

Engineering UPDATE[®]

MEA MARINO ENGINEERING ASSOCIATES, INC. • Issue 20

INVESTIGATION OF PAVEMENT PERFORMANCE

The owner of a trucking terminal had concerns about the performance of pavement placed over four years ago. These concerns were based on observed damage conditions on site such as pavement cracking and concrete breaks, accelerated wear and tear, and large systematic depressions in pavement. Some of the suspected causes for these damage conditions were variations in asphalt thickness, a stone subbase of varying thickness, and an improperly installed base under concrete pads at loading dock areas. In order to evaluate the pavement performance MEA conducted an on-site investigation in addition to an evaluation of design and construction requirements, asphalt, concrete, subbase, and subgrade specifications, past and future performance of facilities, and laboratory testing. The site investigation consisted of site wide mapping of distress in asphalt and concrete pads, Falling Weight Deflectometer (FWD) tests to assess pavement structural properties, and drilling, sampling, and lab testing of pavement and substructure.

An integral part of the analyses involved performing the Falling Weight Deflectometer (FWD) testing. FWD testing consists of vertically loading the pavement structure and measuring how much it deflects. This test data can actually quantify the capacity of the pavement and substructure to determine its present structural condition and whether it meets design expectations.

The FWD unit and setup is shown in Figures 1 and 2. The principal findings of the site investigation indicated: the property owner's contracted geotechnical engineering firm misclassified the dominant soil type as mostly clayey silt, which actually contradicted their own mechanical gradation tests that show silt as the smallest soil fraction present. The actual dominant subgrade materials were sandier than considered in the design and, in fact, provided more support than the design anticipated. This



FIGURE 1: FALLING WEIGHT DEFLECTOMOETER (FWD) IN USE

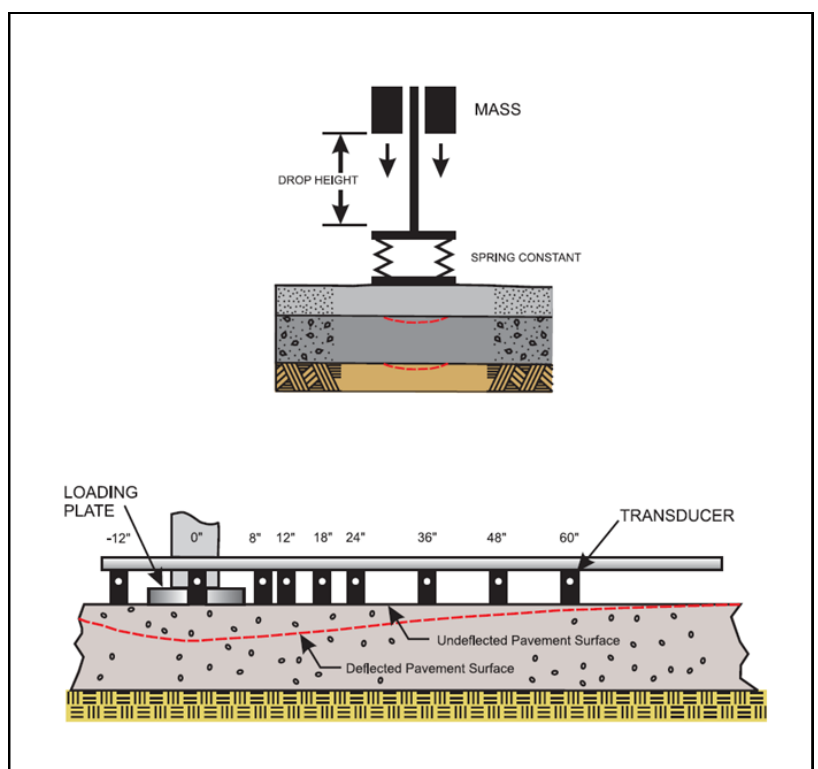


FIGURE 2: SCHEMATIC OF FALLING WEIGHT DEFLECTOMOETER (FWD) TEST SETUP

type of misclassification can greatly impact the support capacity of the pavement. Also, the soils subgrade moisture was very similar to those at the time of construction and were adequately compacted. The areas of heavy-duty asphalt were suspected of being inadequate, but FWD testing found that the overall existing capacity of placed Hot Mix Asphalt (HMA) was still greater than the designed expectations.

A complete geotechnical and pavement investigation of the site resulted in the following findings:

- Moisture contents of the soils subgrade have not changed over a period of almost five years indicating that there is proper drainage. Therefore, there was no significant loss of the support soil.
- Subgrade soils were compacted to local DOT requirements of 95% with Hot Mix Asphalt (HMA), and subbase thicknesses also met these requirements.
- Traffic volume going through the facility was originally designed for 100 trucks per day, but it was estimated to actually be at 300 trucks per day or more. This difference in daily traffic volumes can greatly impact pavement surface characteristics (texture, smoothness), as well as pavement and material behavior. Despite the overloading of traffic volumes, the pavement remained functional after nearly five years of use.
- FWD testing determined that the structural characteristics of the light-duty and heavy-duty HMA pavement areas exceeded the design capacity even after almost five years of use.
- Truckers were resting truck dollies directly on pavements which caused depressions, and excessive truck washing done on asphalt surfaces caused an acceleration of asphalt hardening and cracking due to the chemicals utilized in that process.

From these findings, it was determined that all damages and accelerated wear and tear on the trucking facility were mainly caused by unanticipated facility traffic volume and not performing routine pavement maintenance. It is important to note that facilities under constant traffic and loading conditions must be properly designed with reasonable traffic volume estimates and be maintained on a routine basis in order to function properly and last for the estimated design life.

Other Engineering UPDATES of Interest:

[UPDATE 7: Soil Provides Poor Road Construction Support](#)

[UPDATE 12: Investigation of a Roadway Failure](#)

[UPDATE 15: Asphalt Quality Investigation](#)

ABOUT MEA: Marino Engineering Associates, Inc. focuses on engineering research, practice and expert evaluations and is licensed in 24 states in the U.S. Our projects primarily have an emphasis on Geotechnical Engineering, however, we also have significant experience in projects involving transportation, subsidence engineering, laboratory testing, training, and geophysical exploration. Gennaro G. Marino, Ph.D., P.E., D.GE is president and principal engineer of Marino Engineering Associates, Inc., and has been a licensed professional engineer since 1984. To obtain additional information on MEA, one can also visit our website at www.meacorporation.com.

FOR MORE INFORMATION: There is a significant amount of additional information that is available on the above subject. For more information, please contact Dr. Marino at the address listed below.