

State of Wisconsin/Department of Transportation
RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: DECEMBER 31, 2007

Program: SPR-0010(36) FFY99	Part: II Research and Development
Project Title: Materials Characterization and Analysis of the Marquette Interchange Project	Project ID: 0092-07-13 (MRUTC 08-08)
Administrative Contact: Jason Bittner	Sponsor: MRUTC
WisDOT Technical Contact: Leonard Makowski	Approved Starting Date: May 1, 2007
Approved by COR/Steering Committee: \$60,000	Approved Ending Date: August 31, 2008
Project Investigator (agency & contact): Marquette University, Dr. James A. Crovetti	

Description: The objectives of this study are to characterize the materials used to construct the HMA perpetual pavement within the Marquette Interchange project and to analyze the collected pavement response data to investigate the interactions between materials, environment, and traffic loadings. This study will require a detailed examination of the predictive equations and sub-routines which are part of the mechanistic-empirical design procedures developed under NCHRP Project 1-37A to determine how well these reflect the actual response measures. The conclusions of this study should provide guidance for the Wisconsin Department of Transportation to perform mechanistic-empirical pavement designs which are validated for local conditions.

Total study budget	Current FFY budget	Expenditures for current quarter	Total Expenditures to date	Percent Complete
\$60,000	\$45,000	\$11,109.10	\$13,773.84	25%

Progress This Quarter:

(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

The results of compaction and resilient modulus testing on the native subgrade fine-grained soil materials were provided from testing completed at UW-Milwaukee. Figures 1 and 2 illustrate the compaction curve and resilient modulus trends, respectively, for the upper soils extracted from a depth of 0 – 12 inches below the top of the native subgrade soils. Figures 3 and 4 illustrate similar data for the lower soils, extracted from a depth of 12 – 24 inches from the top of the native subgrade soils. As shown, both soil layers exhibit stress-softening behavior which is typical for fine-grained soil materials. The upper soil layer shows increased stiffness over the range of test parameters.

The results of dynamic resilient modulus testing on the HMA materials were provided from testing completed at Iowa State. Figure 5 illustrates the master curves developed for each of the three component HMA mixtures used in construction. As shown, the lower layer materials (E30, C2) have very similar trends while the surface layer (SMA) has reduced stiffness for all but the lowest test frequencies.

Traffic data collected from the on-site weigh in motion system was sampled to develop typical trends of heavy truck loading within the instrumented travel lane. Figure 6 and 7 illustrate average daily truck distributions from data sampled from 11/10/07 through 11/16/07. For this sample period, 4.5% of the classified vehicles were considered as heavy trucks per FHWA classification 4 – 13. As shown in Figure 6, peak truck traffic occurs during the morning hours from 8AM – 12PM. Figure 7 provides a breakdown of the truck traffic based on the WisDOT truck classifications. As shown, the 2-S1-2 Truck Types (standard semi-tractor trailers) dominate during the morning peak trucking period.

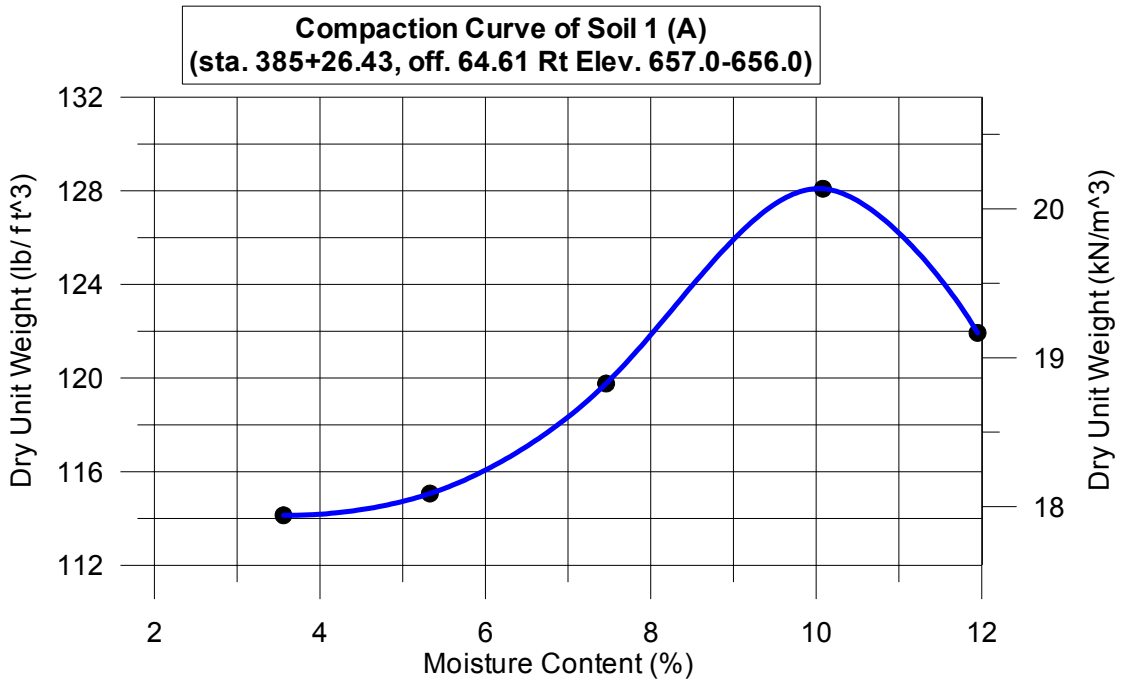
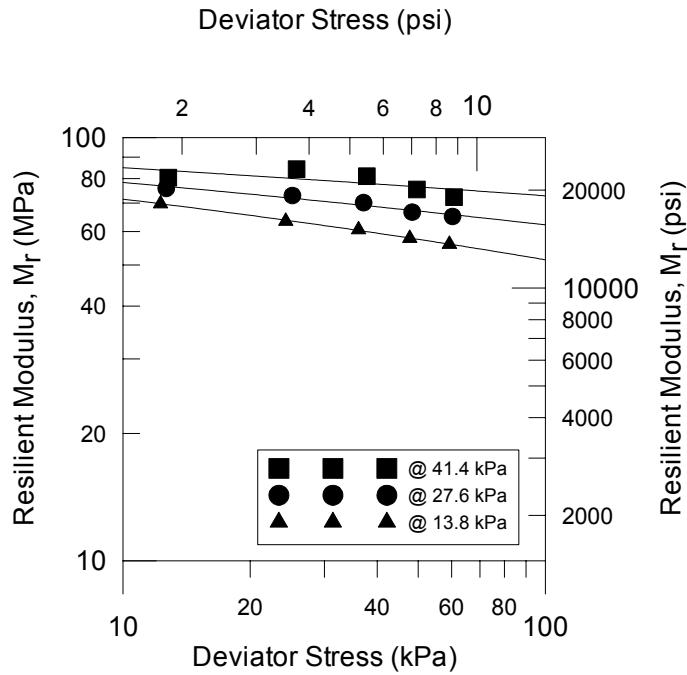
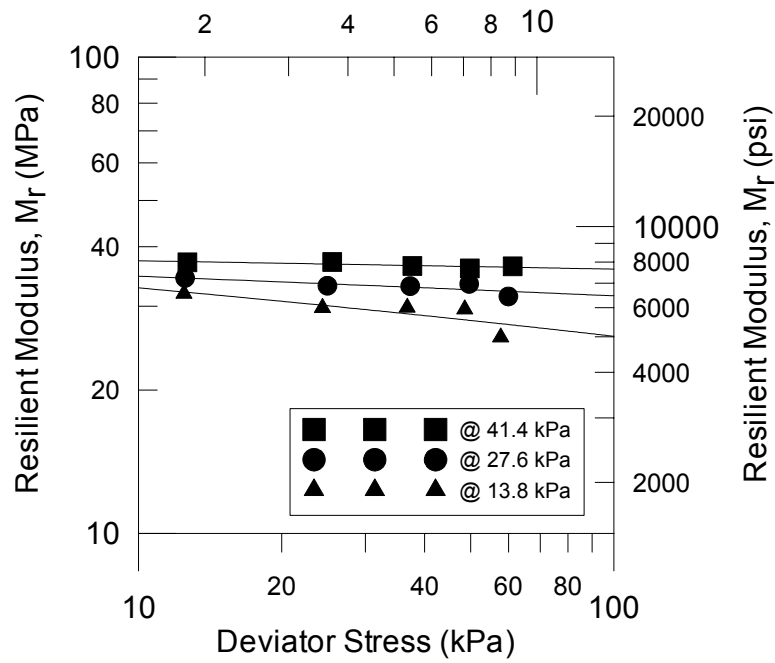
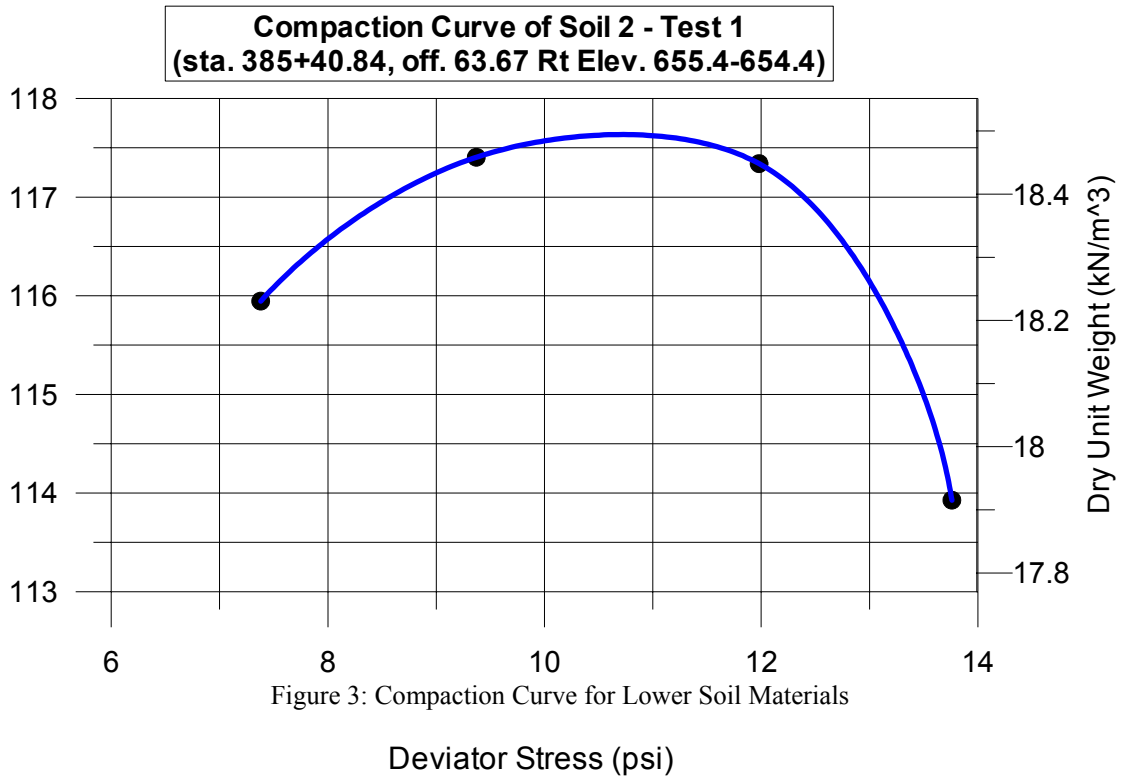


Figure 1: Compaction Curve for Upper Soil Materials



Test 1 on Soil 1A

Figure 2: Resilient Modulus vs Deviator Stress for Upper Soil Materials



Test 1 on Soil 2

Figure 4: Resilient Modulus vs Deviator Stress for Lower Soil Materials

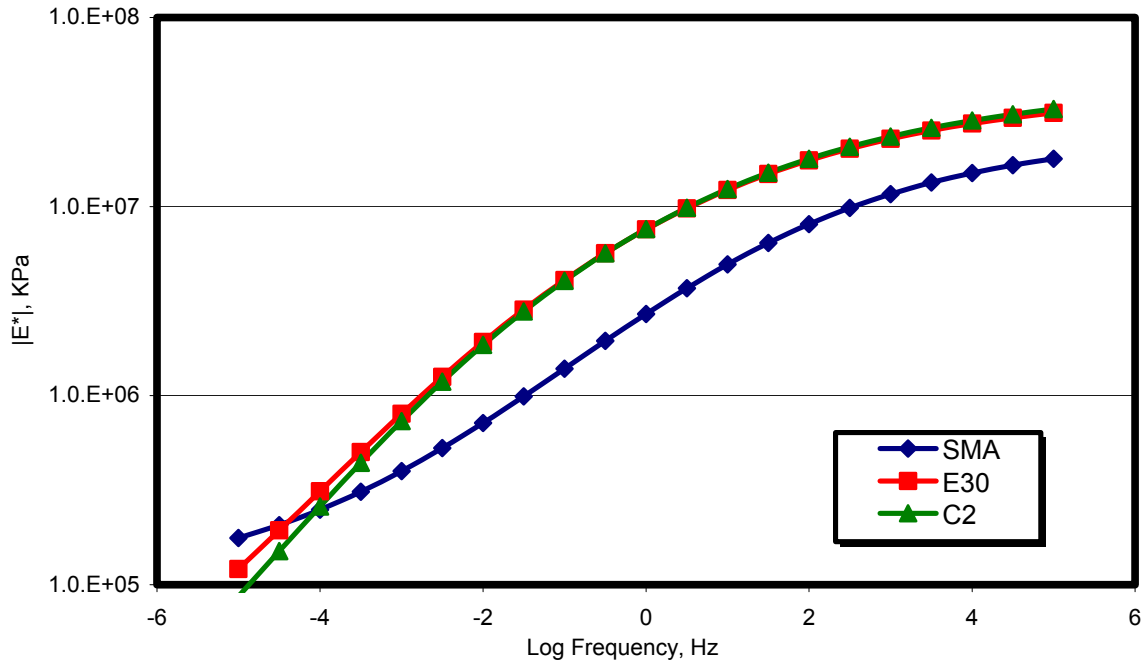


Figure 5: Dynamic Modulus Master Curves for HMA Mixtures

Average Hourly Truck Distribution Nov 10-17, 2007

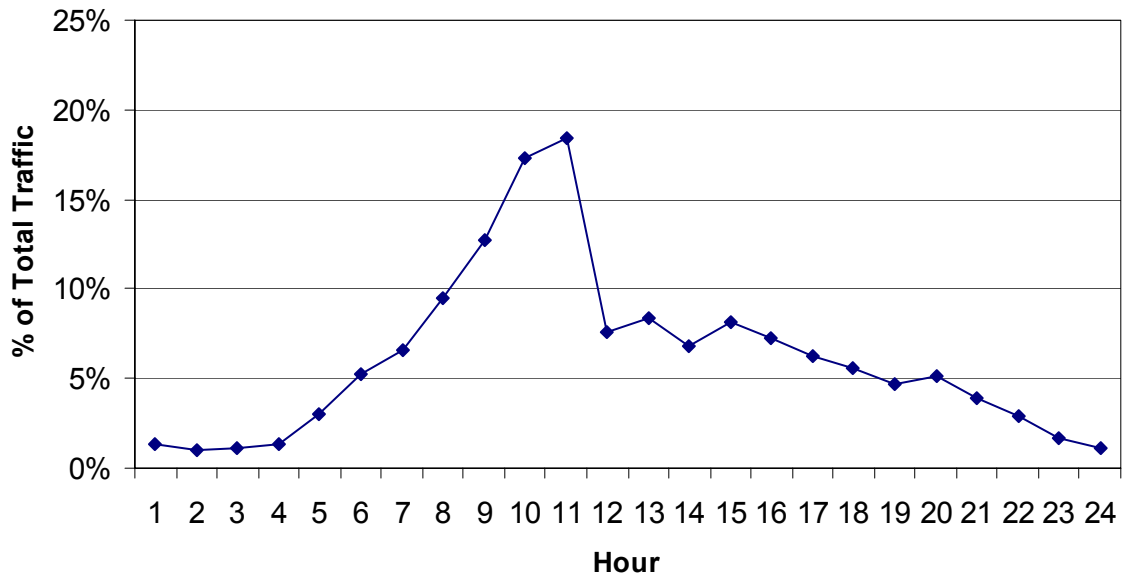


Figure 6: Average Hourly Truck Distribution, November 2007

Average Hourly Truck Distribution Nov 10-16, 2007

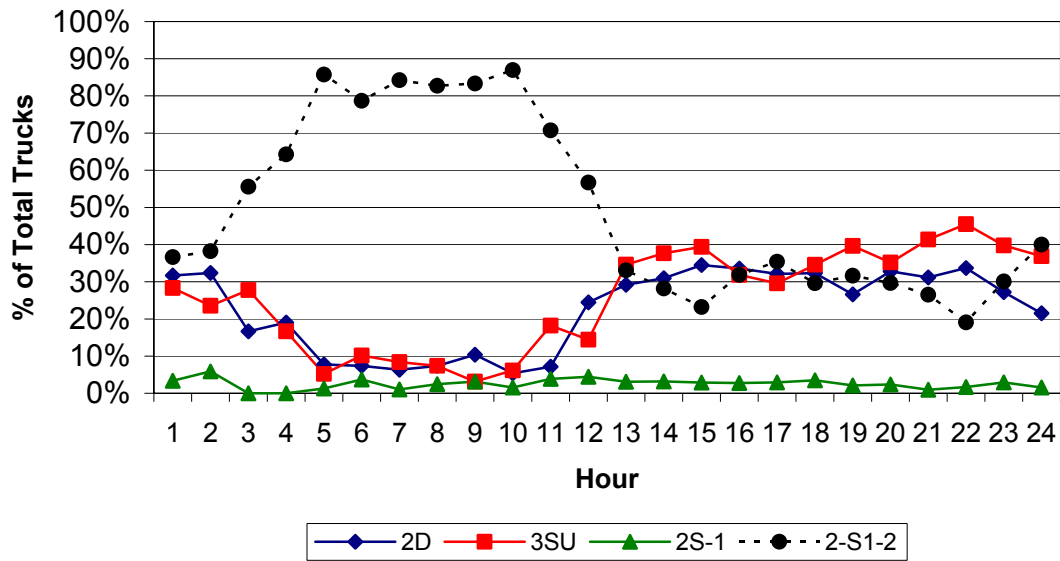


Figure 6: Average Hourly Distribution of WisDOT Truck Types, November 2007

Work Next Quarter:

Work for the next quarter will include finalization of laboratory testing and refinement of inputs for MEPDG software analysis. Additional traffic data will be obtained from the WisDOT Traffic Operations Center to provide typical hourly distributions of heavy truck traffic in all travel lanes of I-43. Performance predictions for the perpetual HMA pavement along I-43 will be developed using the MEPDG software. Separate analyses will be conducted for the general HMA pavement conditions and for specific pavement conditions existing within the instrumented section of I-43. Additional analyses will be performed using stand-alone software such as EVERSTRESS and KENLAYER. The software packages allow for the determination of specific pavement outputs, such as HMA strain and subgrade compressive stresses, which can be compared directly to actual field measurements obtained with on-site instrumentation.

Circumstances affecting progress/budget:

This project was proposed to begin on March 1, 2007. The actual start date was delayed by 2 months until May 1, 2007. Every effort is being made to accelerated early project activities to ensure a project completion by the approved ending date of August 31, 2008.

Gantt Chart:

Project Task	CY 2007								CY 2008							
	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
1-Lit Review	P	P	P	P	P											
	A	A	A	A	A											
2-Lab Testing		P	P	P	P	P	P	P								
		A	A	A	A	A	A	A								
3-Database Analysis		P	P	P	P	P	P	P								
		A	A	A	A	A	A	A								
4-Performance Prediction								P	P	P	P	P				
								A								
5-Final Report											P	P	P	P	P	P