Florida Method of Test for Nonrepetitive Static Plate Load of Soils and Flexible Pavement Components

Designation: FM1-T222
Modified AASHTO T 222

1. SCOPE

This method covers the procedures for nonrepetitive static plate load testing on subgrade soils (compacted or the natural state), base materials and flexible pavement components.

2. REFERENCED DOCUMENTS

2.1. AASHTO T 222 - Nonrepetitive Static Plate Load Test of Soils and Flexible Pavement Components for use in Evaluation and Design of Airport and Highway Pavements.

2.2. Florida Research Report 68-B, Field Procedure for Performing Plate Bearing Test.

3. DEFINITIONS

Refer to AASHTO T 222 Section 3 for terminology and definitions.

4. APPARATUS

Refer to AASHTO T 222 Section 4 except make the following changes:

4.1. The loading device in 4.1.1 shall have a total load of at least 60,000 pounds.

4.2. Delete section 4.1.7.

5. PROCEDURE

Delete Section 5 of AASHTO T 222 and replace with the following:

5.1. Where unconfined load tests are to be performed, strip or remove the material lying above the elevation of the material to be tested. The stripped area should be at least twice the diameter of the largest plate to eliminate surcharge or confining effects. Clear the area to be tested of any loose materials and level it. Extreme care should be taken not to disturb the soil in the test area, especially in granular material. For confined tests, the diameter of the excavated circular area shall be just sufficient to accommodate the selected bearing plate.

Carefully center a bearing plate of the selected diameter under the jack assembly. Set the remaining plates of smaller diameter concentric with, and on top of, the bearing plates. Set the bearing plate level in a thin bed of a mixture of sand and plaster of paris (gypsum cement), or plaster of paris alone, or of fine sand, using the least quantity of materials required for uniform bearing. If additional testing is to be conducted it is necessary to cover the exposed soil material to a distance of 6 feet from the circumference of the bearing plate with a tarpaulin or proof paper to prevent loss of moisture from the soil during the load test.

Note 1 – For routine evaluations, Florida uses a 12 inch unconfined load test. Leveling of the bearing plate is accomplished with plaster of paris alone.

5.2. Seat the selected bearing plate on the sand or plaster of paris. Turning or working the plate back and forth will help to provide uniform seating of the plate. Center the remaining plates of smaller diameter concentric with, and on top of, the bearing plate. Center the hydraulic jack on the smallest diameter plate.

If shimming is needed, shim between the hydraulic jack and loading device but use a ball joint between the shim and loading device. If a proving ring is being used to measure the load, it should be placed on top of the hydraulic jack and the ball joint used between the proving ring and loading device. For safety reasons, shims should not be used between the ball joint and loading device. The loading device must be long enough so that its supports (wheels in the case of a truck or trailer) will be at least 8 feet from the bearing plate. Three dial gauges shall be used to measure deformation of the soil under load. Place these dial gauges so that the stems rest on the bearing plate not more than 3/4 inches from the outer edge, spaced 120 degrees apart. Fasten the dial gauges to a frame whose supports are at least 4 feet from the edge of the bearing plate and loading device supports (wheels in the case of truck or trailer).

5.3. Seating Procedures – Seat the loading system and bearing plate by applying three seating loads. Each seating load shall produce an average total deflection of 0.030 inches. Each of the three seating loads shall be applied in five uniform increments (minimum). After each increment of load has been applied, allow its action to continue until a rate of deflection, not more than 0.001 inches per minute, has been maintained for three consecutive minutes. Record load and deflection readings for each load increment (see **Figure A**). When the average total deflection of 0.030 inches or the capacity of the loading device has been reached, record the total deflection, after which release the load, and maintain zero load until the rate of recovery does not exceed 0.001 inches for three consecutive minutes. Record the rebound deflection (see **Figure A**) and then reset each dial indicator accurately at its zero mark. Repeat the above sequence for the second and third seating loads.

5.4. Load Application – Apply load in uniform increments. The magnitude of each load increment shall be such as to permit the recording of a sufficient number of load-deflection points to produce an accurate load-deflection curve (not less than five). After each increment of load has been applied, allow its action to continue until a rate of deflection of not more than 0.001 inches per minute has been maintained for three consecutive minutes. Record load and deflection readings for each load increment. Continue this procedure until the average total deflection obtained is either 0.050 inches plus average rebound deflection from third seating load or until the load capacity of the apparatus has been reached, whichever occurs first. At this point, maintain the load until an increased deflection of not more than 0.001 inches for three consecutive minutesis obtained. Record the total final deflection. Each individual set of readings will be averaged and this value is recorded as the average deflection reading.

6. REPORT

Refer to AASHTO T 222 Section 6 except delete 6.1.2.

7. CALCULATION AND PLOTTING OF LOAD DEFLECTION RELATIONSHIPS

Delete Section 7 of AASHTO T 222 and replace with the following:

7.1. Plot Load-Deflection Curve – Plot only the final load and the average deflections for each load (see **Figure C**).

7.1.1. Total Load (P) – Determine the residual deflection, $\delta_{residual}$, by connecting the straight portion of the load-deflection curve with a straight line that intersects the "x" coordinate. The intercept deflection value is the residual deflection value. This value is added to the selected total deflection, 0.050 inches, to obtain the corrected deflection value, $\delta_{corrected}$. The total load (load at the corrected deflection, in pounds) is determined from the deflection’s point of intercept on the load-deflection curve (see **Figure C**).

Total Stress (σ) – Calculate the total stress by dividing the total load at $\delta_{corrected}$ (0.050 inches plus $\delta_{residual}$) by the selected bearing plate’s area, expressed in square inches. The equations would take the following form:

$$A = \pi R^2$$

$$\sigma = \frac{P}{A}$$

where:

$\pi \approx$ 3.14159
R = Radius of selected bearing plate, in inches
P = Total load, in pounds, at $\delta_{corrected}$

7.1.2. Modulus (E) and Soil Reaction (k) – Shall be determined using Burmister's theory for rigid circular plates. Burmister extended Boussinesq's theory of deflections at the center of a flexible circular plate to rigid plates. Florida's equations are as follows:

$$E = \frac{1.18\ (\sigma)\ (R)}{\delta}$$

$$k\ (pci) = \frac{E}{1.18\ (R)}$$

Where:

1.18 = Constant for rigid plate
δ = 0.050; selected total deflection in inches

FDOT	STATE MATERIALS OFFICE	GEOTECHNICAL FIELD OPERATIONS	FM 1-T222 - NON-REPETITIVE STATIC PLATE LOAD TEST OF SOILS & FLEXIBLE PAVEMENT COMPONENTS	Revised: Jameson/ Shishlova 02/2025

PROJECT INFORMATION							
Project ID:		Test Date		Testing Firm:			
Project Descr.:				Weather Cond.:			
MATERIAL INFORMATION							
Mtl Descr.:				LBR (FM 5-515):			
Proctor Type		Proctor (pcf):		Opt. Moisture (%):		-200:	
PLATE LOAD DATA							
Plate Diameter (in):		Loading Device:		Test Note:			

Mode	Applied Load		Duration	Deflections (in)			
	(lbs)	(psi)	(min)	LVDT 1	LVDT 2	LVDT 3	Average
Seating Load # 1							
Seating Load # 2							
Seating Load # 3							
Final Load							

Figure A. Test Record Sheet

STATE MATERIALS OFFICE	GEOTECHNICAL FIELD OPERATIONS	FM 1-T222 - NON-REPETITIVE STATIC PLATE LOAD TEST OF SOILS & FLEXIBLE PAVEMENT COMPONENTS	Revised: Jameson/ Shishlova 02/2025

PROJECT INFORMATION

Project ID:	123456-7-52-01	Test Date	2/14/2025	Testing Firm:	FDOT - SMO
Project Descr.:	US 301 FDOT Test Track			Weather Cond.:	90°F Sunny

MATERIAL INFORMATION

Mtl Descr.:	Limerock Base (tan A-1 b material)			LBR (FM 5-515):	Soaked	110	
Proctor Type	T180 Modified	Proctor (pcf):	122.0	Opt. Moisture (%):	11.5%	-200:	8.1%

PLATE LOAD DATA

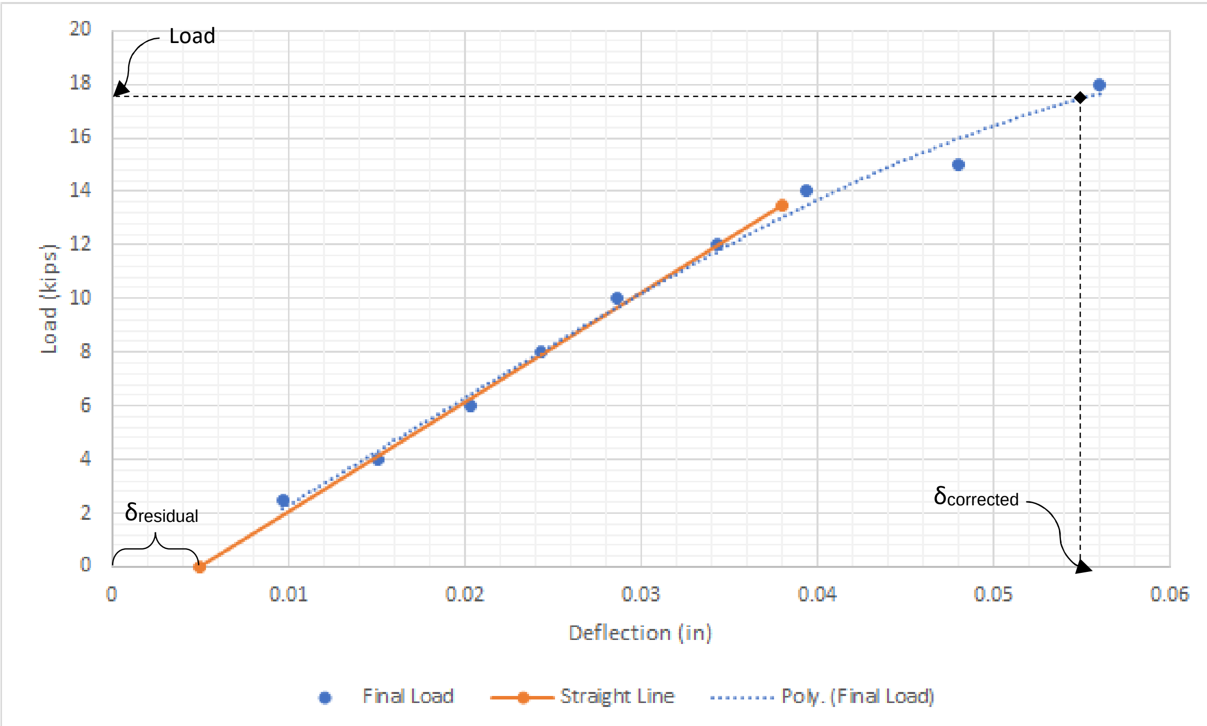
Plate Diameter (in):	12	Loading Device:	Tanker truck	Test Note:	

Mode	Applied Load		Duration	Deflections (in)			
	(lbs)	(psi)	(min)	LVDT 1	LVDT 2	LVDT 3	Average
Seating Load # 1	1500	13.26	3	0.008	0.010	0.011	0.010
	3250	28.74	3	0.019	0.021	0.021	0.020
	5000	44.21	3	0.029	0.032	0.031	0.031
	Rebound			0.016	0.019	0.020	0.018
Seating Load # 2	2000	17.68	3	0.009	0.009	0.009	0.009
	4000	35.37	3	0.016	0.015	0.015	0.015
	6000	53.05	3	0.021	0.022	0.020	0.021
	8000	70.74	3	0.032	0.033	0.030	0.032
	Rebound			0.013	0.012	0.013	0.013
Seating Load # 3	2500	22.10	3	0.009	0.010	0.008	0.009
	5000	44.21	3	0.015	0.016	0.013	0.015
	7500	66.31	3	0.021	0.023	0.019	0.021
	10000	88.42	3	0.029	0.032	0.027	0.029
	11000	97.26	3	0.032	0.034	0.030	0.032
	Rebound			0.011	0.011	0.011	0.011
Final Load	2500	22.10	3	0.009	0.010	0.010	0.010
	4000	35.37	3	0.014	0.016	0.015	0.015
	6000	53.05	3	0.019	0.021	0.021	0.020
	8000	70.74	3	0.024	0.024	0.025	0.024
	10000	88.42	3	0.028	0.029	0.029	0.029
	12000	106.10	3	0.034	0.034	0.035	0.034
	14000	123.79	3	0.039	0.039	0.040	0.039
	15000	132.63	3	0.048	0.048	0.048	0.048
	18000	159.15	3	0.056	0.056	0.056	0.056
	Rebound						

Figure B. Test Record Sheet Example

FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
5007 NE 39th Avenue
Gainesville, Florida 32609 June 16, 2025

LOAD-DEFLECTION CURVE



DATA ANALYSIS

$\delta_{residual}$ (in):	0.005	$\delta_{corr.}$ (in):	0.055	$\delta_{Req'd. Avg. Final Load}$ (in):	0.061	$\delta_{Final Load}$ (in):	0.056
Wet $Density_{Test Area}$ (pcf):	131.4	$Moisture_{Test Area}$ (%):	10.2%	Dry $Density_{Test Area}$ (pcf):			119.2
Load @ δ=0.055 (lbs.):	17.47	σ, T.Stress @ δ=0.055 (psi):	154.4	% Compct'n (%):			98%

Modulus, E (psi)	**21,868.94**	**Soil Reaction, k (lbs/in):**	**3,088.83**

Figure C. Load-Deflection Curve