
Standard Practice for Preparation of Test Specimens Using the Plastic Mold Compaction Device

AASHTO Designation: R 120-24¹

Adopted with Revisions: 2024

**Technical Subcommittee: 1b, Geotechnical Exploration,
Instrumentation, Stabilization, and Field Testing**



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1. SCOPE

- 1.1. This standard practice covers the use of the plastic mold compaction device (PM device) to prepare cylindrical test specimens with an approximate 2:1 height to diameter aspect ratio for use in a variety of mechanical property testing (e.g., compressive strength, elastic modulus, tensile strength). This practice is intended for chemically stabilized materials (e.g., soil–cement, cement treated aggregate base, soil–lime). The PM device has been manufactured in two sizes [76.2 by 152.4 mm (3 by 6 in.) and 101.6 by 203.2 mm (4 by 8 in.)], and the appropriate PM device size is determined by the particle size distribution of the material being tested.
- 1.2. Method A utilizes the 76.2 by 152.4 mm (3 by 6 in.) PM device (also referred to as 3x6) and is intended for material passing a 9.5-mm (³/₈-in.) sieve.
- 1.3. Method B utilizes the 101.6 by 203.2 mm (4 by 8 in.) PM device (also referred to as 4x8) and is intended for material passing a 19.0-mm (³/₄-in.) sieve.
- 1.4. This standard practice may be used to fabricate test specimens in the laboratory or in the field.
- 1.5. The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - M 205M/M 205, Molds for Forming Concrete Test Cylinders Vertically
 - M 231, Weighing Devices Used in the Testing of Materials
 - T 99, Moisture–Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
 - T 134, Moisture–Density Relations of Soil–Cement Mixtures
 - T 180, Moisture–Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
 - T 265, Laboratory Determination of Moisture Content of Soils
- 2.2. *ASTM Standard:*
 - E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. SIGNIFICANCE AND USE

- 3.1. This standard practice provides procedures to compact chemically stabilized materials into plastic cylinder molds, with variability described in Appendix X1, for the purpose of fabricating a test specimen with a height to diameter aspect ratio of approximately 2:1. Methods of compaction are designed to achieve a desired percentage of a target specimen density which is typically determined using T 99 or T 134. A photo showing the different apparatus used in this standard practice is shown in Figure 1.



Figure 1—Overview Photo of All PM Device Apparatus Items

- 3.2. Uses include utilizing the PM device to produce laboratory and field test specimens. This can provide interconnection between pavement layer thickness design testing, mixture design testing, and quality assurance testing during construction. Utilizing the same method of compaction for laboratory and field test specimens will enable more direct comparison of as-built and design properties.

4. APPARATUS

- 4.1. *Plastic Mold Device Assembly (Split-Mold, Collar, and Base Plate)*—Figure 2 shows a representative photo of a PM device. For both sized devices, the PM device assembly consists of the split-mold (labeled A in Figure 2), collar (labeled B in Figure 2), and base plate (labeled C in Figure 2). The split-mold and collar shall be made of solid steel, and the base plate may be made of the same solid steel or aluminum. All components shall be manufactured with dimensions and capacities shown in Annex A. The collar shall be approximately 50.8-mm (2-in.) tall to permit preparation of specimens of the desired height and volume. The split-mold component shall be constructed so that it can be fastened firmly to the base plate during operation (see Annex A).

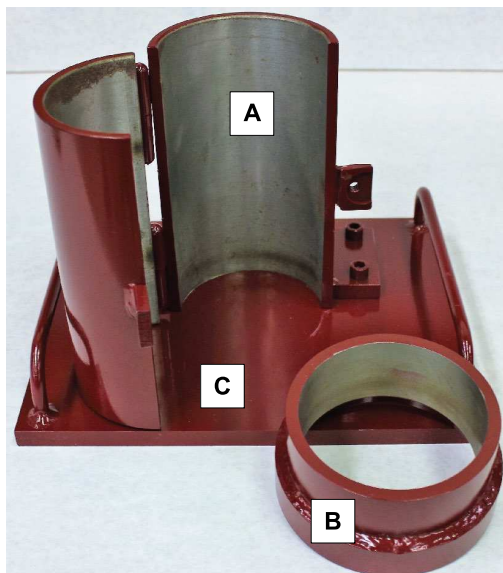


Figure 2—PM Device Assembly: (A) Split-Mold, (B) Collar, and (C) Base Plate

- 4.2. *Rammer*—A manual rammer conforming to criteria specified in T 180 (4.54-kg [10-lb] rammer and a 457-mm [18-in.] drop).
- 4.3. *Plastic Mold Assembly*—The plastic mold assembly used in conjunction with the PM device consists of a modified cylindrical plastic mold, aluminum plate, and plastic plug. Figure 3 is a photo of the plastic mold assembly components. The aluminum plate is placed inside the plastic mold and allowed to rest at the bottom of the mold. The plastic plug is taped to the outside bottom surface of the plastic mold to give the mold assembly an even bottom surface for compaction. The plastic mold assembly may be used multiple times.

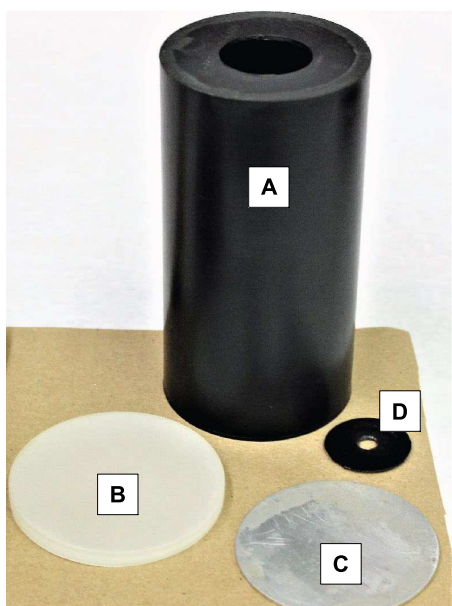


Figure 3—Plastic Mold Assembly: (A) Modified Plastic Mold, (B) Plastic Lid, (C) Aluminum Plate, and (D) Plastic Plug

- 4.3.1. *Cylindrical Plastic Mold (Mold, Plastic Lid, and Plastic Plug)*—A 76.2-mm (3-in.) diameter by 152.4-mm (6-in.) tall or 101.6-mm (4-in.) diameter by 203.2-mm (8-in.) tall plastic cylinder mold conforming to M 205M/M 205 may be used. The outside bottom of the plastic mold shall be sanded smooth and a 35-mm ($1\frac{3}{8}$ -in.) diameter hole cut in the center with a spade drill bit to aid specimen extraction. The plastic plug from the cutting process is retained for the plastic mold assembly. The plastic lid is used to cover the top surface of the specimen after compaction.
- Note 1**—Plastic molds with a vertical slit have shown the possibility of being an alternative to the plastic molds described in Section 4.3.1. Alternative plastic mold configuration attempts to date by two different laboratories have documented some level of success, but also have identified some challenges. Deviations to the plastic mold described in Section 4.3.1 are permitted if the alternative approach is documented to produce test specimens that are comparable to those produced via the mold configuration shown in Figure 3 in terms of dimensions and mechanical properties. If used, alternative plastic mold modifications should be noted alongside test results.
- 4.3.2. *Aluminum Plate*—A 75.8-mm (2.984-in.) or a 101.2-mm (3.984-in.) diameter aluminum plate with a thickness of 1.59-mm ($\frac{1}{16}$ -in.). The diameter of the aluminum plate corresponds to the inside diameter at the bottom of the plastic mold, and the plate is utilized for the plastic mold assembly.
- 4.4. *Sample Extruder*—A jack, lever, and frame as shown in Figure 4, or other device adopted for the purpose of extruding compacted specimens from the plastic mold assembly. The jack should be mounted to the frame perpendicular to the extrusion plate. The diameter of the opening in the extrusion plate should be slightly larger than the specimen diameter and have a small lip to catch the edge of the plastic mold assembly to facilitate extraction without specimen damage.

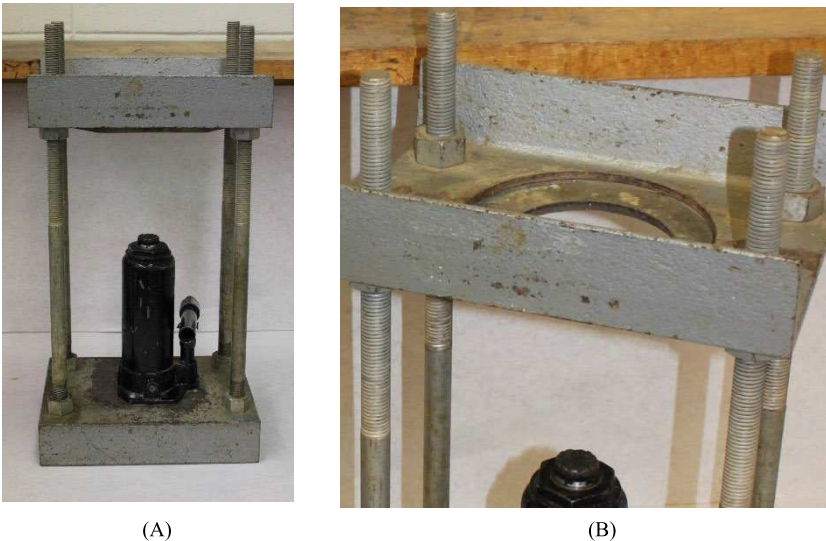


Figure 4—(A) Specimen Extruder and (B) Extruder Plate Opening

- 4.5. *Straightedge*—A hardened-steel straightedge at least 250-mm (10-in.) in length. It shall have one beveled edge, and at least one longitudinal surface (used for fine trimming) shall be plane within 0.250-mm per 250-mm (0.01-in. per 10-in.) (0.1 percent) of length within the portion used for trimming the material.
- 4.6. *Locking Clamp*—A pair of locking pliers (e.g., vise-grips) or clamping tool capable of fastening together the split-mold component of the PM device during compaction.
- 4.7. *Sieves*—9.5-mm ($\frac{3}{8}$ -in.) and 19.0-mm ($\frac{3}{4}$ -in.) sieves conforming to the requirements of ASTM E11.

- 4.8. *Measuring Devices*—Balance conforming to the requirements of M 231, Class G 2 with 0.1-g resolution and calipers with appropriate range and minimum resolution of 0.1-mm (0.01-in.).
- 4.9. *Miscellaneous Tools*—Tape, scoop, scarifying tool, and labeling materials.

METHOD A—3X6 PM DEVICE

5. SAMPLE

- 5.1. For laboratory prepared specimens, thoroughly mix all mixture components (i.e., soil, chemical stabilizer, and water) to a uniform color. For field prepared specimens, take a sample after all components are incorporated and at the completion of all mixing operations. Record the time of initial mixing to the nearest minute.
- 5.2. Sieve an adequate quantity of representative material over the 9.5-mm ($\frac{3}{8}$ -in.) sieve. Discard the coarse material, if any, retained on the 9.5-mm ($\frac{3}{8}$ -in.) sieve.
- 5.3. Obtain a representative sample with a mass sufficient to fabricate desired test specimen(s). Determine the moisture content of the sample immediately before compaction according to T 265.
- Note 2**—Three replicate specimens should be suitable for most applications.

6. PROCEDURE

- 6.1. Insert the plastic mold assembly into the split-mold component of the 3x6 PM device as shown in Figure 5A. Secure the PM device together at the latch with the locking clamp. Place the collar on top of the device. The PM device shall rest firmly on a dense, uniform, rigid, and stable foundation or base during compaction. Figures 5B and 5C are photos of the PM device ready to begin specimen preparation.

Note 3—Each of the following are considered to be a satisfactory base on which to rest the PM device during compaction: a block of concrete, with a mass of not less than 90-kg (200-lb), supported by a relatively stable foundation; a sound concrete floor; and for field application, such surfaces as are found in and around concrete box culverts, bridges, and pavements.

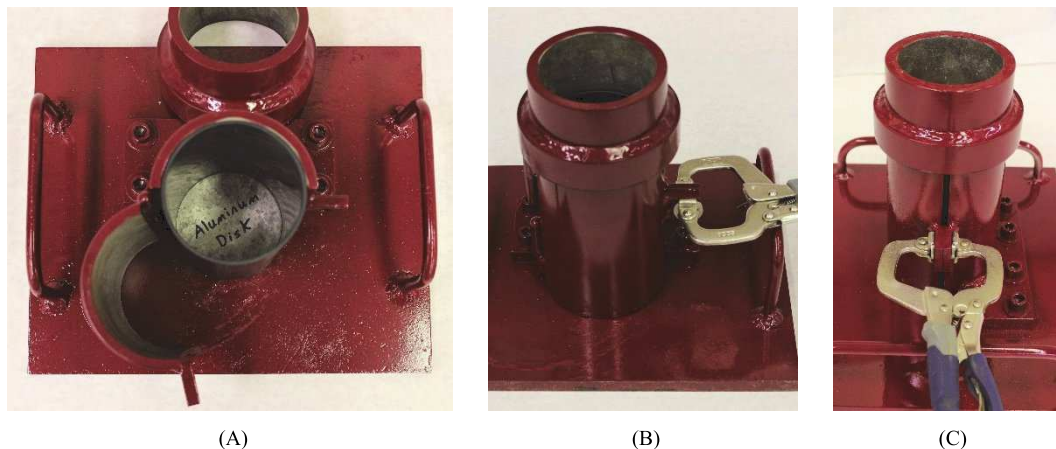


Figure 5—(A) 3x6 PM Device with Plastic Mold Assembly and (B and C) PM Device Ready for Use

- 6.2. Form a specimen by compacting the sampled material into the plastic mold assembly in three approximately equal layers. Compact each layer with a prescribed number of uniformly distributed blows from the 4.54-kg (10-lb) rammer dropping free from a height of 457-mm (18-in.) above the elevation of the stabilized material. A minimum of four blows are to be applied to each layer, but more blows may be used to achieve desired specimen density. The number of blows shall be the same for each layer. Use a scarifying tool to scarify the top surface of layers before compacting subsequent layers to prevent compaction planes within the specimen. After compaction approximately 6.4-mm (0.25-in.) of compacted material should extend above the top of the plastic mold. Record the time of compaction completion to the nearest minute.
- Note 4**—Compaction approach presented is intended to produce test specimens with an appropriate specimen density as related to the target density during construction. The level of desired specimen density is at the owner's discretion. Appendix X2 provides a procedure to determine the number of blows per layer to achieve a desired specimen density.
- 6.3. Remove the collar and plastic mold from the PM device. Carefully trim the compacted specimen even with the top of the plastic mold by means of a straight edge. Immediately place the plastic lid on top of the specimen.
- 6.4. Label specimens with appropriate information and allow to cure inside the plastic mold for at least 24-h before extruding the test specimen. To extract the specimen from the plastic mold assembly, remove the plastic plug and use a sample extruder. The jack should press against aluminum plate during the extraction process to prevent specimen damage. Curing conditions should be reported (e.g., on lab bench at room temperature, at project site, etc.).
- 6.5. Once extruded, remove the aluminum plate from the bottom of the specimen. Measure specimen mass with a balance and specimen volume with calipers. Measured moisture content, mass, and volume can be used to calculate specimen dry density. The specimen is now ready for additional curing and/or mechanical property testing.
- Note 5**—Guidance on expected specimen dimensions is provided in Appendix X1.

METHOD B—4X8 PM DEVICE

7. SAMPLE

- 7.1. For laboratory prepared specimens, thoroughly mix all mixture components (i.e., soil, chemical stabilizer, and water) to a uniform color. For field prepared specimens, take a sample after all components are incorporated and at the completion of all mixing operations. Record the time of initial mixing to the nearest minute.
- 7.2. Sieve an adequate quantity of representative material over the 19.0-mm ($3/4$ -in.) sieve. Discard the coarse material, if any, retained on the 19.0-mm ($3/4$ -in.) sieve.
- 7.3. Obtain a representative sample with a mass sufficient to fabricate desired test specimen(s). Determine the moisture content of the sample immediately before compaction according to T 265.
- Note 6**—Three replicate specimens are believed to be suitable for most applications.

8. PROCEDURE

- 8.1. Insert the plastic mold assembly into the split-mold component of the 4x8 PM device and secure the PM device together at the latch with the locking clamp. Place the collar on top of the device.