

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

MDOT PROJECT MANAGER			JOB NUMBER (JN)	CONTROL SECTION (CS)
DESCRIPTION				
MDOT PROJECT MANAGER: Check all items to be included in RFP WHITE = REQUIRED GRAY SHADING = OPTIONAL			CONSULTANT: Provide only checked items below in proposal	
Check the appropriate Tier in the box below				
TIER I (\$25,000-\$99,999)	TIER II (\$100,000-\$250,000)	TIER III (>\$250,000)		
			Understanding of Service	
			<i>Innovations</i>	
			<i>Safety Program</i>	
N/A			Organizational Chart	
			Qualifications of Team	
			Past Performance	
Not required As part of Official RFP	Not required As part of Official RFP		Quality Assurance/Quality Control	
			Location: 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		Presentation	
N/A	N/A		Technical Proposal (if Presentation is required)	
3 pages (MDOT Forms not counted) (No Resumes)	7 pages (MDOT Forms not counted)	19 pages (MDOT Forms not counted)	Total maximum pages for RFP not including key personnel resumes	

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 _____

Prequalified Services – See page ___ of the attached Scope of Services for required Prequalification Classifications.

Non-Prequalified Services - 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. **Form 5100J is required with Proposal for firms not currently prequalified with MDOT**

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	PROPOSAL/BID DUE DATE	TIME DUE
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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

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

MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION

5100D – Request for Proposal Cover Sheet

5100J – Consultant Data and Signature Sheet (Required only for firms not currently prequalified with MDOT)

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

Michigan Department of Transportation

**SCOPE OF SERVICE
FOR
MULTI-MODAL TRANSPORTATION SERVICES**

Chicago – Detroit/Pontiac Passenger Rail Corridor Investment Plan

CONTROL SECTION(S): N/A

JOB NUMBER(S): N/A

MDOT PROJECT ENGINEER MANAGER:

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MDOT PROJECT COORDINATOR:

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Michigan Department of Transportation
Bureau of Transportation Planning
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ANTICIPATED SERVICE START DATE: January, 2012

ANTICIPATED SERVICE COMPLETION DATE: January, 2014

PRIMARY PREQUALIFICATION CLASSIFICATION(S):

Prime consultant must be prequalified in at least one of the following states/classifications:

MICHIGAN Environmental Assessment and Impact Statements – Surface Transportation
ILLINOIS Environmental Reports (Environmental Impact Statement)
INDIANA Environmental Document Preparation – EA/EIS

SECONDARY PREQUALIFICATION CLASSIFICATION(S):

Consultant team must be prequalified in all of the following states/classifications:

Michigan Project Development Studies
 Railroad Bridges
 Road Design Surveys
 Structure Surveys
 Hydraulic Surveys
 Photogrammetry
 Photogrammetric Control Surveys

Illinois Railway Engineering
 Location Design Studies (New Construction/Major Reconstruction)
 Structures (Railroad)

DBE REQUIREMENT:

The use of DBE firms is encouraged on this project. Any participating DBE firms used should be listed in the Proposal. DBE Program information and a current DBE directory can be found at www.michigan.gov/mdotdbe.

PROJECT DESCRIPTION:

The Michigan Department of Transportation (MDOT), in partnership with the Illinois Department of Transportation (IDOT), the Indiana Department of Transportation (INDOT), and Norfolk Southern (NS) Railroad, requests proposals for services of a qualified and experienced transportation (planning, environmental and engineering services) consultant or consultant team to complete a Service Development Plan (SDP) and a Federal Railroad Administration (FRA) Tier-1 Environmental Impact Statement (EIS) for the Chicago, Illinois – Detroit/Pontiac, Michigan Rail Corridor.

On April 1, 2010, the FRA issued a Notice of Funding Availability for the High-Speed Intercity Passenger Rail (HSIPR) Program in the *Federal Register*. In response, MDOT submitted an [application](#) on May 19, 2010, which the Secretary of the U.S. Department of Transportation selected to receive funding through a [Cooperative Agreement](#) to develop a Passenger Rail Corridor Investment Plan (PRCIP) for the Corridor.

Because of the complexity of service development programs, extensive preconstruction preparation is required, including service planning, environmental review, conceptual engineering efforts, and design efforts. The first phase of this process, known as the Planning Phase, is the development of a PRCIP consisting of an SDP and a Tier-1 EIS for the *Chicago-Detroit/Pontiac* Rail Corridor Program, including what is commonly known as the South Of the Lake Corridor (SOLC), in compliance with the FRA Procedures for Considering Environmental Impacts [*64 Federal Register 28545 (May 26, 1999)*] and the Council of Environmental Quality's (CEQ) National Environmental Policy Act (NEPA) implementing regulation (*40 CFR, 1500-08*). A PRCIP provides sufficient information to support a future decision to fund and implement a major investment in a passenger

rail corridor and is made up of two components: 1) an environmental analysis of the proposed rail service, which in the case of the *Chicago-Detroit/Pontiac* Rail Corridor, will require completion of a Tier-1 EIS to satisfy NEPA requirements; and 2) an SDP.

The service-level environmental analysis will satisfy the NEPA requirements for federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of proposed actions and reasonable alternatives to those actions. For large-scale rail service development programs, this process begins with studies and documentation that address the broad environmental effects for the entire corridor along the route of the proposed service. FRA has termed this level of environmental review as “Service” NEPA. FRA is the lead federal agency for this environmental review and is therefore responsible for establishing the scope and approach and the class-of-action determination. To assess the environmental impact of proposed actions on the *Chicago - Detroit/Pontiac* Rail Corridor, FRA has determined that a Tier-1 EIS is required. A Tier-1 EIS will examine the various alternatives for implementing the proposed train service, including a no-action alternative; consider transportation options using other modes that could address the transportation need; identify the construction projects necessary to implement those service alternatives; and analyze the types of environmental impacts that may be associated with those projects at a general level of detail.

Following the Draft Tier-1 EIS and the Final Tier-1 EIS, FRA will issue a Record of Decision (ROD). The ROD is a document separate from, but associated with, the Tier-1 EIS that publicly and officially discloses FRA’s decision as to which alternative assessed in the EIS is to be implemented. Although the Tier-1 EIS and ROD will satisfy NEPA requirements, the SDP will articulate the overall scope and approach for the proposed service, addressing the purpose and need of the service, proposed alternatives, operational and financial feasibility, and the discrete capital projects required to implement the service. Subsequent Tier-2 analyses [not a part of this Request for Proposal (RFP)] would examine the various project alternatives for actually constructing the specific projects identified in the Tier-1 document and analyze the site-specific environmental impacts associated with those project alternatives.

Together, the Service NEPA and SDP complete the PRCIP, which would provide sufficient information to support a potential future FRA decision to fund and implement a major investment in the *Chicago - Detroit/Pontiac* Rail Corridor. Acting under MDOT’s management as the Grantee and in close coordination with FRA, NS, IDOT, and INDOT, the Consultant will be responsible for the coordination and monitoring of all aspects of the total project.

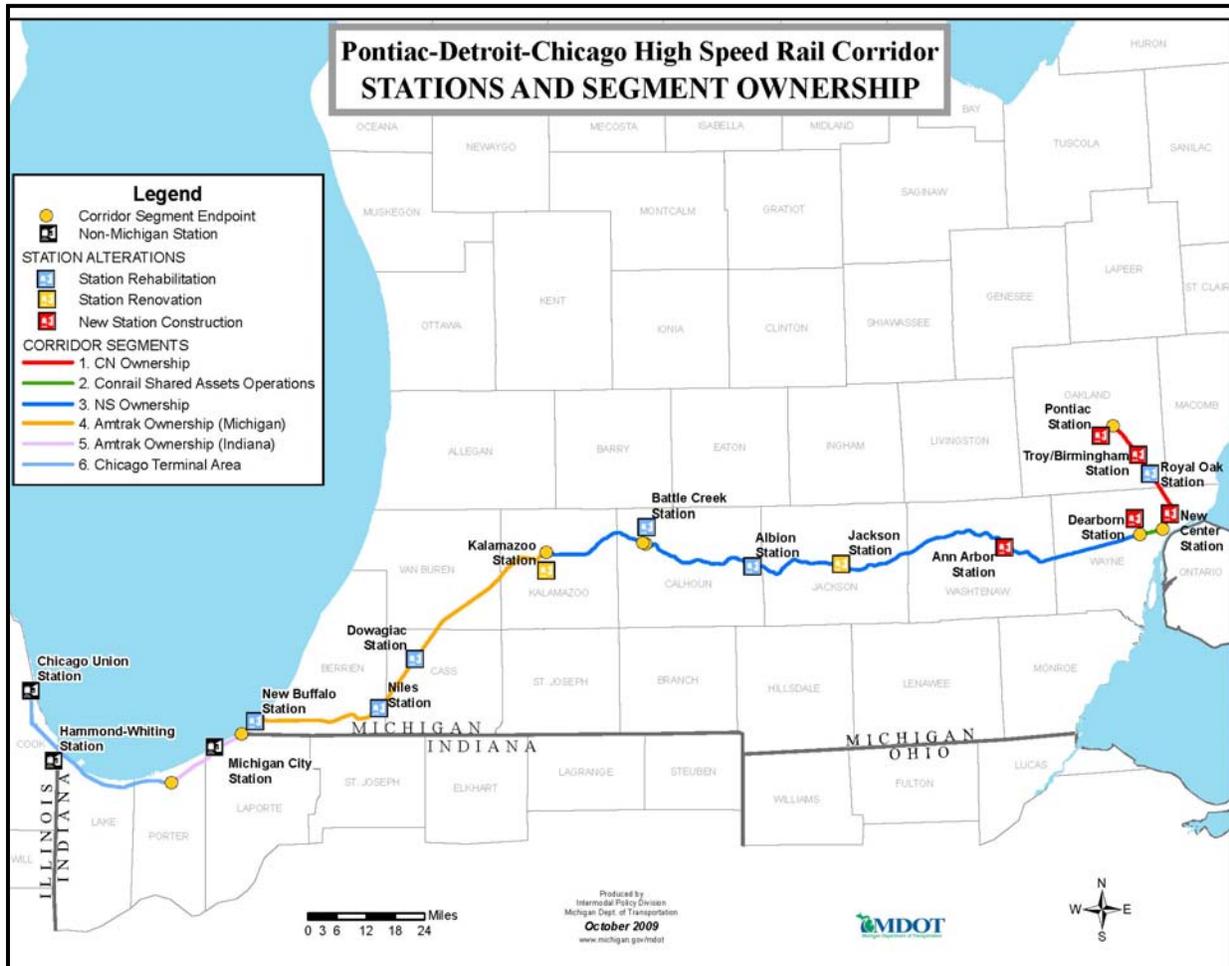
For the purposes of this RFP, the term “Project” means the completion of the Service NEPA and SDP work activities for the construction of the *Chicago - Detroit/Pontiac* Rail Corridor Program. Also for the purposes of this RFP, the term “Corridor Program” means final design and construction work activities for the construction of the passenger rail corridor (see *Appendix A – State Rail Plans*, *Appendix B - Previous Studies/Design Work*, and *Appendix C - Ongoing and Near-Term Corridor Improvements*, for further information).

PROJECT FUNDING:

The Project will be funded from a federal grant [Federal Railroad Administration’s High Speed Intercity Passenger Rail (HSIPR) grant] requiring a match from MDOT, IDOT, INDOT, and NS. Vendors are advised that MDOT does not guarantee award of this contract and that the award is

contingent upon obtaining signed Memorandums of Understanding with NS, IDOT, and INDOT.

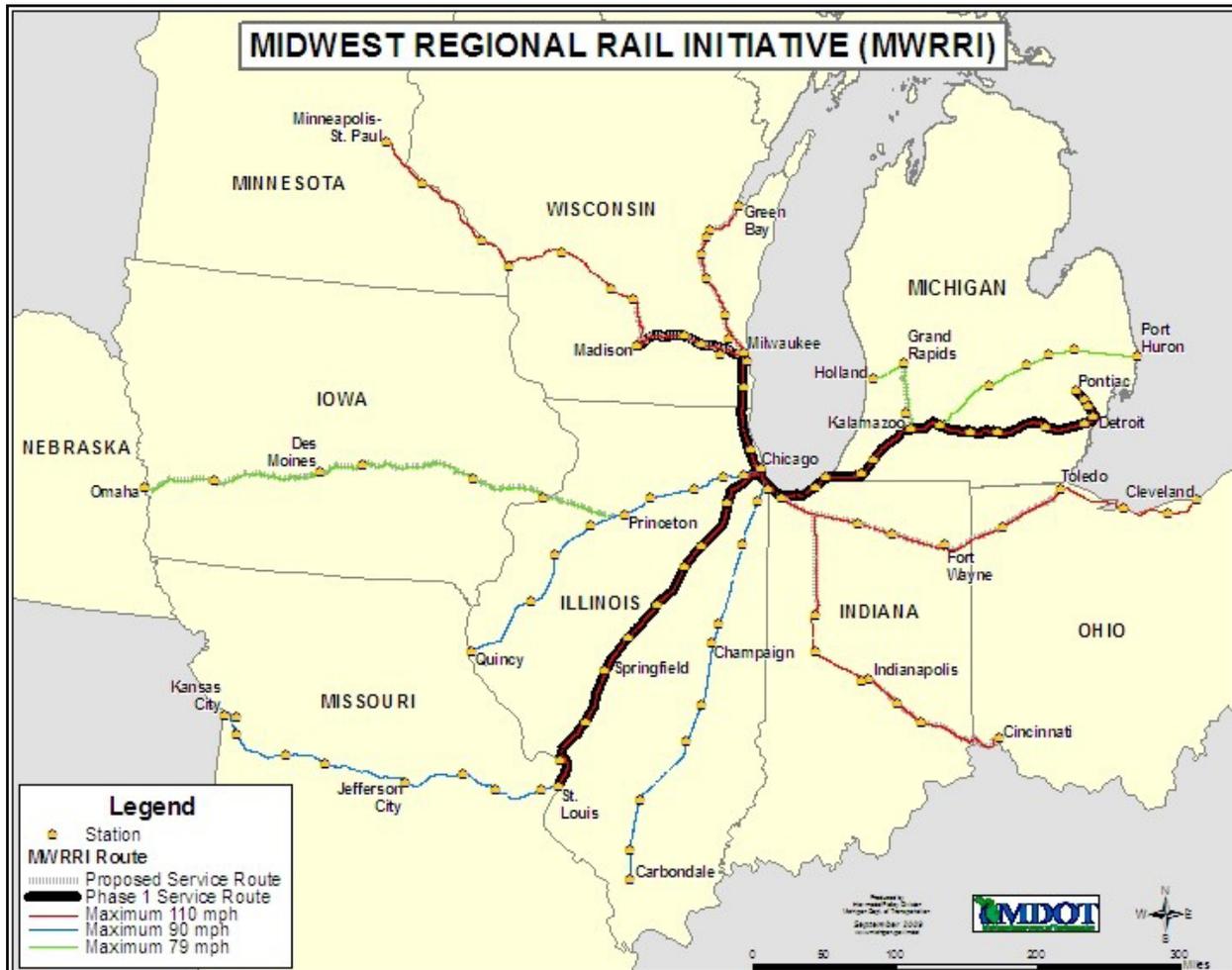
PROJECT LOCATION AND CORRIDOR DESCRIPTION:



The 304 mile corridor between Chicago and Detroit/Pontiac, Michigan is part of the Chicago Hub Network and a federally-designated High-Speed Rail (HSR) Corridor. This existing corridor is also one of several major branches in the hub and spoke passenger rail system centered on Chicago as identified in the Midwest Regional Rail Initiative (MWRRI).

The *Chicago - Detroit/Pontiac* Rail Corridor traverses through 3 states (Michigan, Indiana, and Illinois), with four host railroads [Grand Trunk Western Railroad (CN), Conrail Shared Assets Operations (CSAO), NS, and Amtrak]. Within each state, the passenger rail service travels through many counties and cities. The Illinois portion of the *Chicago - Detroit/Pontiac* Rail Corridor begins at the Illinois/Indiana state line and ends at The Chicago Union Station. This segment of 15 miles is entirely within the City of Chicago & Cook County. The Indiana portion of the *Chicago - Detroit/Pontiac* Rail Corridor is 43 miles in length and begins at the Illinois/Indiana state line, ends at the Indiana/Michigan state line, and includes Lake, Porter, and La Porte Counties, Indiana. Finally, in Michigan, the *Chicago - Detroit/Pontiac* Rail Corridor is 246 miles long, begins at the Michigan/Indiana state line, ends at the Pontiac Station located in Oakland County, Michigan, and travels through the counties of Berrien, Cass, Van Buren, Kalamazoo, Calhoun, Jackson,

Washtenaw, Wayne, and Oakland. Within these counties, the *Chicago - Detroit/Pontiac* Rail Corridor in Michigan serves the cities of New Buffalo, Niles, Dowagiac, Kalamazoo, Battle Creek, Albion, Jackson, Ann Arbor, Dearborn, Detroit, Birmingham/Troy, Royal Oak, and Pontiac.



To ensure that planning considers the interrelationships of the broader rail network, the following segments beyond the *Chicago - Detroit/Pontiac* Rail Corridor will be considered in order to fully inform service development planning and service environmental work:

1. Chicago Union Station
2. Chicago – Toledo – Cleveland (to Porter, IN)
3. Chicago – Indianapolis – Cincinnati (to Porter, IN)
4. Chicago – Grand Rapids (to Porter, IN)
5. Chicago – Port Huron (to Battle Creek, MI)
6. Kalamazoo – Grand Rapids
7. Detroit – Lansing – Grand Rapids
8. Detroit – Toronto
9. Detroit – Toledo – Cleveland



Intercity passenger service in the Michigan portion of the corridor currently includes three daily round trips between Chicago and Detroit/Pontiac (*Amtrak Wolverine Service*), with an additional daily round trip between Chicago and Battle Creek (*Amtrak Blue Water Service*), which continues beyond the corridor to Port Huron.

In Indiana, fourteen Amtrak trains (ten from Michigan and four from points east of Porter in Indiana) traverse the portion of the corridor owned by NS, and ten trains per day operate over the portion owned by Amtrak. In Illinois, these fourteen trains continue operation across both NS and Amtrak ownership segments.

SCOPE OF WORK & DELIVERABLES:

The scope of work is divided into six major tasks and several subtasks, described in detail below. Tasks 1 and 2 include early planning and project management efforts; many of these tasks will

continue throughout the duration of the project. Under Tasks 1 and 2, the consultant will perform planning and project management efforts to include a kick-off meeting, and work closely with MDOT to develop a detailed project management plan and schedule for conducting the subsequent tasks and other tasks associated with ensuring the project is executed on time and within budget. Under Task 3 the consultant will conduct preliminary service planning and prepare other technical information to identify and develop preliminary alternatives. Under Task 4 the consultant will develop a detailed public involvement plan. The deliverables resulting from Tasks 3 and 4 will be used to perform Task 5, the development of the Tier-1 EIS and selection of the preferred alternative, and Task 6, the refinement and finalization of the SDP. Tasks will often overlap, require close coordination, and will be conducted through an iterative analytical process. Tasks will be performed in close coordination with MDOT, FRA, and other state agency funding partners.

Task 1: Project Planning and Kick-off

This task includes all early planning efforts of the project. The term “Project File” refers to files maintained by the consultant during the NEPA process. The agency’s “Administrative Record” includes all relevant studies, data, and documents used by the agency to prepare the NEPA documents considered by the decision-maker (FRA). Courts use the Administrative Record as the basis for reviewing the agency’s NEPA compliance if the process is challenged.

Subtask 1.1 Project Work Plan

The selected consultant will prepare a detailed project work plan itemizing the work tasks necessary for completing the scope of work. The project work plan will include a project team organization chart and other information on the project team, team decision-making processes, roles and responsibilities, interactions with MDOT, FRA, and other state agency funding partners, a detailed project schedule in MS Project, a fully developed Work Breakdown Structure (WBS), budget, standards (graphics, report, and communications) manual, invoicing and progress reporting methods and procedures, a draft public involvement plan, and the scope of work. The project work plan will be reviewed and approved by MDOT, FRA, and other state agency funding partners. The selected consultant will coordinate with MDOT to determine the appropriate electronic format for all project deliverables, which will be documented in the project work plan.

Subtask 1.2 Development and Maintenance of the Project File

The selected consultant will prepare minutes for all meetings attended for this contract, and will provide a copy to the MDOT project manager. Further, the selected consultant will develop and maintain a master Project File of all project activity throughout the course of the project, including key telephone communications, correspondence, media coverage, copies of reports, and other documents. The Project File will serve as the basis for the Administrative Record.

Subtask 1.3 Development and Maintenance of the Administrative Record

The consultant will develop and maintain the Administrative Record throughout the course of the project, consisting of all documents and communications considered throughout the SDP, NEPA and any other associated planning processes. The Administrative Record will be developed and maintained as per *Maintaining a Project File and Preparing an Administrative Record for a NEPA Study* (<http://environment.transportation.org/pdf/programs/PG01.pdf>), *AASHTO Practitioner’s Handbook, July 2006*. Documentation included in the Administrative Record will support decisions and rationale, document the SDP process, and aid interested parties in determining whether the decision-making process was rational and in compliance with NEPA.

The consultant will maintain a working file copy of all original documents, including a searchable master index in Excel format (or as otherwise agreed with the Project Manager) that identifies the contents of the Administrative Record. Upon completion of the SDP process, and electronically at regular monthly intervals, the Administrative Record will be delivered to MDOT. MDOT will be the official custodian of the final Administrative Record, and will be in charge of its long-term maintenance.

Subtask 1.4 Availability of Referenced Material

The consultant is encouraged by NEPA implementing regulations and FRA guidance to incorporate information by reference from existing documents to decrease the volume of the Draft and Final Documents. As such, material that is not directly related to preparing the documents should be incorporated by reference, and included in the Administrative Record. This would include referencing other EIS documents, research papers, technical background papers, or other technical material. However, the referenced documents must be readily available upon request. The consultant will be prepared to provide the materials incorporated by reference in a timely fashion to avoid delay to public review periods.

Subtask 1.5 Creation and Maintenance of the Master Contact List

The consultant will create and maintain throughout the life of the project a Master Contact List recording all stakeholders identified via NEPA-related public involvement activities, stakeholders associated with various compliance processes, local/regional/tribal/State/Federal government contacts, key contacts with civic and business groups, relevant interest groups, present and potential riders/users, and private service providers/shippers.

Subtask 1.6 Project Kickoff

MDOT will host a kick-off meeting with FRA and corridor stakeholders to discuss the project goals, scope, and schedule. The selected consultant will support MDOT by developing the agenda, presentation, and any other necessary materials for this meeting. The agenda for the meeting will include a discussion of the roles and responsibilities for FRA, MDOT, stakeholders and consultants; discussion of the project schedule with major milestones identified; and a discussion of the scoping process and public involvement opportunities.

Task 1 Deliverables

- Project Work Plan
- Project File
- Meeting Minutes
- Administrative Record
- Referenced Material
- Master Contact List
- Project Kickoff Meeting Materials

Task 2: Project Management

Subtask 2.1 Project Management Plan

The consultant will submit an initial, resource-loaded project management plan to MDOT within 30-days of consultant selection which will include the final, negotiated Work Plan/WBS, and summarize major tasks and milestones.

Throughout the project, the consultant will track progress and cost against the baseline project management plan, and maintain up-to-date estimates of schedule and cost to complete remaining tasks.

Subtask 2.2 Monthly Progress Reports

The consultant will provide monthly progress reports to MDOT to be shared with FRA and other state agency funding partners. These reports will include information tracked and maintained by the consultant for *Subtask 2.1*; identify sources of cost and schedule variance as compared to the baseline; major accomplishments; issues; any proposed changes to the WBS and schedule; and an estimated percent completion of each task.

Subtask 2.3 Program Review Meetings

The consultant will participate as required in meetings with FRA and/or other state agency funding partners to review program status on accomplishments, next steps, schedule, and budget.

Task 2 Deliverables

- Draft and Revised Project Management Plans
- Monthly Progress Reports
- Program Review Meeting Materials and Minutes

Task 3: Service Planning and Preliminary Alternatives Development

The purpose of Task 3 is to perform initial service planning and alternatives development such that the consultant can sufficiently complete the Tier-1 EIS and SDP in Tasks 5 and 6. The SDP will articulate the overall scope and approach for the proposed service, addressing the purpose and need of the service, proposed alternatives, operational and financial feasibility, and the discrete capital projects required to implement the service.

Under this task, the consultant will collect, assimilate, and develop a wide array of technical information used to analyze, evaluate, and screen the preliminary alternatives. First, the consultant will identify all possible representative alternatives, and from this list, conduct a feasibility analysis to narrow down the selection to reasonable alternatives. Next, the consultant will evaluate the proposed reasonable alternatives on a range of technical criteria such as benefits realized, capital costs, operational feasibility, multi-modal connectivity, and financial performance to sufficiently define the alternatives to be evaluated in the EIS. The technical analyses from Task 3 form the core of the alternatives analyses and the environmental documentation developed in Task 5, and the final SDP developed in Task 6.

Subtask 3.1 Purpose and Need

The fundamental starting point of any transportation planning effort is the identification of the purpose and need for an improvement to the transportation system service in the market. Under *Subtask 3.1*, the consultant will outline the transportation problems in the *Chicago - Detroit/Pontiac* Corridor in need of a solution. A Purpose and Need statement will provide, at a minimum, a description of the transportation challenges and opportunities in the *Chicago - Detroit/Pontiac* Corridor, based on current and forecasted population, travel demand, and multi-modal capacity conditions. The challenges to be addressed may include, but are not limited to, congestion,

infrastructure capacity, state of good repair, environmental concerns, livability, and economic development. Alternatives to be developed in subsequent analyses must address the purpose and need as described in the Purpose and Need statement.

Subtask 3.2 Develop HSR Corridor Alternatives

Development of alternatives in this task is a concurrent and complementary task to *Subtask 5.2 Refine Alternatives for NEPA Analysis*. Under *Subtask 3.2*, the consultant will describe the transportation system in the *Chicago - Detroit/Pontiac* Corridor and connecting rail network including the required overall endpoints, cities/towns/communities to be served, and various possible alignments connecting identified stations. While “corridor” refers to the general rail network or passenger service routes encompassed within or interfacing with the *Chicago - Detroit/Pontiac* Corridor, “alignments” refers to specific track positions and layouts to meet the needs of the system. The process of defining minimum system requirements, screening criteria, corridor alternatives, and alignments will include input from Amtrak, state and local transportation organizations, infrastructure owners, and the general public. The process will consider previous studies and plans and also utilize information gleaned from geographic information systems (GIS) such as land use, environmental characteristics, and topography, information on current and future population, and existing intercity and local transportation assets. General screening data such as populations served and approximate corridor length will be provided initially, to be followed by more detailed and precise analysis that provides data on potential track locations, length and curvature, special structures, and right-of-way ownership. Map depictions of the alternatives will similarly be provided in increasing level of detail appropriate to the analysis, from a high-level scale (1” = 500’) for early conceptual work to a more detailed scale (1” = 100’) for refinement and selection. The consultant will take the following steps to define the corridor alternatives:

3.2.1 *Establish Screening Criteria.* Working closely with MDOT, FRA, and other state agency funding partners, the consultant will develop screening criteria that will be applied in an initial screening of alternatives. The screening factors used by the consultant will include some combination of the following:

- Major environmental impact concerns
- Conservation of land and natural resources
- Enhanced regional mobility and access through connections to high-density centers; the potential for economic development efficiencies through agglomeration and compact development near stations
- Integration of the project with supportive land use and urban form to include enhanced livability through physical connectivity of the transportation network, especially for public transport passengers and pedestrians as well as social and public health improvements through increased access to employment and services
- Increased ridership
- Improved travel time, frequencies, on-time performance, and reliability
- Constructability
- Right-of-way availability and physical route characteristics
- Compatibility with other existing and planned rail services
- Safe operating conditions
- Capital and operating costs

3.2.2 *Develop Initial Preliminary Alternatives.* MDOT and the consultant will

establish the initial preliminary alternatives to which the above screening criteria are applied. The consultant will draw heavily on prior studies and include identifying existing alignments that may be used, and alternative new alignments and combinations thereof. An important piece of any preliminary alternative will be the South of the Lake Route portion; for a detailed analysis of previous work evaluating possible alignments through northeastern Illinois and Northwestern Indiana, see *MWRI Phase 7 - South of the Lake Route Alternatives Analysis Report – (April 2011)*: http://www.michigan.gov/documents/mdot/mdot_south_lake_route_analysis_rpt_354612_7.pdf. MDOT and the consultant will work closely with FRA and other state agency funding partners to establish desired service areas for the alignments within the *Chicago - Detroit/Pontiac* Corridor. These include but are not limited to the desired intercity service, desired regional service, station locations, and connections to feeder services. Additionally, MDOT and the consultant will confer with impacted railroads, regional metropolitan planning organizations, and local transit agencies regarding station locations and connectivity issues. These alternatives will be graphically depicted and also described in narrative form. The consultant will consider all alternatives for the proposed service, including a no-action alternative.

3.2.3 *Screening Preliminary Alternatives.* Using the screening criteria described in 3.2.1 above, the consultant will prepare a preliminary alternatives development report describing the process followed; the initial preliminary alternatives considered; graphics and narrative descriptions of those alternatives; a screening matrix based on the criteria developed above; identification of those alternatives screened out and why; identification of those alternatives carried forward for further study; and documentation for why those alternatives are being advanced. The consultant, in conjunction with MDOT and FRA, will dismiss unreasonable alternatives from further study with supporting justification. Not all alternatives are reasonable or practicable. Reasonable alternatives meet the purpose and need of the service development program and reflect input received from the scoping process.

3.2.4 *Documentation of Alternatives Development Process.* The consultant will assemble a draft Alternatives Development Report that will document the process and factors leading up to the selection of alternatives that will go into the Tier-1 EIS for further analysis.

Subtask 3.3 Forecast Baseline Trip-making

The consultant will provide a description of the regional transportation challenges and opportunities based on current and forecasted travel demand and capacity conditions for the rail, aviation, and highway modes. The consultant will describe assumptions, data collection, and surveying methods used to quantify the existing travel market at the zone pair and station pair levels and provide forecasts of the travel market for a 20-year period. A 20-year planning horizon is chosen, to be consistent with all FRA capital commitment funding agreements. Documentation will include the manner in which exogenous growth (e.g., related to general economic, employment, or population growth), has been accounted for in the model and estimates.

Subtask 3.4 Ridership Forecasts/Travel Demand

The consultant will estimate ridership and revenues for each of the alternatives being considered. The reported output will include origin-destination trip tables suitable as input for other elements of the planning and environmental assessment process. The ridership report will also include pricing assumptions, including the rationale and basis for including or excluding both revenue-maximizing and public benefit-maximizing pricing models, and travel time-related assumptions, including frequency, reliability, and schedule data for the service. The revenue estimates will also provide base and forecast year auxiliary revenue, including, but not limited to, food and beverage revenue, station concessions, advertising, and mail and express package revenue.

Subtask 3.5 Develop Ridership Model

The consultant will document the modeling methodology and approach used to forecast passenger rail demand and revenues. The model documentation will address topics including, but not limited to, access and egress times, user characteristics (such as population, employment, and income), trip characteristics (such as trip purpose, trip length, and travel mode), model sensitivities (such as oil prices, auto congestion, and fare structure), market share (auto, bus, air, rail), and feeder and complementing modes (intercity bus, local bus, light rail). It will also consider alternative system configurations, service levels, service features (such as travel time, on-time performance, and modern equipment), and capacity (such as restraints imposed by consist size, station design, and system configuration). The model documentation will include the mode choice model structure (such as logit-nested diagrams), the model calibration and validation process, and the resulting equations and derived elasticities.

Subtask 3.6 Specify Train Equipment Options

The consultant will develop and describe a range of train equipment options that can be selected for the various alternatives. The descriptions will be of specific consist configurations and can then be matched to one or more of the alignment alternatives included in the operations modeling and screening analyses. The descriptions will include motive-power (locomotive or multiple-unit), characteristics (e.g., weight, horsepower, tractive effort, etc.), non-powered equipment characteristics (e.g., consist lengths in units and distance, trailing tonnage, etc.), and any use of distributed power, electronically controlled pneumatic (ECP) braking systems, or other practices and characteristics affecting train performance and cost. The consultant will provide baseline acceleration rates and braking curves for all trains included in the operations modeling, consistent with the consist characteristics described. The consultant will also describe seating capacity, classes of service, and other service options (baggage, café car, bicycle storage, etc.) that affect capacity and thus revenue. The consultant will develop cost estimates for each equipment option, supported by a detailed description of the methodology and assumptions used in developing the estimates. The consultant will include values and sources of unit costs along with design, acquisition, or other overhead costs.

Subtask 3.7 Develop Operating Plans

The consultant will develop an operating plan for each alternative, including a description of the underlying analysis, railroad operation simulations, and equipment and crew scheduling analyses, which in turn reflect such variables as travel demand and rolling stock configuration. The modeling will include all rail activity in the corridor, including freight and commuter rail. Outputs of this task are base case and alternative-specific timetables for existing and new intercity passenger rail service and commuter rail service, and operating windows or schedules, if applicable, for rail freight and other activities (e.g., maintenance of way). The analysis will include both revenue operations and all

scheduled or likely non-revenue (deadhead) movements. The planning horizon should be consistent with the anticipated useful lives of the improvements to be introduced.

3.5.1 *Modeling Methodologies.* The consultant will describe in detail the railroad operations simulation models and methodologies used, including the method through which potential infrastructure improvement were identified and incorporated into the modeling effort. Specifically, the consultant will describe how stochastic operations variation, in terms of operational reliability of scheduled rail service, operational variability of non-scheduled rail service, and equipment and infrastructure reliability, has been incorporated into the modeling effort.

3.5.2 *Operating Timetables.* The consultant will provide base case and alternative-specific schedules for existing, new service and commuter rail service, and operating windows or schedules, if applicable, for rail freight and other activities (e.g., maintenance of way). The consultant will include both revenue operations and all scheduled or likely non-revenue (deadhead) movements.

3.5.3 *Equipment Consists.* The consultant will describe the equipment consist for each alternative described in Task 3.2.

3.5.4 *Rail Infrastructure Characteristics.* The consultant will describe the origin of the rail infrastructure network employed in the operations modeling, including whether or not it was provided by the infrastructure owner or independently developed. The consultant will describe any major infrastructure-related assumptions employed in the operations modeling, including signal system characteristics, maximum unbalance, and turnout speeds.

3.5.5 *Outputs.* The consultant will provide detailed outputs from the operations modeling of all base case and alternative scenarios, including service trip times, stringline (time and distance) diagrams, delay matrices, and train-performance calculator speed and distance graphs, and energy consumption.

3.5.6 *Equipment and Train Crew Scheduling.* The consultant will provide outputs of equipment and train crew schedule modeling, demonstrating how equipment and train crews will turn at endpoints, and the total equipment and train crew resources required to meet each modeled operating timetable. The consultant will derive the equipment and train crew requirements from and consistent with ridership trip tables, load factor assumptions, service frequency, trip times, and trainset capacity.

3.5.7 *Terminal, Yard, and Support Operations.* The consultant will provide outputs of detailed modeling of operations at major terminals, demonstrating the adequacy of identified platform tracks, pocket tracks, yard capacity, and maintenance of equipment facilities to meet the requirements of each modeled operating timetable.

Subtask 3.8 Estimate Capital Costs for Each Corridor Alternative

The consultant will provide a description of the infrastructure improvements and the estimated costs for each discrete service implementation alternative. The level of detail will increase as the analysis proceeds from the initial conceptual engineering level for many alternatives, to preliminary

engineering and a more detailed description of alternatives selected for further consideration in the Alternative Development Report. Cost estimate reports will provide unit cost and quantities at the appropriate level of detail in constant dollars. In addition to the core track structures, the cost estimates will include all required construction or improvements of bridges, communications, signaling, stations, parking facilities, land acquisition, maintenance facilities, any new facilities or upgrades required for HSR operational control and management offices, all design and construction management allowances, and contingencies. The consultant will present estimated capital costs for projects and project groups, with documentation of assumptions and methods. Initial capital expenditures estimates to bring the service to its full operating capability, to accommodate future traffic growth, and ongoing expenditures for replacement of system components will be included. The consultant will also develop proposed phased implementation plans that can result in service improvements that have independent utility and reflect constructability considerations. The implementation plans will include annual expenditure estimates accounting for contingencies and inflation to support financial planning. Finally, the consultant will estimate any additional ongoing capital costs beyond those incurred in the initial implementation of the service, that are anticipated to be required due to lifecycle replacement or other factors through the 20-year planning horizon of the investment.

Subtask 3.9 Estimate Annual Operations and Maintenance Costs

The consultant will develop an operations and maintenance (O&M) costing model and show its reasonableness in comparison with Amtrak and other passenger rail systems. The consultant will prepare estimates of O&M costs for each phase of the planned intercity passenger rail service. The O&M cost estimates will include all operating expenses for the train service, including maintenance of way, maintenance of equipment, train movement, passenger traffic, and services such as marketing, reservations/information, station, and on-board services, and general/administrative expenses. The estimates should reflect potential operational savings achieved through implementing environmental sustainable building and infrastructure. Cost-sharing arrangements with infrastructure owners and other rail operators will also be reflected in the analysis.

Subtask 3.10 Develop a Phased System Development Plan and Schedule

The consultant will develop and present proposed implementation schedules that describe the time-phasing of the capital investments required for the new HSR service for each alternative. If there are long intervals (more than a few months) anticipated between phases of the capital investment, the plan/schedules should also include descriptions of any interim operations scenarios.

Subtask 3.11 User and Non-User Benefits

The consultant will develop the methodology for performing a comprehensive benefit-cost analysis (BCA) for the selected alternatives. The BCA will cover 20 years of operation to properly reflect the long-lived infrastructure and long-term benefits of the initial capital expenditures. The methodology will include user and non-user benefits and, to the extent readily quantifiable, the estimated economic value of those benefits, with particular attention to job creation and retention, and potential energy savings.

Task 3 Deliverables - Service Planning Documents and Preliminary Alternatives Development

- Draft Purpose and Need Statement
- Draft Alternatives Development Report
- Screening Criteria for Corridor Alternatives
- Capital Cost estimates for each alternative

- Descriptions of train equipment options and associated cost estimates
- Operating Plans for each alternative
- Report documenting methodology and approach used for passenger forecast
- Regional transportation challenges and opportunities
- Estimated ridership and revenue for each alternative
- Operations and maintenance costs for each alternative
- Proposed implementation schedules with phasing plan for each alternative
- Benefit-Cost Analysis for selected alternatives

Task 4: Public Involvement Plan

The selected consultant, in close coordination with MDOT, FRA, and other state agency funding partners, will prepare and implement a Public Involvement Plan (PIP), which will outline and coordinate review with federal, state, and local agencies and the general public as appropriate for preparing the Tier-1 EIS. The PIP will identify key contacts within agencies, the news media, public officials, and the general public; and include the Master Contact List (see *Subtask 1.5*). The PIP will identify public involvement activities and how they will be linked to key milestones in the planning/engineering and environmental analytic process, including:

1. Notice of intent publication and scoping activities.
2. Approval of purpose and need statement.
3. Identification of the range of alternatives.
4. Collaboration and concurrence on impact assessment methodologies.
5. Completion of the Draft EIS, including public hearing(s).
6. Identification of the preferred corridors and the level of design detail.
7. Completion of the Final EIS.
8. Completion of the ROD.

The PIP will also include the Public Participation Plan developed as part of Subtask 5.11.1, which will outline strategies and methods to properly inform and engage the public on a regular basis throughout the project.

Finally, the PIP will contain a series of public involvement and educational activities that will include interactive/informational workshops; educational materials and displays; briefings for federal, state, and local elected officials; small group meetings; media outreach strategy; creation of a public Web page; creation and maintenance of a comment/response database; creation and maintenance of a public outreach database; an agency coordination effort; and assistance to MDOT with a project steering committee (See *Subtask 5.11 Transparency for detailed descriptions of these items*).

Task 4 Deliverables:

- Public Involvement Plan, approved by MDOT, FRA, and other state agency funding partners.

Task 5: Tier-1 EIS and ROD Development

The purpose of Task 5 is for the consultant and MDOT to fully consider the environmental impacts of proposed actions, evaluate the reasonable alternatives to those actions in the EIS document, select a preferred service alternative, and for FRA to publicly and officially disclose FRA's decision as to which alternative assessed in the EIS will be implemented, thereby satisfying federal requirements under NEPA. Under Task 5, the consultant will perform multiple subtasks required to develop a Tier-1 EIS for the *Chicago - Detroit/Pontiac* Corridor. In close coordination with the analyses conducted under Task 3, the consultant will examine the various alternatives for implementing the proposed train service, consider transportation options using other modes that could address the transportation need, identify the construction projects necessary to implement those service alternatives, analyze the types of environmental impacts that may be associated with those projects at a general level of detail, and propose mitigation as appropriate.

Subtask 5.1 Conduct NEPA Scoping

Under this subtask, the consultant will conduct a scoping period with a length of 30 calendar days. The scoping process provides persons affected by the proposed action an opportunity to express their views and concerns. Scoping information is also important to help determine the most likely potential impacts to be studied as part of the environmental review. The consultant is encouraged to consult with appropriate federal, state, and local authorities, as well as the public, at the earliest practicable time. The consultant, in conjunction with MDOT, will develop the public involvement and agency coordination plan for the development of the Tier-1 EIS at the beginning of the process under Task 4. Scoping activities begin with developing and publishing a Notice of Intent (NOI) to prepare an EIS, and are followed by several other tasks aimed at soliciting input from the public, agencies, and other stakeholders to understand the potential impacts and other significant issues relating to the proposal. Information presented during scoping will describe the proposed corridor, identify the need and goals for the study, and indicate the possible alternatives identified for consideration within the environmental document. During scoping, the consultant will also consider the 20-year planning horizon for the corridor. Considering information gathered during scoping, MDOT and the consultant may refine the purpose and need statement and alternatives.

5.1.1 *Develop and Issue Public Notices.* The consultant will place a notice in local newspapers. The purpose of the notices will be to (1) inform the public about the *Chicago - Detroit/Pontiac* Corridor and announce that FRA is assembling a NEPA document; (2) request comments on the scope of the environmental review and identify interested parties for a mailing list; and (3) notify the public of a time and place for a public scoping meeting(s). The FRA will be responsible for all appropriate publications of Federal Register notices. The consultant will develop draft and final versions of a NOI, to be published in the *Federal Register* by the FRA, that informs the public about the Chicago to Detroit high-speed rail project; the details of the scoping process; instructions for submitting comments and attending meetings; information on how to obtain additional information on the *Chicago - Detroit/Pontiac* high-speed rail project; and a press release, to be published in relevant local press, that presents similar information as the NOI but in slightly more detail and in reader-friendly language.

5.1.2 *Develop Scoping Package.* The consultant will develop draft and final versions of a scoping package that presents a description of the proposed and/or alternative corridor(s); identifies the need and goals for the study; indicates the possible initial

alternatives identified for consideration within the environmental document to solicit input from the public, agencies, and other stakeholders on these topics; the potential impacts of the proposal; and other significant issues relating to the proposal. The consultant will be responsible for producing electronic and hard copies as necessary in order to accommodate a reasonable distribution of the scoping package to online venues and venues local to significant population centers along the corridor. For both agency and public scoping meetings, the consultant will develop agendas, meeting materials, presentations, and manage logistics. The consultant will provide for the collection of comments at the meetings, record meeting minutes, and after review by MDOT, develop final drafts of meeting minutes for the Administrative Record.

5.1.3 *Conduct Agency Scoping.* In each state through which the planned corridor is to pass, the consultant will host an agency scoping meeting in the city nearest to the corridor. However, adjustments to the number and location of agency scoping meetings may be made depending on logistics and actual corridor alignments. The consultant will establish, through work initiated at the kickoff meeting, the appropriate agencies to be involved and points of contacts at those agencies. The consultant will supply invitation letters and scoping packets to the agencies and will maintain responses.

5.1.4 *Conduct Public Scoping.* During the kickoff meeting, the requirement for public scoping meetings will be discussed in the context of the public informational opportunities and workshops. A decision will be made regarding the number and location of scoping meetings. The consultant will advertise the public scoping meetings as appropriate and with at least 2 weeks advance notice.

5.1.5 *Scoping Comment Summary.* The consultant will collect comments through the U.S. Government www.regulations.gov docket, mail, fax, and email. The consultant will prepare a Scoping Comment Summary. The summary will list each issue identified during the public involvement process and illustrate the item with key statements created by the analyst, using the words of the commentators to the extent possible. The consultant will document responses in table format with an explanation or a brief indication of how the comment content will be reflected or addressed in the NEPA process. The summary table will be a tool used in the alternative development process.

Subtask 5.2 Refine Alternatives for NEPA Analysis

Development of alternatives in *Subtask 3.2* is a concurrent and complementary task to the task of refining alternatives for the Tier-1 EIS. As described in *Subtask 3.2.3*, the consultant will develop a draft Alternatives Development Report. After agency and public comments are obtained from the scoping meetings, the consultant, MDOT, FRA, other state agency funding partners, and project stakeholders will conduct an alternatives development meeting to define the set of proposed alternatives for further analysis in the Tier-1 EIS. The consultant will prepare a presentation, posters, and accompanying handouts to use at the alternatives development meeting, as well as provide all materials needed to facilitate. The results of the alternatives development meetings will be documented in an updated Alternatives Development Report. As noted in *Subtask 3.2.3*, this report will include all relevant information about the alternatives analysis process, including lists of

significant issues, preliminary alternatives, screening criteria, alternatives initially considered but dismissed from further analysis, and alternatives that are to undergo detailed analysis in the Tier-1 EIS.

Subtask 5.3 Prepare Preliminary and Draft Tier-1 EIS Document & Section 4(f) Analysis

Under *Subtask 5.3*, the consultant will conduct an environmental impact analysis and focus on the likely environmental effects for the entire corridor relating to the type of service being proposed for the identified range of reasonable alternatives. The consultant will include impacts associated with:

- Route alternatives
- Cities and stations served
- Train service levels
- Train technology
- Train operating speeds
- Ridership projections
- Major infrastructure components

At the Tier-1 stage of NEPA compliance, the consultant will conduct the analysis at a general level of detail for the corridor. As noted in the background section of this RFP, as the area of potential impact can be more specifically defined, the consultant will conduct more detailed impact analyses at the site-specific level. The Tier-2 stage, also called the “Project” NEPA, is not included in this RFP. In conducting the impact analysis required for the Tier-1 EIS, the consultant will also undertake appropriate additional studies as necessary in order to properly describe the environmental impacts of the rail project alternatives.

The consultant will consider the following aspects of potential environmental impacts in the preparation of the Tier-1 EIS:

- Air quality
- Water quality
- Ecological systems
- Impacts on wetlands areas
- Impacts on endangered species or wildlife
- Flood Hazards and floodplain management
- Coastal zone management
- Use of energy resources
- Use of other natural resources, such as water, minerals, or timber
- Aesthetic and design quality impacts
- Possible barriers to the elderly and handicapped
- Land use, existing and planned
- Environmental justice
- Public health
- Public safety, including any impacts due to hazardous materials
- Recreational opportunities
- Use of 4(f)-protected properties
- Environmental sustainability
- Impacts on the socioeconomic environment, including the number and kinds of available jobs; the potential for community disruption and demographic shifts; the need for and availability of relocation housing; impacts on commerce, including existing business districts, metropolitan areas, and the immediate area of the alternatives; and impacts on local

government services and revenues.

- Impacts on transportation of both passengers and freight by all modes, including the bicycle and pedestrian modes; in local, regional, national, and international perspectives; and including impacts on traffic congestion.
- Locations of historic, archeological, architectural, or cultural significance, including, if applicable, consultation with the State Historic Preservation Officer.
- Construction period impacts
- Operation period impacts

As noted previously, material developed under Task 3 will be used in developing the Tier-1 EIS. Specifically, the consultant will use ridership forecasts to consider how other modes of transportation may be impacted, and operations analysis to consider how other rail operations will be impacted. Cost and revenue estimates, and other relevant factors, will be used to examine socioeconomic impacts of the proposed high speed rail line. Additionally, the consultant will follow the *FRA High-Speed Ground Transportation Noise and Vibration Impact Assessment Manual* to conduct noise and vibration studies. The consultant will also quantify air quality and climate change impacts in order to address construction effects and show potentially beneficial impacts from high-speed rail.

In general, site-specific studies, including those for cultural resources, water resources, and examinations of biological impacts, are not required at the Tier-1 level, but the consultant will consider general impacts associated with high-speed rail using remote sensing data and field reconnaissance. At the direction of MDOT, the consultant may be required to perform some studies to analyze the impacts along the proposed corridor and identify potential mitigation strategies. The consultant will ensure all assumptions and data sources are clearly explained in final reports associated with each study. Once established, the consultant will undertake the necessary steps as required by law and FRA implementing policy to (a) achieve compliance with the relevant Act and (b) streamline that compliance with the NEPA process. In most cases, the consultant will be required to write at the earliest practicable time a letter officially initiating the compliance process with the relevant government agency or agencies; separately maintain contact with the agency, including conducting meetings if necessary, in regards to potential impacts to the particular resource in question for each regulation; undertake additional examinations of impacts if they could be potentially significant; and conduct appropriate consultation for a Tier-1 study with the relevant agency for each regulation through completion. In addition to conducting all required compliance actions, the consultant is expected to maintain appropriate documentation of compliance activities for each regulation as part of the Administrative Record for this project.

The consultant will prepare the Tier-1 EIS as per CEQ guidance and in accordance with FRA's *Procedures for Considering Environmental Impacts* [64 Fed. Reg. 28545 (May 26, 1999)]. The consultant will provide an annotated EIS outline for MDOT/FRA review and approval, as well as draft, draft-final, and final chapters of the Draft Tier-1 EIS for review and comment throughout the development process. The following text briefly outlines several sections of the NEPA document.

1. Purpose and Need. The consultant will edit the Purpose and Need with form and format modified as appropriate for use in the Tier-1 NEPA document.
2. Alternatives Development. The consultant will summarize the actions leading up to the finalization of the alternatives. This includes a description of all reasonable alternatives and

the analysis that defined the alternatives, as well as describing the “No Action” alternative. The consultant will reference the Alternatives Development Report to reduce the volume of this section.

3. *Affected Environment.* The consultant will present a description of the natural, cultural, and socioeconomic resources for all impact categories potentially affected by the proposed action in the Affected Environment Section. In order to satisfy various other environmental compliance requirements, the consultant may need to further describe specific aspects of the environment through specialized studies regulations.
4. *Environmental Consequences.* The consultant will present an analysis of the natural, cultural, socioeconomic, and cumulative impacts for all potential impact categories listed in FRA’s *Procedures for Considering Environmental Impacts [64 Fed. Reg. 28545 (May 26, 1999)]* in the Environmental Consequences section. The discussion will focus on the extent of the impacts, both beneficial and adverse, and include direct, indirect, and cumulative impacts, as well as the duration—short-term and long-term—and must convey to the reader the context and intensity of the impact. Pursuant to NEPA regulations (*40 CFR 1500-1508*), effects will be evaluated based on the criteria of context and intensity. Context means the affected environment in which a proposed project occurs. The severity of the effect is examined in terms of the type, quality, and sensitivity of the resource involved; the location and extent of the effect; the duration of the effect (short- or long-term); and other considerations of context. Intensity means the degree or magnitude of a potential adverse effect where the effect is thus determined to be negligible, moderate, or substantial.
5. *Unavoidable Impacts and Mitigation Strategies.* The consultant will provide a summary of the potential unavoidable adverse impacts and potential mitigation strategies to be applied at Tier-2 level in the Unavoidable Impacts and Mitigation Strategies section. The consultant will form conclusions about specific impacts and mitigation measures through Tier-2, site-specific NEPA documentation.
6. *Section 4(f) and 6(f) Consultation.* In this section, the consultant will identify all Section 4(f) and 6(f) resources on or very close to the proposed alternatives and the relative potential impacts of the alternatives on these resources. For this Tier-1 EIS, the primary goal of the analysis is the identification of Section 4(f) and 6(f) resources; at this stage, it is not practical or required to study and measure the severity of each potential impact identified. As such, no fieldwork will be conducted as part of this analysis.
7. *Compliance with Other Special Purpose Laws, Executive Orders, and Regulatory Requirements.* In this section, the consultant will note compliance with other special purpose laws, executive orders (EO), and regulatory requirements. For *EO 13514*, FRA has an opportunity to adopt a federal leadership role by applying environmental sustainability requirements applicable to federally owned and operated facilities over rail projects. In addition, CEQ proposes that NEPA incorporate federal, state, and local greenhouse gas (GHG) reduction (*CEQ 2010 Memo - Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*). Northeastern states have aggressive GHG reduction goals (*RGGI MOU, 2005*), and FRA has the opportunity to align NEPA analysis with regional climate change regulations.

8. *Coordination, Consultation, and Public Involvement.* In this section, the consultant will include a summary of coordination, consultation, and public involvement, including scoping comments and responses. To supplement this portion of the NEPA document, a public participation summary document will be referenced in this section of the Tier-1 EIS document. The public participation summary document will be maintained throughout the entire NEPA process in order to document all public participation activities including meetings, consultations, workshops, and correspondence with agencies and other stakeholder groups. Depending on the extent of events and comments, the public participation summary document will include a short summary of all actions for each public participation activity; a summary list of how the activity was publicized to the general public; a summary list of material made available outside of any meetings that may have taken place and exactly how it was made available; for any meeting conducted, the agenda, meeting minutes, handouts, presentation materials, attendance sheets, and any references to oral comments; and a copy of all comments received.

Subtask 5.4 Preliminary and Draft Tier-1 EIS.

The consultant will edit and format the entire Preliminary Draft Tier-1 EIS (including supporting appendices). To ensure the highest level of accuracy and completeness, a rigorous Quality Assurance/Quality Control (QA/QC) review of the preliminary Draft Tier-1 EIS will be completed by MDOT and the consultant. The QA/QC team will be made up of senior NEPA practitioners. After MDOT and consultant QA/QC review, the Preliminary Draft Tier-1 EIS will be submitted to the FRA for review and comment. This Preliminary Draft document will be provided in an unbound hard copy and in .docx file format on a Compact Disc (CD). The consultant will incorporate comments from MDOT and FRA into the Preliminary Draft Tier-1 EIS. This Preliminary Draft document will be provided to FRA in unbound hard copies and in .docx file format on six CDs.

Subtask 5.5 Printing and Distributing the Draft Tier-1 EIS

The consultant will print and distribute bound hard copies and electronic copies (on CD, in Section 508- compliant PDF format) of the Draft Tier-1 EIS. The Draft Tier-1 EIS will be circulated to interested parties and to depositories, as well as consulting agencies, including the EPA, together with an invitation to comment on the Draft. The distribution list will be developed and maintained by the consultant under *Subtask 1.5 – Creation and Maintenance of the Master Contact List*. Placement on the public Web site will be accomplished by the consultant under *Subtask 5.11.3 – Public Web Site*. The consultant will develop the Notice of Availability (NOA) for comment by MDOT and FRA. Once MDOT and FRA comments are incorporated into the NOA, the consultant will publish the NOA in newspapers as well as placing the announcement on the public Web site. FRA will submit the NOA to the EPA filing station for publication in the Federal Register.

Subtask 5.6 Public Hearings

Following publication of the Draft Tier-1 EIS and during the comment collection period, the consultant will conduct public hearings on the project. The consultant is responsible for all related logistics and will provide a stenographer at each public hearing. The number of public hearings and locations will be determined by the consultant with approval by MDOT and FRA. All materials will be delivered to MDOT and FRA for comment at least three weeks before the hearings. The consultant will develop, prepare, and produce the posters and poster stations for the public hearing, as well as accompanying handouts to use at these hearings. Electronic files of appropriate documents should be placed on the public Web site after approval by MDOT and FRA.

Subtask 5.7 Collect and Incorporate Comments on Draft Tier-1 EIS Document

Compilation of all responsible comments into the Final Tier-1 EIS document is part of the NEPA process, and the consultant will consider all appropriate public comments in the Final Tier-1 EIS document. The consultant will summarize appropriate comments and responses in a Public Comment Summary Document. In addition, the consultant will address any unresolved significant issues in the Draft Tier-1 EIS. Prior to incorporating the responses to comments, the consultant will provide the Public Comment Summary Document to MDOT and FRA for review and comment. The summarized comments and responses will be in .docx format. After comments are received from MDOT and FRA, the consultant will incorporate the Public Comment Summary Document into the Final Tier-1 EIS. After the comments are incorporated into the Final Tier-1 EIS, the document will be provided to the FRA for review and comment. Each of the review copies will be provided in unbound hard copies and in .docx file format on six CDs.

Subtask 5.8 Distribute Final Tier-1 EIS

The consultant will incorporate MDOT and FRA comments into the Final Tier-1 EIS and distribute the Final Tier-1 EIS to the public and appropriate agencies. The consultant will provide Section 508-compliant PDF files for all Draft and Final documents to be posted on the MDOT website.

Subtask 5.9 Section 106 Consultation

This will occur simultaneously with the NEPA process to the extent possible. The State Historic Preservation Officer (SHPO) and/or appropriate Tribal Historic Preservation Officer (THPO) and other appropriate agencies will be contacted and consulted by the FRA. This task will serve to conduct initial consultation with the SHPOS and THPOs to inform them about the project and to involve them as stakeholders in the process. The consultant will prepare all materials needed for consultation, but the actual consultation will be initiated by the FRA. The consultant will incorporate the results of the 106 compliance into the NEPA document.

Subtask 5.10 Prepare NEPA Decision Document

The consultant will develop a Draft ROD for review and comment by MDOT and FRA. The Draft ROD will include a description of the proposed action and the environmental information necessary to support the decision. Any site-specific Mitigation Plans will be part of the Draft ROD. Alternatives will be discussed to show, if appropriate, that some alternatives were initially considered but found to be not practical based on select screening criteria. The alternatives section will discuss practical program level alternatives, and a summary analysis of the environmental impacts of the alternatives will be identified. The document will show evidence of consultation with appropriate federal, state, and local officials. After incorporating comments by MDOT and FRA on the Draft ROD, the consultant will prepare a Final ROD for execution by the FRA.

Subtask 5.11 Transparency

The consultant will provide a well-developed and executed public informational program. This is not to be confused with the NEPA requirements of EIS scoping or a public hearing, but rather, this task is intended to increase transparency of the project. The objective of these efforts is to encourage early, open, and continuous engagement. Events held as part of this task will be included in the Public Participation Summary.

5.11.1 Prepare Public Participation Plan (PPP). The consultant will prepare a PPP to be approved for implementation by MDOT. The PPP will outline strategies and methods to properly inform and engage the public on a regular basis throughout the

project. The PPP will be included in the Public Involvement Plan developed in *Task 4*.

5.11.2 Newsletter. A quarterly newsletter will be produced by the consultant for approval by MDOT. This newsletter will be posted on the public Web site (see *Subtask 5.11.3*), mailed to the project mailing list, and e-mailed to those who have signed up to receive the newsletter electronically.

5.11.3 Public Web Site. The consultant will develop and maintain a public Web site that will identify up-to-date information on the project, allow downloading of public documents germane to the project, and identify internet links to pertinent information.

5.11.4 Master Mailing List. Based on public and agency requests for information, the consultant will be responsible for establishing and maintaining a master mailing and email list of interested stakeholders. The list will be on a searchable database (see *Subtask 1.5 – Master Contact List*).

5.11.5 Public Workshops. The consultant will provide public workshops as necessary that will entail progress to-date and future plans.

5.11.6 Public Participation Summary. As with the Scoping Comment Summary, the consultant will develop and maintain a Public Participation Summary throughout the entire NEPA process in order to document all public participation activities, including meetings, consultations, workshops, and correspondence with agencies and other stakeholder groups. The summary will include, but is not limited to, a short summary of all public participation activities, and separately for each public participation activity; a summary list of how the activities were publicized to the general public; a summary list of material made available outside of any meetings that may have taken place and exactly how it was made available; for any meeting conducted, the agenda, meeting minutes, handouts, presentation materials, attendance sheets, and any references to oral comments; and a copy of all comments received.

Task 5 Deliverables

- NEPA Scoping Materials and Report
- Draft and Final Notice of Intent (NOI)
- Scoping Comment Summary
- Updated Alternatives Development Report for Tier-1 EIS
- Annotated EIS Outline
- Preliminary Draft, Draft Final and Final Tier-1 EIS Chapters
- Final Purpose and Need Statement
- Preliminary and Draft Tier-1 EIS
- Draft and Final Notice of Availability (NOA)

- Public Hearing Materials
- Public Comment Summary and Refinement of Draft Tier-1 EIS document
- Draft Final and Final Tier-1 EIS document
- Materials for Section 106 consultation
- Draft and Final Record of Decision
- Public Participation Plan, quarterly newsletter, project website, mailing list of stakeholders, workshop materials, and Public Participation Summary

Task 6: Create a Service Development Plan

The consultant will produce a SDP for the final selected service alternative identified through Tasks 3 and 5. The SDP is a document that describes the major aspects of the proposed service required to support a funding decision. The SDP will describe only the preferred alternative, relying on and summarizing the analytical methodologies employed in, and outputs resulting from, work performed under Tasks 3 and 5. The *Chicago - Detroit/Pontiac* Corridor SDP will lay out the overall scope and approach for the proposed service by clearly demonstrating the purpose and need for new or improved HSIPR service; analyzing alternatives for the proposed new or improved HSIPR service and identify the alternative that would best address the identified purpose and need; demonstrating the operational and financial feasibility of the alternative that is proposed to be pursued; and describing how the implementation of the HSIPR SDP will be divided into discrete phases. The paragraphs below describe the specific elements and content that the consultant will include in the *Chicago - Detroit/Pontiac* Corridor SDP.

Section 1: Transportation Need

In the Purpose and Need section, the consultant will outline the transportation problem in need of a solution, and will provide, at a minimum, a description of the transportation challenges and opportunities faced in the markets to be served by the proposed service, based on current and forecasted travel demand and capacity conditions.

Section 2: Rationale

In the Rationale Section, the consultant will demonstrate how the proposed new or improved HSIPR service will cost-effectively address transportation and other needs. The rationale will be based on current and forecasted travel demand and capacity condition. This section will demonstrate how the proposed service can cost-effectively address transportation and other needs. Drawing from the analyses conducted under Task 3, the consultant will consider multimodal system alternatives (highway, air, other, as applicable), including a qualitative and quantitative assessment of the costs, benefits, impacts, and risks of the alternatives. The rationale section will also explore synergies between the proposed service and large-scale goals and development plans within its service region and communities.

Section 3: Planning Methodology

The SDP will clearly describe the basic elements of the methodology used in developing the plan. This may address a wide array of topics, but at a minimum, it will address the 20-year planning horizon utilized, any major, cross-cutting assumptions employed throughout the SDP, and the level of public involvement in developing the plan.

Section 4: Identification of Alternatives

This section describes the alternative transportation improvements, including HSIPR improvements and improvements to other modes, which have been considered within the SDP as a means of addressing the underlying transportation purpose and need. At a minimum, this section will identify a base case (also known as a “do-nothing” or “do-minimum” case), against which these alternatives have been analyzed within the SDP, and provide a rationale for the selection of the base case.

Section 5: Operations Modeling

This section will describe the underlying operational analyses for the proposed service alternative, including railroad operation simulations and equipment and crew scheduling analyses, which in turn reflect such variables as travel demand and rolling stock configuration. The modeling should include all rail activity in the corridor, including freight and commuter rail, for the 20-year planning horizon. If the proposed service contemplated under the SDP makes use of facilities that would be shared with rail freight, commuter rail, or other Intercity Passenger Rail services, the existing and future characteristics of those services—as developed cooperatively with the rail freight, commuter, and Intercity Passenger Rail operators—should be included as integral elements to the SDP. In particular, the SDP will show how the proposed service will protect the quality of those other services through all planning horizon years. The section on operations modeling should provide information on the following topics and outputs:

- a. *Modeling Methodologies.* Describe in detail the Service Network Analysis models and methodologies used, including the method through which potential infrastructure improvements were identified and incorporated into the modeling effort.
- b. *Operating Timetables.* Provide base case and alternative-specific schedules for existing and new HSIPR service and commuter rail service; and operating windows or schedules, if applicable, for rail freight and other activities (e.g., maintenance of way). Include both revenue operations and all scheduled or likely non-revenue (deadhead) movements.
- c. *Equipment Consists.* Describe the equipment consists for all services included in the operations modeling, including motive-power (locomotive or multiple-unit) characteristics (e.g., weight, horsepower, tractive effort, etc.), non-powered equipment characteristics (e.g., consist lengths in units and distance, trailing tonnage, etc.), and any use of distributed power, electronically controlled pneumatic (ECP) braking systems, or other practices affecting train performance. Provide baseline acceleration rates and braking curves for all trains included in the operations modeling, consistent with the consist characteristics described.
- d. *Rail Infrastructure Characteristics.* Describe the origin of the rail infrastructure network employed in the operations modeling, including whether or not it was provided by the infrastructure owner or independently developed. Describe any major infrastructure-related assumptions employed in the operations modeling, including signal system characteristics, maximum unbalance, and turnout speeds.
- e. *Outputs.* Provide detailed outputs from the operations modeling of all base case and alternative scenarios, including stringline (time and distance) diagrams, delay matrices, and train performance calculator speed and distance graphs.

- f. *Equipment and Train Crew Scheduling.* Provide outputs of HSIPR equipment and train crew schedule modeling, demonstrating how equipment and train crews will turn at endpoints and the total equipment and train crew resources required to meet each modeled HSIPR operating timetable.
- g. *Terminal, Yard, and Support Operations.* Provide outputs of detailed modeling of operations at major terminals, demonstrating the adequacy of identified platform tracks, pocket tracks, yard capacity, and maintenance of equipment facilities to meet the requirements of each modeled HSIPR operating timetable.

Section 6: Station and Access Analysis

This section of the SDP will address the location of the stations to be served by the proposed service, how these stations will accommodate the proposed service, how passengers will access the stations, and how the stations will be integrated with connections to other modes of transportation. Generally, in serving existing stations, detailed planning of station locations is not required. This section of the SDP will provide information on the following topics and outputs:

- a. *Station Location Analysis.* Provide an analysis of potential alternatives for station locations, with the identification of preferred locations. A description of the methodology employed in selecting station locations, including consideration of zoning, land use, land ownership, station access, demographics, and livable community factors such as the relative consideration of center-city and “beltway” type stations. A description of any planned joint use or development of each station facility by other passenger rail operators, other transportation operators such as transit, intercity bus, and air transport, or commercial or residential real estate developments.
- b. *Station Operations.* Provide an analysis that determines the adequacy of station capacity to meet the needs of the service, including platform length, platform and concourse pedestrian capacity, ticketing capacity, compliance with Americans with Disabilities Act (ADA) requirements, and compatibility between station facilities and HSIPR equipment such as platform and equipment floor heights.
- c. *Intermodal Connectivity.* Provide a detailed descriptions of all non-HSIPR passenger transportation operations and services to be integrated into each station, and a description of the degree of integration of intermodal connections with each station facility, including estimates of door-to-door passenger transfer times (excluding waiting, ticketing, and/or check-in time) from one mode to another (e.g., the time it would take to go from the HSIPR service platform to a subway station entrance or an airline check-in counter). Also provide a description of additional intermodal integration measures to be employed, such as integrated ticketing, schedule coordination, travel information integration, etc.
- d. *Station Access.* Provide an analysis of how passengers will access each station, and how these access options will provide sufficient capacity to satisfy forecasted ridership to and from the station, including public transportation, road network capacity, vehicle pick-up/drop-off, and parking.

Section 7: Demand and Revenue Forecasts

The SDP will address the methods, assumptions, and outputs for travel demand forecasts, and the

expected revenue from the service. It should provide information on the following topics and outputs:

- a. *Demand Forecasts.* This section will document the modeling methodology and approach used to forecast passenger rail demand, including competing modes, HSIPR alternatives considered, and the method for reflecting passenger capacity constraints (such as equipment, station, and station access capacity) within the HSIPR service. Next, this section will describe the extent of the study area, road network, rail stations, airports, and intercity bus terminals considered and will provide the assumptions and data used to quantify the existing travel market and forecast year travel market. The section will show the demand model structure, including example equations and elasticities, and will describe the base and future year model, including specific travel network and service characteristics. This demand model will include pricing assumptions (including the rationale and basis for including or excluding both revenue-maximizing and public benefit maximizing pricing models) and travel time-related assumptions (including frequency, reliability, and schedule data for the service), and will include the manner in which demand changes due to exogenous factors (e.g., related to general economic, employment, or population changes), have been accounted for in the model. The section will include the mode choice model structure and will explain the model calibration and validation. Finally, this section will present and explain the detailed base and forecast year ridership outputs (including trip-table outputs), along with the ramp-up methodology employed for determining ridership during the intermediate years between project completion and the model forecast year.
- b. *Revenue Forecasts.* This section will explain base and forecast year ticket revenue forecasts and if applicable, provide base and forecast year auxiliary revenue, including but not limited to, food and beverage revenue, mail and express revenue.

Section 8: Operational Financial Performance

The SDP will describe the anticipated operational financial performance and projections for each phase of the planned intercity passenger rail service, including operating costs and revenues, capital replacement costs, and other institutional arrangements affecting the system finances. The SDP will address the methods, assumptions, and outputs for operating expenses for the train service, including maintenance of way; maintenance of equipment; transportation (train movement); passenger traffic and services such as marketing, reservations/information, station, and on-board services; and general/administrative expenses. Cost-sharing arrangements and access fees with infrastructure owners and rail operators will also be included. Where applicable, allocation of costs across routes should also be discussed.

- a. *Costing Methodology and Assumptions.* For each different cost area, the SDP will provide the basis for estimation of operating expenses. The SDP will include documentation of key assumptions and provide back-up data on how unit costs and quantities and cost escalation factors were derived. Typical cost areas include:
 - Maintenance of way--Includes the cost of maintaining the ROW, signals, buildings, structures, bridges etc.
 - Maintenance of equipment--Includes the cost of layover and turnaround servicing, preventive maintenance, bad orders, wrecks & accidents, overhaul, and contractor maintenance.

- Transportation (train movement)--Includes the cost of trainmen, enginemen, bus connections, train fuel, propulsion power, railroad access and incentive payments.
 - Marketing and Information--Includes the cost of advertising, marketing, reservations, sales, and information.
 - Station--Includes the cost of station staff (ticketing, baggage, red caps, porters etc.), building rent, maintenance, utilities, and security.
 - On-board services--Includes the cost of on-board service staff, food and provisions.
 - General/administrative expenses.
- b. *Summary of Operating Costs.* Provide Route Operating Profit and Loss Statements for the proposed service based on revenue and operating cost forecasts. Provide a phased financing plan, including both expenditures and funding sources in current year (inflated) dollars.
- c. *Capital Replacement Costs.* Provide detailed estimates of any additional capital costs, beyond those incurred in the initial implementation of the service, that are anticipated to be required due to lifecycle replacement or other factors through the 20-year planning horizon of the SDP.
- d. *Innovative Finance.* Describe any public-private partnerships, alternative contracting methods (design-build, design-build-operate-maintain), or other innovative finance mechanisms used that might affect the financial performance of the system.
- e. *Overall Financial Performance.* Describe the overall financial performance of the proposed system, including revenues, operating costs, and capital replacement costs at several time intervals, including at the time of initial operations, at ten years of operations, and at twenty years of operations.

Section 9: Conceptual Engineering and Capital Programming

The SDP will describe the rail equipment, infrastructure improvements and other investments required for each discrete phase of service implementation. The SDP will prioritize improvements for each phase. The SDP will present estimated capital costs for projects and project groups, with documentation of assumptions and methods.

- a. *Project Identification.* The SDP will identify in detail each discrete project that will be necessary to implement the improved service, such as construction of specific stations; individual sections of additional or upgraded track; and locomotive and rolling stock purchases. "Projects" will be defined at a level of detail sufficient to delineate between elements of the overall scope with differing geographic locations, different types of investments (e.g., track improvements vs. station projects vs. equipment purchases), and different implementation schedules. In general, each "project" will be defined with the aim of making its scope easily comprehensible and identifiable to a layperson.
- b. *Project Cost Estimates.* The SDP will include project cost estimates in both the WBS and HSIPR Standard Cost Category format. The SDP will include the documentation of the cost estimates in their original format, illustrating exactly how those cost estimates were calculated. The cost estimates will be supported by a detailed description of the methodology and assumptions used in developing the estimates. Unless explicitly justified,

total contingencies for cost estimates developed during the planning phase will be no greater than 30 percent.

- c. *Project Schedule and Prioritization.* The SDP will present the proposed schedule for the implementation of the Service Development Program, organized in the format of WBS and consistent with the phases of project development. The schedule will illustrate the duration of each activity within the WBS, the earliest date at which each activity could commence, and the dependencies between the various activities.
- d. *Conceptual Engineering Design Documentation.* The SDP will include basic visual depictions of the projects encompassed by the proposed Service Development Program, including maps and track charts. Track charts will clearly show the current and proposed future track configurations throughout the geographic area encompassed by the SDP (and any proposed interim configurations, if phased implementation is proposed). Track charts will be drawn to an appropriate linear scale for the level of complexity of the track configuration in a particular segment, and will clearly show turnout sizes, road crossings, overhead and under-grade bridges, station and yard locations, junctions, track curvature, grade, signal location, signal rule applicability and maximum authorized speeds. The physical location of specific projects will be shown clearly, including the limits of any linear-oriented projects (such a rail replacement, tie replacement, undercutting, and ditching).

Section 10: Benefit-Cost Analysis

The SDP will include a description and quantification of benefits, whether operational, transportation output-related, and economic in nature, with particular focus on job creation and retention, “green” environmental outcomes, potential energy savings, and effects on community livability. Except where clearly unmonetizable, the SDP will provide the estimated economic value of those benefits. At a minimum, this section of the SDP will include:

- a. *Operational and Transportation Output Benefits.* Clearly identify the operational and transportation output-related benefits that will be generated by the project. Examples of operational benefits include trip-time improvements, reliability improvements (as measured by train delay-minutes and frequency increases), and passenger capacity increases (as measured by seat-miles). Transportation output benefits include increases in HSIPR passenger trips and passenger-miles traveled, reductions in passenger-delay-minutes, and passenger-travel time savings resulting from faster scheduled trips times.
- b. *User and Non-User Economic Benefits.* The SDP will include an analysis of the monetized economic benefits that would accrue to users and non-users of the HSIPR service as a result of the project, regardless of how or where those benefits are generated. User benefits include items such as the value of travel time savings to rail users, while non-user benefits include items such as the monetized value of emissions reductions, community development, and travel time savings due to congestion reduction for users of other modes from which demand is anticipated to shift to the new or improved HSIPR service.
- c. *Benefits by Rail Service Type.* All user and non-user benefits will be delineated by the type of improved rail service (i.e., HSIPR, commuter, or freight) that will generate those benefits. For example, user benefits in the form of travel time savings generated by a project for

HSIPR passengers will be delineated from those travel time savings accruing to users of a commuter rail service that will also benefit from the project. Likewise, non-user benefits in the form of emission reductions resulting from the shift of passengers to HSIPR service will be separated from benefits resulting from a shift of road freight transport to rail freight service.

Task 6 Deliverables:

- Draft Service Development Plan for Selected Service Alternative
- Final Service Development Plan for Selected Service Alternative

DELIVERABLES:

The matrix below lists all deliverables associated with this contract. Deliverables will include one hard copy and electronic copies when available of all field data sheets, photographs, videotapes, field notes, trip reports, analysis and final reports (unless otherwise noted within the task details).

The Consultant shall deliver all electronic files associated with this project in their native format (Microsoft Word, PowerPoint, Excel, PDF, CADD files, GEOPAK files, etc.) on DVD, CD or uploaded to ProjectWise, as directed by the MDOT Project Manager. Principal deliverables will be supplied in Microsoft Word (if document), PowerPoint (if presentation), and PDF format.

Proposal documents shall be submitted in their native format with standard naming conventions as well as combined into one Adobe PDF file in the sequence specified by MDOT. To provide text search capabilities the combined proposal shall be created by converting native electronic files to PDF. Scanning to PDF is discouraged except in instances where it is necessary to capturing a legally signed document or a hard copy version of a document is all that exists.

1.0	Project Planning and Kickoff
1.1	<i>Project Work Plan</i>
1.2	<i>Meeting Minutes and Project File</i>
1.3	<i>Administrative Record, searchable with index</i>
1.4	<i>Referenced Material</i>
1.5	<i>Master Contact List</i>
1.6	<i>Kickoff Meeting Materials</i>
2.0	Project Management
2.1	<i>Draft and Revised Project Plan</i>
2.2	<i>Monthly Progress Reports</i>
2.3	<i>Program Review Meeting Materials and Minutes</i>
3.0	Service Planning and Preliminary Alternatives Development
3.1	<i>Draft Purpose and Need Statement</i>
3.2	<i>Draft Alternatives Development Report</i>
	<i>Screening Criteria for Corridor Alternatives</i>
3.3	<i>Regional transportation challenges and opportunities</i>

3.4	<i>Estimated ridership and revenue for each alternative</i>
3.5	<i>Report documenting methodology and approach used for passenger forecast</i>
3.6	<i>Descriptions of train equipment options and associated cost estimates</i>
3.7	<i>Operating Plans for each alternative</i>
3.8	<i>Capital Cost estimates for each alternative</i>
3.9	<i>Operations and maintenance costs for each alternative</i>
3.10	<i>Proposed implementation schedules with phasing plan for each alternative</i>
3.11	<i>Benefit-Cost Analysis for selected alternatives</i>
4.0	Public Involvement Plan
4.1	<i>Public Involvement Plan</i>
5.0	Tier-1 EIS and ROD Development
5.0	<i>Tier-1 Environmental Impact Statement</i>
5.1	<i>NEPA Scoping Materials and Report</i>
	<i>Draft and Final NOI</i>
	<i>Scoping Comment Summary</i>
5.2	<i>Updated Alternatives Development Report for Tier-1 EIS</i>
5.3	<i>Preliminary Draft, Draft Final and Final Tier-1 EIS Chapters</i>
	<i>Annotated EIS Outline</i>
	<i>Final Purpose and Need Statement</i>
5.4	<i>Preliminary and Draft Tier-1 EIS</i>
5.5	<i>Draft and Final NOA</i>
5.6	<i>Public Hearing Materials</i>
5.7	<i>Public Comment summary and Refinement of Draft Tier-1 EIS document</i>
5.8	<i>Draft Final and Final Tier-1 EIS document</i>
5.9	<i>Materials for Section 106 consultation</i>
5.10	<i>Draft and Final Record of Decision</i>
5.11	<i>Public Participation Plan, quarterly newsletter, project website, mailing list of stakeholders, workshop materials, and Public Participation Summary</i>
6.0	Service Development Plan
	<i>Draft Service Development Plan for Selected Service Alternative</i>
	<i>Final Service Development Plan for Selected Service Alternative</i>

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.

APPENDIX A: STATE RAIL PLANS

Michigan, Indiana, and Illinois have each developed a state rail plan. Michigan's comprehensive plan ([*Michigan State Rail Plan, May 2011 Draft, Final expected by end of November 2011*](#)) identifies current and future needs for the Michigan rail system and defines long-range strategies to direct future federal and state investments for both passenger and freight rail, including commuter rail operations. The completed state plan meets the requirements established by the federal Passenger Rail Investment and Improvement Act of 2008 (PRIIA), making Michigan eligible for new federal funding programs developed by the act for passenger rail services.

The purpose of the Michigan State Rail Plan is to provide the framework through which rail service benefits can be expanded in the future. The plan establishes a vision - "A rail system that provides enhanced mobility for travelers and the efficient movement of goods, while supporting economic development and environmental sustainability."

The goals of the State Rail Plan are to:

1. Promote the efficient movement of passengers.
2. Promote the efficient movement of freight.
3. Encourage intermodal connectivity
4. Enhance state and local economic development
5. Promote environmental sustainability
6. Promote safe and secure railroad operations. Passenger and freight rail services provide extensive benefits to the citizens of Michigan.

In 2009, the Indiana Rail Plan was developed as part of the Indiana Multimodal Freight and Mobility Plan to direct the State of Indiana's future freight and passenger rail policy, provide a framework to guide future decisions regarding rail system investments, and ensure the efficient use of resources to support system wide objectives. The Rail Plan supports INDOT's Long-Range Transportation Plan, and in so doing will address how rail freight and passenger mobility impacts the entire transportation system of Indiana. Indiana will publish a new Rail Plan in November 2011.

A major component of the Rail Plan is the establishment of economic and industry profiles which assess the State of Indiana's economy as it relates to trends in goods movement and logistics, discussing the factors that drive the demand for rail transportation in Indiana. The plan also identifies and discusses the policies and issues that impact rail mobility in the State, focusing on potential institutional barriers that may hinder the integration of rail and freight-specific issues into the transportation planning and programming process. Based on the information collected and assessments performed, the Rail Plan then identifies the State's rail transportation system gaps and needs, potential funding sources, a methodology for evaluating and prioritizing freight projects, and a phased implementation plan for policy, capital and operational rail improvements.

IDOT has combined its Rail Program and Rail Plan into one document, which provides an overview of the rail transportation system in Illinois. The rail plan describes rail programs administered by the department and list projects planned for Fiscal Years 2011-2015.

APPENDIX B: PREVIOUS STUDIES/DESIGN WORK

Numerous studies have been conducted by the State of Michigan and various regional and local governmental agencies that address the role of rail in the state's transportation network. These studies have focused on determining current and future rail needs and the benefits of investing in the state's rail network. Studies range from comprehensive statewide policy development plans to individual studies designed to move rail projects forward to implementation. Summary descriptions of some of the studies conducted since 1995 (these are supplied for reference/background purposes only; they do not indicate the level of analysis that will be required for this RFP):

- [*MWRRI Reports \(2004-2006\)*](#)

The Midwest Regional Rail Initiative (MWRRI) is a cooperative, multi-agency effort that began in 1996 and involves nine Midwest states (Indiana, Illinois, Iowa, Michigan, Minnesota, Missouri, Nebraska, Ohio, and Wisconsin) as well as the FRA and Amtrak. This collaboration forges an enhanced partnership between USDOT, FRA and the Midwestern states for planning and providing passenger rail service. The MWRRI has developed a plan for the Midwest Regional Rail System (MWRRS) that includes:

- Amtrak operation of a Chicago-centered hub and spoke passenger rail system.
- Use of 3,000 miles of rail rights-of-way to connect rural, small urban, and major metropolitan areas and operate on eight corridors; connecting 100 cities and 80 percent of the Midwest's 65 million residents.
- Projected ridership: 13.6 million passengers annually.
- 90 percent of the Midwest's population would be within an hour ride of a MWRRI rail station.
- Introduction of modern trainsets capable of operating at speeds up to 110 mph.
- Provision of multi-modal connections to improve system access.
- Introducing a contracted rail operation that improves efficiency and reliability.

The Chicago–Detroit–Pontiac corridor is one of the key corridors recommended for upgrade to 110 mph operation. Under the MWRRI plan, this 304-mile corridor would see a significant improvement in rail service resulting from upgrades to the track and signal network, the use of modern equipment, improved travel times and frequencies; competitive fares that maximize revenue yields, improved reliability and enhanced on-board and station amenities. The MWRRI Plan proposes to complement this Michigan high-speed rail corridor with conventional enhanced passenger rail service in the Pere Marquette and Blue Water corridors and with feeder bus service.

The goal of the initiative is to develop a passenger rail system that offers business and leisure travelers shorter travel times, additional train frequencies, and connections between urban centers and smaller communities. The MWRRI will provide a large increase in service and will cut travel time between destinations by 30 to 50 percent.

As a result of these improvements that will create more frequent and higher quality on-time service, rail ridership in the routes that encompass the MWRRI are expected to increase greatly. This will help to reduce expected growth in automobile congestion on highways and reduce overcrowding and runway delays at regional airports.

- [EA and FONSI for the Dearborn to Kalamazoo Corridor Acquisition and Improvements, Dearborn to Kalamazoo, Michigan](#) – (July and September 2011)
- [Dearborn to Kalamazoo Norfolk Southern Railway Section Improvements EA](#) – (August 2011)
- [MWRRI Phase 7 - South of the Lake Route Alternatives Analysis Report](#) – (April 2011)
- [Service NEPA EA; Chicago-Detroit/Pontiac Rail Corridor Improvements from Chicago to Pontiac](#)
- [The Ohio & Lake Erie Regional Rail Ohio Hub Study](#) – (July 2007)
- [Final Environmental Impact Statement \(FEIS\) and Final Section 4\(f\) Evaluation – Detroit Intermodal Freight Terminal \(DIFT\) - December, 2009](#)

The FEIS for the Detroit Intermodal Freight Terminal (DIFT) describes the social, economic, and natural environmental impacts of a proposed freight terminal located in southwest Detroit between Wyoming and Livernois avenues, south of I-94. The preferred alternative involves consolidating intermodal operations of the CSX, NS, and CP railroads in Southwest Detroit at the Livernois-Junction Yard. The CP/Oak terminal will continue to be used for non-intermodal railroad purposes. The CN/GTW has opted not to shift its operations at the Moterm Yard to the Livernois-Junction Yard and not to expand its terminal. However, it will pay its share of external-to-terminal rail improvements that are part of the DIFT project. Such improvements by the DIFT project will increase the efficiency of operations. Road improvements also will be made.

This terminal will be used as a center for stimulating economic revitalization in southeast Michigan by improving rail freight transportation opportunities and efficiencies at a consolidated terminal in southwest Detroit. There is a current lack of adequate intermodal capacity in Southeast Michigan, and the connectivity between intermodal terminals is poor. Roadway improvements would be needed to realize this plan to successfully direct traffic into, out of, and around the terminal. The consolidated terminal would accommodate existing and future demands, while supporting the needs of residential neighborhoods and businesses in the area.

- [Ann Arbor-Detroit Regional Rail Project](#)

The Southeastern Michigan Council of Governments (SEMCOG) has been working to improve transit services along the 38-mile corridor between downtown Detroit and Ann Arbor. This project is part of the Lansing-Detroit project that emerged in 1999. The Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) completed in 2006 analyzed five different alternatives using a combination of three different technologies (Bus Rapid Transit, Light Rail Transit and Commuter Rail Transit). The preferred alternative selected in the DEIS includes passenger rail service connecting to the proposed Woodward Avenue/M1 light rail corridor in Detroit.

The AA/DEIS determined that the proposed service would not meet the Federal Transit Administration's cost effectiveness requirements and was therefore not eligible for federal

funding. Consequently, the state and SEMCOG decided to move this project forward. The intent is to start with a three to five year demonstration project plus run trains for special events. This will hopefully demonstrate that costs and ridership would be in a range to better qualify the project in either the federal New Starts or Small Starts program. The federal process would be continued at a later date after a successful demonstration period.

The Great Lakes Central Railroad is in the process of refurbishing 24 former Metra bi-level commuter rail cars. Nine cars will be used on the passenger rail system between Ann Arbor and Detroit, and fifteen will be used for the line between Ann Arbor and Howell (see WALLY description below).

- [Washtenaw Livingston Rail Line](#) (WALLY)

WALLY is a proposed north-south passenger rail service between Ann Arbor and Howell, a distance of approximately 27 miles, with three intermediate stops. Under this proposal, the Ann Arbor Transportation Authority will operate four trips to Ann Arbor beginning in the morning and four return trips to Howell beginning in the afternoon. Projections estimate 1,200 passengers per day. Capital costs are estimated to be \$32 million and the annual operating expense is approximately \$7 million. In April 2010, supporters announced a scaled-back proposal with start-up costs of \$16-\$20 million, and yearly operating costs of \$7.1 million.

MDOT has already invested \$6.2 million to rehabilitate all the mainline track and grade crossings between Ann Arbor and Howell, and to build a siding just north of Ann Arbor. This track is owned by MDOT and currently operated by the Great Lakes Central Railroad.

This line would ease traffic congestion on US-23 and promote economic development in Livingston and Washtenaw counties. MDOT determined that adding a third lane of traffic to the highway would cost approximately \$500 million, far exceeding any budget in place. This line would also create economic development opportunities for existing and new businesses. Station sites are currently undergoing planning and environmental reviews.

- **Other Plans and Studies**

- [Illinois High-Speed Rail Chicago to St. Louis Project](#)
- [Lansing to Detroit Passenger Rail Study](#)
- [Environmental Assessment \(EA\) for the Troy Transit Center Intermodal Rail Passenger Facility, Oakland County, Michigan](#) – (June 2011)
- [EA and FONSI for the City Of Dearborn Intermodal Rail Passenger Facility, Wayne County, Michigan](#) – (June 2011)
- [FRA Categorical Exclusion Worksheet for the Battle Creek Station](#) – (April 2010)
- [Jackson Rail Passenger Station Development Study Final Report](#) – (December 2010)
- [Direction2035 Regional Transportation Plan for Southeast Michigan](#)
- [TranslinkeD Driving Global Connectivity](#)

- [*Detroit Regional Aerotropolis: Strategic Development Master Plan*](#)
- [*Sault Ste. Marie Multi-Modal Initiative, Phase I Market Assessment Final Report, Destiny Sault Ste. Marie, 2007*](#)
- [*High-Speed Intercity Passenger Rail \(HSIPR\) Program*](#)
- [*Vision for High-Speed Rail in America \(Federal Railroad Administration, 2009\)*](#)
- [*Preliminary National Rail Plan \(Federal Railroad Administration, 2009\)*](#)

APPENDIX C: ONGOING AND NEAR-TERM CORRIDOR IMPROVEMENTS

Federal commitment in the corridor over the next several year is nearly \$640M, with an additional \$268.2M in new equipment. Michigan has plans to further develop stations on the high speed rail corridor as indicated on the above map. FRA has provided initial funding to begin some of this work, including:

- [Troy](#) (\$8.5M) - relocate the existing station stop in Birmingham to a new site in Troy as part of the transit oriented development to serve both communities.
- [Dearborn](#) (\$28.2M) - Relocate the existing station stop in Dearborn to a new location adjacent to the Henry Ford Museum as part of a planned transit oriented development.
- [Battle Creek](#) (\$3.6M) – to renovate the existing station.
- [Ann Arbor](#) (\$3.5M) – to complete PE/NEPA for a new station location at Fuller Road.
- [Jackson](#) (\$1.0M, FHWA/ARRA) – to begin restoration of the historic Jackson Station which may be the oldest active station in the country built in 1874.
- [West Detroit Connection Track Project](#) (\$18.3M) – Funding in Southeast Michigan that provides a direct connection for passenger service between CSAO and CN at west Detroit. This separates the current passenger and freight rail congestion experienced at Bay City Junction on the existing route for passenger service. (See [MDOT's completed Environmental Study form](#) and [FRA's Categorical Exclusion Worksheet](#))
- [Kalamazoo-Dearborn Service Development Program](#) (\$150M for acquisition/\$196.5M track/signal/train control) – Final negotiations are underway for MDOT to acquire this segment of the corridor. This includes completing an initial track maintenance program this construction season to improve the worst areas that have added significant delays to the service. This will allow us to begin the corridor enhancement program in FY 2012 and complete it over three construction seasons. (See [EA for the Dearborn to Kalamazoo Corridor Acquisition and Improvements, Dearborn to Kalamazoo, Michigan – July 2011.](#))
- [Englewood Flyover Project](#) (\$133 M) and the [Indiana Gateway Projects](#) (\$71.4M) to help with existing congestion and service reliability issues in this area. The western end of the corridor known as the Chicago Terminal Area includes some of the busiest mixed passenger and freight rail traffic in the country and will require major infrastructure improvements to allow for increased capacity and reliability as part of the Chicago Region Environmental and Transportation Efficiency Project ([CREATE](#)). (See [FRA Categorical Exclusion Worksheets and SHPO documentation for the individual Indiana Gateway projects](#)).
- [AMTRAK](#) (\$32.9M) - has also received funding and is expanding ITCS (incremental train control system) coverage from New Buffalo, Michigan to Porter, Indiana. This work is also expected to be completed later this year. This will allow for speeds of up to 110 mph over their entire ownership, nearly 100 miles.

- [Midwest Next Generation Train Equipment Procurement](#) (\$268.2) – Illinois DOT is the lead applicant for Illinois, Missouri, and Michigan. Funding would replace existing train equipment on all three Michigan services (Blue Water, Pere Marquette, and Wolverine). This is a 100% federal funding request; the total order is for 7 locomotives and 48 coaches.

ATTACHMENT A

April 2011

SURVEY SCOPE OF WORK

Survey Limits: As needed for Design, Right of Way, and Construction. A description of survey limits detailing length, width and cross roads must be included in the Survey Work Plan.

NOTES: The Selected Consultant shall discuss the scope of this survey with an MDOT Region Surveyor or an MDOT Lansing Design Surveyor before submitting a priced proposal.

The Selected Consultant surveyor must contact the Region or TSC Traffic and Safety Engineer for work restrictions in the project area prior to submitting a priced proposal.

A **detailed Survey Work Plan must** be included in the project proposal. A **spreadsheet estimate** of hours by specific survey task such as traversing, leveling, mapping, etc., **must** be included in the **priced proposal**.

It is the responsibility of the Professional Surveyor to safeguard all corners of the United States Public Land Survey System, published Geodetic Control and any other Property Controlling corners that may be in danger of being destroyed by the proposed construction project.

GENERAL REQUIREMENTS:

1. Surveys must comply with **all Michigan law** relative to land surveying.
2. Surveys must be done under the **direct supervision** of a Professional Surveyor licensed to practice in the State of Michigan, according to Public Act 299 of 1980.
3. Work in any of the following categories of survey: Road Design, Structure, Hydraulic, Right-of-Way, Photogrammetric Ground Control, and/or Geodetic Control must be completed by a survey firm which is pre-qualified by MDOT for that category.
4. Surveys must meet all requirements of the Michigan Department of Transportation (MDOT) Design Surveys *Standards of Practice* dated March 2009. Please contact the MDOT Design Survey office to clarify any specific questions regarding these standards.
5. Consultants must obtain all necessary permits required to perform this survey on any public and/or private property, including an up-to-date permit from the MDOT Utilities Coordination and Permits Section.
6. Prior to performing the survey, the Consultant must contact all landowners upon whose lands they will enter. The contact may be personal, phone or letter, but must be

16. **All data**, whether electronic or paper, **must be recorded on non-rewritable Compact Discs (CD's) or DVD's**. All paper files, including MicroStation files, must be scanned and/or converted to Adobe Acrobat .PDF format. It is not necessary to include raw survey data files in the Adobe file. CD's must be organized in the same manner as the portfolio, such as by Administrative section, Control section, etc. A Table of Contents in Adobe Acrobat format is required that has all .PDF pages of the CD bookmarked/linked so each place in the .PDF archive can be accessed with a single click of the computer mouse. Specified format files such as Microsoft Word, CAiCE and MicroStation must have separate access in native format outside of the .PDF file.
17. It is not necessary to label each individual paper page in the portfolio.
18. The MDOT Project Manager is the official contact for the Consultant. The Consultant must send a copy of all project correspondence to the MDOT Project Manager. The MDOT Project Manager shall be made aware of all communications regarding this project. Any survey related questions regarding this project should be directed to an MDOT Survey Consultant Project Manager or MDOT Region Surveyor.

At the completion of this survey for this project, legible copies of all field survey notes, all electronic data, and all research records obtained for this project will be considered the property of MDOT and **must be sent to** the MDOT, Design Division, Supervising Land Surveyor, P.O. Box 30050, Lansing, MI 48909. Please use MDOT's Form 222(5/01) entitled "SURVEY NOTES: RECEIPT AND TRANSMITTAL" for all transmittals. A copy of this transmittal form must also be sent to the MDOT Project Manager for Design.

Acceptance of this survey by the MDOT Supervising Land Surveyor and/or the MDOT Project Manager does not relieve the Consultant of any liability for the content of the survey.

WORK RESTRICTIONS

The Selected Consultant, and the Selected Consultant only, is advised to discuss Traffic Control scenarios with the MDOT Traffic and Safety Engineer at the closest MDOT TSC prior to submitting a priced proposal.

No work shall be performed or lane closures allowed during the Memorial Day, July 4th, or Labor Day holiday periods, as defined by the MDOT Project Manager or representative specifically designated by the Project Manager (the Traffic & Safety Engineer at the MDOT TSC).

Work on weekends, if approved, shall be as directed by the MDOT Project Manager or Designate.

The Consultant must call the MDOT Region or TSC Traffic and Safety Engineer before beginning work to inform him or her of surveying activity in the area. The MDOT Region or TSC must be notified at least two weeks prior to lane closures so advance notice can be posted on the Web site.

Traffic shall be maintained by the Consultant throughout the project in accordance with Sections 812, 922, 103.05 and 103.06 of the *Standard Specifications for Construction*, 2003 edition, www.mdot.state.mi.us/specbook/, and Supplemental Specification 03SS001(2) Errata to the

2003 Standard Specifications and all other supplemental specifications currently in effect against the Standard Specifications for Construction. All traffic control devices shall conform to the current edition, as revised, of the *Michigan Manual of Uniform Traffic Control Devices* (MMUTCD). All warning signs for maintenance of traffic used on this project shall be fabricated with prismatic retro-reflective sheeting, and shall be set up five feet above ground.

The Consultant shall use MDOT standard “maintaining traffic” typicals for any and all closures.

Typical MDOT traffic control diagrams are available on line at www.mdot.state.mi.us/tands/plans.cfm

COORDINATION WITH OTHER CONTRACTS IN THE VICINITY

The Consultant shall coordinate operations with contractors performing work on other projects within or adjacent to the Construction Influence Area (CIA).

MDOT maintenance crews and/or Contract Maintenance Agencies may perform maintenance work within or adjacent to the CIA. The Maintenance Division of MDOT and/or Contract Maintenance Agency will coordinate their operations with the MDOT Project Manager or Designate to minimize the interference to the Consultant.

The Consultant must contact the Development Engineer at the nearest MDOT TSC for information regarding project coordination.

The Consultant’s attention is called to the requirements of cooperation with others as covered in Article 104.07 of the 2003 Standard Specifications for Construction. Other contracts or maintenance operations may occur during the life of the project.

No claim for extra compensation or adjustment in contract unit prices will be allowed on account of delay or failure of others to complete work unit scheduled.

POST SURVEY CLEAN-UP

Once the survey is complete, all stakes must be removed from the MDOT median and ROW to aid the maintenance crews and adjacent property owners. All benchmarks and control points and their witnesses must remain in place.

FINAL REPORT: DELIVERABLES

The final report for this project shall include:

1. In the first pocket of the portfolio, and first directory on the CD, labeled **ADMINISTRATIVE**, the following will appear:
 - a. MDOT’s Form 222(5/01) entitled “SURVEY NOTES: RECEIPT AND TRANSMITTAL”
 - b. The project’s Professional Surveyor's Report on company letterhead consisting of:
 - i) A comprehensive synopsis of the work performed on this project, signed **and sealed** by the project’s Professional Surveyor.

- ii) The source and methods used to establish the project horizontal and vertical control and alignment(s) for this project.
 - iii) A detailed explanation of anything discovered during the survey of this project that may create a problem for the designer or another surveyor.
 - c. CD or DVD with all documents scanned or converted into PDF files. Each page must be inserted in a master PDF file and bookmarked for easy retrieval. An example can be provided upon request.
 - d. MDOT QA/QC Portfolio Checklist (revised March 2009).
2. In the second pocket of the portfolio, and second directory on the CD, labeled **ALIGNMENT**, the following will appear:
- a. An annotated MicroStation drawing of the alignment(s), showing:
 - i) A statement defining the alignment(s) as **survey, as constructed, and/or legal**
 - ii) Stationing, source of stationing, and station equation to existing stationing
 - iii) Horizontal coordinates of P.I.'s, at a minimum
 - iv) Curve data
 - v) Alignment points found or set
 - vi) Control points
 - vii) Reference lines and angles of crossing (if appropriate)
 - viii) Government corners and ties to government lines
 - b. Witness list for the alignment points found or set, which shows coordinates, stationing and four witnesses for each alignment point. Witness lists must use only uppercase letters.
 - c. LCRC's for legal alignment points found or set.
3. In the third pocket of the portfolio, and third directory on the CD, labeled **CONTROL**, the following will appear:
- a. Documentation of horizontal and vertical datum sources.
 - b. OPUS documentation, long version..
 - c. Least squares adjustments for the horizontal and vertical control.
 - d. It is not necessary to submit electronic raw survey data in hardcopy form, or in the .PDF file.
 - e. Text files which contain the witness lists for the horizontal alignment ties, horizontal control points, benchmarks and government corners. All witness lists must note the datum(s), a combined scale factor for state plane grid-to-ground conversion, and an example thereof. Witness lists must use only uppercase letters.
 - f. An MDOT-formatted Microsoft Word file, SurveyInfoSheet.doc, showing the data in e. above, using only upper case letters.
4. In the fourth pocket of the portfolio, and fourth directory on the CD, labeled **PROPERTY**, the following will appear:
- a. Tax maps and descriptions with owner names, addresses and phone numbers, if Right of Way is to be acquired, or if riparian ownerships are required.
 - b. Maps, plats, and recorded surveys.
 - c. Documents such as plats, Act 132 Certificates and/or tax maps marked with point numbers as property ties, if Right of Way is to be acquired.

- d. Legible **recorded** copies of all Land Corner Recordation Certificates (LCRC) filed for the government corners (PLSS corners and Property Controlling Corners) used for computations and/or in danger of obliteration by impending construction.
5. In the fifth pocket of the portfolio, and fifth directory on the CD, labeled **MAPPING**, the following will appear:
 - a. Mapping file in MDOT MicroStation V8 format, and also converted to .PDF format. All point and line descriptions must use only upper case letters.
 - b. An archived CAiCE software file.
 - c. Geopak files produced from CAiCE.
 - d. All field survey notes and electronic mapping data used for the project. It is not necessary to submit electronic raw survey data in hardcopy form, or in the .PDF file.
 - e. All supporting and supplemental information or data, such as drainage and utilities, electronically only if possible.
 6. In the sixth pocket of the portfolio, and sixth directory on the CD, labeled **MISCELLANEOUS**, the following will appear:
 - a. Any photographs taken for clarity of an area
 - b. Any newspaper clippings related to the project
 - c. Any information not covered in this scope that will be of benefit to the designer or another surveyor.

ATTACHMENT B

November 2011

LIDAR, PHOTOGRAMMETRY AND PHOTOGRAMMETRIC CONTROL SURVEY SCOPE OF WORK

GENERAL NOTES

The limits of survey and mapping are as needed to prepare the Service Development Plan and the Tier-1 EIS.

The Selected **Consultant** shall discuss the scope of the project with the MDOT Survey/Photogrammetry Project Manager or an MDOT Lansing Design Surveyor before submitting a work plan and price proposal.

The selected **Consultant surveyor** must contact the TSC or Region Traffic and Safety Engineer closest to the proposed project for work restrictions in the project area prior to submitting a work plan and price proposal.

The selected Consultant will be required to submit a **detailed Work Plan specific to Survey, LiDAR and/or Photogrammetry** that addresses each specific task applicable to the project with the project price proposal.

A **spreadsheet estimate** of hours broken down by specific survey task such as research, horizontal control, vertical control, targeting, reports, portfolio, etc., and LiDAR and photogrammetry tasks such as flight, image scanning, targeting, photo control survey, aerial triangulation, mapping, etc., **must** be included in the **priced proposal**.

GENERAL REQUIREMENTS:

1. Surveys must comply with **all Michigan law** relative to land surveying.
2. Surveys must be done under the **direct supervision** of a Professional Surveyor licensed to practice in the State of Michigan. All Photogrammetric work must be done under the **direct supervision** of an ASPRS Certified Photogrammetrist.
3. Work in any of the following categories: Road Design Surveys, Structure Surveys, Hydraulic Surveys, Right-of-Way Surveys, Photogrammetry, and/or Photogrammetric Control Surveys, must be completed by a firm which is pre-qualified by MDOT.
4. Surveys and Photogrammetric Mapping work must meet all requirements of the Michigan Department of Transportation (MDOT) project scope (this document), the current versions of the MDOT Design Surveys *Standards of Practice*, MDOT Survey QA/QC Checklist, the MDOT Design Survey Manual on-line, the MDOT RTK guidelines, the Photogrammetry Checklist, the Photogrammetric Control QA/QC Checklist, and the National Standard for Spatial Data Accuracy (NSSDA). Acquisition of Photogrammetric products must also meet the requirements of the DRAFT ASPRS Aerial Photography Standards, September 1995.
5. The Consultant is responsible for using the latest MDOT feature table, cell, seed and tugboat(macro) files, MicroStation V8 cell and seed files, Microstation Road Resource file and Bridge Resource file, available on the MDOT website and Survey FTP site.

Please contact the MDOT Survey / Photogrammetric Project Manager for information to access the MDOT Survey FTP Site. **PowerGeoPak software shall be used as well as MicroStation Version 8i, or the most current software as required by MDOT for survey and plans production.**

6. Consultants must obtain all necessary permits required to perform this survey on any public and/or private property, including an up-to-date permit from the MDOT Utilities Coordination and Permits Section. The **Consultant shall be responsible for obtaining up to date access permits** and pertinent information for any tasks involving work within the MDOT Right of Way (ROW).
7. Prior to performing any ground survey work, the Consultant must contact all landowners upon whose lands they will enter. The contact may be personal, phone or letter, but must be documented. This notice must include the reasons for the survey on private land, the approximate time the survey is to take place, the extent of the survey including potential brush cutting (which must be minimized), and an MDOT contact person (the MDOT Survey Project Manager).
8. The Consultant must contact any and all Railroads prior to commencing field survey on railroad property. The cost for any permit, flaggers and/or training that is required by the Railroad will be considered as a direct cost, but only if included in the Consultant's priced proposal.
9. The Consultant must adhere to all applicable OSHA and MIOSHA safety standards, including use of the appropriate traffic signs for the activities and conditions for this job.
10. Consultants are responsible for a comprehensive and conscientious research of all records, including MDOT records, essential for the completion of this project.
11. Measurements, stationing, recorded data, and computations must be in **International Feet** units, unless specified otherwise by the MDOT Survey/Photogrammetric Project Manager.
12. Coordinate values shall be based upon the Michigan State Plane Coordinate System of 1983, NAD83/CORS96 or NAD83(NSRS2007), North, Central or South Zone . A local project coordinate control system is acceptable only on approval of the MDOT Survey/Photogrammetric Project Manager or the MDOT Supervising Land Surveyor. All elevations must be based upon the North American Vertical Datum of 1988 (NAVD88) if control is available within four miles. **Use of other datums must be approved by the MDOT Design Division, Supervising Land Surveyor.** The datums to be used must be clearly stated in the Photogrammetric Control Survey Work Plan. A preliminary submittal of the adjusted Horizontal and Vertical control for the project shall be submitted to the MDOT Survey/Photogrammetric Project Manager for review and acceptance as soon as it is available and prior to commencing any photogrammetric map compilation.
13. For a **Road Design Survey, Hydraulic Survey, Right of Way Survey, Photo Control Survey, or Photogrammetry, 3 copies of the complete "Electronic portfolio" on CD's/DVD's** and only paper copies of the Surveyor's Report and all signed documents must be submitted to the Design Survey Unit in 10" by 12" divided portfolios with flap covers. For a **Structure Survey, two complete portfolios and a total of 3 copies of the CD's or DVD's** each containing a complete "Electronic portfolio" and any other electronic files must be submitted. As many portfolios should be used as needed to contain all of the required documents and electronic media (CD's/DVD's).
14. The survey notes and/or photogrammetric information must be submitted to MDOT Design Surveys in 10" by 12" divided portfolios with flap covers organized as follows:

17. The MDOT Project Manager is the official contact for the Consultant. The Consultant must send a copy of all survey and photogrammetric project correspondence to the MDOT Survey/Photogrammetric Project Manager and the MDOT Project Manager. The MDOT Project Manager shall be made aware of all communications regarding this project. Any survey or photogrammetry related questions, in regard to this project, should be directed to the MDOT Survey/Photogrammetric Project Manager, Kelvin J. Wixtrom, P.S. at 517-241-4527, or e-mail wixtromk@michigan.gov.

At the completion of this project, legible copies of all field survey notes, photogrammetry information, all electronic data, and all research records obtained for this project will be considered the property of MDOT and **must be sent to** MDOT Design Surveys, MDOT Survey/Photogrammetric Project Manager, P.O. Box 30050, Lansing, MI 48909.

Please use **MDOT's Form 0222(05/01)** entitled "**SURVEY NOTES: RECEIPT AND TRANSMITTAL**" for all Survey and Photogrammetric Control Survey transmittals.

Please use **MDOT's Form 0222P(02/09)** entitled "**PHOTOGRAMMETRIC INFORMATION: RECEIPT AND TRANSMITTAL**" for all Photogrammetry related transmittals. A copy of the transmittal forms must also be sent to the MDOT Project Manager.

Acceptance of this Survey and/or Photogrammetric Mapping by the MDOT Survey/Photogrammetric Project Manager, MDOT Supervising Land Surveyor and/or the MDOT Project Manager does not relieve the Consultant of any liability for the content of the survey.

Electronic Files

The following are acceptable means of electronic file transfer:

- i. CD's and/or DVD's can be used to submit most survey project electronic data.
- ii. Digital electronic scans of aerial photograph negatives can be submitted on DVD's, or external USB/Firewire hard drives.
- iii. Electronic aerial triangulation deliverables may be submitted on DVD's, CD ROM, or external hard drives. Files attached to an e-mail are acceptable for gaining MDOT approval to start mapping as long as a final version is delivered by one of the above methods.
- iv. Preliminary files can be transferred by compressing and attaching the files to an e-mail.
- v. Final mapping shall be submitted on DVD's, or CD ROM, or external hard drives.

Electronic Reporting Format - Deliverables

1. It is desired that as much project information as possible be prepared and submitted in a digital electronic format, to facilitate future electronic storage and transmission of survey data.
2. All data, whether electronic or paper, including MicroStation files, must be scanned or converted to Acrobat PDF format and recorded on acceptable electronic media. The data on this electronic media must be organized in the same manner as the portfolio, by sections, as applicable to the particular project.
3. CD's/DVD's and or external hard drives must be labeled with the Consultant name, route, location, control section, job number, data type, file names and date.

4. A Table of Contents is required in the PDF file and will have all parts/pages of the portfolio book-marked/linked so that any part/page of the portfolio can be accessed immediately. Microsoft Word files can be saved directly into PDF format. MicroStation drawings and research data, etc. will need to be scanned into PDF format.
5. All project reports and final CADD file deliverables shall be also converted into and submitted in a single Adobe Ver. 6, linked and book-marked, PDF file.

It is the responsibility of the Consultant to insure that all electronic files submitted to MDOT conform to the required format and all documents are legible

REQUIREMENTS FOR MOBILE MAPPING, TERRESTRIAL AND AERIAL LiDAR

The use of Mobile mapping(LiDAR) and Terrestrial Laser Scanning (LiDAR) may be proposed by the consultant and will be considered by MDOT for use on this project provided a savings in project costs, schedule, improved safety and reduce traffic control costs among other benefits can be shown. Low level Helicopter based aerial LiDAR combined with digital imagery acquisition will also be considered by MDOT.

Due to the extremely technical requirements needed to effectively utilize these technologies and the rapid improvements in the industry, MDOT will require very detailed and specific information be presented describing the LiDAR project parameters and acquisition plan to be used to acquire the survey information for the project.

The use of these technologies shall conform to and utilize existing MDOT terrestrial scanning standards and the Specifications/Guidelines based on the Caltrans Survey Manual Chapter 15 Terrestrial Laser Scanning Specifications. Project deliverables and reporting for any mobile scanning shall provide the information and reports referred to in these Caltrans Specifications in addition to MDOT requirements and shall specified in more detail and approved by the MDOT Survey/Photogrammetry Project Manager.

REQUIREMENTS FOR AERIAL PHOTOGRAPHY ACQUISITION (including Digital Imagery and Lidar acquisition) P/PMS Task Numbers 2320, 2321, 2322

The specific parameters and details, such as flight limits, photo scale, coverage width, targets, etc. related to the flight and acquisition of photography tasks will be determined in more detail at a later date. The consultant shall use the following as a actual work required will be

Description of Work for Task 2320(Aerial Flight): Aerial photography acquisition (flights).

Description of Work for Task 2321(Prepare for Aerial Photography): Project planning, Flight planning, and Target planning.

Description of Work for Task 2322(Finish/Print Aerial Photography): Aerial photograph film processing, image scanning and printing.

CONSULTANT DUTIES

The Consultant shall provide:

A. Photography

1. Color, Color Digital, or Black & White (as requested for particular projects) "Vertical" aerial photography of the entire project(s) site taken from a suitable fixed-wing aircraft or helicopter.
2. **The flight altitude** will be the **nominal height in feet** as determined from the project photo scale, above average ground elevation to produce vertical aerial photography at the scales required for the project(s). This altitude shall be approved by MDOT.
3. **Color Film Requirements - Aviphot Color X100 or Kodak Aerocolor IV 2460 negative film or equivalent** fine grained aerial film suitable for high accuracy use at lower flight altitudes shall be used.
 - a. **MDOT requires stringent adherence to obtaining the highest quality imagery possible to provide the best possible mapping accuracy.** Imagery shall be obtained with specific exposure parameters that will produce **no perceptible image blur or smear** when viewed at a magnification of 8X or less. Because transportation work requires high accuracy to support good design, MDOT uses lower altitude flights than generally used for other applications. This usually requires modified exposure settings and use of **fast shutter speeds** to help eliminate movements caused by turbulence not accounted for by FMC or other means.
 - b. If MDOT requests Black and White Photography for a project, the aerial negative film used shall be **Agfa Aviphot Pan 200, Agfa Aviphot Pan 400S, Kodak Double-X Aerographic 2405 film, or equivalent** high speed fine grained aerial film suitable for high accuracy use at lower flight altitudes. For Helicopter type very low level photography, high speed black and white aerial film such as the **Agfa Aviphot Pan 400S, Agfa Aviphot Pan 200 or equivalent shall be used along with faster shutter speed and exposure settings, such as 1/250 to 1/300 for the Agfa Pan 200 and 1/700 to 1/1000 for the Kodak 2405,** to help eliminate movements caused by turbulence not accounted for by FMC or other means.
 - c. The combination of film, exposure settings used, and film processing shall be done to meet an **average gamma equal to 1.0** (average gradient equal to 0.95).
 - d. Along with the film, a process control strip containing the density gradients from the film processing shall be submitted to MDOT.
 - e. Sensitometric curve graphs of the processing of the film showing the characteristic curve graph and the average gradient/developing time shall be provided.
 - f. The specific exposure settings and processing settings used for the project shall be listed and outlined in the project report.
4. A precision aerial mapping film camera shall be used that has a nominal focal length of 6 inches, (153 mm) and having a nominal 9 inch by 9 inch film format. A motion compensation system is recommended.
 - a. **Submit camera calibration certificate (not more than three years old).**
 - b. **Film Cameras shall have an AWAR rating of not less than 90-100.**
5. Each consecutive photograph will overlap the previous exposure by at least 60% of the image area. The entire project area will be covered with overlapping images.

6. Each photograph and flight line will be centered on the median centerline of the highway, to provide complete coverage of the paved portions of the roadway, **or as specified and approved by the MDOT Survey/Photogrammetry Project Manager.**
7. **Digital Sensor Imagery** - The Consultant may be requested to provide digital imagery for the project instead of the traditional film photography.
 - a. When requested, the digital imagery shall be obtained using a digital frame sensor “camera”. Frame format images such as produced by the Z/I Imaging DMC are preferred.
 - b. The consultant shall contact the MDOT Photogrammetric Project Manager to discuss the flight parameters, altitude, ground sample distance, overlap, image data post-processing parameters, any multi-spectral requirements, and any other specific details for the project.
 - c. Special reporting and deliverables requirements are listed in the deliverables section below.

B. Flight Diagram(s) and Target Diagram(s)

1. **The Consultant shall** provide a diagram with a suggested layout of flight lines, exposures, targets and check targets to MDOT prior to flights.
2. The diagram shall be **submitted to the Photogrammetry Project Manager for approval prior to flight.**
3. **The Consultant must notify** MDOT Photogrammetry Project Manager with a **projected date for flight** and keep the MDOT Photogrammetry Project Manager informed on the progress of the flight and project.
4. Targets shall be placed on the ground prior to flight. See Specific Scope of Services for Photogrammetric Targeting and Ground Control Survey for more details on placing targets.

C. Airborne GPS(ABGPS)

1. The Consultant shall collect the ABGPS raw data files for all flight lines and exposures for the project.
 - a. This ABGPS data is not to be a substitute or used in place of ground control.
 - b. ABGPS will be used as initial EO positions to aid the Aerial Triangulation process. This will also be used as check data to compare against the aerial triangulation results.
2. The GPS files for the base stations along with the GPS files of the aircraft shall be collected and delivered to MDOT in RINEX format.
 - a. The Consultant is urged to utilize the MDOT CORS stations as much as possible for the base stations. MDOT CORS data may be acquired from the MDOT CORS Website at <http://mdotcors.org/>
 - b. Provide offsets for GPS antenna, Inertial Measurement Unit (IMU), etc. to Camera exposure center along with a sketch of the offsets and location of and dimensions between the GPS antenna, IMU and camera within the aircraft.
3. The Consultant shall provide to MDOT the final EO coordinates for each exposure formatted in ASCII, comma delimited files.
 - a. The file information shall be arranged as follows:
Flight number, Photo number, X, Y, Z, Kappa, Phi, Omega
4. If IMU orientation information can be collected, the Consultant shall provide the precise exposure orientation readings (Kappa, Phi and Omega) for each exposure in the ASCII formatted files.

- a. If an IMU is not used, **approximate orientation values shall be recorded or derived and shall be submitted** in ASCII format for each exposure for use during aerial triangulation.

D. Aerial Photograph Negative Scanning

1. The Consultant shall scan each image from the negatives exposed in the aerial photography taken for this project and provide digital files on DVD's, CD-ROM's or external USB/Firewire hard drives.
2. Scan parameters and specifications:
 - a. Scan all images exposed for this photography acquisition project.
 - b. Scan Resolution between 7.5 microns and 15 microns, with a preferred scan rate of 12 or 14 microns. Scan rate shall not be re-sampled to meet these resolutions
 - c. A full set of over-views shall be produced and delivered for each scan.
 - i. **Overviews shall be** created using the **preferred Gaussian Method** or if unavailable, use the **Averaging Method**. Use of the Subsampling method is not acceptable.
 - d. Scan orientation shall be with fiducial #1 located in the lower left corner.
 - e. File names of scans shall contain flight line number, photo symbol and exposure number such as: 1GNJ10.cmp or 12GNZ59.cmp.
 - f. File formats of scans shall be preferably in Intergraph (*.cmp) format [JPEG compressed COT (Continuous Tone) files]. COT is an Intergraph native file format.
 - i. Q Factor for Color Photography shall be between 3 and 7 based on a Z/I ImageStation workstation. **No** compression artifacts shall be visible when viewed at a 1:1 ratio.
 - ii. Q Factor for Black and White Photography shall be **10** based on a Z/I ImageStation workstation. Regardless of the numeric Q factor used, **no** compression artifacts shall be visible when viewed at a 1:1 ratio.
3. **Scanning of negatives shall be done** as soon as possible after negatives are exposed and **prior to any titling and printing** of diapositives and contact prints, if part of the consultant's workflow.
4. Scans of all raw images shall be submitted to MDOT on DVD's, or external hard drives in Intergraph (*.cmp) or Tiff format.

E. Lidar Point Data Acquisition

1. Lidar data may be used with approval by MDOT. When Lidar is proposed to be used, the Consultant shall contact the MDOT Photogrammetric Project Manager to fully discuss the parameters and requirements of the Lidar data to be acquired for that project.
2. Lidar data shall be reported, and deliverables submitted, to MDOT per the deliverables listed below and the scope as defined for that particular project.
3. The consultant shall refer to and follow the ASPRS Lidar Guidelines – Horizontal Accuracy Reporting and the ASPRS Guidelines – Vertical Accuracy Reporting for Lidar Data.

Unless otherwise specified, the general specifications for vertical aerial photography shall follow the criteria set forth in the DRAFT Aerial Photography Standards, ASPRS Professional Practice Division, Specifications and Standards Committee, September 1995; OR as set forth in the SURVEY AND MAPPING MANUAL, US. Department of Transportation, Federal Highway Administration, November 1985.

Compliance with these standards will be the burden of the Consultant.

DELIVERABLES for Aerial Photography Acquisition

A. Flight Deliverables

1. A Report containing information relative to the Flight, Camera, Film and Printing for this project.
2. When a digital camera is used to fly the project, the digital imagery shall be delivered. See item "E. Digital Camera Imagery Deliverables and Reports" below.
3. When the project is flown using a film camera, the original color or black and white negatives shall be delivered; to be 9 x 9 inch aerial film roll format.
 - a. The exposed aerial film will be processed (developed) into negative images. The negatives are to remain un-cut. The un-cut negatives will be titled and numbered consecutively. The use of automated numbering and title information printed by the camera/camera software during flight is encouraged. The numbering scheme will be specified by the Project manager for each project. Project numbers for exposure labels will be assigned by the Project manager. ***Refer to Film labeling detail per MDOT Standards or per the MDOT Survey/Photogrammetric Project Manager.***
 - b. The **process control strip containing the density gradients** used in processing the film.
4. A flight index map/flight diagram showing the flight lines, flight numbers, model limits, targets/check point locations and the beginning and ending photograph numbers in each flight line on a topo quad, photo image, or ortho-photo background will be submitted. The original flight and target diagram may be used.
5. Survey Report showing the number of each target placed, the location of each target (a copy of the target diagram maybe used), the type of target (painted or otherwise), and at least two witnesses to permanent objects from the location of the target.
6. Provide camera calibration report(s) for each aerial camera used for the project. Camera calibration certificate must not be more than three years old.

B. Airborne GPS(ABGPS) Deliverables

1. The GPS files for the base stations along with the GPS files of the aircraft shall be collected and delivered to MDOT in RINEX format.
 - a. Consultant is urged to utilize the MDOT CORS stations as much as possible for the base stations. MDOT CORS data may be acquired from the MDOT CORS Website at <http://mdotcors.org/> but copies of the data files utilized for this project must be submitted as part of the deliverables.
 - b. Provide offsets for GPS antenna, Inertial Measurement Unit (IMU), etc. to Camera exposure center along with a sketch of the offsets and location of the GPS antenna, IMU and camera within the aircraft.
2. The Consultant shall provide to MDOT the final EO coordinates for each exposure formatted in ASCII, comma delimited files.
 - a. The file information shall be arranged as follows:
Flight number, Photo number, X, Y, Z, Kappa, Phi, Omega
3. If IMU orientation information can be collected, the Consultant shall provide the precise exposure orientation readings (Kappa, Phi and Omega) for each exposure in the ASCII formatted files.
 - a. If an IMU is not used, **approximate orientation values shall be recorded or derived and shall be submitted** in ASCII format for each exposure for use during aerial triangulation.

C. Image Scanning Deliverables

1. Scanning Report outlining scanning methods, operations and details for the scanning of the exposures for this project.
2. **The raw image scans** of all exposures on DVD's or external USB/Firewire hard drives in Intergraph (*.cmp) or .tif format.
3. Scan parameters used for this project.

D. Project Report Deliverables

1. **A Photogrammetrist's Project Report on company letterhead** discussing the project and the following as applied to this project: aerial photography, raw image scanning, ground control, AAT, LiDAR data, map compilation, digital ortho-photos, final mapping files, any problems encountered and how they were resolved, and any issues of interest to the next Surveyor, Photogrammetrist, or Engineer that are involved with the project. In addition the Photogrammetrists Project report shall include the project, datums, coordinate systems and units used for the deliverable products and the accuracies attained as submitted for the deliverable products.
2. See more **detailed information** related to the **format of the portfolio contents** as outlined near the end of this scope.

E. Digital Camera Imagery Deliverables and Reports - When acquisition by digital camera is proposed as part of the project, the following deliverables shall be submitted to MDOT:

1. The acquisition of the information by digital camera, the processing and the final imagery data shall be fully described in the project reports and shall include a complete listing of the flight parameters, camera settings, altitude, overlap, GSD (ground sample distance), pixel resolution and image data post-processing parameters, and all other pertinent parameters (meta-data) used in this project.
2. **Level 1 Digital Images shall be submitted to MDOT.** ("Raw" DMC digital image files obtained during the Digital Camera Imagery Acquisition shall be processed to the stage that creates a viewable image that would be considered the equivalent of images obtained from scanning film negatives, and which are ready for use in potential future photogrammetric map compilation processes using soft-copy methods.)
 - a. Level 1 images shall be provided in **natural Color RGB format. Black and White, Color Infra-red (CIR) and/or Multi-spectral formats shall be supplied when requested by MDOT** and shall be provided on large capacity 1 TB, 2 TB or similar **portable hard drive digital storage media.** Files shall be in TIFF or GeoTiff format.
3. **Photogrammetric project files** – Provide complete Z/I Imaging formatted project files containing photogrammetric project parameters, settings, camera info, aerial triangulation, exterior orientation, etc. that could be utilized with the level 1 images to set models and compile mapping, if necessary.
4. Applicable standard portfolio reports, documents and certifications as described in this As-Needed Scope and the Photogrammetry Check list, as they pertain to the acquisition of digital imagery and this project in general, shall be prepared and submitted with the final portfolio/PDF. Hard copies of large documents, such as AAT results, are not required however the electronic files must be included.

5. The consultant shall report the actual accuracies obtained/used on this project along with a narrative statement discussing any qualifying issues contributing to these values and the intended use of the above products. (e.g. all pertinent metadata associated with the data products relative to this project area.)

F. Lidar Deliverables

1. A Lidar Report shall provide a detailed listing of the equipment, methods and processes used to obtain the Lidar data as well as a comprehensive narrative describing the Lidar data set and resulting products.
2. Lidar Settings – Prepare a listing of the equipment settings, acquisition parameters, flight settings, etc. Provide the information listed in the Photogrammetry Checklist.
3. The Horizontal accuracies attained for the acquired Lidar data shall be reported. The consultant shall utilize the ASPRS Lidar Guidelines – Horizontal Accuracy Reporting.
4. The Vertical Accuracies attained for the acquired Lidar data shall be reported. The consultant shall utilize the ASPRS Guidelines – Vertical Accuracy Reporting for Lidar Data.
5. Lidar Raw data shall be provided in ASPRS .LAS format, with the .LAS version to be determined.
6. Lidar Raw data shall be also provided in ASCII format.
7. Lidar based digital elevation model (DEM) processed to a Bare Earth Model (BEM), 3D Microstation file shall be provided.
8. Lidar DSM (Digital Surface Model of the first reflective surface) in a 3D Microstation file.
9. Lidar Index file containing an index of the tiles in a 3D Microstation file.
10. Lidar Enhanced by Photogrammetry in a 3D Microstation file.

**REQUIREMENTS FOR
AERIAL PHOTOGRAMMETRIC MAPPING
(including Lidar data and Digital Ortho-photos)
P/PMS Task Number 3310**

The specific parameters and details such as limits, photo scale, mapping widths, etc. related to this photogrammetric mapping task will be determined.

Description of Work for Task 3310(Prepare Aerial Topographic Mapping): The actual work required may include some or all of the following but is not limited to the following tasks: Aerial triangulation, planimetric mapping, terrain mapping, CAiCE surface generation and contour mapping, map merging, use of and merging of Lidar data, and digital ortho-photos.

SCOPE OF CONSULTANT DUTIES

The Consultant will provide:

1. Ground control surveying will be the responsibility of the Prime Consultant and be accomplished by an MDOT qualified firm, if the Prime is not pre-qualified for photogrammetric control surveys. **New ground control is generally required as part of new project mapping. Reference PPMS task # 3320.**
 - A. CONTROL – Check Shots

The **Consultant must contact** the Photogrammetry Project Manager **prior** to commencing work to **discuss the Check Shots to be used** for this project. The Check Shots are to be with-held from the Analytical Aerial Triangulation (AAT) adjustment and compared with the AAT adjustment results. **This comparison shall be documented in tabular form or spreadsheet along with a written report discussing the AAT adjustment and check shots, and delivered to MDOT as part of the intermediate AAT review prior to commencing map compilation.** Once MDOT has reviewed the AAT report, the Consultant shall utilize the check shots in the map compilation process to verify proper model setup prior to mapping. **As part of the final mapping deliverable, the Consultant shall provide additional data to the spreadsheet that shows the comparison of the check points to the final map coordinates and elevations determined after aerial map compilation is complete.**
 2. Topographic Mapping of the project as specified and including:
(See MDOT requirements for preparation of engineering plans).
 - A. Aerial Triangulation Data for the project.
 1. Aerial triangulation to establish the photogrammetric mapping control parameters shall be performed as part of this scope.
 - B. Planimetric map data.
 1. Collect data for map scale of project.
 2. Mapping shall be compiled from the photography acquired for this project.
 - C. Digital Terrain Model DTM data.

(Exact values will be determined for the project and approved by MDOT. The following spatial data accuracies are for example only.)

 1. Spatial data accuracy of **0.04 feet (rmse) [0.09 feet (95%)]** for hard surface features and well defined points.
 2. Spatial data accuracy of **0.10 feet (rmse) [0.20 feet (95%)]** for terrain and other not well defined points.

The Power GeoPak terrain surface (TIN/DTM) shall be generated,

edited and named "EXPHO".

D. Contour generation from DTM.

1. Contour Interval shall be computed at **2.00 feet**.

(**Note: Contour interval** is for **display only** and **shall not** be used as criteria for the determination of **vertical accuracy** of mapping being requested.)

E. Composite map generation and editing.

1. These files must be created with the current MDOT English seed and cell files.
2. Current MDOT symbology must be used exclusively as shown on the MDOT Survey FTP site.
3. The MDOT Survey FTP site: Please contact the MDOT Survey Project Manager for information to access the FTP site.
4. Mapping data shall be displayed, with the appropriate descriptive attributes, Microstation levels, size of text, etc. as noted on the FTP site. The Consultant is required to use the latest MDOT Tugboat (macro) to produce the final project deliverables.
5. The Consultant photogrammetrist, surveyor or CADD technician is expected to use due judgment in the event of necessary deviations from this standard. Survey chains (line items) will be processed and edited so as to be displayed as lines and smooth curves as appropriate and displayed at the requested scale with the appropriate pattern. All descriptive text shall be arranged such that text shall not overwrite each other. The delivered product should be legible and professional in appearance and portray an accurate representation of existing field conditions. As there are many variations in standard practices throughout the industry, it is recommended that the consultant refer to the MDOT FTP site and the MDOT Design Division Plans Preparation Guidelines for additional information regarding such things as font size, display attributes, symbology, levels, etc., to be displayed in the submitted planimetric file. Questions or confusion should be immediately brought to the attention of the MDOT Project Manager for clarification.
6. A Digital Terrain Model (DTM) will be created from the appropriate terrain data using the Power GeoPak terrain modeling format. It shall be checked for accuracy and edited as necessary to provide a true representation of the existing terrain. All triangles in the triangulation network that fall outside of the limits of this survey, or are deemed inappropriate in the judgment of the photogrammetrist or surveyor, are to be obscured so as to have no effect on cross-sections, contours and profiles developed from the model. These would include triangles which have legs so long as to cross areas that contain no survey data. Contours are to be generated from the Digital Terrain Model (DTM), to depict the site conditions for this project and plotted as noted above.

- F. Merging of photogrammetric aerial mapping, ground survey mapping and all other forms of mapping information necessary for the project. The Consultant is responsible for obtaining and providing personnel with the necessary expertise in Power GeoPak, Microstation and map merging methods and procedures to prepare complete and accurate terrain surface (DTM) and mapping files. The Consultant shall include a detailed narrative in their work plan, describing the personnel and procedures to be used for any merging required on this project. (Typical items requiring merging include, obscured mapping areas, utilities, detailed hard surface elevation mapping, etc.)
- G. **Digital Rectified Ortho-Photo maps** generated from the aerial photography, and utilizing the terrain data from a standard altitude flight or in combination with terrain mapping from VLAP photography.
1. Ground Pixel resolution of the final image shall be **0.25 feet** unless otherwise stated in the individual job parameters.
 2. Prepare two dimensional (2-D) digital orthometric images of the subject area, or as defined. The photographs will be digitally scanned, or the digital image may be re-sampled to produce a ground pixel resolution of **0.25 feet** for the final ortho image. Individual stereo image models or alternate aerial photographs maybe used, to create the orthometric images. The individual orthometric images will be re-projected to their true ground position on the DTM (digital terrain model) for the specified area.
 - a. **Width of Digital ortho-photos shall extend to the neat limits of the photography.**
 3. The individual re-projected orthometric images will be assembled into a digital mosaic to produce one seamless orthometric image for the specified area.
 4. Digital Terrain Model (DTM) data for Digital ortho-photos.
 - a. Spatial data accuracy for Digital Ortho-photos of **0.25 feet** or as specified.
 - b. The terrain data collected for the Microstation terrain file and the Power GeoPak surface shall be utilized to minimize compilation efforts.
 - c. In addition to the DTM in 4.b. the Consultant shall collect Digital Elevation Model (DEM) data out beyond the DTM coverage to extend the elevation data necessary to produce Digital ortho-photos covering the entire neat model width of the photography.
 5. Horizontal accuracy of Digital ortho-photo shall be **1.0 feet or better.**
 6. The Digital ortho-photo image files shall be in uncompressed geo-referenced tiff or tiff/world tiff format. The image files shall be delivered in tiles of approximately 50mb to 100mb for black and white and color images.
 7. **Prepare MrSID or ECW compressed files** of the seamless image mosaic with a compression ratio of 10:1 or less.

Unless otherwise specified, the general specifications for vertical aerial photography and mapping shall follow the criteria set forth in the DRAFT Aerial Photography Standards, ASPRS Professional Practice Division, Specifications and Standards Committee; September 1995, OR as set forth in the SURVEY AND MAPPING MANUAL; US. Department of Transportation, Federal Highway Administration; November 1985. In addition, the Consultant shall follow and comply with MDOT Specifications for Photogrammetric Mapping.

Compliance with these standards will be the burden of the Consultant.
ALL OF THE TASKS CITED ABOVE RELATE TO MDOT'S PPMS TASK # 3310, AND SHOULD BE REFERENCED ON BILLING.

PROJECT SCHEDULE for Aerial Photogrammetric Mapping

The aerial mapping deliverables should be submitted for MDOT review as soon as possible after completion and prior to commencing Design from this information.

The Selected Consultant must provide a detailed schedule in his work plan which must be reviewed and approved by the MDOT Survey/Photogrammetric Project Manager and MDOT Project Manager.

The schedule **must include** the following:

- Date to Submit Flight & Target Diagram(s) for MDOT Review and Approval.
- Date Aerial Targets Completed
- Date Flight Completed
- Date Photogrammetric Control Survey Completed & Submitted for MDOT Review
(include a map of the targets and control overlaid on an aerial image backdrop)
- Date of Submitting Aerial Triangulation & First Model for MDOT Review and Approval
- Date of Submitting Final Photogrammetric Mapping Deliverables including merged survey information
- Date of Submitting Final Supplemental Road Survey Deliverables including data merged with photogrammetric mapping

DELIVERABLES for Aerial Photogrammetric Mapping

A. Aerial Triangulation

1. Electronic data file containing a listing of interior orientation results for each photo.
2. Listing of relative orientation results for all strips.
3. Listing of the final least squares adjustment including files of:
 - a. All initial parameter settings set for the adjustment, including datum, units, a priori, standard deviation error estimates, etc.
 - b. All input data.
 - c. Initial run with all control points in solution unless previous runs have been removed.
 - d. Final run that will be used to determine the exterior orientation parameters.
 - e. Results file containing all possible reports of adjustment.
 - f. Report explaining the reasons for withholding any point.
4. Listing of the final exterior orientation parameters.
5. Electronic orientation files in Intergraph Image Station project format are preferred. Other formats that allow the set up of the project's models on an Intergraph Image station (Bluh, Bingo, Patb, Patm, PEX, Phorex, BCPI & SD BCPI) are acceptable.
6. **Spreadsheet of comparison results between the AAT adjustment and the Check Shots.**

B. Photogrammetric Mapping

All mapping will be transmitted to MDOT by the scheduled date as set forth in the project scope. The electronic files shall conform to the **current** MDOT standards for MicroStation and Power GeoPak software versions and MDOT CADD standards. The following shall be submitted as specified in the scope:

1. A three-dimensional Micro Station file, containing all compiled planimetric and terrain

information and formatted to current MDOT V8 CADD requirements. This file will be used to load all the information into Power GeoPak to develop the terrain surface and merge data with any supplemental conventional survey. This will create the file that engineering design will be based upon and used as a reference.

- a. This file shall be named similar to: **JN123456Photo_3D.dgn**
2. Contours shall be created and included in the 3D MicroStation file.
3. Power GeoPak related deliverable files:
 - a. A three-dimensional MicroStation triangle file for use in Bentley Geopak created through the use of Power GeoPak.
 - i. For the Photogrammetry based surface this file shall be named similar to: **JN123456_Triangle_EXPHO.dgn**.
 - ii. For a Combined Photogrammetry and Supplemental ground survey Merged surface, the file shall be named similar to: **JN123456_Triangle_EXMERG.dgn**
 - b. Project deliverables will include **Geopak (.TIN) and Inroads .DTM files for each surface**. These files must be created with the current MDOT English seed and cell files. Current MDOT symbology must be used exclusively as shown on the MDOT FTP site.
4. Edited PowerGeoPak terrain surface of the photogrammetric data named "EXPHO". The MDOT **current version** of PowerGeoPak shall be used to produce the terrain surface and the entire PowerGeoPak project is to be delivered in the 3D MicroStation file.
5. All necessary merged data products in Power GeoPak, Microstation, or other formats prepared as a result of combining the photogrammetric mapping, ground survey mapping and any other data needed for the project.
6. Digital ortho-photos in uncompressed geo-referenced Intergraph tiff or world tiff format.
7. Digital mosaic in one seamless orthometric image file for the specified area in Intergraph tiff or world tiff format (if the file size will be extremely large contact the MDOT Survey/Photogrammetry Project Manager for alternatives).
8. MrSid or ECW file format with compression ratio of 10:1 or less, of the project area using the geo-referenced, ortho-photo image mosaic.
9. The three-dimensional Microstation terrain data file used strictly to generate the ortho-photo images.
10. **The raw image scans** of all exposures on DVD's or external USB/Firewire hard drives in Intergraph tiff (*.cmp) format.
11. The original negatives that were exposed as part of the project or were supplied by MDOT for this project.
12. Marked-up contact prints and flight maps and any materials originally supplied by MDOT.
13. **Spreadsheet of comparison results** showing the **Check Shots** and the comparison to the **AAT adjustment results**.
14. **Spreadsheet of comparison results** showing the **Check Shots** and the comparison to the **final compiled mapping coordinates**.
15. **A Photogrammetrist's Project Report on company letterhead** discussing the project and the following as applied to this project: aerial photography, ground control, AAT, LiDAR data, map compilation, digital ortho-photos, final mapping files, any problems encountered and how they were resolved, and any issues of interest to the next Surveyor, Photogrammetrist, or Engineer that are involved with the project. In addition the Photogrammetrists Project report shall include the project, datums, coordinate systems

and units used for the deliverable products and the accuracies attained as submitted for the deliverable products.

a. See more **detailed information** related to the **format of the portfolio contents** as outlined near the end of this scope.

16. **Accuracy certification statements** shall be provided as a signed statement on company letterhead containing the following information:

Project Description
Job Number
Control Section
Photo Job Number
Photo Scale & Date
Mapping Scale
Ground Pixel Resolution of Digital Ortho-Photos
Horizontal Datum and Units
Vertical Datum and Units

Include a separate accuracy statement for **each type** of deliverable including the planimetric mapping, terrain mapping, the DTM surface, digital ortho-photos and LiDAR terrain data, etc. which states the actual tested NSSDA accuracies and are in a format similar to the following:

(Type of deliverable) was/were compiled by (Consultant's Name) for the Michigan Department of Transportation on (Completion Date) to meet _____feet accuracy (horizontal) at 95 percent confidence level and _____ feet accuracy (vertical) at 95 percent confidence level for hard surface and well defined points and to meet _____ feet accuracy (horizontal) at 95 percent confidence level and _____ feet accuracy (vertical) at 95 percent confidence level for terrain and not well defined points based on the National Standard for Spatial Data Accuracy(NSSDA), (date of standard), currently in effect. This statement should be signed by the Certified Photogrammetrist in responsible charge of the work preformed.

(Note: Separate accuracies for both well-defined hard surface locations and for ground/mass point locations shall be described in the above statement. Accuracies based on the NMAS or based on contour intervals and map scale, are not acceptable.)

D. Lidar Deliverables

1. A Lidar Report shall provide a detailed listing of the equipment, methods and processes used to obtain the Lidar data as well as a comprehensive narrative describing the Lidar data set and resulting products.
2. The Horizontal accuracies attained for the acquired Lidar data shall be reported. The consultant shall utilize the ASPRS Lidar Guidelines – Horizontal Accuracy Reporting.
3. The Vertical Accuracies attained for the acquired Lidar data shall be reported. The consultant shall utilize the ASPRS Guidelines – Vertical Accuracy Reporting for Lidar Data.
4. Lidar based digital elevation model (DEM) processed to a Bare Earth Model (BEM), 3D Microstation file shall be provided.

5. Lidar DSM (Digital Surface Model of the first reflective surface) in a 3D Microstation file.
6. Lidar Index file containing an index of the tiles in a 3D Microstation file.
7. Lidar Enhanced by Photogrammetry in a 3D Microstation file.

E. QA/QC Certification Statement

1. Each submittal must be accompanied by the following certification statement contained in a letter format on the Consultant’s letterhead and signed by the lead QA/QC person in responsible charge on this contract.
2. If the submittal does not contain the following statement, the submittal is subject to a reduction in the QA/QC costs for the submittal at the MDOT Project Manager’s discretion.

I _____ certify as lead QA/QC person in charge on this contract that I have thoroughly reviewed the project and any corrections identified have been completed.

Name of Certified Photogrammetrist
Project QA/QC Officer
ASPRS Certified Photogrammetrist No. _____

Date

PHOTOGRAMMETRY DELIVERABLES

Format Of Deliverables For Aerial Photography Acquisition And Photogrammetric Mapping

- P/PMS Task 2320 (Conduct Aerial Flight)
- P/PMS Task 2321 (Prepare for Aerial Photography)
- P/PMS Task 2322 (Finish/Print Aerial Photography)
- P/PMS Task 3310 (Prepare Aerial Topographic Mapping)

(Photogrammetric Report shall include some duplicate information of P/PMS Task 3320 – Conduct Photogrammetric Control Survey and P/PMS Task 3321 – Set Aerial Photography Targets)

The **FINAL PHOTOGRAMMETRIC REPORT** shall include **1 complete set** of hardcopies for **only** those documents that are signed or unable to be clearly scanned into an electronic format and shall be submitted in a 10" by 12" portfolio with flap cover divided into pockets. **Three (3) complete sets** of the “**Electronic Portfolio**” of the reports and deliverables for the entire project on CD-ROM or DVD-ROM shall be included, containing the following:

QA/QC review and signature for the Photogrammetry Tasks portfolio must be provided by an ASPRS Certified Photogrammetrist having MDOT Prequalification in Photogrammetry.

When MDOT PPMS Tasks 3320 and 3321 (Photogrammetric Control Survey and Targeting) are part of the project scope, all data, reports and deliverables associated with those tasks shall be organized and delivered in a separate portfolio/”Electronic Portfolio”. **QA/QC review and signature for a Task 3320 portfolio must be provided by a Michigan Professional Surveyor having MDOT Prequalification in Photogrammetric Control Surveys. See the section discussing Photogrammetric Control Survey and deliverables later in this document.**

The portfolio shall contain the following 12 sections. Each section in the portfolio shall be named with the titles listed below to identify the type of data contained in the section. **Each sheet in the Electronic portfolio(PDF) shall be labeled with the MDOT Photogrammetry Project Number, Job Number, Control Section, and Page Number using the Header/Footer tool in Adobe. CD's, DVD's and electronic storage media shall be labeled with the MDOT Photogrammetry Project Number, Job Number, Control Section, and Date of the latest revision.** The MDOT Photogrammetric Project Check List shall be prepared and included in the Administration section.

General Notes

The outline below contains a sample listing of typical information to be provided for the final photogrammetric reports and PDF file. The final project report required by the project scope may contain some or all of these items and/or additional items not listed here and shall provide the complete information needed for another Photogrammetrist or Professional Surveyor to determine what was done as part of this project.

1. In the first pocket of the portfolio, labeled **1 ADMINISTRATION**, the following will appear:
 - a. Table of Contents (Adobe PDF files should contain this bookmarked on left side of screen)
 - b. MDOT Photogrammetric Information Receipt and Transmittal form to MDOT
 - c. QA/QC Certification, signed by lead QA/QC person
 - d. **MDOT Photogrammetric Project Check List**
 - e. Photogrammetrist's Project Report containing detailed information about the project
 - f. Project Accuracy Certification by Photogrammetrist
 - g. MDOT Authorization to Proceed
 - h. MDOT Scope of Work
 - i. Consultant Proposal and Work Plan
 - j. Work Permits required for the project
 - k. Correspondence including meeting minutes, e-mails, and phone conversations.
2. In the second pocket of the portfolio, labeled **2 FLIGHT PLAN**, the following will appear:
 - a. Flight Report
 - b. Flight diagram showing flight line, model limits and targets/check point locations on a topo quad, high altitude photographic image, or ortho-photo background
 - c. Listing of Flight parameters (also include text file for input to Ascot)
3. In the third pocket of the portfolio, labeled **3 TARGETING**, the following will appear:
 - a. Targeting Report
 - b. Target Parameters, including size, shape, material and location types
 1. Include the location of and description of the type of semi-permanent object (nail, re-rod, iron, etc.) and how it is positioned within the target, (ie. PK nail in center of cross or plus, nail in center intersection of "T")
 - c. Check Point Target Parameters, including size, shape, material and location types
 - d. Witness sketches of all targets with enough information for another person to be able to locate the target.
4. In the fourth pocket of the portfolio, labeled **4 PHOTOGRAPHY**, the following will appear:

- a. Camera, Film and Printing Report
 - b. Camera Calibration(s) (must be current within last 3 years)
 - c. Negatives - Original un-cut film negatives in roll
 - d. Contact Prints (Only if Requested) – Scanning done prior to printing contact prints and diapositives
5. In the fifth pocket of the portfolio, labeled **5 IMAGE SCANNING**, the following will appear:
 - a. Scanning Report
 - b. Scanning settings and parameters
 - c. Raw image scans of all exposures with camera generated annotation labeling done prior to printing contact prints and diapositives if they are used by the consultant as part of their work flow.
 6. In the sixth pocket of the portfolio, labeled **6 AIRBORNE CONTROL**, the following will appear:
 - a. Airborne GPS information, including raw data files for base stations, CORS, and aircraft, and final coordinate file for exposure centers
 - b. Offset information from GPS antenna to Camera exposure center
 - c. Airborne GPS relation to Ground Control
 7. In the seventh pocket of the portfolio, labeled **7 CONTROL**, the following will appear:
 - a. Ground Control Report
 1. Explain how ground control coordinates and data fit into this project and any issues associated with the control survey.
 - b. Include copies of all ground control information supplied by surveyors to the photogrammetric work group and used to prepare the aerial triangulation and mapping.
 - c. Reference any separate portfolios prepared for Task 3320 Photogrammetric Control Survey.
 - d. Ground Control Coordinate Listing including specification of datums, units, etc.
 8. In the eighth pocket of the portfolio, labeled **8 AERIAL TRIANGULATION**, the following will appear:
 - a. Aerial Triangulation Report
 - b. Aerial Triangulation solution and all associated Aerial Triangulation project settings, adjustments and output report files
 - c. Comparison of AT solution to check point data (Spreadsheet format)
 9. In the ninth pocket of the portfolio, labeled **9 MAPPING**, the following will appear:
 - a. Mapping Report including planimetric and terrain accuracies
 - b. Report and spreadsheet comparison of compiled mapping to checkpoints and resulting accuracies for project
 - c. 3D Microstation File in MDOT MicroStation V8 format
 - d. Planimetric information and 3D Planimetric Microstation files
 - e. Terrain information and 3D Terrain Microstation files
 - f. Power GeoPak DTM information and 3D Power GeoPak files containing complete edited surface
 - g. Contour files in Microstation format generated from Power GeoPak

- h. Combined Mapping containing Photogrammetric and Supplemental Ground Survey, if proposed in scope.
 - 1. Power GeoPak DTM of edited, Merged Terrain surface information. Merged Power GeoPak project contains both Photogrammetric and supplemental Ground Survey information
 - 2. Provide separate Supplemental ground survey information used to enhance hard surface information, fill in obscured areas and in general supplement the photogrammetric mapping.
 - 3. 3D Power GeoPak formatted files.
 - 4. Provide 3D Power GeoPak files for each of the following conditions
 - a. Photogrammetric data
 - b. Merged Photogrammetric and Ground Survey data

- 10. In the tenth pocket of the portfolio, labeled **9A ORTHO-IMAGERY**, the following will appear:
 - a. Digital Ortho-photo Report
 - b. Digital Ortho-photo Parameters and Accuracies
 - c. Digital Ortho-photo files
 - d. MrSid Parameters
 - e. MrSid Files

- 11. In the eleventh pocket of the portfolio, labeled **9B LiDAR**, the following will appear:
 - a. Lidar Report
 - b. Lidar Settings
 - c. Horizontal accuracies attained
 - d. Vertical Accuracies attained
 - e. Lidar Raw data in ASPRS .LAS Version 1.2 format
 - f. Lidar Raw Data in ASCII format
 - g. Lidar DEM processed to a Bare Earth Model (BEM) 3D Microstation file
 - h. Lidar DSM (Digital Surface Model) 3D Microstation file
 - i. Lidar Index file containing and index of the tiles 3D Microstation file
 - j. Lidar Enhanced by Photogrammetry in a 3D Microstation file

- 12. In the twelfth pocket of the portfolio, labeled **MISCELLANEOUS**, the following will appear:
 - a. Include other items relevant to the project but not fitting in above categories. The Photogrammetrist's Project Report must detail any items included in this area.

**REQUIREMENTS FOR
PHOTOGRAMMETRIC TARGETING AND CONTROL SURVEY
 PPMS Tasks 3321 and 3320**

SURVEY DESCRIPTION: Ground Control Survey to support photogrammetric aerial flights and mapping. Use a point numbering sequence as assigned for the Photo control targets and Check targets or as designated by the MDOT Survey/Photogrammetric Project Manager.

Note: Prior to starting work the Consultant shall contact MDOT Traffic and Safety in the

TSC closest to the project site.

NOTES:

The Selected Consultant surveyor **must** submit a **detailed Survey Work Plan**, with an **estimate** of hours, by specific survey task, such as targeting, traversing, leveling, etc., as part of the project price proposal.

The Selected Consultant surveyor must discuss the scope of this survey with the project MDOT Survey/Photogrammetric Project Manager before initiating any work on this project. Notes of this meeting and a detailed Survey Work Plan with an estimate of hours broken down by specific survey task must be submitted to the MDOT Survey/Photogrammetric Project Manager within two weeks of this meeting.

The MDOT Standards of Practice for Design Surveys, current dated version, shall be used for this project. This scope shall hold when conflicts occur between the scope and the Standards of Practice for Design Surveys.

GENERAL REQUIREMENTS:

This survey includes setting out photogrammetric control targets, either by painting or cloth (or other suitable materials acceptable by MDOT) targets in non-paint areas. A panel/target diagram with target locations and numbers must be submitted and approved by the MDOT prior to the placement of the targets. A panel/target diagram must also be returned with the survey with any changes so noted. The requirements for the placing of targets shall follow the (MDOT) Standards of Practice for Design Surveys, current version, and the MDOT Design Survey Manual.

PROJECT SCHEDULE for Photogrammetric Control Survey

The photogrammetric control survey deliverables should be submitted for MDOT review as soon as possible after completion and prior to commencing the aerial triangulation and mapping portion of this project.

FIELD SURVEY – Photogrammetric Ground Control Survey

The purpose of the field survey is to obtain all information and/or data required to support photogrammetric mapping, to leave control in the field for future construction staking, and to provide a sufficient history of the area to enable the MDOT surveyors to perform dependable surveys in the future.

The field survey must include, but is not limited to, the following:

CONTROL - Primary

HORIZONTAL CONTROL - (State Plane Coordinate System)

A three dimensional coordinate network has been established for this project. The horizontal component of this coordinate network is based on the Michigan Coordinate System (MCS 83), NAD 1983/CORS96, or NAD83(NSRS2007), Michigan Appropriate Zone, North, Central or South. **The horizontal least squares adjustment statistics must be reported at the 95% confidence level.**

The vertical component of this network is based upon the North America Vertical Datum of

1988 (NAVD 88). All subsequent control must be based on the established control. Any traverse points or bench marks established must adhere to the Michigan Department of Transportation (MDOT) Design Surveys *Standards of Practice*, current version and be listed in the Control pocket of the portfolio.

The Consultant must contact the MDOT Survey/Photogrammetric Project Manager prior to commencing work to discuss the existing control, amount of new control to be used for this project and the locations to be used for placing new control monuments. It is intended that generally pairs of inter-visible primary control monuments shall be placed for the project. In some projects, primary control that is not inter-visible may be requested to be placed for the project. The control pairs are to be **located out of the proposed construction area** and in the most permanent places possible given the urban nature of many projects. It is intended, to the extent possible, that the Primary control would be **placed to last for 5 to 10 years** and be usable for future construction projects. The Consultant shall use CORS and existing NGS control monumentation to establish the Primary Control. OPUS shall be used **only as a check** and verification of the control coordinates established by other means.

For any and all OPUS solutions, a RINEX format file of the GPS data must be included, as well as the OPUS solution from NGS. All OPUS solutions must be verified within 0.10 feet, either by a separate OPUS position from an independent occupation, or by a NGS/CORS adjustment.

Upon request, the MDOT Design Survey Unit will supply descriptions of nearby published Nation Geodetic Survey (NGS) control stations and bench marks. A complete history, as well as a recovery description with new witnesses to be submitted in DDPROC to NGS, for each NGS horizontal and vertical control station and bench mark **used and/or searched** for this project must be included in the final report submitted to the MDOT Design Survey Unit. The DDPROC program is available or the Consultant may opt to use the Mark Recover Entry Form on the NGS Website at www.ngs.noaa.gov. If this is done, a copy of the information submitted to NGS shall be included in the portfolio.

The horizontal control for this project will be classified as primary project control according to the MDOT Standards of Practice, current version. These points are intended for control and staking and should be located outside the proposed construction area to insure their availability for all phases of construction. Each control point must be accurately described and witnessed to at least three nearby features. **Please contact the MDOT Survey Project Manager to discuss the specifics of the placement of the control monuments.**

GPS TECHNIQUES

When using GPS techniques to obtain coordinates on the primary control networks, a closed network must be run and adjusted between three or more known horizontal points and four or more known vertical points. If the above mentioned benchmarks are observable, they may be used as known vertical for this project. Open radial vectors are **NOT** acceptable.

Unadjusted network vector measurements must produce an error of closure of not greater than 1:100,000. **Any permissible error of closure shall be distributed throughout the network by means of a least squares adjustment software program which meets the approval of MDOT.** GPS processing software must be capable of importing and using the most current NGS antenna definitions files. Initial error estimates shall be set equal to or less than 0.03 feet + 1ppm for both horizontal and vertical.

The primary control points must be inter-visible pairs that are observed simultaneously, and must not be set less than 2640 feet nor more than 5280 feet apart, semi-permanent in nature, and located outside the proposed construction area to insure their availability for all phases of construction. A minimum of two pairs of primary control are required on each project, with a pair required every 5.0 miles. All data collection on photogrammetric control points must be tied to the primary control established for this project. Primary control notes must include all least squares adjustment information.

The use of fixed height tripods for GPS observations is highly recommended.

All points shall be occupied at least two times and at least 10% shall be occupied three or more times. Only non-trivial baselines shall be used as part of the adjustment. The consultant shall ensure that in the final network adjustment, all network baseline connections used shall contain at least two vector measurements from independently observed sessions. The network adjustments shall contain redundant vectors/baselines for all connections.

VERTICAL CONTROL - NAVD88

The vertical component of this project must be based upon the North America Vertical Datum of 1988 (NAVD 88). Software currently accepted by MDOT for Vertical adjustments includes LevProc and Starnet-Pro/StarLev. The vertical least squares adjustment statistics must be reported at the 95% confidence level.

New benchmarks may be required to be established for the project if no acceptable vertical control exists on the project. Using the criteria outlined below to support control for VLAP (very low altitude aerial photography) mapping or SAP (standard altitude aerial photography) mapping, provide the necessary results showing both the existing benchmarks for this project, if any, and all newly established benchmarks.

New bench marks must be set on massive structures at or near 1000 foot spacing along the corridor, outside the proposed construction area. Chiseled squares or 'X' in concrete is acceptable but must be clearly identifiable and well described, with good witnesses. Chiseled marks of any kind are **not acceptable in galvanized sign bolts due to the destructive nature and corrosion it subsequently causes. Each bench mark must be accurately described by four witnesses or its horizontal position referenced by measurement from a horizontal control point and by plus and outs from stenciled alignment stationing.**

Bench mark leveling must be performed to meet 0.03 feet times the square root of the distance in Miles for VLAP mapping or 0.05 feet times the square root of the distance in Miles for SAP standard altitude mapping as designated by the MDOT Survey/Photogrammetric Project Manager. Any error of closure must be distributed throughout the level runs by means of a suitable least squares adjustment software program. Closed level loops are to be run. Open level loops are **NOT acceptable.**

The bench mark notes must include all field observations, the unadjusted loop closures and the final adjusted elevations. A **bench mark list** must be developed that includes datum, benchmark designations, descriptions and elevations. All benchmarks observed in the course of leveling are

to be included in the bench mark list, including NGS and fixed benchmarks along with all new benchmarks. **This bench mark list must be printed on 8.5" x 11" sheets and placed on a CD with the rest of the project files. This list must be generated in ASCII format, without tabs, as shown in Attachment A.** The printed list and the CD are to be submitted with the Consultant's final report.

CONTROL - Intermediate

The three dimensional coordinate network, as established above under Primary control for this project, shall be used as the basis for the intermediate control. The horizontal component of this coordinate system must be based upon the Michigan Coordinate System (MCS 83), NAD 1983/CORS96, or NAD83(NSRS2007), Michigan Appropriate Zone, North, Central or South. The vertical component of this system must be based upon the North America Vertical Datum of 1988 (NAVD 88). All photogrammetric control points shall be classified as intermediate control for this project and shall be tied as a network to the primary control as established.

The elevations on photogrammetric targets along one side of the project shall be measured during the benchmark leveling and adjusted as part of the primary vertical control. The targets on the opposite side may be observed with GPS and adjusted by constraining the target elevations on the leveled side as fixed, or they may be measured by conventional leveling. Doing so will ensure elevations to accuracies necessary for this project.

A closed network must be run and adjusted holding the horizontal and vertical control as fixed to obtain coordinates on the photogrammetric targets. Open radial vectors are **NOT** acceptable. Adjacent Photogrammetric targets falling in the same model shall be occupied in the same simultaneous session. **All points shall be occupied at least two times and at least 10% shall be occupied three or more times. Only non-trivial baselines shall be used as part of the adjustment. The consultant shall ensure that in the final network adjustment, all network baseline connections used shall contain at least two vector measurements from independently observed sessions. The network adjustments shall contain redundant vectors/baselines for all connections.**

Rapid/Fast static procedures are preferred although RTK GPS is acceptable provided the Consultant follows the **MDOT Standards and Specifications for RTK GPS Surveys. Contact the MDOT Design Survey Project Manager to discuss specific RTK GPS survey procedures that will be acceptable for the particular project.** Unadjusted network vector measurements must produce an error of closure of not greater than 1:20,000. Any permissible error of closure shall be distributed throughout the network by means of a suitable least squares adjustment software program approved by MDOT.

It is preferred that the nearest targeted points to one another (opposites on highway), be observed simultaneously to ensure measurement and adjustment quality. This generally means a minimum of four receivers may be necessary when static GPS techniques are used.

All field observations, unadjusted network computations and final adjusted coordinates must be included in the notes. A list of all photogrammetric control points must be developed which includes a header with 1983 State Plane Coordinate datum and zone, and contains all point designations, state plane coordinates (X & Y), elevation (Z) and standard deviations for each

component. **This list must be printed on 8.5" x 11" sheets and placed on a CD with the rest of the project files. This list must be generated in ASCII format, without tabs, as shown in Attachment A.** The printed list and the CD are to be submitted with the Consultant's final report. All data relating to the horizontal component of the system must be included in the portfolio.

All field observations, unadjusted traverse computations and final adjusted coordinates must be included in the notes. **A list of all horizontal control points** must be developed which includes datum, point designations, descriptions, horizontal coordinates with standard errors, station and offset, witnesses and combined scale factors. This list must also provide a formula for the conversion of state plane grid values to ground values and be generated using the **MSWord.doc format, without tabs. This list must also be placed in the file named MDOT_Survey_Info_Sheet_JN123456C.doc per the format shown in the example on the Survey FTP site.** All data relating to the horizontal component of the system must be included in the control section of the portfolio.

When using GPS techniques to obtain coordinates on either Primary or Intermediate Control points, two of the following three methods must be used:

1. A minimally constrained CORS solution
2. An OPUS solution with at least 2 hours of occupation per point. For any and all OPUS solutions, a RINEX format file with a minimum of two hours of GPS data must be included, as well as the OPUS solution from NGS. All OPUS solutions must be verified within 0.20 foot, either by a separate OPUS position from an independent occupation, or by a NGS/CORS adjustment.
3. The procedure outlined in Section 7.2.1 of the MDOT Survey Manual.

Open radial vectors are not acceptable.

Unadjusted network vector measurements must produce an error of closure of not greater than 1:100,000 for primary control and 1:20,000 for intermediate control. Any permissible error of closure shall be distributed throughout the network by means of a suitable least squares adjustment software program. The difference in global location between the two chosen methods must not exceed 0.20 feet (0.0610 m). A narrative explaining the process and errors must be included in the Surveyor's Report.

Use of RTK GPS mapping methods needs to be discussed with the MDOT Survey/Photogrammetric Project Manager prior to the beginning of any project.

CONTROL – Check Shots

The Consultant must contact the Survey/Photogrammetry Project Manager prior to commencing work to discuss the Check Shots to be used for this project. The Consultant shall obtain coordinates and elevations for Check shots. **Check Shots** shall be obtained and are to be taken in areas between photogrammetric target groups and not directly adjacent to an existing control point or target. Approximately **three (3) check shots** shall be spaced across the photo model and approximately centered on the highway corridor. The Consultant shall obtain check shot groups along the flight line at approximately **6 to 10 model intervals** along each flight line or as defined by the MDOT Photogrammetric Project Manager. Short flight lines shall have a minimum of three check shot group areas, to include one group near each end of the flight

line and one spaced evenly in the middle. Where flight lines overlap, a check shot group may be located so that the one group is useable for both flight lines. For cross-flight lines on crossroads check shot groups consisting of a minimum of 2 targets with at least one target being located near the center of the model (Flight line centerline) and one on the cross road hardsurface.

Additional photogrammetric targets painted on hard surfaced areas and specifically set for check shots are preferred. Easily identified hard surfaced physical objects with sharp edges or intersections that would be identifiable from aerial photography may be acceptable. Objects with rounded corner edges, utility poles, objects on bridges, objects in shadows, etc., are not acceptable for check shots.

The Check Shots are to be with-held from the Analytical Aerial Triangulation (AAT) adjustment and compared with the AAT adjustment results. **This comparison shall be documented in tabular form or spreadsheet along with a written report discussing the AAT adjustment and check shots, and delivered to MDOT as part of the intermediate AAT review prior to commencing map compilation.** Once MDOT has reviewed the AAT report, the Consultant shall utilize the check shots in the map compilation process to verify proper model setup prior to mapping. **As part of the final mapping deliverable, the Consultant shall provide additional data to the spreadsheet that shows the comparison of the check points to the final map coordinates and elevations determined after aerial map compilation is complete.**

Check Shots are to be surveyed with the same standards as intermediate control points. The same standards and accuracies used to obtain the coordinates and elevations for the photogrammetric target control points (see the section labeled GPS Techniques above) shall be used to obtain the coordinates for these Check Shots. **As an optional method, Check Shots may be surveyed using Real Time Kinematic (RTK) GPS provided the methods used adhere to the MDOT Standards and Specifications for RTK GPS Surveys and the Consultant obtains prior approval from the MDOT Photogrammetric Project Manager.**

The methods used to establish the horizontal and vertical components of the project coordinate control system must be fully discussed in the Surveyor's Project Report.

MISCELLANEOUS

Any information that would not be appropriately placed in the control section must be included in this section. General photographs and local newspaper articles and project-related comments from residents are examples of miscellaneous data.

TARGETING AND CONTROL SURVEY DELIVERABLES

The following outline contains a list of deliverables by P/PMS task number that must be submitted to MDOT Design Surveys immediately upon completion of the P/PMS tasks listed here and prior to commencing the design engineering portion of the project.

DELIVERABLES FOR PHOTOGAMMETRIC CONTROL SURVEY

P/PMS Task 3320 - (Conduct Photogrammetric Control Survey)

P/PMS Task 3321 - (Set Aerial Photo Targets)

The following deliverables shall be submitted to MDOT Design Surveys as soon as possible upon completion of this task.

When MDOT PPMS Tasks 3320 and 3321 (Photogrammetric Control Survey and Targeting) is part of the project scope, all data, reports and deliverables associated with that task shall be organized and delivered in its own separate portfolio. **QA/QC review and signature for a Task 3320 portfolio must be provided by a Michigan Professional Surveyor having MDOT Prequalification in Photogrammetric Control Surveys.**

The **FINAL REPORT shall include 1 complete set** of hardcopies for **only** those documents that are signed or unable to be clearly scanned into an electronic format and shall be submitted in a 10" by 12" portfolio with flap cover divided into pockets. **Three (3) complete sets** of the **“Electronic Portfolio”** of the reports and deliverables for the entire project on CD-ROM or DVD-ROM shall be included, containing the following:

1. In the first pocket of the portfolio, labeled **1 ADMINISTRATION**, the following will appear:
 - a. MDOT’s Form 222(05/01) entitled “SURVEY NOTES: RECEIPT AND TRANSMITTAL”
 - b. The project’s Professional Surveyor's Report on company letterhead consisting of:
 1. Limits of Survey
 2. A comprehensive synopsis of the work performed on this project, **signed and sealed** by the project’s Professional Surveyor.
 3. The source and methods used to establish the project horizontal and vertical control for this project.
 4. A statement from the Consultant surveyor supervising the project certifying compliance with Michigan Department of Transportation (MDOT) Design Surveys *Standards of Practice*, current version.
 5. A detailed explanation of anything discovered during the survey of this project that may create a problem for the designer or another surveyor. The stamped concrete shoulder stationing numbers should be referenced.
 - c. **MDOT QA/QC Certification Check List for Photogrammetric Control Surveys** filled out and signed/sealed by a Professional Surveyor.
 - d. MDOT Authorization and copy of Contract
 - e. Original MDOT Photogrammetric Control Survey Scope
 - f. The Consultant’s detailed Work Plan
 - g. Three duplicate CD's with all documents scanned or converted into PDF files. Each page must be inserted in a master PDF file and bookmarked for easy retrieval. An example can be provided upon request.
 - h. All supporting and supplemental information/data. Include any instructions from the Prime Consultant.
2. In the second pocket of the portfolio, labeled **3 TARGETING**, the following will appear:
 - a. Targeting Report
 - b. Target Parameters, including size, shape, material and location types

1. Include the location of and description of the type of semi-permanent object (nail, re-rod, iron, etc.) and how it is positioned within the target, (ie. PK nail in center of cross or plus, nail in center intersection of "T")
 - c. Check Point Target Parameters, including size, shape, material and location types
 - d. Witness sketches of all targets with enough information for another person to be able to locate the target
 - e. Aerial Photogrammetric target or panel diagram. Note any changes in target positions from planned location to location as surveyed.
 - f. Contact prints marked up with the target locations and point numbers as surveyed.
3. In the third pocket of the portfolio, labeled **CONTROL**, the following will appear:
- a. Synopsis Report on Control
 - b. Sketch or printout of the Control Network.
 - c. Photogrammetric Target X,Y,Z list with standard deviations of each X,Y,Z component, in ASCII text file format, without tabs. **The file shall be formatted with one point per line and shall not contain witness information.**
 - d. Check Shot X,Y,Z list with standard deviations of each X,Y,Z component, in ASCII text file format, without tabs. **The file shall be formatted with one point per line and shall not contain witness information.**
 - e. Check Shot Description list containing the X,Y,Z coordinates and description of object. The list shall be delivered in text files, in ASCII format per Attachment A.
 - f. Witness lists for the primary horizontal control points, bench mark lists including descriptions, Control Point witness list for all intermediate control used, and any photogrammetric target and check target control points that have been witnessed as well as horizontal alignment ties and government corners. The lists shall be delivered in **MSWord.Doc format** per the example form on the Survey FTP site and be named **MDOT_Survey_Info_Sheet_JN123456C.doc**
 - g. **A 3d Microstation file shall be prepared and submitted that includes all primary control, intermediate control, photogrammetric targets, check targets, and benchmarks plotted in their correct 3d coordinate positions. This data shall be prepared using the most current MDOT Cadd symbology and formats. The point number/name and elevation text shall be labeled next to each point.**
 - h. Copies of all Mark Recovery Information submitted to NGS for all NGS control monumentation used during the project documentation of submission of the data to NGS via the NGS web site http://www.ngs.noaa.gov/FORMS_PROCESSING-cgi-bin/recvy_entry_www.prl
4. In the fourth pocket of the portfolio, labeled **HORIZONTAL CONTROL**, the following will appear:
- a. Synopsis Report of Horizontal Control
 - b. Documentation of horizontal datum sources.
 - c. GPS raw data in electronic format
 - d. Least squares adjustments (including both minimal and constrained versions) and analysis for the horizontal control, along with the input or *.dat files used.
 - e. **A vector diagram/map of each GPS survey and adjustment for the project.**
 - f. The Consultant is responsible for verifying all residuals and standard deviations to ensure they meet this scope and the Standards of Practice for MDOT Design Surveys, current version.

5. In the fifth pocket of the portfolio, labeled **VERTICAL CONTROL**, the following will appear:
 - a. Synopsis Report of Vertical Control
 - b. Documentation of vertical datum sources.
 - c. Least squares adjustments (including both minimal and constrained versions) and analysis for the vertical control, along with the input or *.dat files used.
 - d. **A diagram/map showing the location of all vertical control and the level runs/loops performed for the project.**
 - e. The Consultant is responsible for verifying all residuals and standard deviations to ensure they meet this scope and the Standards of Practice for MDOT Design Surveys, current version.

6. In the sixth pocket of the portfolio, labeled **FIELD NOTES**, the following will appear:
 - a. A copy of all field survey notes shall be submitted including data gathering sheets at each point, all electronic data, and all research records obtained for this project. All survey notes are to be included on CD with the rest of the project files, in ASCII format. Data collection files may be in electronic format only, no hard copy is necessary for submission.

7. In the seventh pocket of the portfolio, labeled **MISCELLANEOUS**, the following will appear:
 - a. Any photographs taken for clarity of an area.
 - b. Any newspaper clippings related to the project.
 - c. Any information not covered in this scope that will be of benefit to the designer or another surveyor.

A. QA/QC Certification Statement

1. Each submittal must be accompanied by the following certification statement contained in a letter format on the Consultant's letterhead and signed by the lead QA/QC person in responsible charge on this contract.
2. If the submittal does not contain the following statement, the submittal is subject to a reduction in the QA/QC costs for the submittal at the MDOT Project Manager's discretion.

I _____ certify as lead QA/QC person in charge on this contract that I have thoroughly reviewed the project and any corrections identified have been completed.

Name of Professional Surveyor
Project QA/QC Officer
Michigan PS # _____

Date