# NORTH CAROLINA
# DEPARTMENT OF TRANSPORTATION

## Aggregate Sampling Manual

**Materials and Tests Unit**
**GeoMaterials Laboratory**

# Aggregate Sampling Manual
## (Roadway Assurance Samples)

**February 5, 2003**
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North Carolina Department of Transportation
Materials and Tests Unit - GeoMaterials Laboratory

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# Section 1 - Purpose

The purpose of this training manual is to explain the techniques for obtaining aggregate samples (i.e. Aggregate Base Course – ABC, Cement Treated Base Course – CTBC, etc). These samples are called Roadway Assurance (RA) samples. The Department (NCDOT) is responsible for obtaining and testing these samples to check the material against specification requirements. Any technician obtaining a RA sample for specification acceptance must have a valid ABC Sampling Certification. Personnel with a valid ABC Sampling certification and are actively sampling aggregate material must be assessed once per year.

Under the current Aggregate Quality Control/Quality Assurance (QC/QA) Program, NCDOT certified representatives of aggregate producers obtain Quality Control (QC) samples at the quarry and NCDOT Materials Inspectors obtain Quality Assurance (QA) samples at the quarry. This is sampling and testing of the material prior to project delivery. Sampling under this Program is discussed in the QC/QA Sampling and Testing Certification Course. Under the QC/QA Program aggregate producers can also take Roadway Quality Control (RC) samples from the roadway for their internal use, that is, to obtain additional information concerning quality. Due to safety concerns an aggregate producer must obtain permission from the Resident Engineer prior to visiting a construction project. Additional details regarding the QC/QA Program can be obtained from the *QC/QA Program Manual* produced by the NCDOT - Materials and Tests Unit.

Resident Engineers can review the Aggregate Producer's QC test results by accessing the Q.A.P. database in HiCAMS. However, the Quality Assurance Engineer monitors QC test results and will notify the Resident Engineer if a sample fails to meet minimum specification requirements. Due to the importance of aggregate materials, representative(s) of the Department should study the following items as it relates to any aggregate that is utilized on a project.

- *NCDOT Standard Specifications for Roads and Structures (Standard Specifications)*
- *Aggregate Sampling Manual*
- Plans
- Project Special Provisions
- *NCDOT Construction Manual*

## Section 2 – Importance of Proper Sampling

A sample is defined as a "portion, piece, or segment that is representative of a whole". It is therefore important that the procedure(s) used to obtain this small portion not compromise the requirement that it be a representation of the larger portion.

There are penalties associated with non-conformity with the *Standard Specifications*. For material that has been laid out on a roadway, non-conformity can result in a rejection of the material. Improper sampling (that is, when the portion obtained did not represent the larger portion) of the material has repercussions that can be costly. Therefore, following proper sampling procedures cannot be overemphasized.

## Section 3 – Aggregate Materials

A. Definitions and uses

Several aggregate based products are available and may be used during construction. The most common products are as follows:

- **Aggregate Base Course (ABC) -** When ABC is placed on the roadway as part of the pavement structure it is defined in the *Standard Specifications* as "a base composed of an approved aggregate material hauled to the road, placed on the road, mixed, compacted, and shaped to conform to the lines, grades, depths, and typical sections shown in the plans or established by the Engineer".
- **Stabilizer Aggregate (S.A.)** - In order to stabilize some subgrade soils, a two- to three-inch thick layer of ABC is added and mechanically mixed with the soil
- **Cement Treated Base Course (CTBC)** – is ABC with the addition of cement and is generally placed on the roadway as part of the pavement structure.
- **Select Material Class IV** – coarse aggregate material meeting gradation requirements of ABC (refer to Appendix C Table 1010-1).
- **Incidental Stone Base** - is "a graded stone material used for driveways, temporary maintenance of traffic, adjacent to mailboxes, beneath traffic islands, median covers, and at any other locations that are not part of any base course on which pavement is to be placed".

The following table lists aggregate products, if a project acceptance sample is required and related section(s) to reference in the *Standard Specifications*.

| Aggregate Product | Sample Required | Related Section(s) of the *Standard Specifications* |
|---|---|---|
| Aggregate Base Course (ABC) | Yes | Section 520, Section 1005, Section 1006, Section 1010 |
| Stabilizer Aggregate (SA) | Yes | Section 510, Section 1005, Section 1006, Section 1008 |
| Cement Treated Base Course (CTBC) | Yes | Section 540, Section 1005, Section 1006, Section 1010-4 |
| Select Material Class IV | Optional | Section 1016, Section 1010 |
| Incidental Stone Base | No* | Section 545 |

* When ABC or any other aggregate product is used as Incidental Stone Base as defined in Section 545 of the *Standard Specifications*, sampling or testing is NOT required.

B. Types of ABC

There are two types of ABC depending on how and when they are sampled and tested for conformity to specifications. These are: Type A ABC and Type B ABC. Type A ABC is sampled by the aggregate producer from a production pile. Type B ABC is sampled by the aggregate producer from an "approved" stockpile, which has specific permissible dimensions in terms of layer thickness, tonnage per layer, etc. There is tighter control in building an approved stockpile compared to a production pile. At a quarry, a production pile (Type A ABC) may have material being added at one end of the pile while material is simultaneously being shipped from the other end. For an approved stockpile (Type B ABC), the material is continuously added until the specified pile is completed, sampled, tested, and approved by the GeoMaterials Engineer. Once approval is granted, no additional material can be added and shipment to the project can begin.

## Section 4 – Roadway Assurance (RA) Sampling

Whether Type A ABC or Type B ABC is used for a roadway, it has presumably already been tested by the producer (QC) and by the Department (QA) for conformity with specifications while the material is still at the quarry. Again, the purpose of obtaining RA samples is to ensure that the quality of the material placed in the roadway is no different from the quality of the material from the quarry that has satisfied the QC/QA Program requirements. The sampling procedure to be used depends on how the product will be used at the project. As required by the *Standard Specifications*, aggregate material is placed on the roadway using a mechanical spreader. A mechanical spreader reduces segregation and controls the depth of material as it is placed. If, due to unusual circumstances, a mechanical spreader can not be used, follow the applicable items (i.e. lot size, sample size, etc.) discussed in Section 4 of this manual; however, utilize the sampling procedures described in Appendix E. If a Contractor elects to obtain aggregate

from two or more quarries, care must be taken to keep each quarry's material separated for acceptance purposes (i.e. gradation, density, etc). For example, material represented in a sampling lot must be from one quarry. If you are unsure of any aspects regarding aggregate sampling contact the GeoMaterials Laboratory for assistance (919) 329-4150.

A. Aggregate Base Course (ABC)

When sampling ABC from the roadway, a NCDOT-approved sampling ring is used. The purpose of the sampling ring is to "isolate" the sample from the rest of the roadway. The specifications for this ring and the procedure to be followed in sampling are given in Appendix A. Sample(s) should be obtained prior to any compaction or manipulation of the material. As stated in the *Standard Specifications* Sub-article 520-7, ABC shall be machined and compacted "within 48 hours after beginning placement of the base". No more than five days of ABC placement shall occur without a sample. No RA samples are required if a project utilizes less than 2,500 total tons of ABC (falls under small quantity as stated in Minimum Sampling Guide). Random numbers are used to locate sampling sites in order to prevent biased sampling. However, samples should not be located within 2 feet of the edge. The procedure for using random numbers is described in Appendix B of this manual. If the specifications require two layers of ABC to be placed, "close-out" the sampling lot of the first layer prior to placement of the second layer of material.

Each sample will require a RA sample weighing a minimum of 70 pounds dry (two full sample bags) in order to be processed.

For sampling and acceptance purposes, a lot will be 2,500 tons or a fraction thereof.

For each lot of aggregate placed on the road, one (1) sample will be taken at a random location on the road prior to compaction. The LL, PI, and gradation results of this sample will be used to determine the acceptability of the lot.

**Liquid Limit/Plasticity Index (LL/PI)** - The material passing the No. 40 sieve shall not have a Liquid Limit in excess of 30 or a Plasticity Index in excess of 6. If any individual test result indicates values exceeding these, the lot will be rejected.

**Gradation** - For the lot to be acceptable, the gradation test results shall meet the gradation requirements shown in Column C of Table 1010-1. When the gradation test result falls outside the limits of Column C of Table 1010-1, the lot will be rejected.

B. Sampling ABC used for stabilization - "Stabilizer Aggregate - SA"

In order to obtain a representative sample, Stabilizer Aggregate is sampled while it is in the spreader box prior to spreading and mixing. Each test will require a RA sample weighing 70 pounds dry in order to be processed. The guidelines for determining the lot size are given below and are exactly the same for roadway sampling.

For sampling and acceptance purposes, a lot will be 2,500 tons or a fraction thereof.

For each lot of aggregate delivered to the project, one (1) sample will be taken at a random interval. The LL, PI, and gradation results of this sample will be used to determine the acceptability of the lot. Sample(s) must be obtained prior to spreading the material to the 2 to 3 inch thickness on the roadway. No more than five days of stabilizer aggregate placement shall occur without a sample. Random numbers are used to determine sampling tonnage in order to prevent biased sampling. The procedure for using random numbers is described in Appendix B.
When a dump truck loads the material in a spreader box, typically a conical pile is formed. In sampling stabilizer aggregate, the upper half of this conical pile is struck off and the required sample obtained using a sampling ring (see Appendix A) from the exposed flat surface.

It is intended that the gradation of aggregates be in the middle of the range shown in Column B of Table 1008-1. If, however, the test results for a lot are within the limits shown in Column B of Table 1008-1, the gradation of the lot will be considered as acceptable.

When the LL/PI and gradation test results for a lot exceeds any of the limits shown in Column B of Table 1008-1, the lot will be rejected. The rejected lot will be considered for acceptance only after corrective material has been furnished, placed, and mixed with the in- place aggregate to an acceptable gradation.

C. Sampling ABC used for Cement-Treated Base Course (CTBC)

When Plant-Mixed CTBC is manufactured, cement is added and mixed with the ABC in a pugmill. Sampling of the ABC must be done before the cement is added. Usually samples can be obtained from the conveyor belt before the cement is added. If the contractor elects to manufacture Roadway-Mixed CTBC, Roadway Acceptance samples can be obtained using the same procedures as described for sampling roadway ABC.

When sampling from a conveyor belt the following equipment is needed: flat-tip shovel, brush, 5-gallon bucket, scoop, sample bags, and sample cards (M&T Form 1).

Random numbers are used to determine the tonnage at which the sample is to be taken (see Appendix B). To obtain a sample, the conveyor belt is stopped at the appropriate tonnage and a flat-tip shovel is used to isolate about an 18-inch section. Using a scoop, the material in that isolated section is placed into a 5-gallon bucket and later transferred to bags. It is important that all the material in that isolated section be removed, including the fines that can be removed with a brush.

For sampling and acceptance purposes, a lot will be 2,500 tons or a fraction thereof.

For each lot of aggregate placed on the road, one (1) sample will be taken at random from the pugmill conveyor belt or roadway prior to the cement being added. The LL, PI, and gradation results will be used to determine the acceptability of the lot.

**Liquid Limit/Plasticity Index LL/PI** The material passing the No. 40 sieve shall not have a Liquid Limit in excess of 30 or a Plasticity Index in excess of 4. If any individual test result indicates values exceeding these, the lot will be rejected.

**Gradation** For the lot to be acceptable, the test results shall meet the gradation requirements shown in Column B of Table 1010-4. When the gradation test result falls outside the limits of Column B of Table 1010-4, the lot will be rejected.

D. Select Material Class IV

Obtaining RA samples of Select Material Class IV is optional and sound engineering judgment should be followed when determining whether or not to sample. Select Material Class IV must meet the same specification requirements as roadway ABC (refer to Appendix C Table 1010-1 in this manual).

When sampling Select Material Class IV from the roadway, a NCDOT-approved sampling ring is used. The purpose of the sampling ring is to "isolate" the sample from the rest of the roadway. When the material is placed using a mechanical spreader box, the specifications for this ring and the procedure to be followed in sampling are given in Appendix A. If a mechanical spreader is not used to place the material, follow sampling procedures described in Appendix E. Sample(s) should be obtained prior to any compaction, mixing, or manipulation of the material. Random numbers are used to locate sampling sites in order to prevent biased sampling. The procedure for using random numbers is described in Appendix B of this manual.

Each sample will require a RA sample weighing a minimum of 70 pounds dry (two full sample bags) in order to be processed.

For sampling and acceptance purposes, a lot will be 2,500 tons or a fraction thereof.

For each lot of aggregate placed on the road, one (1) sample will be taken at a random location on the road prior to compaction. The LL, PI, and gradation results of this sample will be used to determine the acceptability of the lot.

**Liquid Limit/Plasticity Index (LL/PI)** - The material passing the No. 40 sieve shall not have a Liquid Limit in excess of 30 or a Plasticity Index in excess of 6. If any individual test result indicates values exceeding these, the lot will be rejected.

**Gradation** - For the lot to be acceptable, the gradation test results shall meet the gradation requirements shown in Column C of Table 1010-1. When the gradation test result falls outside the limits of Column C of Table 1010-1, the lot will be rejected.

# Section 5 – Sample Identification and Numbering

Correct sample identification is just as important as using proper sampling procedures to obtain the sample. Without proper tracking test data will not be incorporated into the acceptance process. If the sample is lost, the effort in actually digging the samples is for nothing and, ultimately, the project may have sample shortages when it is certified or audited.

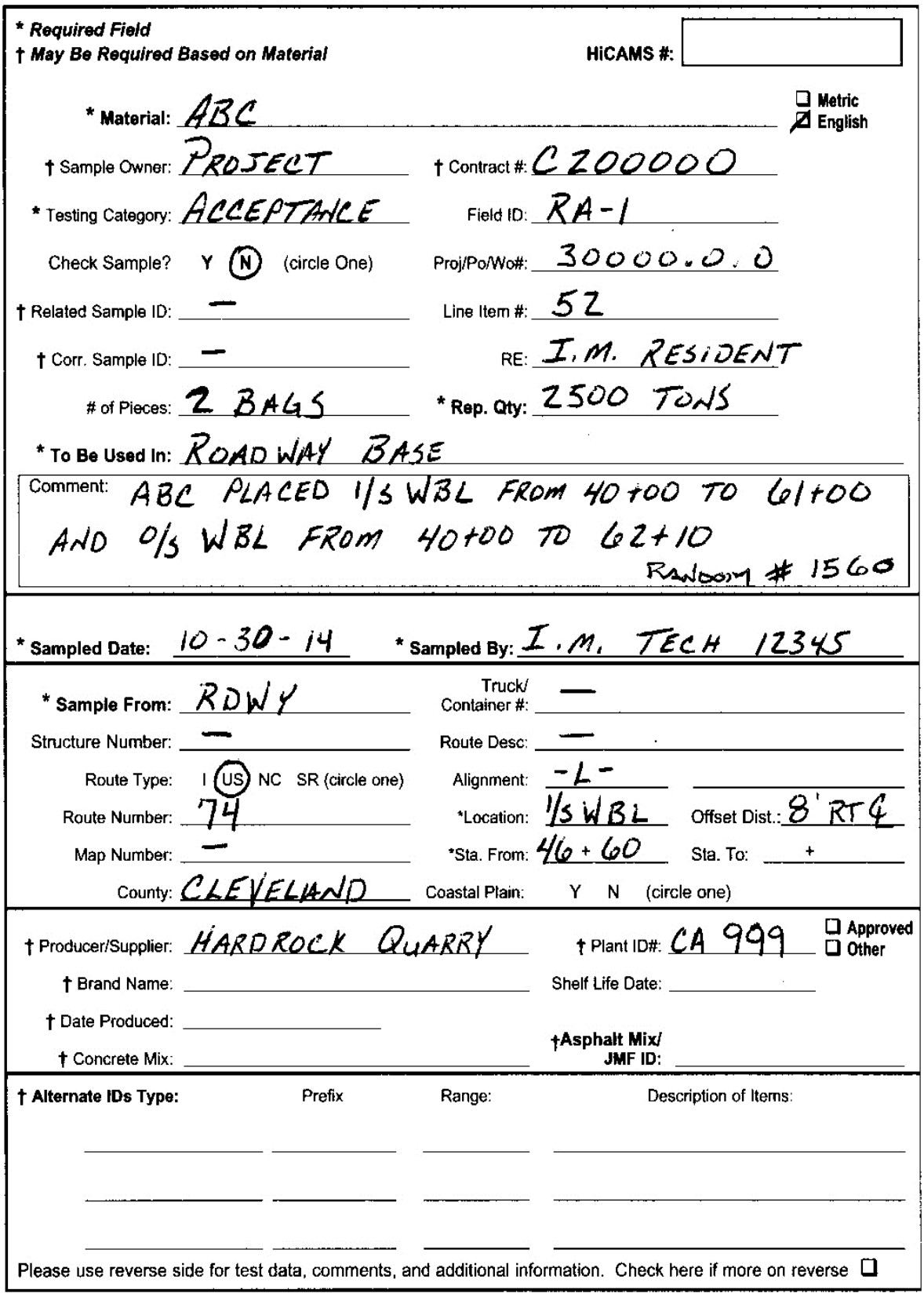
Samples are given an "RA" designation followed by the sample number. For example, the first 2,500 ton sampling lot on a given project will be represented by a sample labeled RA-1 weighing 70 pounds minimum. The second 2,500 ton sampling lot would be labeled RA-2, followed by RA-3, RA-4, etc. Numbering will start with "1" and will run consecutively for the entire project. Each product that is sampled will have its own series of numbers. For example, if CTBC and ABC are being placed on the same project, each material will have its own consecutive numbering series beginning with "RA-1".

One sample card is completed for each sample bag and one duplicate is completed for project files. When completing the represented quantity (***Rep. Qty:**) line on the sample card, enter the total amount of material represented by the sample. For example, if sample RA-4 represents a fraction lot of 1,525 tons then record "1,525" tons on each card. Place completed cards in a plastic bag (to protect the card) and then place each card in the corresponding sample bag.

Figure 1 shows an example of a completed sample card.

The actual sampling site and the beginning and ending stations for each sampling lot should be recorded to ensure the section can be identified if a check sample is required.

For each sample complete the required information in the ABC Sample Field Log book. Refer to Appendix F for an example of the notebook.



* Required Field
† May Be Required Based on Material

HiCAMS #:

* Material: ABC ☐ Metric ☑ English

† Sample Owner: PROJECT † Contract #: C200000

* Testing Category: ACCEPTANCE Field ID: RA-1

Check Sample? Y (N) (circle One) Proj/Po/Wo#: 30000.0.0

† Related Sample ID: — Line Item #: 52

† Corr. Sample ID: — RE: I.M. RESIDENT

# of Pieces: 2 BAGS * Rep. Qty: 2500 TONS

* To Be Used In: ROAD WAY BASE

Comment: ABC PLACED 1/S WBL FROM 40+00 TO 61+00 AND O/S WBL FROM 40+00 TO 62+10 RANDOM # 1560

* Sampled Date: 10-30-14 * Sampled By: I.M. TECH 12345

* Sample From: RDWY Truck/ Container #: —

Structure Number: — Route Desc: —

Route Type: I (US) NC SR (circle one) Alignment: -L-

Route Number: 74 *Location: 1/S WBL Offset Dist.: 8' RT ℄

Map Number: — *Sta. From: 46+60 Sta. To: +

County: CLEVELAND Coastal Plain: Y N (circle one)

† Producer/Supplier: HARDROCK QUARRY † Plant ID#: CA 999 ☐ Approved ☐ Other

† Brand Name: Shelf Life Date:

† Date Produced:

† Concrete Mix: †Asphalt Mix/ JMF ID:

| † Alternate IDs Type: | Prefix | Range: | Description of Items: |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

Please use reverse side for test data, comments, and additional information. Check here if more on reverse ☐

**Figure 1 - Information Required on Sample I.D. Card**

# Section 6 – Check Samples

**Check Samples (ABC)** – The Roadway Construction Engineer and appropriate representative from the aggregate producer should be notified prior to taking a check sample. Check sample(s) will be taken by a representative of Materials and Tests with assistance from project personnel. The Technical Trainer will conduct an investigation and compile a report documenting the results. When obtaining check samples from lots that are rejected, the following steps are to be taken:

(1) Perform additional sampling of the lot. The procedure for this additional sampling consists of obtaining another sample within 5 feet of the original sample.

(2) If check sample test results for the lot are within the limits for LL/PI, and gradation, the lot will be considered acceptable.

(3) When the test results for a lot are outside any of the limits for gradation, and the lot cannot be corrected by the addition of aggregate, or when the gradation of a corrected lot exceeds any of the limits of Table 1010-1, Column B, or the LL or PI exceed the limits of Table 1010-1 Column B, the lot will be rejected and shall be removed and replaced at no additional cost to the Department unless otherwise approved by the Engineer. Correction of a lot when LL or PI results exceed *Standard Specifications* will not be permitted.

(4) When the test results for a lot are outside any of the limits shown in 3 above and the test results indicate the material can be corrected by the addition of aggregate, the Engineer may allow the material to be corrected provided there is no additional cost to the Department for furnishing, adding, re-mixing, re-shaping, and re-compacting of the added material. The method of correcting the lot shall be approved both by the Roadway Construction Engineer and the GeoMaterials Engineer.

(5) One sample will be randomly taken from the corrected lot. When the LL/PI or gradation of a corrected lot exceeds any of the limits of Table 1010-1, Column B, the material will be removed and replaced at no additional cost to the Department in accordance with the requirements of Article 520-6 of the *Standard Specifications*

Additional information regarding check samples can be found in Appendix H and Appendix I.

**Check Samples (CTBC)** - Check Samples of the material will be taken by a representative of Materials and Tests with assistance from project personnel in accordance with the procedures listed below if cement has not yet been added. The Field Engineer will conduct an investigation and compile a report documenting the results. The Roadway Construction Engineer and appropriate representative from the aggregate producer should be notified prior to taking the check sample.

(1) Perform additional sampling of the lot. The procedure for this additional sampling consists of obtaining another sample within 5 feet of the original sample.

(2) When the test results for a lot are within the limits for LL/PI and gradation of Column B of Table 1010-4, the lot will be considered acceptable.

(3) When the test results for a lot are outside any of the limits for gradation, and the lot cannot be corrected by the addition of aggregate or when the gradation of a corrected lot exceeds any of the limits of Table 1010-4, Column B, or the LL or PI of the sample exceed the limits of Table 1010-4 Column B, the lot will be rejected and shall be removed and replaced at no additional cost to the Department unless otherwise approved by the Engineer. Correction of a lot when LL or PI exceeds specifications will not be permitted.

(4) When the test results for a lot are outside any of the limits shown above and the test results indicate the material can be corrected by the addition of aggregate, the Engineer may allow the material to be corrected provided there is no additional cost to the Department for furnishing, adding, re-mixing, re-shaping, and re-compacting of the added material. The method of correcting the lot shall be approved both by the Roadway Construction Engineer and the GeoMaterials Engineer.

(5) One sample will be randomly taken from the corrected lot. When the LL/PI or gradation of a corrected lot exceeds any of the limits of Table 1010-4 Column B, the material will be removed and replaced at no additional cost to the Department in accordance with the requirements of Sub-article 520-6 (B) of the *Standard Specifications*.

Additional information regarding check samples can be found in Appendix H and Appendix I.

**Check Sample Select Material Class IV** - Due to various applications and methods of placement obtaining check samples for Select Material Class IV may or may not be possible. Therefore, when a sample fails for Class IV material it will be evaluated on a case by case basis. If a check sample can be taken the same procedures used for obtaining ABC check samples will apply.

## Section 7 – Check Sample Identification and Numbering

Check sample(s) will be taken by a representative from Materials and Tests and may be taken before correction and are labeled as follows: RA-1A. In the event the Contractor elects to correct the lot, the Resident Engineer's personnel will re-sample the lot and use the next suffix to designate the sample (i.e. RA-1B). The same guidelines for obtaining and submitting samples are to be followed.

## Section 8 – Ethics / Falsification

Ethics has the following definitions when referenced in a dictionary:

1. A principle of right or good behavior
2. A system of moral principles or values
3. The study of general nature of morals and the specific moral choices an individual makes in relating to others
4. The rules or standards of conduct governing the members of a profession

In order to the maintain trust of the general public, the Department has implemented an Ethics Policy and the latest version is as follows:

North Carolina Department of Transportation

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ETHICS POLICY

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### Preamble

The holding of a public office by appointment or employment is a public trust. Independence and impartiality of public officials and employees of the Department of Transportation are essential to maintain the confidence of our citizens.
The members of the Board of Transportation, officers and employees of the North Carolina Department of Transportation have a duty to the people of North Carolina to uphold the public trust, prevent the occurrence of conflicts of interest, and endeavor at all times to use their position for the public benefit.
To this end, members of the board, officers, and employees of the Department of Transportation shall ensure that an atmosphere of ethical behavior is promoted and maintained at all times.

### Introduction

The major transportation functions of the North Carolina Department of Transportation (NCDOT) include highways, public transportation, motor vehicles, railways, bicycles, pedestrian facilities, aeronautics and ferries. The NCDOT is statutorily responsible for providing the necessary planning, construction, maintenance, and operation of an integrated statewide transportation system for the economical and safe transportation of people and goods as provided for by law, including the registration of transportation vehicles and driver's license. It is in the public interest to establish policies on ethical

conduct which set forth a code of behavior to be followed by employees of the NCDOT that is consistent with federal and state laws, as well as related Department policies. These policies on ethical behavior are intended to guide the actions of all employees of NCDOT.

Employees of the NCDOT are expected to maintain and exercise the highest ethical standards of conduct in the performance of their duties and responsibilities, and as a condition of employment shall abide by this policy. Employees of the NCDOT are expected to conduct themselves in a manner that prevents all forms of impropriety, to include but not limited to, placement of self-interest above public interest, partiality, prejudice, favoritism and undue influence.

This policy applies to all employees of the NCDOT and shall be brought to the attention of each employee during orientation and through annual training by Human Resources. Failure to comply with this policy will be grounds for disciplinary action up to and including dismissal.

**Definitions**

1. Conflict of interest -

A conflict of interest arises when an employee's private interest, usually of a personal, financial or economic nature, conflicts or creates the appearance of a conflict with the employee's public duties and responsibilities.

2. Gift -

A gift is anything of value given without compensation.

3. Favor -

A favor is any opportunity, service, accommodation, use of facility, or other benefit made available for less than fair market or normal value given in exchange for being influenced in the discharge of one's duties and responsibilities.

4. Employee -

Employee for the purposes of this policy shall mean both State officer and employee holding an office or employment with the North Carolina Department of Transportation.

5. Family -

Family for the purposes of this policy includes spouse, you and your spouse's children, parents, in-laws, step-parents, step-child, step-sibling, grandchildren, brother, sister, uncle, aunt, first cousin, also any dependent person living in the same household.

**I. Conflict of Interest**

No employee shall have any interest, financial or otherwise, direct or indirect, or engage in any business, transaction or activity that is in conflict or could appear to be in conflict with the proper discharge of his or her duties. An appearance of a conflict of interest exists when a reasonable person would conclude from the circumstances that the employee's ability to protect the public interest, or perform public duties, is compromised by personal interest. Examples of conflict of interest are as follows:

**A. Misuse of Official Position**

No employee shall use or attempt to use his or her position with the NCDOT to secure unwarranted privileges or advantages for himself, herself or others.

**B. Contracts and Purchasing Order Agreements**

No employee authorized to draft, negotiate, administer, accept or approve any contract, subcontract or purchase order agreement on behalf of the State, or any member of his/her family, shall have, directly or indirectly, any financial interest in such contract, subcontract or purchase order agreement.

In an effort to avoid the appearance of impropriety while conducting the public's business, employees will be restricted from accepting any employment or engaging in any relationship following their employment with NCDOT with any business entity in connection with any contract, subcontract or purchase order agreement that they participated in any of the following activities:

1. Drafting the contract, subcontract or purchasing order agreement;
2. Defining the scope of the contract, subcontract or purchasing order agreement;
3. Selection of the business entity for services;
4. Negotiation of the cost of the contract, subcontract or purchasing order agreement, including calculation of man-hours, fees or extent of services;
5. Administration of the contract or purchase order agreement.

This section is not intended to prohibit employment with a business entity if the employment is on work other than the specific contract, subcontract or purchase order agreement with which they were involved. An exception to this section of the policy may be granted when recommended by the Secretary of Transportation and approved by the Board of Transportation.

**C. Real/Personal Property**

No employee or member of his/her family shall use an employee's position to profit from, directly or indirectly, an interest in real or personal property.

**D. Business Opportunities**

No employee or member of his/her immediate family shall accept any business or professional opportunity when such person knows, or reasonably should know, that the opportunity is being afforded to them with the intent to influence the performance of the employee's official duties.

**E. Outside Employment and Activities**

In accordance with NCDOT Secondary Employment policy, the employment responsibilities to the State are primary for any employee working full-time and and other employment in which that person chooses to engage is secondary. An employee shall have the approval from the division, branch or unit manager before engaging in any secondary employment.

No employee shall accept employment or render services for any private or public interest when that employment or service is in conflict with the discharge of his or her official duties or when that employment may tend to impair his or her objectivity or independence of judgment in the performance of such duties or induce them to disclose confidential or any information gained through their State duties.

**F. Use of Information**
No employee shall, directly or indirectly, use, disclose, or allow the use of official information which was obtained through or in connection with his or her official duties and which has not been made available to the general public for the purpose of furthering the private interest or personal profit of any business entity or person, including the employee.

**II. Gifts and Favors**
No employee shall knowingly, directly or indirectly, ask, accept, demand, exact, solicit, seek, assign, receive, or agree to receive anything of value for the employee or for another person, in return for being influenced in the discharge of the employee's duties and responsibilities.
No employee shall solicit for a charitable purpose a gift from a subordinate employee, except as provided in NC General Statute, Section 138A-32 (b).
No employee shall solicit or accept, directly or indirectly, on behalf of himself or herself or family member, any gift or favor from a contractor, subcontractor, vendor, supplier, lobbyist or any other individual or other business entity that:
1. Has or is seeking to obtain contractual or other business or financial relations with the Department;
2. Conducts operations or activities that are regulated by the Department;
3. Have interests that may be substantially affected by the performance or non-performance of the employee's official duties.

Exceptions to this section, gifts and favors, are noted in NC General Statute, Section 138A-32 (e).

Any such gift or favor received from a contractor, subcontractor, supplier, lobbyist or any other individual or other business entity must be reported and remitted immediately through the appropriate chain of command to the Secretary of Transportation.

**III. Consultation**
Employees are urged to consult with the Division of Human Resources, Classification, Compensation & Policy Unit staff when an ethical question arises under this policy.

**IV. Distribution and Training of Ethics Policy**
A copy of this policy will be presented to all new employees at the time of employment and posted in a conspicuous place throughout the Department and made available on the NCDOT web site.
Training shall be provided by Human Resources every other year.

**V. Enforcement and Compliance**
This policy will be enforced by the Secretary of Transportation. Failure to comply with the above policy will be grounds for disciplinary action up to and including dismissal from employment with the NCDOT. Conflicts of interest or unethical behavior that

defrauds the Department, vendor, contractor, subcontractor, or supplier may also be violations of criminal law and may result in criminal prosecution.

**VI. Disclosures**

Any employee who identifies a conflict of interest shall disclose the same promptly in writing through appropriate management channels to the Secretary of Transportation.

**Falsification**

North Carolina State Law G.S. Chapter 136 Roads and Highways
13.2 Falsifying highway inspection reports

(a) Any person who knowingly falsifies any inspection report or test report required by the Department of Transportation in connection with the construction of highways shall be guilty of a Class H Felony.
(b) Any person who directs a subordinate under his direct or indirect supervision to falsify an inspection report or test report required by the Department of Transportation in connection with the construction of highways shall be guilty of a Class H Felony.

Punishment for a Class H Felony can result in up to 10 years in jail, up to $10,000.00 in fines or both.

Federal Law Title 18-Crimes and Criminal Procedure
Part I – Crimes
Chapter 47 – Fraud and False Statements
Section 1020. Highway Projects

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

Whoever knowingly makes any false statement or false representation as to a material fact in any statement, certificate, or report submitted pursuant to the provisions of the Federal-Aid Road Act approved July 11, 1916 (39 Stat. 355), as amended and supplemented, Shall by fined under this title $10,000.00 or imprisoned not more than five years, or both.

## Falsification of Records is defined as the changing or misrepresentation of Data or Tests. Falsification also includes the destruction of alteration of records.

# Appendix A

## ABC Sampling Using Steel Sampling Ring

Equipment

Steel sampling ring (12-inch outside diameter, 9-inch deep)
Scoop/Large spoon
Small pick
Sample bags (in good condition)
Wooden mallet
Sample card
Plastic bags (for sample cards)
Plastic ties

Procedure

NOTE: The following procedure is for taking a sample when the material is placed using a mechanical spreader box. Note that 70 pounds of material will require a minimum of 2 full M&T sampling bags. The sample is to be obtained on the loose lift (prior to any compaction, manipulation, or sealing) and should not be within 2 feet of the edge of a spread. If the sampling site looks unusually segregated when visually compared with the surrounding material, do not sample in the segregated area. Move the ring out of the segregated area and obtain the sample. Note your decision and actions (in the Field Log Book), and include the location of the segregated area. If you continue to notice segregated areas, investigate to determine the cause. If you have any questions regarding this issue, contact your Technical Trainer.

1. Place sample ring on flat surface of material to be tested.
2. Use the pick to carefully loosen material. Remove the material with the scoop or spoon and place it in a sample bag.
3. Lower the ring as the material is removed. This can be accomplished by lightly tapping the top of the ring with a wooden mallet. Remove all material down to the full depth of the layer.
4. If two full bags have been obtained after the ring reaches the bottom of the layer, go to step 6. If not, move the ring over such that the new position of the ring overlaps with the previous position (see Figure A.1). The technician will exercise judgment on whether there is sufficient material within the ring's new position so that the two-bag minimum will be attained.
5. Repeat steps 2 to 4.
6. Fill out a sample card accordingly. A sample card must be placed in each bag of material.
7. Enter sample details into HiCAMS
8. Deliver sample(s) to Materials and Tests within **48 hours** of obtaining samples.

This is a top view of the ring. The solid circle shows the location of the sampling ring. The dashed circle is an example of an acceptable new location for obtaining additional material. Note that the two locations must overlap.

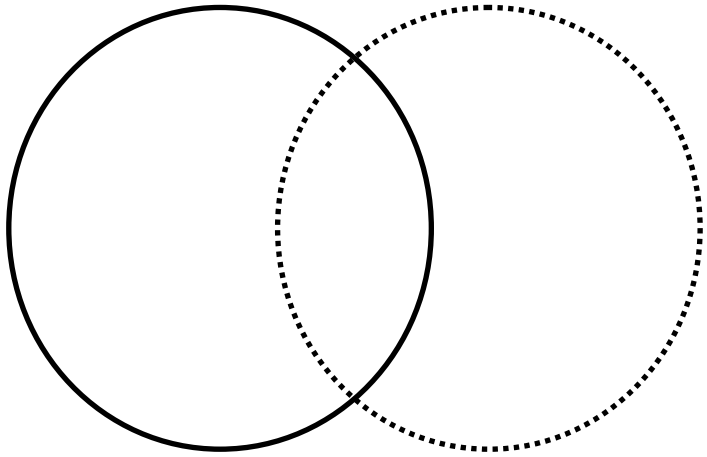


**Figure A.1 - Moving the Sampling Ring**

# Appendix B

**Random number calculation examples**

The purpose of using random numbers in taking samples is to ensure that sampling is unbiased. It prevents the preferential selection of a sample location based on some form of bias, such as sample appearance, etc.

Use the random numbers provided in Appendix K of this manual. Record the random numbers used for calculating the sample location on the "Comment" box on the sample card and in the "Remarks" column in the ABC Field Log Book (Appendix G). To ensure that the numbers obtained from these tables are truly random, a consistent pattern must be used in extracting numbers from the tables. Once a pattern is established, it shall be used for the duration of the project.

In ABC sampling, the random numbers are typically used to obtain the tonnage at which a sample is to be obtained.

**Example 1**: First sample of ABC used in roadway (assume 12 foot lay-down width).

a) Random numbers are as follows:

| | 0 |
|---|---|
| 1 | 8121 |
| 2 | 4185 |
| 3 | 7423 |
| 4 | 9153 |
| 5 | 1617 |

b) Lot size = 2,500 tons

c) The sample is to be taken at

2,500 tons x 0.81 = **2,025 tons**

12 ft x 0.21 = **2.5 or 3 feet from either edge**

d) Once a random number(s) is used, strikethrough the number

**Example 1 (continued):** Second sample of ABC used in roadway (assume 12 foot lay-down width)

a) Random numbers are as follows:

| | 0 |
|---|---|
| 1 | ~~8121~~ |
| 2 | 4185 |
| 3 | 7423 |
| 4 | 9153 |
| 5 | 1617 |

b) Lot size = 2,500 tons

c) The sample is to be taken at

2,500 x 0.41 = 1,025 tons

1,025 + 2,500 = **3,525 tons**

12 ft x 0.85 = **10 feet**

d) Once a random number(s) is used strikethrough the number

e) Repeat these procedures for the remaining sampling lots

**Example 2:** Stabilizer Aggregate sampled from spreader box (no need to calculate random location for the width)

a) Random numbers are as follows:

| | 0 |
|---|---|
| 1 | ~~8121~~ |
| 2 | ~~4185~~ |
| 3 | 7423 |
| 4 | 9153 |
| 5 | 1617 |

b) Lot size = 1,255 tons

c) The sample is to be taken at

1,255 x 0.74 = **928.7 or 929 tons**

**Example 3**: Select Material Class IV (placed without spreader box, refer to sampling procedures listed in Appendix E)

a) Random numbers are as follows:

| | 0 |
|---|---|
| 1 | ~~8121~~ |
| 2 | ~~4185~~ |
| 3 | ~~7~~423 |
| 4 | 9153 |
| 5 | 1617 |

b) Lot size 2,500 tons

c) The sample is to be taken from the center of the pile at:

2,500 x 0.23 = **575 tons**

d) Once a random number(s) is used, strikethrough the number

**Example 4**: ABC sampled from a project which utilizes a total of 3,500 tons (ABC placed with spreader box 12 foot width). This process stratifies the sampling locations to obtain a better representation of the material being delivered. This process should be followed when a project uses less than 5,000 tons.

a) Minimum of two samples required, therefore divide the 3,500 tons into two equal lots:

3,500 / 2 = **1,750 ton sampling lots**

b) Utilize proper sampling procedures (refer to Appendix A)

c) Randomly locate sampling site form the each 1,750 ton lot

d) Random numbers are as follows:

| | 0 |
|---|---|
| 1 | ~~8121~~ |
| 2 | ~~4185~~ |
| 3 | ~~7423~~ |
| 4 | 9153 |
| 5 | 1617 |

e) The first sample is to be taken:

1,750 x 0.91 = 1592.5 or **1,593 tons**

12 ft x 0.53 = 6.36 or **6 feet from edge**

d) The second sample is to be taken:

1,750 x 0.16 = 280

280 + 1750 tons = **2,030 tons**

12 ft x 0.17 = 2.04 or **2 feet from edge**

e) Once a random number is used, strikethrough the number.

# Appendix C

## Roadway Assurance Specification Tables

**Table 1008-1**
Aggregate for Stabilization – Stabilizer Aggregate
Gradation Acceptance Ranges, Liquid Limit, and Plasticity Index

| Column A (Sieve Size) | Column B % Passing |
|---|---|
| 1-1/2” | 100 |
| 1” | 72-100 |
| ½” | 51-83 |
| #4 | 35-60 |
| #10 | 20-50 |
| #40 | 10-34 |
| #200 | 3-13 |
| Material Passing No. 40 Sieve | |
| L. L. | 0-30 |
| P. I. | 0-6 |

Table 1008-1

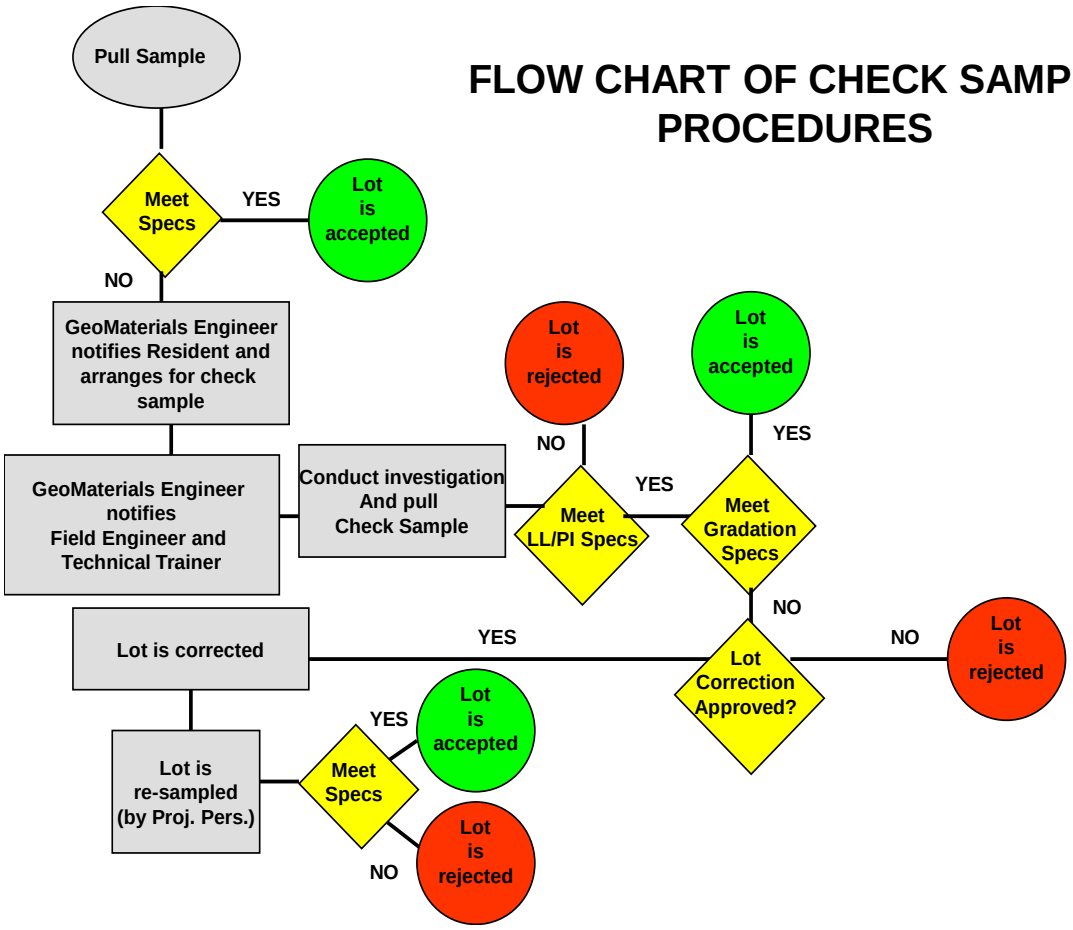
**Table 1010-1**
Base Course – ABC, CTBC, and Select Material Class IV
Gradation Acceptance Ranges, Liquid Limit, and Plasticity Index

| Column A (Sieve Size) | Column B % Passing | Column C % Passing | Column D (penalty points) |
|---|---|---|---|
| 1-1/2” | 100 | 98-100 | 1 |
| 1” | 75-97 | 72-100 | 1 |
| ½” | 55-80 | 51-83 | 1 |
| #4 | 35-55 | 35-60 | 3 |
| #10 | 25-45 | 20-50 | 2 |
| #40 | 14-30 | 10-34 | 3 |
| #200 | 4-12 | 3-13 | 5 |
| * Material Passing No. 10 Sieve (Soil Mortar) | | | |
| #40@ | 40-84 | 36-84 | 2 |
| #200@ | 11-35 | 10-36 | 2 |
| Material Passing No. 40 Sieve | | | |
| L. L. | 0-30 | 0-30 | - |
| P. I. | 0-4 | 0-4 | - |

Table 1010-1

*Soil Mortar specification requirements (#40@ and 200@) apply if P.I. is greater than 4. If the P.I. exceeds 6, material shall be rejected**.** P.I. cannot exceed 4 for CTBC.

# Appendix D


FLOW CHART OF CHECK SAMPLE PROCEDURES
Pull Sample
Meet Specs
YES
Lot is accepted
NO
GeoMaterials Engineer notifies Resident and arranges for check sample
GeoMaterials Engineer notifies Field Engineer and Technical Trainer
Conduct investigation And pull Check Sample
Meet LL/PI Specs
NO
Lot is rejected
YES
Meet Gradation Specs
YES
Lot is accepted
NO
Lot Correction Approved?
NO
Lot is rejected
YES
Lot is corrected
Lot is re-sampled (by Proj. Pers.)
Meet Specs
YES
Lot is accepted
NO
Lot is rejected

# Appendix E

**Sampling procedures when a mechanical spreader is not used**

If aggregate is placed without a mechanical spreader, segregation will occur as the material is "tailgated" or spread on the grade. Once material is spread in this manner it may not represent what was actually delivered. Therefore, when sampling in this manner, the following procedures will apply:

Equipment

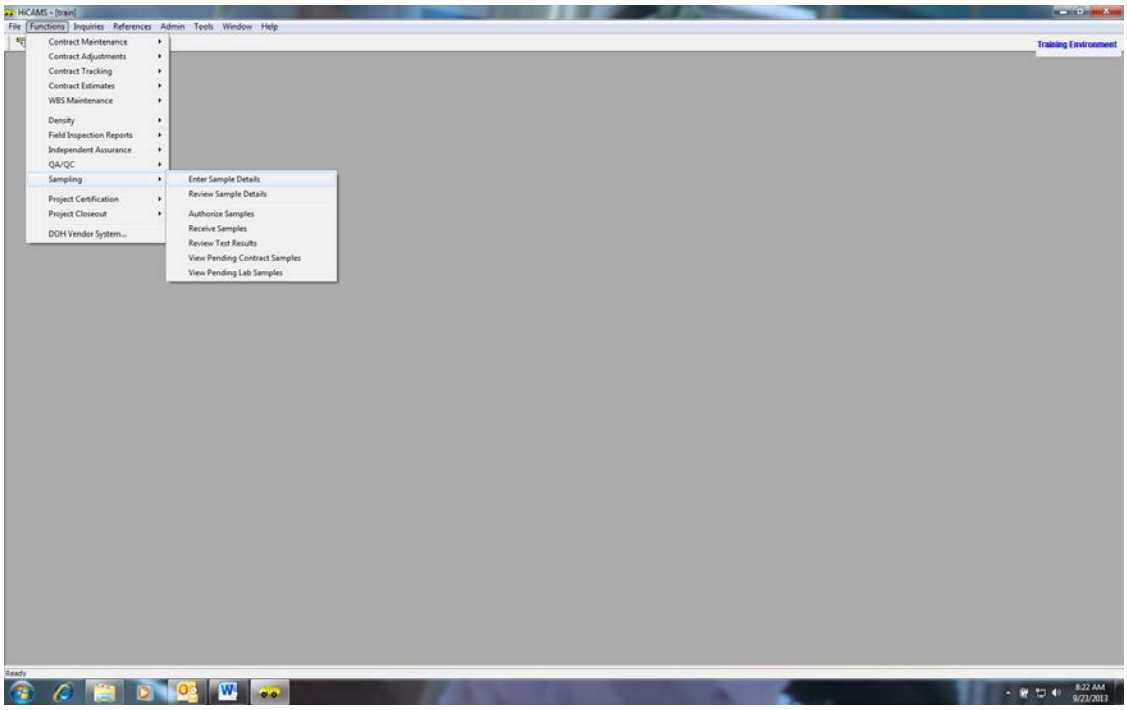
Steel sampling ring (12-inch outside diameter, 9-inch deep)
Scoop/Large spoon
Small pick
Shovel (not used to take the sample)
Sample bags (in good condition)
Wooden mallet
Sample card
Plastic bags (for sample cards)
Plastic ties

1. Use random numbers as described in Appendix B to determine the sampling tonnage.
2. When the truck dumps the material a conical shaped pile is formed.
3. Using the blade of a motor grader, dozer, or if necessary, a shovel, strike off the top half of the pile.
4. Place the NCDOT approved sampling ring in the middle of the pile.
5. Use the pick (if necessary) to loosen material from within the ring and use a scoop or spoon to place the material from within the ring into the sample bag.
6. Lower the ring as material is removed. This can be accomplished by lightly tapping the top of the ring with a wooden mallet (never tap top of ring with a metal object).
7. Obtain two full bags of material (approximately 70 pounds).
8. Fill out a sample card for each bag.
9. Place each sample card in a plastic bag.
10. Place a sample card in each bag.
11. Seal top of bag.
12. Enter sample details into HiCAMS.
13. Deliver samples to Materials and Tests within **48 hours** of obtaining the sample.

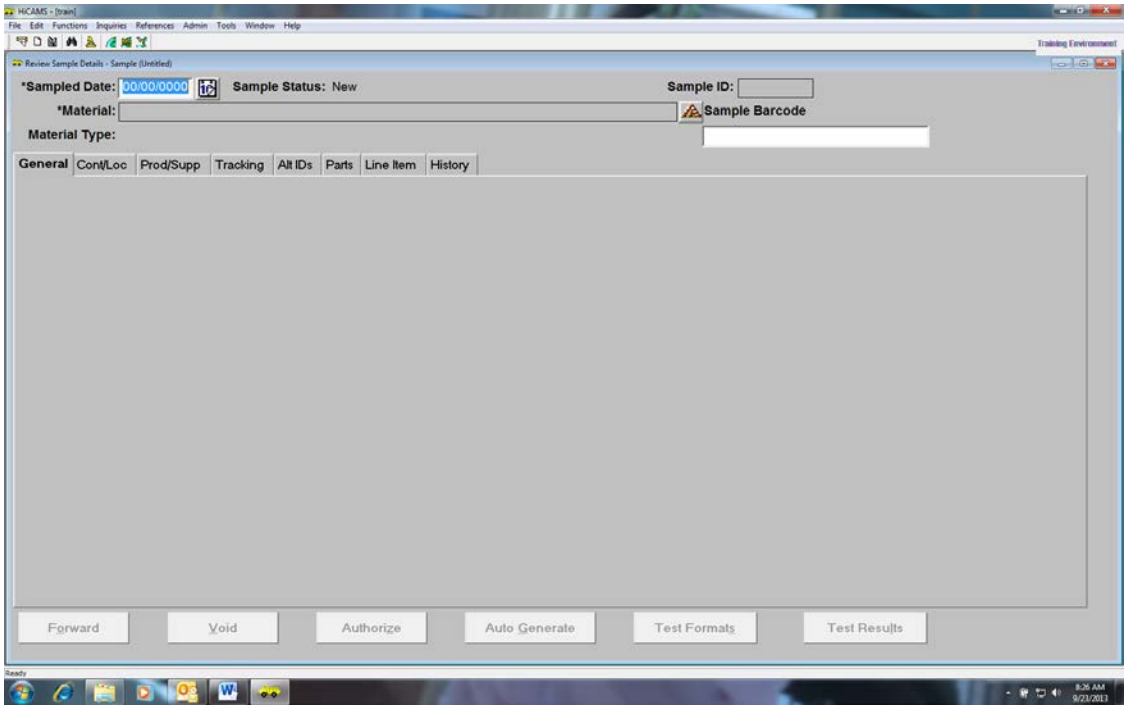
# Appendix F

## Procedures for entering samples into HiCAMs

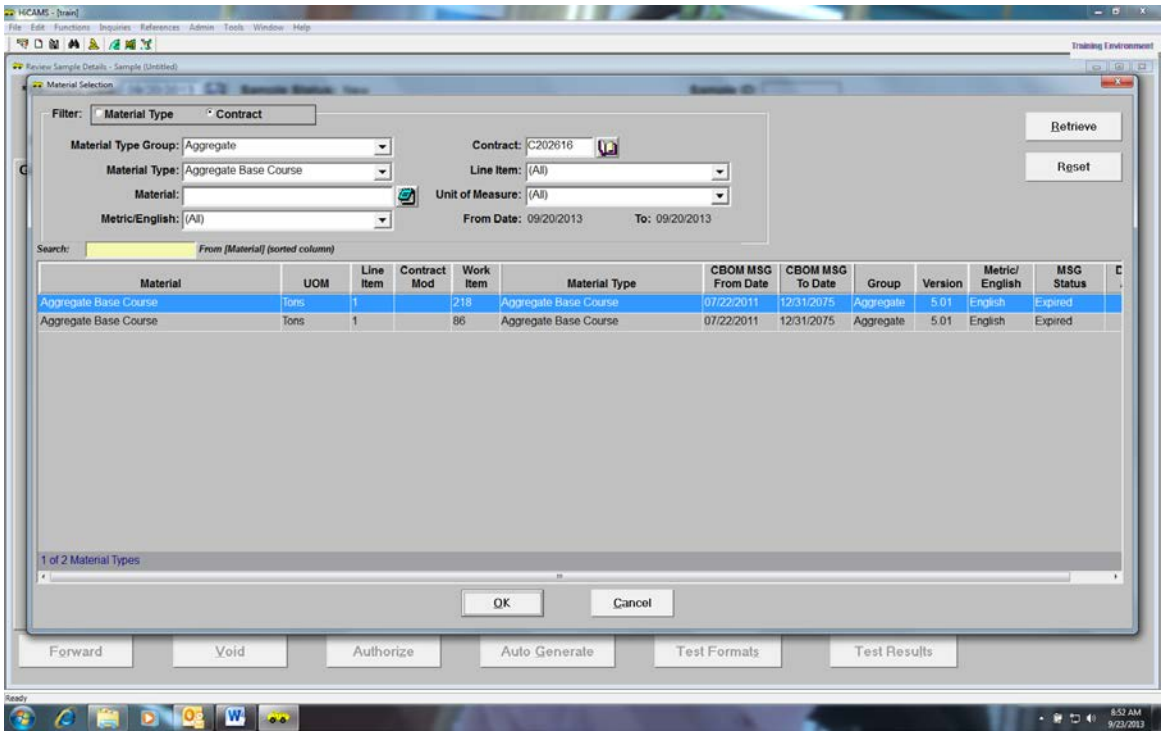
Select “Functions”; then “Sampling”; then “Enter Sample Details”



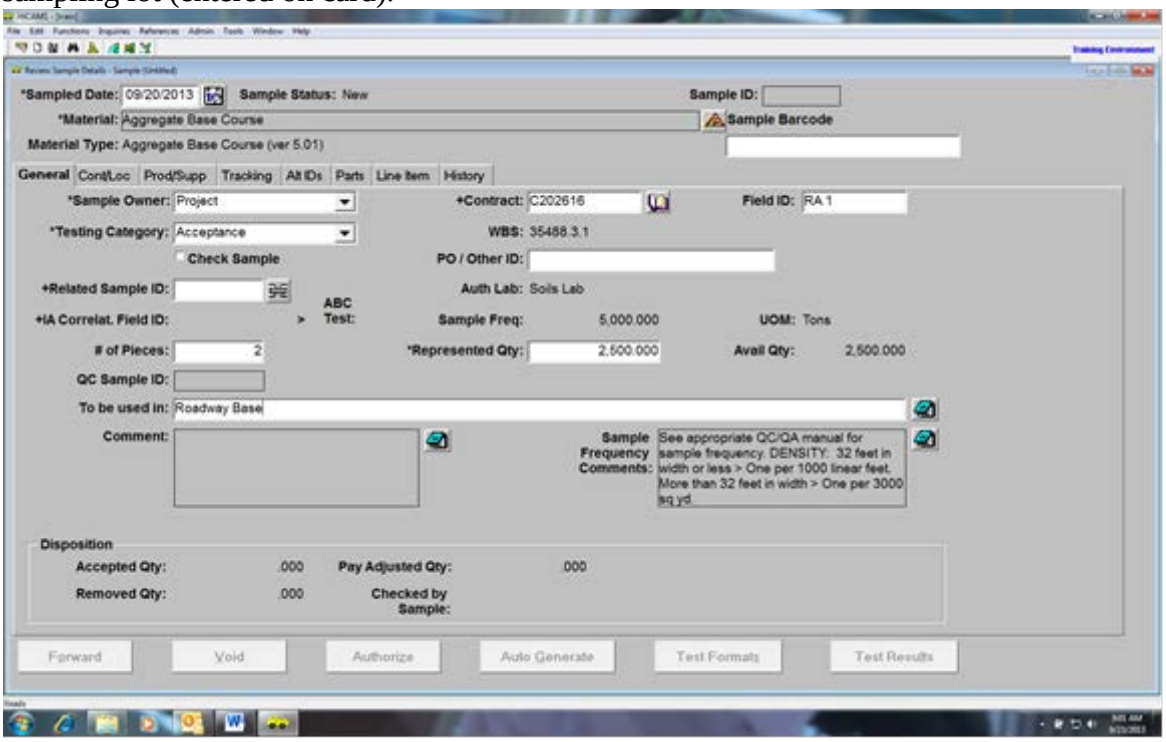

Enter the “Sampled Date”



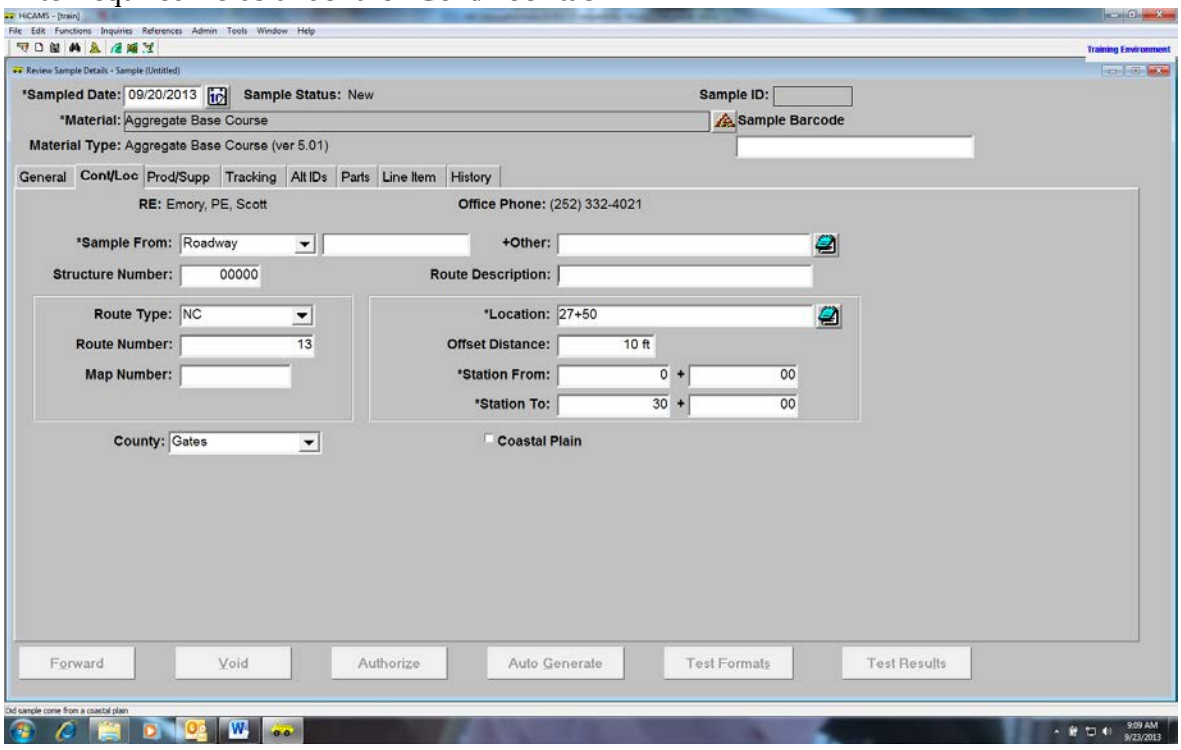
Enter “Contract” and select “Material Type” = “Aggregate Base Course”. Highlight appropriate item the aggregate material is being used in.



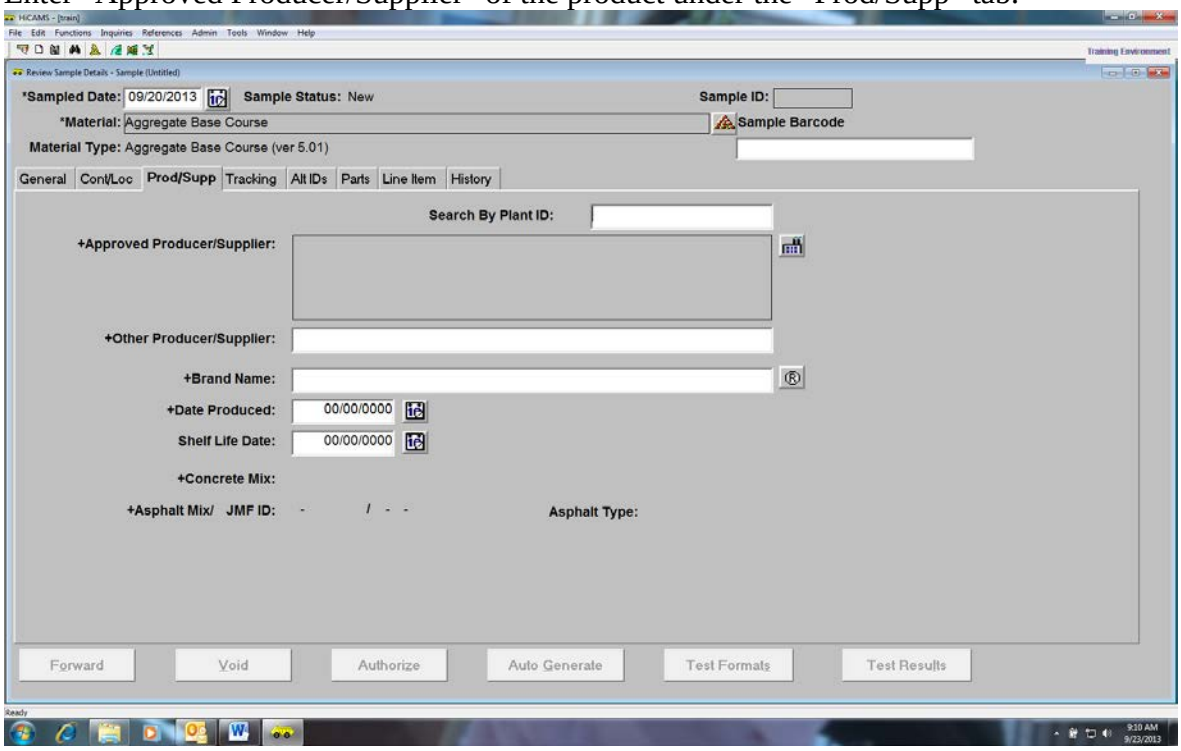

Enter required fields under the “General” tab. The “**Sampling Freq**:” should be 2,500 and the “**Represented Qty**:” should equal the amount of material represented in the sampling lot (entered on card).



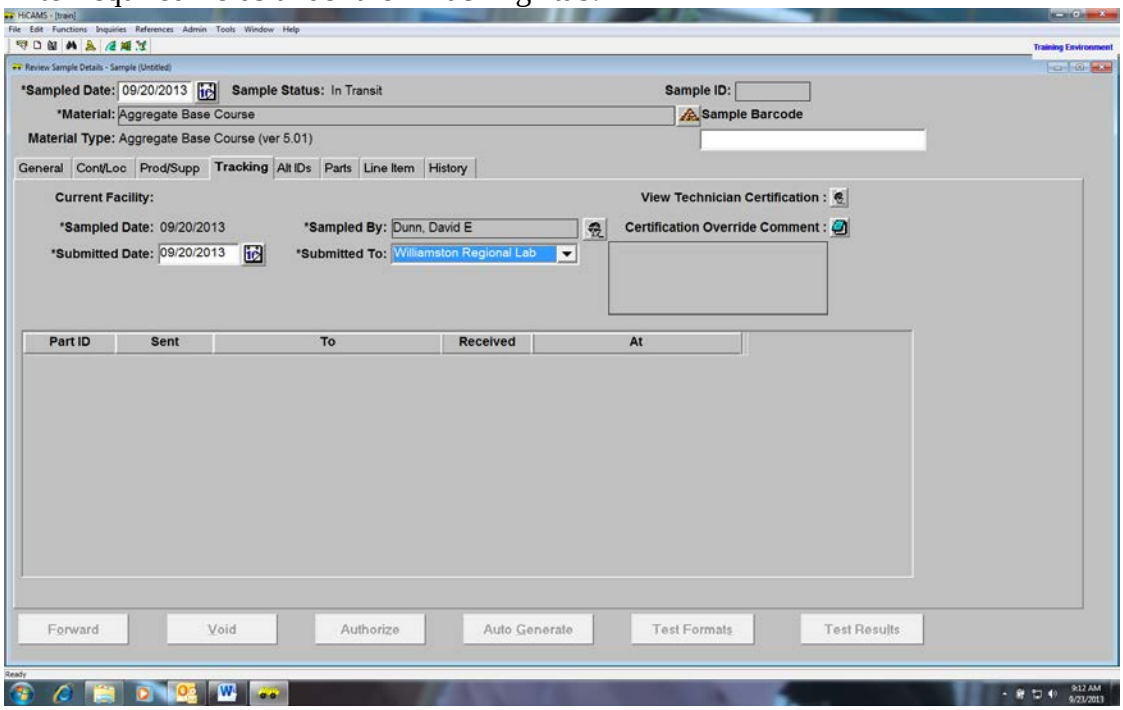
Enter required fields under the “Cont/Loc” tab



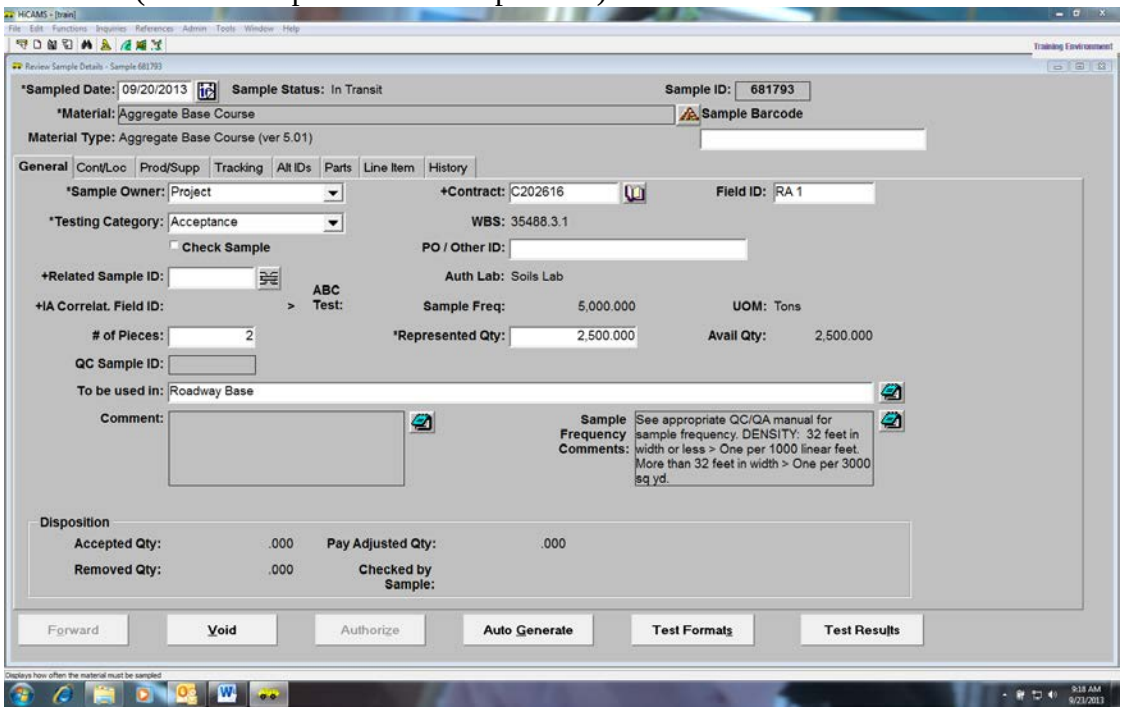

Enter “Approved Producer/Supplier” of the product under the “Prod/Supp” tab.



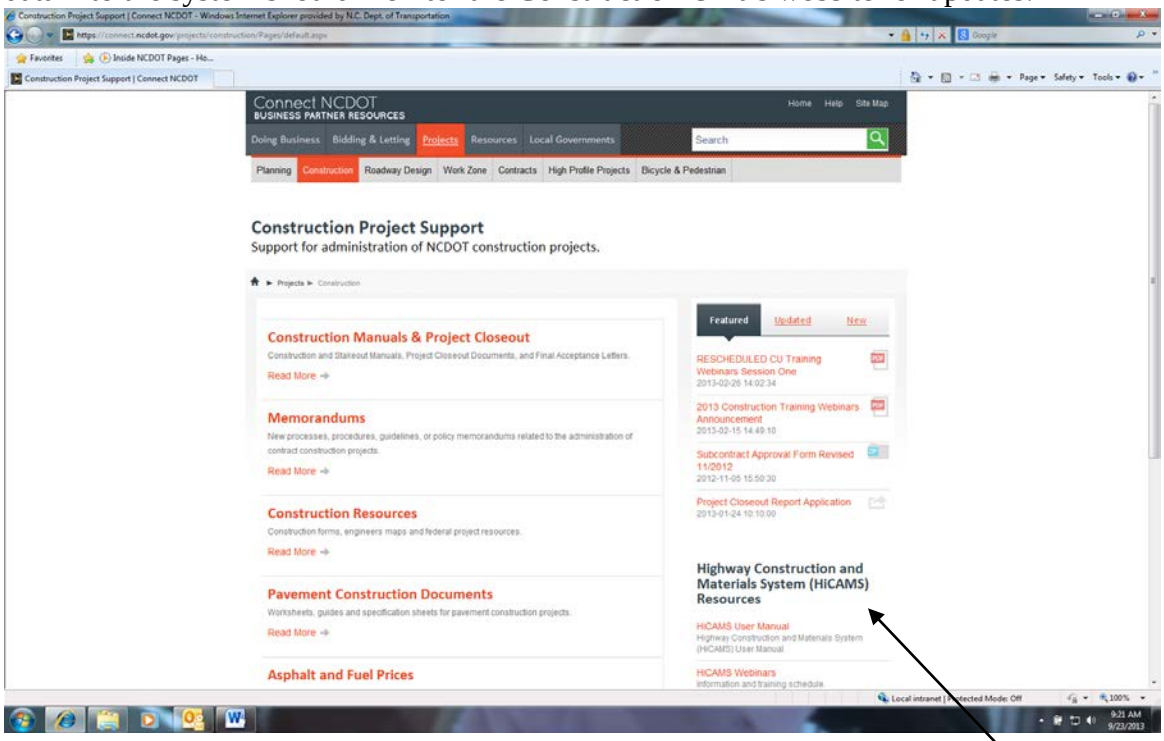
Enter required fields under the “Tracking” tab.




If all required information has been entered, pick the “Save” function. The system will prompt you if any required field(s) has not been entered. A “Sample ID:” will be displayed if all information is entered and the sample was successfully saved into HiCAMS (record Sample ID # on sample card).



Since the HiCAMs database is changed periodically, personnel responsible for entering data into the system should monitor the Construction Unit's website for updates.




Information regarding HiCAMS can be accessed at this website.

# Appendix G

Refer to figure below for an example of a maintaining an ABC Field Log

| LC 32 Aggregate Base Course | | | Roadway Assurance (RA) Sample Book | | | | | | | | Sample Frequency | - 1 Sample per 2,500 Tons or fraction thereof<br>- No more than 5 days of ABC placement without a sample<br>- Samples may be taken more often to ensure minimum samples are obtained, or as deemed necessary by the RE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample # | Alignment | Station | Distance From C/L | Random Number | Daily Total | Cumulative Total | Represented Quantity | Result | Date | Initials | Remarks | | |
| | | | | | 895.04 | 895.04 | | | 9/12/2009 | | | | |
| | | | | | 763.66 | 1658.7 | | | 9/23/2009 | | | | |
| | | | | | 37.68 | 1696.28 | | | 9/26/2009 | | | | |
| RA - 1 | -L- | 13+35 | 28.8 Rt | 7316 | 579.77 | 2276.05 | 2276.05 | Pass | 10/10/2009 | BYO | | | |
| RA - 2 | -Y1- | 15+23 | 2.0 Rt | 3204 | 604.24 | 2880.29 | 604.24 | Fail | 12/12/2009 | BYO | RE requested sample due to failure to use spreader box | | |
| | | | | | 1030.99 | 3911.28 | | | 10/18/2009 | | | | |
| RA - 2A | -Y1- | 15+23 | 6.6 Rt | 2392 | ---- | ---- | ---- | Pass | 10/18/2009 | DOP | Check Sample Passed (Taken by M&T) | | |
| | | | | | 100.11 | 4011.39 | | | 10/19/2009 | | | | |
| | | | | | 284.05 | 4295.44 | | | 10/20/2009 | | | | |
| RA - 3 | -L- | 22+54 | 43.2 Rt | 2976 | 1084.85 | 5380.29 | 2500 | Pass | 10/23/2009 | BYO | Today's quantity (1438.99) split between RA-3 and RA-4 | | |
| | | | | | 354.14 | 5734.43 | | | 10/23/2009 | | | | |
| | | | | | 310.56 | 6044.99 | | | 10/24/2009 | | | | |
| | | | | | 1133.28 | 7178.27 | | | 10/25/2009 | | | | |
| | | | | | 18.91 | 7197.18 | | | 10/27/2009 | | | | |
| | | | | | 75.39 | 7272.57 | | | 10/28/2009 | | | | |
| RA - 4 | -L- | 12+34 | 44.2 Lt | 4820 | 82.52 | 7355.09 | 1974.8 | Pass | 11/2/2009 | BYO | Sample taken due to 5 days of placement | | |
| | | | | | 370.74 | 7725.83 | | | 11/15/2009 | | | | |
| | | | | | 194.08 | 7919.91 | | | 11/16/2009 | | | | |
| RA - 5 | -L- | 15+94 | 40.12 Lt | 3937 | 1309.89 | 9229.8 | 1874.71 | Fail | 11/17/2009 | BYO | | | |
| RA - 5A | -L- | 15+94 | 41.62 Lt | 2930 | ---- | ---- | ----- | Fail | 11/23/2009 | DOP | Check Sample Failed (Taken by M&T) Removed & Replaced | | |
| | | | | | 911.82 | 10,141.62 | | | 12/12/2009 | | | | |
| | | | | | 19.53 | 10161.15 | | | 12/14/2009 | | | | |
| RA - 6 | -L- | 19+32 | 47.0 Lt | 3203 | 1192.21 | 11353.36 | 2123.56 | Pass | 3/22/2010 | FRH | | | |
| | | | | | 743.63 | 12096.99 | | | 3/29/2010 | | | | |
| | | | | | 292.33 | 12389.32 | | | 3/30/2010 | | | | |
| RA - 7 | -L- | 21+10 | 33.4 Lt | 3465 | 678.8 | 13068.12 | 1714.76 | Pass | 4/1/2010 | FRH | | | |
| RA - 8 | -L- | 25+37 | 29.8 Rt | 3920 | 2301.4 | 15369.52 | 2301.4 | Pass | 4/15/2010 | BYO | | | |
| RA - 9 | | 31+98 | 31.5 Rt | 3827 | 2500 | 17869.52 | 2500 | Pass | 4/16/2010 | KLM | Today's quantity (3019.93) split between RA-9 & RA-10 | | |
| | | | | | 519.93 | 18389.45 | | | 4/16/2010 | | | | |
| RA - 10 | | 35+21 | 42.3 Rt | 9372 | 1913.33 | 20302.78 | 2433.26 | Pass | 4/17/2010 | KLM | | | |

Notes
> Random number when days production is less than 2500 should be based on estimated days production for day which sample is taken
> Represented quantity should be 2500 tons or quantity represented since last sample
> Check samples must be taken by M&T Independent Assurance Technician

## LC 32 Aggregate Base Course — Roadway Assurance (RA) Sample Book

Sample Frequency
- 1 Sample per 2,500 Tons or fraction thereof
- No more than 5 days of ABC placement without a sample
- Samples may be taken more often to ensure minimum samples are obtained, or as deemed necessary by the RE

| Sample # | Alignment | Station | Distance From C/L | Random Number | Daily Total | Cumulative Total | Represented Quantity | Result | Date | Initials | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
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Notes
> Random number when days production is less than 2500 should be based on estimated days production for day which sample is taken
> Represented quantity should be 2500 tons or quantity represented since last sample
> Check samples must be taken by M&T Independent Assurance Technician

# Appendix H

## Procedures for Failing Roadway Assurance Samples

1. As soon as the test results are available, the GeoMaterials Engineer will contact the Resident Engineer's office by phone and email notifying of the failure, with corresponding HiCAMs information, and arranging for a check sample to be obtained by M&T. The State Materials Engineer, State Construction Engineer, applicable Area Construction Engineer, Quality Assurance Engineer, GeoMaterials representative, and aggregate producer's representative will be copied on the email to the Resident Engineer.

2. The Quality Assurance Engineer will immediately process and provide a QC and QA data summary (see #3) to the GeoMaterials representative and the aggregate producer for reference. This data will be incorporated into a report with the findings of the GeoMaterials representative (see #4).

3. The QC/QA summary will contain analysis of any trends in the test results obtained from the production site based on the 20 QC samples obtained prior to the time of placement and the Department's corresponding verification of those results. If necessary, the review will include data from a larger time frame in order to provide meaningful information to the project personnel. All data used in compiling the summary should be attached.

4. The GeoMaterials representative will be notified with the information of the failing sample(s) and will contact the Resident Engineer's office, the aggregate producer, and the Roadway Construction Engineer to schedule taking a check sample in accordance with the *Aggregate Sampling Manual*.

5. All observations (sample location, visible segregation, coarseness vs. fineness, proper sampling procedure, proper placement procedures, etc.) will be noted and combined with the QC/QA summary in a report with the results of any check sample attached. This report will be sent from the GeoMaterials Engineer to the Area Construction Engineer.

# Appendix I

**Investigation Procedures of RA Failure for Technical Trainer**

1. The GeoMaterials Engineer notifies the Technical Trainer that a roadway sample has failed.

2. The Technical Trainer contacts the Resident Engineer for the project to arrange obtaining a check sample within 5 feet of the original sample location. The Department has the right to sample beyond the 5 feet original sample location if any conditions listed in 5 and/or 8 are present or any other extenuating circumstances that may influence the sample.

3. The Field Engineer contacts the Area Construction Engineer for that Division, and a representative from the quarry supplying the ABC in question, to schedule a meeting on the project to investigate the failure. At this time, the quarry technicians may take a check sample adjacent to the Department's check sample for their information only.

4. Before any check sampling takes place, the ABC soil reports from the GeoMaterials Laboratory are reviewed along with QC and QA to determine any trends or irregularities. The previous 20 QC samples and corresponding QA samples obtained prior to the RA failure will be used for this analysis.

5. The Field Engineer also meets the ABC sampling technician to discuss and confirm that he or she is certified to take ABC samples and that the proper sampling procedures were followed in the original sampling of the ABC. Items that will be reviewed include:

    - using random numbers to determine sample location
    - staying 2 feet away from edges of spread when sampling
    - using the ABC steel sampling ring
    - sampling completely through to the next layer of material
    - making sure the quantity of the sample meets the 70 lbs. dry weight requirement
    - was the mechanical spreader being utilized in the area in question
    - could the sample have been taken on a seam where 2 lanes get blended together potentially leading to segregation
    - noting any observations from the ABC sampling technician or other project inspectors that may be pertinent to the investigation

6. After consideration of the above information, a check sample will be taken in accordance with the current version of the *Aggregate Sampling Manual*.

7. If requested, the check sample is split with half to be tested at the Producer's Laboratory and the other half to be tested at the Materials and Tests – GeoMaterials Laboratory.

8. Other considerations will be made if:

    - it is impossible to sample within 5 feet of the original sample due to location (material covered, in a taper, unknown location of original sample)
    - the dump and push method was used in a tapered area
    - tailgated material was not sampled using the alternate method in accordance with Appendix E of the *Aggregate Sampling Manual*

# Appendix J - Contact Information

| GeoMaterials Laboratory Technical Training Staff | | | |
|---|---|---|---|
| **Materials and Tests Website** | **https://connect.ncdot.gov/resources/Materials/Pages/default.aspx** | | |
| **Name** | **Office** | **Mobile** | **Email** |
| Jim Sawyer, P.E.<br>GeoMaterials Training Engineer | (919) 329-4150 | (919) 418-0771 | jsawyer@ncdot.gov |
| John Flowers, Jr.<br>Tech. Trainer (Div. 1, 2, 4) | | (919) 330-3466 | jtflowers@ncdot.gov |
| Vacant<br>Tech. Trainer (Div. 3, 5, 6) | | | |
| Scotty Jarman<br>Tech. Trainer (Div. 8, 10) | | (919) 427-1639 | sjarman@ncdot.gov |
| Mike Ricker<br>Tech. Trainer (Div. 7, 9, 11) | | (919) 219-2443 | mdricker@ncdot.gov |
| Doug Phillips<br>Tech. Trainer (Div. 12, 13, 14) | | (828) 442-0946 | jdphillips1@ncdot.gov |
| **GeoMaterials Laboratory** | | | |
| **Name** | **Office** | **Mobile** | **Email** |
| Mehdi Haeri<br>GeoMaterials Engineer | (919) 329-4150 | N/A | mhaeri@ncdot.gov |
| C.K. Su, P.E.<br>GeoMaterials Laboratory Engineer | (919) 329-4150 | N/A | cksu@ncdot.gov |

The following table provides contact information for Section Materials Specialist who can be contacted when scheduling an annual assessment.

| Field Operations (contact for assessment scheduling) | | | |
|---|---|---|---|
| **Materials and Tests Website** | **https://connect.ncdot.gov/resources/Materials/Pages/default.aspx** | | |
| **Name** | **Office** | **Mobile** | **Email** |
| Maria Bonds<br>Section Matls Spec. (Div. 1) | (252) 792-7627 | (252) 799-1056 | mmlong@ncdot.gov |
| Section Matls. Spec. (Div. 2) | | | |
| Section Matls. Spec. (Div. 3) | (910) 343-6356 | | |
| Bobby Watkins<br>Section Matls. Spec. (Div. 4) | (252) 296-3576 | (919) 868-2153 | bwatkins@ncdot.gov |
| Rick Shearer<br>Section Matls. Spec. (Div. 5) | (919) 329-4221 | (919) 614-1229 | eshearer@ncdot.gov |
| Guy Christian<br>Section Matls. Spec. (Div. 6) | (910) 485-7213 | (910) 323-0956 | gchristian@ncdot.gov |
| Robert Fosque<br>Section Matls. Spec. (Div. 7) | (336) 256-2567 | (336) 312-3475 | rfosque@ncdot.gov |
| Rusty Tucker<br>Section Matls. Spec. (Div. 8) | | (980) 521-0939 | rtucker@ncdot.gov |
| Section Matls. Spec. (Div. 9) | | | |
| Mark Thomas<br>Section Matls. Spec. (Div. 10) | (704) 847-1314 | (704) 201-3916 | markthomas@ncdot.gov |
| Tracy Church<br>Section Matls. Spec. (Div. 11) | (336) 903-9105 | (336) 984-0421 | tchurch@ncdot.gov |
| Section Matls. Spec. (Div. 12) | | | |
| Rob Rhymer<br>Section Matls. Spec. (Div. 13) | (828) 298-1516 | (828) 768-0375 | rrhymer@ncdot.gov |
| Michael Wood<br>Section Matls. Spec. (Div. 14) | (828) 891-7911 | (828) 553-4532 | dmwood@ncdot.gov |

# Appendix K – Random Numbers

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8121 | 3695 | 7367 | 7390 | 8568 | 9550 | 3107 | 3589 | 8240 | 3059 |
| 2 | 4185 | 5885 | 0699 | 3204 | 5610 | 3896 | 1692 | 2695 | 3354 | 9693 |
| 3 | 7423 | 7796 | 3747 | 8271 | 6052 | 8188 | 7913 | 4975 | 2525 | 3610 |
| 4 | 9153 | 3997 | 4351 | 5758 | 1611 | 0736 | 9949 | 9995 | 0791 | 5927 |
| 5 | 1617 | 6057 | 8761 | 8397 | 9092 | 0148 | 6552 | 7139 | 1588 | 0437 |
| 6 | 8760 | 3170 | 1224 | 4708 | 0815 | 7609 | 6584 | 4617 | 7047 | 6426 |
| 7 | 3588 | 2066 | 9567 | 9292 | 0174 | 4935 | 8792 | 5666 | 4876 | 7563 |
| 8 | 8103 | 5156 | 3440 | 4230 | 5757 | 5140 | 6858 | 5421 | 1223 | 8256 |
| 9 | 8871 | 2553 | 7202 | 1987 | 6385 | 6288 | 0497 | 0593 | 6161 | 1683 |
| 10 | 2558 | 2199 | 3805 | 9831 | 2606 | 0624 | 2742 | 6778 | 8157 | 3922 |
| 11 | 1647 | 1685 | 0752 | 8003 | 8052 | 2455 | 7920 | 1365 | 4418 | 6671 |
| 12 | 3135 | 8556 | 7712 | 6194 | 0847 | 4364 | 8858 | 2267 | 9994 | 4963 |
| 13 | 1724 | 3556 | 1740 | 5269 | 4034 | 9277 | 5271 | 2460 | 6228 | 9373 |
| 14 | 2328 | 3165 | 8382 | 7037 | 2065 | 4960 | 8404 | 6799 | 5599 | 9198 |
| 15 | 1350 | 8343 | 8993 | 2840 | 3880 | 6539 | 5501 | 9722 | 8424 | 2622 |
| 16 | 7427 | 7379 | 3549 | 1647 | 4225 | 0282 | 9025 | 2254 | 3500 | 7996 |
| 17 | 7022 | 0294 | 6714 | 9525 | 0941 | 3820 | 4074 | 8394 | 2468 | 9783 |
| 18 | 8582 | 9671 | 1036 | 5445 | 2233 | 6034 | 4240 | 2131 | 8345 | 7991 |
| 19 | 1345 | 4065 | 8880 | 5665 | 0032 | 7527 | 0726 | 8775 | 4522 | 2962 |
| 20 | 3849 | 0739 | 2216 | 6402 | 3115 | 4240 | 6081 | 2627 | 2578 | 9722 |
| 21 | 2250 | 7900 | 4486 | 2135 | 5081 | 2413 | 3685 | 5667 | 7988 | 4918 |
| 22 | 1078 | 4157 | 4885 | 8291 | 3507 | 0345 | 5105 | 9547 | 0599 | 5050 |
| 23 | 6836 | 1367 | 4019 | 5421 | 6796 | 1270 | 9592 | 0791 | 5013 | 5774 |
| 24 | 0978 | 2451 | 6865 | 3278 | 1912 | 7451 | 1343 | 8765 | 4038 | 9477 |
| 25 | 7835 | 8049 | 9898 | 8251 | 1842 | 7846 | 9007 | 9482 | 6945 | 6260 |
| 26 | 4356 | 9453 | 8545 | 5332 | 0915 | 6979 | 2074 | 2311 | 9361 | 8185 |
| 27 | 9158 | 3851 | 2403 | 5209 | 3580 | 1300 | 6650 | 3150 | 9335 | 5735 |
| 28 | 4316 | 7272 | 4590 | 6287 | 6553 | 9722 | 0058 | 0401 | 3953 | 8653 |
| 29 | 5549 | 7531 | 1942 | 3645 | 5393 | 0629 | 6401 | 3296 | 0927 | 2436 |
| 30 | 6446 | 5760 | 6850 | 8674 | 5189 | 9503 | 9662 | 6626 | 6170 | 8798 |
| 31 | 5533 | 5470 | 4593 | 4133 | 3524 | 9750 | 6566 | 4050 | 3014 | 9224 |
| 32 | 7379 | 0162 | 5237 | 1777 | 9430 | 2462 | 3288 | 5292 | 3377 | 8172 |
| 33 | 1664 | 5435 | 8368 | 3431 | 0291 | 8455 | 0159 | 9895 | 5849 | 5898 |
| 34 | 5630 | 6913 | 4948 | 7774 | 3575 | 0962 | 3186 | 9191 | 9381 | 0363 |
| 35 | 6847 | 7886 | 3963 | 8404 | 0751 | 0896 | 2633 | 9154 | 3847 | 5726 |
| 36 | 0950 | 4958 | 0297 | 1385 | 1083 | 8430 | 7831 | 4219 | 7010 | 1479 |
| 37 | 1363 | 4546 | 0731 | 3425 | 7256 | 0680 | 1903 | 7998 | 6275 | 1711 |
| 38 | 1184 | 2079 | 7299 | 9090 | 3535 | 3001 | 2088 | 1327 | 7482 | 8025 |
| 39 | 0736 | 5980 | 7034 | 6469 | 8688 | 6732 | 0461 | 5775 | 1210 | 7049 |
| 40 | 2673 | 8834 | 8132 | 0201 | 3634 | 0894 | 0819 | 6503 | 2522 | 6862 |
| 41 | 9059 | 7950 | 3589 | 1176 | 0131 | 8472 | 6691 | 6129 | 3032 | 5897 |
| 42 | 1605 | 7970 | 6152 | 4179 | 3269 | 1914 | 1468 | 9593 | 0850 | 2435 |
| 43 | 6865 | 3708 | 4096 | 0209 | 0469 | 7307 | 3216 | 3367 | 7560 | 9979 |
| 44 | 2379 | 2554 | 9753 | 2693 | 4604 | 8478 | 7480 | 7997 | 0441 | 8842 |
| 45 | 9821 | 7026 | 1331 | 3689 | 6738 | 8468 | 4876 | 5971 | 3939 | 2112 |
| 46 | 2140 | 9626 | 9884 | 3633 | 7163 | 5128 | 1821 | 9941 | 8127 | 5608 |
| 47 | 5432 | 6779 | 6373 | 6790 | 0845 | 7405 | 1457 | 6813 | 2481 | 6026 |
| 48 | 3460 | 8006 | 3670 | 6930 | 0523 | 5017 | 6487 | 1702 | 9237 | 1591 |
| 49 | 5265 | 7029 | 8790 | 6612 | 1052 | 8625 | 7070 | 3711 | 9177 | 8296 |
| 50 | 4271 | 3777 | 0048 | 6319 | 8807 | 0362 | 4318 | 9076 | 3108 | 2183 |

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 4724 | 4526 | 5407 | 2546 | 8332 | 4853 | 4422 | 1499 | 4129 | 5573 |
| 52 | 1277 | 8872 | 2569 | 9657 | 2544 | 8421 | 8617 | 8572 | 8662 | 1449 |
| 53 | 7992 | 6889 | 3350 | 1842 | 3408 | 8162 | 9357 | 5693 | 8528 | 4256 |
| 54 | 1908 | 4882 | 1892 | 0335 | 0131 | 9624 | 1024 | 5572 | 0089 | 4228 |
| 55 | 9525 | 7954 | 0657 | 9898 | 1340 | 9036 | 8409 | 3500 | 3784 | 6469 |
| 56 | 6089 | 6132 | 9614 | 6758 | 0288 | 0108 | 8623 | 8408 | 3360 | 3024 |
| 57 | 4909 | 2362 | 5297 | 3386 | 8329 | 8149 | 0845 | 6834 | 8831 | 4806 |
| 58 | 7386 | 1628 | 1494 | 8937 | 7838 | 8812 | 2994 | 6349 | 7933 | 8200 |
| 59 | 7320 | 7019 | 8328 | 7948 | 3274 | 5229 | 5753 | 0248 | 2559 | 0390 |
| 60 | 9763 | 0440 | 7154 | 0970 | 1852 | 3077 | 1522 | 3851 | 9877 | 6720 |
| 61 | 7820 | 1467 | 9175 | 7889 | 7498 | 3613 | 5527 | 7392 | 8590 | 1015 |
| 62 | 3167 | 2673 | 5391 | 5861 | 0901 | 4319 | 8630 | 9741 | 5844 | 7179 |
| 63 | 1701 | 9045 | 6529 | 3580 | 5265 | 5790 | 0414 | 1969 | 6780 | 7105 |
| 64 | 9024 | 2687 | 9310 | 8705 | 6172 | 4296 | 4610 | 4770 | 9415 | 5817 |
| 65 | 6613 | 4140 | 2942 | 2429 | 9435 | 8638 | 8063 | 1782 | 6352 | 7470 |
| 66 | 8449 | 3176 | 2217 | 2969 | 9996 | 0447 | 0516 | 7859 | 4525 | 9581 |
| 67 | 2557 | 8074 | 1255 | 0774 | 0337 | 0577 | 1722 | 9844 | 2828 | 1217 |
| 68 | 9599 | 1141 | 1301 | 9528 | 2589 | 1320 | 7096 | 1065 | 3956 | 6446 |
| 69 | 1992 | 3807 | 2096 | 2780 | 3358 | 2803 | 1457 | 3717 | 7601 | 3117 |
| 70 | 9415 | 4611 | 2177 | 6089 | 5341 | 5515 | 5414 | 6149 | 9383 | 6722 |
| 71 | 6277 | 6742 | 2609 | 2270 | 6942 | 1263 | 8254 | 1222 | 7007 | 7702 |
| 72 | 6330 | 0455 | 9317 | 8445 | 4361 | 5738 | 5322 | 4667 | 1433 | 1937 |
| 73 | 3087 | 5719 | 9831 | 9429 | 4720 | 7923 | 3490 | 3870 | 4504 | 4822 |
| 74 | 1623 | 3781 | 9202 | 2754 | 1574 | 3176 | 3289 | 3261 | 9601 | 8993 |
| 75 | 3456 | 3994 | 6498 | 8484 | 2594 | 2955 | 4836 | 9337 | 1417 | 6546 |
| 76 | 4065 | 3370 | 8734 | 2929 | 4353 | 0030 | 8154 | 6112 | 8268 | 3625 |
| 77 | 3117 | 5586 | 3840 | 7581 | 0440 | 7342 | 1148 | 2381 | 9102 | 6323 |
| 78 | 5770 | 4381 | 6456 | 4863 | 6505 | 2027 | 3656 | 4672 | 4027 | 5691 |
| 79 | 3540 | 0884 | 0684 | 7373 | 7772 | 2173 | 5824 | 6140 | 5151 | 2873 |
| 80 | 1383 | 6130 | 0608 | 0641 | 1401 | 3446 | 0809 | 6275 | 4667 | 6200 |
| 81 | 1694 | 1598 | 9773 | 1641 | 7271 | 9571 | 0956 | 3317 | 0638 | 1462 |
| 82 | 2261 | 1353 | 1201 | 0736 | 8451 | 0263 | 0675 | 6441 | 5095 | 5745 |
| 83 | 0879 | 8102 | 3441 | 9589 | 6066 | 6034 | 2895 | 0705 | 8152 | 1118 |
| 84 | 0267 | 1101 | 5030 | 2776 | 4676 | 9728 | 9698 | 0278 | 3653 | 5743 |
| 85 | 2050 | 0889 | 3674 | 9318 | 0837 | 2335 | 5784 | 4499 | 8971 | 3147 |
| 86 | 6512 | 9995 | 8944 | 5634 | 7796 | 4263 | 9758 | 6645 | 1275 | 1092 |
| 87 | 7778 | 2306 | 9643 | 1905 | 5315 | 3015 | 3158 | 7265 | 0190 | 2208 |
| 88 | 8201 | 5616 | 9194 | 1858 | 9491 | 0217 | 4368 | 7537 | 5073 | 4929 |
| 89 | 2415 | 0561 | 8289 | 2994 | 7341 | 4908 | 1498 | 8806 | 9611 | 5683 |
| 90 | 1938 | 6471 | 6108 | 5497 | 8081 | 5295 | 2897 | 5618 | 7229 | 3668 |
| 91 | 8780 | 5691 | 2190 | 8789 | 2697 | 8130 | 1357 | 4497 | 4674 | 6903 |
| 92 | 8632 | 5993 | 7960 | 0241 | 5771 | 9741 | 9251 | 3265 | 6100 | 6505 |
| 93 | 8636 | 2303 | 8091 | 0273 | 2265 | 1886 | 6465 | 5330 | 3707 | 6802 |
| 94 | 2814 | 8569 | 7178 | 0352 | 7279 | 8659 | 3164 | 3247 | 3857 | 9803 |
| 95 | 7407 | 7803 | 7879 | 1235 | 4695 | 8607 | 5468 | 3632 | 5282 | 4763 |
| 96 | 6352 | 6868 | 2150 | 6844 | 7191 | 4442 | 1561 | 8629 | 8724 | 7650 |
| 97 | 3135 | 5350 | 8557 | 9532 | 7192 | 5708 | 2930 | 8740 | 2747 | 5827 |
| 98 | 6418 | 0736 | 8251 | 5329 | 6641 | 8120 | 8985 | 3926 | 6810 | 0857 |
| 99 | 2070 | 3609 | 9184 | 7250 | 1270 | 8171 | 3581 | 7679 | 8326 | 3488 |
| 100 | 6862 | 4480 | 5051 | 5262 | 8832 | 6762 | 0369 | 2089 | 6209 | 1998 |

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 101 | 2899 | 1397 | 0235 | 0319 | 5904 | 0003 | 8088 | 1905 | 7733 | 8060 |
| 102 | 7825 | 5409 | 9375 | 8387 | 7821 | 4044 | 2004 | 3784 | 4062 | 1510 |
| 103 | 2554 | 7423 | 3644 | 2702 | 5572 | 1547 | 4754 | 7605 | 0586 | 7517 |
| 104 | 9202 | 0022 | 0512 | 9403 | 4981 | 0887 | 8136 | 3810 | 2234 | 0531 |
| 105 | 6587 | 4132 | 4073 | 1627 | 0845 | 7391 | 5286 | 9327 | 8620 | 8679 |
| 106 | 2936 | 3705 | 1683 | 6125 | 9589 | 4711 | 5039 | 2451 | 1535 | 1785 |
| 107 | 0866 | 5059 | 3535 | 4076 | 3550 | 7915 | 3887 | 4104 | 9853 | 0749 |
| 108 | 2291 | 1818 | 2466 | 7884 | 2218 | 2089 | 8594 | 4615 | 9316 | 4174 |
| 109 | 4657 | 3232 | 4034 | 2133 | 7406 | 5246 | 3377 | 8644 | 3751 | 7402 |
| 110 | 4684 | 1278 | 1045 | 7780 | 1042 | 3752 | 8510 | 4452 | 6530 | 4322 |
| 111 | 5150 | 0521 | 7345 | 5987 | 0250 | 0216 | 3283 | 6590 | 0612 | 5895 |
| 112 | 6216 | 0290 | 0287 | 1327 | 1261 | 6902 | 7833 | 6256 | 1022 | 6096 |
| 113 | 0299 | 4050 | 7214 | 6390 | 7254 | 0100 | 1926 | 6506 | 1355 | 0648 |
| 114 | 8268 | 5594 | 6620 | 4371 | 2606 | 9710 | 1366 | 9945 | 2715 | 7083 |
| 115 | 2147 | 1822 | 7118 | 9840 | 2088 | 9800 | 0022 | 8955 | 2936 | 9209 |
| 116 | 1993 | 1361 | 4090 | 4753 | 7990 | 2339 | 6809 | 2638 | 2294 | 4783 |
| 117 | 0888 | 8380 | 5567 | 0165 | 5333 | 9343 | 6287 | 0128 | 7050 | 9734 |
| 118 | 8392 | 0864 | 4284 | 1869 | 4291 | 8100 | 3582 | 2437 | 0650 | 8812 |
| 119 | 3474 | 8099 | 3307 | 8070 | 2799 | 5794 | 5904 | 4804 | 5860 | 4604 |
| 120 | 9301 | 9691 | 6256 | 6788 | 5190 | 8793 | 7480 | 2763 | 0468 | 1625 |
| 121 | 1853 | 7462 | 9459 | 9440 | 9875 | 7335 | 7369 | 8559 | 0987 | 9817 |
| 122 | 8015 | 2527 | 0764 | 8683 | 6457 | 3355 | 0294 | 1177 | 7623 | 3952 |
| 123 | 9671 | 5790 | 1460 | 9181 | 3987 | 6303 | 0321 | 3132 | 0770 | 7984 |
| 124 | 3144 | 7732 | 9614 | 3003 | 7232 | 0436 | 1470 | 5735 | 3160 | 5356 |
| 125 | 8246 | 3283 | 0251 | 6136 | 8041 | 3041 | 4981 | 2605 | 7530 | 0581 |
| 126 | 9410 | 9785 | 5355 | 5616 | 9907 | 9222 | 5300 | 3212 | 1632 | 0273 |
| 127 | 2616 | 5706 | 2815 | 1768 | 8394 | 0528 | 5177 | 1961 | 7451 | 0067 |
| 128 | 8657 | 8901 | 0217 | 5872 | 8963 | 8326 | 0714 | 8769 | 9706 | 0651 |
| 129 | 6101 | 0251 | 5333 | 5253 | 7051 | 5492 | 5837 | 9508 | 8029 | 2154 |
| 130 | 8736 | 4493 | 5116 | 1812 | 9457 | 9663 | 8396 | 0350 | 9900 | 7197 |
| 131 | 2240 | 8483 | 1383 | 3288 | 5045 | 6135 | 3773 | 0869 | 3415 | 8494 |
| 132 | 7945 | 5971 | 1429 | 9426 | 6198 | 2241 | 1371 | 6798 | 9069 | 0059 |
| 133 | 0107 | 7447 | 9726 | 0740 | 2626 | 8312 | 1683 | 6095 | 3929 | 4847 |
| 134 | 2686 | 3354 | 9387 | 1732 | 9036 | 2679 | 4551 | 0372 | 5562 | 1932 |
| 135 | 5762 | 2898 | 0169 | 9265 | 1804 | 8196 | 4461 | 3044 | 8148 | 3440 |
| 136 | 2362 | 0927 | 2213 | 1456 | 5872 | 7563 | 7873 | 8148 | 7408 | 9834 |
| 137 | 0943 | 2552 | 3463 | 5792 | 1722 | 5702 | 0579 | 2125 | 3553 | 7613 |
| 138 | 0968 | 5505 | 7917 | 7812 | 3297 | 0996 | 9626 | 3931 | 4954 | 8197 |
| 139 | 7411 | 6269 | 7709 | 2010 | 5424 | 7489 | 4087 | 1861 | 7894 | 2424 |
| 140 | 1229 | 9675 | 5555 | 1766 | 3242 | 2756 | 8831 | 1411 | 6424 | 6419 |
| 141 | 5477 | 7684 | 5707 | 6457 | 4473 | 4401 | 1814 | 1203 | 8406 | 1503 |
| 142 | 2924 | 2030 | 0232 | 0669 | 2015 | 2321 | 0028 | 3343 | 0103 | 9635 |
| 143 | 6147 | 3463 | 9393 | 6931 | 7262 | 0635 | 0100 | 2920 | 6879 | 9018 |
| 144 | 5397 | 1006 | 1167 | 8094 | 7679 | 9271 | 9529 | 2107 | 0380 | 2781 |
| 145 | 4924 | 4787 | 8326 | 3602 | 4829 | 8769 | 7156 | 3560 | 0245 | 0460 |
| 146 | 8302 | 2334 | 7454 | 2980 | 6858 | 8002 | 9723 | 6961 | 4359 | 2603 |
| 147 | 8116 | 1613 | 9955 | 7589 | 6207 | 6364 | 1470 | 4641 | 3399 | 4119 |
| 148 | 7772 | 0518 | 6668 | 6220 | 6073 | 5577 | 1132 | 4089 | 6615 | 7817 |
| 149 | 3005 | 6141 | 3449 | 7778 | 9822 | 2978 | 6583 | 6365 | 4640 | 9828 |
| 150 | 0515 | 2611 | 5698 | 1784 | 1272 | 6277 | 1186 | 6157 | 6562 | 0114 |

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 151 | 3801 | 9094 | 3984 | 9662 | 7013 | 4675 | 3305 | 9477 | 6052 | 6463 |
| 152 | 5112 | 8493 | 3522 | 9082 | 1259 | 9393 | 1363 | 8384 | 9077 | 7256 |
| 153 | 6661 | 7321 | 5734 | 2238 | 7349 | 4913 | 2483 | 8800 | 2084 | 5533 |
| 154 | 9440 | 7478 | 8781 | 8877 | 0784 | 0963 | 6873 | 1825 | 1932 | 5033 |
| 155 | 5575 | 9490 | 3125 | 9746 | 8568 | 4724 | 1302 | 3744 | 5244 | 2820 |
| 156 | 5284 | 0256 | 6717 | 4189 | 4073 | 4327 | 3656 | 5039 | 4245 | 6650 |
| 157 | 9402 | 0218 | 7307 | 4515 | 6334 | 8394 | 3425 | 6806 | 3673 | 5666 |
| 158 | 3906 | 6392 | 1065 | 1416 | 8697 | 0728 | 7785 | 5091 | 3460 | 7425 |
| 159 | 2766 | 6735 | 3663 | 1802 | 1945 | 0226 | 2890 | 9448 | 7061 | 6863 |
| 160 | 0941 | 1822 | 4303 | 2196 | 5075 | 6276 | 2804 | 6772 | 7075 | 9958 |
| 161 | 9641 | 5726 | 2258 | 5528 | 1576 | 9655 | 1350 | 9548 | 4420 | 1533 |
| 162 | 8979 | 7285 | 9994 | 3207 | 6047 | 2331 | 8674 | 6722 | 4125 | 0510 |
| 163 | 1714 | 8090 | 1709 | 6994 | 1431 | 2278 | 2794 | 2976 | 6309 | 2646 |
| 164 | 4473 | 4405 | 2564 | 4567 | 3264 | 2473 | 8196 | 0385 | 5586 | 9738 |
| 165 | 5375 | 7532 | 1932 | 4760 | 9993 | 9806 | 9774 | 0254 | 5170 | 5947 |
| 166 | 4603 | 9646 | 8579 | 9149 | 1790 | 4482 | 1995 | 3069 | 0243 | 2391 |
| 167 | 8730 | 2372 | 0050 | 5351 | 0881 | 0813 | 7665 | 3128 | 1342 | 1692 |
| 168 | 2327 | 6572 | 9247 | 8958 | 3354 | 2747 | 5210 | 1817 | 6554 | 7970 |
| 169 | 8861 | 7298 | 6073 | 4138 | 6858 | 1097 | 2735 | 4934 | 3751 | 3858 |
| 170 | 6806 | 8850 | 7228 | 1330 | 8635 | 5597 | 1984 | 6638 | 0457 | 6876 |
| 171 | 8652 | 8362 | 1567 | 4844 | 5784 | 2737 | 9932 | 1684 | 8423 | 2794 |
| 172 | 6088 | 8885 | 2404 | 3769 | 3819 | 1362 | 7183 | 4445 | 7179 | 8671 |
| 173 | 1815 | 6022 | 9460 | 7823 | 8611 | 4410 | 7561 | 2609 | 0254 | 4294 |
| 174 | 3473 | 8945 | 0964 | 8240 | 6844 | 0396 | 3358 | 8447 | 7657 | 9587 |
| 175 | 4161 | 4157 | 7503 | 9125 | 8884 | 3890 | 8211 | 8391 | 2024 | 0696 |
| 176 | 3023 | 6708 | 3570 | 8685 | 3584 | 8230 | 4494 | 8788 | 1539 | 1088 |
| 177 | 5655 | 0644 | 5188 | 3485 | 6691 | 2698 | 5291 | 9690 | 3617 | 5423 |
| 178 | 8740 | 9861 | 2845 | 2286 | 6512 | 5913 | 4321 | 5439 | 4228 | 7904 |
| 179 | 1434 | 3335 | 3009 | 1410 | 9929 | 3214 | 2694 | 0530 | 6950 | 8837 |
| 180 | 1737 | 5691 | 9354 | 6787 | 2523 | 6040 | 3340 | 3542 | 1793 | 8388 |
| 181 | 0161 | 8195 | 9583 | 6276 | 0864 | 3568 | 4505 | 2997 | 2970 | 6221 |
| 182 | 9370 | 2850 | 5188 | 0492 | 0391 | 3796 | 2465 | 6420 | 2489 | 6883 |
| 183 | 3775 | 2928 | 8101 | 1313 | 6547 | 3748 | 3816 | 9558 | 0907 | 8016 |
| 184 | 6584 | 0790 | 2139 | 0854 | 2152 | 1231 | 4360 | 5694 | 8259 | 7658 |
| 185 | 4667 | 7582 | 2206 | 8373 | 2859 | 7140 | 3121 | 9352 | 6677 | 2725 |
| 186 | 6455 | 5130 | 1084 | 2872 | 4378 | 3176 | 7364 | 1393 | 1209 | 4810 |
| 187 | 0060 | 5586 | 6029 | 8412 | 9000 | 6808 | 0742 | 6397 | 4092 | 1542 |
| 188 | 6850 | 8675 | 7744 | 0269 | 2198 | 8756 | 1343 | 6312 | 8701 | 6551 |
| 189 | 2517 | 8132 | 4397 | 7633 | 4431 | 8702 | 8616 | 3250 | 0689 | 3254 |
| 190 | 1036 | 5789 | 6891 | 3343 | 0728 | 2997 | 0805 | 5021 | 4329 | 1727 |
| 191 | 9404 | 1396 | 6110 | 1404 | 4309 | 0810 | 5538 | 8437 | 6531 | 6233 |
| 192 | 7108 | 3253 | 6374 | 5536 | 6072 | 1705 | 0244 | 4504 | 4154 | 6666 |
| 193 | 0998 | 2139 | 0131 | 0188 | 1107 | 9274 | 3802 | 4429 | 7715 | 4470 |
| 194 | 1886 | 4751 | 0727 | 3940 | 8296 | 4045 | 8515 | 5907 | 8092 | 4462 |
| 195 | 0410 | 0317 | 6966 | 2726 | 0128 | 4489 | 9773 | 6389 | 8605 | 3374 |
| 196 | 5696 | 2690 | 8968 | 1055 | 1258 | 7378 | 0854 | 5822 | 9896 | 3157 |
| 197 | 4121 | 7845 | 1399 | 1548 | 5388 | 9814 | 5393 | 2307 | 2361 | 0736 |
| 198 | 2653 | 7554 | 3951 | 3033 | 4620 | 7119 | 9086 | 6337 | 5045 | 1744 |
| 199 | 9176 | 7228 | 0312 | 9807 | 0250 | 2529 | 3850 | 6094 | 3210 | 8576 |
| 200 | 7889 | 9222 | 3120 | 4810 | 8011 | 6547 | 0712 | 4644 | 2915 | 1757 |

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| 283 | 2428 | 0148 | 6214 | 3472 | 8179 | 9928 | 7228 | 7385 | 4670 | 0145 |
| 284 | 4788 | 3796 | 8751 | 5801 | 7445 | 6592 | 6390 | 6925 | 3650 | 6391 |
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| 286 | 4915 | 0972 | 1814 | 3753 | 3967 | 3774 | 4364 | 9655 | 7802 | 3470 |
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| 288 | 1165 | 0540 | 1930 | 5730 | 2238 | 1212 | 5065 | 8288 | 1810 | 9952 |
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| 290 | 9206 | 4169 | 5360 | 5897 | 8004 | 1263 | 1236 | 5349 | 0249 | 9954 |
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| 319 | 2327 | 4580 | 3942 | 0111 | 9792 | 6565 | 9369 | 6582 | 6979 | 4906 |
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| 324 | 3180 | 7799 | 3047 | 5571 | 3707 | 2169 | 3793 | 4893 | 9386 | 5076 |
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| 333 | 5455 | 3963 | 9270 | 7772 | 2076 | 6947 | 1196 | 3554 | 4870 | 9012 |
| 334 | 5924 | 9407 | 5714 | 2668 | 3667 | 6455 | 3736 | 8000 | 0996 | 6479 |
| 335 | 2062 | 0663 | 9732 | 7210 | 7176 | 0600 | 2711 | 8263 | 8836 | 0248 |
| 336 | 6634 | 8562 | 4390 | 9896 | 5874 | 8468 | 5407 | 2706 | 5132 | 3233 |
| 337 | 5243 | 5667 | 4099 | 1093 | 8198 | 0419 | 3648 | 5472 | 3009 | 6040 |
| 338 | 9597 | 7559 | 7021 | 5907 | 2099 | 4749 | 8298 | 9985 | 4888 | 0488 |
| 339 | 7760 | 2517 | 3740 | 1071 | 9069 | 0307 | 5007 | 6464 | 8696 | 7642 |
| 340 | 8368 | 7543 | 9761 | 8222 | 6295 | 1429 | 8476 | 0702 | 5817 | 2201 |
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| 343 | 2818 | 8346 | 2583 | 1128 | 2617 | 3164 | 5323 | 8621 | 7900 | 5153 |
| 344 | 9695 | 5029 | 4842 | 1958 | 0011 | 1191 | 8417 | 3693 | 0577 | 8155 |
| 345 | 9332 | 6231 | 6059 | 4504 | 5868 | 0919 | 8981 | 0255 | 5019 | 0132 |
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| 349 | 6143 | 3506 | 0304 | 7631 | 5600 | 5362 | 5023 | 4429 | 7326 | 4962 |
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| 354 | 8057 | 0244 | 6347 | 7837 | 9492 | 2710 | 8695 | 0157 | 8189 | 3298 |
| 355 | 6464 | 4582 | 6471 | 4256 | 9834 | 8259 | 5265 | 3994 | 9955 | 1857 |
| 356 | 8676 | 0217 | 6172 | 6026 | 2868 | 1308 | 4572 | 1540 | 8804 | 3022 |
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| 393 | 9248 | 4854 | 1800 | 4241 | 6937 | 1053 | 4814 | 1170 | 0575 | 2612 |
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| 426 | 1801 | 9449 | 0797 | 3895 | 8311 | 0289 | 4797 | 1398 | 8431 | 1286 |
| 427 | 3294 | 9090 | 8380 | 5944 | 6006 | 1522 | 2214 | 0292 | 6575 | 3530 |
| 428 | 3445 | 2270 | 3259 | 7507 | 4084 | 7868 | 5625 | 1212 | 8575 | 3991 |
| 429 | 1022 | 0982 | 6854 | 1429 | 3931 | 6639 | 9170 | 1290 | 8998 | 8304 |
| 430 | 1019 | 2949 | 3740 | 2736 | 0035 | 9443 | 2872 | 5922 | 9422 | 4088 |
| 431 | 3259 | 0725 | 4998 | 6694 | 2155 | 6976 | 0381 | 6600 | 2252 | 2088 |
| 432 | 9556 | 6103 | 8231 | 6413 | 4297 | 2694 | 2367 | 9508 | 3610 | 4606 |
| 433 | 2916 | 3812 | 8645 | 8275 | 7166 | 8914 | 4340 | 8743 | 8870 | 1759 |
| 434 | 1634 | 3824 | 5008 | 4400 | 7670 | 7111 | 0210 | 6252 | 6571 | 4695 |
| 435 | 9727 | 1073 | 8076 | 9090 | 9802 | 9161 | 1969 | 4320 | 8970 | 4953 |
| 436 | 8288 | 1981 | 1202 | 5977 | 4534 | 1534 | 0361 | 8131 | 9021 | 1074 |
| 437 | 1991 | 0425 | 1232 | 0507 | 9400 | 3951 | 1574 | 6427 | 4018 | 0565 |
| 438 | 6855 | 9445 | 8507 | 2710 | 7031 | 3891 | 4395 | 4966 | 6465 | 0254 |
| 439 | 3829 | 3090 | 2294 | 5862 | 8456 | 0838 | 4262 | 2207 | 9315 | 1708 |
| 440 | 0687 | 0834 | 7690 | 5627 | 8793 | 9704 | 8979 | 3715 | 7620 | 1140 |
| 441 | 1192 | 6075 | 3222 | 8556 | 6901 | 0933 | 4516 | 0926 | 4335 | 4495 |
| 442 | 0828 | 8628 | 5557 | 4267 | 8715 | 4172 | 0999 | 3878 | 2273 | 7895 |
| 443 | 8506 | 4635 | 9763 | 3061 | 1415 | 1827 | 2584 | 3268 | 0820 | 6347 |
| 444 | 3664 | 7739 | 5915 | 6699 | 1254 | 5051 | 2199 | 9780 | 8256 | 9094 |
| 445 | 5207 | 0281 | 3380 | 4663 | 3723 | 3713 | 6068 | 7919 | 4572 | 3562 |
| 446 | 4758 | 3038 | 9066 | 6631 | 2989 | 0399 | 5011 | 3155 | 4363 | 5134 |
| 447 | 2948 | 2150 | 5274 | 2619 | 0872 | 4823 | 3397 | 9551 | 3514 | 0578 |
| 448 | 2916 | 6211 | 7975 | 3521 | 0002 | 8336 | 3572 | 4460 | 8194 | 4152 |
| 449 | 4074 | 8791 | 1711 | 9092 | 1662 | 1968 | 5890 | 8876 | 7886 | 8459 |
| 450 | 5522 | 0630 | 9099 | 9412 | 1987 | 2213 | 0365 | 0857 | 7059 | 5607 |

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 451 | 2818 | 1644 | 4095 | 6517 | 7888 | 7497 | 2504 | 8517 | 4795 | 9180 |
| 452 | 4008 | 2178 | 9797 | 2511 | 0230 | 3206 | 4609 | 9199 | 9555 | 4257 |
| 453 | 9270 | 6757 | 3094 | 1902 | 9576 | 4245 | 1907 | 3537 | 5024 | 2212 |
| 454 | 4283 | 0575 | 9216 | 8849 | 2046 | 6433 | 4348 | 4006 | 5419 | 7348 |
| 455 | 1995 | 9490 | 1002 | 4583 | 1903 | 0695 | 9105 | 6675 | 9853 | 8560 |
| 456 | 7486 | 7617 | 4960 | 5009 | 9875 | 4046 | 2463 | 5190 | 0337 | 1009 |
| 457 | 6740 | 4125 | 1009 | 3464 | 5270 | 4471 | 9111 | 2489 | 0515 | 1710 |
| 458 | 2040 | 3384 | 2173 | 7430 | 7710 | 9138 | 9836 | 4218 | 4788 | 6353 |
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| 460 | 5452 | 1798 | 7818 | 3843 | 3198 | 4116 | 9760 | 7388 | 4983 | 6146 |
| 461 | 2200 | 9082 | 1932 | 0727 | 4111 | 2410 | 7424 | 8087 | 4815 | 1699 |
| 462 | 1380 | 8104 | 6786 | 8552 | 3552 | 1648 | 4648 | 9452 | 5785 | 1241 |
| 463 | 8680 | 4358 | 2373 | 2783 | 4619 | 2527 | 0836 | 6785 | 0440 | 6401 |
| 464 | 1442 | 8608 | 9787 | 4313 | 9567 | 5835 | 5847 | 9018 | 8906 | 3386 |
| 465 | 6968 | 6542 | 4931 | 0323 | 0554 | 8831 | 8249 | 0884 | 9401 | 6952 |
| 466 | 7017 | 6936 | 0751 | 5273 | 9485 | 4538 | 3094 | 9626 | 9738 | 9804 |
| 467 | 7916 | 6025 | 2082 | 4194 | 9689 | 4313 | 8267 | 3151 | 2120 | 9043 |
| 468 | 4313 | 3979 | 1380 | 2564 | 0454 | 7942 | 7243 | 1338 | 7826 | 9340 |
| 469 | 2089 | 8835 | 2164 | 5938 | 8577 | 0985 | 0234 | 2946 | 2419 | 5892 |
| 470 | 0110 | 8951 | 0140 | 6090 | 1500 | 7194 | 0908 | 5051 | 5922 | 7749 |
| 471 | 1634 | 2255 | 6261 | 4023 | 9225 | 8815 | 4309 | 3774 | 2946 | 2517 |
| 472 | 5586 | 2457 | 2063 | 8645 | 0523 | 6201 | 7859 | 8115 | 0258 | 5695 |
| 473 | 0104 | 3562 | 6376 | 0844 | 7930 | 8418 | 9693 | 5009 | 9286 | 4414 |
| 474 | 2735 | 6851 | 1541 | 6615 | 8432 | 4800 | 7595 | 4895 | 8951 | 2809 |
| 475 | 4918 | 5473 | 2964 | 7280 | 2406 | 3790 | 3510 | 2381 | 5010 | 6320 |
| 476 | 4472 | 6105 | 3805 | 3445 | 8048 | 1078 | 8687 | 7530 | 4655 | 9307 |
| 477 | 7816 | 2237 | 8693 | 7775 | 7897 | 6151 | 9126 | 4346 | 5236 | 7570 |
| 478 | 4887 | 4977 | 7314 | 2769 | 2370 | 9663 | 9521 | 7514 | 5813 | 9469 |
| 479 | 1139 | 7560 | 1276 | 5646 | 3261 | 8693 | 3199 | 6530 | 2934 | 0526 |
| 480 | 3444 | 8169 | 7650 | 6183 | 5108 | 4653 | 5072 | 3348 | 3792 | 5971 |
| 481 | 8104 | 6577 | 1738 | 8790 | 4278 | 4361 | 0730 | 1096 | 4115 | 5109 |
| 482 | 2371 | 2964 | 2888 | 3142 | 9540 | 2366 | 0706 | 1236 | 0671 | 1067 |
| 483 | 0999 | 1401 | 4609 | 0833 | 8450 | 5466 | 3812 | 2756 | 7902 | 0033 |
| 484 | 7795 | 3205 | 8089 | 6436 | 9586 | 4275 | 2515 | 7261 | 0958 | 0312 |
| 485 | 4848 | 3403 | 1042 | 3406 | 0964 | 5409 | 5612 | 8689 | 6122 | 7344 |
| 486 | 9440 | 0676 | 9834 | 6449 | 4216 | 9188 | 6150 | 8022 | 3893 | 8890 |
| 487 | 7111 | 1014 | 8160 | 5340 | 3426 | 0695 | 1038 | 3751 | 4974 | 1411 |
| 488 | 8938 | 4688 | 2284 | 0285 | 4845 | 8425 | 4891 | 2736 | 7926 | 3523 |
| 489 | 6950 | 5210 | 1565 | 0431 | 9641 | 4016 | 4505 | 2629 | 0111 | 4095 |
| 490 | 4622 | 6658 | 6572 | 3213 | 6579 | 5854 | 9445 | 2878 | 3584 | 2564 |
| 491 | 6744 | 0048 | 1861 | 2664 | 0433 | 4286 | 8231 | 6419 | 5599 | 9079 |
| 492 | 5695 | 8530 | 1924 | 6177 | 8870 | 4822 | 9070 | 6201 | 6412 | 7507 |
| 493 | 6966 | 3987 | 6009 | 2936 | 4683 | 1084 | 9613 | 7013 | 6260 | 2609 |
| 494 | 7066 | 8247 | 9253 | 8223 | 0395 | 5403 | 2097 | 7574 | 5642 | 0500 |
| 495 | 9895 | 7280 | 6024 | 4505 | 0338 | 0706 | 8514 | 0659 | 5178 | 4059 |
| 496 | 3081 | 0287 | 4712 | 5215 | 7088 | 7707 | 0787 | 7815 | 7176 | 7655 |
| 497 | 2725 | 3254 | 8246 | 4645 | 9448 | 7622 | 0063 | 9307 | 9870 | 2843 |
| 498 | 7315 | 0408 | 0976 | 3714 | 3932 | 9194 | 6425 | 6438 | 0639 | 0028 |
| 499 | 5270 | 0138 | 2015 | 7250 | 0504 | 5008 | 2431 | 8394 | 1859 | 7517 |
| 500 | 6729 | 4405 | 0043 | 5901 | 9227 | 5824 | 5584 | 1345 | 9856 | 2515 |

# References

ASTM Manual, D-3665 Standard Practice for Random Sampling of Construction Materials, Volume 04.03.