Florida Department of Transportation

TRUCK PARKING AVAILABILITY SYSTEM

Concept of Operations (ConOps)

Version 1.2

November 2016

PREPARED FOR

Florida Department of Transportation
State Traffic Engineering and Operations Office
605 Suwanee Street, MS 90
Tallahassee, FL 32399-0450

Document Control Panel

Version No.	Date	Prepared By	Reviewed By	Comments
0.1	8/24/15	Vic Blue	R Sharma S Bahler	Initial review QC Review
0.2	9/15/15	V Blue	S Bahler	QC Review
0.2	9/29/15		P Clark	Owner Review
0.3	9/30/15	V Blue	S Bahler	QC Review
1.0	9/30/15	V Blue	P Clark	Owner Review
	10/6/15	V Blue	S Bahler	Revisions
1.1	7/19/16	C Toth		Update for D5 Phase I
1.1	8/5/2016	V Blue		
1.2	11/10/16	V Blue		Revision for Generic Stage I

Table of Contents

List of Figures

List of Tables

List of Acronyms

ATMS	Advanced Traffic Management System
BSM	Basic Safety Message
CCTV	Closed Circuit Television
ConOps	Concept of Operations
CV	Connected Vehicle
CVO	Commercial Vehicle Operations
DMS	Dynamic Message Sign
DTPS	Dynamic Truck Parking Signs
DSRC	Dedicated Short Range Communications
EMO	Emergency Management and Operations
FMCSA	Federal Motor Carrier Safety Administration
FDOT	Florida Department of Transportation
FHP	Florida Highway Patrol
FIU	Florida International University
FTE	Florida's Turnpike Enterprise
GUI	Graphical User Interface
HOS	Hours of Service
ICM	Integrated Corridor Management
ISP	Information Service Provider
ITS	Intelligent Transportation System
MOU	Memorandum of Understanding
MVDS	Microwave Vehicle Detection System
NITSA	National Intelligent Transportation System Architecture

PPP	Public-Private Partnership
PTZ	Pan-Tilt-Zoom
RITIS	Regional Integrated Traffic Information System
RITSA	Regional Intelligent Transportation System Architecture
RPM	Routine Preventative Maintenance
RTMC	Regional Transportation Management Center
SITSA	Statewide Intelligent Transportation System Architecture
SOP	Standard Operating Procedures
TIM	Traffic Incident Management
TMC	Traffic Management Center
TPAS	Truck Parking Availability System
TPIMS	Truck Parking Information and Management System
TSPS	Truck Smart Parking Services
WAN	Wide Area Network
WIM	Weigh in Motion

1.0. Overview

1.1. Identification

The Florida Department of Transportation (FDOT) is developing plans to create a Truck Parking Availability System (TPAS) for commercial carriers on the four primary Interstate corridors in Florida:

- I-4
- I-10
- I-75
- I-95.

The TPAS will be fully integrated with the statewide Florida Intelligent Transportation System (ITS) through its network of Traffic Management Centers (TMCs).

1.1.1 Phases and Stages Defined

The TPAS project will support the development of a truck parking system to disseminate information related to the availability of truck parking spaces at existing locations. In this report the term "Stage" applies to:

- Stage I – FDOT Public Rest Areas
- Stage II – Private Rest Stops.

The TPAS will include public areas (Stage I - rest areas, welcome centers, weigh stations) and, in its fully realized expansion, it will also include off-system private facilities (Stage II - private truck stops, gas stations). The second stage (Stage II) of private truck stop availability will be treated in a separate Concept of Operations (ConOps) when it is initiated.

1.1.2 TPAS Features

The TPAS will electronically measure parking availability. The system will alert commercial vehicle operators to the available number of spaces through various methods, including roadside Dynamic Truck Parking Signs (DTPSs), the Florida 511 Traveler Information System and cellular-based applications.

DTPSs will be operated from the Regional Transportation Management Center (RTMC) and interfaced with the State and Regional Intelligent Transportation Management System Architectures (SITSA, RITSA). The project will not use overhead Dynamic Message Signs (DMS). The project will only use DTPSs that consist of static ground mounts with three brick embedded DMSs.

Required standards for highway design are designated in the AASHTO "Green Book" (AASHTO, 2011), AASHTO Interstate Standards Manual (AASHTO, 2005) and for signing in the Manual on Uniform Traffic Control Devices (USDOT FHWA, May 2012).

1.2. Document Overview

This document provides the ConOps for a TPAS on Interstate corridors in Florida. It includes stakeholders, their associated roles, and functions of the TPAS. This ConOps plan is written for the FDOT Central Office Traffic Engineering and Operations Office. It is also written for the system designer, software designer, contractor and integrator to ensure the ultimate facilities meet the intentions of the Department.

Primary users of the information derived from the TPAS include RTMC operators and commercial vehicle operators. Commercial vehicle operators will receive information via DTPSs, cellular phone-based applications and/or third-party applications.

1.3. Systems Overview

Truck parking on Florida's Interstate roadways can overflow onto rest area ramps, freeway ramps and shoulders, and adjacent roads. This overflow creates safety concerns for other motorists and for the commercial vehicle operators along the corridor. Expansion of the rest areas to accommodate the need for more truck parking is costly. Rather than building more parking spaces, FDOT has undertaken a project to evaluate if existing spaces along the corridor can be more efficiently utilized through better communication of parking availability to the trucking community. Identifying available parking that provides safe alternatives for the overflow and communicating that information to commercial vehicle operators are the primary needs to be addressed by this project.

The functions of the FDOT's TPAS are to:

- Enhance highway safety by providing timely and reliable truck parking information
- Provide sustainable and scalable truck distribution to available spaces
- Provide a secure solution that protects user privacy and data
- Maximize user acceptance of the system for truck parking decisions.

The TPAS will include capabilities to measure truck parking availability at public rest areas and weigh stations. FDOT will be responsible for collecting truck parking availability information at the public rest areas and weigh stations. Truck parking availability information will be shown DTPSs, and the information will be disseminated over the Internet, via a smart phone application and/or dedicated FDOT website. Though not part of this project's scope, truck parking information could additionally be made available in-vehicle through Dedicated Short Range Communications (DSRC) and connected vehicle (CV) applications.

1.3.1 Architectures Related to TPAS

This ConOps document lays a foundation for designing a TPAS to meet stakeholder needs and requirements and TPAS functions listed above. Since the TPAS is expected to operate consistently statewide, the SISTA would be the level of architecture, rather than the individual RITSAs, to define the TPAS architecture.

1.3.1.1 Architecture Service Package

At the present time, a Commercial Vehicle Operations (CVO) TPAS is not expressly listed or supported in the National ITS Architecture (NITSA) (Iteris, ITS National Architecture 7.0.website). In the NITSA there are no Service Packages that relate to Advanced Commercial Vehicle Operations (ACVO) Parking Systems, but in other sections of the NITSA there are several generic Service Packages for Advanced

Traffic Management Systems (ATMS) and Advanced Traveler Information Systems (ATIS) that can be applied to TPAS:

- ATMS 05 –Information Service Provider (ISP)-Based Trip Planning and Route Guidance
- ATMS 09 – Transportation Decision Support and Demand Management
- ATMS 16 – Parking Facility Management
- ATMS 17 – Regional Parking Management
- ATIS 01 – Broadcast Traveler Information
- ATIS 02 – Interactive Traveler Information.

In the Florida SITSA, an ITS Architecture for ATMS 17, Regional Parking Management for Commercial Vehicles comprises a generic statewide system for parking information (Florida Department of Transportation, Accessed September 2015) and whose User Services are shown in Figure 1. In the figure reference is made to FTE – Florida's Turnpike Enterprise, which is not part of this TPAS effort, though one day may be included.

The ATMS 17 User Services diagram comprises a system for parking information where the RTMC controls field equipment such as DTPSs and Closed Circuit Television (CCTV) cameras. Parking space data is sent from the public rest area to the RTMCs' SunGuide TPAS software. The analyzed data is sent to the ISP, which is Florida 511 software, and that information is sent to the commercial vehicle operators directly, via their fleet managers and from other ISPs, such as Waze, Drivewyze, etc.

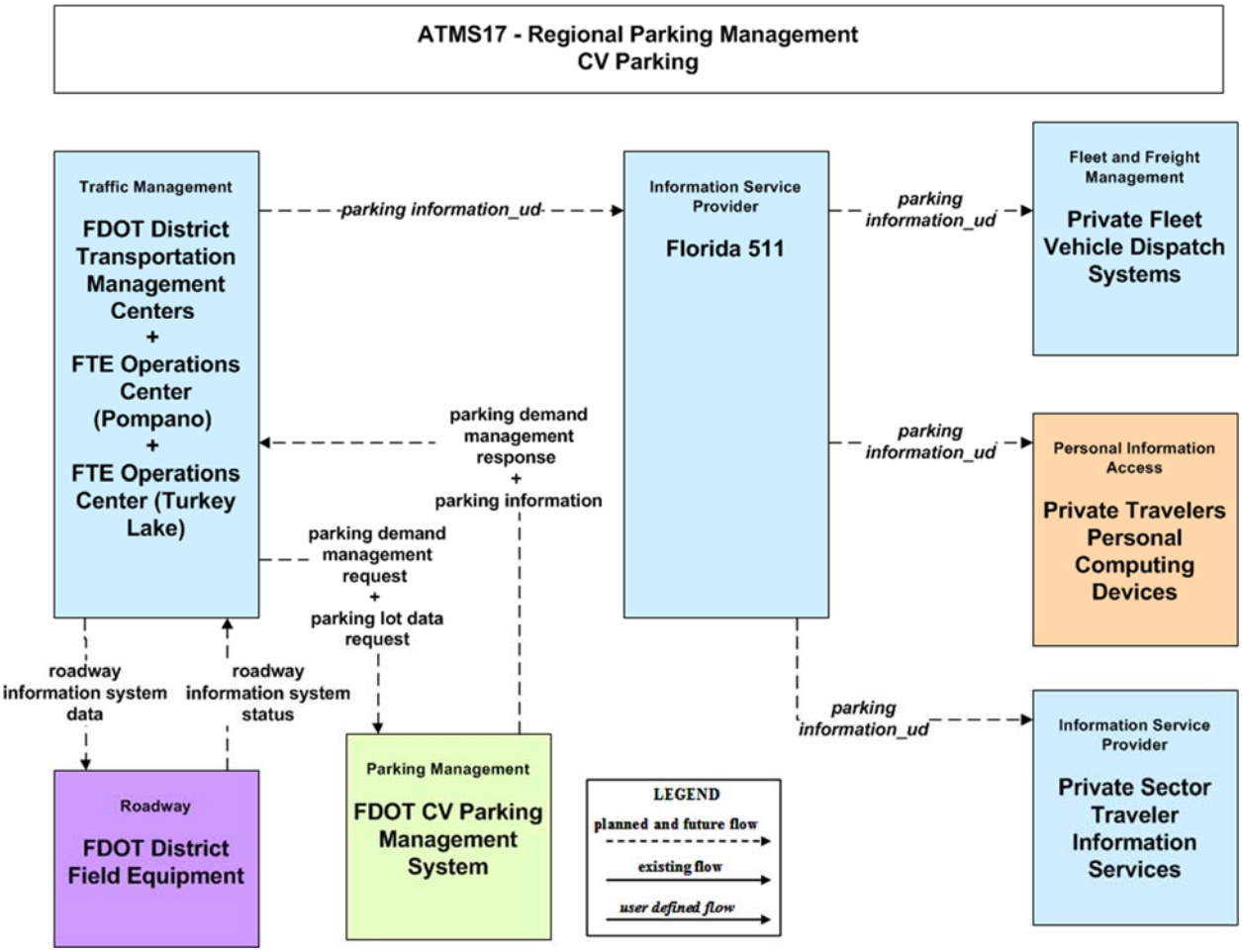

Figure 1: FDOT SISTA ATMS 17 Service Package.

(Source: http://www.consystec.com/florida/state/web/files/mpimages/ATMS17-1_DS.htm).

2.0. Referenced Documents

The following documents were used in the production of this document:

AASHTO. (2005). A Ploicy on Design Standards - Interstate System, 5th Edition. Washington, D.C.: American Association of State Highway and Transportation Officials.

AASHTO. (2011). *A Policy on Geometric Design of Highways and Streets, 6th Edition.* Washington, D.C.: American Association of State Highway and Transportation Officials.

Bayraktar, M. E., Zhu, Y., & Arif, Y. (2012). *Commercial Motor Vehicle Parking Trends at Rest Areas and Weigh Stations, FDOT Contract BDK80 977-14.* Miami, Florida: Florida International University, http://www.dot.state.fl.us/research-center/Completed_Proj/Summary_TE/FDOT-BDK80-977-14-rpt.pdf.

CATT Lab. (Accessed 2015). *A User-Focused R&D Laboratory at the University of Maryland.* http://www.cattlab.umd.edu/, http://www.cattlab.umd.edu/.

Federal Highway Administration. (1999). *Rest Area Forum: Summary of Proceedings, Report FHWA-RD-00-034.* Washington, D.C.

Florida Department of Transportation. (Accessed July 2015). *Rest Area Information.* http://www.dot.state.fl.us/statemaintenanceoffice/Rest_Area_App/restareainfo.shtm.

Florida Department of Transportation. (Accessed September 2015). *Florida Statewide ITS Architecture.* Retrieved from http://www.consystec.com/florida/state/web/files/mpimages/ATMS17-1_DS.htm.

Florida Department of Transportation. (referenced May 2015). *SunGuide Software.* http://www.dot.state.fl.us/trafficoperations/ITS/Projects_Arch/SunGuide.shtm.

Florida Department of Transportation, District 2. (February 2015). *Truck Parking Information System (TPIS).*

Florida Department of Transportation, Regional Transportation Management Centers website. (referenced August 2016). *Retrieved from: http://www.dot.state.fl.us/trafficoperations/ITS/Projects_Deploy/RTMC.shtm.*

HNTB Corp. (2012). *I-94 Truck Parking Information and Management System: Concept of Operations Document.* Michigan Department of Transportation.

Iteris, ITS National Architecture 7.0.website. (n.d.). *Retrieved from http://www.iteris.com/itsarch/index.htm.*

Iteris, ITS National Architecture 7.0.website. (Accessed July 2015). *Retrieved from http://www.iteris.com/itsarch/index.htm.*

Morris, B. (2015, January 20). Too Many Trucks, Too Little Parking. *Wall Street Journal*, pp. http://www.wsj.com/articles/truck-drivers-face-shortage-of-legal-safe-places-to-park-1421799404.

Trombley, J. (2003). *Dealing with Truck Parking Demands, NCHRP Synthesis 317.* Washington, D.C.: Transportation Research Board.

USDOT FHWA. (May 2012). *Manual on Uniform Traffic Control Devices.* Washington, D.C.: http://mutcd.fhwa.dot.gov/pdfs/2009r1r2/mutcd2009r1r2edition.pdf.

USDOT, Federal Motor Carrier Safety Administration. (Accessed August 2015). *Summary of Hours of Service Regulations.* http://www.fmcsa.dot.gov/regulations/hours-of-service.

3.0. Current System Situation

This section of the report describes the problem that is being resolved by the introduction of the TPAS and answers basic questions about motivations for developing the system.

3.1. Current System Background, Objective and Scope

3.1.1 FDOT's RTMCs

Throughout the past decade, the FDOT's ITS program has grown into a mature deployment and a recognized national model. The FDOT operates RTMCs that perform freeway management services on all the Interstate corridors where the TPAS would be in operation. The RTMCs use the SunGuide® software for ITS data gathering and analysis, alerts, dispatching and verification of situations that arise on the roadways (Florida Department of Transportation, referenced May 2015). In addition to ITS activities, each RTMC coordinates with Florida Highway Patrol (FHP) and the Emergency Operations Centers (EOC) in its region of coverage. RTMC staff is responsible for using the facility to monitor the highways, offer motorist advisories, and dispatch aid. Location information (Figure 2) and descriptive information about each RTMC is shown on the FDOT website for RTMCs (Florida Department of Transportation, Regional Transportation Management Centers website, referenced August 2016).

Figure 2 shows that RTMCs are strategically distributed across the State of Florida Interstate system. This would suggest a distributed operation mapping according to the geographical proximity of the nearest rest areas with truck parking to respective TMCs. Alternatively, a centralized, overarching and/or redundant system could be configured for safety and security reasons. That remains for a later stage of the development process.

FDOT's RTMCs using the SunGuide software have amply demonstrated the capability of extending operations to include new software. This will require a SunGuide software modification to include a truck parking module to operate TPAS.

Figure 2: Florida Regional TMCs.

Source: (Florida Department of Transportation, Regional Transportation Management Centers website, referenced August 2016).

3.1.2 Trucking Industry Parking Needs and Issues

Florida's Interstates are an essential economic link to the rest of the United States and for internal Florida trade. The corridors facilitate the safe and efficient movement of goods and enhance economic vitality. As they travel the nation's highways, drivers of commercial motor vehicles are faced with a number of operational and regulatory challenges including hours-of-service limitations, limited availability of parking

at public and privately operated rest facilities, pressure resulting from just-in-time delivery schedules, and severe congestion in many urban areas and/or major truck corridors. These issues also impact the general motoring public, agencies that maintain and operate the transportation infrastructure, and private business, in terms of the safety, operational and economic implications they pose. FDOT and its partners are seeking innovative ways to achieve this strategic objective through the use of advanced technologies.

There is an extensive body of research on truck parking utilization and safety. In a study conducted in 2002, the Federal Motor Carrier Safety Administration (FMCSA) determined that fatigue is a primary factor in 4.5 percent of truck-related fatal crashes and is a secondary factor in 10.5 percent of such cases (see (Trombley, 2003) for a review). Congress, on more than one occasion, has directed the National Transportation Safety Board (NTSB) and USDOT to review the causes of accidents involving trucks and the adequacy of the nation's parking supply for commercial vehicles. One resulting study, carried out by the FHWA (Federal Highway Administration, 1999), documents a common complaint of truck drivers – the difficulty of obtaining information on truck parking availability. Also as part of this study, operators of privately owned truck stops indicated that they often have spaces available. The study recommended "ITS deployments to provide commercial motor vehicle drivers with real-time information on the location and availability of parking spaces."

3.2. Current Operational Constraints

Since the TPAS is conceived as a new ITS system within Florida, the current ITS situation with respect to truck parking is not treated here. However, coordination between public and private agencies is a foreseeable operational constraint that will need to be addressed when private parking information is integrated in the system.

Within the current operations of the Florida Interstate System, a study by Florida International University (FIU) showed there is need for additional truck parking (Bayraktar, Zhu, & Arif, 2012). Simply assigning more land for parking is not feasible in many cases and not cost effective when ample public and private parking supply goes unused. The TPAS aims to provide a means for the marketplace of truck parking demand and supply to operate with perfect or nearly perfect information and significantly better efficiency.

Any TPAS for Interstate facilities needs to operate at all hours since drivers may take rest at unpredictable times, due to federal Hours of Service (HOS) Regulations for drivers of interstate commercial vehicles carrying property (USDOT, Federal Motor Carrier Safety Administration, Accessed August 2015). Among other rules the HOS Regulations prescribe:

- Mandatory rest breaks of 30 minutes after eight hours
- Maximum daily driving of 11 hours after 10 hours off duty
- No driving beyond the 14th consecutive hour after a 10 hour rest period.

SunGuide software would have to be reliable 24/7 for drivers seeking parking when operators are not on shift or attending to other duties. TPAS needs to be automated and to adequately make parking availability known before a driver reaches the facility. Any RTMCs that do not operate 24/7 would need to be backed up by another RTMC. Private parking coordination should be seamless between public and private parking facilities.

3.3. Description of the Current Situation

3.3.1 Public Rest Areas

FDOT contracted with FIU to study the truck parking on Interstate corridors in Florida. This work, *Commercial Motor Vehicle Parking Trends at Rest Areas and Weigh Stations* (Bayraktar, Zhu, & Arif, 2012) examined the utilization of available truck parking spaces on: I-10, I-95, and I-75 (not including I-4). An inventory of public truck parking at weigh-in-motion (WIM) stations and rest areas is offered in that study. A modified table of public facilities is presented in Appendix A that includes truck parking spaces from that study and, in addition, the four rest areas and two weigh stations on the I-4 segment which was not included in that study. The report findings showed that many of the facilities studied were over 100 percent utilized with trucks regularly parking on shoulders of ramps and roadways illegally for lack of adequate spaces. A select few facilities were underutilized, presumably due to their proximity to pick-up origins and delivery destinations near larger cities, making parking on the Interstates unnecessary. Weigh stations, though providing overnight parking, were underutilized, ostensibly due to driver concerns of inspectors giving their loads extra attention.

Figure 3 shows a FDOT web-based interactive map of public facilities: 53 Rest Areas, 8 Turnpike Service plazas, 19 Truck Comfort Stations (WIM) and 4 Welcome Centers (Florida Department of Transportation, Accessed July 2015). The interactive features show location information, restrooms and nighttime security availability and contact information, but parking capacity or availability is not offered.

According to the FIU study, the total number of truck parking spaces for I-10, I-75 and I-95 (excluding I-4) is 1702 (Appendix A). Including the 130 truck spaces on I-4, there are 1832 spaces on the four corridors.

Figure 3: Map of Florida's Public Rest Areas.

Source: (Florida Department of Transportation, Accessed July 2015).

3.3.2 Private Truck Stops

Finding truck parking by web search lacks statewide or corridor-wide organization. Of Florida's private truck parking sites that are identified through various publicly available websites, some show parking capacity, though none show current availability. Most truck stop listings are oriented toward gas station locations and only occasionally show truck parking. See examples (as of August 2016):

- http://www.findfuelstops.com/truck-stop-in-FL (select site and drill down on Amenities for parking)
- http://m.roadnow.com/i4/Truck-Stops-Along-I-4-Florida-0.html
- http://www.truckstopsandservices.com/listcatbusinesses.php?id=23&state=9 (WalMarts with truck parking in Florida).

Utilization levels of private facilities are not presently coordinated between sources, with truckers or with the RTMCs. There appear to be no publicly available sources of comprehensive truck parking information for Florida's Interstates. That it is not possible to easily find parking via the web illustrates the need for the TPAS being prescribed in this ConOps for Florida Interstate corridors.

One of the more complete websites is Truck Smart Parking Services (TSPS) (http://www.onlineparkingnetwork.net/map) that shows many truck stops in Florida, and in the U.S. In Florida, TSPS does indicate overnight parking, but not the number of spaces or current availability. TSPS is under contract with Michigan DOT on I-94 in a pilot project that informs the basis of this TPAS.

A variety of online truck stop guides were "scrubbed" to determine locations and Google Earth was used to count the number of parking spaces from each location along the four Interstate Corridors which yielded approximately 4500 private parking spaces.

3.4. Current User Profiles

Since the TPAS is a new system, there are no current users in the State of Florida. There is no statewide database for truck parking available on the web and none show current availability. There is one project nationally that shows public-private truck parking availability in which Michigan DOT in cooperation with TSPS operates a TPAS service over a stretch of I-94 offering real-time parking information (http://www.onlineparkingnetwork.net/map). A pilot study of rest area parking was made by FDOT District 2 at a rest area on I-95 near St. Augustine.

3.5. Support Environment

There are power supply lines and fiber optic communication infrastructure along the proposed Interstate corridors which can support new ITS devices and connect to the RTMCs. The statewide SunGuide software can provide a platform for the RTMC operators to check the status and post any DTPS messages, as well as monitor supporting field hardware using the necessary software module integration.

SunGuide software currently posts information to the My Florida 511 website and telephony system. SunGuide software also shares Florida data with private information service providers such as WAZE and with data archival systems such as the Regional Integrated Traffic Information System (RITIS) (CATT Lab, Accessed 2015).

Private sector organizations such as Drivewyze and PrePass provide information to trucking companies and truck operators primarily related to weigh stations. Drivewyze is a member of the TSPS initiative in Michigan and is providing truck parking availability to trucking companies and drivers. TSPS provides data to their website, mobile apps, and makes available a third party data stream. Drivewyze receives the parking availability feed from TSPS and has integrated it into their apps.

4.0. Justification and Nature of the Changes

This section discusses the needs of the current system that motivate the development of TPAS and the nature of the desired changes.

4.1. Justification for the Changes

Everyone benefits from fewer crashes caused by fatigued driving, adequate and appropriate rest area space for commercial vehicles, and reliable movement of goods. Making the available parking known beforehand will save drivers time and fuel when seeking parking where it isn't available. To keep roads safer federal regulations forbid drivers to work more than prescribed hours. The additional stress and fatigue of searching for parking when required by law to be resting would be reduced.

Overcrowding at facilities often causes drivers to park their trucks on the entrance/exit ramps of rest areas or truck stop exits and the shoulders of adjacent roadways which leads to the degradation of the pavement in that area. Pavement on the shoulders and ramps was not designed to support parked vehicles for extended periods of time, especially at the loading requirements of commercial vehicles. The damage to the pavement leads to the need for expensive repairs over time.

In urban areas, truck drivers utilizing the TPAS would spend less time driving in urban settings looking for parking. Less time spent on urban streets decreases wear and tear on those roads. Reduced truck volume on urban streets also benefits motorists by decreasing congestion. Drivers are vulnerable to crime in urban settings where they are parked alone in vacant unpatrolled areas (Morris, 2015).

Drivers are also reluctant to use weigh stations in Florida for nighttime parking and better utilization could alleviate parking capacity problems at some rest areas. TPAS signs at weigh stations might attract more use by indicating availability.

The costly solution of providing new parking is unwarranted when much private parking goes unused at nearby facilities. Making better use of extant parking, public and private, is possible given the availability of:

- SunGuide software at RTMCs
- Fiber optic communications on the Interstates
- Remote electronic monitoring of parking
- Ascertaining corridor-wide truck parking availability
- DTPSs and cellular communications to convey parking status to drivers
- ITS WAN microwave network.

4.2. Description of the Desired Changes

The TPAS Project will not add or replace existing truck parking facilities. Instead, it will deploy a package of ITS technology applications at existing facilities to more closely optimize truck parking facility utilization and performance and, when feasible, eliminate overcrowding by spreading trucks across many other available facilities. This ConOps recommends deploying the FDOT TPAS on the public truck parking

facilities along the Interstates (Stage 1) and later deploy a version of TPAS on private truck parking stops in the Interstate corridors (Stage 2).
In overview the system will:

1. Instrument the rest area and weigh station truck parking lots to measure and transmit space occupancy to the RTMC
2. Modify SunGuide to calculate truck parking space availability and transmit to FL511 and DTPSs, etc.
3. Install CCTV for RTMC verification of occupancy counts
4. Install DTPSs to inform drivers of parking availability.

There will be no changes in operational staff, since the system will be automated. An RTMC operator will verify by CCTV the occupancy of the rest areas and weigh stations and recalibrate the readings as necessary in SunGuide. Calibration will be checked at the start of each shift and as estimated to be needed according to the need for recalibration at the start of the shift.

Maintenance will be done by contracted O&M staff as needed.

There are no additional changes expected to operational policies, procedures, or methods.

4.3 Change Priorities

Stage I will be done with phased-in contracts of the public rest stop system which will be defined in several distinct Request for Proposals (RFPs). Stage II will extend the public rest stops to private truck stops.

The implementation of media notification may be prioritized from a field that includes: DTPSs, websites, smartphone apps, 511 services, dissemination to third parties, reservation systems, and radio broadcasts. Any and all of these media may be used ensure that truckers easily receive correct information about available truck parking.

4.4. Changes Considered but Not Included

In Stage I, it is not yet determined what the final form the system will take with respect to operations and maintenance (O&M) when the private side is added in Stage II.

SunGuide software has a CV module that can be modified to disseminate truck parking information, but may be developed in a later phase of TPAS development. Also, CV Basic Safety Message (BSM) data that sends accurate location and time ten times per second could one day be used for wireless and detector-less parking space occupancy, but at this time CV BSM data is in limited use and so is not being considered further.

4.5. Assumptions and Constraints

4.5.1. Assumptions

Several assumptions/requirements appear to be important to determining the final form of the TPAS:

- Data will automatically be kept accurate by SunGuide software

- RTMC operators will visually check the accuracy of the TPAS counts at each Regional rest area and weigh station and recalibrate as necessary
- SunGuide software will run the automated TPAS 24/7/365 with minimal operator involvement
- In RTMCs that do not operate 24/7 TPAS oversight will be shared with another RTMC during its off hours
- SunGuide will collect consistent data among RTMCs for performance measurement
- A SunGuide software patch(es) will be developed.

4.5.2 Constraints

Constraints on developing the TPAS include:

- Geometric constraints with CCTV coverage of detecting parking spaces at facilities (e.g., from trees, etc.).
- Manual checks by RTMC operators and recalibration will be a factor in maintaining correct occupancy.

5.0. Concepts for the Proposed System

This section describes the proposed system that results from the desired changes previously specified. The level of detail presented intends to explain how the proposed system is envisioned to fulfill user needs and requirements.

5.1. Conceptual Background, Objectives and Scope

5.1.1 Conceptual Background

The TPAS concept of operations proposed in this report builds off the experiences and insights of two recent projects in FDOT District 2 and in Michigan.

5.1.1.1 FDOT District 2 Parking Lot Availability Study

FDOT District 2 undertook a pilot study in 2014 to ascertain the viability of electronically monitoring and reporting truck parking at a rest area on I-95 northbound near Exit 329 at CR 210, north of St. Augustine. A white paper was written reporting this Truck Parking Information System (TPIS) procedure and findings that presents additional details (Florida Department of Transportation, District 2, February 2015). The D2 pilot did not include a private-sector component. Traffic counts into and out of the truck parking lots were monitored electronically with Microwave Vehicle Detection Systems (MVDSs) and the difference between entries, exits and total truck parking spaces (available spaces) was reported to a dedicated DTPS upstream before the exit. An operator at the RTMC monitored the CCTV feed for calibration with the MVDS counting system. The counting system was not integrated into the SunGuide software but ran as a stand-alone system alongside the SunGuide software. At the exit three privately-owned truck stops were available for overflow parking at the I-95 rest area.

Findings of the study:

- Overflow truck parking at the rest area decreased.
- Secondary verification by CCTV or Road Ranger checks of the available spaces is essential.
- Integration of the available space counting program with SunGuide software is important to reduce RTMC operator fatigue, which in the study was a separate, stand-alone effort.
- Integrating public and private truck parking would allow better use of all the corridor parking spaces.
- Scalability and security of the computer system needed should be investigated.
- Additional personnel may be needed to ensure efficient operation and maintenance.
- FDOT resources should check intellectual property conflicts where private patents may be held.

The next steps recommended included:

- Integration of parking information software with robust calibration properties into SunGuide software
- Integration of parking information into SunGuide software in order to disseminate it over any of several media sources, such as DTPSs, the My Florida 511 website, and private phone apps and websites.
- Consideration of statewide deployment - ITS expansion in the District would enable deployment in 23 private and 16 public truck parking areas in the next few years.

5.1.1.2. Michigan I-94 Truck Parking Information and Management System

The Michigan I-94 Truck Parking Information and Management System (TPIMS) (HNTB Corp., 2012) is a conceptually similar truck parking system to the TPAS as envisioned in both Stages I and II. The TPIMS was recently developed and instituted on I-94, a heavily traveled truck corridor in Michigan. This discussion focuses on the public parking side of the Michigan project which has demonstrated that a public TPAS is practicable.

The truck parking availability information on I-94 is captured using sensors at rest areas and private truck parking facilities. Truck parking availability data from the rest areas is transmitted to the ATMS Server. The Michigan TPIMS network includes five public rest areas deployed and operated by MDOT. MDOT operates roadside signs, a connected vehicle application, and the Mi Drive website (www.michigan.gov/drive).

5.1.2 Goals and Objectives, Strategy and Tactics

The TPAS goals and objectives are delineated in Table 1.

The objective of the TPAS is not to solve a parking supply problem, but to distribute drivers to where parking is available. A TPAS does not address truck parking supply directly, but indirectly by distributing demand to available supply.

Studies have shown that private lots often are underutilized (Federal Highway Administration, 1999). On the public side with TPAS (Stage I) drivers need not drive through full lots needlessly nor cut their HOS short because of lack of knowledge of downstream rest area parking on their trip.

Table 1: Florida Interstate Corridor TPAS Goals and Objectives

Goals	Objectives
1. Provide a safe transportation system	• Allow for on-time rest as required by law • Ensure access to safe rest areas and reduce use of unprotected vacant lots • Reduce time required for truck drivers to find spaces • Reduce searching for parking in urban areas • Reduce truck VMT when drivers are fatigued • Reduce fatigue of truck drivers • Reduce delay from incidents caused by driver fatigue
2. Ensure the mobility of people and goods	• Improve efficiency of freight transport by truck • Improve intra- and inter-state goods movement • Reduce delay and improve statewide travel for all modes • Reduce unnecessary truck VMT • Improve motorist access through the use of traveler information systems
3. Enhance economic prosperity	• Improve the predictability of travel and delivery times • Support JIT delivery, efficiency measures • Reduce wear on ramp and roadway shoulders • Better use of financial resources by not building parking infrastructure but by using available parking • Improve use and effectiveness of private parking facilities • Reduce motorists' delay and energy use by reducing crashes from fatigue
4. Preserve the quality of our environment and communities	• Reduce truck VMT as searching for parking uses fuel and causes emissions • Reduce energy use and air quality degradation by reducing crashes from fatigue and ensuing delays

Briefly, strategy involves *what* will be done and tactics involve *how* to get it done. For this project the two are defined below:

Strategy:

1. Distribute trucks to available parking at public and (in a later Stage) at private lots.

Tactic:

1. Instrument rest area truck parking lots to measure and transmit space occupancy to RTMC
2. Modify SunGuide to calculate availability and transmit to FL511 and DTPSs, etc.
3. Install CCTV for RTMC verification and calibration of occupancy counts.

5.2. Operational Policies and Constraints

For the TPAS to be useful to truck drivers to take rest at any time of day, it must be in operation 24/7/365. The TPAS will be an automated electronic system that displays the number of parking spaces available without operator involvement. Wireless ground sensors (i.e., pucks) would make it possible to identify parking space occupancy and identify the spaces in the SunGuide software on a Florida 511 TPAS website or app graphic. The TPAS operation in the RTMC is not expected to substantially increase the workload of an operator and shift supervisor. It is expected that minimal operator time will be needed to switch SunGuide software focus to TPAS operations in response to alerts or to check that the SunGuide software is properly reporting available spaces in the parking facilities. RTMC Standard Operating Procedures (SOPs) and training materials will need to be developed and used in order to provide necessary TPAS training and supervision of the RTMC operations staff. This shall include the operators and support staff. The SOP and training materials will describe operator access and response to TPAS checks.

TPAS will require coordination between the RTMC and the private-sector operator data provider's application. There will be regular meetings, performance monitoring and sharing and verification inspections of performance measurement accuracy. The private parking information provider will perform to clearly specified standards of accuracy to be defined in a later stage of development.

5.3. Description of the Proposed System

The TPAS project concept involves three primary components:

1. The collection of truck parking availability data at public rest areas
2. Data aggregation and processing
3. The creation and dissemination of truck parking availability information.

In this ConOps the primary focus is on the public rest areas and weigh-stations and the secondary focus is on the private truck stops which will follow in Stage II. With respect to Stage I, there are a number of ways in which the public-private combinations of the TPAS can be implemented:

- Traditional public deployment with standard O&M: FDOT designs and owns the infrastructure, with operations handled by RTMCs and maintenance through standard means.
- Traditional public deployment with private O&M: FDOT designs and owns the infrastructure, with operations and maintenance wholly or partially contracted to a third party (e.g., MDOT configuration above).
- Private turn-key deployment with O&M: A vendor is hired to design, build, operate, and maintain the system. FDOT would receive a truck parking availability data feed, with maintenance obligations and outage requirements specified in a multi-year contract. A private vendor would own the entire infrastructure.

The decision to privatize some or all of the system requires consideration of budget, capacity of the current operations staff, and current priorities of the Department. All approaches would support performance metrics and management, provide data to truckers to improve safety, economy and the environment, and provide data to FDOT for infrastructure/asset management.

An advantage of operating a fully public system would be to maintain control over information within the system (i.e., data integrity) and to maintain transparency of costs. However, including private truck stop locations may be an issue in a fully FDOT-owned and operated system.

Advantages associated with using a partially or wholly privatized system, which could conceivably be a network of private operators, include a potentially easier method to involve private truck stop locations and future integration of data into a larger regional/national network across state lines. A private system could also potentially create a business model to shift O&M costs to the private sector. A private system allows FDOT to stay closer to DOT core services, engaging private sector expertise in a specialized area. Privatizing O&M puts the operation into the hands of people that are organized to manage parking.

Disadvantages of a fully private system are the reverse of the advantages of a public system. A disadvantage of operating a fully private system would be inability of FDOT to maintain control over information within the system (i.e., data integrity) and to maintain transparency of costs. Also, if private operators were to have difficulty during an economic downturn, the entire TPAS could fail, instead of only the private side. This would also apply to a system of private operators, though some operator(s) might be more robust and pick up the failed part of the network.

Initially, FDOT plans to operate the system through SunGuide software and RTMC's. In the second stage of adding private facilities, the Department will determine the most cost-effective combination of public-private interdependence.

5.3.1 SunGuide Software

The FDOT SunGuide software will be enhanced to interface with the TPAS and to disseminate truck parking information. Many of the required functions are already part of the SunGuide software. For example, SunGuide software has mechanisms for collecting count data from sensors. Functions to receive and aggregate the parking space counts would be added. Design-level actions, however, are appropriate in a later stage in development. Further discussion of SunGuide software requirements is in Section 5.4, Modes of Operation.

5.3.2 Signage and CV App

FDOT will be responsible for disseminating truck parking information from its public areas. This will be done by means of DTPSs. It is likely that in a future project new CV applications for en route information will be employed as well.

The DTPS application will be similar to current overhead DMS functions within the RTMCs. Fixed message signs to check Florida 511 for truck parking availability will be located less than ten (10) miles upstream on the Interstate roadways to allow drivers time to assimilate the information. The MUTCD requires DMS signs to be at least 800 feet from any static signs. The DTPS upstream of the rest area will have a static component and a dynamic component which will show the count of vehicle spaces available for use, at the present moment, at the next rest area. The project will not use overhead DMSs. The project will use only DTPSs that consist of static ground mounts with three brick embedded DMSs.

At the Florida DOT test site in District 2 (Florida Department of Transportation, District 2, February 2015) one important lesson learned was:

> *In order to avoid potential calibration errors, the lower limit for the truck parking availability was established. In this case, it was set to a minimum of five when the truck parking sign will start showing "00" spots available at the rest area. It is recommended to consider displaying "LOW" instead of "00" for reliability and to avoid situations with the truck drivers noticing parking spots available even though the sign displayed "00". This may create a situation with truck drivers not trusting the information on the sign or park on ramp shoulders without checking the parking lot to find a spot.* (Florida Department of Transportation, District 2, February 2015)

When the calculated number of spaces is less than five (5), the sign should read "LOW." Otherwise the calculated number should be shown.

The CV SunGuide software application will require enhancement for CV message formats and protocols for DSRC communications.

5.3.3 FDOT Website, Florida 511

SunGuide software will also update the FDOT website, My Florida 511. The FDOT website will provide information for route and rest stop planning in a dedicated section for trucks. Florida 511 will also make data available to other ISPs.

5.3.4 Smartphone App

The Florida 511 TPAS data will be accessible to smartphone application developers. Application development will be addressed in a future phase.

Most truck drivers now carry mobile devices, such as smart phones. As this technology becomes even more pervasive, it is expected that truck drivers will take advantage of applications that help them with their work. However, most trucking companies have strict rules against hand-held cell phone use while driving. The envisioned mobile application will use text-to-speech and speech-to-text capabilities to minimize driver distraction. Visual use will be available when the truck is stopped, as Florida 511 will be with this roll out. Mobile data service from multiple providers (e.g., Verizon, AT&T, Sprint) is good throughout the Interstate corridors. Full 4G coverage is expected from all suppliers.

5.3.5 ITS Field Equipment and Support Structures

Field equipment (e.g., puck detectors, CCTV) will electronically and accurately identify occupied from unoccupied truck parking spaces and be mechanically supported safely and effectively. Identification and placement of electronics and support structures will be determined in a later design phase of the project. Included are also support structures that may be needed for the ITS equipment, such as poles and gantries. Discussion of CCTV camera requirements is expanded in Section 5.4 Modes of Operation.

5.3.6 Communications Medium

The medium(s) of data transmission (e.g., fiber optic cable, cellular, microwave to ITS Wide Area Network (WAN)) will be determined in a later stage. Use depends on availability and cost. Cellular is limited by bandwidth considerations and monthly service charges. Insufficient bandwidth may limit the amount of full motion available with CCTV coverage. An analysis in a later design phase will determine the most cost-

effective, reliable and appropriate transmission for the equipment to be used. Transmission with existing equipment near the location will be surveyed to help in this determination.

5.3.7 Electrical Power Supply

There are existing power sources along the Interstate corridors and will be identified for use with the ITS field equipment. Power to existing field equipment will be surveyed to help in this determination.

5.4. Modes of Operation

The statewide TPAS system will be treated as a number of subsystems that function independently and automatically with oversight and recalibration of the TPAS public phase provided by local RTMC operators.

FDOT SunGuide software operates 24/7/365 and will operate the TPAS 24/7/365. Where an RTMC is not a 24/7 operation, coverage will be done by arrangement with another RTMC. A local RTMC Operator will be assigned the monitoring and operational oversight of the TPAS along with other duties. It is expected that this will be a part-time assignment for a person from each RTMC. The RTMC operator will periodically visually check, via the CCTV feeds, the actual number of parking spaces available against the number being reported by the TPAS software. In the District 2 pilot study operators checked accuracy every four hours during the day and more frequently in the evening. The operators would then adjust the truck parking space availability on the roadway sign. The checking process should correspond to the error frequency observed during operations. In Michigan the rest areas have Sensys Networks wireless "puck" sensors at the parking lot entrance and exit. RTMC operators check the camera feeds and reset the availability once per day, though some of the lots could go a few days before needing to be reset, depending on accuracy tolerances. MVDS would operate similarly. The exorbitant cost of providing precision-level accuracy of the truck count feeds is offset by routine observation of the lots by an operator, which also benefits maintenance and security.

In this initial Stage I of public-side development details of how the private side will operate and how much staff will be needed is an open question. It will be necessary for the private-side operator to develop a Stage II ConOps and/or define its operation sufficiently in its proposal. When the private-side is in development, the extent of RTMC oversight will be reevaluated to include additional time for any additional recalibration that may be required if the RTMC is to have some oversight of the private operation.

The SunGuide TPAS software shall include at a minimum:

- TPAS Graphical User Interface (GUI)
- Operator choice of parking facility
- Count of occupied spaces for facilities with space detection
- Count data input feeds of vehicles entering and leaving a parking facility for facilities with entrance/exit detection
- Calculation of available parking at each parking facility
- Capability to calculate TPAS performance measures (e.g., mean, mode, periods of full occupancy)
- Transmission of available spaces to communications media
- Output of available parking to the TPAS GUI

- Capability of operator to manually change the number of spaces available (recalibration)
- CCTV input feed
- Access to CCTV images of lot parking from SunGuide software CCTV GUI
- Access to pan, tilt, zoom CCTV camera control from SunGuide software CCTV GUI.

Another requirement is that the CCTV coverage allow for an operator to count the number of parking spaces available. This may require more than one camera due to obstructions from truck positioning blocking complete viewing. CCTV coverage is to be unobstructed, with placement anticipating the approximate obstructions extant foliage will present in the future. The number of cameras needed will be determined in the next stage of development. The need for cameras to have pan-tilt-zoom (PTZ) capability may vary with the siting and installation opportunities which should be minimized while allowing complete coverage.

5.5. User Involvement and Interaction

This section delineates the way users and stakeholders interact with the system:

1. FDOT District Offices
2. RTMCs
3. Truckers and Truck Fleet Managers
4. Law Enforcement and Public Safety Agencies
5. RTMC Maintenance Support Services.

5.5.1. FDOT District Offices

FDOT District Offices play an important role in planning, design, and implementation of new ITS operations to determine design and performance standards. FDOT is the initiator of the TPAS and will ultimately determine the form it takes as a public-private enterprise. Initially, FDOT plans to develop the TPAS to cover the Interstate public rest areas. Once the parameters of the Interstate public rest areas are executed, FDOT will pursue the potential expansion to the private truck rest areas. The changeover to public-private operations will then determine the private side's role and responsibilities. The decision as to a hierarchical or distributed TPAS lies with FDOT in subsequent stages of project development. Other responsibilities of the FDOT and RTMCs have been amply discussed in this ConOps narrative. Inclusion of revised truck flows in Integrated Corridor Management (ICM) plans may be helpful in this determination.

5.5.2. Regional Transportation Management Center

The RTMC monitors roadway conditions, provides information to motorists and support to field personnel responding to roadway incidents, and actively manages traffic flow. Following are the roles and responsibilities of the RTMCs as it relates to TPAS:

- Conduct operations in accordance with the RTMC mission statement to include TPAS along with its other responsibilities, including, but not limited to, Traffic Incident Management (TIM), Emergency Management and Operations (EMO), and Traveler Information Services
- Provide available truck parking traveler information on DTPSs and other communications media, such as the FDOT website, My Florida 511 and future third party ISPs
- Coordinate with other RTMCs with respect to TPAS sign accuracy and verification of available parking spaces as needed.

5.5.3. Truckers and Truck Fleet Managers

Truckers and their fleet operators will be the primary beneficiaries of the proposed TPAS. With the TPAS truck drivers and fleet managers will make travel decisions that improve driver safety and compliance with the law. Truck drivers play an important role in providing feedback about their trips and about the TPAS traveler advisory system and thereby contributing to upgrades and improvements of a system that is user friendly and provides clear direction.

5.5.4. Law Enforcement and Public Safety Agencies

The FHP polices the Interstate roadways in Florida. FHP enforces laws with respect to truck driver rest and may request to inspect a driver's log book of hours at any time. FHP can cite drivers who use rest areas improperly by parking on ramps and in areas not marked for parking. FHP feedback with respect to driver compliance and use of the TPAS would be valuable to FDOT efforts to operate and improve the system. FHP may also include TPAS into their decision support system to coordinate with federal, state and local agencies and participate in stakeholder meetings to discuss and verify their roles and responsibilities.

5.5.5. RTMC Maintenance Support Services

FDOT will require Routine Preventative Maintenance (RPM), Responsive Maintenance, and diagnostic and replacement services by qualified contractors. These contractors will provide services for TPAS communication infrastructure and field devices, RTMC network, communication network, and operator work station hardware and software. This will be done under the RTMC system contract.

The RTMC RPM provider will work with the private parking data service provider's RPM to create a seamless environment for information to reach the target trucking community.

5.6. Support Environment

FDOT has in place viable contract methods authorized by Florida law. There are local design-build contractors within the state who can offer FDOT a unique, standard-based, flexible, and cost effective solution that will seamlessly integrate the public rest area TPAS into the RTMCs.

Upon completion and final acceptance, all field devices and physical field infrastructure built on the FDOT right of way becomes the property of the Department. The Department will get extended warranties for all project components to three (3) years for critical components from the contractor. All equipment, hardware, software, and miscellaneous items will be warranted for a two (2) year period from system acceptance, and critical components will be warranted for an extended three (3) year period. The contractor's local presence will provide the District with fast reliable service during and after the warranty periods.

The fully built out TPAS (Stage I and II) is envisioned as a Public-Private Partnership (PPP), so an agreement (e.g., Memorandum of Understanding (MOU)) will define FDOT's and the private operator's duties, responsibilities, liabilities, and so forth. If only the Stage I system is deployed on the public facilities, then an MOU is not needed.

6.0. Operational Scenarios

These primary operational scenarios are anticipated:

1. Truck Drivers
2. RTMC Operators
3. FHP Troopers.

The scenarios presented below portray respective perspectives toward the TPAS.

6.1. Scenario 1 – Truck Drivers

Entering Florida on I-95, the driver sees a sign for Florida 511 and accesses his smartphone for Florida 511, Drivewyze, or PrePass. Upstream of a rest area, he sees a DTPS that gives him current readings. He has an hour-and-a-half left to drive and so keeps an eye on availability as he proceeds. He notices the availability drops to LOW in the next hour, so he decides to play it safe and stop at the rest area which has two spaces remaining.

6.2. Scenario 2 – RTMC Operators

The RTMC operator starts the shift and runs through the SOP which includes making a visual check of the cameras at the three lots in the District. She looks over the monitor displays and counts the number of rigs against what the TPAS shows. If she makes an adjustment, she notes it in the log. If there is a discrepancy, she checks it again in four hours. Otherwise, the TPAS runs itself. She requisitions field maintenance technicians as needed.

The RTMC manager occasionally talks to truck fleet managers, FHP and staff from other RTMCs about their experiences.

6.3. Scenario 3 – FHP Trooper

The FHP officer enters the truck parking lot to check parking along rest area ramps and roadway shoulders. He may ticket a driver on the ramp or not since the drivers are only doing what they are required to do to observe the HOS law and it is safer that they rest when needed. He notifies the RTMC when he sees a problem with the occupancy counts.

7.0 Summary of Impacts

The main impact of the system is that truck drivers will more easily meet their HOS requirements, spend less time searching for parking and reduce parking on freeway ramps and shoulders. Less time spent searching for parking results in improved safety, fuel savings, congestion reduction, smoother traffic flow and air quality improvements. The goals and objectives shown in Table 1 summarize the impacts.

Other than the costs and efforts involved in system software and hardware setup, the TPAS is designed to be an automated system with minor operations and maintenance costs. The TPAS is far less costly than building new parking and will better enable use of existing off-Interstate parking, making its cost impacts very low.