AGGREGATE SAMPLING

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North Carolina Department of Transportation
Materials and Tests Unit - Soils Laboratory

SECTION I - 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 North Carolina Department of Transportation (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.

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 and Testing Manuals 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 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 the aggregate product, 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 Soils 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 State (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 Soils 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 material. A minimum of three samples per project is required and no more than five days of ABC placement shall occur without a sample. No RA samples are required if a project utilizes less than 1,000 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. A minimum of three samples per project is required and 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 I.D. 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 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, and so on. 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 "1".

Sample cards are to accompany the samples. One duplicate sample card is filled for each bag of material. 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. The completed cards should be placed in a plastic bag (to protect the card) and then placed in the corresponding sample bags.

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 check samples are 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 #: 2600769

* Material: ABC

☐ Metric
☒ English

† Sample Owner: PROJECT

† Contract #: C200001

* Testing Category: ACCEPTANCE

Field ID: RA - 1

Check Sample? Y N (circle One)

Proj/Po/Wo#: 34444.3.1

† Related Sample ID:

Line Item #:

† Corr. Sample ID:

RE: I.M. RESIDENT

# of Pieces: 2 - BAGS

* Rep. Qty: 2,500 TONS

* To Be Used In: ROADWAY BASE

Comment:

* Sampled Date: 2-2-10

* Sampled By: I.M. TECH ABC - 1234

* Sample From: ROADWAY

Truck/ Container #:

Structure Number:

Route Desc: OUTER LOOP

Route Type: (US) NC SR (circle one)

Alignment: -L-

Route Number: 540

*Location: NBL 10+15

Offset Dist.: 10'

Map Number:

*Sta. From: 0+00

Sta. To: 15+00

County: WAKE

Coastal Plain: Y N (circle one)

† Producer/Supplier:

† Plant ID#:

☐ 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 Area 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. 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 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, remixing, reshaping, and re-compacting of the added material. The method of correcting the lot shall be approved both by the Area Roadway Construction Engineer and the Soils 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

In addition to taking a check sample, items that should be reviewed when failing samples occur are:

- Proper sampling techniques
- Sample location
- QC/QA results
- Method of placement and handling of material

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 Area 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, remixing, reshaping, and re-compacting of the added material. The method of correcting the lot shall be approved both by the Area Roadway Construction Engineer and the Soils 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).

In addition to taking a check sample, items that should be reviewed when failing samples occur are:

- Proper sampling techniques
- Sample location
- QC/QA results
- Method of placement and handling of material

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.

APPENDIX A

ABC Sampling Using Steel Sampling Ring

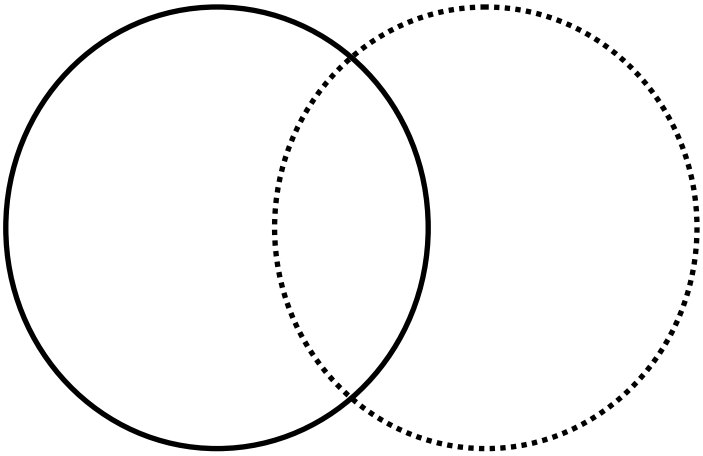
Equipment

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 bag. 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, 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 as soon as possible.



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

Sampling Using Random Numbers

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.

Calculators with random-number generation features may be used. If this feature is not available, random numbers may be obtained from one of the twenty-six (26) random number tables available from the department (see example in Chapter 7 of manual). 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. Record required sample location information in the ABC Field Log Book (Appendix G).

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

a) Random numbers are as follows:

1234 ← column numbers
9264
5858
2889
5131
9055

b) Lot size = 2,500 tons
c) The sample is to be taken at
2,500 tons x 0.92 = **2,300 tons**
12 ft x 0.64 = **8 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:

1234 ← column numbers
~~9264~~
5858
2889
5131
9055

b) Lot size = 2,500 tons
c) The sample is to be taken at
2,500 x 0.58 = 1,450 tons
1,400 + 2,500 = **3,950 tons**
12 ft x 0.58 = **7 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:

1234 ← column numbers
~~9264~~
~~5858~~
2889
5131
9055

b) Lot size = 1,255 tons
c) The sample is to be taken at
1,255 x 0.28 = **351 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:

1234 ← column numbers
~~9264~~
~~5858~~
~~28~~89
5131
9055

b) Lot size 2,500 tons
c) The sample is to be taken from the center of the pile at:
2,500 x 0.89 = **2,225 tons**
d) Once a random number(s) is used, strikethrough the number

Example 4: ABC sampled from 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 three samples per project, therefore stratify the 3,500 tons into three equal lots
3,500 / 3 = 1166.667 or **1167 ton sampling lots**
b) Utilize proper sampling procedures (refer to Appendix A)
c) Randomly locate sampling site form the first 1167 ton lot
d) Random numbers are as follows:

1234 ← column numbers
~~9264~~
~~5858~~
~~2889~~
5131
9055

e) The first sample is to be taken:
1167 x 0.51 = 595.17 or **595 tons**
12 ft x 0.31 = 3.72 or **4 feet from edge**

d) The second sample is to be taken:
1167 x 0.90 = 1,050.3
1050 + 1167 tons = **2,217 tons**
12 ft x 0.55 = 6.6 or **7 feet from edge**
e) Once a random number is used, strikethrough the number

f) Repeat procedures for the third sample

APPENDIX C

Roadway Assurance Specification Tables

Table 1008-1
Aggregate for Stabilization – Stabilizer Aggregate
Gradation Acceptance Ranges, Liquid Limit, 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 1010-1
Aggregate Base Course – ABC and Select Material Class IV
Gradation Acceptance Ranges, Liquid Limit, 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

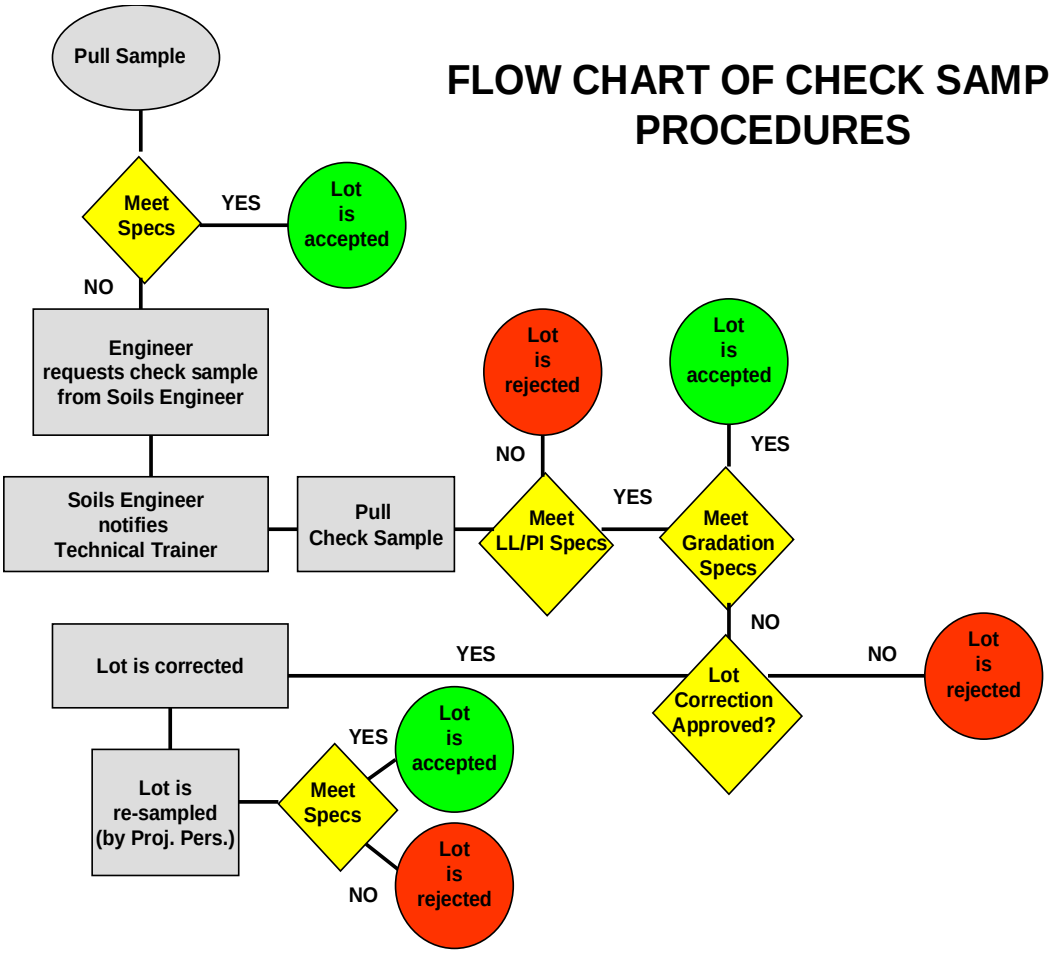
Material Passing No. 10 Sieve (Soil Mortar)			
#40	40-84	36-84	2
#200	11-35	10-36	2
Material Passing No. 40 Sieve			
L. L.	0-30	0-30	-
P. I.	0-6	0-6	-

Table 1010-4
Aggregate for Portland Cement Treated Base Course - CTBC
Gradation Acceptance Ranges, Liquid Limit, Plasticity Index

Column A (Sieve Size)	Column B % Passing	Column C (penalty points)
1-1/2”	100	1
1”	80-100	1
½”	58-83	1
#4	38-60	3
#10	28-50	2
#40	15-33	3
#200	6-13	5
Material Passing # 10 Sieve (Soil Mortar)		
#40	40-85	2
#200	12-35	2
Material Passing # 40 Sieve		
L. L.	0-30	-
P. I.	0-4	-

APPENDIX D

FLOW CHART OF CHECK SAMPLE PROCEDURES



APPENDIX E

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

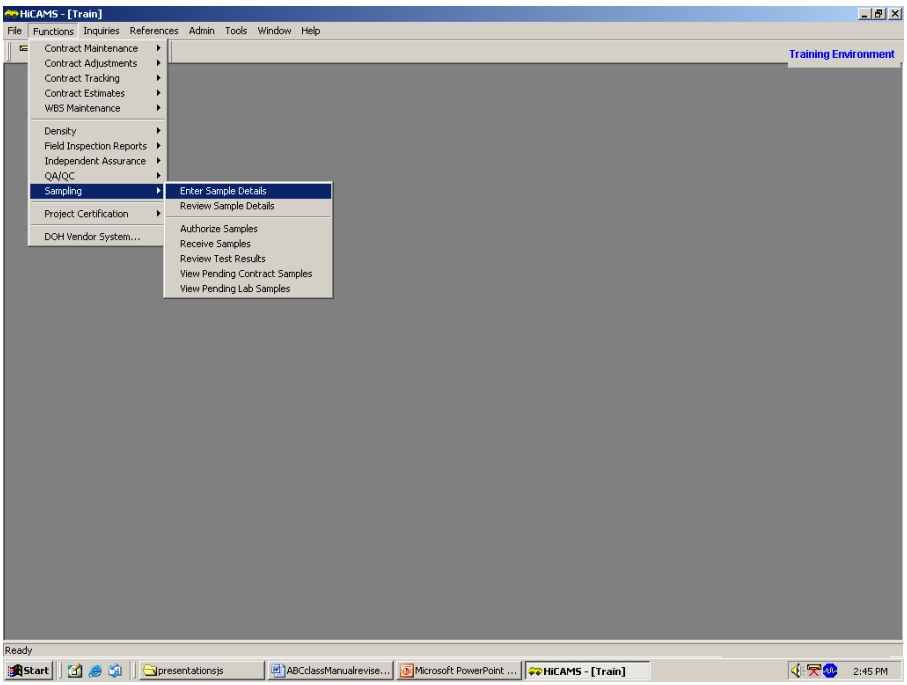
Steel sampling ring (12-inch outside diameter, 9-inch deep)
Scoop/Large spoon
Small pick
Shovel (not used to take the sample)
Sample bags (in good condition)
Wooden mallet
Sample card
Plastic bags (for sample cards)
Plastic ties

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 as soon as possible.

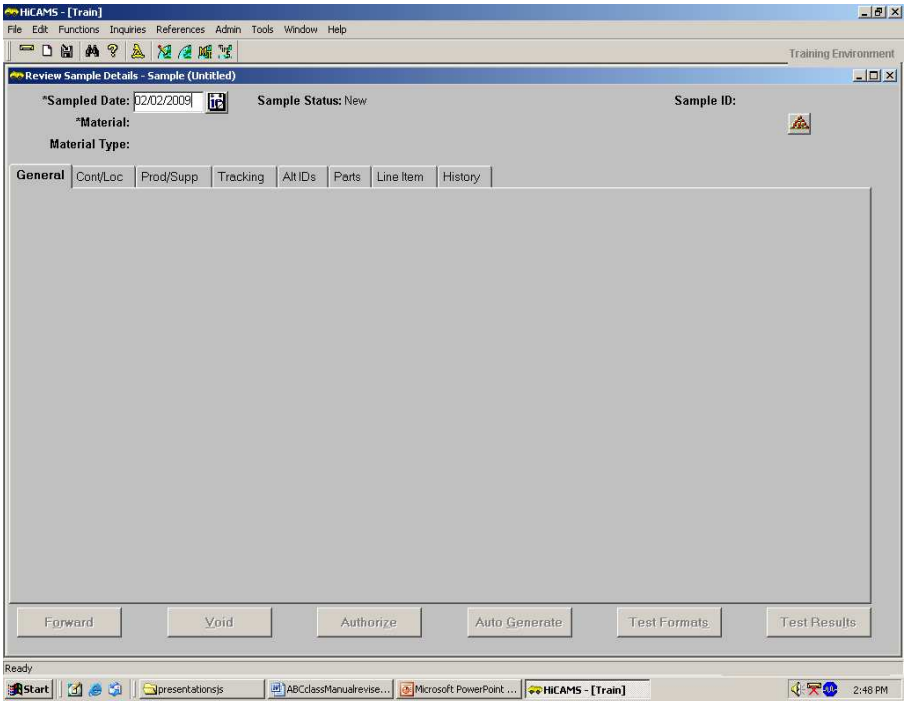
APPENDIX F

Procedures for entering samples into HiCAMs

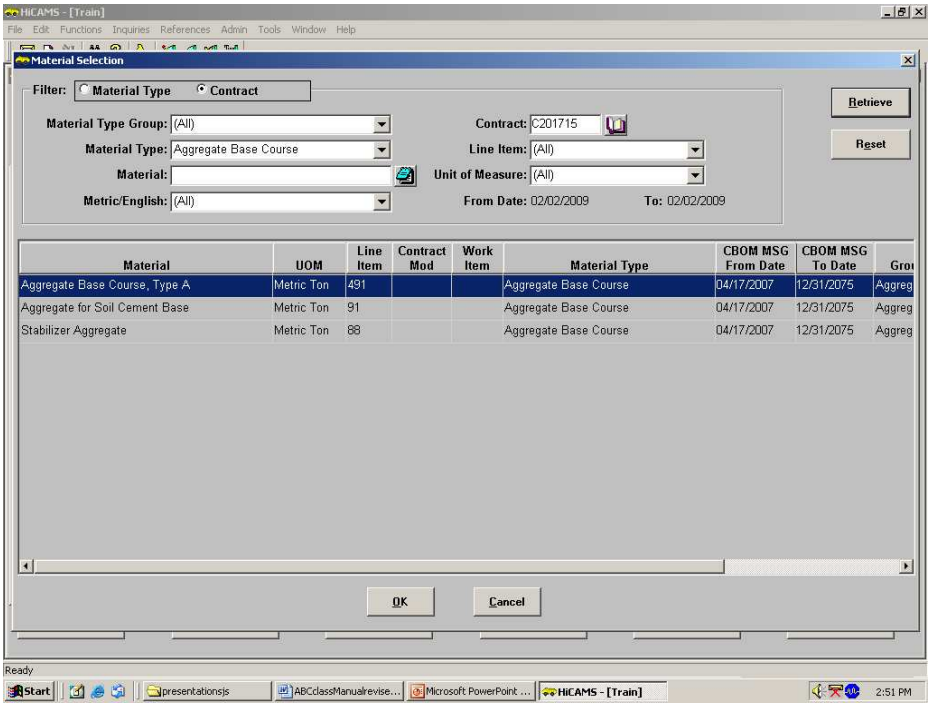
Select “Functions”; then “Sampling”; then “Enter Sample Details”



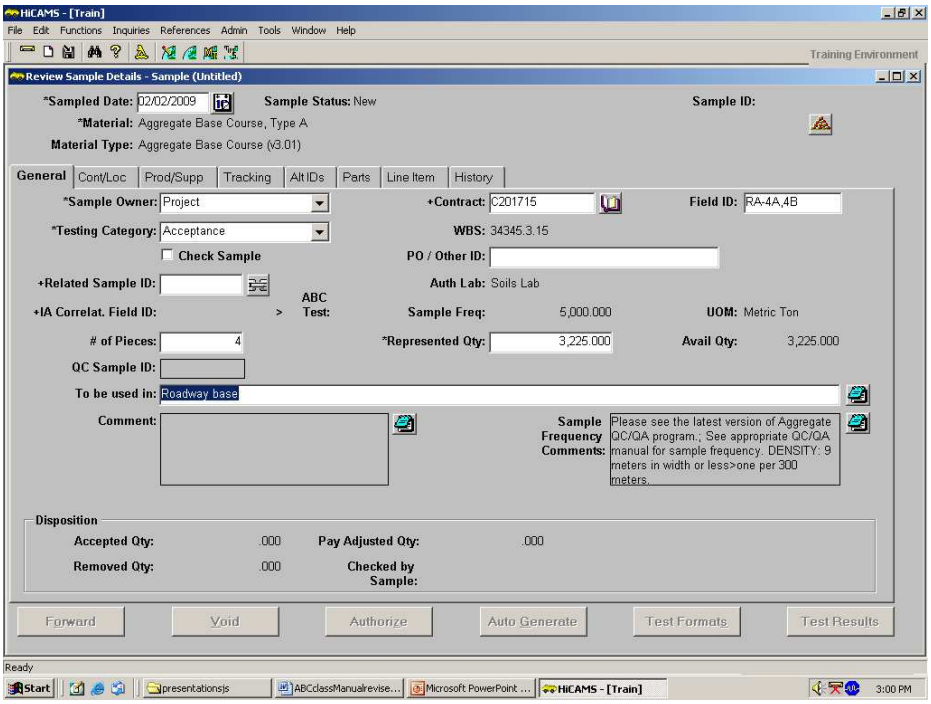
Enter the “Sampled Date”



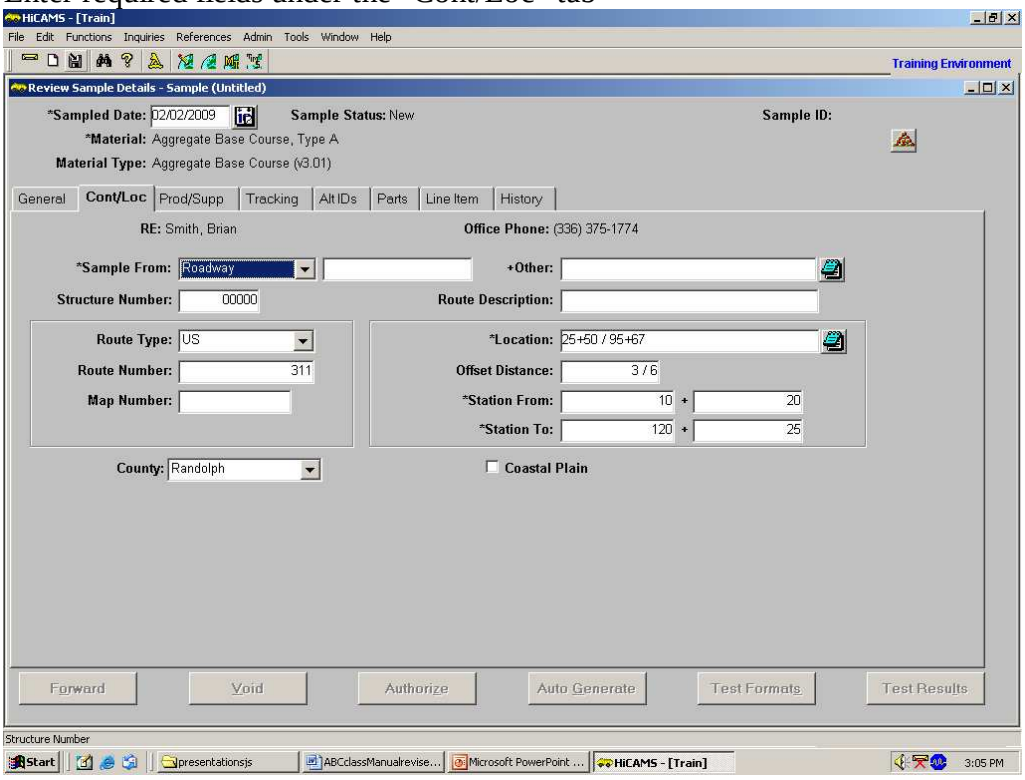
Enter “Contract” and select “Material Type” = “Aggregate Base Course”. Highlight appropriate item the aggregate material is being used in.



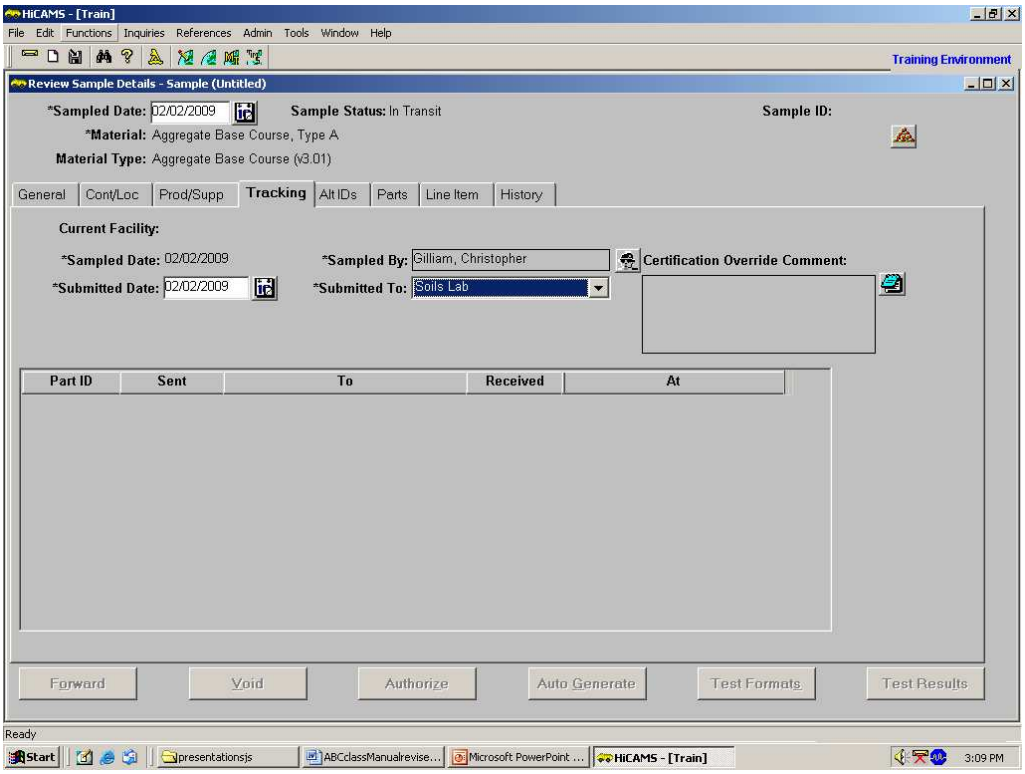
Enter required fields under the “General” tab. The “**Sampling Freq**:” should be 2,500 and the “**Represented Qty**:” should equal the amount of material represented in the sampling lot (entered on card).



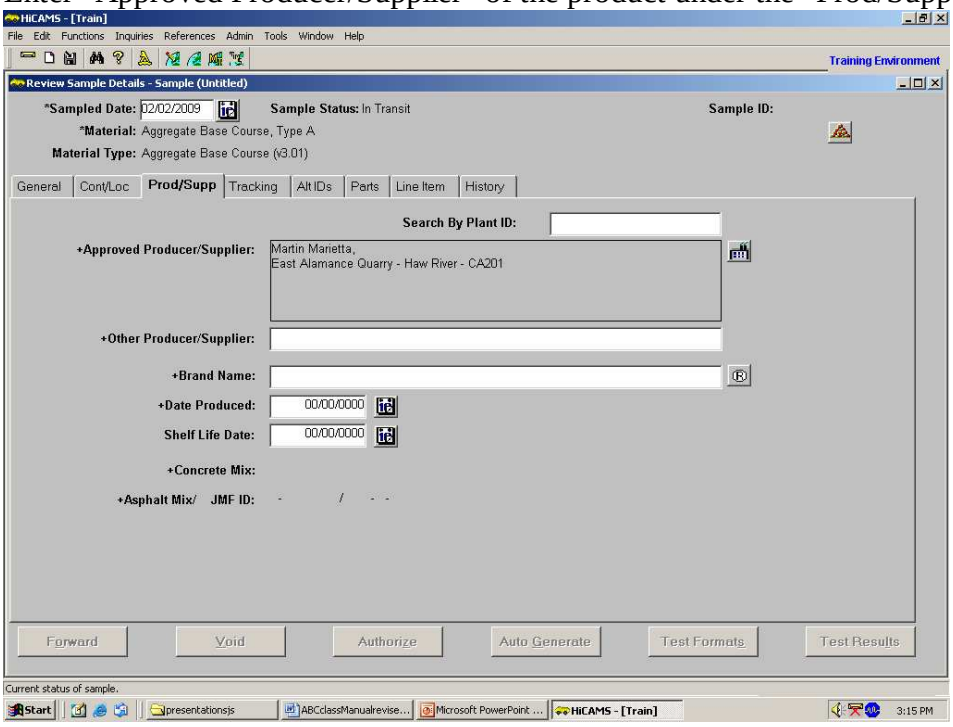
Enter required fields under the “Cont/Loc” tab



Enter required fields under the “Tracking” tab.

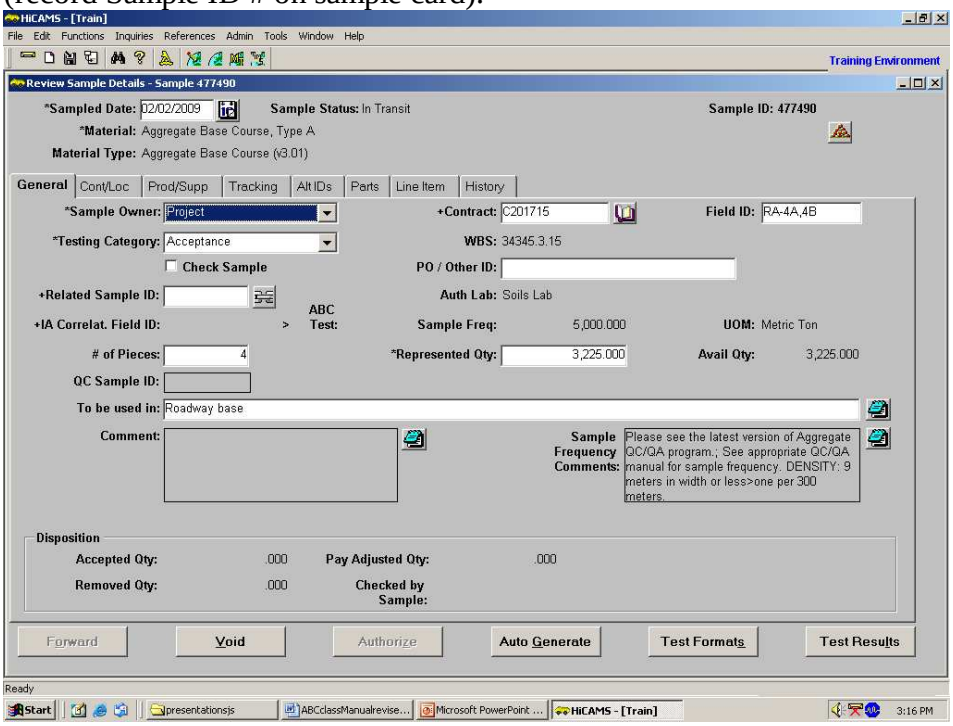


Enter “Approved Producer/Supplier” of the product under the “Prod/Supp” tab.

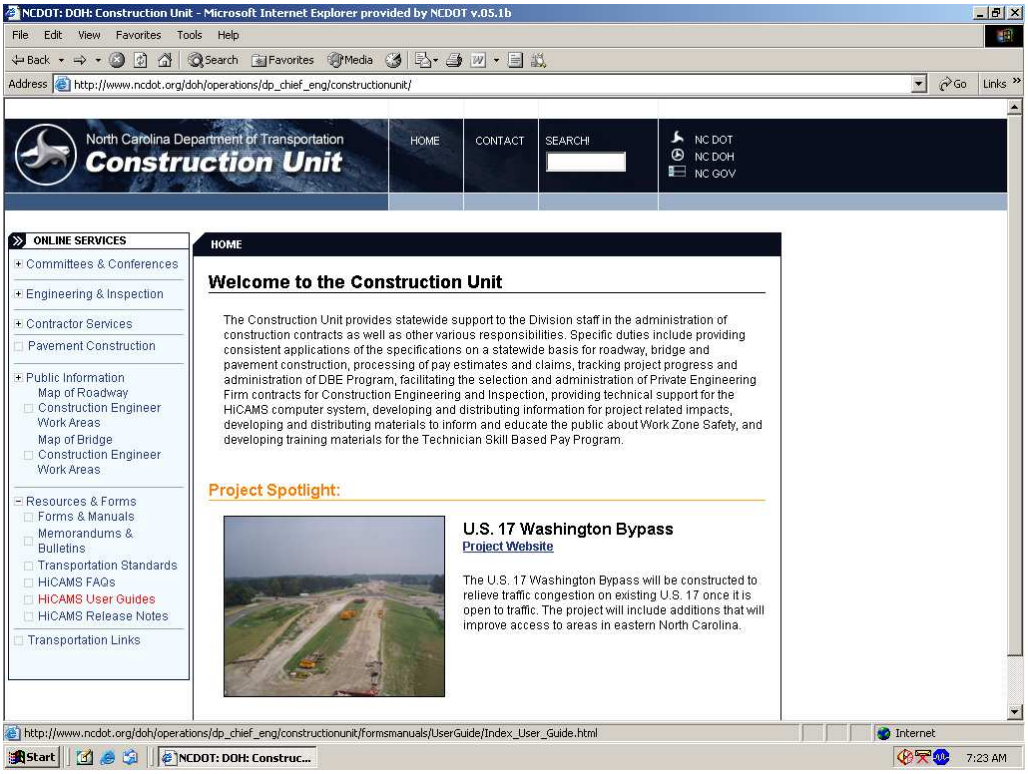


If all required information has been entered, pick the “Save” function. The system will prompt you if any required field(s) has not been entered. A “Sample ID:” will be

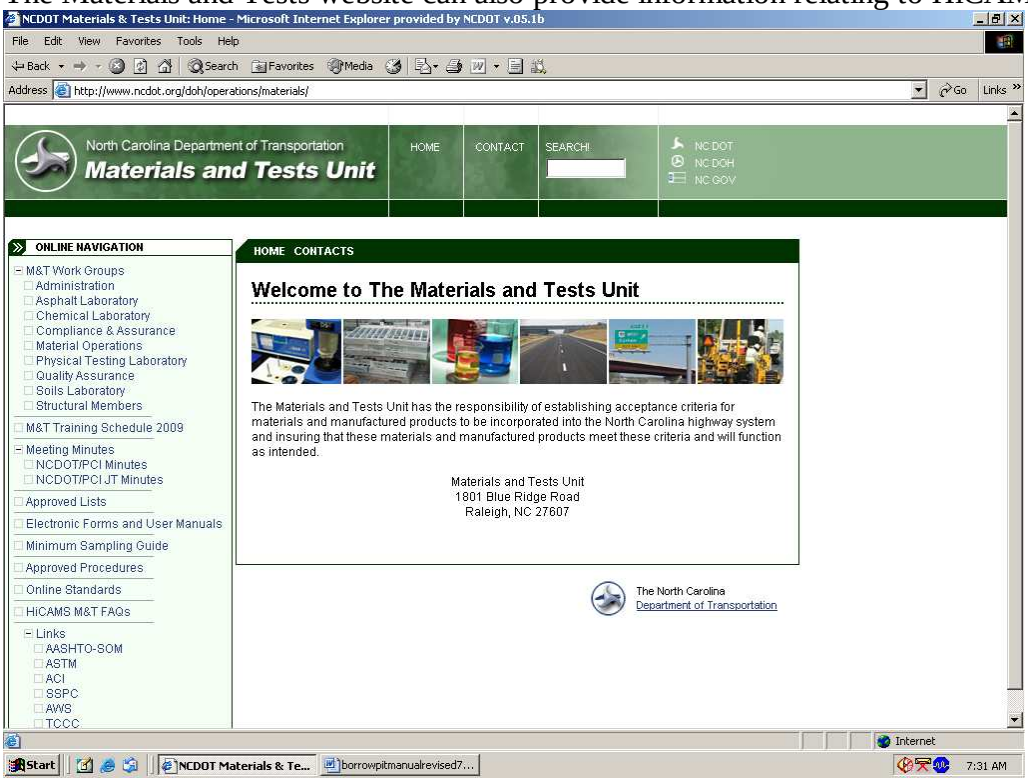
displayed if all information is entered and the sample was successfully saved into HiCAMS (record Sample ID # on sample card).



Since the HiCAMs database is changed periodically, personnel responsible for entering data into the system should monitor the Construction Unit's website for updates. The information can be found under the "Resources & Forms" Section.



The Materials and Tests website can also provide information relating to HiCAMs.



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 - 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
					895.04	895.04			9/12/2009		
					763.66	1658.7			9/23/2009		
					37.58	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	3372	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
			Distance	Random	Daily	Cumulative	Represented				
Sample #	Alignment	Station	From C/L	Number	Total	Total	Quantity	Result	Date	Initials	Remarks

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