I-95 Corridor Coalition
Truck Parking Initiative

Work Plan and
Truck Parking Availability System Architecture

Prepared For

Federal Highway Administration (FHWA)

Prepared By

I-95 Corridor Coalition

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APPROVALS

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Maryland State Highway Administration   Date

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Federal Highway Administration   Date

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1. Introduction

Truck parking in the United States is a problem today. The long-term, overnight parking problem is especially severe and growing worse. Commercial drivers seeking to comply with the Federal Motor Carrier Safety Administration's Hours of Service regulations often park illegally on freeway shoulders and ramps when legal parking is either not available, or the location of available parking is not known. However, improved safety and greater operational efficiency could be realized by directing commercial drivers to available parking at known locations within an area.

To help alleviate this problem, the I-95 Corridor Coalition (the Coalition) was awarded $5.5 million to conduct a truck parking project as part of the Federal Highway Administration's (FHWA) Truck Parking Initiative. The proposed project area is along one of the U.S. Department of Transportation's (USDOT) recently designated Corridors of the Future, a segment of the I-95 corridor extending from Connecticut through North Carolina. This stretch of the I-95 corridor passes through a number of the nation's most congested urban areas. The eight states comprising the project area are home to 130,000 active commercial motor carriers, or 18 percent of all interstate and hazardous materials carriers nationwide; tens of thousands of additional carriers domiciled outside the region operate in and through these states. In 2006, 14 percent of all large truck crashes nationwide occurred in the project area states.

The project encompasses activities in three areas:

2.0   Dissemination of real-time information on truck parking space availability to truckers;

3.0   Capacity expansion, including state-sponsored expansion initiatives and exploration of use of warehouse/retail/industrial parking and weigh stations to accommodate truckers during nighttime hours; and

4.0   Augmentation projects, intended to help transition the demonstration activities into long-term, self-sustaining programs.

This Work Plan includes a detailed task-by-task scope and approach for the project, a preliminary project schedule and budget, and a Program Management Plan that:

- Describes how the project will be managed, including a management organizational structure, monitoring and reporting procedures, how risk will be managed, and quality assurance procedures; and

- Describes how project stakeholders will be provided an opportunity to participate.

The project schedule and budget contained herein are considered preliminary. Early project activities, especially Subtask 2.2 – Conduct Site Surveys, Subtask 2.3 – Define System Requirements, and Subtask 2.4 – Prepare System Design, will produce information that will enable preparation of a more precise and accurate schedule and budget. This Work Plan will be revised accordingly after completion of those tasks.

This document also defines the architecture of the proposed Truck Parking Availability System, including the identification of key system components, functions, and interfaces among the components.

2. Project Scope and Approach

This section presents a task-by-task approach to the project scope along with key activities and outputs for each task.

2.1 Task 1: Project Startup

2.1.1 Subtasks 1.1 and 1.2: Project Initiation and Establishment of Governing Committees

Objective: Initiate project activities and establish governing committees (Project Management Team and Stakeholder Steering Committee).

Firms/Key Staff: Maryland Department of Transportation, The Secretary's Office (MDOT/TSO), I-95 Corridor Coalition staff, Telvent, and project stakeholders.

Activities/Approach: Under this task, the project Work Plan (this document) will be prepared. The Project Management Team and Stakeholder Steering Committee will be formed (these are described in the Section 3, Program Management Plan). A teleconference will be held with the Stakeholder Steering Committee to review the project and discuss technology options.

A draft version of the Work Plan will be prepared and reviewed by the Project Management Team (described later under the Program Management Plan) and discussed at a project kick-off meeting. Based on that meeting and immediate follow-on activities or investigations, the Coalition will refine or modify the project scope, schedule and Management Plan. A final version of the Work Plan will then be submitted to the FHWA and used by the Project Management Team throughout the project.

Timeframe: Month 1.

Milestones/Deliverables: (1) Work Plan, including:
  • Final task-by-task project scope
  • Preliminary project schedule
  • Project Management Plan
(2) Formation of Oversight Panel and Stakeholder Steering Committee
(3) Stakeholder Steering Committee teleconference on technology options.

Notes: Kick-off meeting will be between FHWA, MDOT/TSO, key I-95 Corridor Coalition staff, consultant support staff, and other stakeholders as necessary to discuss the project scope and methodology. The Work Plan will identify and describe key elements of the project, such as a summary of the project scope and schedule, deliverables, staffing, and quality assurance and risk management procedures.

2.2   Task 2: Real-Time Truck Parking Availability System

The I-95 Corridor Coalition will implement a modular Truck Parking Availability System to advise over-the-road truck drivers on the real-time availability of truck parking spaces. The system will be composed of three (3) major subsystems:

- <u>Data Collection Subsystem</u> – Collects raw vehicle occupancy data in designated truck parking areas.
- <u>Data Integration Subsystem</u> – Integrates and processes vehicle occupancy data collected from all instrumented truck parking areas to calculate parking availability by area.
- <u>Data Dissemination/Traveler Information Subsystem</u> – Disseminates real-time parking availability information to truck operators through a range of mechanisms and media.

The proposed system is based on hardware and software that have been successfully used in other venues and are readily available in the commercial marketplace. These include major system components such as:

- Optical imaging technology to collect raw vehicle occupancy data in designated truck parking areas,
- Data fusion and storage tools to aggregate raw parking data and store the data for subsequent dissemination, and
- Traveler information dissemination technologies such as interactive voice response (IVR) systems and traveler information web components to deliver parking availability information to the trucking community.

The architecture of the system is also modest in its complexity. Additional information regarding the system architecture can be found in Section 6, Real-Time Truck Parking Availability System Architecture.

Subtasks for system analysis, development, rollout, and operations and maintenance are described below and are based on FHWA's system engineering process.

2.2.1   Subtask 2.1: Prepare Concept of Operations

Objective: Prepare Concept of Operations (COO) paper.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Draft COO; (2) review and critique COO by the Project Management Team and Stakeholder Steering Committee; (3) revise COO.

Timeframe: Months 2-3.

Milestones/Deliverables: Final COO.

Notes: The COO will be developed and detailed so that deployment can proceed promptly and smoothly. This activity will be conducted under the guidance and auspices of the Stakeholder Steering Committee, supported by the Coalition's CVO and Intermodal Program Track Committees. As part of this effort, a series of meetings will be conducted with state public rest area/service area operators, private truck stop operators, trucking industry and truck driver representatives,

law enforcement through the Commercial Vehicle Safety Alliance, and other key stakeholders to understand and address a range of institutional issues.

2.2.2 Subtask 2.2: Conduct Site Surveys

Objective: Conduct surveys of parking areas and develop System Deployment Plan.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Define site-selection criteria; (2) identify candidate parking lot locations along the I-95 corridor in participating states that meet the criteria; (3) gather and assess general information on parking conditions for candidate locations; (4) conduct physical surveys at the most promising parking areas; (5) select optimal locations for system deployment; and (6) document outcomes in a System Deployment Plan.

Timeframe: Months 2-4.

Milestones/Deliverables: (1) Site Survey Report; and (2) System Deployment Plan.

Notes: Site surveys and analyses along the I-95 corridor – at both public commercial vehicle rest areas and private truck stops – will be conducted in conjunction with the baseline evaluations of existing truck parking conditions (see Subtask 4.1). Analyses for each parking area will, at a minimum, include research into the following: (1) nighttime parking lot conditions and space availability; (2) illegal parking activity; (3) availability of power and communications; (4) lot size and configuration; (5) lighting levels; (6) existence and layout of lighting poles and other infrastructure; and (7) need for work permits for system installation. Based on the results of the site surveys, and the requirement to demonstrate a broad-based, region-wide solution, the System Deployment Plan will define the parking sites to be utilized both for the initial system pilot test (Tier 1 sites) and the full system implementation (Tier II sites).

                              A limited number of backup locations will be identified in the Systems Deployment Plan, to come into play should it later be determined that some of the preferred locations prove impractical.

2.2.3 Subtask 2.3: Define System Requirements

Objective: Develop System Requirements Specification (SRS).

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Draft SRS; (2) review and critique SRS by the Project Management Team and Stakeholder Steering Committee; (3) revise SRS.

Timeframe: Months 3-4.

Milestones/Deliverables: Final System Requirements Specification.

Notes: The System Requirements Specification will be based on the Concept of
                                          Operations and site survey results and define the technical requirements
                                          for the Truck Parking Availability System. The Requirements
                                          Specification will define *what* the Truck Parking Availability System will
                                          do, but not *how* the system will do it. The following information will be
                                          provided for each requirement: (1) ID, (2) description, (3) source, (4)
                                          allocation/categorization (e.g., user interface, performance, operations
                                          and maintenance), (5) priority, and (6) comments/notes where
                                          appropriate.

2.2.4   Subtask 2.4: Prepare System Design

Objective: Develop System Design document.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Draft System Design; (2) review and critique System Design by the
                                          Project Management Team; (3) revise System Design.

Timeframe: Months 4-5.

Milestones/Deliverables: Final System Design Document.

Notes: The System Design document will be developed based on the defined
                                          system requirements that will present an overview of the functionality of
                                          the system and define the system architecture, data and user interfaces,
                                          and hardware and software components.

2.2.5   Subtask 2.5: Prepare System Test Plan

Objective: Develop System Test Plan.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Draft System Test Plan; (2) review and critique System Test Plan by
                                          the Project Management Team; (3) revise System Test Plan.

Timeframe: Months 5-6.

Milestones/Deliverables: Final System Test Plan.

Notes: The System Test Plan will be developed during the design and
                                          development phases and identify the system deployment environment,
                                          testing roles and responsibilities, and the types of tests to be conducted
                                          to ensure that the resulting system operates as expected and meets the
                                          defined requirements. Test procedures will be developed as step-by-step
                                          instructions.

2.2.6   Subtask 2.6: Develop/Configure System

Objective: Develop, configure, and integrate Truck Parking Availability System.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Procure off-the-shelf system components; (2) develop customized system components; (3) integrate system; (4) conduct internal system testing; (5) develop system documentation.

Timeframe: Months 2-9.

Milestones/Deliverables: Truck Parking Availability System software, hardware, field equipment, and documentation.

Notes: All of the subsystems—the Data Collection Subsystem, Data Integration Subsystem, and Data Dissemination/Traveler Information Subsystem— will utilize existing, commercial off-the-shelf (COTS) components, and most of the effort will focus on customization and integration. The three subsystems will all be configured and developed concurrently. Data collection will be based on the use of existing optical imaging and video analytics equipment to monitor individual truck parking spaces as described in the System Architecture document. Data integration will make use of off-the-shelf hardware, software, and communications technologies to aggregate the raw data in preparation for dissemination to the trucking community. Data dissemination will initially focus on IVR and web technologies and be based on reuse of many components utilized from other related projects. A structured systems engineering approach will be employed. System development activities will be performed by the Coalition's system integrator, Telvent, under strict configuration control in accordance with Telvent's ISO-9001 quality management procedures. These procedures and associated tools are based on the use of open standards and configuration management methodologies to ensure the resulting system meets expectations, performs reliably, and facilitates system maintenance and enhancement efforts. System development, configuration, integration, and internal testing will take place in Telvent's development facilities and test lab in Rockville, MD. The necessary customized software and COTS software, hardware, and field equipment will be integrated and tested before rollout to any deployment sites. System documentation will also be developed for system installation, operations, and maintenance purposes.

2.2.7   Subtask 2.7: Rollout System to Tier I Sites

Objective: Install, deploy, and test system at 4-6 selected Tier I parking sites.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Install and configure field equipment and software; (2) install and configure central system equipment and software; (3) test system in accordance with System Test Plan in preparation for operations.

Timeframe: Months 9-10.

Milestones/Deliverables: (1) Documented results of Truck Parking Availability System testing; (2) operational Truck Parking Availability System at 4-6 Tier I sites.

Notes: Initially, the Truck Parking Availability System will be installed, deployed, and operated at 4-6 parking lot sites in order to test system performance and reliability, and fine-tune the dissemination procedures. Sites will be selected in accordance with the site surveys and System Deployment Plan prepared in Subtask 2.2, Conduct Site Surveys. After deployment, several weeks of internal operational testing will be conducted by the Coalition as per the System Test Plan. The testing process will include placing staff at instrumented parking facilities to perform manual parking counts to validate the outputs of the system. Testing staffers will document the results of each test defined in the System Test Plan. A punch list of any items that need to be corrected will be developed. The project team will troubleshoot and fix all the items that failed, and then retest those items until the system passes all tests signifying that all requirements have been met.

2.2.8   Subtask 2.8: Operate and Refine Tier I System

Objective: Operate Tier I system and refine as needed.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Invite closed group of drivers to participate in the Tier I activity; (2) operate and maintain Tier 1 system; (3) develop, test, and apply system modifications based on problems identified, as needed.

Timeframe: Months 11-16.

Milestones/Deliverables: (1) Updated/Repaired Truck Parking Availability System software, hardware, and field equipment as necessary; (2) Truck Parking Availability System performance reports.

Notes: A closed group of drivers will be selected from several large carriers and/or identified by the American Trucking Associations and state trucking associations in accordance with the Marketing Plan developed in Subtask 4.3. See Subtask 2.10, Conduct System Operations and Maintenance, for additional information in operating and maintaining the system. Development and testing of system modifications will adhere to the same system engineering approach as discussed in Subtask 2.6, Develop/Configure System.

2.2.9   Subtask 2.9: Rollout System to Tier II Sites

Objective: Install, deploy, and test system at 45-60 selected Tier II parking sites.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Install and configure field equipment and software; (2) update and configure central system equipment and software; (3) test system in accordance with System Test Plan in preparation for operations.

Timeframe: Months 16-21.

Milestones/Deliverables: Operational Truck Parking Availability System at 45-60 Tier II sites.

Notes: Following completion of the Tier I activity, the Truck Parking Availability System will be deployed at 45-60 additional public and private lots along the I-95 corridor between Connecticut and North Carolina in accordance with the site surveys and Deployment Plan prepared in Subtask 2.2, Conduct Site Surveys. Use of the system will be open to all commercial carriers and drivers. See Subtask 4.3, regarding marketing the availability and use of the system to the trucking industry.

2.2.10 Subtask 2.10: Conduct System Operations and Maintenance

Objective: Operate and maintain system at all Tier I and Tier II sites.

Firms/Key Staff: I-95 Corridor Coalition/Telvent.

Activities/Approach: (1) Operate system on a 24x7 basis; (2) monitor and review activities, usage, and performance daily; (3) troubleshoot, repair, and replace field equipment and central system components as necessary; (4) document potential system enhancements.

Timeframe: Months 11-46.

Milestones/Deliverables: (1) Updated Operations and Maintenance documentation/procedures as needed; (2) Updated/Repaired Truck Parking Availability System software, hardware, and field equipment as necessary; (3) Truck Parking Availability System performance reports; report on potential system enhancements.

Notes: Once deployed, the system will be operational and monitored 24 hours per day, seven days per week. A network of maintenance engineers will be available for system troubleshooting and reparations. A central operations manager will oversee performance during peak (evening/nighttime) periods. Modifications to improve performance may be made to the system during the project period. Additional operations and maintenance responsibilities will include:
- Adjusting system configuration parameters
- Restoring and backing up the system
- Installing software and hardware upgrades

2.3   Task 3: Capacity Expansion

The addition of parking capacity is an important element of the Coalition's overall truck parking strategy. The subtasks in this section represent (1) initiatives to add capacity that are being funded by various Coalition member states, and (2) an innovative strategy to explore using space available in weigh stations, warehousing and retail centers for overnight truck parking.

2.3.1   Subtask 3.1: State-Sponsored Expansion

Objective:　　　　　　　Provide additional truck parking capacity in the project area.

Firms/Key Staff:　　　　Various Coalition member State DOTs.

Activities/Approach:　　Additional capacity will be provided, at a minimum, through the projects summarized in the table below. Assuming project schedules can be coordinated, and with the <u>funding availability</u> and cooperation of the state DOTs, these spaces will be considered for inclusion in the Truck Parking Availability System.

Table 1 – State-Sponsored Truck Parking Capacity Expansion Initiatives

Location	Description	Number of New Spaces	Date Available
Newark, Delaware	Existing service plaza will be completely rebuilt, and will include 50 truck parking spaces, 36 of which will have anti-idling technology hookups	50	May 2010
Baltimore, Maryland	Convert approximately one mile of existing pavement width (36'+/-) approaching an existing park and ride facility to truck parking.	60-70	January 2010
Belcamp, Maryland	Modify existing park and ride facility at I-95/MD 543 to provide truck accessibility during non-peak hours.	20	January 2010
Perryville, Maryland	Construction of Comfort Station buildings at the current Commercial Vehicle Inspections Stations (North and Southbound). These facilities will house restrooms, vending and informational video monitors displaying real-time weather, traffic and roadwork information.	80	January 2010

Timeframe:　　　　　　　See available dates in Table 1.

Milestones/Deliverables:　Additional truck parking spaces that will be will be given priority consideration for inclusion in the Truck Parking Availability System.

Notes:　　　　　　　　　The Coalition will work with its member organizations to monitor progress on the above projects and to incorporate the new spaces into the real-time information dissemination system. The Coalition will also

investigate the provision of additional capacity in other locations in the project area not listed above, including additional spaces made available by private providers (see Subtask 3.2, Warehouse/Retail/Industrial Parking and Use of Weigh Stations, for additional information). We will strive to also include information on their availability in the Truck Parking Availability System. Progress on providing additional capacity will be monitored throughout the project and reported to FHWA at project briefings.

2.3.2 Subtask 3.2: Warehouse/Retail/Industrial Parking and Use of Weigh Stations

Objective: Determine the conditions under which overnight truck parking is acceptable to owners and operators of warehouses, distribution centers, retail establishments, and industrial and office parks.

Prepare a primer that describes a process that a proponent could follow to identify potentially acceptable sites.

Firms/Key Staff: I-95 Corridor Coalition/Cambridge Systematics.

Activities/Approach: The Coalition will work with the Stakeholder Steering Committee to (1) identify the issues that may affect the decision to provide overnight parking; (2) identify candidate locations where additional truck parking could be made available and associated contacts; (3) develop an interview methodology/procedure; (4) conduct interviews, refining the interview methodology/procedure throughout the process; (5) summarize, present and discuss the results with the Stakeholder Steering Committee; (6) based on the results, prepare a draft primer that documents the issues and interview methodology/procedure such that it can be used as a guide for similar activities to be conducted by others; (7) review the draft primer with the Stakeholder Steering Committee, revise, and prepare a final version.

Timeframe: Months 2-12.

Milestones/Deliverables: (1) Set of issues that affect the decision to provide overnight truck parking; (2) Candidate locations and contracts; (3) Interview methodology/procedure; (4) Interview summaries; (5) Draft and final versions of primer.

Notes: Potential issues to be addressed include how to mitigate air quality, noise, and vibrations associated with the movement of trucks and truck idling; negotiating who is responsible for the initial and recurring costs associated with providing overnight truck parking, including any necessary amenities, infrastructure, or appurtenances like signage and lighting; who is responsible for security for truckers parked overnight and for neighboring communities and businesses; whether the overnight parking will be limited to truckers doing business with the landowner or a tenant on the property; encouraging truckers to use alternative parking locations; and strategies to address truckers' fears they may be subjected to enforcement actions if they park at facilities such as weigh

stations. The fear of enforcement issue will be explored in consultation with the CVSA.

2.4   Task 4: Augmentation Projects

The following is a series of projects integral to the success of the Coalition's overall long-term truck parking program strategy that will provide deliverables that can be used by the Coalition and the FHWA to help ensure that this demonstration project transitions into a successful long term operation.

2.4.1   Subtask 4.1: Project Evaluation

Objective: Evaluate the Coalition's truck parking program to determine its effectiveness and needed improvements.

Firms/Key Staff: I-95 Corridor Coalition/Consultant TBD.

Activities/Approach: The Coalition will work with the Stakeholder Steering Committee to (1) prepare draft and final versions of an Evaluation Plan that will define evaluation objectives and data collection needs and procedures; (2) conduct a baseline assessment of conditions at the outset of the effort; (3) conduct follow-up assessments at six-month intervals; (4) obtain and analyze usage and performance statistics generated by the real-time information dissemination system; (5) prepare a draft evaluation report that documents findings relative to the evaluation objectives; (6) review the draft report with the Stakeholder Steering Committee, revise, and prepare a final version.

Timeframe: Months 2-46.

Milestones/Deliverables: (1) Evaluation Plan; (2) Baseline assessment; (3) Six-month interval assessments; (4) Draft and final versions of evaluation report.

Notes: The evaluation module will be designed to yield both quantitative and qualitative results. Important issues to be addressed by the evaluations include the following: (1) What impacts are the parking-inducement strategies having on safety and truck parking conditions (i.e., on parking behavior along the corridor, on parking behavior at individual lots, on illegal shoulder parking, etc.)? (2) Is the automated system able to communicate accurate, real-time parking space availability data to inquiring truckers quickly and reliably? (3) From truckers' perspectives, are the date timely and accessible, and do they help drivers make knowledgeable decisions on where to park? (4) What impact are key variables (time-of-day, traffic conditions, weather, etc.) having on parking activity? (5) Are the various parking strategies more conducive to some parking environments and settings than others? (6) What impact are the parking strategies having on congestion and safety?

2.4.2 Subtask 4.2: Sustainability Plan

Objective:	Develop a plan for transitioning the truck parking system from a demonstration system to an operating system that will continue to be supported into the future.
Firms/Key Staff:	I-95 Corridor Coalition/Telvent.
Activities/Approach:	This project will be conducted using private investment funds contributed by Telvent. (1) Options for providing the necessary funding support will be identified; (2) institutional options for oversight and management of the system will be identified; (3) opportunities to extend the utility of the system will be explored, including their potential to generate additional revenue; (4) the options and opportunities will be assessed as to their strengths and weaknesses; (5) the assessment will be discussed with the Stakeholder Steering Committee; (6) draft and final versions of the Sustainability Plan will be prepared.
Timeframe:	Months 20-24.
Milestones/Deliverables:	(1) Assessment of financial and institutional options and enhancement opportunities; (2) Draft and final versions of the Sustainability Plan
Notes:	Primary among the funding options to be considered will be various private sources, including fees paid by parking lot operators and fees paid by third parties to access and disseminate parking space availability data, bundled with other information. The latter would include, for example, travel information providers, truck parking reservation system service providers, truck stop marketing service providers, truck stop anti-idling service providers, in-vehicle navigation system service providers, and satellite radio service providers.
	Opportunities to extend the performance and utility of the system will include prospective value-added service such as (1) the ability to reserve parking spaces, perhaps in conjunction with truck "anti-idling" services, (2) security monitoring services using the installed visual surveillance cameras, and (3) new media or venues for disseminating parking availability information.

2.4.3 Subtask 4.3: Marketing

Objective:	Inform commercial operators about the availability of new parking capacity and inform them of the various methods of obtaining real-time parking availability information.
	Inform jurisdictions outside the Coalition region about the Coalition's truck parking program.
Firms/Key Staff:	I-95 Corridor Coalition/Consultant TBD.
Activities/Approach:	The Coalition will work the Stakeholder Steering Committee to: (1) identify target audiences and craft messages for each audience; (2)

identify the best methods for conveying the messages to each audience; (3) prepare draft and final versions of the materials chosen to convey messages to each audience, including jurisdictions outside the Coalition region; (4) message dissemination.

Timeframe: Months 2-46.

Milestones/Deliverables: (1) Marketing Plan (audiences, messages and conveyance methods); (2) Marketing materials.

Notes: Marketing materials may include brochures, e-mail messages, Internet advertisements, presentations, etc.

In developing the Marketing Plan and materials, the need to reach audiences outside the project area, both within the Coalition and nationally, will be considered. Materials developed for these audiences will be targeted at explaining project concepts, including those associated with both parking expansion and real-time system monitoring and dissemination elements; system evaluation results; long-term operating strategy; etc.

2.4.4 Subtask 4.4: Outreach/Coordination

Objective: Supplement the work of the Stakeholder Steering Committee by coordinating the Coalition's truck parking program activities with the Coalition's established management and program track structure.

Firms/Key Staff: I-95 Corridor Coalition/Telvent/Cambridge Systematics.

Activities/Approach: This project will be conducted at no additional cost to FHWA using annual Coalition funding. The Coalition will regularly apprise its Executive, Steering and Intermodal and Commercial Vehicle Program Track Committees of truck parking program progress and results.

Timeframe: Months 2-46.

Milestones/Deliverables: Meetings of the Coalition Executive, Steering and Program Track committees at which truck parking progress will be discussed.

Notes: Outreach to the Coalition committees will enable FHWA to take advantage of participation by states, MPOs, and other transportation and enforcement agencies in the region.

The Coalition will share the progression of work with other states and organizations within the Corridor as a "best practice" enhancing the longer term potential for seamless deployment/integration.

3. Project Management Plan

3.1   Project Charter

3.1.1 Agreement between FHWA and the I-95 Corridor Coalition

The I-95 Corridor Coalition is a volunteer-based organization consisting of state departments of transportation and other transportation and public safety organizations. It is financially supported by annual set-aside funding in the SAFETEA-LU federal surface transportation program authorizing legislation. The work of the Coalition is managed by committees of volunteers from its member organizations, including an Executive Board and Steering Committee. Part of the SAFETEA-LU funding is used to support a small staff that manages the Coalition's work on a day-to-day basis.

The Coalition is not a legal entity. The University of Maryland serves as the Coalition's administrative agent. The SAFETEA-LU funding that supports the Coalition's annual work program is obligated by the FHWA to the Maryland State Highway Administration through a partnership agreement. The Maryland SHA then supplements an existing contract with the University of Maryland through a supplemental work order to add scope and budget for a set of defined work activities.

This same procedure will be used for this truck parking project. The FHWA has obligated funding to the Maryland SHA to conduct the truck parking project. The funds have been added to the SHA's contract with the University of Maryland through a work order.   The University of Maryland is providing the administrative services, including financial and contract management services, necessary to support carrying out the work. Project management services are being provided by Coalition staff.

3.1.2 Contract between the I-95 Corridor Coalition/University of Maryland and Telvent

Much of the Coalition's work is done by private firms under contract to member agencies, or under contract to the University of Maryland, serving on behalf of the Coalition. In regard to the latter, the Coalition/University holds a competitively awarded contract with a consulting team led by Telvent for program management support and project services. The Coalition has elected to use this contract to perform this truck parking project.

Telvent will be the lead firm for the truck parking project. It will be supported by several of its subcontractors, including Cambridge Systematics and subcontractors to be determined who will provide evaluation and marketing services.

A separate task order in Telvent's contract will house the truck parking project. Funding to carry out project activities will be authorized on an incremental basis as decided by the Project Management Team. The Coalition's project manager will work with the University of Maryland's contract manager who will work with the University's contracting officer to take the necessary actions to add funding to support specified activities to the Telvent task order.

3.1.3 Project Management Organization

Ms. Marygrace Parker, the Coalition's Program Coordinator for Freight Mobility, Safety and Security, will be the Coalition's project manager. She will be the Coalition's point-of-contact with the FHWA Truck Parking Program Manager and will direct the work of the Telvent consulting team. Ms. Parker will work with Ms. Kathy Frankle, the manager of the Coalition/University of Maryland contract with Telvent on all contracting and financial management activities.

As project manager, Ms. Parker will work collaboratively with the designated FHWA Truck Parking Program Manager; with Mr. Ed Miller of the Maryland DOT, a champion of Coalition truck parking activities who will represent state interests; and with representatives from the Coalition's Commercial Vehicle Operations (CVO) and Intermodal Program Track Committees. This Project Management Team will strive to make final project determinations on a consensus basis regarding project scope content and changes, or other programmatic and policy issues as may arise throughout the project duration. Should consensus not be reached, final project decisions will be negotiated and decided by Ms. Parker in consultation with the FHWA Truck Parking Program Manager. It is anticipated that meetings of the Project Management Team will convene on a monthly basis. Figure 1, below, depicts the administrative and project management structures.
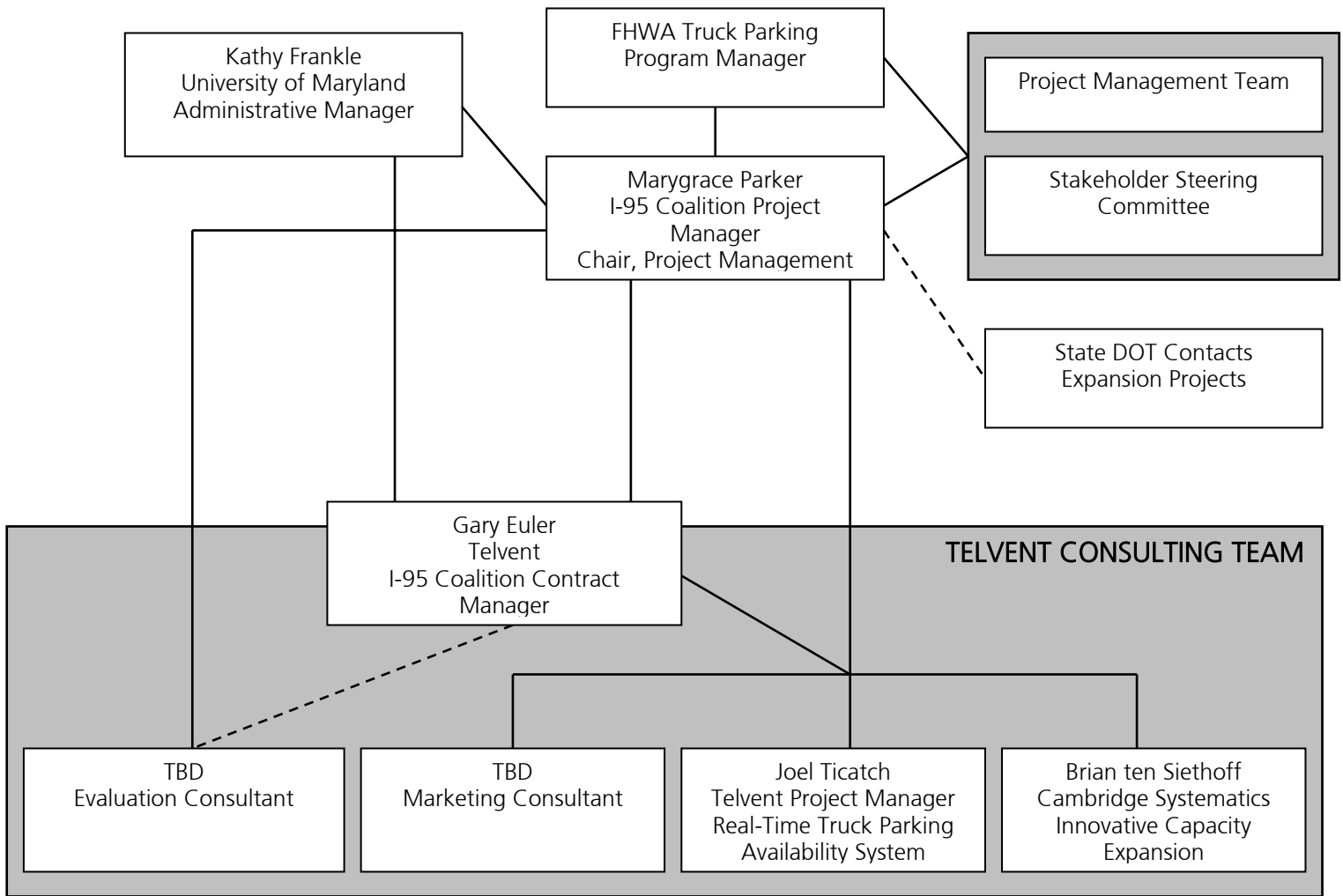

Figure 1 – Project Management Organization

3.2   Project Communications

A Stakeholder Steering Committee will support system development. The Stakeholder Steering Committee will include the members of the Project Management Team and representatives of the involved State Departments of Transportation (DOTs), the American Trucking Association (ATA), the Commercial Vehicle Safety Alliance (CVSA), and National Association of Truck Stop Operators (NATSO). When a broader audience is desirable, or when discussion of specific issues warrants the participation of other organizations, representatives from Authorities, Metropolitan Planning Organizations (MPO's), NATSO, state trucking organizations and potentially other organizations will be invited.

The Stakeholder Steering Committee will be asked to help identify locations for the Truck Parking Availability System and to facilitate installation at these locations (e.g., help with site permits, etc.). Input will be gathered from the Stakeholder Steering Committee at major project decision points. The Stakeholder Steering Committee members will be asked for comments on major project deliverables. It is expected that meetings of the Committee will occur on a quarterly basis.

As described above in Subtasks 4.3 and 4.4, the Coalition will undertake both outreach/coordination and marketing augmentation projects. Outreach/coordination activities, which will be contributed by the Coalition, will focus on using the Coalition's existing committee structure and relationships to share information about project progress and discuss possible expansion to other facilities and other states. Members of the Coalition's committees, including the CVO and Intermodal Program Tracks, and the Coalition's Steering Committee and Executive Board, will be briefed and provided an opportunity to comment and suggest improvements.

Marketing activities will focus on external audiences, and will specifically cover those activities aimed at informing commercial operators about the availability of new parking capacity and how to obtain information on real-time parking availability. Marketing activities will include communications with commercial carriers, independent drivers and private truck stop operators, both through direct contacts and through the appropriate representative trade organizations, e.g., state trucking organizations and the National Association of Truck Stop Owners (NATSO).

All final project documents will be stored on a truck parking page easily accessible on the Coalition's website (www.i95coalition.org).

3.3   Project Monitoring and Control

3.3.1   Procedures

The project will be monitored and controlled using the procedures described in the Coalition's operating procedures manual and/or contained in the contract between the University of Maryland and the Telvent consulting team. These procedures include:

- Designation of a Telvent consulting team project manager – Mr. Joel Ticatch.
- Approval processes for project scopes of work and budgets – These will be used as each funding/work scope increment is provided to Telvent by the University of Maryland. Signatories will be Mr. Ticatch, Mr. Gary Euler (Telvent manager for its Coalition program management support contract with the University of Maryland), Mr. Miller and Ms. Parker.
- Monthly progress reporting and invoicing – using formats defined in the Coalition/University of Maryland contract with Telvent.

- Monthly financial status reporting – based on the latest invoicing information.
- Quarterly progress documentation – using formats and processes already required by the Coalition/University.
- Progress reporting at meetings of the Coalition's CVO and Intermodal Program Track Committees, its Steering Committee and its Executive Board.
- All project deliverables will be reviewed by the Project Management Team. Major project deliverables (as determined by Ms. Parker) will also be reviewed by the Stakeholder Steering Committee. Final acceptance of deliverables will made by Ms. Parker in consultation with the FHWA Truck Parking Program Manager and the Project Management Team.

3.3.2 Responsibilities

The project monitoring responsibilities of the key management individuals are as follows:

- Ms. Marygrace Parker, I-95 Coalition staff – Coalition project manager with project management responsibility for all aspects of the truck parking project, with accountability to Coalition members and FHWA.
- Mr. Joel Ticatch, Telvent truck parking project manager – manages day-to-day development and technical activities associated with the Truck Parking Availability system, with accountability to Ms. Parker and Mr. Euler.
- Mr. Gary Euler, manager of Telvent's program management support contract with the Coalition/University of Maryland – responsible for the work activities of Mr. Ticatch and Telvent consulting team members involved in other aspects of the truck parking project.
- Ms. Kathy Frankle, University of Maryland – administrative management responsibilities for the University of Maryland/Telvent contract, acting on behalf of the Coalition.

3.3.3 Scope and Schedule Management

Ms. Parker will be responsible for scope and schedule management. She will:

- Work with Mr. Ticatch on scope and schedule matters pertaining to the Truck Parking Availability System project.
- Coordinate with State DOT contacts on matters pertaining to State capacity expansion projects.
- Work with responsible Telvent consulting team personnel on matters pertaining to the warehouse/retail and weigh station capacity expansion project and the various augmentation projects.

Project schedule status information will be provided in monthly and quarterly progress reports.

Proposed changes to the current version of the project scope and schedule will be prepared in writing and submitted to Ms. Parker. She will discuss them with Mr. Euler and Mr. Ticatch or other responsible Telvent consulting team personnel, and then present and discuss them with the Project Management Team (which includes the FHWA Truck Parking Program Manager). Changes to the project scope and schedule approved by the Project Management Team will be effected using the existing procedures of the University of Maryland/Telvent contract.

3.3.4 Systems Engineering Process

Project processes will comply with the Federal regulations for systems engineering contained in 23 CFR 940.11. The table below addresses how the seven minimum requirements of those regulations and how they will be addressed in the project.

Requirement	How Addressed
Identification of portions of the regional ITS architecture being implemented	Links to National ITS Architecture addressed in System Architecture.
Identification of participating agencies roles and responsibilities	Addressed in Section 3.2 above and Subtasks 4.3 and 4.4.
Requirements definitions	Addressed in Subtasks 2.1 and 2.3 thru 2.5.
Analysis of alternative system configurations and technology options to meet requirements	Addressed in Table 2 of System Architecture.
Procurement options	Addressed in Subtasks 2.6, 2.7 and 2.9.
Identification of applicable ITS standards and testing procedures	Addressed in Subtask 2.6.
Procedures and resources necessary for operations and management of the system	Addressed in Subtasks 2.8 and 2.10 and Subtask 4.2.

3.3.5 Risk Management

Risk will be addressed at all Project Management Team meetings. A running summary of the 3-5 highest risk factors will be prepared and maintained. These will represent the consensus of the Project Management Team, who will consider input from the Stakeholder Steering Committee. For each risk, the probability of its occurrence and the degree of impact to project budget and schedule (should it occur) will be assessed. Actions to mitigate each risk will be identified and, with the approval of the Project Management Team, pursued should the risk occur.

3.3.6 Quality Assurance

Quality assurance procedures will be used in conjunction with all project activities, including documents, software, and field installations to ensure that the resulting Truck Parking Availability System meets requirements and performs reliably.

All documents will be review internally by Telvent consulting team members (other than those that prepared the documents) prior to delivery to the Coalition. Documents will then be reviewed by the Project Management Team and (in the case of major deliverables) by the Stakeholder Steering Committee. Comments received from the Project Management Team and Stakeholder Steering Committee will be addressed by the document author, and a record of comment disposition will be prepared.

As described in the work scope, the system engineering process will be followed in the development of the Truck Parking Availability system. Reviews of the system engineering documents produced will follow the process described above. Telvent's ISO-9001 certified quality assurance procedures will be followed in the development of the system software. These processes encompass software design, development, testing, configuration management, and documentation. Copies of the Telvent procedures can be made available upon request.

On-going assessments will be performed to ensure that data disseminated to truckers is accurate and timely. These will be conducted in two tiers: first, as part of system acceptance testing, and

second, as part of independent system evaluation. Outfitted parking lots will be monitored remotely for equipment malfunctions and crews will be dispatched to correct problems and deficiencies. Central system redundancy and the use of backup power supplies should mitigate the occurrence of major, system-wide outages. An automated issues database will be maintained for the purpose of identifying problems and monitoring the status of correctional activities.

3.4   Project Close-Out

Project close-out activities will be initiated once all deliverables have been accepted by the Project Management Team, in coordination with the FHWA Truck Parking Program Manager.   A final monthly progress report and invoice will be prepared by the Telvent consulting team and submitted to the Coalition/University of Maryland for payment. A close-out form (as required by the University of Maryland/Telvent contract) will be prepared and stored on the Coalition's website. Outstanding issues related to ownership of all intellectual property (documents, hardware installations and software) will be resolved and appropriate legal document transfers made.   The University of Maryland will take appropriate actions to close its work order with the Maryland SHA, which in turn, will take appropriate actions relative to its partnership agreement with the FHWA.

The goal of all parties is that the system developed under this project will continue to operate after the close of the project. The Sustainability Plan will identify possibilities for future funding support, focusing on various fee arrangements. The long term sustainability will be discussed with the Stakeholder Steering Committee and Project Management Team. Based on these discussions, the Coalition will discuss possible follow-on activities with the FHWA Truck Parking Program Manager.

4. Schedule/Timeline

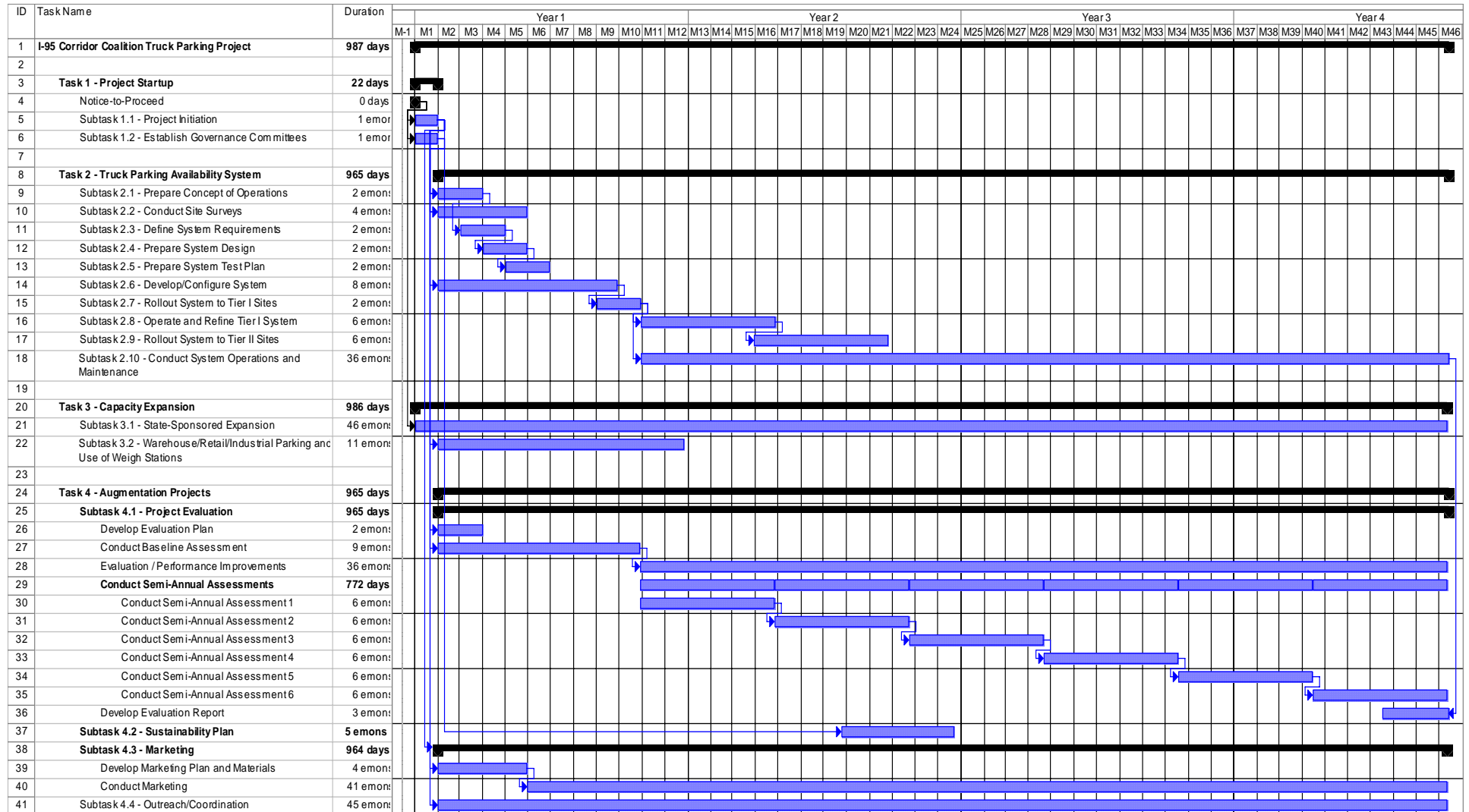A preliminary project schedule is shown in Figure 2, below.

ID	Task Name	Duration
1	**I-95 Corridor Coalition Truck Parking Project**	**987 days**
2		
3	**Task 1 - Project Startup**	**22 days**
4	Notice-to-Proceed	0 days
5	Subtask 1.1 - Project Initiation	1 emon
6	Subtask 1.2 - Establish Governance Committees	1 emon
7		
8	**Task 2 - Truck Parking Availability System**	**965 days**
9	Subtask 2.1 - Prepare Concept of Operations	2 emons
10	Subtask 2.2 - Conduct Site Surveys	4 emons
11	Subtask 2.3 - Define System Requirements	2 emons
12	Subtask 2.4 - Prepare System Design	2 emons
13	Subtask 2.5 - Prepare System Test Plan	2 emons
14	Subtask 2.6 - Develop/Configure System	8 emons
15	Subtask 2.7 - Rollout System to Tier I Sites	2 emons
16	Subtask 2.8 - Operate and Refine Tier I System	6 emons
17	Subtask 2.9 - Rollout System to Tier II Sites	6 emons
18	Subtask 2.10 - Conduct System Operations and Maintenance	36 emons
19		
20	**Task 3 - Capacity Expansion**	**986 days**
21	Subtask 3.1 - State-Sponsored Expansion	46 emons
22	Subtask 3.2 - Warehouse/Retail/Industrial Parking and Use of Weigh Stations	11 emons
23		
24	**Task 4 - Augmentation Projects**	**965 days**
25	**Subtask 4.1 - Project Evaluation**	**965 days**
26	Develop Evaluation Plan	2 emons
27	Conduct Baseline Assessment	9 emons
28	Evaluation / Performance Improvements	36 emons
29	**Conduct Semi-Annual Assessments**	**772 days**
30	Conduct Semi-Annual Assessment 1	6 emons
31	Conduct Semi-Annual Assessment 2	6 emons
32	Conduct Semi-Annual Assessment 3	6 emons
33	Conduct Semi-Annual Assessment 4	6 emons
34	Conduct Semi-Annual Assessment 5	6 emons
35	Conduct Semi-Annual Assessment 6	6 emons
36	Develop Evaluation Report	3 emons
37	**Subtask 4.2 - Sustainability Plan**	**5 emons**
38	**Subtask 4.3 - Marketing**	**964 days**
39	Develop Marketing Plan and Materials	4 emons
40	Conduct Marketing	41 emons
41	Subtask 4.4 - Outreach/Coordination	45 emons

Figure 2 – Project Schedule

5. Project Cost Estimate

6. Real-Time Truck Parking Availability System Architecture

This section defines the architecture of the proposed Real-Time Truck Parking Availability System. This architecture identifies key system components, functions, and interfaces among the components as well as the National ITS (Intelligent Transportation System) Architecture. As mentioned previously, the purpose of the system is to disseminate real-time information on truck parking availability to the trucking community along a segment of the I-95 corridor extending from Connecticut through North Carolina.

The Truck Parking Availability System will be designed using a modular approach composed of three (3) major subsystems:

- **Data Collection Subsystem** – Collects raw vehicle occupancy data in designated truck parking areas.

- **Data Integration Subsystem** – Integrates and processes vehicle occupancy data collected from all instrumented truck parking areas to calculate parking availability by area.

- **Data Dissemination/Traveler Information Subsystem** – Disseminates real-time parking availability information to truck operators through a range of mechanisms and media.

Figure 3, below, depicts the system architecture and associated subsystems. The proposed system is based on hardware and software that have been successfully used in other venues and are readily available in the commercial marketplace.
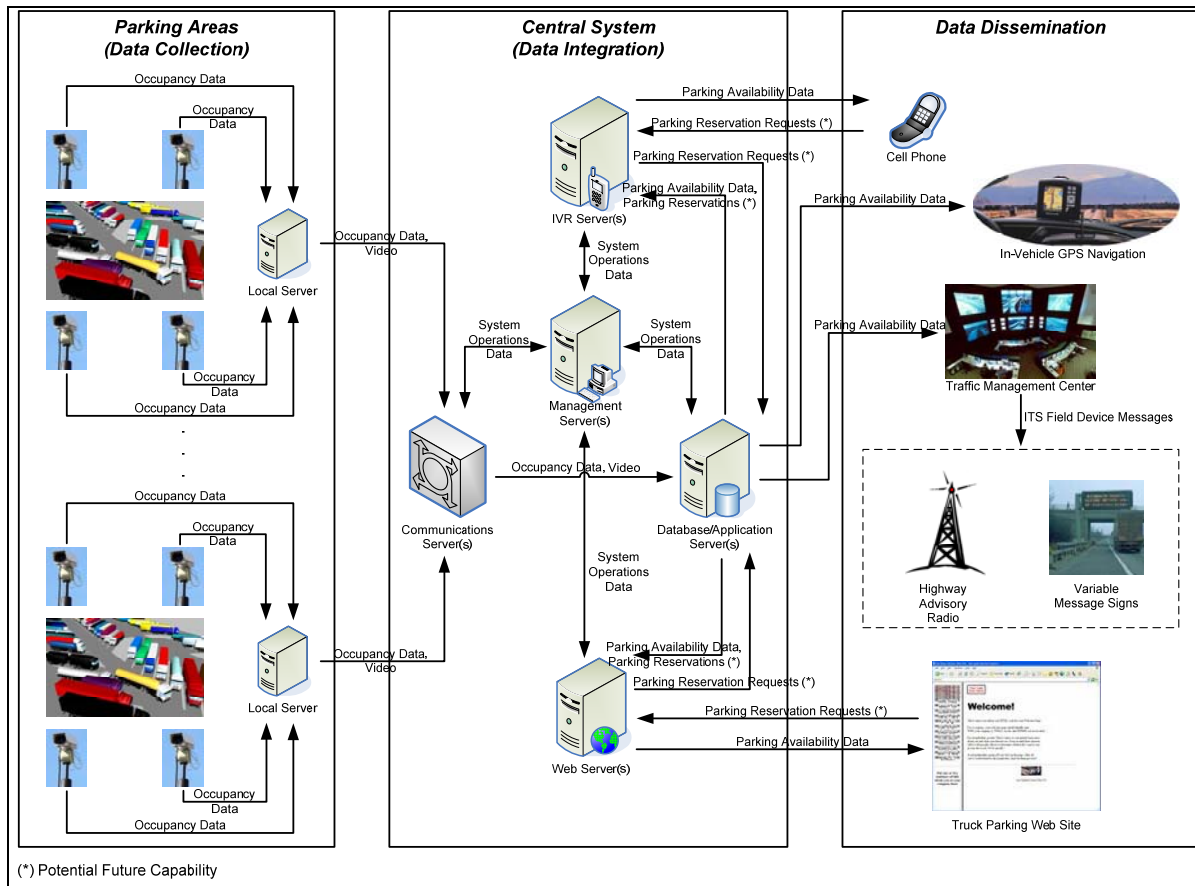

Figure 3 – Truck Parking Availability System Architecture

Although a parking reservation capability is depicted in the diagram above, this function will not be included in the initial system but may be added as a feature in the future. During the course of the project, research will be conducted into trucker interest and operational and technical issues relating to a parking reservation capability.

6.1   Data Collection Subsystem

The system utilizes optical imaging technology as the primary component in collecting raw vehicle occupancy data in designated truck parking areas. Depending on the layout and size of each parking area, one or more fixed video cameras will be strategically located to maximize the number of parking spaces that can be monitored within each camera's field of vision.

Video cameras will be mounted on existing structures (e.g., light poles, building structures), where possible, to minimize installation costs; otherwise, poles with sufficient strength and height will be installed to house the camera equipment. Commercially available cameras of different types will be employed to support varying weather conditions depending on deployment location. Where possible, solar powered devices will be used to minimize the need for power cabling/trenching.

Video images from each camera within the parking area will be transmitted in real-time to a local processor/server housing specially designed imaging software. The transmission will occur using wireless communications technology, where possible. Using sophisticated algorithms, this software will analyze the video streams and determine actual vehicle occupancy within each monitored parking space. Each parking space will be configured during system setup ahead of time as an individual "detection zone". Once a vehicle has stopped in the "detection zone" after a configurable amount of time (e.g., 30 seconds), the system will issue an internal "alarm" that the space is occupied. Likewise, the alarm will be turned off after a vehicle leaves a detection zone. In near-real-time, vehicle occupancy for each monitored parking space will be calculated and forwarded to a central system for data integration and subsequent processing. Note that the software will also be able to support video captured under harsh environmental conditions, such as snow/rain/ice and insect disturbances.

As a value-added option, video captured from the individual parking area cameras can be stored through a digital video recorder for use as a security monitoring application. The video can be transmitted to a central system, along with the occupancy data, for use by operations personnel, rest area owners, etc. Video can be made available on an as-needed basis, or streamed continuously depending on the need and available communications bandwidth.

6.2   Data Integration Subsystem

The "Central System" shown in the middle box in Figure 3, above, will be responsible for key data integration and processing functions. Primary capabilities include retrieving raw occupancy data from each monitored truck parking area, calculating parking availability by area, and forwarding the parking availability data to dissemination outlets.

Because the system must function in a 24x7 environment, redundant and secure system components will be employed to minimize service disruptions. This will include the use of "hot" standby hardware that can automatically resume operations in the event of a primary server failure, firewalls to prevent system incursions, and redundant communications paths between data collection components and data dissemination elements.

The Central System will consist of multiple servers to perform the following functions:

- **Communications** – Receives raw occupancy data and video from each instrumented parking area for transfer to Database Management/Application Processing servers.

- **Database Management/Application Processing** – Calculates parking availability by area, stores raw and processed data and video, and disseminates parking availability information to specific outlets.

- **Interactive Voice Response (IVR) Dissemination** – Provides automated parking availability data via cell phone.

- **Web Dissemination** – Provides automated parking availability data via the Web.

- **Overall Management/Operations** – Supports management and administration of the overall Truck Parking Availability System. This will include:
  - Monitoring the general health of the system (e.g., to ensure that data flows between system components are operating properly).
  - Reporting and responding to system alarms/failures.
  - Reporting/querying capabilities (e.g., to monitor trends in parking area utilization).
  - Adjusting system configuration parameters (e.g., to modify frequencies in receiving raw occupancy data and disseminating parking availability data to external systems, or to modify the configuration of detection zones for data collection).
  - Restoring and backing up the system.
  - Installing software and hardware upgrades.

Note that some of the above servers may be combined, depending on the overall load on the system and specific hardware to be implemented. Pertinent factors affecting this decision include the number of parking areas to be monitored, the types of dissemination methods to be employed, and additional system functionality to be provided.

6.3   Data Dissemination / Traveler Information Subsystem

The proposed system will be capable of providing near-real-time truck parking availability information via a range of mechanisms and media in order to ensure that the information is available to as many truckers as possible. As part of the overall project, the I-95 Corridor Coalition will reach out to trucking organizations and transportation agencies to inform them of the availability of this information and ways to obtain it. The primary methods include:

- **Cell Phone** – Automated parking availability information will be provided through an interactive voice response (IVR) system with easy-to-use prompts for desired parking locations; an automatic call-back system will update truckers on parking space status at the specified lots as the drivers progress through their routes. Since most truck drivers already carry cell phones, this will be a convenient method of accessing parking availability information both pre-trip and en-route. Fixed roadside signs at strategic locations along freeways will inform drivers of the phone number to call to obtain parking availability information.

- **Truck Parking Web Site** – For pre-trip planning, a dedicated web site will be developed to enable truck operators to view parking availability information by location. In addition, the I-95 Corridor Coalition will reach out to local and state transportation agencies to provide linkages to the Truck Parking Web Site from their agency web sites. Alternatively, data feeds could be established to provide parking availability data to the transportation agencies for display directly from their own web sites, if desired.

The system will include a data feed mechanism to provide real-time truck parking availability information that other systems can receive and disseminate through additional methods, such as:

- **511 Systems** – These systems are typically developed and deployed by state departments of transportation to provide the motoring public with pre-trip and en-route traffic, roadway, and transit information within each state. Many states and certain metropolitan areas currently have 511 systems or are in the process of developing them. The integration of truck parking availability data falls within the scope of 511 systems and provides the potential for another commonly used outlet of parking information for truckers. Both Pennsylvania and Virginia have expressed interest in using their 511 systems for this purpose.

- **Highway Advisory Radio (HAR) / Variable Message Signs (VMS)** – These types of en-route traveler information devices can be used, where available and appropriate, to provide truck parking availability information at downstream lots. As these roadway devices are owned and operated by transportation agencies within each State, the Coalition will work with these agencies to provide data feeds containing parking availability data for dissemination through the appropriate devices.

- **In-Vehicle GPS (Global Positioning System) Navigation Systems** – As built-in and after-market GPS navigation devices become more prevalent in commercial vehicles, they present an ideal opportunity to reach truck drivers while en-route. Real-time traffic data is currently provided through GPS navigation system displays in certain geographic areas, so it is entirely feasible that parking availability data could be provided in a similar manner.

- **Kiosks** – Kiosks can be implemented at travel centers, welcome centers and rest areas to provide parking availability information for downstream parking locations as well as other travel and weather information. Although specialized software could be developed for this application, it will be most cost-effective and consistent to establish the kiosk as a gateway to accessing the dedicated Truck Parking Web Site discussed above. This also makes the web site concept useful in an en-route environment.

6.4   Linkages with the National ITS Architecture

The proposed Truck Parking Availability System has linkages with the National ITS Architecture in a number of ways. As shown in Figure 4, below, the National ITS Architecture consists of a series of physical subsystems (shown in white boxes). In this diagram, the most pertinent subsystem to the Truck Parking Availability System is "Parking Management", shown in the bottom right corner.
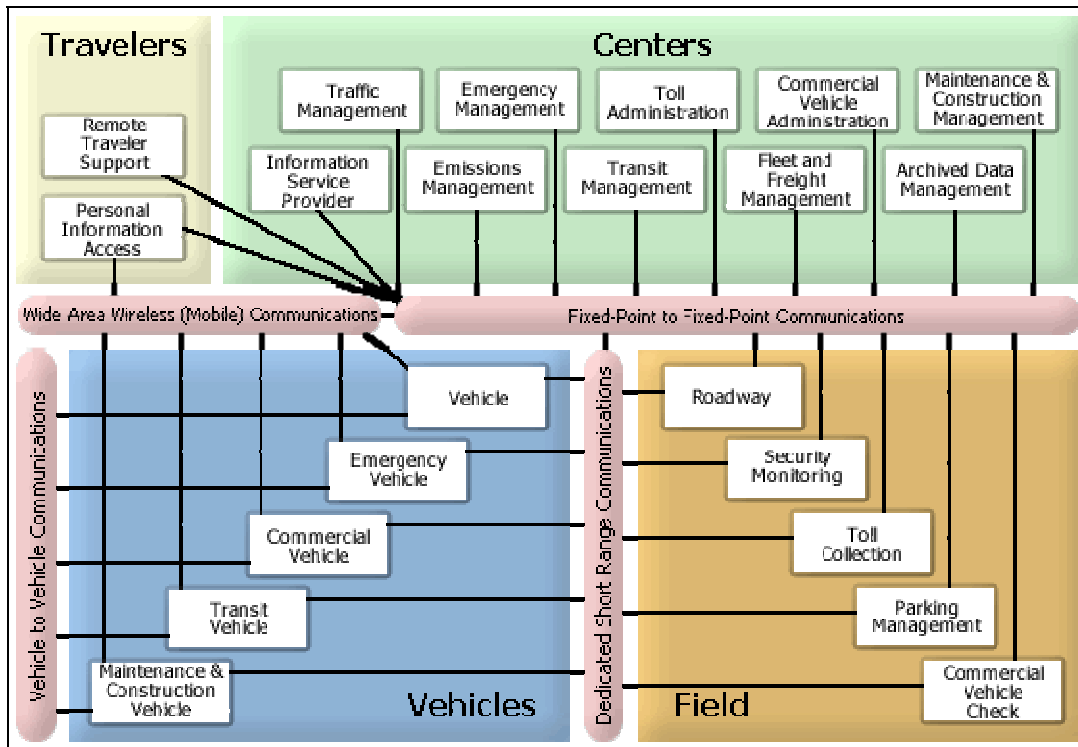
Figure 4 – National ITS Architecture

The Parking Management Subsystem interfaces with several other subsystems as shown in Figure 5, below.
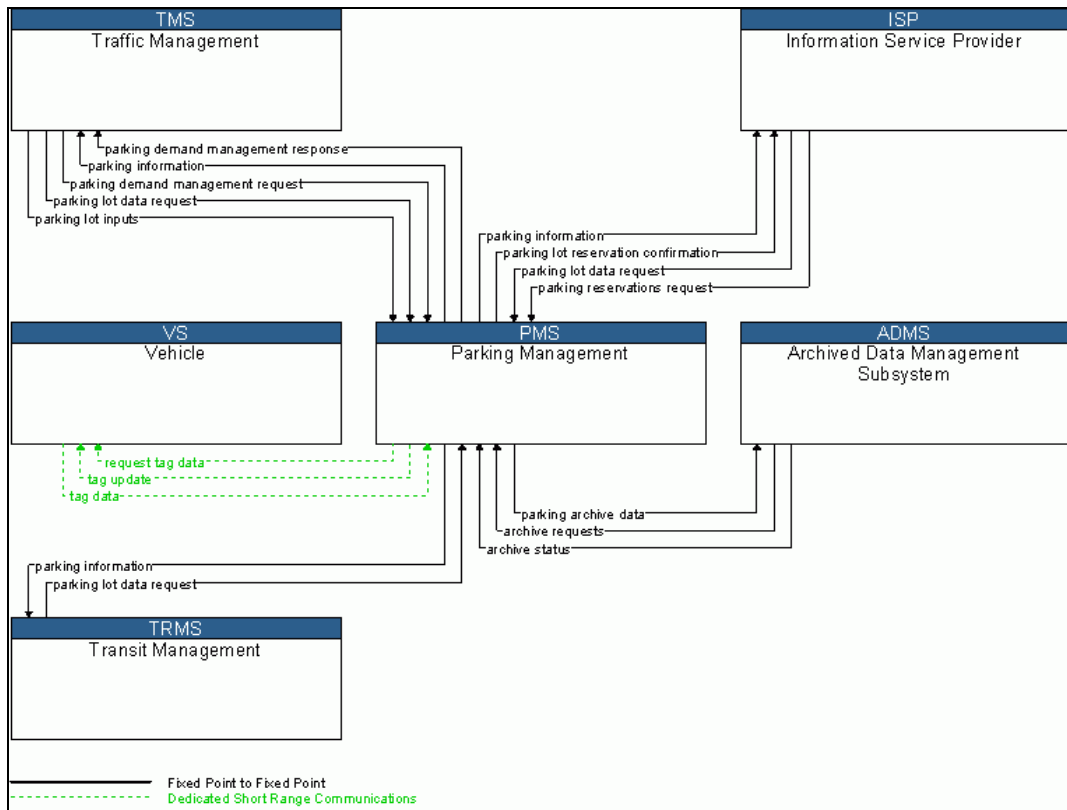

Figure 5 – National ITS Architecture Parking Management Subsystem Data Flows

In this diagram, parking information is sent to Information Service Providers and the Traffic Management Subsystem. This equates to the capabilities of the Truck Parking Availability System collecting parking availability data and distributing aggregated information to the trucking community through different mechanisms. Similarly, parking reservation requests and resulting reservation confirmations are exchanged between the Parking Management and Information Service Provider subsystems; this represents a potential future reservation capability that may be added to the Truck Parking Availability System.

Equipment Packages

In the National ITS Architecture, the Parking Management Subsystem also consists of a number of equipment packages that represent a set of similar processes grouped together for implementation. The pertinent equipment packages comprising the Parking Management Subsystem are as follows:

- **Parking Coordination** – This equipment package supports communication and coordination between equipped parking facilities and also supports regional coordination between parking facilities and traffic and transit management systems. This equipment package also shares information with transit management systems and information service providers to support multimodal travel planning, including parking reservations capabilities. Information including current parking availability, system status, and operating strategies are shared through this equipment package to enable local parking facility management that supports regional transportation strategies.

- **Parking Data Collection** – This equipment package collects and stores parking information that is collected in the course of parking system operations performed by the Parking Management Subsystem. This data can be used directly by operations personnel or it can be made available to other data users and archives in the region.

- **Parking Management** – This equipment package detects and classifies vehicles at parking facility entrances, exits, and other designated locations within the facility. Current parking availability is monitored and used to inform drivers through dynamic message signs/displays so that vehicles are efficiently routed to available spaces. Parking facility information, including current parking rates and directions to entrances and available exits, is also provided to drivers. Coordination with traffic management supports local traffic control coordination in and around the parking facility.

Market Packages

Another way to look at the National ITS Architecture is through the use of market packages, which address specific services. A market package collects together several different subsystems, equipment packages, and architecture flows that provide the desired service. Below is a list of applicable market packages related to the Truck Parking Availability System.

- **ATMS 06 - Traffic Information Dissemination** – This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, incident information, and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a

traffic management center to the media, Transit Management, Emergency Management, and Information Service Providers.

- **ATMS 09 - Traffic Forecast and Demand Management** – This market package includes advanced algorithms, processing, and mass storage capabilities that support historical evaluation, real-time assessment, and forecast of the roadway network performance. This includes the prediction of travel demand patterns to support better link travel time forecasts. The source data would come from the Traffic Management Subsystem itself as well as other traffic management centers and forecasted traffic loads derived from route plans supplied by the Information Service Provider Subsystem. The package collects information on vehicle pollution levels, parking availability, usage levels, and vehicle occupancy to support these functions. Demand management requests can also be made to Toll Administration, Transit Management, and Parking Management Subsystems.

- **ATMS16 - Parking Facility Management** – This market package provides enhanced monitoring and management of parking facilities. It assists in the management of parking operations, coordinates with transportation authorities, and supports electronic collection of parking fees. This market package collects current parking status, shares this data with Information Service Providers and Traffic Management, and collects parking fees using the same in-vehicle equipment utilized for electronic toll collection or contact or proximity traveler cards used for electronic payment.

- **ATMS17 - Regional Parking Management** – This market package supports coordination between parking facilities to enable regional parking management strategies.

- **ATIS 01 - Broadcast Traveler Information** – This market package collects traffic conditions, advisories, general public transportation, toll and parking information, incident information, roadway maintenance and construction information, air quality and weather information, and broadcasts the information to travelers using technologies such as FM subcarrier, satellite radio, cellular data broadcasts, and Internet web casts. The information may be provided directly to travelers or provided to merchants and other traveler service providers so that they can better inform their customers of travel conditions.

- **ATIS 02 - Interactive Traveler Information** – This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. Although the Internet is the predominate network used for traveler information dissemination, a range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal and web pages via kiosk, personal digital assistant, personal computer, and a variety of in-vehicle devices. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means.

- **ATIS 05 - ISP Based Trip Planning and Route Guidance** – This market package offers the user trip planning and en-route guidance services. It generates a trip plan, including a multimodal route and associated service information (e.g., parking information), based on traveler preferences and constraints. Routes may be based on static information or reflect real-time network conditions. The trip plan may be confirmed by the traveler, and advanced payment

and reservations for transit and alternate mode (e.g., airline, rail, and ferry) trip segments and ancillary services (e.g., parking reservations) are accepted and processed. The confirmed trip plan may include specific routing information that can be supplied to the traveler as general directions or as turn-by-turn route guidance depending on the level of user equipment.

- **ATIS 07 - Yellow Pages and Reservation** – This market package provides yellow pages and reservation services to the user. These additional traveler services may be provided using the same basic user equipment used for Interactive Traveler Information. This market package provides multiple ways for accessing information either while en route in a vehicle using wide-area wireless communications or pre-trip via fixed-point to fixed-point connections.

Appendix A – Acronyms

Acronym   Description

APU   Auxiliary Power Unit
ATIS   Advanced Traveler Information System
ATMS   Advanced Transportation Management System
COO   Concept of Operations
COTS   Commercial off the Shelf
CVO   Commercial Vehicle Operations
CVSA   Commercial Vehicle Safety Alliance
DOT   Department of Transportation
FHWA   Federal Highway Administration
GPS   Global Positioning System
HAR   Highway Advisory Radio
ISO   International Standards Organization
ITS   Intelligent Transportation System
IVR   Interactive Voice Response
MDSHA   Maryland State Highway Administration
MPO   Metropolitan Planning Organization
NATSO   National Association of Truck Stop Owners
PMP   Project Management Plan
SAFETEA-LU   Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SRS   System Requirements Specification
USDOT   United States Department of Transportation\
VMS   Variable Message Sign

Appendix B – Video Analytics Product Evaluations

Over a period of several months, the project team conducted a detailed evaluation of several video analytics vendor products to determine the most suitable tools available for use in the Data Collection Subsystem of the Truck Parking Availability System.

As background information, the architecture of the proposed Truck Parking Availability System is based on the use of video analytics technology which is envisioned to monitor individual parking spaces as "detection zones" to determine if the space is occupied or vacant. Depending on the layout and size of each parking area, one or more fixed video cameras with associated video analytics will be strategically located to maximize the number of parking spaces that can be monitored within each camera's field of vision. Video cameras will be mounted on existing structures (e.g., light poles, building structures), where possible, to minimize installation costs; otherwise, poles with sufficient strength and height will be installed to house the camera equipment.

Video images from each camera within the parking area will be transmitted in real-time to a local processor/server housing specially designed imaging software. Using sophisticated algorithms, this software will analyze the video streams and determine actual vehicle occupancy within each monitored parking space. Each parking space will be configured during system setup ahead of time as an individual "detection zone". Once a vehicle has stopped in the "detection zone" after a configurable amount of time (e.g., 30 seconds), the system will issue an internal "alarm" that the space is occupied. Likewise, the alarm will be turned off after a vehicle leaves a detection zone. In near-real-time, vehicle occupancy for each monitored parking space will be calculated and forwarded to a central system for data integration and subsequent processing.

Based on the above data collection requirements and operational environment, the project team met with each vendor to discuss their products and evaluate their applicability to the proposed Truck Parking Availability System. When available, demonstration units were provided to the team for a more detailed evaluation. Certain vendors also provided system documentation that the project team analyzed to determine methods for configuring the tool, establishing detection zones, and integrating resulting video analytics data into the overall system.

Key findings of the evaluation are summarized below:

- Video analytics products are designed for the security and surveillance markets. These products generally focus on the following areas:
  o Intrusion detection
  o Loitering
  o Object removal tracking
  o Stopped vehicle detection – This area is most applicable to the Truck Parking Availability System

- Products continue to evolve. Most of the companies started operations in the early 2000's, especially in response to the events on September 11, 2001.

- Most products track when a vehicle enters a detection area and stops for a configurable period of time.

- An alarm is signaled on entry and exit of a detected area.

- Video analytics algorithms are incorporated into (1) a video encoder attached to each camera or (2) software that resides on a computer server.

The evaluation revealed a number of challenges and issues common to many of the video analytics products that may prevent integration into the Truck Parking Availability System:

- Several products are unable to track individual "alarms". Even though multiple detection zones (i.e., parking spaces) may be configured, individual alarms could not be tracked to determine which spaces are occupied.

- Some products require additional development to ensure operation is consistent.

- One vendor indicated that their technology could only support a limited number of individual alarms (e.g., 5-10) to be detected by each camera. This would require the installation of many cameras to fully monitor most parking areas, a costly proposition.

- Several vendors have existing products that would require costly and time consuming enhancements to support the truck parking application. Unfortunately, there are also no guarantees that the resulting product would meet the needs of the application in time for deployment.

Table 2, below, provides a summary of each vendor/product evaluated along with current status.

Table 2 – Video Analytics Product Descriptions and Status

Vendor	Product Description	Status	Further Consideration?
Quantum Signal Ann Arbor, MI	Quantum Signal has a video analytics product, although the product is not suited for parked vehicle detection. According to the vendor, this type of capability could be developed in approximately 2-3 months using existing toolkits, although there are no guarantees. The vendor recommended talking with IO Image and ObjectVideo (see below).	Product cannot support parked vehicle detection	No
IO Image Denton, TX (Headquarters in Israel)	IO Image's video analytics product is able to detect when a vehicle has stopped in a location after a configurable amount of time and issue an "alarm" that the space is occupied. The video analytics are incorporated into IO Image's video encoders. Unfortunately, using "static rules", the product cannot check for alarms individually for each space (i.e., all alarms will be triggered if only one space becomes occupied). Using "motion rules", the individual alarms can be tracked, but the system behaves inconsistently with many anomalies. In addition, with "motion rules", the alarm will disappear after a period of time (e.g., 10 seconds). IO Image may be implementing a fix to handle each alarm individually for each space in a future release - waiting for answer.	Unknown if/when product fix will be available to support truck parking application	TBD
Geutebruck Chantilly, VA (Headquarters in Germany)	Geutebruck does not have an off-the-shelf product for parked vehicle detection. Their video analytics product has some vehicle detection capabilities, although this would not be sufficient for the truck parking application as is. Geutebruck can add image referencing and improve their vehicle detection capabilities, but this would not be a cost effective solution given the accuracy that is needed.	Significant product enhancements required; not cost effective	No

Vendor	Product Description	Status	Further Consideration?
Cornet / Video Convergence Springfield, VA	Cornet / Video Convergence has integrated ObjectVideo's "loitering/object left behind" video analytics product into their video encoders to detect when a vehicle has stopped in a location after a configurable amount of time and issue an "alarm" that the space is occupied. (ObjectVideo only works with it's own partners). As of August 2008, Cornet's product was only able to handle detection of up to 5 areas (parking spaces) at a time. The product also was unable to associate each alarm with an individual detection zone (parking space), thereby preventing determination of specific parking spaces that are occupied. Both of these limitations were to be corrected by October 2008. According to Cornet, the most significant problem is that many cameras would be needed, depending on the size/layout of the parking lot and positioning of the cameras. For example, approximately 15 cameras would be required for a 150-space lot with the following parameters: - 1,000 ft by 1,000 ft - 5 rows of spaces with 30 spaces per	Product unsuitable given number of cameras required	No
NICE Systems Rutherford, NJ (Headquarters in Israel)	NICE's video analytics product does not have the ability to setup individual detection zones to monitor each individual parking space, but it could be used for entry/exit counting into the overall parking area with size filtering to detect trucks. The problem with this solution is that there may be many large entry/exit points to/from the parking areas. In addition, vehicle counts could drift over time due to tailgating, passing vehicles, and shadowing.	Product can only support entry/exit counting	TBD
Coretec Lake Mary, FL	Coretec has integrated ObjectVideo's video analytics technology into their encoders, but they determined that their product cannot support a truck parking application (no reason given).	Product cannot support truck parking application	No
SightLogix Princeton, NJ	SightLogix's video analytics product is able to detect when a vehicle has stopped in a location after a configurable amount of time and issue an "alarm" that the space is occupied. The product is designed to cover large areas (3-10 times the range of other systems), which could help minimize the number of cameras needed in each parking lot. Their product uses Google Earth to geo-register each parking lot to improve detection capabilities. SightLogix provides a packaged solution that includes the camera with a built-in computer for handling the video analytics, along with a video management system, so there may not be a need for a local server at each parking lot. SightLogix recommends using thermal cameras (more expensive) to minimize false detections due to sun glare, vehicle lights, and shadows, although this may not be necessary if the camera is positioned high enough. SightLogix has a SightSurvey tool that works with Google Earth to help determine the number of cameras that would be needed for each lot.	Product is being tested at Telvent office and appears to meet project requirements	Yes
Rileen Innovative Technologies Virginia Beach, VA	Rileen has a video analytics product that can supposedly detect parked vehicles, but they encountered technical difficulties in configuring/customizing the product for a truck parking application. They have not been successful in resolving these issues after several months of effort.	Product is technically unfeasible	No
Delta Digital Video EarthCam	All are video analytics products. Further research is needed.	Under Investigation	TBD

Vendor	Product Description	Status	Further Consideration?
Foster-Miller Siemens			