (SG_{ncp}), multiply the percent noncarbonate (%NC) by a specific gravity adjustment factor (SG_{cp}/SG_{ncp}) to obtain a corrected result. Usually, this is not a concern. The Materials Bureau will issue notification, if this is required.

A. Hot Bin Samples (HMA Batch Plants)

When determining the percent noncarbonate content of the aggregate using hot bin samples, the target batch masses are used to calculate the batch percentage for each
bin. Target batch masses can be obtained from the automation recordation for the time of sampling.

\[ \% B_{ybin} = \left( \frac{W_{ybin}}{W_T} \right) \times 100 \]

where:
- \( \% B_{ybin} \) = The batching percentage for bin y (e.g., 1 bin or 1A bin).
- \( W_{ybin} \) = The target batch mass for bin y.
- \( W_T \) = The sum of all aggregate target batch masses used to produce the mixture.

1. **12.5 Mixtures**

See Table 2 - Quality Control Samples, or Table 4 – HMA Quality Assurance Sample Sizes to determine the appropriate sample type. Use form BR 330 for all calculations.

**a.** Separate the No. 1 bin sample on the 3/8" and 1/8" sieves, and separate the No. 1A bin sample on the 1/8" sieve. Determine the percent retained on each sieve using equation 2.

\[ \% R_{x\_ybin} = \left( \frac{W_{x\_ybin}}{W_{o\_ybin}} \right) \times 100 \]

where:
- \( \% R_{x\_ybin} \) = percent of sample from bin y retained on sieve x.
- \( W_{x\_ybin} \) = mass of material from bin y sample retained on sieve x.
- \( W_{o\_ybin} \) = mass of total sample from bin y.

*Note: If the mass of the material retained on one or both sieves \( W_x \) is too large to run a practical separation, reduce the material \( W_x \) to a testable sample size \( W_{xs} \) as described in Section VI. A. – PREPARING AGGREGATE SAMPLES (Table 7).*

**b.** Determine the percent noncarbonate for each size fraction using equation 3.

\[ \% NC_{x\_ybin} = \left( \frac{W_{NC}}{W_{XS}} \right) \times 100 \]

where:
- \( \% NC_{x\_ybin} \) = noncarbonate content of size fraction x from bin y sample.
- \( W_{XS} \) = mass of split sample of material (reduced from \( W_x \)).
- \( W_{NC} \) = mass of noncarbonate particles retained on sieve x.
Note: If the mass of material retained on sieve x (Wx) is appropriate for running the identification test(s), and no reduction in sample size is necessary, then Wx = Wx.

c. Determine the noncarbonate content for each size fraction as a percent of the total aggregate, using equations 4 and 5.

equation 4 \[ \% \text{NC}_{\text{total}} = \frac{\% R}{100} + \frac{\% \text{NC}}{100} + \frac{\% B_{\text{thin}}}{100} \]

equation 5 \[ \% \text{NC}_{\text{total}} = \left( \frac{\% R_{\text{1A bin}}}{100} + \frac{\% \text{NC}_{\text{1A bin}}}{100} + \frac{\% B_{\text{1A bin}}}{100} \right) \times 100 \]

where:
\%NC_{3/8\text{total}} = noncarbonate content retained on the 3/8" sieve as a percent of the total aggregate.
\%NC_{1/8\text{total}} = noncarbonate content retained on the 1/8" sieve as a percent of the total aggregate.

d. Determine the percent noncarbonate larger than 1/8" as a percentage of the total aggregate using equation 6.

equation 6 \[ \% \text{NC}_{\text{TOTAL}} = \% \text{NC}_{\text{total}} - \% \text{NC}_{\text{total}} \]

where:
\%NC_{\text{TOTAL}} = noncarbonate content expressed as a percent of total aggregate.

e. Record all measurements and calculations on form BR 330.

2. 9.5 Mixtures Batched using Coarse Aggregate Only from the No. 1A Hot Bin

See Table 2 - Quality Control Samples, or Table 4 – HMA Quality Assurance Sample Sizes to determine the appropriate sample type. This is the most common type of calculation for 9.5 mixtures produced at batch plants. Use form BR 330 for all calculations.

a. Separate the Sample on the No.4 and 1/8" sieves, and determine the percent retained on each sieve using equation 2.

b. Determine the percent noncarbonate content of both size fractions using equation 3.

c. Determine the total noncarbonate content of the total aggregate using equation 7.
equation 7

\[
\% NC_{TOTAL} = \left[ \left( \frac{\% R_{No.4}}{100} \right) + \left( \frac{\% NC_{No.4}}{100} \right) + \left( \frac{\% B_{1A\text{bin}}}{100} \right) \right] \times 100
\]

d. Record all measurements and calculations on form BR 330.

3. 9.5 Mixtures Batched Using Coarse Aggregate from the No. 1 and No. 1A Hot Bins with No Cold Feed of No. 1 Stone.

See Table 2 - Quality Control Samples, or Table 4 - HMA Quality Assurance Sample Sizes to determine the appropriate sample type.

If the 9.5 mixture contains material from the No. 1 size hot bin, form BR 330 and equation 7 cannot be used. Since both the No. 1 and No. 1A size hot bins contribute material retained on the No.4 sieve, the noncarbonate content of that size fraction must be determined for each hot bin sample, and weighted average used to determine the noncarbonate content retained on the No.4 sieve as a percentage of the total aggregate. To do this, both No.1 and No.1A hot bin samples must be separated into the size fractions -3/4", +No.4 and -No.4, +1/8", resulting in up to four noncarbonate content determinations per hot bin analysis. Use form BR 312 M to record the calculations.

a. Separate each hot bin sample on the No.4 and 1/8" sieves, and determine the percent retained on each sieve using equation 2.

b. Determine the percent noncarbonate content of each size fraction using equation 3.

c. Determine the percent noncarbonate for aggregate larger than No.4 sieve using equations 8, 9 and 10.

\[
\text{equation 8}
\]

\[
P_{No.4} = \left\{ \left( \frac{\% R_{No.4\_\text{Abin}}}{100} \right) + \left( \frac{\% B_{1\text{Abin}}}{100} \right) \right\}
\]

\[
\text{equation 9}
\]

\[
P_{NC_{No.4\_\text{Abin}}} = \left\{ \left( \frac{\% R_{No.4\_\text{Abin}}}{100} \right) \left( \frac{\% NC_{No.4\_\text{Abin}}}{100} \right) + \left( \frac{\% B_{1\text{Abin}}}{100} \right) \right\}
\]
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*equation 10* \( \% \text{NC}_{\text{No.4, total}} = \frac{P_{\text{NC,No.4}}}{P_{\text{No.4}}} \times 100 \)

where:
\[ P_{\text{No.4}} = \text{Portion of aggregate that is larger than No.4 sieve.} \]
\[ P_{\text{NC,No.4}} = \text{Portion of aggregate that is noncarbonate, and larger than No.4 sieve.} \]
\[ \%\text{NC}_{\text{No.4, total}} = \text{noncarbonate content retained on the No.4 sieve as a percent of the total aggregate.} \]

d. Determine the percent noncarbonate of the total aggregate using equations 11, 12 and 13.

*equation 11* \[ \%\text{NC}_{\text{No.4}} = \left( \frac{\% \text{R}_{\text{No.4,A,bin}} \times \% \text{NC}_{\text{No.4,A,bin}} \times \% \text{B}_{\text{A,bin}}}{100} \right) \times 100 \]

*equation 12* \[ \% \text{NC} = \left( \frac{\% \text{R}_{\text{No.1, A, bin}} \times \% \text{NC}_{\text{No.1, A, bin}} \times \% \text{B}_{\text{A, bin}}}{100} \right) \times 100 \]

*equation 13* \[ \% \text{NC}_{\text{TOTAL}} = \% \text{NC}_{\text{No.4}} - \% \text{NC} \%

e. Record all measurements and calculations on form BR 312.

4. 9.5 Mixtures Batched Using Coarse Aggregate from the No. 1A and No. 1 Hot Bins, But Evaluated Using only the No. 1A Hot Bin.

See Table 2 - Quality Control Samples, or Table 4 – HMA Quality Assurance Sample Sizes to determine the appropriate sample type. This method may only be used with the Regional Materials Engineer’s approval.

When producing 9.5 mixtures with coarse aggregate from the No. 1 size hot bin, the calculation of noncarbonate content can, in some cases, be simplified from the preceding procedure. If the aggregate in the No. 1A size hot bin contains enough noncarbonate material to satisfy all specification requirements when the aggregate in the No.1 size hot bin is assumed to be 100% carbonate, a sample can be taken from the No. 1A size hot bin only. The \%\text{NC}_{\text{No.4, total}} and \%\text{NC}_{\text{TOTAL}} can be then conservatively estimated from equations 14 and 7 respectively.

The BR 330 form can be used for this calculation method, but the estimate for \%\text{NC}_{\text{No.4, total}} will not be located in the top box of the column labeled Nₓ in the upper
calculation table (the box marked with double lines). Instead the estimate for \( \%NC_{\text{No.4, total}} \) will be found in the lower calculation table in the column labeled +No.4.

**a.** Separate the Sample on the No.4 and 1/8" sieves, and determine the percent retained on each sieve using equation 2.

**b.** Determine the percent noncarbonate content of both size fractions using equation 3.

**c.** Estimate the percent noncarbonate for aggregate larger than No.4 using equation 14.

\[
\text{eq. 14} \quad \% NC_{\text{No.4,total}} = \left( \frac{\% R_{\text{No.4,1Abin}}}{100} \right) \left( \frac{\% NC_{\text{No.4,1Abin}}}{100} \right) \left( \frac{\% B_{1Abin}}{100} \right) \times 100
\]

**d.** Estimate the total noncarbonate content of the total aggregate using equation 7.

**e.** Record all measurements and calculations on form BR 330.

### 5. 6.3 Mixtures

See Table 2 - Quality Control Samples, or Table 4 – HMA Quality Assurance Sample Sizes to determine the appropriate sample type. Use form BR 55 for all calculations.

**a.** Separate the No. 1A bin sample on the No.4 and No.8 sieves, and separate the fines bin sample on the No.8 sieve. Determine the percent retained on each sieve using equation 2.

**Note:** If the mixture contains enough noncarbonate +No.8 material in the 1A bin sample, the fines bin sample need not be tested.

**b.** Determine the percent noncarbonate for each size fraction using equation 3.

**c.** Determine the noncarbonate content for each size fraction as a percent of the total aggregate, using equations 15 and 16.

**Note:** If the fines bin sample is not tested enter zero for \( \%NC_{\text{No.8,Fbin}} \).

\[
\text{equation 15} \quad \% NC_{\text{No.4,total}} = \left( \frac{\% R_{\text{No.4}}}{100} \right) \left( \frac{\% NC_{\text{No.4}}}{100} \right) \left( \frac{\% B_{1Abin}}{100} \right) \times 400
\]
Materials Method 28

\[
\% \text{NC}_{\text{No.8, total}} = \left( \frac{\% R_{\text{No.8, 1bin}}}{100} \times \frac{\% \text{NC}_{\text{No.8, 1bin}}}{100} \times \frac{\% B_{1\text{bin}}}{100} \right) + \left( \frac{\% R_{\text{No.8, Fbin}}}{100} \times \frac{\% \text{NC}_{\text{No.8, Fbin}}}{100} \times \frac{\% B_{\text{Fbin}}}{100} \right)
\]

where:

\[
\% \text{NC}_{\text{No.4, total}} = \text{noncarbonate content retained on the No.4 sieve as a percent of the total aggregate.}
\]

\[
\% \text{NC}_{\text{No.8, total}} = \text{noncarbonate content retained on the No.8 sieve as a percent of the total aggregate.}
\]

d. Determine the percent noncarbonate larger than No.8 sieve as a percentage of the total aggregate using equation 17.

e. Record all measurements and calculations on form BR 55.

B. HMA Composite Samples

See Table 2 - Quality Control Samples, or Table 4 - HMA Quality Assurance Sample Sizes to determine the appropriate sample type.

When evaluating composite aggregate samples from drum plants, the calculation must be adjusted to account for the use of mineral filler. This correction is referred to as \%B on forms BR 55 and BR 330 (see note on forms). This correction is not needed for aggregate samples recovered from composite mixture samples. When using equations 2 or 3 for composite aggregate samples, ignore the term “y” in the variable subscripts that denotes bin size.

Use form BR 330 for calculations with 9.5 and 12.5 mixes. Use form BR 55 for calculations with 6.3 mixes.

1. 12.5 Mixtures

a. Separate the sample on the 3/8” and 1/8” sieves, and determine the percent retained on each sieve, according to equation 2.

b. Determine the percent noncarbonate retained on each sieve using equation 3.
c. Determine the percent noncarbonate in the total mix using equation 18.

\[
\% NC_{TOTAL} = \frac{\% R \times \% NC}{100} + \frac{\% R \times \% NC}{100} + \frac{\% R \times \% NC}{100} \times 100 \% MF
\]

where:
\[\% MF = \text{Target percentage of mineral filler obtained from the automation recordation system for the time of sampling.}\]

\[\text{d. Record all measurements and calculations on form BR 330.}\]

2. 9.5 Mixtures

a. Separate the sample on the No.4 and 1/8" sieves, and determine the percent retained on each sieve, according to equation 2.

b. Determine the percent noncarbonate retained on each sieve using equation 3.

c. Determine the percent noncarbonate in the total mix using equation 19.

\[
\% NC_{TOTAL} = \frac{\% R_{No.4} \times \% NC_{No.4}}{100} + \frac{\% R_{No.8} \times \% NC_{No.8}}{100} \times 100 \% MF
\]

\[\text{d. Record all measurements and calculations on form BR 330.}\]

3. 6.3 Mixtures

a. Separate the sample on the No.4 and No.8 sieves, and determine the percent retained on each sieve, according to equation 2.

b. Determine the percent noncarbonate retained on each sieve using equation 3.

c. Determine the percent noncarbonate in the total mix using equation 20.

\[
\% NC_{TOTAL} = \frac{\% R_{No.4} \times \% NC_{No.4}}{100} + \frac{\% R_{No.8} \times \% NC_{No.8}}{100} \times 100 \% MF
\]

\[\text{d. Record all measurements and calculations on form BR 55.}\]

X. CALCULATING THE PERCENT NONCARBONATE PARTICLES OF PCC MIXTURES

Use form BR 53, Determination of percent noncarbonate particles in PCC aggregate, to record all measurements and calculations (see Appendix D for sample calculations and Appendix E for example forms). Round all results according to Appendix C.

\[\text{Note: When the specific gravity of the carbonate particles (SG_{cp}) is substantially different from that of the noncarbonate particles (SG_{ncp}), multiply the percent noncarbonate (\%NC) by a specific gravity adjustment factor (SG_{cp}/SG_{ncp}) to obtain a corrected}\]
result. Usually, this is not a concern. The Materials Bureau will issue notification, if this is required.

See Table 2 – Quality Control Samples, or Table 5 – PCC Quality Assurance Sample Sizes to determine the appropriate sample type.

**A. AGGREGATE SAMPLES**

1. Calculate the batch percentage for each bin as a percentage of coarse aggregate using the target batch masses. Target Batch masses can be obtained from the automation recordation for the time of sampling. Calculate batch percentages even if sampling from the corresponding stockpiles.

   When testing composite aggregates samples, e.g. samples recovered from fresh PCC mixture, %B is always 100.

   \[
   \%B_{ybin} = \left( \frac{W_{ybin}}{W_T} \right) \times 100
   \]

   where:
   - \%B_{ybin} = The batching percentage for bin y (bin numbers are assigned by the producer).
   - \( W_{ybin} \) = The target batch mass for bin y.
   - \( W_T \) = The sum of all aggregate target batch masses used to produce the mixture.

2. Separate the samples on the appropriate sieves according to Table 7b – Required Test Specimens for PCC Quality Control or Table 7e – Required Test Specimens for PCC Quality Assurance. Use equation 2 to calculate the percent retained on each sieve.

   \[
   \%R_{x, ybin} = \left( \frac{W_{x, ybin}}{W_{o, ybin}} \right) \times 100
   \]

   where:
   - \%R_{x, ybin} = percent of sample from bin y retained on sieve x.
   - \( W_{x, ybin} \) = mass of material from bin y sample retained on sieve x.
   - \( W_{o, ybin} \) = mass of total sample from bin y.
3. Calculate the percentage of total coarse aggregate made up of each size fraction of each bin using the equation 21.

\[
\% P_{x, ybin} = \left( \frac{\% B_{ybin}}{100} - \frac{\% R_{x, ybin}}{100} \right) \times 100
\]

where:
\%
\%P_{x, ybin} = \text{percent of total coarse aggregate made up of material from bin } y \text{ and retained on sieve } x.

4. Use equation 3 to calculate the percent noncarbonate of the each size fraction from each bin or stockpile sample.

\[
\% NC_{x, ybin} = \frac{W_{NC}}{W_{XS}} \times 100
\]

where:
\%
\%NC_{x, ybin} = \text{noncarbonate content of size fraction } x \text{ from bin } y \text{ sample.}
W_{XS} = \text{mass of split sample of material (reduced from } W_x).$
W_{NC} = \text{mass of noncarbonate particles retained on sieve } x.$

\textbf{Note: If the mass of material retained on sieve } x (W_x) \text{ is appropriate for running the identification test(s), and no reduction in sample size is necessary, then } W_{XS} = W_x.$

5. Calculate the percentage of total coarse aggregate that is noncarbonate particles from each size fraction of each bin using equation 22.

\[
\% P_{NCx, ybin} = \left( \frac{P_{x, ybin}}{100} - \frac{\% NC_{x, ybin}}{100} \right) \times 100
\]

where:
\%
\%P_{NCx, ybin} = \text{percent of total coarse aggregate that is noncarbonate particles from bin } y \text{ and retained on sieve } x.$
6. Calculate the total percent noncarbonate each size fraction using equation 23.

\[
\text{eq. 23 } \% NC_{TOTAL,x} = \frac{\% P_{NCx_{bin1}} + \% P_{NCx_{bin2}} + \% P_{NCx_{bin3}} + \% P_{NCx_{bin4}}}{100 + 100 + 100 + 100} \times 100
\]

where:

\[
\% NC_{TOTAL,x} = \text{total percent noncarbonate for material retained on sieve } x, \text{ which is the sum the noncarbonate contents of size fraction } x \text{ from each bin, proportioned according to the batch percentages for each bin.}
\]

B. HARDENED CONCRETE SAMPLES

Identify the exposed plus 1/4” size aggregate particles on each prepared circular face according to the procedures in ASTM C295, Standard Guide for Petrographic Examination of Aggregate for Concrete. Use equation 24 to determine the percent noncarbonate particles in the sample.

\[
\text{equation 24 } \% NC_{TOTAL} = \frac{\text{Number of non-carbonate particles}}{\text{Total number of particles}} \times 100
\]

Note: For hardened concrete samples, compliance with the coarse aggregate specification will be evaluated on particle saw-cut faces 1/4” and larger.

Note: For fine PCC mixtures (having a nominal maximum particle size of 1/4” or less) the minimum aggregate particle size to identify will be determined by Department.
APPENDIX A
EQUIPMENT FOR PERFORMING
AGGREGATE IDENTIFICATION PROCEDURES

I. EQUIPMENT FOR PREPARING SAMPLES

Set of US Standard Sieves conforming to the requirements in ASTM E-11 and AASHTO M 92 of the following sizes:

<table>
<thead>
<tr>
<th>HMA and PPST</th>
<th>Micro-Surfacing and Quick-Set Slurry</th>
<th>PCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4&quot;</td>
<td>No.30</td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>No.200</td>
<td></td>
</tr>
<tr>
<td>3/8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/4&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/8&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. EQUIPMENT FOR IDENTIFYING AGGREGATE

1. Balance, 1200 g minimum capacity, sensitive to 0.1 g.
2. Glass or polyethylene beakers suitable for performing the staining test (Section VII. D. - COPPER NITRATE STAINING). 1000 mL and 600 mL heavy duty Pyrex beakers with pouring spouts are suggested.
3. Oven and/or hot plate of sufficient size to accommodate the beakers and capable of maintaining a uniform temperature of 140°F.

III. EQUIPMENT FOR DETERMINING PERCENT A.I.R.

1. 1000 ml glass or polyethylene beakers.
2. Balance, 800 g minimum capacity, sensitive to 0.1 g.
3. Hot plate with ceramic or acid resistant top.
5. Watch glasses of sufficient size to cover the beakers (optional).
6. Wash bottle to add water to slow the reaction.

Note: Nylon mesh sieves and plastic holders are recommended. Wooden holders are not recommended as they tend to absorb water making it difficult to establish an accurate tare mass.
APPENDIX B

PROCEDURES FOR PREVENTIVE MAINTENANCE SLURRY SURFACING

Micro-surfacing and quick-set slurry are used as preventive and corrective maintenance overlays. These products are cold applied mixtures of aggregate, asphalt emulsion, mineral filler, and water. Because these products use finer aggregate than HMA, 100% passing the 3/8" sieve, different size fractions provide friction in the pavement.

I. EVALUATING FRICTION AGGREGATE CONTENT BEFORE AND DURING PRODUCTION

Quality control sampling and testing are the responsibility of the Aggregate Source unless the Contractor is blending aggregates from multiple sources. All quality control testing shall be performed using Section VIII. Determination of Percent Acid-insoluble Residue. Quality Assurance sampling and testing will be performed by the Department according to Section IV. B. - QUALITY ASSURANCE. Quality Assurance testing may be performed on stockpile samples, gradation samples, truck or haul unit samples, samples removed from utility protectors, and cured pavement samples.

1. Collect a 1 qt sample of aggregate, regardless of the maximum aggregate size.

2. Take samples at frequencies given in Table B1 - Minimum Testing Frequencies for Slurry Surfacing Aggregates.

<table>
<thead>
<tr>
<th>Aggregates</th>
<th>Aggregate Source</th>
<th>Contractor</th>
<th>NYSDOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Blended from 2 or more sources.</td>
<td>None required</td>
<td>One per stockpile(1)</td>
<td></td>
</tr>
<tr>
<td>High Residue Carbonates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand &amp; Gravel aggregates.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naturally Occurring Blends, excluding Gravel.</td>
<td>See Table 1</td>
<td>QA monitoring by the Contractor is recommended.</td>
<td>One per stockpile(1)</td>
</tr>
<tr>
<td>Quarry-Blended aggregates.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Other Aggregates.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. A sample is required from every stockpile used on a project. Whenever new material is added to an existing stockpile, the entire stockpile is considered to be new.
II. EVALUATING THE FRICTION AGGREGATE CONTENT OF SLURRY SURFACED PAVEMENTS

If quality control or quality assurance test results do not meet the appropriate specification requirements for friction aggregate, the Contractor will be given the following options.

1. Obtain and submit pavement samples to refine the area(s) requiring remediation.
2. RemEDIATE all pavement sections represented by failing samples as required in Section V. I. – SURFACE COURSE REMEDIATION.

A. EVALUATING SLURRY SURFACING PAVEMENT SAMPLES

Pavement samples can be taken from any transverse position in the lane at the designated sample longitudinal location. Taking samples from around drainage structures or at the curb line is advantageous. Sampling shall be the responsibility of the Contractor and at the Contractor’s expense. The Contractor must backfill the sample holes as soon as possible using materials and procedures approved by the Engineer.

1. Pavement Sampling Limits for Slurry Surfacing
   Follow Section V. C. – SURFACE COURSE SAMPLING LIMITS.

2. Pavement Sample Evaluation Procedure for Slurry Surfacing
   Follow Section V. D. – PAVEMENT SAMPLE EVALUATION PROCEDURE.

3. Additional-pavement-sampling Evaluation Procedure for Slurry Surfacing
   Follow Section V. E. – ADDITIONAL-PAVEMENT-SAMPLING EVALUATION PROCEDURE.

4. Alternative Pavement Sample Procedure for Slurry Surfacing
   Follow Section V. F. – PAVEMENT SAMPLING LIMITS.

5. Determining Acceptance or Rejection of Slurry Surfaced Areas
   Follow Section V. H. – DETERMINING ACCEPTANCE OR REJECTION OF SURFACE COARSE AREAS.

6. Remediation of Slurry Surfaced Areas
   Follow Section V. I. – SURFACE COURSE REMEDIATION.

III. SLURRY SURFACING AGGREGATE SAMPLE PREPARATION

Reduce the aggregate samples by quartering or by splitting in accordance with AASHTO T-248 and remove the undersized material to produce a test sample of the appropriate size shown in Table 7 for PCC sand.

IV. DETERMINATION OF PERCENT ACID-INSOLUBLE RESIDUE

Follow Section VIII. – DETERMINATION OF PERCENT ACID-INSOLUBLE RESIDUE.
APPENDIX C

ROUNDING PROCEDURE

The following Rounding Procedure was developed to ensure test results obtained using this Method are uniformly calculated statewide.

I. PROCEDURE

This procedure has been developed to ensure all test results obtained using this Method are uniformly calculated statewide.

When the digit immediately following the last digit to be retained is less than 5, leave the last digit to be retained unchanged.

When the digit immediately following the last digit to be retained is equal to or greater than 5, increase the last digit to be retained by 1.

II. PRECISION

A. AGGREGATE MASSES
   Round all aggregate masses to the nearest 0.1 g.

B. INTERMEDIATE CALCULATIONS
   Round all intermediate calculations to the nearest 0.01 unit or percent.

C. FINAL RESULTS
   Round final results to the nearest 0.1 unit or percent.
APPENDIX D

EXAMPLES OF NONCARBONATE CONTENT CALCULATIONS

I. HMA BATCH PLANT - 12.5 MIXTURE

Note: Appendix E contains an example form completed using the information from the following exercise.

A set of 20 lbs. hot bin samples are taken from a batch plant producing a 12.5 Superpave HMA is taken to determine the percentage of noncarbonate particles in the coarse aggregate.

At the time of sampling, the aggregates are being proportioned using the following batch masses:

No. 1’s = 616.7 lbs. \((W_a)\)
No. 1A’s = 1009.1 lbs. \((W_b)\)
Fine Aggregate = 1177.2 lbs. \((W_c)\)

From the batch masses the batching percentages for each bin are calculated from equation 1.

\[
\frac{W_a}{W_{\text{total}}} = \frac{616.7}{2803} = 22.00\%
\]

\[
\frac{W_b}{W_{\text{total}}} = \frac{1009.1}{2803} = 36.00\%
\]

The samples from the No. 1 and No. 1A bins are reduced by a sample splitter to the following sizes:

The No. 1 - 621.2 g \((W_o)\).
The No. 1A - 105.6 g \((W_o)\).

The No. 1 bin sample is sieved over the 3/4", 3/8" and 1/8" sieves to the following masses:

Total mass retained on the 3/8" sieve: 323.2 g \((W_{3/8})\)
Total mass retained on the 1/8" sieve: 298.0 g \((W_{1/8})\)

The No 1A bin sample is sieved over the 1/8" sieve to the following mass:

Total mass retained on the 1/8" sieve: 100.2 g \((W_{1/8A})\)

The percents retained on each sieve for each bin sample are calculated using equation 2.

\[
\frac{W_{3/8}}{W_o} = \frac{323.2}{621.2} = 52.03\%
\]

\[
\frac{W_{1/8}}{W_o} = \frac{298.0}{621.2} = 47.97\%
\]
The material retained on the 1/8" from the No. 1 bin sample sieve is reduced with a sample splitter to 150.9 g \((W_{1/8S})\) for aggregate identification testing.

Using the appropriate identification test, the blend is found to contain dolomite (carbonate) (specific gravity = 2.71 \([SG_{cp}]) and granite (noncarbonate) (specific gravity = 2.81 \([SG_{ncp}]\)). The specific gravities of this dolomite and this granite are similar and no adjustment factor is necessary. The carbonate and noncarbonate particles are separated from each size fraction and their noncarbonate masses \((W_{NC})\) are recorded.

For the No. 1 bin sample:
- 3/8" sieve: 89.9 g of noncarbonate particles \((W_{NC3/8_{_1bin}})\)
- 1/8" sieve: 21.3 g of noncarbonate particles \((W_{NC1/8_{_1bin}})\)

For the No. 1A bin sample:
- 1/8" sieve: 20.9 g of noncarbonate particles \((W_{NC1/8_{_Abin}})\)

The percent noncarbonate particles for each size fraction are calculated using equation 3.

\[
\% \text{NC}_{1_{bin}} = \frac{89.9}{323.2} \times 100 = 27.82\%
\]

\[
\% \text{NC}_{1_{bin}} = \frac{21.3}{150.9} \times 100 = 44.12\%
\]

\[
\% \text{NC}_{A_{bin}} = \frac{20.9}{100.2} \times 100 = 20.86\%
\]

The total noncarbonate content expressed as a percentage of the total mix are calculated using equations 4, 5, and 6 as shown below.

\[
\% \text{NC}_{\text{total}} = 0.5203 \times 0.2782 \times 0.2200 \times 100 = 3.18\%
\]

\[
\% \text{NC}_{\text{total}} = 0.4797 \times 1.170 \times 0.9489 \times 0.3600 \times 100 = 8.62\%
\]

\[
\% \text{NC}_{\text{TOTAL}} = 3.18\% + 8.62\% = 11.80\%
\]

Report:

For percent noncarbonate -3/4", +3/8" sieves, report 27.8%.

For percent noncarbonate +1/8", of total mix, report 11.8%.

II. HMA DRUM PLANT COMPOSITE SAMPLE OF 12.5 MIX

Note: Appendix E contains an example form completed using the information from the following exercise.
A 20 lbs. composite sample of 12.5 Superpave HMA is taken using an automatic belt sampling device. According to the JMF production targets, the percent passing the 3/8" sieve is 88.5%. Therefore the percent retained on the 3/8" sieve is 11.5%. Using the percent retained on the 3/8" sieve a sample size can be calculated to provide approximately 300 g of material on the 3/8" sieve for identification testing.

\[
\text{necessary sample size } \frac{300 \text{g}}{0.115} = 2608 \text{g}
\]

Since the original sample size is 20 lbs, the sample can be easily reduced to approximately 2500 g. This is done using a sample splitter, and the final mass of the sample is 2548.2 g. This sample is sieved over the 3/4", 3/8" and 1/8" sieves to the following masses:

- Total mass retained on the 3/8" sieve: \( W_{3/8} = 303.2 \text{ g} \)
- Total mass retained on the 1/8" sieve: \( W_{1/8} = 1142.0 \text{ g} \)

The percent retained on each sieve is calculated using equation 2.

\[
\% R_{3/8} = \left(\frac{303.2}{2548.2}\right) \times 100 = 11.90\%
\]
\[
\% R_{1/8} = \left(\frac{1142.0}{2548.2}\right) \times 100 = 44.82\%
\]

The material retained on the 1/8" sieve is reduced using a sample splitter to 144.3 g \( W_{1/8S} \) for friction aggregate identification testing.

Using the appropriate identification test, the blend is found to contain limestone (carbonate) (specific gravity = 2.69 \( [SG_{cp}] \)) and granite (noncarbonate) (specific gravity = 2.81 \( [SG_{ncp}] \)). The specific gravities of this limestone and this granite are similar and no adjustment factor is necessary. The carbonate and noncarbonate particles are separated from each size fraction and their noncarbonate masses \( W_{NC} \) were:

- 3/8" sieve: 84.9 g of noncarbonate particles \( W_{NC3/8} \)
- 1/8" sieve: 27.8 g of noncarbonate particles \( W_{NC1/8} \)

The percent noncarbonate particles for each size fraction is calculated using equation 3.

\[
\% NC_{3/8} = \left(\frac{84.9}{303.2}\right) \times 100 = 28.00\%
\]
\[
\% NC_{1/8} = \left(\frac{27.8}{144.3}\right) \times 100 = 19.27\%
\]

The total noncarbonate coarse aggregate content as a percentage of the total mix is calculated using equation 15.

\[
\% NC_{TOTAL} = \left(\frac{0.1190}{0.2800}\right) \times 0.4482 \times 0.1927 \times 100 = 1.97\%
\]

Report:

For percent noncarbonate -3/4", +3/8" sieves, report 28.0%.

For percent noncarbonate +1/8" of total mix, report 12.0%.
III. PCC WITH CA 2 GRADATION AND SEPARATE STOCKPILES OF NO. 1 AND NO. 2 COARSE AGGREGATE

Note: Appendix E contains an example form completed using the information from the following exercise.

Stockpile samples from a batch plant producing class HP using separate stockpiles of No. 1 and No. 2 sized aggregate from the same source are taken to determine the percentage of noncarbonate particles in the coarse aggregate.

At the time of sampling the coarse aggregates are being proportioned using the following batch masses:

- No. 1’s = 13,228 lbs., bin 1
- No. 2’s = 40,345 lbs., bin 2

From the batch masses the batching percentages as percents of total coarse aggregate are calculated for each bin using equation 1.

\[ \frac{W_t}{13,228 - 40,345} = 53,573 \text{ lbs.} \]

\[ \% B_1 = \left( \frac{13,228}{53,573} \right) \times 100 = 24.69\% \quad \% B_2 = \left( \frac{40,345}{53,573} \right) \times 100 = 75.31\% \]

Based on the usual gradation of each stockpile, the appropriate sample sizes are calculated.

<table>
<thead>
<tr>
<th>Stockpile 1 Usual Gradation</th>
<th>Stockpile 2 Usual Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Retained</td>
<td>% Retained</td>
</tr>
<tr>
<td>1/2” 5%</td>
<td>1/2” 90%</td>
</tr>
<tr>
<td>1/2” 90%</td>
<td>1/4” 8%</td>
</tr>
</tbody>
</table>

The No. 1 stockpile typically had 5% retained on the 1/2” sieve and 90% retained on the 1/4” sieve. Using the percent retained on the 1/2” sieve a sample size was calculated as:

\[ \text{Stockpile 1 sample size} = \frac{1200g}{0.05} = 24000 \text{g} = 24 \text{kg} \]

\[ \text{Stockpile 2 sample size} = \frac{300g}{0.08} = 3750 \text{g} \]

Because the sample size for stockpile 1 is so large and the +1/2” material from stockpile 1 is such a small portion of the total coarse aggregate, the process can be simplified by taking a smaller sample from stockpile 1 and only testing the -1/2”, +1/4” material. The target sample size for the No. 1 stockpile is then 300 g.

Note: Discarding any portion of a sample assumes that that portion contains no noncarbonate material. Assuming any component of a mixture has no noncarbonate particles produces a conservative estimate of the actual noncarbonate content. If the...
tests result is below the specification requirement with this assumption, repeat the test without making this assumption.

The samples from the each stockpile are reduced by a sample splitter to the following sizes:

Stockpile 1 sample – 352.1 g (W_{o\_bin1}).

Stockpile 2 sample – 4021.2 g (W_{o\_bin2}).

Each specimen is scalped on the 1 1/2” sieve and separated over the 1/2” and 1/4” sieves. The masses retained on each sieve are recorded.

No. 1 Stockpile

\[ W_{1/2\_bin1} = 17.1 \quad W_{1/4\_bin1} = 319.2 \]

No. 2 Stockpile

\[ W_{1/2\_bin2} = 3632.3 \quad W_{1/4\_bin2} = 315.4 \]

The percents retained on each sieve for each stockpile sample are calculated using equation 2.

\[ \% R_{1/2\_bin1} = \frac{17.1}{352.1} \times 100 = 4.86\% \quad \% R_{1/4\_bin1} = \frac{319.2}{352.1} \times 100 = 90.66\% \]

\[ \% R_{1/2\_bin2} = \frac{3632.3}{4021.2} \times 100 = 90.33\% \quad \% R_{1/4\_bin2} = \frac{315.4}{4021.2} \times 100 = 7.84\% \]

The percents of the total coarse aggregate made up by each size fraction of each stockpile material are calculated using equation 21.

\[ \% P_{bin1\_1/2} = \frac{24.69}{100} \times 100 = 4.20\% \quad \% P_{bin1\_1/4} = \frac{24.69}{100} \times 100 = 22.38\% \]

\[ \% P_{bin2\_1/2} = \frac{75.31}{100} \times 100 = 75.31\% \quad \% P_{bin2\_1/4} = \frac{75.31}{100} \times 100 = 7.84\% \]

The material retained on the 1/4” sieve from the No. 1 stockpile sample is reduced with a sample splitter to 159.0 g (W_{bin1\_1/4S}) for aggregate identification testing.

The material retained on the 1/2” sieve from the No. 2 stockpile sample is reduced with a sample splitter to 1816.0 g (W_{bin1\_1/2S}) for aggregate identification testing.

Multiple types of carbonate and noncarbonate aggregates with similar specific gravities were identified in each sample. The carbonate and noncarbonate particles are separated from each size fraction and their noncarbonate masses (W_{NC}) are recorded.

For the No. 1 stockpile sample:

\[ W_{nc1/2\_bin1} = \text{assumed to be zero} \quad W_{nc1/2\_bin1} = 52.5 \text{ g} \]

For the No. 2 stockpile sample:

\[ W_{nc1/2\_bin2} = 628.6 \text{ g} \quad W_{nc1/4\_bin2} = 54.7 \text{ g} \]
The percents noncarbonate particles for each size fraction are calculated using equation 3.

\[
\% \text{NC}_{\text{bin}_1, \frac{1}{2}} = 0.00\%
\]
\[
\% \text{NC}_{\text{bin}_1, \frac{1}{2}} = \frac{52.5}{159.0} \times 100 = 33.02\%
\]
\[
\% \text{NC}_{\text{bin}_2, \frac{1}{2}} = \frac{628.6}{1816.0} \times 100 = 34.61\%
\]
\[
\% \text{NC}_{\text{bin}_2, \frac{1}{2}} = \frac{54.7}{315.4} \times 100 = 17.34\%
\]

The percents of total coarse aggregate made up by noncarbonate particles from each size fraction of each stockpile are calculated using equation 22.

\[
\% P_{\text{NC}}_{\frac{1}{2}, \text{bin}_1} = \frac{1.20}{100} \times \frac{0.00}{100} \times 100 = 0.00\%
\]
\[
\% P_{\text{NC}}_{\frac{1}{2}, \text{bin}_1} = \frac{22.38}{100} \times \frac{33.02}{100} \times 100 = 7.39\%
\]
\[
\% P_{\text{NC}}_{\frac{1}{2}, \text{bin}_2} = \frac{68.03}{100} \times \frac{34.61}{100} \times 100 = 23.55\%
\]
\[
\% P_{\text{NC}}_{\frac{1}{2}, \text{bin}_2} = \frac{5.90}{100} \times \frac{17.34}{100} \times 100 = 0.02\%
\]

The total percent noncarbonate for each size fraction is calculated using equation 23.

\[
\% \text{NC}_{\text{TOTAL}, \frac{1}{2}} = \frac{0.00 - 0.2355}{0.0120 - 0.6803} \times 100 = 34.02\%
\]
\[
\% \text{NC}_{\text{TOTAL}, \frac{1}{2}} = \frac{0.0739 - 0.0102}{0.2238 - 0.0590} \times 100 = 29.74\%
\]

Report:
For total percent noncarbonate -1 1/2", +1/2", report 34.0%
For total percent noncarbonate -1/2", +1/4", report 29.7%

IV. PCC WITH CA 2 GRADATION USING TWO BINS OF CA 2 AGGREGATE

Note: Appendix E contains an example form completed using the information from the following exercise.

At a plant producing Class C, two 10 lbs samples are taken from the stockpiles representing material from bins 1 and 2. The material in bin 1 is a high noncarbonate gravel. The material in bin 2 is a crushed limestone with few chert particles.
At the time of sampling the coarse aggregates are being proportioned using the following batch masses:

No. 1’s = 21,385 lbs, bin 1
No. 2’s = 32187 lbs, bin 2

From the batch masses the batching percentages as percents of total coarse aggregate are calculated for each bin using equation 1.

\[ W_1 = \frac{21385}{53572} \times 100 = 39.92\% \]
\[ W_2 = \frac{32187}{53572} \times 100 = 60.08\% \]

Based on the usual gradation of each stockpile the appropriate sample size are calculated as:

<table>
<thead>
<tr>
<th>Stockpile 1 Usual Gradation</th>
<th>Stockpile 2 Usual Gradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Retained</td>
<td>% Retained</td>
</tr>
<tr>
<td>1/2”</td>
<td>1/2”</td>
</tr>
<tr>
<td>50%</td>
<td>43%</td>
</tr>
<tr>
<td>1/4”</td>
<td>1/4”</td>
</tr>
<tr>
<td>46%</td>
<td>55%</td>
</tr>
</tbody>
</table>

Stockpile 1 sample size = 1200g / 0.50 = 2400 g
Stockpile 2 sample size = 1200 g / 0.43 = 2790 g

The sample from stockpile 1 is reduced using a mechanical splitter to. The stockpile 2 sample is not reduced.

Stockpile 1 sample = 2518.1 g (W_o)
Stockpile 2 sample = 5135.2 g (W_o)

Each sample is scalped on the 1 1/2” sieve and separated on the 1/2” and 1/4” sieves. The weights retained on each sieve are recorded.

W_{1/2, bin1} = 1216.3 g    W_{1/4, bin1} = 1206.5 g
W_{1/2, bin2} = 2213.4 g    W_{1/4, bin2} = 2716.6 g

The percents retained on each sieve are calculated using equation 2.

\[ \% R_{1/2, bin1} = \frac{1216.3}{2518.1} \times 100 = 48.30\% \]
\[ \% R_{1/2, bin2} = \frac{2213.4}{1315.2} \times 100 = 43.10\% \]
\[ \% R_{1/4, bin1} = \frac{1206.5}{2518.1} \times 100 = 47.91\% \]
\[ \% R_{1/4, bin2} = \frac{2716.6}{1315.2} \times 100 = 52.90\% \]

The percents of total aggregate made up of each size fraction of each bin material are calculated using equation 21.

\[ \% P_{1/2, bin1} = \frac{39.92}{100} \times \frac{48.30}{100} \times 100 = 9.28\% \]
Each sample is reduced, using a sample splitter, to an appropriate specimen size for aggregate identification.

\[ W_{xs1/2\_bin1} = 1216.7 \text{ g} \quad W_{xs1/4\_bin1} = 302.9 \text{ g} \]
\[ W_{xs1/2\_bin2} = 1208.8 \text{ g} \quad W_{xs1/4\_bin2} = 340.0 \text{ g} \]

Multiple types of carbonate and noncarbonate aggregates with similar specific gravities were identified in each sample. The carbonate and noncarbonate particles are separated from each size fraction and their noncarbonate masses \( W_{NC} \) are recorded. The noncarbonate particles are separated from each specimen and weighed.

\[ W_{nc1/2\_bin1} = 833.1 \text{ g} \quad W_{nc1/4\_bin1} = 203.3 \text{ g} \]
\[ W_{nc1/2\_bin2} = 57.2 \text{ g} \quad W_{nc1/4\_bin2} = 13.4 \text{ g} \]

The percents noncarbonate particles in each size fraction are then calculated using equation 3.

\[ \% \text{ NC}_{\frac{1}{2}\_bin1} = \frac{833.1}{1216.7} \times 100 = 68.47\% \]
\[ \% \text{ NC}_{\frac{1}{4}\_bin1} = \frac{203.3}{302.9} \times 100 = 67.12\% \]
\[ \% \text{ NC}_{\frac{1}{2}\_bin2} = \frac{57.2}{1208.8} \times 100 = 4.73\% \]
\[ \% \text{ NC}_{\frac{1}{4}\_bin2} = \frac{13.4}{340.0} \times 100 = 3.94\% \]

The percents of total aggregate made up on noncarbonate particles from each size fraction of each bin material are calculated using equation 22.

\[ \% \text{ P}_{\text{NC}_{\frac{1}{2}\_bin1}} = \frac{19.28}{100} \times 68.47 \times 100 = 13.20\% \]
\[ \% \text{ P}_{\text{NC}_{\frac{1}{4}\_bin1}} = \frac{19.13}{100} \times 67.12 \times 100 = 12.84\% \]
\[ \% \text{ P}_{\text{NC}_{\frac{1}{2}\_bin2}} = \frac{25.89}{100} \times 4.73 \times 100 = 1.22\% \]
\[ \% P_{NC, \text{bin2}} = \left( \frac{31.78}{100} \right) + \left( \frac{3.94}{100} \right) = 4.25\% \]

The total percent noncarbonate for each size fraction is calculated using equation 23.

\[ \% N_{C, \text{TOTAL, \%}} = \left( \frac{0.1320 - 0.0122}{0.1928 - 0.2589} \right) = 31.92\% \]

\[ \% N_{C, \text{TOTAL, \%}} = \left( \frac{0.1284 - 0.0125}{0.1913 - 0.3178} \right) = 27.68\% \]

Report:

For percent noncarbonate of -1 1/2", +1", report 31.9%.

For percent noncarbonate of -1/2", +1/4", report 27.7%.
APPENDIX E

EXAMPLES OF COMPLETED FORMS
<table>
<thead>
<tr>
<th>Region</th>
<th>Facility Code</th>
<th>Sample Description or Item Number</th>
<th>D Number</th>
<th>Project Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99999</td>
<td>Friction - Lot 15B</td>
<td>D00001</td>
<td>Route 1 - Saratoga County</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Sizes Sampled</th>
<th>Aggregate Producer</th>
<th>Source No.</th>
<th>Town</th>
<th>County</th>
<th>USGS Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Bins</td>
<td>3 2 1 (1A) 1B 2M 3M FA Comp.</td>
<td>U.S. Aggregates</td>
<td>1-200R</td>
<td>Scotia</td>
<td>Schenectady</td>
<td></td>
</tr>
</tbody>
</table>

| Actual Batch Percentage (Friction Samples Only) | | | | | | | Remarks |
|-------------------------------------------------|------------|------------|------------|-------------|------------------|--------------------------------------------------|
| No. 1 | No. 1A | No.1B, 2M, 3MS | FA | Mineral Filler | | | Dutchmen HMA |
| 30 % | 31 % | 15 % | 24 % | 0 % | | | Union City - Facility 00003 |

<table>
<thead>
<tr>
<th>Sampled By</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.S. Kapp</td>
<td>11/20/00</td>
<td>12:50 p.m.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To</th>
<th>Materials represented by the sample described above was</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accepted</td>
<td>Rejected</td>
<td>Other</td>
</tr>
</tbody>
</table>

| on | for |

| By | Date |
## NYSDOT Aggregate Sample and Acceptance Transmittal

<table>
<thead>
<tr>
<th>Region</th>
<th>Facility Code</th>
<th>Sample Description or Item Number</th>
<th>D Number</th>
<th>Project Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99999</td>
<td>Friction - Lot 15B</td>
<td>D00001</td>
<td>Route 1 - Saratoga County</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Aggregate Belt</th>
<th>Sizes Sampled</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>1A</th>
<th>1B</th>
<th>2M</th>
<th>3M</th>
<th>FA</th>
<th>Comp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18403.1252</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Requested</th>
<th>Aggregate Producer</th>
<th>Source No.</th>
<th>Town</th>
<th>County</th>
<th>USGS Coordinates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friction</td>
<td>U.S. Aggregates</td>
<td>1-200R</td>
<td>Scotia</td>
<td>Schenectady</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Actual Batch Percentage (Friction Samples Only)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>No. 1A</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>30 %</td>
<td>31 %</td>
</tr>
</tbody>
</table>

Sampled By: **Al G. Roe**

Date: 11/20/00  Time: 12:50 p.m.

Materials represented by the sample described above was

<table>
<thead>
<tr>
<th>Accepted</th>
<th>Rejected</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For

By

Date
**NEW YORK STATE DEPARTMENT OF TRANSPORTATION MATERIALS BUREAU**

**Determination of Percent Non-Carbonate Particles in HMA Top Course Mixtures**

<table>
<thead>
<tr>
<th>MIX CODE / TYPE</th>
<th>JMF / MIX NO.</th>
<th>PLANT LOT NO.</th>
<th>SUBLOT</th>
<th>DATE SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5, F2</td>
<td>0001</td>
<td>0001</td>
<td>2</td>
<td>2/2/98</td>
</tr>
</tbody>
</table>

**Hot Bin** | **Composite** |

| LOCATION | UNION CITY NEW YORK |

<table>
<thead>
<tr>
<th>JMF SERIAL NO.</th>
<th>TESTED BY</th>
<th>TIME SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR-3A</td>
<td>Lamont Davidson</td>
<td>11:25 AM</td>
</tr>
</tbody>
</table>

---

### Sieve Sizes

<table>
<thead>
<tr>
<th>Sieve Sizes</th>
<th>No. 1 Stone or 1/2&quot; Composite</th>
<th>No. 1A Stone or 3/8&quot; Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>W₀</td>
<td>Wₓ</td>
<td>WₓS(1)</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>303.2</td>
<td>303.2</td>
</tr>
<tr>
<td>No.4(2)</td>
<td>2548.2</td>
<td></td>
</tr>
<tr>
<td>1/8&quot;</td>
<td>1142.0</td>
<td>144.3</td>
</tr>
</tbody>
</table>

**Note:** Use all percents in the decimal form when performing calculations.

- **W₀** = Mass of sample prior to gradation analysis.
- **Wₓ** = Mass of material retained on sieve x.
- **%Rₓ** = Percent of W₀ retained of sieve x.
- **WₓS** = Mass of split sample of size x before non-carbonate analysis.
- **W_NC** = Mass of non-carbonate particles.
- **%NCₓ** = Percent of WₓS that is non-carbonate particles.
- **%B** = Batch Percentage for the appropriate hot bin.

---

### Percent Batched

<table>
<thead>
<tr>
<th>Mixture Type or Bin</th>
<th>12.5 Mixture</th>
<th>9.5 mm Mixture</th>
<th>Total Percent Non-Carbonate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+3/8&quot;</td>
<td>+1/8&quot;</td>
<td>+No.4</td>
</tr>
<tr>
<td>1/2&quot; or No. 1</td>
<td>100.00%</td>
<td>3.33%</td>
<td>8.64%</td>
</tr>
<tr>
<td>3/8&quot; or No. 1A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3.33%</td>
<td>8.64%</td>
<td></td>
</tr>
</tbody>
</table>

1) When WX is of an appropriate size for testing (the sample does not need to be reduced further), enter the value of WX under both WX and WₓS.

2) When calculating the friction aggregate content for a 12.5 mixture the No.4 sieve is not used.

3) Enter %B as a percentage of TOTAL aggregate. When calculating the %NC for a Drum Mix Plant or Stockpile samples, the Percent Batched is 100.0%.
When $W_X$ is of an appropriate size for testing (the sample does not need to be reduced further), enter the value of $W_X$ under both $W_X$ and $W_{XS}$. When calculating the friction aggregate content for a 12.5 mixture the No.4 sieve is not used. Enter %B as a percentage of TOTAL aggregate. When calculating the %NC for a Drum Mix Plant or Stockpile samples, the Percent Batched is 100.0%.

1) When $W_X$ is of an appropriate size for testing (the sample does not need to be reduced further), enter the value of $W_X$ under both $W_X$ and $W_{XS}$.

2) When calculating the friction aggregate content for a 12.5 mixture the No.4 sieve is not used.

3) Enter %B as a percentage of TOTAL aggregate. When calculating the %NC for a Drum Mix Plant or Stockpile samples, the Percent Batched is 100.0%.
**New York State Department of Transportation**

**Materials Bureau**

Determination of Percent Noncarbonate Particles in Portland Cement Concrete Aggregate

---

**PRODUCER:** Always Ready Mix  **FACILITY NO.:** 99999

**REGION:** 4  **CONTRACT/JOB:** D99999

**JOB LOCATION:** Rte 104 over Fishing Creek  **OTHER:**

---

**SAMPLE TYPE:** Stockpile  ■  **Bin:**

**G.P. NO.:**

**DATE SAMPLED:** 4/6/2004  **TIME SAMPLED:** 8:22 A.M.

**PRODUCER **...

---

Prepare all samples using the appropriate scalping screen required by M.M. 28

<table>
<thead>
<tr>
<th>Bin(1)</th>
<th>Source</th>
<th>Stone Size</th>
<th>W, (lbs)</th>
<th>%B</th>
<th>W,</th>
<th>%Rx</th>
<th>%P</th>
<th>Wx</th>
<th>%NCsub</th>
<th>%PNC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bin #1</td>
<td>4-999G</td>
<td>C.A. 2</td>
<td>13,228</td>
<td>24.69%</td>
<td>352.1</td>
<td>1/2(2)</td>
<td>17.1</td>
<td>4.86%</td>
<td>f1/2_1=</td>
<td>1.20%</td>
</tr>
<tr>
<td></td>
<td>No. 2</td>
<td>C.A. 1</td>
<td></td>
<td></td>
<td></td>
<td>1/4</td>
<td>319.2</td>
<td>90.66%</td>
<td>f1/4_1=</td>
<td>22.38%</td>
</tr>
<tr>
<td></td>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bin #2</td>
<td>4-999G</td>
<td>C.A. 2</td>
<td>40,345</td>
<td>75.31%</td>
<td>4021.2</td>
<td>1/2(2)</td>
<td>3632.3</td>
<td>90.33%</td>
<td>f1/2_2=</td>
<td>68.03%</td>
</tr>
<tr>
<td></td>
<td>No. 2</td>
<td>C.A. 1</td>
<td></td>
<td></td>
<td></td>
<td>1/4</td>
<td>315.4</td>
<td>7.84%</td>
<td>f1/4_2=</td>
<td>5.90%</td>
</tr>
<tr>
<td></td>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**%B** = Batch Percentage for the appropriate bin.

**W, =** Mass of coarse aggregate batched

**Wx =** Mass of sample prior to gradation analysis.

**%Rx =** Percent retained on sieve x.

**%P =** Percent of total coarse aggregate that is from the specific bin and size fraction.

**%NCsub =** Mass of split sample before noncarbonate analysis (3)

**%NC =** Mass of noncarbonate particles.

**%PNC =** Percent of total coarse aggregate that is noncarbonate and from the specific bin and size fraction.

---

<table>
<thead>
<tr>
<th>Sieve (in)</th>
<th>Sum of %P by Sieve</th>
<th>Sum of %NC by Sieve</th>
<th>%NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>n = f1 + f2 + f3 + f4</td>
<td>p = k1 + k2 + k3 + k4</td>
<td>p / n (100)</td>
</tr>
<tr>
<td>1/2</td>
<td>69.23%</td>
<td>23.55%</td>
<td>34.0%</td>
</tr>
<tr>
<td>1/4</td>
<td>28.28%</td>
<td>8.41%</td>
<td>29.7%</td>
</tr>
</tbody>
</table>

(1) Enter information for corresponding bin, even if sample was taken from stockpile.

(2) 1/2" sieve is not used to evaluate mixtures requiring C.A. 1 sized aggregate.

(3) When Wx is of appropriate size for testing (the sample does not need to be reduced further), enter the value of Wx under both Wx and WxS.
New York State Department of Transportation  
Materials Bureau  
Determination of Percent Noncarbonate Particles  
in Portland Cement Concrete Aggregate

**APPENDIX E**

<table>
<thead>
<tr>
<th>CLASS</th>
<th>SAMPLE TYPE:</th>
<th>Stockpile</th>
<th>Bin</th>
<th>DATE SAMPLED</th>
<th>4/6/2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-998G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.A. 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C.A. 1</td>
<td></td>
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Prepare all samples using the appropriate scalping screen required by M.M. 28

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<tr>
<th>Bin</th>
<th>Source</th>
<th>Stone</th>
<th>W_y</th>
<th>%B</th>
<th>W_o</th>
<th>Sieve (in)</th>
<th>W_x</th>
<th>%Rx</th>
<th>%P</th>
<th>W_xs</th>
<th>W_rc</th>
<th>%NC sub</th>
<th>%P_NC</th>
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<td>1216.3</td>
<td>48.30%</td>
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<td>52.90%</td>
<td>f_1/2 = 31.78%</td>
<td>340.0</td>
<td>13.4</td>
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</tbody>
</table>

%B = Batch Percentage for the specific bin.  
W_y = Mass of coarse aggregate batched.  
W_x = Mass of sample prior to gradation analysis.  
W_o = Mass of material retained on sieve x.  
%Rx = Percent retained.  
%P = Percent of total coarse aggregate that is from the specific bin and size fraction.  
%NC sub = Percent noncarbonate content of each size fraction from each bin.  
%P_NC = Noncarbonate content of each size fraction.

<table>
<thead>
<tr>
<th>Sieve (in)</th>
<th>Sum of %P by Sieve</th>
<th>Sum of %P_NC by Sieve</th>
<th>%NC</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>n = f_1 + f_2 + f_3 + f_4</td>
<td>p = k_1 + k_2 + k_3 + k_4</td>
<td>p / n (100)</td>
</tr>
<tr>
<td>1/2</td>
<td>45.17%</td>
<td>14.42%</td>
<td>31.9%</td>
</tr>
<tr>
<td>1/4</td>
<td>53.57%</td>
<td>14.09%</td>
<td>27.7%</td>
</tr>
</tbody>
</table>

(1) Enter information for corresponding bin, even if sample was taken from stockpile.  
(2) 1/2" sieve is not used to evaluate mixtures requiring C.A. 1 sized aggregate.  
(3) When W_y is of appropriate size for testing (the sample does not need to be reduced further), enter the value of W_x under both W_x and W_o.
### Appendix F

### Forms List

<table>
<thead>
<tr>
<th>Form Number</th>
<th>Title</th>
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<tr>
<td>BR 3&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>Aggregate Sample and Acceptance Transmittal</td>
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<tr>
<td>BR 53</td>
<td>Determination of Percent Noncarbonate Particles in Portland Cement Concrete Aggregate</td>
</tr>
<tr>
<td>BR 54</td>
<td>Determination of Percent Acid Insoluble Residue</td>
</tr>
<tr>
<td>BR 55</td>
<td>Determination of Percent Noncarbonate Particles in 6.3 Top Course Mixtures</td>
</tr>
<tr>
<td>BR 57</td>
<td>Determination of Percent Noncarbonate Particles in 19.0 Top Course Mixtures from Hot Bin Samples&lt;sup&gt;(2)&lt;/sup&gt;</td>
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<tr>
<td>BR 310</td>
<td>Determination of Percent Non-carbonate Particles in Marshal HMA Top Course Mixtures</td>
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<tr>
<td>BR 311</td>
<td>Determination of Percent Non-carbonate Particles in Micro-surfacing Aggregate</td>
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<tr>
<td>BR 312</td>
<td>Determination of Percent Noncarbonate Particles in Superpave 9.5 Mixtures From Hot Bin Samples of No. 1 and No. 1A Stone. &lt;sup&gt;(2)&lt;/sup&gt;</td>
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<tr>
<td>BR 330</td>
<td>Determination of Percent Non-carbonate particles in HMA Top Course Mixtures</td>
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</table>

<sup>(1)</sup> NYSDOT Internal Form

<sup>(2)</sup> Specialized form, not for general use.