DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
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METHODS OF TEST FOR SAMPLING HIGHWAY MATERIALS AND PRODUCTS USED IN THE ROADWAY STRUCTURAL SECTIONS

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A. SCOPE

This test method describes the procedures for obtaining representative samples of various highway materials and products that are incorporated in roadway structural sections.

Representative sampling is defined as the taking of all materials in the same proportion as they exist or will be used. Good sampling practices must be followed during the process of obtaining materials or products for testing. If the sample does not represent the true conditions of the material under consideration, the subsequent test results and analysis of the data will be erroneous.

The sampler will review the requirements for the tests being performed to ensure that a sufficient quantity of material is sampled (e.g. CT 214, Schedule A for aggregates). It is also important to accompany each sample with a properly completed sample identification card (TL-101). The materials or products to be sampled are listed in Appendices A through E of this test method. For ease of use, procedures for sampling groups of similar materials are included in appendices as follows:

Appendix A – Aggregates, Soils, and Lime
Appendix B – Hot Mix Asphalt (HMA)
Appendix C – Cement and Cementitious Materials
Appendix D – Bituminous Materials
Appendix E – Concrete Admixtures

This test method addresses acceptable locations that are routinely used for sampling. If it is necessary to sample from other locations, check the references or contact the Transportation Laboratory.

B. REFERENCES

AASHTO T 2 – Sampling of Aggregates
AASHTO T 40 – Sampling Bituminous Materials
AASHTO T 248 – Reducing Samples of Aggregate to Testing Size
AASHTO T 47-14 Reducing Samples of Hot Mix Asphalt (HMA) to Testing Size
ASTM C 183 – Sampling and the Amount of Testing of Hydraulic Cement
ASTM C 260 – Air-Entraining Admixtures for Concrete
ASTM C 494 – Chemical Admixtures for Concrete
ASTM C 702 – Reducing Samples of Aggregate to Testing Size
ASTM D 75 – Sampling Aggregates
ASTM D 140 – Sampling Bituminous Materials
ASTM E 300 – Sampling Industrial Chemicals
American Public Health Association
American Water Works Association
Water Environment Federation – "Standard Method for the Examination of Water and Waste Water." *Collection and Preservation of Samples*

C. APPARATUS

1. Sample Splitters: sample splitters (riffle splitters) must have an even number of equal-width permanently fixed chutes which discharge alternately to each side of the splitter. There must be not less than a total of 8 chutes for splitters used for coarse aggregate and 12 chutes for fine aggregate. The minimum width of the individual chutes should be approximately 50 % larger than the largest particles in the sample to be split. The chutes must be fixed (not adjustable). For dry, fine aggregate in which the entire sample will pass the ⅜ in. sieve, the minimum width of the individual chutes should be at least 50 % larger than the largest particles in the sample to be split with a maximum width of ¾ in.

   The splitter must be equipped with 2 receptacles to hold the 2 halves of the sample following splitting. It must also be equipped with a hopper or straight-edged pan by which the sample may be fed at a controlled rate to the chutes. The hopper or straight-edged pan must have a width equal to or slightly less than the overall width of the assembly of chutes. The splitter and accessory equipment must be so designed that the sample will flow smoothly without restriction or loss of material.

   NOTE: Typically 3 different sized splitters (large, medium, and small) are sufficient.

2. Mechanical Quartering Device: mechanical quartering devices such as QuarterMaster™ or equivalent device (figure 1) can be used for a sample weighing between 25 and 100 lb. The mechanical quartering device must have 4 fixed chutes of equal width which will discharge the material in 4 approximately equal portions into appropriately sized containers. The mechanical quartering device must be designed with a receiving hopper that will hold the sample until a handle releases the material to fall through a divider. The mechanical quartering device must be designed so that the sample will flow smoothly and freely through the divider without loss of material.

   For the Field and Laboratory Procedure for splitting with the Mechanical Quartering Device, see Appendix B, Section E.

3. Quartering Canvas: a sheet of canvas approximately 5 ft × 5 ft used to quarter aggregates in the field.

4. Sample Containers: various-sized heat resistant containers are required. Some should have the following approximate capacities: 65 lb, 15 lb, 7.5 lb, 1 lb, and 0.5 lb.

5. Fan, Forced Air Heater or Oven: to remove moisture from wet samples. When air drying is not practical, typical equipment may be fans with or without heating coils or a vented, forced draft oven capable of maintaining a temperature of 140°F ± 9°F or 230°F ± 9°F.

6. Automatic Sampling Device: A device capable of taking homogenous samples. The device may be electric, hydraulic, pneumatic, or any combination of the three. The device will be capable of capturing and discharging material into a container ready for blending and splitting in one continuous operation. The device will have a minimum capability of 50 pounds per cycle.

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D. DRYING OF SAMPLES

1. Dry wet samples sufficiently to permit a complete separation on the No. 4 sieve and to develop a free-flowing condition in the portion passing the No. 4 sieve. Drying may be performed by any means that does not heat the aggregate in excess of 140°F or cause degradation of the particles. Sunlight, oven, or forced drafts of warm air are the most common drying methods.

   a. Drying can be expedited by occasionally stirring the material during the drying process.

   b. Drying may be done at 230°F ± 9°F when all subsequent tests require or permit drying at this temperature or above.

2. When drying aggregate samples containing reclaimed asphalt pavement (RAP), the oven drying temperature must not exceed 100°F. After drying, particles of RAP can be separated by hand so that the particles of the fine aggregate portion are no larger than ¼ in. Care must be taken to avoid fracturing the aggregate.

E. COMBINING OR REDUCING SAMPLES

Some sampling procedures result in excess material. It is practical to reduce the amount to a sample size equal to or slightly in excess of the minimum weight required before transporting or shipping to the laboratory. The use of a mechanical quartering device or riffle splitter is preferred. However, splitting with a quartering canvas is acceptable if carefully performed. Splitting with a quartering canvas of any HMA is not acceptable.

If combining samples will result in a sample weighing in excess of 100 lb, split each sample separately and combine the smaller portions.

Splitter and accessory equipment may be heated to 110°C (230°F)

1. Splitting samples with a riffle splitter

The procedures for splitting and reducing samples with riffle splitters are as follows:

   a. The sample must be at a free-flowing condition.
   b. Thoroughly mix the sample and spread it evenly across the pan or hopper.

   c. Open the hopper gate or pour the material from the pan so that material flows evenly through all the chutes. Control the rate of discharge as necessary to maintain a continuous flow of materials through the chutes.

   d. Continue to split or combine successive portions until the desired sample size is achieved.

   e. Clean excess material from riffle splitters after each use.

2. Splitting samples with a mechanical quartering device

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Use a mechanical quartering device for splitting a sample weighing between 25 and 100 lbs. The procedures for splitting samples with a mechanical quartering device to either combine samples or to reduce the sample are as follows:

a. Secure the receiving hopper door. Place 4 sample containers of sufficient capacity to accommodate the reduced portion of the sample under the discharge chutes.

b. Pour the sample evenly into the hopper, utilizing a continuous pour or pouring from each side of the hopper to avoid segregation. Release the hopper door.

c. Combining or reducing samples:

(1) Combining Samples: remove 2 diagonally opposite quarters from sample A and sample B. Load remaining quarters from samples A and B into hopper and repeat process so that samples A and B form a combined sample.

(2) Reducing Sample Size: remove 2 diagonally opposite quarters from an individual sample. Load remaining quarters into hopper and repeat the process until the sample is reduced to the desired size.

d. Clean excess material from mechanical quartering device after each use.

3. Splitting with a quartering canvas

A quartering canvas can be used for splitting a sample weighing up to 100 lbs. The procedures for splitting samples with a quartering canvas are as follows:

For samples weighing between 20 and 100 lbs:

a. Place the sample in a conical pile in the center of the canvas. Mix the sample by shoveling material from around the bottom edges to the center of the pile. Place each shovelful so that the material spills over the cone equally in all directions.

b. Flatten the cone with the shovel, spreading the material to a circular layer of uniform thickness.

c. Insert a stick (or pipe or shovel handle) under the canvas at the center of the pile and lift both ends, dividing the sample into 2 equal parts. Remove the stick, leaving the canvas in a folded position. Insert the stick (or pipe or shovel handle) under the canvas at the center of pile at right angles to the first division and again lift both ends, dividing the sample into 4 equal parts. In lieu of dividing by use of a stick, a square point shovel may be used to divide the sample into 4 equal parts.

d. Take samples from 2 diagonally opposite quarters being careful to clean all the fines from the canvas.

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e. Repeat steps a through d, combining split portions as necessary until the desired sample size is achieved.

For samples weighing less than 20 lbs:

a. Place the sample on the canvas or a clean sheet of paper. Mix thoroughly with a trowel and form into a conical pile.

b. Flatten the pile by pressing downward with the trowel.

c. Separate into quarters with trowel at right angles.

d. Take samples from 2 diagonally opposite quarters being careful to clean all the fines from the canvas or paper.

e. Repeat steps a through d combining split portions as necessary until the desired sample size is achieved.

F. HEALTH AND SAFETY

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.
Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

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(California Test 125 contains 19 pages)

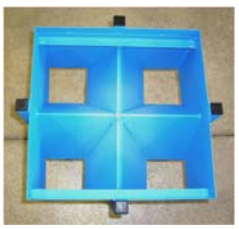

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FIGURE 1. Example of a typical mechanical quartering device

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APPENDIX A

AGGREGATES, SOILS AND LIME

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Appendix A contains the procedures for sampling coarse and fine aggregates at various locations for HMA, portland cement concrete, aggregate base and subbase, treated bases, bituminous seals, polymer concrete, soil, and lime

PROCEDURES

Obtain sufficient materials to equal or exceed the minimum sample weight required. If taking material from multiple locations for a composite sample, obtain approximately equal amounts of material from each location and combine to form a field sample which is equal to or in excess of the minimum weight required. Quarter or split the sample to the required size.

Aggregates

A. From HMA Batch Plants

1. At each aggregate storage bin, the contractor is required to provide a safe and suitable sampling device that will provide a sample of the aggregate as it is being discharged into the weigh hopper. This device normally consists of a pan of sufficient size to intercept the entire cross-section of the discharge stream and hold the required quantity of material without overflowing. A set of rails is necessary to support the pan as it is passed under the discharge stream.

2. Supplemental fine aggregate may be sampled from the feed line or surge tank preceding the proportioning device. The selected location must not be pressurized.

3. Baghouse dust may be sampled from the bottom of the baghouse, under the feed screw with a sampler that is fixed under the baghouse. The sampler consists of a valve, a section of pipe and a cap for the bottom end of the pipe. To sample, the valve is closed, the pipe cap removed, and the pipe cleaned. Then the cap is replaced and the valve opened. When the pipe is full, the valve is closed, the cap removed, and the sample of dust collected.

   Baghouse dust may also be sampled similarly to supplemental fine aggregate.

B. From HMA Continuous Mixing Plants

1. The contractor is required to provide a safe and suitable aggregate-sampling device for obtaining a sufficient sample of the combined aggregate while the plant is in full operation. The device must be located in advance of the point where the aggregate enters the drier-drum mixer.

   Some plants are equipped with a sampling device (pan) similar to ones used for batch plant bins. This device normally consists of a pan of sufficient size to intercept the entire cross-section of the discharge stream and hold the required quantity of material without overflowing. A set of rails is necessary to support the pan as it is passed under the discharge stream.

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Devices used to divert the stream of combined aggregate into a container must be used with care. Samples taken using diverters that move vertically to cut the stream will not be permitted.

Side-to-side diverters are less susceptible to segregation problems as the aggregate stream will normally be layered horizontally. A representative sample may be obtained by diverting the whole stream into an 8 to 12 in. diameter pipe and wasting the first and last quarter of the sample. This method often requires splitting the remaining portion of the sample. Systems that divert the stream of aggregate to a belt for sampling allow the sample size to be selected. Use 2 templates that conform to the shape of the belt to separate an appropriate size section from the middle half of the diverted aggregate. Sample all the material between the templates.

2. Supplemental fine aggregate may be sampled from the feed line or surge tank preceding the proportioning device. The selected location must not be pressurized.

3. Baghouse dust may be sampled from the bottom of the baghouse, under the feed screw with a sampler that is fixed under the baghouse. The sampler consists of a valve, a section of pipe and a cap for the bottom end of the pipe. To sample, the valve is closed, the pipe cap removed, and the pipe cleaned. Then the cap is replaced and the valve opened. When the pipe is full, the valve is closed, the cap removed, and the sample of dust collected.

   Baghouse dust may also be sampled similarly to supplemental fine aggregate.

C. From Portland Cement Concrete Batch Plants

The contractor is required to provide safe and suitable facilities, including necessary splitting devices, for obtaining samples of aggregates.

Sampling the belt feeding; the continuous mixer or the batch plant bins immediately preceding the weigh hopper is the most prevalent location for pulling aggregate samples. Use 2 templates that conform to the shape of the belt to separate an appropriate size section. Sample all the material between the templates. Completely remove the aggregate from a section of the stopped conveyor belt. Quarter or split the sample to the required size.

Many plants are equipped with large storage bins (i.e., 100 to 150 yd^3). On small projects, samples from the belt that feeds the bins may not be representative of the aggregate used on the project if the bins have material in them. In this case, empty the bins prior to sampling. To eliminate this problem, a request that the plant operator keep the bins empty or near empty prior to sampling is recommended.

D. From Windrows

Obtain samples from within the middle half of the windrow. Sample the entire cross section of the windrow before water is added. This can be done using steel plates or plywood to isolate the initial sample.

An alternate procedure is to remove a cross section of the windrow at least the width of

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1 shovel. From either remaining face, select an appropriate width to provide the needed sample and make a vertical cut. Be sure to include the material that sloughed after removing the cross section.

E. From Roadways

Obtain at least 3 approximately equal portions selected at random transversely across the width of the roadway after the material has been spread and prior to compaction. Combine the 3 portions to form a field sample that is equal to or in excess of the minimum weight required. Take all portions from the roadway for the full depth of the material, taking care to exclude any underlying material.

F. From Transportation Units

Obtain samples from a hauling vehicle from at least 3 points a minimum of 12 inches below the surface and evenly distributed over each individual vehicle. Establish the sample location at a distance from the edge that is approximately one-third of the bed.

G. From Stockpiles

In some cases, it may be necessary to sample from stockpiles for testing. In such cases, the procedure should ensure that segregation does not introduce a serious bias in the results.

At times, "one sized" materials such as No. 4 screenings are stockpiled at the job site. This type of material may be sampled for acceptance testing from the stockpile.

It is very difficult to ensure unbiased samples when sampling from stockpiles. This is due to segregation that occurs when material is stockpiled and coarser particles roll to the outside base of the pile. For all aggregates, use a loader to develop a separate, small sampling pile composed of materials drawn from various levels and locations in the main pile. Drag off the top half of the new pile. Take a shovel full of material from several locations of the remaining half of the pile.

Where power equipment is not available, samples from stockpiles should be made up of at least 3 portions, 1 each from the top third, at the midpoint, and the bottom third of the volume of the pile. A board shoved into the pile just above the sampling point can prevent further segregation.

When sampling stockpiles of fine aggregate, remove the outer layer which may have become segregated and take the sample from the material beneath. If available, sampling tubes (with a diameter of approximately 1 in. and a minimum length of 5 ft) may be inserted into the pile at random locations to extract a minimum of 5 portions of material to form the sample.

Samples can be taken from the stream of material at the end of the moving belt that discharges onto the stockpile. These belt systems can be lowered and moved back and forth to assist sampling. Care must be exercised to intercept the entire discharge stream without overflowing the sampling device.

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Soil

A. From the Source

Sample by means of test holes (augured, dug with post-hole digger or shovel or by other mechanical means). Ensure method of sampling does not change the physical characteristics of the material. Sample the test holes to the required depth. Take separate samples to represent different material types so all material types are represented. Reference the location of each sample on the sample identification card.

B. From the Job Site

Sample from within the middle half of the deposit. Take a composite sample from at least 3 locations in a line transversely across the section.

Lime

If lime slurry is being sampled, obtain a minimum of two 1 quart cans having a friction lid or a poly container with screw-on lid. Use care to ensure uniform distribution of the solids before sampling.

If quicklime or hydrated lime is being sampled, obtain a minimum of 2 lb in a can having a friction lid or a poly container with screw-on lid.

A. At the Production Plant

Take samples from the conveyor system with the conveyor stopped. Scoop samples (grab samples) from the sample port opening.

When sampling granular lime for grading analysis, take the entire cross-section of the conveyor.

B. At the Job Site

Take samples from the distributor truck during application.

C. From Pneumatic Tanker

Normally a thief sampler is used to obtain the sample through the inspection cover or loading hatch. The thief is pushed 2 ft ± 0.5 ft. into the material, withdrawn, and emptied into the can or container.

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APPENDIX B

HOT MIX ASPHALT (HMA)

SCOPE

Appendix B contains the procedures for sampling hot mix asphalt (HMA) materials (including HMA, modified HMA (including rubber, fiber, etc.), open graded friction course (OGFC), bonded wearing course (BWC) and asphalt treated permeable base (ATPB) prepared for use in paving.

PROCEDURES

Obtain sufficient materials to equal or exceed the minimum sample weight required.

If taking material from multiple locations for a composite sample, obtain approximately equal amounts of material from each location and combine to form a field sample which is equal to or in excess of the minimum weight required. Typical sample size is approximately 250 pounds. Mix the portions and split the resulting sample to the required size.

Cardboard boxes 8 in. × 8 in. × 3 in. (16 boxes), 8 in. x 8 in. x 4 in., (12 boxes) and 8½ in. × 8½ in. × 4½ in. (10 boxes) are acceptable containers for HMA samples. One gallon metal containers with friction lids are required for BWC, RHMA-O, RHMA-O-HB, OGFC, and ATPB, and may be used for RHMA-G(14 gallons).

NOTE: Cardboard box size is limited to provide for uniform heating.

Anti-stick or release agents may be used on tools if the tool is wiped before sampling. Deposit HMA material in acceptable containers. Prevent contamination and segregation of material.

The TL-101 must identify containers of material from multiple locations or sections as 1 sample regardless of the number of containers. Procedures for sampling plant-mixed HMA are described below:

A. At the Plant

1. From the Conveyor System

Stop the slat conveyor and select at least 3 random locations of approximately equal size. Use 2 templates that conform to the shape of the belt to separate out each section to be sampled. Sample all the material between the templates for each sample location.

When sampling at HMA plants with an automatic sampling device between the drum discharge and storage silos, sample 3 individual times equivalent to full belt cuts or full stream diversions. Take each sample 1 to 4 min apart.

2. From a Windrow laid down at the Plant

From a bottom dump trailer, or end dump trailer, produce a triangular windrow of 1 to 2 feet in height, 2 to 5 feet in width, and a minimum of 6 feet in length.

Divide the windrow into thirds. Sample locations must be a minimum of 1 foot from end and 2 feet apart Do not overlap samples.

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Sample area must be a minimum of 1 foot in width.

Remove and discard approximately 0.5 ft from the top of the windrow. Trim and discard the front of the area to be sampled creating a 60 to 90 degree to the vertical face. Obtain the sample from digging into the vertical face across the entire cross-section of the windrow with a shovel in a horizontal motion.

Obtain a minimum of two full containers of material from each location.

3. From a Silo or Batch Plant discharge.

A. From an end dump trailer, or loader bucket take a single drop, or multiple drops, from the silo or batch plant discharge to produce a rectangular base, triangular pile a minimum of 2 ft in height, 5 ft in width, and 8 ft in length.

   Divide the rectangular base into thirds, along the long axis of the rectangle. Sample locations must be a minimum of 2 feet apart. Do not sample in overlap locations.

   Remove and discard approximately 0.5 ft from the top of the rectangular pile. Trim and discard the front of the area to be sampled creating a 60 to 90 degree to the vertical face. Obtain the sample from by digging into the vertical face across the entire cross-section of the windrow with a shovel in a horizontal motion.

   Sample area must be a minimum of 1 ft in width.

B. With a trailer-mounted bulk sampler system, take a single drop, or multiple drops, from the silo or batch plant discharge into a material hopper that will hold the material and subsequently discharge the material into a mechanical quartering device to produce split samples of the material. Continue to split the material samples produced from the trailer-mounted bulk sampler system to the required sizes by approved splitting devices.

4. From Transportation Units

For trucks with a single bed configuration, divide the truck bed into 3 approximately equal sections as shown in Figure B.1. For trucks with a tandem set up, divide each tandem into 3 approximately equal sections as shown in Figure B.2.

For either configuration, utilize an automatic sampling device to take samples in each section at least 1 ft from the edge of the bed or from section borderlines. Take the sample at least 1 ft from the surface of the material.

Obtain a minimum of two full containers of material from each section.

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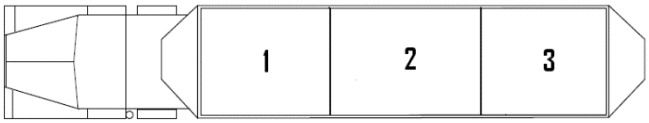

FIGURE B.1. Single Bed Configuration

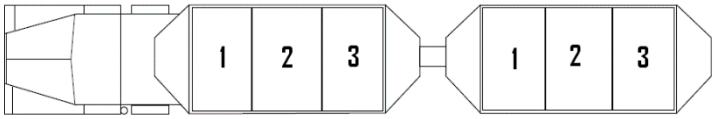

FIGURE B.2. Tandem Setup Configuration

B. From the Paver or Material Transfer Vehicle Receiving Hopper

Stop the paver or material transfer vehicle, turn engine off and make sure brakes are applied. Station a lookout spotter in front of hopper prior to taking the sample.

Sample from 3 locations equally spaced across the width of the hopper and a minimum of 1 ft from the surface of the material and 2 ft from the hopper front or sides. Trim the front of the area of each location to be sampled creating a minimum of a 1 ft vertical face. Obtain the sample from the vertical face by digging into the vertical face with a shovel in a horizontal motion.

Obtain a minimum of two full containers of material from each location.

C. From the Mat behind the Paver

Sample from a minimum of 3 locations starting a minimum of 1 ft from edge and spaced equally in a line transversely across the mat immediately behind the paver. Include the full depth of the material, taking care to exclude any underlying material (i.e., aggregate base or excess tack coat).

Obtain a minimum of two full containers of material from each location.

D. From the Windrow

Choose random locations along the windrow that appears uniform. Sample locations must be a minimum of 10 ft from the beginning or the end of the windrow section. Choose a sample area a minimum of 6 feet in length. Divide the length into thirds. Sample locations must be a minimum of 1 foot from end and 2 feet apart Do not overlap samples.
Sample area must be a minimum of 1 foot in width.

Remove and discard approximately 0.5 ft from the top of the windrow. Trim and discard the front of the area to be sampled creating a 60 to 90 degree to the vertical face. Obtain the sample by digging into the vertical face across the entire cross-section of the windrow with a shovel in a horizontal motion.

Obtain a minimum of two full containers of material from each location.

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E. Quartermaster-Field and Laboratory Procedure

Prior to reducing samples, ensure that the following are done:

1. Splitter is cleaned and surfaces coated with release agent
2. Place splitter in a level surface
3. Level splitter by adjusting bolts in the legs – check with bubble level

Procedure: First split

1. Obtain HMA sample per CT 125
2. Reheat sample on oven
3. Place HMA sample in 5 gallon buckets (preferably steel)
4. Ensure hopper is closed
5. Ensure receptacles are in place
6. Place HMA sample into hopper without segregation or loss of material
7. Using a spatula, level HMA sample in the hopper
8. Release hopper handle and allow material to uniformly flow into the receptacles
9. Clean splitter surfaces of retained HMA, allowing it to fall to the appropriate receptacles

Procedure: Second split

1. Ensure hopper is closed
2. From the first split, return materials from the receptacles back into the hopper without segregation or loss of material
3. Ensure receptacles are in place
4. Using a spatula, level HMA sample in the hopper
5. Release hopper handle and allow material to uniformly flow into the receptacles
6. Clean splitter surfaces of retained HMA, allowing it to fall to the appropriate receptacles

For all combining or reducing samples, always use the 2 diagonally opposite quarters.
Procedure: Reducing samples (only after 2nd split)

1. Ensure hopper is closed
2. Remove 2 diagonally opposite quarters from an individual sample
3. Load remaining quarters into the hopper
4. Release hopper handle and allow material to uniformly flow into the receptacles

Repeat process until sample is reduced to the desired size

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APPENDIX C

CEMENT and CEMENTITIOUS MATERIAL

SCOPE

Appendix C contains the procedures for sampling cementitious products and water to be used in portland cement concrete, lean concrete base, and cement treated permeable base.

PROCEDURES

Cement and Cementitious Material

Place samples directly into plastic bags (double bag) and seal immediately after filling and eliminating excess air.

A. At the Concrete Plant

Sample at the weigh hopper or from the feed line immediately in advance of the hopper. In many plants a thief sampler is installed in the trough feeding the weigh hopper, the weigh hopper itself, or a cement-holding hopper, if so equipped. If samples are obtained in this manner, the plant must be equipped with appropriate safety measures.

On some plants, it would require extensive plant modification in order to make these sampling locations available and safe. In this case, an adequate sample can be obtained by dropping at least 100 lb of cement or supplementary cementitious material from the weigh hopper into the clean bucket of a loader. It can then be lowered to ground level where the material can be sampled. Take a minimum of 3 equal scoops to represent a sample. Take scoops at different locations, but avoid sampling near the edges of the loader bucket.

B. From Package with Tube Sampler

Sample from packaged cement using a tube sampler. Insert the tube sampler diagonally into the valve of the bag (20 in. for packaged cement) and place the thumb over the air hole. Withdraw the sampler. Take a sample from 1 bag for each 4.5 ton or fraction thereof.

C. From Pneumatic Tanker

Sample with a thief sampler through the inspection cover or loading hatch. The thief is pushed 2 ft ± 0.5 ft into the material and withdrawn.

Water

Place a water sample in a clean 2 qt plastic jug with a lined, sealed lid. Prior to obtaining the sample, fill and rinse the jug 3 times with the water being collected. Fill the container to the top, mark the outside of container with time and date, refrigerate or ice to approximately 40°F, and deliver to the laboratory within 24 hr.

A. From Distribution Systems

Flush lines sufficiently to ensure the sample is representative of the supply. Take into account the diameter and length of the pipe to be flushed and the velocity of flow.

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B. From Wells

Collect samples from wells only after the well has been pumped sufficiently to ensure the sample represents the ground water source. Sometimes it will be necessary to pump at a specified rate to achieve a characteristic draw down.

C. From Rivers and Streams

If equipment is available, take an integrated sample from top to bottom at mid-distance horizontally in the stream in such a way that the sample is representative of the river or stream.

If only a grab sample can be collected, take it in the middle of the stream and at mid-depth.

D. From Lakes and Reservoirs

Lakes and reservoirs are subject to considerable variations from normal causes such as seasonal stratification, rainfall, runoff, and wind. Choose location, depth, and frequency of sampling depending on local conditions and the purpose of the sample. Avoid surface scum.

E. In Concrete or Lime Mixing Plants

Sample from the line that feeds water into the mix at the plant facilities.

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APPENDIX D

BITUMINOUS MATERIALS

SCOPE

Appendix D contains the procedures for sampling of liquid, semi-solid, or solid bituminous material at various locations.

PROCEDURES

Except for emulsions, all binder samples must be placed in 1 qt metal, cylindrical shaped cans with open top and friction lids. Emulsion samples must be placed in 2 qt plastic jugs with lined, sealed lids.

Avoid contamination of the sample with solvent, diesel or other parting agents. After pouring the sample, place the lid on as tightly as possible. Any binder spilled on the can or emulsion on the outside of the jug must be wiped off at once. Under no circumstances must the can or jug be placed in a bucket of solvent in order to remove spillage.

Emulsion samples should not be subjected to extremes of temperatures as this will negatively affect the test results. The TL-101 shipped with the emulsion sample must show the anticipated dilution rate (expressed as percent of water present).

After taking the sample, mark the outside of the container with time and date. Attach a completed TL-101 to each sample prior to shipping.

Liquid Bituminous Materials

A. At the Manufacturing Source

Sample bituminous materials in bulk storage tanks equipped with or without mechanical agitators by using existing sampling valves or taps at the lower locations of the tank. Withdraw a 1 qt sample after taking and discarding a minimum of 1 gal of material.

B. From Tank Cars, Tank Trucks, or Re-circulating Storage Tanks

Tanks must be equipped with a sampling valve. The inlet to the valve must be located a minimum of 12 in. from any wall. Withdraw a 1 qt sample after taking and discarding a minimum of 1 gal of material.

C. From Distributor Trucks

Sample from the spray bar of distributor trucks at mid-load during operations.

An acceptable alternative is as follows: Secure the sample with an oil thief. Lower a clean oil thief to the bottom of the tank and withdraw it at such a rate that when removed from the binder, some unfilled space remains in the thief. To prevent contamination of the sample by material remaining in the thief from previous sampling or from traces of solvents used in cleaning, discard the first 2 samples removed with the thief. Pour the third sample drawn into the sampling can.

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D. HMA Plant Feed Line

The contractor is required to provide a suitable sampling device in the binder feed lines connecting plant storage tanks to the binder weighing system or spray bar.

The sampling device must consist of a ½ or ¾ in. valve constructed in such a manner that a 1 qt sample may be withdrawn slowly at any time during plant operations. The valve must be maintained in good condition, and if it fails to function properly, it must be replaced. The sampling device must be readily accessible, in an area free of dangerous obstructions, and must be between 24 and 30 in. above the platform. A drainage receptacle must be provided for flushing the device prior to sampling.

Flush the sample valve plumbing with a minimum of 1 gal of material prior to taking the sample.

Asphalt Emulsion or Polymer Modified Asphalt Emulsion

Sample asphalt emulsion or polymer modified asphalt emulsion at the job site from the distributor truck at mid-load during operations.

Solid or Semi-Solid Material (Crack Filler)

Sample the smallest prepackaged container available. Take 1 sample per lot delivered to the project.

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APPENDIX E

CONCRETE ADMIXTURES

SCOPE

Appendix E contains the procedures for sampling, air entraining agents, chemical admixtures, and curing compounds for use in portland cement concrete and lean concrete base.

It also contains the procedures for sampling polyester resins and high molecular weight methacrylates and their promoters and initiators that are used in polymer concrete.

PROCEDURES

Liquid Air Entraining Agents and Chemical Admixtures

All liquid admixtures must be thoroughly agitated without introducing air immediately prior to sampling. Place samples in clean, moisture proof, airtight cans or plastic bottles.

A. At the Manufacturing Source

Take a 1 qt sample from the mix tank at the conclusion of the mixing operation.

B. From Large Holding Tanks or Bulk Storage Tanks

Sample equally from the upper, intermediate and lower levels by means of drain cocks in the sides of the tanks or a weighted sampling bottle fitted with a stopper that can be removed after the bottle is lowered to the desired depth.

Each grab sample must have a volume of at least 1 pint. Take a minimum of 3 grab samples. Combine and mix the 3 samples thoroughly and sample resultant mixture to provide a composite 1 qt sample.

C. From Drums or Other Smaller Containers

Obtain a 1 qt sample to represent 1 or more selected drums or containers.

D. At Concrete Batch Plants

Take samples from a sampling valve located on the liquid admixture dispensing system. Flush the valve and discard a minimum of 1 qt of admixture. Then take a 1 qt sample.

Non-Liquid Air Entraining Agents and Chemical Admixtures

Samples must be packaged in moisture proof, metal or plastic airtight containers.

A. From Bulk Storage Tanks or Transportation Units

Take a minimum of four 1 lb grab samples from different locations. Combine and thoroughly mix the grab samples. Split the combined material to obtain a resultant composite sample of 2 lb or more.

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B. From Packages

Obtain samples by means of a tube sampler. Insert the tube sampler diagonally into the material, transversing the package. Place the thumb over the air hole. Withdraw the sampler. Repeat to obtain at least 2 lb. Take 1 sample per lot.

Curing Compounds

All curing compounds must be thoroughly agitated without introducing air immediately prior to sampling. Place samples in clean, moisture proof, airtight cans or plastic bottles.

Take a 1 qt sample to represent 1 or more selected drums or containers.

A. From Manufacturing Source

Take a 1 qt sample from the mix tank at the conclusion of the mixing operation.

B. From Large Holding Tanks or Bulk Storage Tanks

Sample equally from the upper, intermediate and lower levels by means of drain cocks in the sides of the tanks or a weighted sampling bottle fitted with a stopper that can be removed after the bottle is lowered to the desired depth.

Each grab sample must have a volume of at least 1pint. Take a minimum of 3 grab samples. Combine and mix the 3 samples thoroughly and sample resultant mixture to provide a composite 1 qt sample.

Polyester Resins, High Molecular Weight Methacrylates, Promoters and Initiators used in Polymer Concrete

Minimum composite sample sizes are:

- Polyester Resin - 1 gal
- High Molecular Weight Methacrylates – 2 qt
- Promoters and Initiators – 1 pt

Place all samples in rust proof cans with screw neck or friction top lids.

A. From Storage Tanks, Tank Trucks, and Tank Cars

Sample equally from the upper, intermediate and lower levels by means of drain cocks in the sides of the tanks or a weighted sampling bottle fitted with a stopper that can be removed after the bottle is lowered to the desired depth.

Each grab sample must have a volume of at least 1 pint. Take a minimum of 3 grab samples. Combine and mix the 3 samples thoroughly and sample resultant mixture to provide a composite 1 qt sample.

B. From Drums or other Smaller Containers (5 gallons or Larger)

Obtain samples from drums and smaller containers using a tube sampler. The sampler must be designed so that it will reach to within ⅛ in. of the bottom of the drum or container.

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Thoroughly agitate the material in the drum or container. Withdraw some liquid with the tube sampler. Rinse the tube with the liquid by holding it horizontally and turning it so the liquid comes in contact with the inside of the tube. Discard the rinse liquid and allow the tube to drain.

Obtain a full depth sample by inserting the tube with the upper end open. When the tube reaches within ⅛ in. of the bottom, place the thumb over the hole and remove the tube quickly.

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