Project Systems Engineering Management Plan for Neptune Road ITS

Neptune Road PD&E

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List of Acronyms and Abbreviations

ATMS.....Advanced Traffic Management Systems
ATSPM.....Automated Traffic Signal Performance Measures
CCTV .....Closed-Circuit Television
CEI .....Construction, Engineering, and Inspection
CFP.....Cost Feasible Plan
ConOps.....Concept of Operations
DMS .....Dynamic Message Signs
FDOT .....Florida Department of Transportation
ITS.....Intelligent Transportation System
MOA .....Memorandums of Agreement
MOE.....Measure of Effectiveness
O&M .....Operations and Maintenance
PERT.....Project Evaluation and Review Technique
PITSA.....Project Intelligent Transportation System (ITS) Architecture
PSEMP .....Project Systems Engineering Management Plan
QC.....Quality Control
QM .....Quality Management
RFP.....Request for Proposals
RITSA .....Regional Intelligent Transportation System (ITS) Architecture
RTVM .....Requirements Traceability Verification Matrix
SEMP .....(Florida's Statewide) Systems Engineering Management Plan
SEP.....Systems Engineering Process
SITSA.....Statewide Intelligent Transportation System (ITS) Architecture
TWLT.....Two-Way Left-Turn Lane

1. Document Overview

This document is the Project Systems Engineering Management Plan (PSEMP) for the Intelligent Transportation System (ITS) proposed as part of the Neptune Road Widening Project in Osceola County, Florida. A PSEMP is a plan that helps manage and control a project utilizing systems engineering processes (SEPs). The PSEMP identifies what items are to be developed, delivered, integrated, installed, verified, and supported.

The document is organized as follows:

- Section 2 – Need for a PSEMP
- Section 3 – Applicable Documents
- Section 4 – Systems Engineering Processes
- Section 5 – Project Management and Control

This PSEMP is a living document and will be updated once all stakeholders involved have reached a consensus on project components and requirements.

2. Need for a Project Systems Engineering Management Plan

The Florida Department of Transportation (FDOT) requires agencies that desire state or federal financial assistance for an ITS deployment to use the SEP.[1] The PSEMP documents how systems engineering will be used for ITS project management and the tasks to be performed for the coordination and control of all ITS device deployments.

Florida's Statewide Systems Engineering Management Plan (SEMP) was used as a reference guide in the creation of this PSEMP.

2.1 Project Identification

Project Name: ITS Deployment for Neptune Road PD&E

Financial Project Identification: 445415-1

Federal Aid Project Number: N/A

[1] FDOT Procedure titled Systems Engineering and ITS Architecture (Topic No 750-040-003). Available online at http://www.dot.state.fl.us/proceduraldocuments/procedures.shtm.

2.2 Purpose and Scope

This document serves as the PSEMP for the ITS proposed as part of the Neptune Road Widening Project in Osceola County, Florida. It provides planning guidance for the technical management, procurement, installation, and acceptance of the project. The Neptune Road PD&E, project limits from Partin Settlement Road to US Route 192/E Irlo Bronson Memorial Highway (US 192), evaluates different alternatives to enhance mobility from US 192 (E Irlo Bronson Memorial Highway) to Downtown Kissimmee.

Some improvements to Neptune Road will include: lane widening, from two lanes to four lanes, addition of bike lanes and sidewalks, concrete median or Two-Way Left-Turn Lane (TWLTL) to enhance safety, signalization, and miscellaneous structures. The ITS components include Closed-circuit Television (CCTV) Cameras for traffic monitoring; Dynamic Message Signs (DMS) for traveler information dissemination; Vehicle Detection System for speed, volume and occupancy data; Automated Traffic Signal Performance Measures (ATSPMs); and Bluetooth devices for travel time measurement. This project will provide transportation infrastructure to support economic growth, provide consistency with local plans and policies, and enhance safety.

Only the ITS component of the project is covered under 23 Code of Federal Regulations Part 940. As such the scope for this PSEMP is limited to those ITS elements but does address the coordination of the ITS design and integration into the overall project.

2.3 Technical Project Summary Schedule

Design, implementation, and integration of the ITS elements will occur concurrently with the design and construction of the Neptune Road Widening Project. An overview of the anticipated project milestones is presented below. As the project progresses, the milestones and corresponding dates indicated below are subject to change and will be reflected in updates to the program schedule.

- Concept of Operations ..... November 2019
- Advertisement ..... July 2019
- Design ..... October 2019
- Construction ..... July 2020

The ITS component of this project is in the preliminary planning stages and will require input and approval from the County Traffic Engineer and District TSM&O Engineer. As the project progresses, various stakeholders that will have an operational interest in the system will define incremental milestones and agree on their respective dates.

2.4 Relationship to Other Plans

2.4.1 Relationship to Florida's Ten-Year ITS Cost Feasible Plan

The ITS Deployment for Neptune Road PD&E is not included in the Ten-Year ITS CFP. The FDOT's current Ten-Year ITS CFP is available online at *https://www.fdot.gov/traffic/its/projects-deploy/ten-year-cfp.shtm*

2.4.2 Relationship to Florida's Statewide ITS Architecture

ITS devices similar to those recommended as part of this project are currently included in several market packages of the FDOT District Five Regional ITS Architecture (RITSA), which was developed as part of the original Statewide ITS Architecture (SITSA). The FDOT District Five Regional Architecture was last updated in January 2016. More information on the current RITSA and SITSA is available online at *http://www.consystec.com/florida/default.htm*. Additional information on the applicable market packages is available in Section 4.1.

2.4.3 Relationship to Osceola County Work Program/CIP

The Neptune Road Widening Project is currently in the planning stage, as defined in the Osceola Work Program/CIP for years 2019 through 2023. The project is divided in the following phases:

- Neptune Road Phase II, Project Number 4331
- Neptune Road Phase III, Project Number 4330
- Neptune Road Phase IV, Project Number 4314

Currently, there is no reference to the ITS component of the project in the Osceola County Work Program. The County is currently updating both the Strategic Plan and the TSM&O Strategic Plan. This project is recommended for inclusion in the TSM&O Strategic Plan.

2.4.4 Relationship to Other "On-project" Plans

The following projects are currently under construction and within the vicinity of the Neptune Road ITS Project:

- ATMS Phase 4: Design, CEI, and Construction of the fiber optic network expansion and associated intelligent transportation systems (ITS) devices along multiple corridors
    - CIP Number 4304
    - Corridor of Interest: US 192 from Budinger to Narcoossee Rd (3.5 Miles)
    - The current construction end date is listed as September 30, 2019.
- Neo City: This project includes a mixed-use research and technology destination designed to be the global center of advanced research, pilot manufacturing, design and commercialization of sensor related technologies.

- The 500-acre planned campus will be located between Highway 192 and Neptune Road.

3. Applicable Documents

The following documents form a part of this PSEMP to the extent specified herein. Should a conflict exist between the contents of the documents referenced herein and the contents of this PSEMP, this PSEMP shall be considered the superseding document.

Table 1: Applicable Documents

Document	Source
CIP Worksheet for 2019 Budget Exercise	Osceola County Work Program/CIP https://www.osceola.org/agencies-departments/transportation-transit/work-program-cip/
State ITS Architecture (SITSA)	Information on SITSA is available on line at http://www.consystec.com/florida/default.htm
Project Traffic Analysis Report (PTAR) Neptune Road PD&E	Under Development

4. Systems Engineering Processes

Key processes that will be incorporated into this project are:

- *Developing the Project ITS Architecture (PITSA)*
- *Development and/or Validation of High-level Functional Requirements*
- *Development and/or Validation of Detailed Functional Requirements*
- *Technical Reviews*
- *Risk Identification, Assessment, and Mitigation*
- *Creation of Performance Measures Metrics*
- *System Test, Integration, and Acceptance*

4.1 Developing the Project Intelligent Transportation System Architecture

The ITS devices recommended as part of this project are already included within several market packages of the FDOT District Five RITSA. These market packages will be used to develop the PITSA:

- ATMS01 – Network Surveillance
- ATMS02 – Traffic Probe Surveillance

- ATMS03 – Traffic Signal Control
- ATMS06 – Traffic Information Dissemination
- ATMS07 – Regional Traffic Management
- ATMS08 – Traffic Incident Management System

One component of this project is the upgrade of existing devices including cabinets, traffic controllers, and vehicle detection systems. These existing devices are already included within several market packages of the FDOT District Five RITSA, which was developed as part of the original SITSA.

The installation and integration of new ITS components are also proposed as a part of the project. The new devices include CCTV cameras, DMS, Bluetooth devices, ATSPM, fiber optic cables, hub equipment shelter with backup power, and other supporting infrastructure (e.g. conduit, pull boxes, splice vaults). Likewise, these devices are similar to existing ITS devices and are also covered within the existing market packages.

4.2 Creating High-Level Functional Requirements

The high-level functional requirements for this Project will be developed with input from the County Traffic Engineer and District TSM&O Engineer. The tasks associated with developing the high-level functional requirements to support the ITS deployment are:

- *Identify high-level performance requirements*
- *Identify interface requirements (i.e., external, ITS devices, data warehouse)*
- *Identify high-level data requirements*
- *Identify enabling requirements (i.e., testing, training, warranty, maintenance)*
- *Identify constraints (i.e., hardware, software)*
- *Identify verification methods (i.e., demonstration, testing, analysis, inspection)*

4.3 Creating Detailed Requirements

The high-level functional requirements for this project will be refined into Detailed Functional Requirements. The Functional Requirements will include a combination of functional, performance, and physical requirements. As the project progresses through design, the Functional Requirements will be refined into a Requirements Traceability Verification Matrix (RTVM).

4.4 Trade-off Studies, Gap Analyses, or Technology Assessments

The Concept of Operations (ConOps) will compare the program needs with the capabilities of the existing system components, functions, and features. The ConOps will also summarize the proposed system and analyzes where “gaps” exist between the existing system components and the program needs. Once completed, the ConOps will be included in the Appendix of this document.

4.5 Technical Reviews

Technical reviews are required to accomplish the work items for the project. It is anticipated that the design entity will develop and/ or update the following ITS plans and documents for submittal to be reviewed:

- Concept of Operations
- PSEMP
- 60% Design Plans
- 90% Design Plans
- Final Design

During implementation, it is anticipated that the design entity will submit various documentation for review and approval. These documents include but are not limited to:

- *System Integration Plan*
- *RTVM, updated at project milestones*
- *System and Verification Plan Guidelines*
- *Final Acceptance Plan and Procedures*
- *System Component Documentation*
- *Operations and Maintenance Plan*
- *Transition Plan*

4.6 Identifying, Assessing and Mitigating Risk

Risk assessment and control procedures will be established for the project. These procedures provide a method for determining the inherent risk in the project and for evaluating the effectiveness of risk reduction efforts. The procedures will also prepare and implement plans for mitigating risk.

Preliminary risk identification was completed and the high-level risk factors are incorporated into the list below. Osceola County will review these risks and may add additional project-level or external risks as the project progresses. These risks will also be evaluated by the System Integrator as the project progresses, especially during or after major reviews and construction activities. The following is an assessment of risks that could affect the scheduled completion of the project.

1. *Planning for Neo City* – A major technology campus that will serve as an innovation epicenter and a focal point for Osceola County is currently under development. Neptune Road will serve as one of several future access points to this technology campus. Opportunity exists for collaborative efforts such as displaying messages on the proposed DMS and sharing data from the proposed ITS devices. To mitigate this risk, the project team will leverage existing relationships between the County, District, and Neo City representatives to provide a forum for collaboration (e.g. including Neo City in project status meetings). This will allow for seamless collaboration in the future.

2. *Business Rules and Information Sharing* – Several stakeholders are included in the project, including the Osceola County and FDOT. A clear delineation of the information shared between agencies will be required to efficiently make use of all available information. Due to multiple stakeholders with different operational objectives, clear business rules need to be established.
   To mitigate the risk, the market packages from the PITSA can be leveraged to communicate the desired information flows and shared data. Then the business rules associated with the data, such as sharing frequency, etc., can be developed based on the updated market packages and established in Memorandums of Agreement (MOA) with stakeholder agencies.

3. *Software Integration* – The County currently uses the Advanced Traffic Management System (ATMS) Centracs® to operate and monitor the signals within their jurisdiction. The Iteris VantageLive!™ system is used to monitor the Bluetooth devices and the County's ATSPM is hosted on the District 5 ITS network. The signal technology, Bluetooth devices, and ATSPM technology recommended as part of this project will be integrated into their respective systems and network for operators to use at the TMC. To mitigate the risk, the Request for Proposals (RFP) will direct the System Integrator to review the legacy device/protocol information before and during the preparation of their submittal packages.

4. *Support System* – The video and DMS software that will be used to collect data from the devices and systems are two disparate systems. These software may require integration with SunGuide®. Integration requirements for SunGuide® will need to be specifically included in the Detailed Functional Requirements.

5. *Local Utility Coordination* – The subsurface utility engineering for the project will need to be conducted during the design phase. Coordination with the existing utility companies will be critical to the project schedule. To mitigate the risk, constant communication must be established between the County Program Manager, the System Integrator, the County personnel supervising the construction, and the local utility companies.

4.7 Creating the Requirements Traceability Verification Matrix

The project requirements will be defined in the future Detailed Functional Requirements. A RTVM will be developed based on the Functional Requirements and updated based on input from project stakeholders. Once completed, the RTVM will become an Appendix to this PSEMP.

4.8 Measures of Effectiveness (MOEs)

The MOEs are used to determine how well the system design meets the requirements and to quantify the project benefits. The project stakeholders will define the list of project MOEs as well as the reporting interval (i.e. monthly basis or annual basis). A preliminary list of measures include:

- *Travel Time Reliability*
  - *Travel time Index*
  - *Planning Time Index*
- *Corridor Throughput*
- *Incident Management Metrics*
  - *Detection and Verification Time*
  - *Response Time*
  - *Clearance Time*

4.9 System Integration, Testing and Acceptance

4.9.1 System Integration

The recommended ITS components are inclusive of central control software, local software, and hardware. The System Integrator is responsible for the integration of all ITS components into the County's ATMS software and delivering a fully functional system. This project is in the preliminary planning stages and as such, the System Integrator has not yet been defined. As the project progresses, various stakeholders that will have an operational interest in the system will be responsible for defining the responsibilities of the System Integrator.

This PSEMP is a living document and will be updated once all stakeholders involved have reached a consensus.

4.9.2 System Testing

The System Integrator will be responsible for all testing of replaced/upgraded devices and new equipment. This project is in the preliminary planning stages and will require input and approval from the County Traffic Engineer and District TSM&O Engineer. As the project progresses, various stakeholders that will have an operational interest in the system will be responsible for defining the requirements for system testing.

This PSEMP is a living document and will be updated once all stakeholders involved have reached a consensus.

4.9.3 Burn-In Period

Following system testing, a 90-day system Burn-In will be completed by the System Integrator. Upon the County's notice of acceptance, a 90 consecutive calendar-day Burn-In Period test shall commence for all subsystems, ITS devices and ancillary components installed, mounted, integrated, made operational, and tested as part of the Neptune Road ITS Project.

4.9.4 System Acceptance

The Final Acceptance will be granted by Osceola County upon the System Integrator's successful completion of the standalone tests, subsystem testing, 90-day system burn-in period, and the approval of all required submittals.

5. Project Management and Control

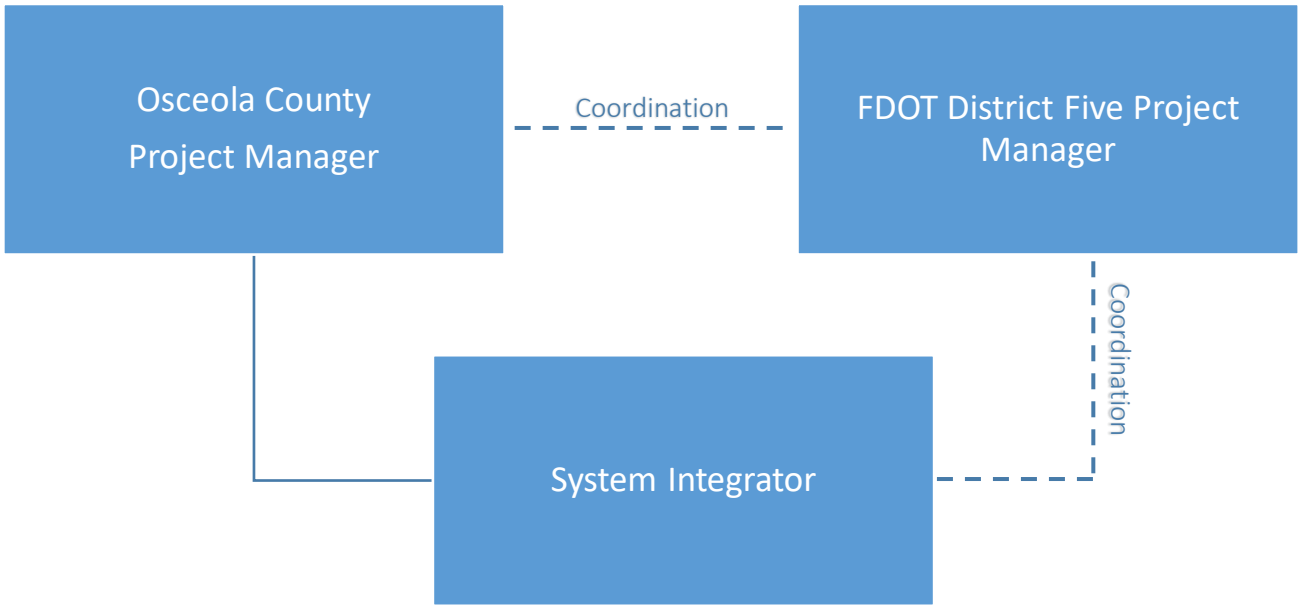
This project is in the preliminary planning stages and will require input and approval from the County Traffic Engineer and District TSM&O Engineer. As such, the project process has not yet been defined. As the project progresses, various stakeholders that will have an operational interest in the system will define the entity responsible for integrating and testing all ITS components.

This PSEMP is a living document and will be updated once all stakeholders involved have reached a consensus on the desired System Integrator.

5.1 Organization Structure

The Osceola County Project Manager will provide oversight for the project as shown below in Figure 1. The FDOT Project Manager will coordinate with both the County Project Manager and the System Integrator as needed throughout the duration of the project.

Figure 1: Project Organizational Structure



The System Integrator will perform the integration of new field devices and their associated sub-system and system-level testing. Additionally, it is anticipated that the System Integrator will provide oversight during the following stages:

- *Design*
- *Construction*
- *Testing*
- *Integration*
- *Training*
- *Operations*
- *Maintenance*

5.2 Managing the Schedule

The detailed schedule with critical paths will be developed as the project progresses. The System Integrator will use the schedule in order to monitor and evaluate the construction. The project schedule will show the project tasks, task durations, and task dependencies.

5.3 Procurement Management

All procurement will adhere to the standards and specifications set forth by the State of Florida and Osceola County. All procurement will also adhere to specific project requirements to be defined in the Request for Proposals (RFP). The System Integrator will procure the contractual items to comply with the contract documents and the technical requirements contained within.

5.4 Risk Management

The preliminary risk identification, assessment, and mitigation strategies were completed in Section 4.6. The Osceola County Project Manager will review these risks and may add additional project-level or external risks as the project progresses. These risks will be evaluated by the System Integrator as the project progresses, especially during or after major reviews and construction activities.

The System Integrator is responsible for coordinating all project activities that interface or physically integrate with the aforementioned projects, and/or other projects in the region to avoid possible conflicts and develop mitigation strategies.

5.5 Subcontractor Management

The System Integrator will be responsible for managing any subcontractors that may be needed for the project. The System Integrator will provide a subcontractor management plan to Osceola County for review and approval. Scheduled reviews of project subcontractors will be conducted. The frequency of these reviews will be defined within the subcontractor management plan.

5.6 Engineering Specialty Integration

Engineering specialties are highly specialized engineering disciplines included in the project to support the Osceola County Project Manager. These specialists increase the expertise available to the project team and support the specialty requirements of the project. The System Integrator will include the following specialties during the appropriate project phase as required.

5.6.1 Configuration Management

The configuration management engineering specialty will address the configuration management of the installed/upgraded devices. This specialist will also be responsible for the documentation and application source codes, as applicable. The configuration management engineering specialty will be provided by the System Integrator.

5.6.2 Test Engineering

The test engineering specialist will verify the compliance of the functional requirements and identify any special tests or test equipment. The test engineering specialist will be provided by the System Integrator.

5.6.3 Integrated Logistics Support and Maintenance Engineering

The logistics support and maintenance engineering specialty will be responsible for determining the total support required for the system to ensure operational readiness and sustainability throughout its lifecycle. The logistics support and maintenance engineering specialist will be provided by the System Integrator.

This specialty provides the following project input:

- Defines support requirements – for example, the mean time to repair
- Supports considerations that influence requirements and design
- Provides the necessary support package
- Provides operational support at a minimum cost

5.7 Project Status Reviews

During the planning and design, Osceola County will conduct monthly meetings with the project stakeholders coinciding with key project milestones. During construction, the County will conduct monthly project status reviews with the System Integrator throughout the contract duration. Agenda items and meeting notes will be provided by the System Integrator for each meeting. At the review meetings, items such as project schedule, cost, action items, etc., will be discussed in detail and documented.

5.8 Change Management

The Project will follow the standard Osceola County change order process for all changes on design and construction projects. The County Project Manager will generally decide the acceptance of design changes and construction changes. Furthermore, with no statewide impacts associated with this project, there are no anticipated resolutions required from the Change Management Board.

5.9 Quality Management

A Quality Control/Quality Assurance Plan may be developed as part of future design initiative and will include a plan to implement Quality Control (QC) and a plan to monitor and verify that quality standards are being achieved.

5.10 Systems Acceptance

The Systems Acceptance is discussed in Section 4.9.4.

5.11 Operations and Maintenance, Upgrade, and Retirement

The Final Acceptance will be granted by Osceola County upon the System Integrator's successful completion of the standalone tests, subsystem testing, 90-day system burn-in period, and the approval of all required submittals. Once the County provides written acceptance of the system to the System Integrator, Osceola County will be responsible for all aspects of operations and maintenance, upgrade, and retirement for the project. Established County operations and maintenance procedures will be applied to the ITS devices recommended as part of this project.

A routine upgrade schedule should be implemented based on the useful life of each device. Typical ranges for the useful life of each device is included below:

- CCTV Cameras – 5 to 7 years
- DMS – 10 years
- Fiber – 10 years
- Bluetooth Devices – 5 to 10 years

5.12 Lessons Learned

As the project progresses, key comments and subsequent action items from design review and/or construction phase progress meetings will be tracked and documented. Updates to the PSEMP will be reflected at the various stages of submittal that will document the lessons learned. The system engineering process will assist project stakeholders in evaluating project performance and tracking of pertinent issues to ensure that all project requirements are met.