TTI: 0-6874

Texas A&M Transportation Institute

Qualification and Testing of NDT and Mechanics-Based Approaches for Evaluating Flexible Base Construction

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Cooperative Research Program

TEXAS A&M TRANSPORTATION INSTITUTE
COLLEGE STATION, TEXAS

in cooperation with the
Federal Highway Administration and the
Texas Department of Transportation
http://tti.tamu.edu/documents/0-6874-P2.pdf

Qualification and Testing of NDT and Mechanics-Based Approaches for Evaluating Flexible Base Construction

TxDOT Project 0-6874 Develop Nondestructive Rapid Pavement Quality Assurance/Quality Control Evaluation Test Methods and Supporting Technology

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Goals

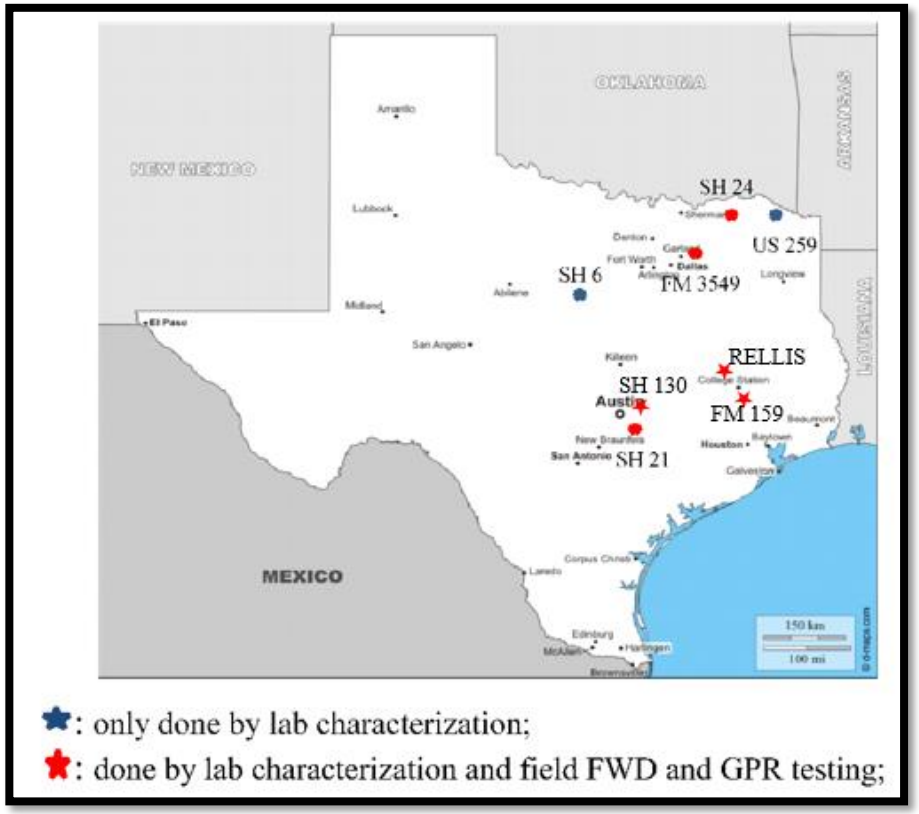
- Identify GPR systems that can perform rapid, non-invasive inspection of pavement layer(s) – focusing on base course
- Develop field methods
- Identify and develop lab methods to provide material properties needed to systematically analyze GPR data into useful engineering and construction information
- Develop analytical methods to convert raw GPR data into material properties – focusing on modulus and volumetrics

Key Activities Completed

- Resilient Modulus & Volumetrics
  - Developed algorithms to calculate the modulus and volumetrics using ground penetrating radar
  - Completed analysis on GPR scans on several test sites
- Testing of commercial GPR Systems
  - Identified suitable systems
    - 2 GHz Horn Antenna System
    - 2.5 GHz RDM System
- Exploratory work on stabilized materials

Testing Summary

GPR testing on Completed Base Course



Participating Test Site Locations

Example Results – SH 21 Actual Field Condition

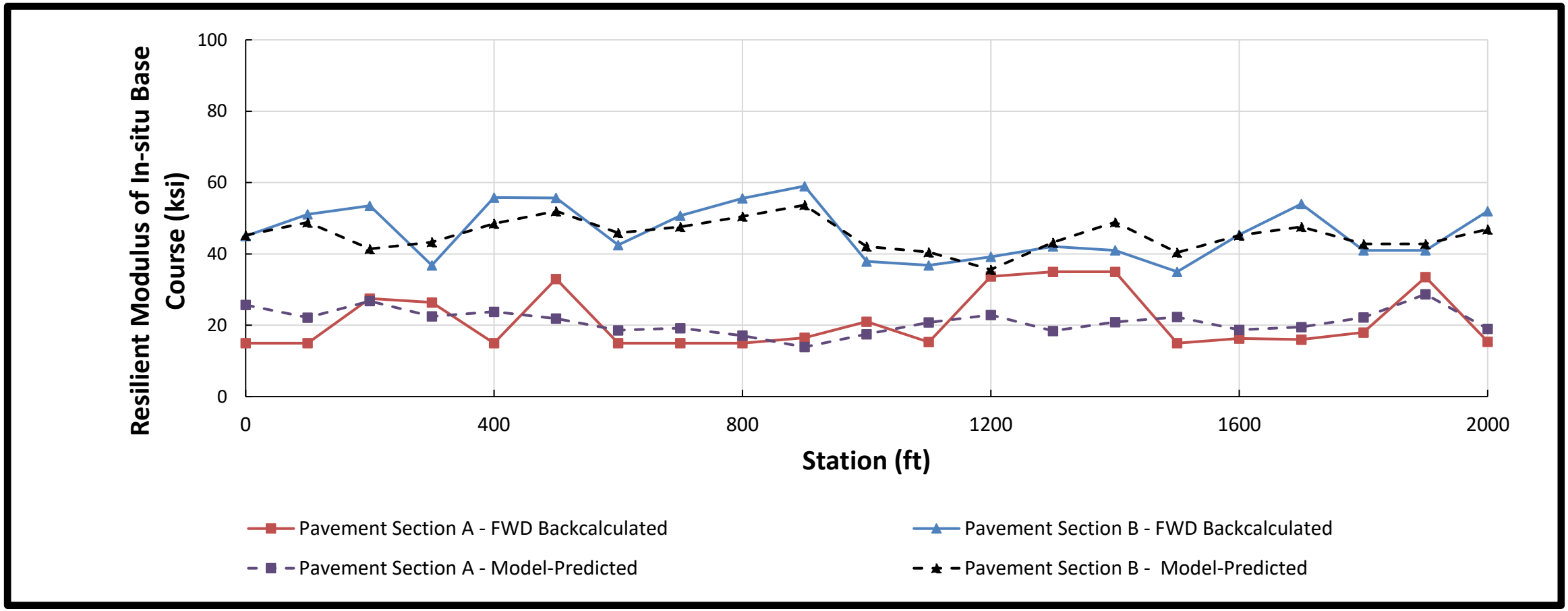
Fatigue cracking in wheel paths generally throughout extents

Section “A”

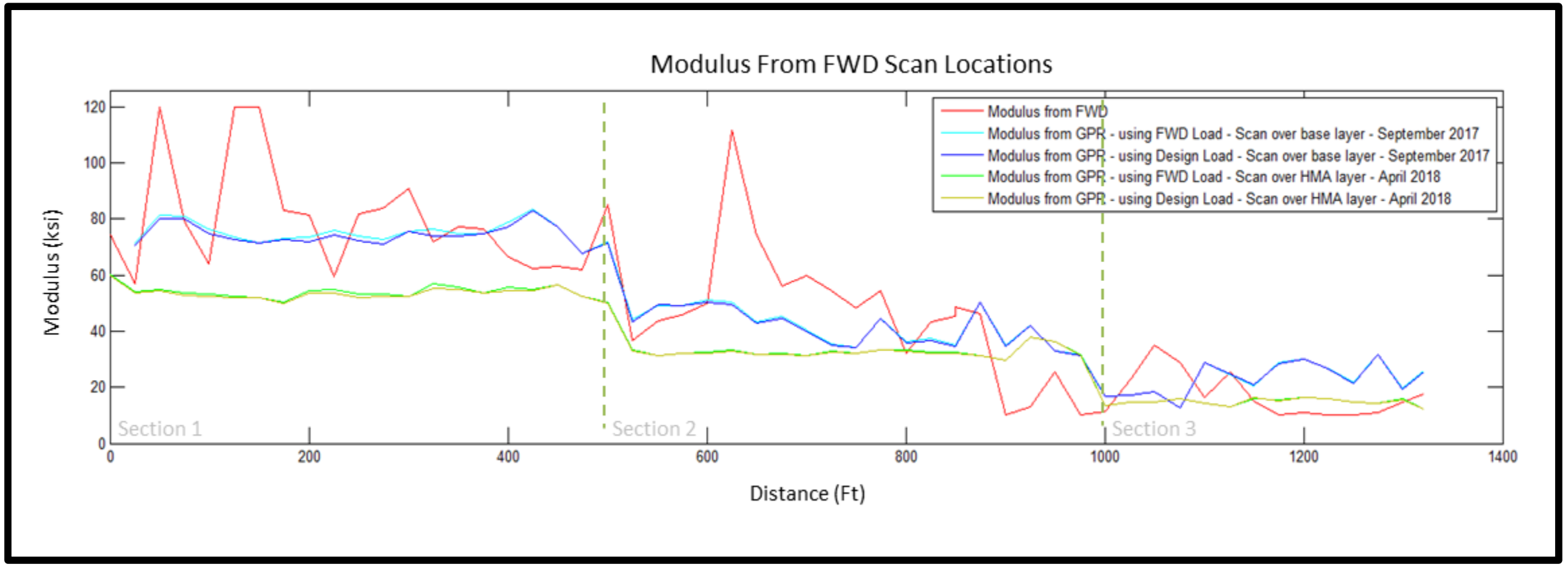
Generally good performance with minimal distress throughout extents

Section “B”

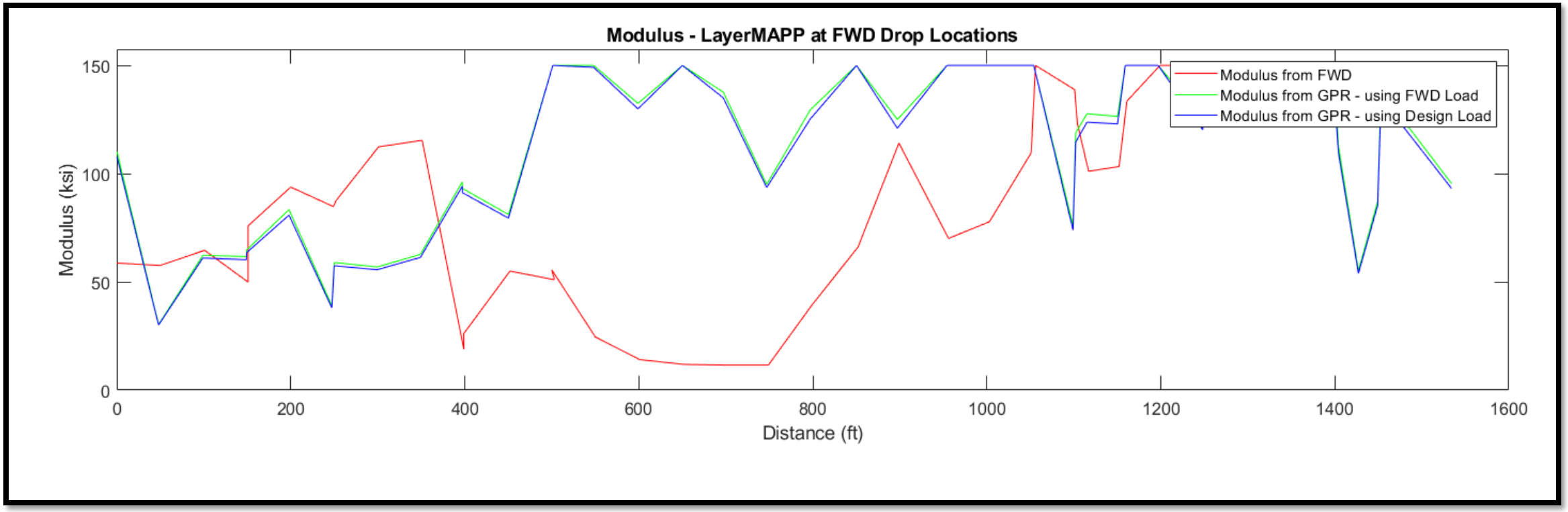
Example Modulus Result – SH21



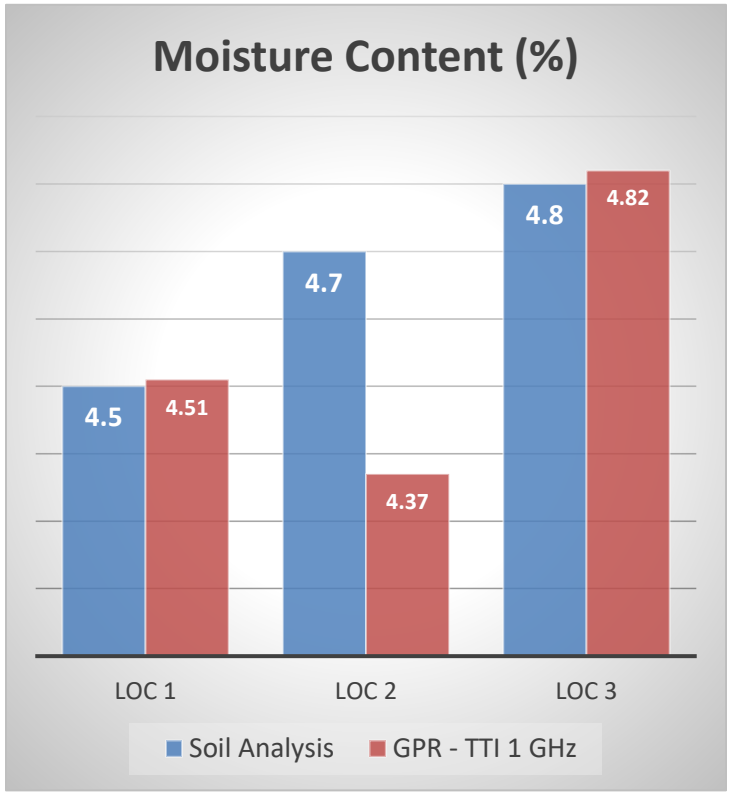
Example Modulus Result – RELLIS Site

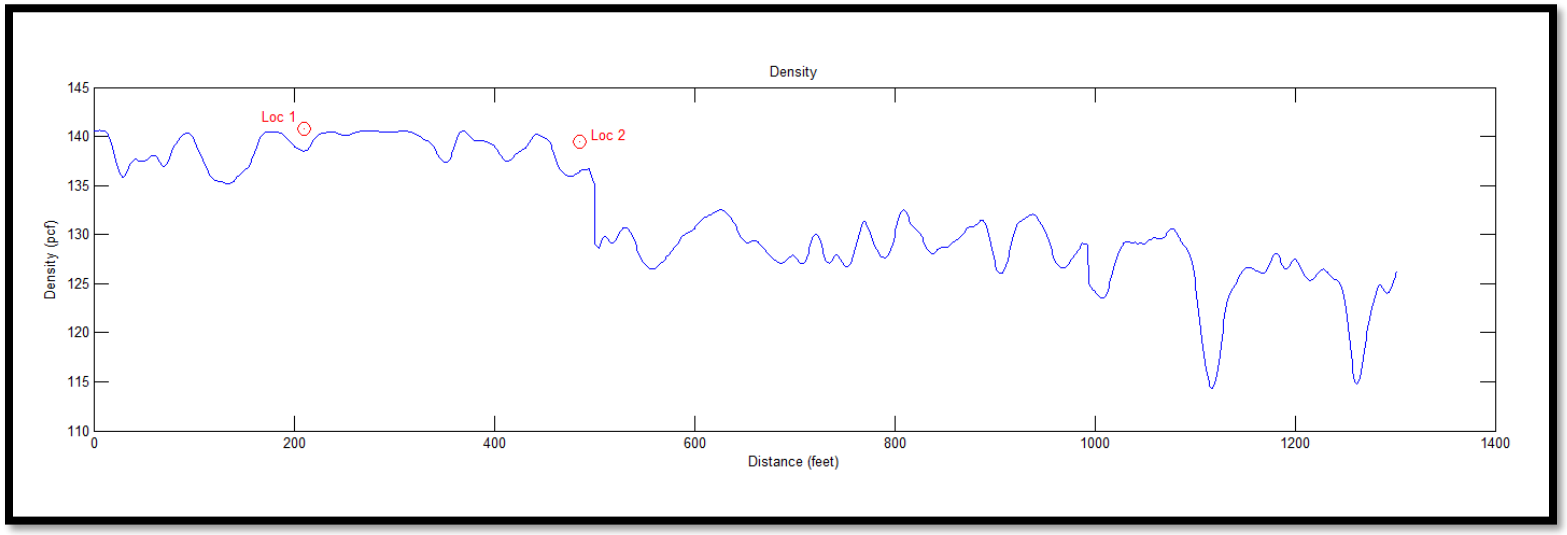


Example Modulus Result – FM 159



Example Volumetric Result – RELLIS Site

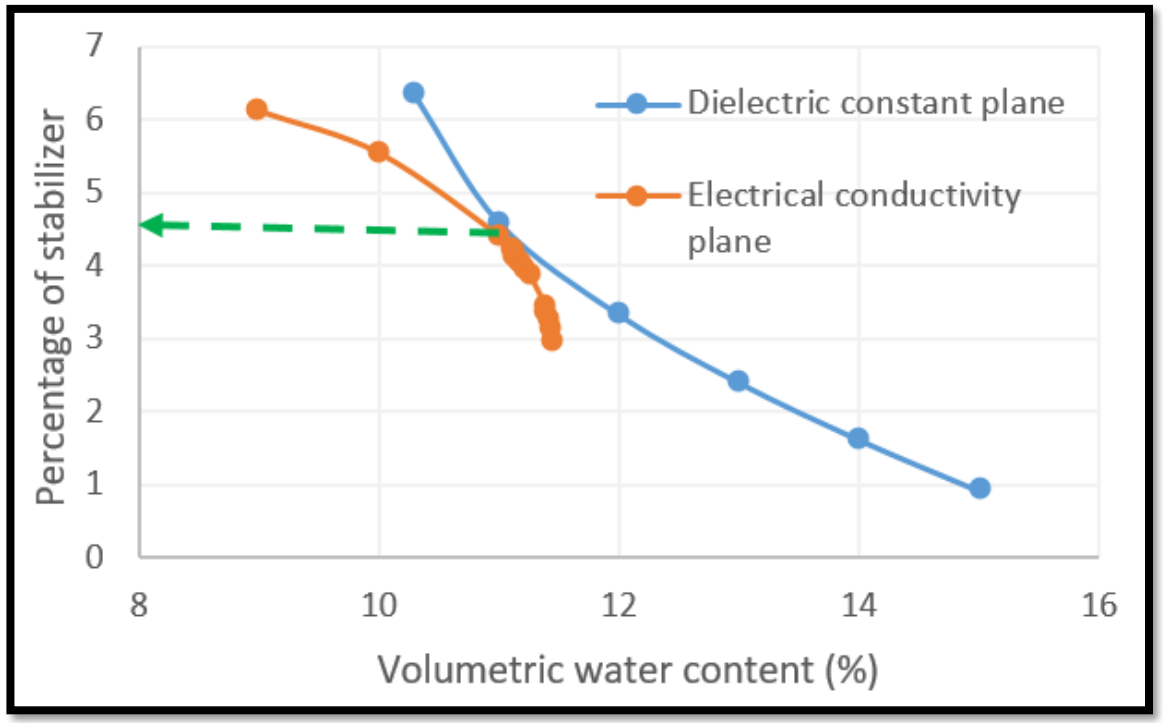




Data from RELLIS test site

Results – US 259 Estimating Stabilizer (cement) Content

- Dielectric and conductivity both increase with increasing water content and increasing amounts of cement
- Intersection of dielectric constant planes and electrical conductivity planes indicates stabilizer content
- GPR can measure the dielectric, and may also be able to measure the conductivity



Summary

- LayerMAPP – generally average predicted modulus value is statistically equivalent to average modulus from FWD
  - Requires supporting lab tests (MBV, AIMS, PFC, M-D curve)
  - Alternate model is needed for non-plastic materials with low percentage of non-plastic fines
  - Need min. ¾” surfacing if pavement already has a surface
- Self-consistent model good promise for estimating density / moisture
- Original vision was construction testing. However, these tools could also apply in forensic or asset mgmt. settings.
  - Identifying how frequently lab index properties or field reference values are needed requires clarification
- Exploratory work for measuring stabilizer content shows promise

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