REQUEST FOR PROPOSAL

The Michigan Department of Transportation is seeking professional services for the project contained in the attached Research Problem Statement.

The prime consultant/vendor is responsible for the successful completion of the service and is expected to perform at least 40 percent of the services, by dollar value, not including direct costs required on the service, unless otherwise specified in the RFP.

If your organization is interested in providing services, please indicate your interest by submitting a proposal following the research guidelines near the top of MDOT's Request for Proposals Web page at http://www.michigan.gov/mdot/0,1607,7-151-9625_32842---,00.html.

RFP SPECIFIC INFORMATION

Problem Title: Preparation for Implementation of the Mechanistic-Empirical Pavement Design Guide in Michigan
ORBP Number: OR10-022

This is Best Value Selection which means the budget amount submitted with the proposal is a component of the proposal score, not the determining factor of the selection.

PROPOSAL SUBMITTAL INFORMATION

REQUIRED NUMBER OF COPIES FOR PROJECT MANAGER	PROPOSAL DUE DATE	TIME DUE
8	**2/25/2011**	**5:00 PM, EST**

PROPOSAL AND BID SHEET MAILING ADDRESSES

Mail the multiple proposal package to:

☒ Calvin Roberts, P.E., Engineer of Research and Best Practices

First Class Mailing Address
Michigan Department of Transportation
Office of Research and Best Practices
P.O. Box 30050
Lansing, Michigan 48909

OR

Overnight/Express Services Address
Michigan Department of Transportation
Office of Research and Best Practices
425 West Ottawa
Lansing, Michigan 48933

Mail one additional copy of the proposal to the Contracting Office indicated below:

☒ First Class Mail:
ORBP Contract Administrator
Contract Services Division
Michigan Department of Transportation
P.O. Box 30050
Lansing, Michigan 48909

OR

Lansing Overnight Mail:
ORBP Contract Administrator
Contract Services Division
Michigan Department of Transportation
425 West Ottawa
Lansing, Michigan 48933

BUDGET

☐ Tier I
($25,000 - $99,999)

☐ Tier II
($100,000 - $250,000)

☒ Tier III
(>$250,000)

GENERAL INFORMATION

Any questions relative to the Research Problem Statement must be submitted by e-mail to: mdot-research@michigan.gov. Questions must be received by **February 18, 2011 at 5:00 p.m. EST.** All questions and answers will be placed on the MDOT RFP Web site as soon as possible after receipt of the questions and at least three (3) days prior to the due date listed above. The names of organizations submitting questions will not be disclosed.

MDOT is an equal opportunity employer and MDOT DBE firms are encouraged to apply. The participating DBE firm, as currently certified by MDOT's Office of Equal Opportunity, shall be listed in the Proposal.

MDOT AND ORBP FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION:

5100D – Request for Proposal Cover Sheet
5100G – Certification of Key Personnel
5100I – Conflict of Interest Statement
ORBP Research Proposal Budget Form Worksheet
ORBP Schedule of Research Activities Form
ORBP Deliverables Table
ORBP Implementation Project Recommendation Form

Michigan Department
Of Transportation
5308-10 (03/10)

OFFICE OF RESEARCH & BEST PRACTICES
MDOT RESEARCH PROGRAM
2010 PROBLEM STATEMENT

PROBLEM TITLE
Preparation for Implementation of the Mechanistic-Empirical Pavement Design Guide in Michigan

ORBP NO.	STRATEGIC PRIORITY NO.	CRITICAL ISSUE CODE	MDOT PROJECT CATEGORY
OR10-022		7-Infrastructure	Program/Project Development: Design & Geotechnical

PROBLEM TO ADDRESS

BRIEFLY DESCRIBE THE PROBLEM TO BE ADDRESSED AND WHY IT IS AN ISSUE FOR MDOT
The Mechanistic-Empirical Pavement Design Guide (M-E PDG) represents the latest generation of pavement design methodology. Michigan, like many other states, is assessing/developing its plan for implementation of M-E PDG. Previous research projects addressed parts of M-E PDG evaluation: evaluation of new and reconstruct pavement designs using M-E, characterization of truck traffic, coefficient of thermal expansion properties, etc. This research project intends to address three areas that are needed in order for Michigan to implement M-E PDG:

1. Characterization of Hot Mix Asphalt (HMA) Mixtures in Michigan

Proper characterization of HMA mixture properties, in particular the dynamic modulus, are critical in appropriately using the Mechanistic-Empirical Pavement Design Guide (M-E PDG). In order to develop the most suitable HMA pavement designs possible, Michigan's typical HMA mixture properties must be determined for use in the M-E PDG.

2. Evaluation of M-EPDG for Pavement Rehabilitation in Michigan

A previous research project evaluated the M-E PDG for new and reconstructed pavements. A majority of the Michigan Department of Transportation (MDOT) projects, however, are pavement rehabilitation rather than new or reconstruction. As such, MDOT needs to evaluate M-E PDG rehabilitation designs to see if it will provide reasonable results for Michigan's pavements.

3. Calibration and Validation of M-E PDG for Michigan

The performance models in the software are currently calibrated to national data. To best utilize M-E PDG it must be calibrated to Michigan data. This will provide pavement performance predictions that reflect materials, traffic, environment, and performance in Michigan.

RESEARCH OBJECTIVES AND TASKS

LIST THE RESEARCH OBJECTIVE(S) TO BE ACCOMPLISHED
Part 1: HMA Mixture Characterization

1. Review what HMA properties are currently being tested by MDOT and which ones need to be considered for future testing in order to appropriately characterize MDOT HMA mixes for the M-E PDG.

2. Test HMA samples collected from MDOT construction projects for the inputs necessary in the M-E PDG. The principal investigator should provide a statistically based test matrix that will cover all of Michigan's geographic regions as well as a majority of the mixes identified in the HMA Mixture Selection Guidelines (Section 6.03.09 of the Road Design Manual available on the MDOT Web site). A number of mixes have already been tested under the MDOT research project “Development of Specification for the Superpave Simple Performance Tests (SPT)”. The researcher is expected to utilize information from this recently completed project.

3. Provide recommendations on the appropriate values and input levels for HMA mixtures for use in the M-E PDG pavement designs.

4. Identify future needs, such as necessary design model calibrations, possible focus of other research, methods for verification of as-built properties, etc., that would be beneficial to MDOT in improving its design practice for new, reconstruct, and rehabilitation pavements.

5. Recommend what types of changes in the HMA should trigger new characterization testing.

Part 2: Evaluation of Rehabilitation Fixes

1. Review the sensitivity analysis completed under MDOT research project “Evaluation of the 1-37A Design Process for New and Rehabilitated JPCP and HMA Pavements”. Identify the most critical/sensitive input parameters for use in the M-E PDG for pavement rehabilitation designs. Recommend any currently available methods (such as tests, procedures, or equipment) to more accurately determine input values for those inputs that are highly sensitive.

2. Provide technical criteria for selecting pavement sections to consider for predicted/observed performance comparisons. This should be a statistically based matrix based on geographic regions, traffic levels, pavement type, fix type, etc.

3. Perform comparisons between the M-EPDG predicted pavement performance and the observed performance of selected pavement sections.

4. Analyze the performance comparisons and provide recommendations as to whether or not M-E PDG should be used by MDOT for rehabilitation designs. Include, if applicable, any limitations of use for rehabilitation that the research results would suggest.

5. Provide recommendations on the appropriate values and input levels for all critical/sensitive parameters for use in M-E PDG pavement rehabilitation designs.

6. Identify future needs, such as necessary design model calibrations, possible focus of other research, etc., that would be beneficial to MDOT in improving its design practice for pavement rehabilitation.

Part 3: Calibration and Validation

1. Determine the best method for calibration.

2. Evaluate the readiness of Michigan's Pavement Management System (PMS) to provide the necessary data for M-E PDG calibration and validation. Identify deficiencies and recommend course of action to remedy.

3. Design a statistically based matrix for comparison of predicted with observed performance. The matrix should be statistically based on geographic regions, traffic levels, pavement type, fix type, etc.

4. Compare predicted performance from M-E PDG to observed performance of in-service pavements.

5. Adjust performance models so that predicted performance more closely matches observed, thereby reducing error and bias.

6. Validate the model adjustments on an independent set of in-service pavements.

7. Recommend a plan for future calibration and validation to ensure that the performance models are continuously improved, including any database needs.

LIST THE MAJOR TASKS TO ACCOMPLISH THE RESEARCH OBJECTIVES:	ESTIMATED PERSON HOURS
Part 1: HMA Mixture Characterization	
1. Literature search to determine what existing or on-going research is being done on HMA mixture characterization for M-E PDG.	80
2. Review MDOT's HMA testing program.	60
3. In consultation with the Research Advisory Panel (RAP), choose construction projects that will allow sampling of mixtures in the matrix developed by the principle investigator.	20
4. Laboratory testing of samples collected (Milestone #1: latest start for laboratory testing complete by December 31, 2011 and Milestone #2:100% of laboratory testing complete by Sept. 30, 2012).	800
5. Quarterly reporting, final report for Part 2 (Milestone #3: draft final report due by Sept. 30, 2012, Milestone #4: accepted final report due by Dec. 31, 2012).	160
Part 2: Evaluation of Rehabilitation Fixes	
1. Literature search to determine what existing or on-going research is being done for rehabilitation designs in M-E PDG. Contact or survey other state DOT's to determine what research they have completed and what procedures they may implement.	80
2. Review MDOT's rehabilitation fixes and design methods (including falling weight deflectometer usage) to determine which can be designed in M-E PDG, and thereby, can be evaluated for this project.	40
3. Determine sensitivity analysis needs for inputs specific to rehabilitation designs based on sensitivity analysis already performed (Milestone #5: complete by June 30, 2012).	250
4. In consultation with the MDOT Research Advisory Panel (RAP), choose projects with enough performance history based on the matrix developed by the principle investigator.	40
5. Check accuracy of M-E PDG models by comparing predicted to observed performance for Task 4 pavements (Milestone #6: complete by January 31, 2013).	350
6. Quarterly reporting, final report for Part 2 (Milestone #7: draft final report due by March 31, 2013, Milestone #8: accepted final report due by June 30, 2013).	160
Part 3: Calibration and Validation	
1. Literature search to determine the potential calibration methods.	80
2. Meet with Pavement Management staff to learn and become familiar with what is contained in Michigan's PMS database. Determine what can be used for calibration of M-E PDG, what is lacking, and how it can be translated into useable form for M-E PDG.	40
3. In consultation with the MDOT Research Advisory Panel (RAP), choose projects with enough performance history based on the matrix developed by the principle investigator.	120
4. Run designs of pavements from the test matrix.	300
5. Compare predicted performance with observed performance to adjust the performance models.	150
6. Validate the adjusted models on pavements that are not a part of the test matrix to verify accuracy and precision.	200
7. Investigate and recommend a database to store the appropriate data that can be used for future calibration needs. Recommend format, data elements, and investigate compatibility with current MDOT database systems.	200

8. Recommend a plan for future calibration efforts, including frequency and methods.	80
9. Quarterly reporting, interim reporting, and final reporting for Part 3 (Milestone #9: draft final report due by December 21, 2013, Milestone #10: accepted final report and conduct tech transfer class by March 31, 2014).	240

ESTIMATED COST AND TIMELINE

ESTIMATE THE COST OF THIS RESEARCH STUDY (Please provide a cost range [min. and max.] associated with the person hours by task above)
Tier III > $250,000

PROVIDE A PROPOSED TIMELINE FOR THE PROJECT (At minimum, the expected duration of the project)
10/1/2011 to 3/31/2014

REQUIRED COMPLETION DATE (At minimum, the date by which results are needed to be applicable)
3/31/2014

BUDGET INFORMATION
(For each FY, list suggested minimum and maximum budgets as targets. Indirect Cost Rate is for ORBP use only.)

TOTAL BUDGET (BY FY)	FY1	FY2	FY3	FY4	INDIRECT COST RATE

DELIVERABLES

WHAT DELIVERABLES SHOULD BE RECEIVED AT THE END OF THIS PROJECT? (e.g., usable technical product, design method, techniques, training, workshops, report, manual of practice, policy, procedure, specification, standard, software, hardware, equipment, training tools, etc.)
Part1: Final report, recommended design inputs, recommended testing program.

Part 2: Final report, recommended design input levels for rehabilitation designs, recommended procedures for falling weight deflectometer testing, one day workshop instructing MDOT pavement designers on how to use M-E PDG for rehabilitation design (includes workshop manual, presentations, etc.).

Part 3: Final report, recommended calibration factors, plan for future calibration frequency and method, recommended database, training of MDOT staff on calibration method.

MDOT INVOLVEMENT (What will MDOT provide for this project and when)
MDOT will provide a majority of the HMA sample collection. The research team should be prepared to collect samples also. MDOT will need to provide the as-built data for M-E PDG inputs in Parts 2 and 3. This will require a significant amount of personnel time to dig through project records. The research team should anticipate needing to investigate project records in paper, microfilm, and electronic form, on a limited basis.

URGENCY, PAYOFF POTENTIAL AND IMPLEMENTATION

HOW URGENT IS THIS RESEARCH? IS IT IMPORTANT THAT IT BE DONE SOON? IF SO, WHY?
Implementation plan for M-E PDG calls for implementation in 2014. Implementation will be delayed until this research is completed.

DESCRIBE HOW THE PROPOSED RESULTS OF THIS PROJECT CAN BE IMPLEMENTED AT MDOT
Adoption of new HMA testing protocols, adoption of recommended HMA design inputs. Recommended procedures for falling weight deflectometer testing could be adopted by MDOT. Determination of sensitive inputs will guide where MDOT puts its resources for providing the best rehabilitation designs. Recommended calibration factors can be adopted. Existing databases could be modified or a new database created depending on the recommendations from Task 7. Recommendations on future calibration could be adopted.

DESCRIBE HOW MDOT WILL BENEFIT FROM THE IMPLEMENTATION OF THIS PROJECT AND WHO THE BENEFICIARIES WILL BE. INCLUDE A DISCUSSION OF HOW MDOT DIVISIONS, OTHER THAN THAT OF THE PROBLEM SUBMITTER, WILL BENEFIT AND HOW.
Improved pavement designs (less variability) that meet our intended design life and thereby more efficient use of transportation investment. Beneficiaries will be the travelling public and pavement design staff.

POTENTIAL OBSTACLES

WHAT RISKS OR OBSTACLES MAY MAKE CARRYING OUT THIS PROJECT DIFFICULT? WHAT STRATEGIES WILL YOU USE TO OVERCOME THEM?
Coordination with many construction projects going on statewide at the same time will make take coordination to obtain HMA samples. This can be overcome by careful selection of the projects to be sampled from and by bringing the Region Soils and Materials Engineers and Region Traveling HMA Inspectors on-board with this project so they can provide assistance. Recommendations for future testing may increase testing costs.

Availability of as-built data has been highly variable with other research projects. Quantity of data needed and the fact that it is located in historical records will require a lot of personnel time which may not be available. Internal resistance to change from current design method. Resistance to change could be overcome with focused training to alleviate potential users concerns.

POSSIBLE INVESTIGATOR(S)

DESIRED QUALIFICATIONS IN AN INVESTIGATOR
Considerable experience in HMA mix design and HMA lab testing. Fully functional laboratory capable of all testing procedures called for in the M-E PDG. Access to triaxial testing equipment is a must. Knowledge of proper HMA sampling. Pavement design experience, especially with M-E PDG. Experience with M-E PDG based research. Adequate time to complete the project. Due to the nature of this research study, it's important that the research team has knowledge and experience in statistical theory and practice.