TECHNICAL REPORT DOCUMENTATION PAGE

1. REPORT NO. FHWA-OK-11-06(1)	**2. GOVERNMENT ACCESSION NO.**	**3. RECIPIENT=S CATALOG NO.**
4. TITLE AND SUBTITLE Development of Flexible Pavement Database for Local Calibration of MEPDG - Volume I		**5. REPORT DATE** June 2011 **6. PERFORMING ORGANIZATION CODE**
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12. SPONSORING AGENCY NAME AND ADDRESS Oklahoma Department of Transportation Planning and Research Division 200 N.E. 21st Street, Room 3A7 Oklahoma City, OK 73105		**13. TYPE OF REPORT AND PERIOD COVERED** Final Report October 2008-December 2010 **14. SPONSORING AGENCY CODE**
15. SUPPLEMENTARY NOTES		

16 . ABSTRACT:

The new mechanistic-empirical pavement design guide (MEPDG), based on the National Cooperative Highway Research Program (NCHRP) study 1-37A, replaces the widely used but more empirical 1993 AASHTO Guide for Design of Pavement Structures. The MEPDG adopted a mechanistic-empirical pavement analysis and design procedure by using material properties, traffic and climate data for local conditions as input. Among material properties, resilient modulus (M_r) of underlying soil and aggregate layers is one of the important parameters for the analysis and design of flexible pavements. Also, dynamic modulus (E*) of the asphalt mixes and rheological properties of asphalt binders are needed to predict pavement distresses for its design life. To this end, M_r data of 712 samples from five unbound subgrade soils, 139 samples from four stabilized subgrade soils, and 105 samples from two aggregates in Oklahoma were evaluated to develop stress-based models. Among selected models for unbound subgrade soils, the universal model outperformed other stress-based models. For stabilized soils and aggregates, the octahedral model, recommended by the MEPDG, performed better than the other models. Also, reasonably good correlations were established to predict M_r values of these materials by using routine material properties (i.e., gradation, index properties). Furthermore, MEPDG input parameters of three performance grade (PG) binders, collected from three different refineries in Oklahoma, were determined as per Superpave® test methods. It was observed that the rheological properties (i.e., viscosity, dynamic shear modulus (G*)) of the same PG grade binders varied significantly based on their sources. The present study is expected to provide ODOT with useful data and correlations that can be used to calibrate the MEPDG for local materials and conditions.

17. KEY WORDS MEPDG, Resilient Modulus, Subgrade Soils, Granular Base, Asphalt Binder	**18. DISTRIBUTION STATEMENT** No restrictions. This publication is available from the Planning and Research Division, Oklahoma DOT.		
19. SECURITY CLASSIF. (OF THIS REPORT) Unclassified	**20. SECURITY CLASSIF. (OF THIS PAGE)** Unclassified	21. NO. OF PAGES 144	22. PRICE N/A