



**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS**

**DRY FLOW TESTING
OF
FLOWABLE BACKFILL
ITM No. 217-15**

1.0 SCOPE.

- 1.1 This test method covers the procedure for the determination of the flow time of dry flowable backfill for the purpose of verifying changes in sand sources for an approved Flowable Backfill Mix Design (FBMD).
- 1.2 This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 AASHTO Standards.

- M 231 Weighing Devices Used in the Testing of Materials
- T 304 Uncompacted Void Content of Fine Aggregate
- T 248 Reducing Samples of Aggregate to Testing Size

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101, and as follows:

- 3.1 Dry flow time. The time to for a specified sample size of dry flowable materials to flow through a specified funnel

4.0 SIGNIFICANCE AND USE.

- 4.1 This ITM is used to determine the time of dry flow of loose uncompacted flowable backfill through a flow cone. The flowable backfill includes sand or sand and fly ash mixture. The test result is done to ensure that an alternate sand shall have the same flow characteristic as the sand in the approved FBMD.
- 4.2 The dry flow cone test characterizes the state of flow of dry materials on any sand of known grading that may provide information about the sand or sand and fly ash mixture angularity, spherical shape, and surface texture.

- 4.3 Other test procedures or test methods exist for various flow cones with different dimensions and cone tip forms and sizes that may or may not have a correlation with the AASHTO T 304 flow cone.

5.0 APPARATUS.

- 5.1 Cylindrical measure, in accordance with AASHTO T 304, except the nominal 100-mL cylindrical measure is replaced by a one quart glass jar
- 5.2 Metal spatula, with a blade approximately 4 in. long, and at least 3/4 in. wide, with straight edges. The end shall be cut at a right angle to the edges. (The straight edge of the spatula blade is used to strike off the fine aggregate.)
- 5.3 Timing device, such as a stop watch, with an accuracy to within ± 0.1 seconds
- 5.4 Balance, Class G2, in accordance with AASHTO M 231
- 5.5 Sample splitter, in accordance with AASHTO T 248 for fine aggregate

6.0 SAMPLE PREPARATION.

- 6.1 The sample may consist of sand or a sand and fly ash mixture proportioned according to the FBMD. The fine aggregate shall be oven dried at $230 \pm 9^\circ\text{F}$ for 24 h prior to mixing with the fly ash. Upon completion of the drying, the fine aggregate shall be split to a sample size using a small sample splitter for fine aggregate in accordance with AASHTO T 248.
- 6.2 The dry sample of sand or sand and fly ash mixture shall be thoroughly mixed with the spatula until the sample is homogenous. The weight of the fine aggregate and fly ash is determined to the nearest gram using the following formulas:

$$FA_{\text{dry}} = FA_{\text{SSD}} / \left(1 + \frac{\text{abs}}{100}\right)$$

$$W_{\text{tfa}} = [FA_{\text{dry}} / (FA_{\text{dry}} + \text{pozz})] \times 1500$$

$$W_{\text{tpozz}} = 1500 - W_{\text{tfa}}$$

where:

- FA_{dry} = FBMD weight of fine aggregate in dry condition
 FA_{SSD} = FBMD weight of fine aggregate at SSD condition
 abs = absorption of fine aggregate, percent
 W_{tfa} = weight of dry fine aggregate used in flow testing
 pozz = FBMD weight of fly ash
 W_{tpozz} = Weight of fly ash used in flow testing

7.0 PROCEDURE.

- 7.1 Place the dry sample into the one quart glass jar and put the lid on. Agitate the glass jar to mix the dry sample for 30 seconds.
- 7.2 Place a finger at the end of the funnel to block the opening of the funnel.
- 7.3 Pour and empty the dry sample of sand or sand and fly ash mixture from the glass jar into the Mason jar.
- 7.4 Level the dry sample in the Mason jar with a spatula
- 7.5 Place the empty glass jar directly under the funnel
- 7.6 Remove the finger and allow the dry sample to fall freely into the glass jar, and start timing the dry flow
- 7.7 Record the time T_1 of the dry flow to an accuracy of ± 0.1 second
- 7.8 Repeat 7.1 through 7.6 for times T_2 and T_3

8.0 CALCULATIONS.

- 8.1 Calculate the average dry flow time of the dry flowable backfill materials as follows:

$$T_{\text{average}} = \frac{T_1 + T_2 + T_3}{3}$$

where:

- T_{average} = average dry flow time, s
- T_1 = dry flow time on first trial, s
- T_2 = dry flow time on second trial, s
- T_3 = dry flow time on third trial, s

9.0 REPORT.

- 9.1 The average dry flow time is reported to ± 0.1 seconds.

