

## CHECKLIST TO DESIGNATE AREAS OF EVALUATION FOR REQUESTS FOR PROPOSAL (RFP)

MDOT PROJECT MANAGER Seve Cook		JOB NUMBER (JN) 102226	CONTROL SECTION (CS) 84900
DESCRIPTION Vehicle-based Information and Data Collection System (VIDAS)			
<b>MDOT PROJECT MANAGER:</b> Check all items to be included in RFP  WHITE = REQUIRED GRAY SHADING = OPTIONAL		<b>CONSULTANT:</b> Provide only checked items below in proposal	
Check the appropriate Tier in the box below			
<input type="checkbox"/> <b>TIER I</b> (\$25,000-\$99,999)	<input type="checkbox"/> <b>TIER II</b> (\$100,000-\$250,000)	<input checked="" type="checkbox"/> <b>TIER III</b> (>\$250,000)	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Understanding of Service
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<i>Innovations</i>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<i>Safety Program</i>
N/A	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Organizational Chart
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Qualifications of Team
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Past Performance
Not required As part of Official RFP	Not required As part of Official RFP	<input checked="" type="checkbox"/>	Quality Assurance/Quality Control
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<b>Location:</b> The percentage of work performed in Michigan will be used for all selections unless the project is for on-site inspection or survey activities, then location should be scored using the distance from the consultant office to the on-site inspection or survey activity.
N/A	N/A	<input type="checkbox"/>	Presentation
N/A	N/A	<input type="checkbox"/>	Technical Proposal (if Presentation is required)
3 pages (MDOT Forms not counted) <b>(No Resumes)</b>	7 pages (MDOT Forms not counted)	19 pages (MDOT Forms not counted)	<b>Total maximum pages for RFP not including key personnel resumes</b>

The Michigan Department of Transportation (MDOT) is seeking professional services for the project contained in the attached scope of services.

If your firm is interested in providing services, please indicate your interest by submitting a Proposal, Proposal/Bid Sheet or Bid Sheet as indicated below. The documents must be submitted in accordance with the latest "Consultant/Vendor Selection Guidelines for Service Contracts" and "Guideline for Completing a Low Bid Sheet(s)", if a low bid is involved as part of the selection process. **Referenced Guidelines are available on MDOT's website under Doing Business > Vendor/Consultant Services > Vendor/Consultant Selections.**

## RFP SPECIFIC INFORMATION

BUREAU OF HIGHWAYS       BUREAU OF TRANSPORTATION PLANNING \*\*       OTHER

THE SERVICE WAS POSTED ON THE ANTICIPATED QUARTERLY REQUESTS FOR PROPOSALS

NO       YES      DATED \_\_\_\_\_ THROUGH \_\_\_\_\_

<input type="checkbox"/> <b>Prequalified Services</b> – See page ___ of the attached Scope of Services for required Prequalification Classifications.	<input type="checkbox"/> <b>Non-Prequalified Services</b> - If selected, the vendor must make sure that current financial information, including labor rates, overhead computations, and financial statements, if overhead is not audited, is on file with MDOT's Office of Commission Audits. This information must be on file for the prime vendor and all sub vendors so that the contract will not be delayed. <b>(Form 5100J Required with Proposal)</b>
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**Qualifications Based Selection** – Use Consultant/Vendor Selection Guidelines

**For all Qualifications Based Selections**, the section team will review the information submitted and will select the firm considered most qualified to perform the services based on the proposals. The selected vendor will be contacted to confirm capacity. Upon confirmation, that firm will be asked to prepare a priced proposal. Negotiations will be conducted with the firm selected.

**\*\*For RFP's that originate in Bureau of Transportation Planning only**, a priced proposal must be submitted at the same time as, but separate from, the proposal. Submit directly to the Contract Administrator/Selection Specialist, Bureau of Transportation Planning (see address list, page 2). The priced proposal must be submitted in a sealed envelope, clearly marked "**PRICE PROPOSAL.**" The vendor's name and return address **MUST** be on the front of the envelope. The priced proposal will only be opened for the highest scoring proposal. Unopened priced proposals will be returned to the unselected vendor(s). Failure to comply with this procedure may result in your priced proposal being opened erroneously by the mail room.

**For a cost plus fixed fee contract**, the selected vendor must have a cost accounting system to support a cost plus fixed fee contract. This type of system has a job-order cost accounting system for the recording and accumulation of costs incurred under its contracts. Each project is assigned a job number so that costs may be segregated and accumulated in the vendor's job-order accounting system.

**Qualifications Review / Low Bid** - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions for additional information.

For Qualification Review/Low Bid selections, the selection team will review the proposals submitted and post the date of the bid opening on the MDOT website. The notification will be posted at least two business days prior to the bid opening. Only bids from vendors that meet proposal requirements will be opened. The vendor with the lowest bid will be selected. The selected vendor may be contacted to confirm capacity.

**Best Value** - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions below for additional information. The bid amount is a component of the total proposal score, not the determining factor of the selection.

**Low Bid** (no qualifications review required - no proposal required.) See Bid Sheet Instructions below for additional instructions.

## BID SHEET INSTRUCTIONS

A bid sheet(s) must be submitted in accordance with the "Guideline for Completing a Low Bid Sheet(s)" (available on MDOT's website). The Bid Sheet(s) is located at the end of the Scope of Services. Submit bid sheet(s) separate from the proposal, to the address indicated below. The bid sheet(s) must be submitted in a sealed manila envelope, clearly marked "**SEALED BID.**" The vendor's name and return address **MUST** be on the front of the envelope. Failure to comply with this procedure may result in your bid being opened erroneously by the mail room and the bid being rejected from consideration.

**PROPOSAL SUBMITTAL INFORMATION**

REQUIRED NUMBER OF COPIES FOR PROJECT MANAGER 6	PROPOSAL/BID DUE DATE 11/24/10	TIME DUE 5:00 PM
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**PROPOSAL AND BID SHEET MAILING ADDRESSES**

Mail the multiple proposal bundle to the MDOT Project Manager or Other indicated below.

MDOT Project Manager  MDOT Other

Steven J. Cook, P.E.  
ITS Program Office  
Construction and Technology Division  
Michigan DOT P.O. 30049, Lansing, MI 48809

Mail one additional stapled copy of the proposal to the Lansing Office indicated below.

**Lansing Regular Mail****OR****Lansing Overnight Mail**

Secretary, Contract Services Div - B470  
Michigan Department of Transportation  
PO Box 30050  
Lansing, MI 48909

Secretary, Contract Services Div - B470  
Michigan Department of Transportation  
425 W. Ottawa  
Lansing, MI 48933

Contract Administrator/Selection Specialist  
Bureau of Transportation Planning B470  
Michigan Department of Transportation  
PO Box 30050  
Lansing, MI 48909

Contract Administrator/Selection Specialist  
Bureau of Transportation Planning B470  
Michigan Department of Transportation  
425 W. Ottawa  
Lansing, MI 48933

**GENERAL INFORMATION**

Any questions relative to the scope of services must be submitted by e-mail to the MDOT Project Manager. Questions must be received by the Project Manager at least four (4) working days prior to the due date and time specified above. All questions and answers will be placed on the MDOT website as soon as possible after receipt of the questions, and at least three (3) days prior to the RFP due date deadline. The names of vendors 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

The following two American Recovery and Reinvestment Act of 2009 (ARRA) notifications, **ARRA MONTHLY EMPLOYMENT REPORTS** and **REQUIRED CONTRACT PROVISIONS TO IMPLEMENT AMERICAN RECOVERY AND REINVESTMENT ACT (ARRA) SECTIONS 902 AND 1515**, are attached to this Request For Proposal for your understanding. These two notifications are only applicable for those projects/contracts funded with ARRA funds and will be included in contract Exhibits.

**MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION**

- 5100D** – Request for Proposal Cover Sheet
- 5100G** – Certification of Availability of Key Personnel
- 5100I** – Conflict of Interest Statement
- 5100J** - Consultant Data and Signature Sheet (Required only for Non-Prequalified Work)

**(These forms are not included in the proposal maximum page count.)**

**Michigan Department of Transportation**

**SCOPE OF SERVICE  
FOR  
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)  
Vehicle-Based Information and Data Acquisition System  
(VIDAS)**

**CONTROL SECTION(S):** 84900

**JOB NUMBER(S):** 102226

**PROJECT LOCATION:**

Statewide

**PROJECT DESCRIPTION:**

This project is intended to study the collection of probe data from specially instrumented vehicles augmented with other situational data which will be used to determine road surface conditions for improving roadway operations and populate the data stream for the Data Use Analysis Processing (DUAP) and DUAP 2 projects.

This project will coordinate with other MDOT IntelliDrive<sup>SM</sup> research projects to evaluate and determine how instrumented vehicles that detect slippery road conditions and pavement roughness can be used to track the environmental state surrounding a vehicle as it moves down the road. Also, determine how weather information and road surface conditions can be used to improve various MDOT business processes, practices, and outcomes. Data collected from vehicles will be uploaded to the server supporting DUAP and DUAP 2. Lastly, this research will bring together dynamic mobility data with other situational data to meet specific use cases and user needs defined in DUAP 2.

**ANTICIPATED SERVICE START DATE:** January 31, 2011

**ANTICIPATED SERVICE COMPLETION DATE:** January 31, 2014

**PRIMARY PREQUALIFICATION CLASSIFICATION(S):**

Intelligent Transportation Systems (ITS)

**SECONDARY PREQUALIFICATION CLASSIFICATION(S):**

none

**DBE REQUIREMENT:** 0%

## **MDOT PROJECT ENGINEER MANAGER:**

Steven J. Cook, P.E.  
Michigan Department of Transportation  
Construction and Technology Division  
8885 Ricks Road  
P.O. Box 30049  
Lansing, MI 48009  
Work: 517-636-4094  
Cell: 517-204-3099  
Fax: 517-322-5664  
cooksj@michigan.gov

### **PART I - GENERAL INFORMATION**

#### **PURPOSE**

To develop probe vehicle data collection platforms to receive situational and environmental data that more effectively, efficiently, and accurately predict weather and road surface conditions for safety, mobility and asset management purposes. Data collected from VIDAS will be used to enhance and support the DUAP and DUAP 2 project applications and compliment current DOT's maintenance, planning, asset management, and operations data collection programs.

#### **Questions**

Questions relative to the scope of services must be submitted by email to the MDOT project manager (PM). Any question(s) must be submitted at least five working days prior to the proposal due date and time. All questions and the answers will be placed on the MDOT website as soon as possible after receipt of the question(s). The name of the vendor submitting the question(s) will not be disclosed.

### **PART II - WORK STATEMENT**

#### **BACKGROUND**

The Michigan Department of Transportation (MDOT) implemented a Roadway Weather Information System (RWIS) in the MDOT Superior & North Regions. RWIS is one element of the statewide Intelligent Transportation System (ITS), consisting of remote Environmental Sensor Stations (ESS) that together form an information system which gathers and transmits weather information to stakeholders. The information may include atmospheric (temperature, wind direction and speed, precipitation, air pressure, etc.), roadway (temperature, pavement conditions, treatment, etc.), and sub-surface (frost depth) characteristics. Other ITS elements can be co-located with an ESS site to further leverage the power and communications required to support the site including vehicle detection and CCTV surveillance cameras.

MDOT's Superior and North Regions are faced with significant operational challenges during the winter months due to numerous lake effect snow and ice events. Also, the large geographical territory and numerous terrains make it difficult to optimize maintenance activities for cost and safety. Implementing RWIS throughout the Superior & North Regions provides a greater density of real-time weather data along state highways which enables users such as the National Weather Service (NWS) to more accurately forecast and monitor road-weather conditions. Improving road-weather monitoring and forecasting will allow roadway maintenance agencies to enhance the efficiency and effectiveness of their weather related services particularly during the costly winter months. Ultimately, the benefits of RWIS data will result in reduced agency expenditures and safer highways which are objectives of the MDOT Strategic Plan and the ITS Strategic Plan.

MDOT continues to be a leader in the development of IntelliDrive<sup>SM</sup> systems. IntelliDrive<sup>SM</sup> primarily focuses on increasing roadway safety and mobility through vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) applications. MDOT continues to work on IntelliDrive initiatives to collect V2I data to provide a better understanding of how IntelliDrive<sup>SM</sup> data can be used to support and enhance the management of a DOT's assets. This data can provide better travel and maintenance information related to road surface conditions. In addition to current MDOT initiatives, MDOT is dedicated to expanding the IntelliDrive infrastructure to demonstrate other applications that improve how data is collected and managed for asset management purposes and to make transportation safer, smarter, and greener.

The focus of this project is to further establish alignment with MDOT's IntelliDrive<sup>SM</sup> Strategic and Business Plan. Some of the strategy goals are to improve safety, mobility, asset management and planning through the support, deployment, and use of IntelliDrive<sup>SM</sup> technology. With these objectives in mind, MDOT's IntelliDrive research and development initiatives to date have primarily focused on various data collection systems and test beds that will help better define standards and refine applications to align with user needs.

## **DESCRIPTION OF WORK**

The consultant shall apply a systems engineering approach for the project. This will require the consultant to provide a concept of operations, requirements, architecture, design, and applications as to how hardware, software and telecommunication needs of the project will come together to allow scalability of future vehicle integration and device interoperability. Also, allow sufficient flexibility so vehicles can connect to available MDOT IntelliDrive<sup>SM</sup> access points (APs) or test beds for data upload to the DUAP and DUAP 2 server. The data collection equipment used in the vehicles must be interoperable and interchangeable between vehicles and different vehicle types and manufactures. All meta-data, hardware, software, programming, operations, and maintenance of the devices/sensors installed in the vehicles must be specified and documented as part of the systems engineering process.

The consultant will be responsible for the procurement, installation, selecting the correct equipment (including vehicle type), testing and validation of the sensors and wireless communication methodology used to collect data from the vehicles as they are operated within Michigan. Data collected from the vehicles will be used to further develop use cases within DUAP and determine how this data can be used to support and enhance current data collection systems within MDOT for purposes for safety, mobility and asset management.

Existing Michigan and MDOT test beds must be used for data backhaul from the vehicles to DUAP and DUAP 2. The consultant must work directly with the consultants responsible for DUAP and DUAP 2 to ensure data frequency, format, and packet size collected in this project are compatible with current data received by DUAP and DUAP 2. Also, twelve (12) new road side equipment (RSE) must be installed at locations to be determined by the Project Manager based on recommendations by the consultant. These new RSEs must be compatible with the current Michigan and MDOT test beds and will be used as data backhaul for this project.

### **Phase I Testing and Validation:**

In Phase I of this project, quality assurance/quality control testing must show that instrumentation of the probe vehicle using the selected devices/sensors will collect the project data sets required and promptly upload data to the DUAP and DUAP 2 server. See Task 1.2 Specifications and Procurement of Equipment for the specific data sets that must be collected. All Phase I tasks should be completed within the first eight months of the project to allow two full years of data collection during Phase II.

Phase I shall include, but not be limited to, the following:

- Recommend any additions and/or changes that may be needed to conduct a more thorough investigation of this project with the Project Manager.
- Develop systems engineering documents as described above.
- Conduct a literature review and itemize required procurement of equipment (i.e. device/sensors)
- Install and validate operation of equipment in the probe vehicles.
- Collect, analyze, and compare data from the existing ESS sites and available data from other weather sources (i.e. MDOT frost depth measurements, National Oceanic and Atmospheric Administration (NOAA), National Weather Services (NWS), etc.). Provide recommendations to the Project Manager as to how these types of weather data resources might be augmented with vehicle data collection systems to enhance data streams to the vehicle and DUAP/DUAP 2 while supporting user needs within MDOT.
- Coordinate all equipment, sensors, communication devices, data needs, and data backhaul with the consultant managing the DUAP and DUAP 2 projects.
- Determine equipment to use on board the vehicles, mounting location on the vehicle (devices installed in a manner to withstand three (3) years of daily use, wear, and tear), calibrate the equipment and provide a demonstration to the Project Manager that the devices will function correctly during Phase II, including data uploading from the vehicle to DUAP and DUAP 2 server.
- Supply a vehicle for Phase I testing and deployment demonstrations. This will require demonstrating to the Project manager that a fully equipped vehicle with sensors can collect data as specified in this RFP and upload that data, using an existing RSE, to DUAP/DUAP 2. The vehicle must be fully functional and capable of collecting and uploading data to DUAP/DUAP 2 before Phase II commences.
- Propose vehicles to be used for the project to the Project Manager for approval. Ensure the data provided from the vehicle Controller Area Network (CAN) bus provides the broadest spectrum of data required to meet the needs of DUAP and DUAP 2.
- Provide a draft written report with executive summary, description and findings, conclusions, recommendations, and lessons learned no later than 8 months after the

notice to proceed for phase I. This report is required to document the activities, systems engineering process and findings in Phase I.

- Provide a final written report no later than 30 days after comments are returned on the draft report for phase I.

## **Phase II Vehicle Deployment**

Phase II will consist of at least two full driving years (2011/2012 and 2012/2013) of data collection and analysis using at least five (5) probe vehicles. During Phase II, the consultant shall provide and prepare a test plan to verify proper installation and operation of the equipment in the vehicles before full deployment of the probe vehicles. Devices used for instrumentation/data collection for this project must be interoperable and interchangeable between vehicles, capable of being used in a field environment, tested and correlated for consistency and interoperability against other known devices that are routinely used to collect road surface and atmospheric condition data (i.e., accelerometer versus laser profilometer). Each probe vehicle will be instrumented with an accelerometer that measures movement in the XY&Z directions and Global Positioning System (GPS) equipment to determine and record location of the measurement. Together, the accelerometer and GPS data will provide information to determine road surface quality, such as, severity of pot holes and transverse cracks at specific locations along a roadway for identification, validation, and asset management purposes. The probe vehicles will also be equipped with instrumentation enabling them to provide wireless transmission of vehicle status to the DUAP and DUAP 2 server. To allow capture of desired Controller Area Network (CAN) Bus signals, a CAN Bus interface will be configured specifically for the probe vehicles selected. All data shall be organized, formatted, and delivered to the DUAP and DUAP 2 server. Data delivery to the DUAP and DUAP 2 server shall be coordinated with the consultant managing the DUAP and DUAP 2 projects in a format that's compatible with current data formats such as Comma Separated Value (CSV), Extensible Markup Language (XML), binary, etc..

The data collection sensors (On-Board Diagnostic Device (OBD), GPS, etc) must be easily installed and not interfere with normal operation of the car or distract the driver. Units must be durable and resilient as they could be moved from probe vehicle to probe vehicle. Any external wiring must be securely attached and have strain relief connections to prevent detachment.

Phase II shall include, but not be limited to, the following:

- Should begin after Phase I is complete.
- Coordinate all efforts of the projects data collection and backhaul with the consultant managing the DUAP and DUAP 2 projects.
- Install twelve (12) new fully functional RSEs compatible with existing systems at locations recommended by the consultant for the Project Manager's approval. These RSEs should be capable of receiving data uploaded from vehicles as they drive by or park near the devices and delivery the data to the DUAP and DUAP 2 projects.
- Supply passenger vehicles, insurance, gas, maintenance, drivers licensed in the State of Michigan, schedule and devices for the driving portion of this project. On a monthly basis, provide the schedule to the Project Manager to review for approval prior to deploying the probe vehicles. The schedule shall include as a minimum:
  - The days of the week the probe vehicles will be in operation collecting data
  - The routes and estimated number of miles the probe vehicles will be traveling

- Install, test, and calibrate the devices to confirm functionality on all vehicles prior to deployment.
- Conduct driving tests and collect data. Equipment in the vehicles should not be installed in such a manner as to create “driver distraction” events and/or safety hazards for the driver, other motorists, and passengers.
- Provide administrative and technical support as required to deploy, collect, analyze, validate, report and explain the findings of this study to the satisfaction of the Project Manager.
- Process data weekly to determine validity of data collected.
- Data collected from on vehicle devices will be in a format acceptable to the DUAP and DUAP 2 projects, and submitted to the consultant managing the DUAP and DUAP 2 project. Data should be uploaded daily to the DUAP and DUAP 2 project via wireless data packets transmitted via MDOT Access Points and/or via other mutually agreeable format or test beds (for example; USDOT proof of concept Develop Test Environment 55 Road Side Equipment in Detroit and/or combination Access Point (AP) and cellular phone telecommunication backhaul and the twelve (12) new RSEs specified here in). Use a mixture of AP/RSE sites for data backhaul.
- Document location of sensors on the probe vehicles.
- Determine and document if accuracy of data collected by the vehicle changes with vehicle speed.
- Document all hardware and software used.

Daily data collected from the vehicles must be automatically uploaded to an AP (Wi-Fi) for the DUAP and DUAP 2 projects. APs are available in Michigan at various locations. The consultant will coordinate with the Project Manager which APs will be used for data upload. The consultant is responsible for coordinating and configuring the device/sensors to allow data transfer using the APs. The data collection devices on the vehicles must have a SD card (min. 2GB (Gigabytes)) that is capable of supporting and storing several thousand miles worth of data.

RWIS data, vehicle based data (weather and pavement ride quality) and data from other sources, including the NWS, shall be collected, properly formatted, time-stamped, stored, and correlated with the vehicle based data to determine if probe vehicles equipped with mobile sensors can be used to enhance the collection, reporting, and dissemination of road-weather information for various MDOT business processes, practices, and outcomes.

Supporting data sources for these applications include:

- *Vehicle CAN-bus messages:* as a minimum: vehicle speed, latitude/longitude, direction/heading, time/date, Anti-lock Brake System ABS Activation, Traction Control Activation, Stability Control Activation, Accelerometer (X, Y and Z coordinates), wipers status, external lights status, engine speed, throttle position, mass air flow, brake pedal position/pressure, outside temperature ambient air, road surface temperature, barometric pressure, humidity, etc. (see expanded list under tasks below).
- *Weather information:* RWIS, National (NWS and Clarus), Maintenance Decision Support System (MDSS), Southeast Michigan Snow and Ice Management (SEMSIM), Southeast Michigan Council of Governments (SEMCOG), MDOT Automated Vehicle Location and other local weather sources.
- *Actual Road Surface Conditions:* as a minimum: road type, grade, road surface material, icy road treatment status, curve radius/location, wet or dry road surface, icy conditions,

snow and/or snow and icy conditions, weather conditions at the time of the observation, time, date and location, etc.

- *GIS Road database:* road type, grade, road surface material, icy road treatment status, curve radius/location, bridge overpass location/grades, etc.

## **Key Tasks**

It is recommended that the respondents to this RFP include a planned list of expanded deliverables to add to the suggested lists below (i.e., alert systems between vehicles used for the project, shared data set between vehicles, expanded data sets not listed here in or proposed in DUAP, DUAP 2, Signal Phase and Timing (SPaT) data, etc.). The following tasks detail the main areas of interest. Due to the complex nature of this project, tasks are presented in as logical an order as possible. The proposals should address, through the systems engineering process, how best to organize these elements to ensure that the final product has the greatest chance of success.

## **CONSULTANT'S RESPONSIBILITIES:**

### **Task 1.0 Phase I**

Phase I will include the completion of an analysis to determine the feasibility of using probe vehicles equipped with mobile sensors to enhance collection, reporting, and dissemination of road-weather information for various MDOT business processes, practices, and outcomes.

#### **Task 1.1 Literature Review, Technology Research and Systems Engineering**

The Consultant will conduct a review of relevant literature and current research efforts to assess the state-of-the-art in probe vehicle and RWIS/ESS data collection, validation, and usage for detecting road surface conditions. The Consultant shall review other programs with similar objectives to identify findings that may be useful for this project including but not limited to MDOT's overall Strategic Plan, MDOT's IntelliDrive Strategic and Business Plan, MDOT's ITS Strategic Plan and the American Association of State Highway and Transportation Officials (AASHTO) IntelliDrive<sup>SM</sup> Strategic Plan. The Consultant shall present a technical memorandum with recommendations to the Project Manager regarding technologies and changes in project approach based on the findings of this research.

Prepare Systems Engineering documents for this project. This should include but not be limited to a Concept of Operations, Requirements, Architecture, Design, and pro-type applications that describe how a fully operational IntelliDrive<sup>SM</sup> vehicle would be used to collect data to meet the business needs of a DOT.

#### **Task 1.2 Specifications and Procurement of Equipment**

The Consultant, under direction of the Project Manager, will specify and procure passenger vehicles equipped with specialized and/or after market and/or newly developed device/sensor equipment for this project. The Consultant shall identify and specify equipment that will collect as a minimum the following data. This list should be expanded and/or modified based on user needs generated by the DUAP and DUAP 2 projects. The Consultant shall coordinate all work in this project with the consultant(s) responsible for the DUAP and DUAP 2 projects:

- Time
- Date
- Latitude
- Longitude
- Elevation
- Heading
- Speed
- Fog
- Visibility
- Ambient Air Temperature
- Barometric Pressure
- Humidity
- Precipitation Type and Density (rain, snow, sleet, freezing rain, fog, blowing snow, etc.)
- Wind Speed
- Wind Direction
- Pavement Temperature
- Pavement Condition (dry, wet, icy, slushy, standing water, snow, etc.)
- Pavement Chemical Concentration
- Wiper – front of vehicle
- Vehicle Exterior Light
- Rain Sensor
- Sun Sensor
- Engine speed
- Throttle position
- Mass Airflow Sensor
- Brake pedal position/pressure
- Traction Control
- Stability Control
- ABS actuation
- Brake Applied
- Steering Wheel Angle
- Steering Wheel Rate of Change
- Vertical Acceleration
- Longitudinal Acceleration
- Lateral Acceleration
- Yaw Rate
- Brake Boost Applied
- Others as suggested by the Consultant and PM

Prior to procuring this equipment, the Consultant shall conduct a technology assessment and prepare specifications including hardware/software/meta-data for presentation to the Project Manager to review for approval.

### **Task 1.3 Quality Assurance/Quality Control (QA/QC) Plan**

The Consultant is tasked with the development and maintenance of a QA/QC Plan. The Consultant will provide quality assurance/quality control for all tasks and work products on this project according to the Consultant's QA/QC practices.

### **Task 1.4 Procurement and Installation of Equipment**

The consultant will procure all of the equipment needed including the five (5) passenger vehicles and twelve (12) RSEs needed for this project. The in-vehicle devices will be approved by the Project Manager prior to installation in the project vehicles. The installation will utilize equipment that will be able to withstand three (3) years of use and "wear and tear" without defect or failure. The installation shall be done professionally installed such a manner that an operator or maintainer could not damage the equipment/device or be distracted by it.

### **Task 1.5 Testing, Validation and Correlation of the Equipment**

The consultant shall test the accuracy of all equipment and devices that will be used on this project. Use existing devices that are currently used by industry to collect data to test the accuracy of devices proposed for the vehicle. For example, laser profilometry equipment can be used to qualify the accuracy of an accelerometer used to collect road surface roughness. The equipment and devices that will be used for data collection shall be interoperable between each other and existing RSEs and APs in the field.

### **Task 1.6 Complete Draft Phase I Feasibility Report**

The Consultant shall analyze the data collected and produce a white paper report outlining the findings and submit to MDOT for review.

### **Task 1.7 Complete Final Phase I Feasibility Report**

The Consultant shall receive comments from MDOT on the draft report and the consultant produce a final report outlining the findings and addressing the comments received from MDOT.

### **Deliverables, Phase I (within first 8 months after project award):**

- Provide white paper on literature review.
- Systems Engineering documents (Con-ops, Requirements, architecture, etc.).
- Provide a list of proposed equipment including hardware/software that meets the requirements of Task 1.2.
- Submit a QA/QC Plan to the Project Manager.
- Requirements listed in Phase I.
- Submit final reports as stated in Phase I and Task 1.6 and 1.7.

### **Task 2.0 Phase II**

Phase II will develop and test the concept of using probe vehicles equipped with mobile sensors to enhance road weather and road surface condition information in order to improve MDOT business processes, practices, and outcomes.

### **Task 2.1 Collect Data**

The consultant shall utilize the equipped passenger vehicles to drive and collect data suggested here in and to meet DUAP and DUAP 2 data user needs. The consultant shall submit a data collection plan to include schedule, locations, data collection in inclement weather, ride quality sections and overall procedures based on lessons learned in Phase I and the consultant's technical knowledge for the Project Manager to review for approval prior to starting data collection efforts.

### **Task 2.2 Implementation Plan/Strategy**

The consultant shall provide an implementation plan/strategy that describes how several hundred vehicles could be used to collect data for mobility, weather and asset management purposes. This should include different scenarios for using a fleet of vehicles to provide data acquisition for supporting a DOT's pavement management system and data collection systems.

### **Task 2.3 Submit Reports**

The consultant will submit the draft Phase II, year 1 report, receive comments from MDOT and produce and submit the final report for Phase II, year 1.

### **Deliverables, Phase II:**

- Complete the Systems Engineering documents as needed from Phase I (Con-ops, Requirements, Architecture, etc.).
- Provide a final list of proposed equipment including hardware/software that meet the requirement of Task 1.2.
- Document location and type of equipment/devices used on vehicles.
- Document location and type of RSEs used.
- Provide an implementation plan/strategy as described in Task 2.2.
- Prepare a draft written year-2 report no later than December 1, 2012.
- Prepare a final written year-2 report no later than 30 days following comments received from Project Manager.
- Submit a final year-2 report by February 15, 2013
- Prepare a draft written final project report no later than December 1, 2013.
- Prepare a final project written report no later than 30 days following comments received from Project Manager.
- Submit a final Project Report by January 31, 2014.
- Each report shall include an executive summary, scope and description of work, findings, and lessons learned conclusions, and recommendations. The Final Project Report shall also help answer the question as to how expanded probe vehicle deployment might be achieved for collecting road weather and road surface condition data that will improve MDOT business processes, practices, and outcomes.

### **Assistant Project Manager**

The Consultant, under direction of the MDOT Project Manager, will assist with Project Management activities which consist of organizing and managing this project with other support services such as system documentation, project coordination, scheduling, cost control, inventory control, vehicle procurement, and performance reporting as defined below.

#### **Prepare and Maintain Schedule**

Consultant(s) shall provide information on their internal method for scheduling and controlling the project to the Project Manager. The Consultant will prepare and submit a project schedule. Major milestones, responsibilities, and delivery dates should be shown on this schedule along with other information required by the Project Manager.

#### **Manage Subconsultants**

Consultant will coordinate, manage, and monitor the performance of subconsultants. The subconsultant coordination meetings will be conducted on an as needed basis. The Consultant will maintain and organize any subconsultants used on the project to effectively complete all required tasks assigned to them and their team. This includes coordinating any on going work with other MDOT projects, like DUAP to ensure data communications and needs are accomplished as described here in.

#### **Prepare Progress Reports and Invoices**

The Consultant will prepare monthly progress reports in a format that will include a summary of the work conducted on each task during the previous month, the work anticipated for the upcoming month, percent complete for major tasks and responsibilities, problems encountered and required MDOT actions.

#### **Vehicles**

**Vehicles proposed for this project shall be owned and operated by the consultant. The consultant will be responsible for all liability associated with the use of the vehicles for the duration of the project.**

**Equipment installed on the vehicles will be the property of MDOT. The Consultant shall coordinate with the Project Manager where this equipment should be sent after project completion. Ensure all equipment is in good operating order and all software and hardware needed to operate the devices are documented for future vehicle use. These devices may be installed on vehicles once this project is complete.**

#### **Conduct Quality Assurance/Quality Control (QA/QC) Activities**

This task includes conducting QA/QC of all tasks and work products including interim and major deliverables. Documents will be checked for understandability, readability, and accuracy. All plan comments and revisions will be documented and tracked.

### **Maintain Project Records and Files**

The team will maintain and organize project records, correspondence, files and deliverables for access by MDOT. The Consultant will maintain and organize project records, correspondence, files and deliverables in both electronic and hard copy.

### **Coordination**

This task covers coordination with the Project Manager, and other work related to this effort. The Consultant will also work with other consultants as deemed necessary by the Project Manager. Monthly Project Review Meetings are to be scheduled and conducted by the Consultant in coordination with the Project Manager. A full written monthly status report will be provided to the Project Manager for review. The status report will contain the meeting minutes, current project status, current schedule, and on-going work effort for the next month. Following review, the monthly status report will be sent to a distribution list of recipients. The Consultant shall comply with all applicable Federal and State laws, rules, and regulations. The Consultant shall perform field operations in accordance with Michigan Occupation Safety and Health Administration (MIOSHA) regulations and accepted safety practices. The Consultant will notify the Project Manager, in writing, prior to any personnel changes from those specified in the Consultant's original approved proposal. Any personnel substitutions are subject to review and approval of the Project Manager. Also, the consultant will be responsible for providing full insurance coverage for the test vehicles for the duration of the project.

### **MDOT RESPONSIBILITIES:**

- A. Perform lead Project Manager responsibilities
- B. Provide notice to proceed.
- C. Provide primary point of Contact.
- D. Grant and assist with site access.
- E. Provide documentation of existing RSEs and APs.
- F. Communicate project changes.
- G. Coordinate access to infrastructure, assist with scheduling, provide current pavement roughness, and RWIS systems that MDOT has available to complete the deliverables described.
- H. Assistance with coordinating DUAP and DUAP 2 efforts with the project. It will be the consultant's responsibility to coordinate day to day activities of DUAP and DUAP 2 to accomplish the requirements specified here in.

### **CONSULTANT PAYMENT – Actual Cost Plus Fixed Fee:**

Compensation for this project shall be on an **actual cost plus fixed fee** basis. This basis of payment typically includes an estimate of labor hours by classification or employee, hourly labor rates, applied overhead, other direct costs, subconsultant costs, and applied fixed fee.

All billings for services must be directed to the Department and follow the current guidelines. The latest copy of the "Professional Engineering Service Reimbursement Guidelines for Bureau of Highways" is available on MDOT's website. This document contains instructions and forms that must be followed and used for billing. Payment may be delayed or decreased if the instructions are not followed.

Payment to the Consultant for services rendered shall not exceed the maximum amount unless an increase is approved in accordance with the contract with the Consultant. Typically, billings must be submitted within 60 days after the completion of services for the current billing. The final billing must be received within 60 days of the completion of services. Refer to your contract for your specific contract terms.

Direct expenses, if applicable, will not be paid in excess of that allowed by the Department for its own employees in accordance with the State of Michigan's Standardized Travel Regulations. Supporting documentation must be submitted with the billing for all eligible expenses on the project in accordance with the Reimbursement Guidelines. The only hours that will be considered allowable charges for this contract are those that are directly attributable to the activities of this project.

The use of overtime hours is not acceptable unless prior written approval is granted by the MDOT Region Engineer/Bureau Director and the MDOT Project Manager. Reimbursement for overtime hours that are allowed will be limited to time spent on this project in excess of forty hours per person per week. Any variations to this rule should be included in the priced proposal submitted by the Consultant and must have prior written approval by the MDOT Region Engineer/Bureau Director and the MDOT Project Manager.

The fixed fee for profit allowed for this project is 11.0% of the cost of direct labor and overhead.