Method of Test for

DRY PREPARATION OF DISTURBED SAMPLES FOR TEST
DOTD Designation: TR 411-10

Method A – Soil
With Less Than 5% Aggregate

I. Scope

A. This procedure is designed to summarize the sample sizes needed and basic preparation for DOTD test procedures for soil with less than 5% aggregate.

B. Reference Documents.
   1. DOTD TR 108 – Splitting and Quartering Samples
   2. AASHTO M 92 – Wire Cloth Sieves for Testing Purposes
   3. AASHTO M 231 – Weighing Devices Used in the Testing of Materials

II. Apparatus

A. Balance – readable to 0.5% of the required sample size.

B. Drying apparatus
   1. Laboratory – approved thermostatically controlled ventilated oven, capable of maintaining temperature within ± 5°C.
   2. Field electric or gas hot plate. Open flame hot plate must be equipped with a suitable shield to disperse heat and to prevent direct contact of the flame with the drying pan.

C. Sieves – 4.75mm (No. 4), 2.00 mm (N. 10) and 425 μm (No. 40); cover sieve(s) as necessary to prevent overload, catch pan and top – conforming to AASHTO M 92.

D. Pans – sufficient to hold sample without spilling and large enough to spread the material for rapid drying.

E. Personal protective equipment – thermal gloves, apron, tools, eye protection, dust mask or respirator.

F. Miscellaneous hand tools – rubber mallet, brushes, spatula, stirrers, scoops as necessary to manipulate the material.

G. Feeler gauge – capable of measuring 0.070 – 0.080 mm.

H. Pulverizing apparatus
   1. Power driven wedge crusher
   2. Drill press – to drive a rubber-covered pestle with a mortar.
   3. Mechanical open-type, flat disc pulverizer

I. Splitters – various sizes meeting the requirements of TR 108, including one with 6-mm (¼ inch) chutes.

J. No. 2 metal can(s)

III. Health Precautions

When preparing soils, do not wear loose clothing, jewelry, or any other apparel or accessory which could be caught by rotating equipment. Hair that is long enough to be caught by equipment must be securely fastened or bound so that it cannot become entangled in the equipment. Be very careful not to catch body parts in the equipment. This equipment is dangerous if not properly used or if used without proper safety equipment and procedures. Be clean
shaven to ensure proper fit of the respirator. Use proper equipment and techniques to ensure safety in handling hot materials.

IV. Sample

For sample size, refer to the “Minimum Quantity” column of the Materials Sampling Manual.

V. Procedure

A. Refer to test procedure to be performed to determine if it is necessary to dry material.
   1. If it is not necessary to dry material, prepare the material in accordance with the applicable test procedure. Refer to Table 1 for general preparation requirements and sample size requirements. (Table 1 is located at the end of Method B.
   2. If it is necessary to dry material, proceed to Step B.

B. Place the sample in the oven and dry to constant weight with the oven set at a temperature of 60°C (140°F). Drying may be facilitated by reducing soil clods to smaller sizes by using the appropriate hand tools.

Note A-1: The oven may be set at a higher temperature if previous experience has demonstrated that no change in soil characteristics will occur. In no case shall the drying temperature exceed 95°C (203°F).

Note A-2: Constant weight for drying purposes is defined as less than 0.1% weight loss between successive weighings no less than 15 minutes apart.

C. Turn on ventilation system and put on all protective equipment.

D. Set wedge crusher to a 10-15 mm (approximately ½ in.) gap. Place catch pan beneath the wedge crusher. Remove the sample from the oven and allow to cool until it can be handled. Turn on the wedge crusher. Pour the dried sample gradually into the wedge crusher. After the sample has been collected, turn off the wedge crusher.

E. Reduce the sample that has gone through the wedge crusher to the appropriate size for the test(s) to be performed using the sample splitter or by quartering in accordance with TR 108. (Refer to Table 1 or the individual test procedure for appropriate sample sizes.) Place the remaining material in the original sample container with the proper identification included.

Note A-3: If multiple representative portions are required, identify each separately after preparation.

F. Nest the appropriate sieves with the catch pan.

G. Pour the reduced sample over the appropriate sieve as indicated in Table 1 or the individual test procedure. Shake the nest of sleeves by hand vigorously while tapping them on a hard surface.

H. Check the catch pan at regular intervals. Empty the material from the catch pan into a pan. Do not allow the catch pan to become too full.

I. Process the material retained on the appropriate sieve by one of the following methods:
1. Drill press
   a. Place a small quantity of the material retained on the sieve in the mortar (bowl of the drill press). Place the mortar on the drill press pedestal centered under the pestle. Turn on the drill press.
   b. While holding the mortar tightly and ensuring that the mortar cover remains on the mortar, lower the pestle into the mortar by rotating the drill press handle.
   c. Advance and release the pestle in short cycles until the material is pulverized to pass the appropriate sieve.
   d. Repeat Steps a – c until only a negligible quantity of material is retained on the sieve. Turn off the drill press when finished.
   e. If there are a significant number of aggregations that will not reduce using the drill press, use the pulverizer in accordance with Steps 2.a – e to reduce them.

   Note A-4: Do not use the flat disc pulverizer on any sand or sandy type material. Perform this process of reducing material size carefully using minimum pressure to break up aggregations without fracturing the individual grains.

2. Mechanical open type, flat disc pulverizer.
   a. Check the adjustment on the plates in the pulverizer to ensure that the soil particle sizes will not be reduced. To check the adjustment, insert a feeler gauge in the opening between each plate.
   b. Brush all soil particles from the internal parts of the pulverizer to prevent contamination of the sample. Put a catch pan beneath the pulverizer.
   c. Turn on the pulverizer. Slowly pour the material into the throat of the pulverizer only one time.
   d. When all material has passed through the pulverizer, turn off the device. Brush all soil particles from the internal parts of the device into the catch pan. Remove the catch pan with the samples.
   e. Pour the pulverized material over the sieve. Discard any particles retained on the sieve. Combine the pulverized material that passes the sieve with the rest of the sample.

J. Stir the sample with the spatula. Thoroughly mix the material after sieving and before testing by pouring across the splitter with 6 mm (¼ in.) chutes. Divide and label the individual representative portions. Stir the individual representative portions with a spatula.

VI. Normal Test Reporting Time

Preparation time is dependent on the material. There is no standard time. Testing and the reporting of results are addressed in each applicable test procedure.
I. Scope

A. This procedure is designed to summarize the sample sizes needed and basic preparation for DOTD test procedures for soil-aggregate mixtures with 5% or more aggregate.

B. Reference Documents
   1. DOTD TR 108 – Splitting and Quartering Samples
   2. AASHTO M 92 – Wire Cloth Sieves for Testing Purposes
   3. AASHTO M 231 – Weighing Devices Used in the Testing of Materials

II. Apparatus

A. Balance – readable to 0.5% of the required sample size

B. Drying apparatus
   1. Laboratory – approved thermostatically controlled ventilated oven, capable of maintaining temperature within ± 5°C.
   2. Field – electric or gas hot plate. Open flame hot plate must be equipped with a suitable shield to disperse heat and to prevent direct contact of the flame with the drying pan.
   3. Sieves – 50 mm (2 in.), 37.5 mm (1½ in.), 25.0 mm (1 in.), 19.0 mm (¾ in.), 12.5 mm (½ in.), 4.75 mm (No. 4), 2.00 mm (No. 10) the catch pan. Remove the catch pan with the 2.00 mm (No. 10) and 425 μm (NO. 40), cover sieve(s) as necessary to prevent overload, catch pan and top – conforming to AASHTO M 92.

C. Sieves – sufficient to hold sample without spilling and large enough to spread the material for rapid drying.

D. Personal protective equipment – thermal gloves, apron, tools, eye protection, dust mask or respirator.

E. Miscellaneous hand tools – rubber mallet, brushes, spatula, stirrers, scoops necessary to manipulate the material.

F. Feeler gauge – capable of measuring 0.070 – 0.080 mm.

G. Pulverizing apparatus
   1. Drill press – to drive a rubber-covered pestle with a mortar.
   2. Mechanical open-type, flat disc pulverizer.
   3. Drum pulverizer or rubber mallet.

H. Splitters – various sizes meeting the requirements of TR 108, including one with 6 mm (¼ in.) chutes.

I. No. 2 metal can(s)

III. Health Precautions

When preparing soils, do not to wear loose clothing, jewelry, or any other apparel or accessory which could be caught by rotating equipment. Hair that is long enough to be caught by equipment must be securely fastened or bound so that it cannot become entangled in the equipment. Be very careful not to catch body parts in the equipment. This equipment is dangerous if not properly used or if used without proper safety equipment and procedures. Be clean shaven to ensure proper fit of the respirator. Use proper equipment and
techniques to ensure safety in handling hot materials.

IV. Sample

For sample size, refer to the “Minimum Quantity” column of the Materials Sampling Manual.

V. Procedure

A. Refer to test procedure to be performed to determine if it is necessary to dry the material.
   1. If it is not necessary to dry material, prepare the material in accordance with the applicable test procedure. Refer to Table 1 for general preparation requirements and sample size requirements.
   2. If it is necessary to dry material, proceed to Step B.

B. Place the sample in the oven and dry to constant weight with the oven set at a temperature of 60°C (140°F). Drying may be facilitated by reducing soil clods to smaller sizes by using the hand or appropriate tools.

Note B - 1: For shell or sand-shell, continue preparation in accordance with the applicable test procedure.

Note B - 2: The oven may be set at a higher temperature if previous experience has demonstrated that no change in soil characteristics will occur. In no case shall the drying temperature exceed 95°C (203°F).

Note B - 3: Constant weight for drying purposes is defined as less than 0.1% weight loss between successive weighings no less than 15 minutes apart.

C. Turn on the ventilation system and put on all protective equipment.

D. Use the drum pulverizer or rubber mallet to break up clods.
   1. If you use the drum pulverizer, put the entire sample in drum. Turn on machine and allow to run until sample is separated into individual particles.
   2. If you use the rubber mallet, place the material in a large pan, cover the material with an opened sample sack to prevent material loss, and strike large particles with the mallet until they are reduced to approximately 13 mm (½ in.).

E. If the entire sample is not needed for testing, reduce it to a smaller quantity (3.5 kg [7.5 lb.], minimum) using the sample splitter or by quartering in accordance with TR 108. Place the remaining material in the original sample container with the proper sample identification.

F. Weigh the material to be prepared and record as total weight of sample on the appropriate worksheet.

G. Nest the appropriate sieves with the catch pan.

H. Pour the entire sample over the appropriate sieve(s) as indicated in the individual test procedure. Shake the sieves vigorously. Retain the material from the individual sieve sizes in separate containers.

I. Check the catch pan at regular intervals. Empty the material from the catch pan into a pan. Do not allow the catch pan to become too full.

J. Using the drill press, reduce material aggregations retained on the appropriate sieve to individual particle size.
Method B

Note B - 4: Perform this process carefully using minimum pressure to reduce aggregation size without changing the original particle sizes.

1. Place a small quantity of the material retained on the sieve in the mortar (bowl of the drill press). Place the mortar on the drill press pedestal centered under the pestle. Turn on the drill press.

2. While holding the mortar tightly and ensuring that the mortar cover remains on the mortar, lower the pestle into the mortar by rotating the drill press handle.

3. Advance and release the pestle in short cycles until the material is pulverized to pass the appropriate sieve.

4. Repeat Steps 1 – 3 until only aggregate is retained on the appropriate sieve.

K. Place the prepared aggregate in a separate pan for each individual particle size; weigh and record the weight of the material retained on each sieve on the appropriate worksheet.

L. Reduce the soil portion of the sample to the appropriate size for the test(s) to be performed using the sample splitter or by quartering in accordance with TR 108. (Refer to Table 1 or the individual test procedure for appropriate sample sizes.) Place the remaining material in the original sample container with the proper sample identification included.

Note B - 5: If multiple representative portions are required, identify each separately after preparation.

M. If the test(s) to be conducted on this material require the inclusion of the aggregate, recomposite the sample by weight returning the aggregate to the sample based on the sizes required in the appropriate test procedure.

VI. Normal Preparation Time

Preparation time is dependent on the material. There is no standard time. Testing and the reporting of results are addressed in each applicable test procedure.
<table>
<thead>
<tr>
<th>DOTD TR</th>
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<th>Remarks</th>
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<td>401</td>
<td>Method A: Determination of In-Place Density (All Nuclear Methods)</td>
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<td>Site Preparation Only Required</td>
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<td>401</td>
<td>Method B: Determination of In-Place Density (Sand Cone)</td>
<td>Total Material</td>
<td>Site Preparation Required</td>
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<td>403</td>
<td>Method A: Determination of Moisture Content (Rapid Drying)</td>
<td>Soils-500 g</td>
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<td>Aggregates – 5 kg (10 lb)</td>
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<td></td>
<td></td>
<td>Soil-Agg.-2.55 kg (5lb)</td>
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<td>Total Material when required</td>
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<td>Soils-500 g</td>
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<tr>
<td></td>
<td></td>
<td>Aggregates – 5 kg (10 lb)</td>
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<td></td>
<td></td>
<td>Soil-Agg.-2.55 kg (5lb)</td>
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<tr>
<td></td>
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<td>Total Material when required</td>
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<tr>
<td>407</td>
<td>Method A: Mechanical Analysis of Soils (Standard)</td>
<td>Sand (100 g) or Clay (50 g)</td>
<td>Prepare total sample. Obtain approx. 225 g (½-lb) of material passing the No. 10 sieve.</td>
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<td>Method B: Mechanical Analysis of Soils (24 Hours)</td>
<td>100 g Minus No. 10</td>
<td>Prepare total sample. Obtain approx. 225 g (½-lb) of material passing the No. 10 sieve.</td>
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<td>Method A: Organic Material in Soil (Standard)</td>
<td>40 g Minus No. 10</td>
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<td>Method B: Organic Material in Soil (Quick Approximation)</td>
<td>10 g Minus No. 40*</td>
<td>Prepare total sample. Obtain approx. 225 g (½-ob) of material passing the #40 sieve.</td>
</tr>
<tr>
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<td>*Minus #10 may be used, if not enough material passes No. 40.</td>
<td></td>
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<tr>
<td>415</td>
<td>Method A: Field Moisture Density Relationships (Family of Curves)</td>
<td>3 kg (6 lb), wet weight Minus No. 4</td>
<td>Field conditions, split total wet sample on No. 4 sieve.</td>
</tr>
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**Preparation Summary**

*Table 1*
<table>
<thead>
<tr>
<th>DOTD TR</th>
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<td>415 Method B</td>
<td>Field Moisture Density Relationships (Average Proctor Values)</td>
<td>7 kg (15 lb), we weight (&lt;5% retained on No. 4)</td>
<td>Field conditions, split total wet sample on No. 4 to determine % plus No. 4.</td>
</tr>
<tr>
<td></td>
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<td>*20 kg (45 lb), wet weight (5% or more retained on No. 4)</td>
<td></td>
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<td>416</td>
<td>Determination of the % Lime for Treatment of Soils or Soil-Aggregate Mixtures</td>
<td>4.5 kg (10 lb) wet weight (soil) 13.6 kg (30 lb) wet weight (soil-agg.)</td>
<td>Broken to pass ½-in. sieve. Atterburg Limits to be determined on each test specimen.</td>
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<td>Mixing Loss of Aggregate Material in Field Condition (Shell or Sand-Shell)</td>
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<td>*Consists of the proper proportions of unmixed components</td>
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<td>417 Method B</td>
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<td>*Consists of the proper proportions of unmixed components</td>
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<td>418 Method A</td>
<td>Moisture Density Relationships (5% agg. and raw soil)</td>
<td>5 kg (10 lb)</td>
<td>Dry material passing No. 4</td>
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<tr>
<td>418 Method B</td>
<td>Moisture Density Relationships (5% agg. and raw soil)</td>
<td>14 kg (30 lb)</td>
<td>Dry material passing No. 4</td>
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<td>418 Method C</td>
<td>Moisture Density Relationships (shell and sand-shell)</td>
<td>55 kg (120 lb) each component</td>
<td>Dry total sample</td>
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<td>418 Method D</td>
<td>Moisture Density Relationships (shell and sand-shell with cement additive)</td>
<td>55 kg (120 lb) each component</td>
<td>Dry total sample</td>
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<td>418 Method E</td>
<td>Moisture Density Relationships (≥5% aggregate)</td>
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<td>Moisture Density Relationships (≥5% aggregate with cement or lime additive)</td>
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<td>418 Method G</td>
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<td>45 kg (90 lb)</td>
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<td>418 Method H</td>
<td>Moisture Density Relationships (raw recycled in place materials)*</td>
<td>45 kg (90 lb)</td>
<td>*Refer to Procedure Scope for specific materials 95 – 100% passing 1” sieve</td>
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<td>418 Method I</td>
<td>Moisture Density Relationships (recycled in-place materials with cement or lime additive)*</td>
<td>45 kg (90 lb)</td>
<td>*Refer to Procedure Scope for specific materials 95 – 100% passing 1” sieve</td>
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<td>water: 1 qt field conditions</td>
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Table 1
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<td>432</td>
<td>Minimum Cement Content (Unconfined Compression Testing – Soils, ≥ 5% agg.)</td>
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<td>432</td>
<td>Minimum Cement Content (Durability)</td>
<td>2 specimens made in accordance with TR 432 – Method B or C</td>
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<td>Identification of Collapsible Silt</td>
<td>0.5 lb. passing No. 10 sieve</td>
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<td>Determining the Percentage of Additive in Stabilization or Treatment (Slurry)</td>
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Table 1