



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

**FIELD DETERMINATION OF DEFLECTION USING
LIGHT WEIGHT DEFLECTOMETER**

ITM No. 508-25

1.0 SCOPE

- 1.1** This test method covers the determination of deflections with a Light Weight Deflectometer (LWD), also known as Portable Impulse Plate Load Test Device.
- 1.2** The LWD may be used for structure backfill, coarse aggregates, chemically modified soils **and stabilized soils**, or as directed by the Department. Only structure backfill size 1 1/2 in. and coarse aggregate sizes No. 43, 53, and 73 shall be tested with the LWD.
- 1.3** The LWD test relates deflection with the Dynamic Elastic Modulus and is defined as the maximum axial stress of a material in sinusoidal loading divided by the maximum axial strain during that loading.
- 1.4** The values stated in SI metric units are to be regarded as standard, as appropriate for a specification with which this ITM is used.
- 1.5** 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 ASTM Standards.

E2835 Measuring Deflections using a Portable Impulse Plate Load Test Device

2.2 ITM.

ITM 521 LWD-Verification Procedure

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

3.1 Structure Backfill. In accordance with 904.05.

3.2 Coarse Aggregate. In accordance with 904.03.

3.3 Chemically Modified Soil. Soil that has been modified with portland cement, fly ash, lime, or a combination of these materials and cement stabilized soils.

4.0 SIGNIFICANCE AND USE. This ITM shall be used to determine the surface deflection resulting from an application of an impulse load using the LWD. The resulting deflections are used to determine the stiffness of structure backfill, coarse aggregates, chemically modified soil, and cement stabilized soils and other approved applications.

5.0 APPARATUS.

5.1 Force-Generating Device (Appendix A), 10 kg \pm 0.1kg falling weight with a guide system, lock pin and spring assembly. The mass of the guide rod is 5 kg \pm 0.25 kg and the maximum impact force is 7.07 kN. The fixed drop height shall be set as established at the last full LWD calibration in accordance with the manufacturer's recommendation.

5.2 Loading Plate, made of steel, having dimensions of 300 mm in diameter and 20 mm in thickness. The plate shall have two handles and weigh 15 kg \pm 0.25 kg.

5.3 Deflection Sensor, capable of measuring the maximum vertical movement with an accelerometer. The accelerometer is required to be attached to the center of the plate.

5.4 Data Processing and Storage System, capable of displaying and recording the loading data, deflection data, and the test location for each test.

5.5 Miscellaneous equipment such as a spade, broom, trowel, and cotton gloves.

6.0 TEST AREA PREPARATION. The test area shall be leveled so that the entire undersurface of the load plate is in contact with the material being tested. Loose and protruding material shall be removed. If required, any unevenness shall be filled with fine sand. The test shall not be conducted if the temperature is below freezing. The test area shall be at least 1.5 times larger than the loading plate.

7.0 PROCEDURE.

7.1 The testing area shall be made level. The LWD should be placed on the testing location.

- 7.2 Rotate the loading plate approximately 45° back and forth to seat the plate. The plate should not move laterally with successive drops of the falling weight.
 - 7.3 Place the force generating device onto the loading plate. Hold the guide rod perpendicular to the loading plate.
 - 7.4 Conduct three seating drops by raising the falling weight to the release mechanism, allowing the hammer to fall freely, and catching the falling weight after the weight rebounds from striking the plate.
 - 7.5 Following the three seating drops, conduct three drops of the falling weight and record the average of the last three drops shown on the LWD display. A test is considered invalid if the operator does not catch the falling weight after the weight rebounds from the load plate or the load plate moves laterally. A new test location is required at least 2 ft away from the original location of testing when the test is invalid. If the change in deflection is 10 % or greater for any two consecutive drops, the material shall require additional compaction or aeration and steps 7.1, 7.2, 7.3, and 7.4 shall be repeated.
 - 7.6 Record the smartcard number and the test drop deflection measurements on the data collection form TD-409 LWD.
- 8.0 **VERIFICATION TESTING.** Perform LWD Verification Testing annually in accordance with ITM 521 with complete equipment identification. This verification shall be provided to the Engineer when requested.
- 9.0 **REPORT.** Report the average deflection (which is the average of the last three drops shown on the LWD display) in mm. This value is one of the three tests required at a random station in accordance with 203.24, 215, and 219.

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