Test Procedure for

POTENTIAL VERTICAL RISE OF NATURAL SUBGRADE SOILS

TxDOT Designation: Tex-124-E

Effective Date: January 2017

1. SCOPE

1.1 This procedure estimates the potential vertical rise (PVR) of the soil horizon below the placement of a pavement structure, bridge, or building foundation.

2. DEFINITIONS

2.1 *Potential Vertical Rise* (PVR)—Potential of soils to swell in the vertical direction at a given density, moisture, and loading condition when exposed to capillary ground or surface water, and thereby increases the elevation of its upper surface, along with anything resting on it. PVR is expressed in inches.

2.2 *Soil Horizon (Natural Subgrade Soil)*—Naturally existing soil layers of varying thicknesses from the plan grade (ground surface) below the pavement structure, bridge, or building foundation. Soil layers are a horizontal structure of uniform material. A new soil layer is recognized when the material changes in color, texture, moisture, density, or composition.

2.3 *Pavement Structure*—Layers or lifts including the flexible base or subbase, treated base, hot-mix asphalt, or concrete pavement that are not considered expansive.

2.4 *Liquid Limit (LL)*—Moisture content at which a soil changes from a plastic to a liquid state. LL is determined in accordance with Tex-104-E, "Determining Liquid Limit of Soils," and is expressed as a percentage of the weight of oven-dried soil.

2.5 *Plastic Limit (PL)*—Moisture content at which a soil changes from a plastic to a semisolid state. PL is determined in accordance with Tex-105-E, "Determining Plastic Limit of Soils," and is expressed as a percentage of the weight of oven-dried soil.

2.6 *Plasticity Index (PI)*—Range of moisture in which a soil remains in a plastic state. PI is determined in accordance with Tex-106-E, "Calculating the Plasticity Index of Soils."

2.7 *Overburden*—Soil above the layer or layers being investigated.

2.8 *Loading*—Vertical pressure from the overburden of each layer of soil investigated. Loading is expressed in lb./ft.^{2} (load per unit area).

3. APPARATUS

Note 1—Section 6 references additional test procedures, each of which includes a list of pertinent apparatus.

3.1 *Sampling device,* Shelby tube, split spoon, or core-drilling rig equipped to take undisturbed core samples of the material in place.

3.2 *Supply of paraffin, small cutting knives,* etc.

4. TEST REPORT FORMS

4.1 Potential Vertical Rise

5. SAMPLING

5.1 Perform exploration and sampling in accordance with TxDOT's *Geotechnical Manual*.

Note 2—Place greater emphasis on sampling the top horizon layers to a depth of 15 ft. in most cases, and as much as 20 ft. when highly expansive clays are present. These depths may be less when sampling devices are pushed to refusal or at the depth of the ground water table. The presence of rock, gravel, or sand substrata will eliminate the necessity for drilling a large number of deep exploration holes.

5.2 Measure the thicknesses of all soil layers within the depth of exploration below the proposed structure.

5.3 Secure cores or drill cuttings to represent material from the layers shown in Form 513, "Drilling Log," or other applicable form or software.

Note 3—Store cores or drill cuttings in a manner to prevent loss of moisture. Cores may be parraffined for moisture preservation.

5.4 Document the depth and description of the material during sampling.

6. PROCEDURE

6.1 Use the Potential Vertical Rise worksheet to estimate the PVR of the soil horizon.

Note 4—An archived version of this test procedure is available online with equations and graphs to manually determine the PVR.

6.2 Enter the depth to the bottom of the layer in column B using 2-ft. increments for convenience, provided the log of the hole will permit.

Note 5—Layers of greater thickness may be used where they consist of uniform soil having similar PI and moisture contents.

Note 6—The average load reported in column C in any layer is the average depth of the layer.

6.3 Determine the LL, percent moisture content, percent soil binder (minus No. 40 material), and the PI of material from cores representative of each soil layer or drill cuttings in accordance with the following test methods.

- Tex-104-E, "Determining Liquid Limit of Soils"
- Tex-103-E, "Determining Moisture Content in Soil Materials"
- Tex-110-E, "Particle Size Analysis of Soils," Part I
- Tex-105-E, "Determining Plastic Limit of Soils"
- Tex-106-E, "Calculating the Plasticity Index of Soils"

6.3.1 Enter the LL for each layer in column D.

6.3.2 Enter the percent moisture for each layer in column G.

6.3.3 Enter the percent soil binder (minus No. 40 material) for each layer in column I.

6.3.4 Enter the PI for each layer in column J.

6.4 The PVR worksheet will compute the PVR at the top and bottom of each soil layer in columns M and N and the total PVR for the soil horizon in column S.

Note 7—The PVR worksheet will also plot a graph below the PVR table to assist with determining a depth of modification for an allowable PVR.

7. ARCHIVED VERSIONS

7.1 Archived versions are available.