9 Sampling

Safety

Sample References

Size of Original Samples

Sample Types

Method of Sampling

Production Sampling
Load-out Sampling
Sampling Directly from Trucks, Rail Cars, or Barges

Reducing a Sample to Test Size

Mechanical Splitter
Sand Splitter
Miniature Stockpile
Quartering

Size of Test Sample (After Splitting)

CHAPTER NINE: SAMPLING

Sampling is perhaps the most important step in assuring that good quality aggregates are being used on INDOT contracts. Since a sample is just a small portion of the total material, the importance that the sample be representative of the material being delivered cannot be overemphasized. Any test conducted on the sample, regardless of how carefully and accurately done, is worthless unless the sample is truly representative of the material used on the contract.

SAFETY

The sampling of materials may expose the Technician to machinery, moving belts, large stockpiles, and other potential dangers. Proper safety practices are always the first concern. When an unsafe condition exists, instructions from the Supervisor on the safety procedures for sampling are required to be obtained.

SAMPLE REFERENCES

A representative sample may be obtained by following the standard procedures detailed in **AASHTO T 2,** or **ITM 207**, Method of Sampling Stockpile Aggregate.

SIZES OF ORIGINAL SAMPLES

The key to any sample program is to obtain a representative sample. A standard sampling method is required to be followed to obtain uniform samples.

The following is a list of recommended minimum sizes of composite samples to be used as a guide when collecting samples.

MATERIAL	SAMPLE SIZE
No. 1 coarse aggregate	385 lb
No. 2 coarse aggregate	220 lb
No. 5 coarse aggregate	110 lb
No. 8 coarse aggregate	55 lb
No. 9 coarse aggregate	35 lb
No. 11 & No. 12 coarse aggregate	25 lb
No. 43 coarse aggregate	110 lb
No. 53 coarse aggregate	135 lb
No. 73 coarse aggregate	80 lb
2 in. Structure Backfill	245 lb
1½ in. Structure Backfill	190 lb
1 in. Structure Backfill	135 lb
½ in. Structure Backfill	60 lb
All sands No. 4 & No. 30 B Borrow	25 lb

The weight of the sample depends on the maximum particle size of the material being inspected. As a rule, a larger top size material requires a larger sample. A 25 lb sample of No. 2 coarse aggregate would not be as representative of that material as a 25 lb sample of natural sand.

TWO IMPORTANT DEFINITIONS TO REMEMBER

Top Size or Maximum Particle Size -- The sieve on which 100 percent of the material passes.

Nominal Maximum Particle Size -- Smallest sieve opening through which the entire amount of the aggregate is permitted to pass.

SAMPLE TYPES

The Technician is required to realize there are different types of samples. The most common sample is a stockpile sample, which is normally the method of load-out sampling under CAPP.

Some samples are required to be taken in the processing operation to assure that the final product is within control limits. These samples are referred to as production samples. The gradation of the production sample may not be the same as a load-out sample at some facilities.

Occasionally, an investigative sample is obtained when verifying a specific feature, such as a certain sieve, oversized material, etc. These tests may consist of many shortcuts and are only used as a quick comfort level check.

Every source may have other types of samples which are unique to their operation.

METHODS OF SAMPLING

Because of the various sampling locations and the availability of equipment, there are several methods of taking aggregate samples. Uniformity of obtaining the sample is very important, since the sampling procedure eliminates one variable in the test results. The Technician should remember that safety comes first.

PRODUCTION SAMPLING

Bin Sample

Sampling the top of the bin is an extremely dangerous as well as a difficult, if not impossible, method to obtain a representative sample. For this reason, this method of sampling is undesirable.

Discharge Sampling of Bins or Belts

Bin samples may be taken at the discharge chute. In these situations, a number of small samples are taken at short intervals and combined to make the total sample. Each of these samples is required to include the entire cross section of the flow of material from the chute or belt.

Continuity of operation normally does not allow the Technician to control the rate of flow from the discharge chute. A mechanical diversion or slide chute system is the quickest, safest, and most accurate system. Unfortunately very few mechanical systems exist. All methods, including manual methods, are required to be included in the Quality Control Plan for the source and designate proper safety practices.

Belt Sampling

Belt sampling consists of taking samples of materials directly from the conveyor belts. The proper procedure is to:

1) Make sure that the belt is carrying a normal load of material that is not segregated

2) Have the plant operator stop the belt and use proper lock out procedures

3) Take a complete cross section of the material, being careful to include all the material on the belt and only the material in the section. A template is recommended, especially on steeply inclined belts. Remove most of the sample with a scoop or shovel and the remainder with a brush.

4) Take as many complete cross sections as necessary to obtain a sample that meets the minimum sample size.

LOAD-OUT SAMPLING

Coarse Aggregate Stockpiles

Coarse aggregates are recommended to be sampled using **ITM 207**.

Fine Aggregate Stockpiles

Fine aggregate samples normally are obtained in the same method as coarse aggregate samples, except a fire shovel or sampling tube is used to collect the material.

SAMPLING DIRECTLY FROM TRUCKS, RAIL CARS, OR BARGES

Direct sampling from trucks, rail cars, or barges is not recommended. There are a number of factors that may influence the gradation of the material, such as segregation or particle breakdown during loading, transporting, and unloading. Therefore, material being shipped by cars or barges is required to be sampled at the point of delivery. Materials being shipped by trucks for local delivery points also are required to be sampled at the point of delivery.

REDUCING A SAMPLE TO TEST SIZE

The total sample (production or load-out) is required to be reduced to a sample size that may be quickly tested. The procedure is conducted in accordance with **AASHTO T 248**. Time does not allow the Technician to test the total sample. The key to sample reduction is to ensure that the sample remains representative of the material in the stockpile. This practice is commonly referred to as splitting a sample. There are four different methods to reduce a sample to the proper test size.

1) The mechanical splitter is the most accepted method of reducing to test size all coarse aggregate material smaller than No. 2 aggregate, except highly moistened compacted aggregate.

2) The sand splitter is the accepted method of reducing fine aggregate or the minus No. 4 material from compacted aggregate samples that is drier than the saturated surface-dry condition. As a quick check to determine this condition, if the material retains the shape when molded in the hand, the material is considered wetter than saturated surface-dry.

3) The miniature stockpile is the method used for fine aggregate that has free moisture on the particle surfaces.

4) Quartering is the method that is used for highly moistened compacted aggregate or when a mechanical splitter is not available.

MECHANICAL SPLITTER

The mechanical splitter separates the sample into halves as the material passes through the spaces between the bars in the splitter. The same number of each particle size goes into each half of the sample, thus keeping the reduced sample representative of the total collected sample.

In using the mechanical splitter, the splitter bars are adjusted so that the bar opening is approximately 50% larger than the maximum particle size of the material to be split. A No. 5 aggregate has a maximum particle size of 1½ in. Therefore, the recommended bar opening is approximately 2.25 in. INDOT allows the bar opening at 3 in. or 6 bars (each bar is approximately 1/2 in) for all coarse aggregate No. 5 or smaller. The splitter is required to be level to ensure that each half of the split is approximately the same size; within approximately 10 percent of each other by weight.

The splitting procedure is as follows:

1) Properly place the pans under the splitter in such a way that all of the particles diverting in both directions will be caught

2) Pour the sample evenly into the hopper

3) Open the hopper fully and allow the material to free fall through the splitter

4) If wet particles stick inside the splitter, gently tap the splitter with a rubber hammer to loosen them

5) To ensure that the sample has not been segregated during sampling, place both halves of the sample back into the hopper and repeat the splitting operation

6) After the second splitting, the two receiving pans contain approximately the same amount of material. Only one pan is placed back into the hopper and the splitting procedure repeated until a sample of the desired size is obtained. Skillful manipulation of the splitter allows a sample of nearly any size to be made that is still representative of the material in the stockpile.

SAND SPLITTER

The sand splitter is a small version of the mechanical splitter except that the openings are fixed and there are no hopper doors.

The splitting procedure is as follows:

1) Place the pans under the splitter to catch all of the particles

2) Slowly pour the dry sample into the splitter from the side (never from the end or corner)

3) Recombine the samples and split the sample a second time to eliminate any segregation

4) Reduce the sample to proper size by additional splitting of the material in one of the pans

MINIATURE STOCKPILE

The miniature stockpile method is used for reducing all samples of fine aggregates when the material is in a damp or moist condition. If the sample to be split is dry, then the material is required to be moistened before using this method.

The splitting procedure is as follows:

1) Place the original sample on a clean, dry plate or other hard, smooth, non-absorptive surface

2) Using a trowel or other suitable tool, turn the entire sample over three times

3) Shape the material into a conical pile

4) With a spoon or small trowel, randomly take at least five small portions of material around the pile and one-third way up the cone until the required test sample is obtained

QUARTERING

Quartering is a non-mechanical method of reducing a sample. This is the best method of reducing highly moistened compacted aggregate or when a mechanical splitter is not available.

The quartering procedure is as follows:

1) Pour the sample in a conical pile in the center of a clean, dry, steel plate or other hard, smooth, non-absorptive surface

2) Using a large trowel, shovel, or other suitable tool, turn the entire sample over three times and reshape the sample into a conical pile

3) Uniformly flatten the pile until the diameter is approximately equal to four to eight times the thickness

4) With a large trowel or other suitable tool, divide the sample in half by vertically passing the tool through the center of the pile. In a similar manner divide each of these halves into two parts, thus quartering the sample

5) Combine diagonally opposite quarters of the material into two samples. Store one of these two halves. If the remaining material still weighs too much, repeat the entire quartering process until the proper test sample size is obtained.

SIZE OF TEST SAMPLE (AFTER SPLITTING)

The original sample is required to be reduced to a test sample size that is within the minimum and maximum weights of the following table.

WEIGHT OF TEST SAMPLE

AGGREGATE SIZE	MINIMUM	MAXIMUM
No. 2	11,300 g	---
No. 5	6000 g	8000 g
No. 8	6000 g	8000 g
No. 9	4000 g	6000 g
No. 11	2000 g	---
No. 12	1000 g	--
No. 43	6000 g	8000 g
No. 53	6000 g	8000 g
No. 73	6000 g	8000 g
No. 91	6000 g	8000 g
B Borrow	4000 g	6000 g
Structure Backfill: 1/2 in., 1 in.,1½ in. & 2 in.	4000 g	6000 g
Structure Backfill: No. 4 & No. 30	300 g	---
Fine Aggregate	300 g	---