SCOTTSVILLE Transportation Area Network (STANET)
System Engineering Technical Assistance
RFP Scope of Work

BACKGROUND

SVMPO seeks a qualified professional engineering firm/team that has both Systems Engineering expertise and Intelligent Transportation Systems (ITS) knowledge and experience to serve as Systems Engineer for the development of an area-wide “system of systems”. This interactive/integrated intermodal transportation management and information system will be based on real-time, computer assisted transportation management and communications. The Systems Engineer will work with stakeholders to establish a concept of operations, define requirements, standardize interfaces and select the project level architecture, prepare the scope of work for System Integrator services, assist in the review of proposals, monitor system implementation and verification, and provide technical assistance to SVMPO throughout the development.

The Scottsville Transportation Area Network (STANET) system will be structured to integrate regional transportation information needed by public and private service providers and users of roadways and public/private transportation systems, including transit and ports, into a real-time environment. This integration will enhance the existing Scottsville Region 511 Travel Information System. It will provide computer assisted decision/management support to transportation management centers and traffic engineering/public safety departments operated by the participating agencies. Improvement to the safety of the transportation system for its users will continue to be a priority to these investments in the Scottsville region.

All agencies will be linked via an information/communications network. The network will connect transportation systems and modes that are presently uncoupled. The communications network will accommodate the exchange of both data and control functions between management centers, as well as the sharing of video. This will allow for cross-jurisdictional transportation management coordination within the Scottsville region. In addition to transportation management aspects, this integration of management centers will facilitate the accumulation and dissemination of corridor-wide traveler information, thereby enhancing the existing 511 system and ultimately making intermodal travel easier.

The STANET system design will be based on an open and modular system architecture that facilitates system and subsystem component integration with defined communication protocols and standards, data dictionary, message sets and other parameters and constraints. This will allow the ability to access latest technologies from competitive sources of supply throughout the system life cycle, to integrate the system...
with other systems in a joint integrated architecture venue, and to integrate and/or retrofit earlier increments with later increments in an evolutionary acquisition context. The STANET system will be realized by building on existing efforts that are as complementary or compatible as possible so that investments are not wasted or redundant. However, an open system architecture as a primary goal of STANET will attain interoperability of legacy and future transportation management systems.

The Scottsville region has demonstrated leadership in the area of Intelligent Transportation Systems (ITS) through several activities and programs aimed at positioning the region to better respond to travel demand and improvements in mobility and safety to travelers. Good progress has been made in planning for the deployment of ITS including:

- An ad hoc ITS committee was formed in 1996 and met informally until 1999 when it was formalized as the “Scottsville Region ITS Partnership” (known as the ITS Partnership), an advisory committee to the SVMPO Board of Directors. All work conducted by the Systems Engineer will be under the guidance of the SCOTTSVILLE Region ITS Partnership, led by SVMPO. Members of the ITS Partnership may include representatives from each participating agency.

  They include:

  SDOT District 06  
  City of Apple  
  City of Orange  
  City of Walnut  
  City of Almond  
  City of Fruitville  
  City of SCOTTSVILLE  
  City of West SCOTTSVILLE  
  County of SCOTTSVILLE  
  Regional Transit

- A regional ITS communication system that links the operations centers in the region was conceptualized in a report completed in early 1999. The Scottsville Transportation Areawide Network (STANET) soon became a regional priority leading to the completion of a Needs Assessment study in late 2001. The 2001 Needs Assessment will be updated as the tasks of this RFP are executed.

- The development of a Strategic Deployment Plan (SDP) has been completed in 2005. The SDP reflects the changes that have occurred since the 1996 Early Deployment Plan (EDP) and sets direction for future ITS planning efforts. As a result, the 1996 EDP is no longer a valid guide for ITS deployment. The regional ITS architecture for the Scottsville region is updated and the architecture requirements of 23 CFR 940 are addressed.

**The Project Manager for this contract will be:**
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Comment [AFC2]: The highlighted information on this page of the Background section is example text that addresses the SEMP Scope requirement for:
- Organizational structure and individual roles.
CONTRACT SUMMARY AND DESCRIPTION

The contract for the Scottsville Transportation Area Network (STANET) System Engineering Technical Assistance will be an agreement between the SVMPO and the consultant. SVMPO will provide contract administration services. SVMPO will fund $500,000 for the consultant services to complete tasks 1 thru 4 (system definition) as described in the Scope of Work. The SVMPO Board of Directors will award the contract and project deliverables will be reviewed by the SVMPO Project Manager. A Task Order will be issued for work involved in Tasks 1 thru 4 and the work of each task will not start until completion and approval of the critical activities of the previous Task. The consultant will invoice SVMPO for services rendered and SVMPO will reimburse the consultant for these services. The scope of services for Task 5 (monitoring and support) will be better specified during Task 4. Additional grant applications may be pending for implementation of future integration phases. SVMPO will issue an RFP to retain a Systems Integrator upon securing additional grant funds. Compensation for the additional Systems Engineer’s services of Task 5 will be acquired through further negotiation as another Task Order of this RFP.

SCOPE OF WORK/SERVICES

The scope of work is described below. The selected consultant or consulting team will be expected to perform all technical and other analyses necessary to complete the scope of Work. The consultant will receive general direction from the SVMPO Project Manager. Tasks will include the following:

General
SVMPO intends to retain a qualified professional engineering firm/team that has both Systems Engineering expertise and Intelligent Transportation Systems (ITS) knowledge and experience to serve as the Systems Engineer for the STANET center-to-center system. In summary, the Systems Engineer will work with stakeholders to establish a concept of operations, define requirements, standardize interfaces and select the project level architecture, prepare the scope of work for System Integrator services, assist in the review of proposals, monitor system implementation and verification, and provide technical assistance to SVMPO throughout the development.

The Systems Engineer and all subcontractors will not be eligible to submit a proposal for the System Integrator services, nor shall offer products or be affiliated with the eventual development team or vendors.

The Vee Development Model (Exhibit B) shall be used as the Systems Engineering approach to analyze, design, procure, construct, install, integrate, test and maintain the ITS elements for the system ultimately to be developed. This engineering framework is a Systems Engineering Process derived from EIA-632-1999, IEEE 1220 (1998); and ISO 15288. Other models may be used to supplement the Vee.

Comment [AFC3]: This requirement should appear in every scope of work for system development. It is the underlying technical model to be tailored for all process tasks.
The “Systems Engineering Guidebook for ITS” (SE Guidebook) shall be used as reference documentation for the Systems Engineering process, tasks, and activities to be undertaken in this contract and described in the proposal. Terminology associated with the Systems Engineering process used within this RFP and to be described in the proposal will be consistent with the SE Guidebook.

Capabilities in software and systems development and project management are being asked for in the SUBMITTAL REQUIREMENTS section below, in addition to the traditional set of qualifications criteria used for proposal evaluation (such as past performance, approach and knowledge of project, etc.). The capability criteria can be found in the tool called Capability Maturity Model Integration (CMMI). A description of CMMI and its Best Practices areas can be found in the SE Guidebook, Section 6 Capabilities and Best Practices in System Development. In the qualifications evaluation process, points will be added for proposers that can show evidence of in-progress work toward a CMMI level of maturity (see http://www.sei.cmu.edu/cmmi/). This can be done by:

- providing documented processes and procedures (drafts or final) showing project principals and/or key technical staff with appropriate certifications, and/or
- undertaking an internal CMMI assessment level 2 or better, and/or
- staff demonstrating their expertise through professional certification programs like the INCOSE Certified Systems Engineering Professional (CSEP) and the Project Management Institute (PMI) Project Management Professional (PMP) certification. More information on these certifications can be found at www.incose.org and www.pmi.org.

All products shall be acceptable to SVMPO and the Federal Highway Administration (FHWA), therefore the design will be based on the most current design standards, regulations, policies, procedures and manuals. Specifically the project implementation requirements of 23 CFR 940 part 11 will be addressed within the contract task work.

The Systems Engineer shall provide strong leadership in addressing technical and institutional issues, and facilitating consensus development within the ITS Partnership throughout the course of the project. The Systems Engineer shall coordinate with the appropriate grant fund administrators, organize project meetings, provide monthly progress reports, as well as attend and make presentations in front of decision-making bodies, the general public and special interest groups regarding project related matters.

It is important that project principals and key technical staff of the Systems Engineer team are easily accessible by the ITS Partnership during the course of the project. Maintaining an office in the SCOTTVILLE Metropolitan Area with project principals and /or key technical staff is highly desirable.

The Systems Engineer shall be familiar with and responsible for providing and performing the following tasks and activities. The Systems Engineer shall describe approach to address the following engineering tasks and include the descriptions in the

Comment [AFC4]: As a requirement for federal funding, the agency should assure that the regulatory requirements be addressed in the system engineer’s proposal and eventual SEMP.
Systems Engineering Management Plan. The work of each task will not start until completion and approval of the critical activities of the previous task.

**Task 1 – Systems Engineering Management Planning**

The Systems Engineer will develop a Systems Engineering Management Plan (SEMP) to address the management of the systems engineering development and serve as repository for project technical plans. **Guidelines for preparation of the SEMP are located in Section 7.5.2 of the SE Guidelines.**

The SEMP will include the following project management documentation. Specifically what shall be included in each of these documents will be found in Section 7.5.2.

**Management Activities:**
- Work Breakdown Structure (WBS)
- Task Inputs – required for each task in the WBS
- Task Deliverables – required products of each task in the WBS
- Task Control Gates – critical activities to be completed before next task begins
- Reviews and Meetings – noted for each task in the WBS
- Task Resources – needed for each task in the WBS
- Master Schedule – sequencing and duration of the activities of each task in WBS

The SEMP will include the following Technical Plans. Specifically what shall be included in each of these documents will be found in Section 7.5.2. **Additional Technical Plans should be recommended within the proposal.**

**Technical Plans:**
- Interface Control Plan
- Technical Review Plan
- System Integration Plan
- Verification Plan
- Configuration Management Plan
- Data Management Plan (include structure of data and data archives used for verification and other analyses)
- Operations and Maintenance Planning
- Risk Management Plan

**Comment [AFC5]:** The agency’s discussion of SEMP in the SOW often only addresses in detail Technical Planning and Control. This is because they have little experience in SE Process, Technology Transitioning, and SE Integration. In this instance, the Agency points to the SEMP template as direction to the SE for a detailed response to each of these other SEMP sections. This reference appears throughout the SOW.

**Comment [AFC6]:** From the SEMP Guidance section on Technical Planning and Control, the agency selects those activities they deem necessary for management of the project.

**Comment [AFC7]:** From the SEMP Guidance section on Technical Planning and Control, the agency selects those plans they believe are necessary to minimize risk in management of the project. The proposer is asked to review and suggest additional plans necessary to manage the development.
A SEMP framework for management of the process developments and preparation of the Technical Plans will be initiated within the proposal submittal as part of the proposal Management Plan. The details of each of the Management Activities above will be addressed. For each of the Technical Plans, the Systems Engineer will detail methods, approaches, analysis techniques, and tools to accomplish each Plan as a part of the SEMP framework. Completed SEMP framework will be approved by SVMPO before Task 2 begins.

The Systems Engineer will complete the Technical Plans during Tasks 2 thru 4. At end of High Level Design, the Systems Engineer will submit to SVMPO a complete set of Plans that have been developed and approved during Tasks 2 thru 4. The SEMP will also include recommended Technical Plans to be developed by System Integrator as well as describe what should be detailed in each of the recommended plans. Special attention shall be given to recommended requirements for the overall Integration Plan to be executed by the System Integrator.

In summary, the proposal shall detail the management planning and describe the approach and methods to provide the services highlighted above and also detailed in Table 5-2 Phase 1, Task 4.3.2 Systems Engineering Management Planning of the SE Guidebook for Systems Engineering Technical Assistance.

Task 2 – Development of the Concept of Operations
The Systems Engineer will develop a Concept of Operations for the system. Guidelines for preparation of the Concept of Operations are located in Section 7.5.5 of the SE Guidelines. This will include the identification of stakeholders, needs, expectations and institutional issues that may impact the successful implementation and operations of the system. The Concept of Operations will include a vision of what the system is to do, what transportation issues the system is going to address, where the system is going to operate, what environment it will be operating in, who will be using it, and what the envisioned support is and how the system will be used. During this task, workshops, interviews, and surveys may be needed to identify all stakeholder needs. Other techniques may be suggested in the proposal to be used to elicit user requirements. Technical metrics will be identified and used to validate the system and assist in tracking technical progress.

In summary, the proposal shall describe the approach and methods to provide the services highlighted above and also detailed in Table 5-2 Phase 1, Task 4.3.3 Concept of Operations of the SE Guidebook for Systems Engineering Technical Assistance.

Task 3 – Development of System Requirements and Verification Plan
The Systems Engineer will develop System Requirements consistent with the ITS Standards. At the completion of Task 3, the System Requirements will be developed to determine what the system will do. Guidelines for preparation of the Requirements are located in Section 7.5.6 of the SE Guidelines. Concurrent with the development of the system Requirements a Verification Plan will be developed to identify the way that the
requirements will be tested. Guidelines for preparation of the Verification Plan are located in Section 7.5.9 of the SE Guidelines. The Verification Plan will include the requirements to be tested, test environment, input source, expected output and method of test, e.g. demonstration, test, inspection, or analysis.

The requirements will be traced back to the user needs and if additional user needs are uncovered the Concept of Operations will be updated to maintain the traceability with requirements. The requirements will be captured, written, analyzed, validated and maintained throughout the life of the project. Requirement attributes will be assigned to each requirement to assess the priority, risk, and cost of each.

Special emphasis shall be given to Requirements Management in the development of the Configuration Management Plan. It is a firm objective that this Plan shall apply through all the system life cycle phases of this C2C application from the requirements phase through the deployment and maintenance phases and to the systems retirement phase. It shall promote the proper identification of the configuration, control of changes, and record the change implementation status of the physical and functional characteristics of the system.

Automated management of requirements and their traceability shall be performed. The proposal shall describe the software tools that the consultant team is most familiar with and/or have used to accomplish this automation. The pros and cons of these requirements management toolsets shall be described with recommended selection for this C2C implementation.

In summary, the proposal shall describe the approach and methods to provide the services highlighted above and also detailed in Table 5-3 Phase 2, Task 4.4.1 Requirements Development of the SE Guidebook for Systems Engineering Technical Assistance.

**Task 4 – Development of the High Level Design Specifications**

The Systems Engineer will develop the project level architecture, identify major subsystems and interfaces, and identify candidate industry and ITS standards that may be used as part of the Interface Control Documents (ICD’s) between systems. This will include defined communication protocols and standards, data dictionary, message sets and other parameters and constraints. It will consider the external interfaces to the system and also develop Interface Control Documents with external agencies. Guidelines for preparation of the High Level Design Specifications are located in Section 7.5.7 of the SE Guidelines. Multiple architectures will be developed and assessed for balanced communications loading and minimal coupling and dependencies. Video sharing architecture considerations shall be included in this assessment. The Systems Engineer will develop verification test plans for each major sub-system. The identification of product Configuration Items will be established and will be used to drive the phasing of the projects as part of Task 5.

The Systems Engineer will verify consistency of the selected project level architecture with the regional ITS architecture for the SCOTTSVILLE region by mapping market
packages with the functions of the project level architecture. This functional “as-built” information will be used by SVMPO for maintenance of the regional ITS architecture.

**The Systems Engineer will provide complete SEMS for review and approval** at the end of Task 4. FHWA review and approval will be required, in accordance with SDOT Local Program Guide, Chapter 4. For more information on SDOT Local Programs requirements, go to [http://________](http://________). The SEMS will include recommended Technical Plans to be developed by System Integrator as well as describe what should be detailed in each of the recommended plans. Special attention shall be given to recommended requirements for the overall Integration Plan. Guidelines for preparation of the Integration Plan are located in Section 7.5.8 of the SE Guidelines.

Based on the project level Architecture, the Systems Engineer shall develop an implementation budget and schedule for the Detailed Design and Implementation phase of the work (Task 5) in addition to detailing necessary operations and maintenance budgets/requirements. The Systems Engineer will prepare the request for proposal or other system procurement documents for hiring a System Integrator. The Systems Engineer will generate a list of potential System Integrators.

There is expectation that ICD’s and configuration items will be revisited when the System Integrator begins work. The Systems Engineer shall provide strong leadership in addressing technical and institutional issues, and facilitating consensus development between the System Integrator and the ITS Partnership.

In summary, the proposal shall describe the approach and methods to provide the services highlighted above and also detailed in Table 5-3 Phase 2, Task 4.4.2 *High Level Design* of the SE Guidebook for Systems Engineering Technical Assistance.

**Task 5 – Detailed Design and Implementation Oversight**

The Systems Engineer will assist in the review of proposals, monitor system implementation and verification by the System Integrator, and provide technical assistance to SVMPO throughout the development. The proposal shall describe the approach and methods to provide the services detailed in the SE Guidebook in Tables 5-3, 5-4, and 5-5 for Systems Engineering Technical Assistance, specifically related to the following Tasks:

- Task 4.4.3 Component Detailed Design
- Task 4.5.1 Hardware / Software Development
- Task 4.5.2 Integration
- Task 4.5.3 Verification
- Task 4.5.4 Initial System Deployment

The scope of services for Task 5 (monitoring and support) will be updated during Task 4. Compensation for the Systems Engineer’s services for Task 5 will be acquired through further negotiation as part of this RFP.