



I-10 Corridor Coalition Truck Parking Availability System

High-Level System Requirements
February 1, 2021



Introduction

This high-level system requirements list summarizes what the I-10 TPAS should do in order to satisfy user needs, which were developed and documented in the Concept of Operations (ConOps). The document includes an itemized list of user needs (**Table 1**), an itemized list of high-level system requirements (**Table 2**), and a traceability matrix to verify that user needs are being met by the system requirements (**Table 3**).

User Needs

A list of user needs, lettered A-P, is provided in **Table 1**. A list of users is provided along the top row, ranging from the FHWA to the end users. An "X" is provided in the table to indicate which user needs apply to each user.

Table 1: User Needs

I-10 Corridor Coalition TPAS User Needs													
User Need		I-10 Corridor Coalition	Individual States	FHWA	Truck Drivers	Fleet Dispatchers/Driver Managers	Traffic Management/ Operation Centers (TOC/TMC)	DOT Travel Information Providers	Contractors (O&M)	Third-Party Website/App Developers	State Highway Patrol/State Police	FMCSA	Industry Freight Organizations
A	Receive timely, reliable, and accurate parking availability information to efficiently locate parking.	X	X		X	X	X	X					X
B	Access consistent information about truck parking availability along the I-10 Corridor.		X		X	X	X	X		X	X	X	
C	Receive consistent information between states.		X		X	X				X			
D	Receive truck parking information through multiple dissemination methods (e.g. Dynamic Parking Availability Signs (DPAS), websites, smartphone applications, etc.).				X	X	X						X
E	Receive information on amenities including lighting, HAZMAT parking and oversize/overweight parking accommodations.				X	X		X					
F	More efficiently utilize existing truck parking to maximize usage of safe, formal truck parking.	X	X	X	X	X					X	X	X
G	Develop a cost-effective, sustainable solution with minimal operation/maintenance requirements.	X	X				X	X	X				
H	Receive information in a way that meets federal safety guidelines for commercial drivers.				X								X
I	Reduce fatigue-related truck crashes in deployed corridors.	X	X	X	X	X	X				X	X	X
J	Reduce unauthorized parking, especially on ramps.	X		X			X				X	X	
K	Protect parking user privacy and proprietary data.	X	X		X			X	X	X			
L	Account for unique parking situations (e.g. HAZMAT, oversize/overweight, drop loads, etc.)	X	X		X	X	X		X		X	X	
M	Maximize understanding and acceptance of the TPAS.	X	X	X	X	X		X					X
N	Comply with the Federal ATCMTD Grant by operating and maintaining a TPAS system for a minimum of 3 years.	X	X	X									
O	Comply with the Federal ATCMTD Grant by providing an operational TPAS system by Q3 2023.	X	X	X									
P	Collect data for performance measurement, operations analysis, and evaluation for future truck parking expansion.	X	X	X			X		X	X			X

High Level System Requirements

The high-level system requirements shown in **Table 2** are broken out into six categories, and each requirement is given an abbreviation and then assigned a number within its category. The abbreviations are listed as follows:

- DC – Data Collection
- SOFT – Software
- OPS – Operations
- MT – Maintenance
- INF – Information Dissemination
- GEN – General

Each state in the I-10 Corridor Coalition is deploying a system that best fits their standards and regulations. Therefore, some system requirements may apply to certain states and not to others. The columns to the right of the system requirements will indicate which states each requirement applies to with an “X”.

Table 2: System Requirements

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
DC-1	Traffic sensing equipment shall be deployed to reliably determine parking availability at public rest areas.	X	X	X	X
DC-2	Space occupancy will be used as the method for data collection.		X	X	
DC-3	Driveway counts without vehicle classification will be used as the method of data collection	X			X
DC-4	Driveway counts with vehicle classification will be used as the method of data collection	X			X
DC-5	The DOT TPAS shall collect data from detection system at public truck parking sites.	X	X	X	
DC-6	Third-party information management service provider shall collect data from detection system at public truck parking sites.				X
DC-7	The system shall protect user privacy by not collecting any Personally Identifiable Information (PII).	X	X	X	X
DC-8	The counting equipment shall be equipped with power service. This service may be either a solar panel installation, line power from a utility service or battery powered with at least a 7-year life, if approved by the state.	X	X	X	X
DC-9	The counting equipment shall be equipped with a communications backhaul that provides a network link to the state. This service may be a cellular connection to the state's network, if approved by the state.	X	X	X	X
SOFT-1	The state TPAS shall process the raw parking site data to calculate the parking availability at each site every 5 minutes.	X	X	X	
SOFT-2	Third-party information management service provider shall process the raw parking site data to calculate the parking availability at each site every 5 minutes.				X
SOFT-3	The state TPAS software shall determine the trend (emptying, steady or filling) for parking availability at each site.	X	X	X	X
SOFT-4	The state TPAS software shall update the truck parking database with current availability data that it calculates.	X	X	X	X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
SOFT-5	The state TPAS software shall have a graphical user interface (GUI) to allow operators to update the capacity, "Low" threshold, and current number of spaces available for a parking site.	X	X	X	X
SOFT-6	The TPAS software shall manage any metadata associated with each parking lot in the system (e.g. restrooms, other amenities).	X	X	X	X
SOFT-7	The state TPAS software shall have a GUI to allow operators to set the site to "Closed" or flag the site as providing erroneous data.	X	X	X	X
SOFT-8	Based on operator input the TPAS software shall broadcast non-numerical information for when a parking lot is closed to truck parking. "CLD" shall be used as a default value, but this shall be user-configurable for at least 3 characters.	X	X	X	X
SOFT-9	The state TPAS software shall include an application program interface to exchange truck parking information with the third-party information management service providers and other states at least every 5 minutes.	X	X	X	X
SOFT-10	The state TPAS software shall include an application program interface that can obtain truck parking availability data from adjacent states at least every 5 minutes for display on DPASs within the state.	X	X	X	X
SOFT-11	The state TPAS software shall update the truck parking database with current availability information provided by third-party information management service provider.				X
SOFT-12	The state TPAS software shall automatically post parking availability data to Dynamic Parking Availability Signs (DPAS).	X	X	X	X
SOFT-13	The state TPAS software shall make available the most current parking availability data and site metadata to the public data feed	X	X	X	X
SOFT-14	The TPAS software shall monitor equipment functionality and the GUI shall include alarms for TPAS communications or device failures.	X	X	X	X
SOFT-15	Parking availability data shall be processed, displayed, and updated at intervals of no more than every 5 minutes.	X	X	X	X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
SOFT-16	The TPAS software shall recognize data that is older than 15 minutes as "stale" data and automatically stop distributing that data. The "stale" data age shall be a user-configurable parameter. The software shall only broadcast "XX" as a default when data is deemed stale, but allow a user to modify the default text up to 3 characters. Users shall have the option to disable automatic actions. The "trustData" element in the data feed will also be set to "false".	X	X	X	X
SOFT-17	The TPAS software shall save real-time parking availability data when updated for each lot for historical performance monitoring purposes.	X	X	X	X
SOFT-18	The TPAS software shall collect and store all parking data, system operational actions, user actions (e.g. manually updating counts for calibration), detector status history, etc. for the purpose of generating reports for performance measurement, operations analysis, and evaluation for future expansion.	X	X	X	X
SOFT-19	The TPAS software shall have the ability to monitor and manage at least 500 parking lots with at least 500 parking spaces in each.	X	X	X	X
SOFT-20	The TPAS software shall allow users to add/remove parking lots, modify the number of parking spaces in a lot, and modify any metadata for a given lot.	X	X	X	X
SOFT-21	The TPAS software shall disseminate data in a format consistent with the latest version of the I-10 TPAS data feed.	X	X	X	X
SOFT-22	The TPAS software shall have the capability of interfacing with the state ATMS as part of a future effort, if operated separately.	X	X	X	X
SOFT-23	The TPAS software shall report device status/failures/errors to software users and report device status to any interfaced software, such as a future ATMS integration.	X	X	X	X
SOFT-24	The TPAS software shall allow users to manually turn on/off dissemination of data for a particular parking lot.	X	X	X	X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
SOFT-25	The TPAS software shall be capable of automatically turning on/off dissemination of each lot's parking information and setting the "trustData" data element to "false" if errors/failures are detected that may result in inaccurate counts. Users shall have the option to disable automatic actions.	X	X	X	X
SOFT-26	The TPAS software shall broadcast non-numerical information based on certain user-defined thresholds. This shall include a designated "LOW" availability threshold, where the TPAS software broadcasts "LOW" when the parking availability drops below that threshold. Thresholds shall be different for each parking lot. "LOW" shall be used as a default value, but allow a user to modify the default text up to 3 characters.	X	X	X	X
SOFT-27	The TPAS software shall allow a user to 1.) add new lots and detectors to the system, 2.) set up lot counting as space-by-space or entry/exit counting, 3.) modify a parking lot's capacity, and 4.) modify system lot capacity/availability for roadside DPAS display messaging and alerts.	X	X	X	X
SOFT-28	The TPAS software shall have a feature for permitted operator to easily calibrate the system by having a process that 1.) ask the operator how many trucks are currently parked or how many spaces are currently open, 2.) identifies if the TPAS counts are different and by how much, 3.) asks the operator if they wish to automatically adjust the TPAS counts to the observed availability, and 4.) upon confirmation from the operator, automatically update the TPAS count and document the manual reset.	X	X	X	X
OPS-1	Third-party information management service provider shall process the raw site data to calculate available parking.				X
OPS-2	Third-party information management service provider shall transmit the availability data to the state every 5 or fewer minutes.				X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
OPS-3	TPAS truck lots shall have a CCTV camera installed in the vicinity that can provide viewing coverage of the lot for visual calibration from the state TMC.	X	X	X	X
OPS-4	The detection and communication equipment at public sites will be operated by state staff.	X	X	X	X
OPS-5	The detection and communication equipment at public sites will be operated by the third-party information management service provider.				X
OPS-6	Accuracy rate of availability above 85% shall be maintained at each site with less than 15 spaces, and 90% at each site with 15 or more spaces. The TPAS counting method shall meet the required accuracy rate requirements with no more than 1 user-initiated calibration in a given 24-hour period.	X	X	X	X
OPS-7	The system shall comprehensively have an uptime percentage that meets or exceeds 99.95% for 24 hours a day, 365 days a year, excluding planned outages on minor disruptions that receive state approval.	X	X	X	X
OPS-8	A combination of detection technology and operational practices shall minimize propagation of errors	X	X	X	X
MT-1	The detection and communication equipment at public sites will be maintained by the state staff.	X	X	X	X
MT-2	The surveillance camera and related equipment at public sites shall be maintained by the state.	X	X	X	X
MT-3	The system shall provide remote monitoring, configuration, and diagnosis to accommodate maintenance	X	X	X	X
INF-1	The state shall meet partnership branding requirements.	X	X	X	X
INF-2	The state shall provide public data feeds available to third-parties and other states that provide parking availability data and parking site metadata per the I-10 TPAS Corridor Coalition data feed format.	X	X	X	X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
INF-3	The state shall provide truck parking availability data on the state traveler information website.	X	X	X	X
INF-4	The state traveler information website shall publish TPAS count data at lots designated as truck parking where TPAS is installed.	X	X	X	X
INF-5	The state traveler information website shall publish 1.) available parking stalls in the lot, as reported by TPAS, 2.) the total number of parking stalls in the lot.	X	X	X	X
INF-6	The state traveler information website shall publish a default message of "Parking Counts Unavailable" for the available parking stalls when the TPAS central software is not reporting data.	X	X	X	X
INF-7	The state shall provide en-route parking availability information to commercial vehicles within 5-10 minutes upstream of rest areas and truck stops using DPAS.	X	X	X	X
INF-8	The roadside DPAS shall utilize dynamic full-matrix panels that allow one row of at least three (3) characters with a minimum 18-inch nominal character height.	X	X	X	X
INF-9	The roadside DPAS shall be composed of static sign panels that utilize a blue "services" background and are consistent with state design standards.	X	X	X	X
INF-10	The roadside DPAS shall be equipped with a power service. This service may be either a solar panel installation or line power from a utility service, if approved by state.	X	X	X	X
INF-11	The roadside DPAS shall be equipped with a communications backhaul that provides a network link to the state. This service may be a cellular connection to the state's network, if approved by state.	X	X	X	X
INF-12	The dynamic matrix panels shall have the capability of displaying a default message in the absence of data from the truck parking management software or during a communications outage. The default message shall be set to "XX", but shall be user-configurable in the sign controller.	X	X	X	X

I-10 TPAS High-Level System Requirements					
Req. No.	Requirement	Texas	New Mexico	Arizona	California
INF-13	Parking availability information shall be disseminated to mobile devices via websites and apps developed by private third-parties	X	X	X	X
INF-14	Rest area closure information shall be disseminated by states using all communications channels included in I-10 TPAS.	X	X	X	X
GEN-1	The system shall be scalable and expandable.	X	X	X	X
GEN-2	The system shall use equipment that has hardware specifications that are suitable to meteorological conditions found in the region of installation.	X	X	X	X
GEN-3	The system shall comply with all state design standards and other relevant standards, including but not limited to AASHTO's Policy on Geometric Design of Highways and Streets, AASHTO's Roadside Design Guide, the Manual on Uniform Traffic Control Devices (MUTCD). Deviations from standards are only permissible with state approval.	X	X	X	X
GEN-4	The system shall utilize the English language for all features and functionalities, and utilize terminology that is understood in the Infrastructure Owner Operator (IOO) and freight industries.	X	X	X	X
GEN-5	The system shall satisfy user acceptance expectations that, at a minimum, demonstrates that transactions are timely, that all toggles or features have a defined and apparent purpose (e.g. no buttons that do not work), and that the system does not needlessly crash.	X	X	X	X
GEN-6	The components of the I-10 TPAS in a state shall comply with the state's standard ITS network security protocols and practices to ensure the proactive protection of digital information, the network, and system equipment.	X	X	X	X

GEN-7	The system—including software-operated hardware and central software controls—shall have varying levels of user permission groups, where users can be assigned to groups that align with their intended level of responsibility (e.g. system administrator, general operator, etc.).	X	X	X	X
GEN-8	The system shall have user accounts that have user-specific passwords.	X	X	X	X
GEN-9	The system shall satisfy all state acceptance testing procedures.	X	X	X	X
GEN-10	The system shall be easily operated and maintained after passing acceptance testing.	X	X	X	X
GEN-11	The system shall provide user documentation, which includes how-to guides for troubleshooting issues.	X	X	X	X

Traceability Matrix

The traceability matrix, shown in **Table 3**, was developed to verify that each user need is being met by at least one system requirement. “X”s in the columns to the left of the system requirements indicate which system requirement applies to each state, and is the same information shown in **Table 2**. “X”s in the columns to the right of the system requirement name indicate which user need each system requirement applies to. Every state has at least one system requirement that fulfills each user need.

Table 3: Traceability Matrix

I-10 TPAS Traceability Matrix																				
TX	NM	AZ	CA	Req. No.	User Needs															
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
X	X	X	X	DC-1	X					X	X		X	X					X	X
	X	X		DC-2															X	X
X			X	DC-3															X	X
X			X	DC-4															X	X
X	X	X		DC-5						X			X	X					X	X
			X	DC-6						X			X	X					X	X
X	X	X	X	DC-7											X					
X	X	X	X	DC-8							X									
X	X	X	X	DC-9							X									
X	X	X		SOFT-1	X					X			X	X			X		X	
			X	SOFT-2	X					X			X	X			X		X	X
X	X	X	X	SOFT-3						X			X	X						X
X	X	X	X	SOFT-4																X
X	X	X	X	SOFT-5		X	X													
X	X	X	X	SOFT-6					X											
X	X	X	X	SOFT-7	X		X						X	X					X	X
X	X	X	X	SOFT-8	X		X						X	X					X	
X	X	X	X	SOFT-9	X	X			X	X			X	X			X		X	
X	X	X	X	SOFT-10		X				X							X		X	
			X	SOFT-11						X									X	X
X	X	X	X	SOFT-12	X		X			X			X	X					X	
X	X	X	X	SOFT-13	X	X	X			X			X	X					X	
X	X	X	X	SOFT-14							X									
X	X	X	X	SOFT-15	X		X			X			X	X			X		X	
X	X	X	X	SOFT-16	X		X				X		X	X			X		X	

I-10 TPAS Traceability Matrix																			
TX	NM	AZ	CA	Req. No.	User Needs														
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
X	X	X	X	SOFT-17														X	X
X	X	X	X	SOFT-18														X	X
X	X	X	X	SOFT-19							X								
X	X	X	X	SOFT-20							X								
X	X	X	X	SOFT-21		X	X		X	X			X	X			X		X
X	X	X	X	SOFT-22							X								
X	X	X	X	SOFT-23							X								
X	X	X	X	SOFT-24	X						X						X		
X	X	X	X	SOFT-25	X		X				X						X		
X	X	X	X	SOFT-26	X		X			X			X	X			X		X
X	X	X	X	SOFT-27							X								
X	X	X	X	SOFT-28	X						X						X		X X
			X	OPS-1						X			X	X		X		X	
			X	OPS-2	X		X			X			X	X			X	X	
X	X	X	X	OPS-3							X					X	X	X	X
X	X	X	X	OPS-4														X	
			X	OPS-5														X	
X	X	X	X	OPS-6	X	X	X						X	X			X	X	
X	X	X	X	OPS-7	X		X						X	X			X	X	
X	X	X	X	OPS-8			X				X					X	X	X	X
X	X	X	X	MT-1							X							X	
X	X	X	X	MT-2							X							X	
X	X	X	X	MT-3							X							X	
X	X	X	X	INF-1		X	X						X	X			X		
X	X	X	X	INF-2	X	X	X	X	X	X			X	X			X		X

I-10 TPAS Traceability Matrix																			
TX	NM	AZ	CA	Req. No.	User Needs														
					A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
X	X	X	X	INF-3	X		X	X		X			X	X			X		X
X	X	X	X	INF-4	X		X	X		X			X	X					X
X	X	X	X	INF-5	X		X	X		X			X	X					X
X	X	X	X	INF-6	X		X	X		X			X	X			X		X
X	X	X	X	INF-7	X	X	X	X		X		X	X	X			X		X
X	X	X	X	INF-8			X	X											
X	X	X	X	INF-9			X	X											
X	X	X	X	INF-10				X			X								
X	X	X	X	INF-11				X			X								
X	X	X	X	INF-12	X	X	X	X		X	X						X		X
X	X	X	X	INF-13	X	X	X	X	X	X		X	X	X			X		X
X	X	X	X	INF-14	X		X			X		X	X	X			X		X
X	X	X	X	GEN-1							X								
X	X	X	X	GEN-2							X						X		
X	X	X	X	GEN-3							X	X					X		
X	X	X	X	GEN-4				X			X						X		
X	X	X	X	GEN-5				X			X								
X	X	X	X	GEN-6	X	X									X		X		
X	X	X	X	GEN-7				X			X				X				
X	X	X	X	GEN-8				X			X				X				
X	X	X	X	GEN-9							X								
X	X	X	X	GEN-10				X			X						X		
X	X	X	X	GEN-11	X			X			X						X		