I-10 Corridor Coalition

Truck Parking Availability System

Data Exchange Specification Document

September 27, 2022

Revision History

The following revision table presents the changes made for each version of this document.

Revision	Date	State/Description
1.0	April 2021	Initial version based on the MAASTO TPIMS Data Exchange Specification Document

Table of Contents

Overview

This document summarizes the standard data feeds that each state will provide for their truck parking sites. The Application Programming Interface (API) guidance provides a recommended approach for implementing the webservices that will facilitate the sharing of truck parking availability data with other users and between the states. The data elements and formatting were agreed upon by the four states participating in the I-10 TPAS project, and are intended to set a standard for future projects.

There are two separate data feeds, each with their own function. The data feeds include a dynamic public feed and static public feed. The dynamic and static public feeds are meant to be shared with third party application developers and other agencies to allow them to disseminate the truck parking availability information through their applications.

This API standard is consistent with the API standard developed by the Mid America Association of Transportation Officials (MAASTO) partnership that deployed the Truck Parking Information Management System in Iowa, Indiana, Kansas, Kentucky, Minnesota, Michigan, Ohio and Wisconsin. Consistency between the systems is considered important to private application developer sharing truck parking availability information with their user base.

Application Programming Interface (API) Guidance

Recommendations for the Application Programming Interface (API), which will allow trusted partners and third-party developers to access I-10 TPAS data, are provided in this section. The I-10 TPAS API should follow HTTP RESTful conventions (REpresentational State Transfer). Recommended sets of HyperText Transfer Protocol (HTTP) request messages are provided, along with a definition of the structure of response messages in JavaScript Object Notation (JSON) format.

The intended RESTful API is stateless, meaning that request authentication does not depend on cookies or sessions. Instead, each request must pass authentication credentials. I-10 Corridor Coalition states may choose to enable authentication on their dynamic public feed and static public feed or keep them open.

Users should be able to access each state's I-10 TPAS API by client browser plugin, cURL or HTTP library. It is recommended the access methods provided by the REST APIs are limited to GET. There are two separate data sets, each with their own function. The data feeds include a ***dynamic public feed*** (dataset #1), and ***static public feed*** (dataset #2). See the data definition section for more information on the contents of these data sets.

Dataset/Datafeed Requests:

Request availability and location information for all truck parking sites (Third Party Requests):

- Dynamic Public Feed Database – Dataset #1
- Static Public Feed Database – Dataset #2 (Updated As-Needed)

Sample Call Datafeeds with Recommended Formats:

1) Request availability and location information for all truck parking sites (Dynamic & Static Public Feeds):

Dynamic Public Feed Database – Dataset #1:

Call Request Open Feed:

GET /api/TPAS_Dynamic.json

Call Request Restricted to Authenticated Users Feed:

GET /api/TPAS_Dynamic?key=<MyKey>

Response:

[{"siteId":"TX00010IS006192OWGUADALWB","timeStamp":"2021-11-17T20:39:59Z","timeStampStatic":"2021-12-02T16:23:22Z","reportedAvailable":"21","trend":"FILLING","open":true,"trustData":true,"capacity":29}]

Static Public Feed Database – Dataset #2 (Updated As-Needed):

Call Request Open Feed:

GET /api/TPAS_Static.json

Call Request Restricted to Authenticated Users Feed:

GET /api/TPAS_Static?key=<MyKey>

Response:

[{"siteID":"TX00010IS006192OWGUADALWB”,"timeStamp":"2021-07 16T18:26:16Z","relevantHighway":"10IS","referencePost":”619”,"exitID":null,"directionOfTravel":"W","name":"Guadalupe Co. Safety Rest Area","location":{"latitude":29.616022,"longitude":-97.806300,"streetAdr":null,"city":”Guadalupe County”,"state":"TX","zip":”78155”,"timeZone":"Central"},"ownership":"PU","capacity":29,"amenities":[],"images":[],"logos":[ ]}]

Dynamic Public Feed

The dynamic public feed contains eight data fields, which are updated every one to five minutes. They are located in this category because the information contained in the data elements needs to be updated frequently in order to provide accurate data to the user. The fields in the dynamic public feed are as follows:

JSON

Element	Type	Description
siteId	string	Unique fixed-length identifier including state, route number, route type, reference post, side of road and unique location number or name abbreviation. See more detailed description in appendix.
timeStamp	string	Provides the date and time that the site record was last updated. See more detailed date and time representation description in appendix.
timeStampStatic	string	Provides the date and time that the site static record was last updated. See more detailed date and time representation description in appendix.
reportedAvailable	string	Number of available spots shared through the data feed. The number is capped at the total number of parking spots at the site and "Low" is reported if the low threshold is reached.
trend	string	Optional. Reports whether the site is emptying, steady or filling. Accepted values: **"CLEARING"** / **"STEADY"** / **"FILLING"** / **null**. See more detailed description in appendix.
open	boolean	Will report open unless the parking site is closed to parking for maintenance or another situation. Possible values: **true** / **false** / **null**
trustData	boolean	This flag will report that the site is operating normally. Possible reasons for a "false" value include periods where the site is under construction while open to traffic, IT maintenance windows, or equipment failures. Possible values: **true** / **false** / **null**
capacity	number	Total number of parking spots within the site.

Dynamic Public Feed - example

JSON format

[{"siteId":"TX00010IS006192OWGUADALWB","timeStamp":"2021-08-15T20:35:15Z","timeStampStatic":"2021-05 03T12:24:19Z","reportedAvailable":"25","trend":"FILLING","open":true,"trustData":true,"capacity":29}]

Static Public Feed

The static public feed contains 19 data fields, which are updated on an as-needed basis. They are located in this category because the information is not expected to change very often. This allows for more efficient use of bandwidth since the information in the static public data feed only needs to be pulled one time after a change is made. As presented above, the dynamic feed contains a timestamp of when the static feed was last updated. The fields in the static public data feed are as follows:

JSON

Element	Type	Description
siteId	string	Unique fixed-length identifier including state, route number, route type, reference post, side of road and unique location number or name abbreviation. See more detailed description in appendix.
timeStamp	string	Provides the date and time that the site record was last updated. See more detailed date and time representation description in appendix.
relevantHighway	string	Provides the highway from which the truck parking area can be accessed. See highway nomenclature in appendix.
referencePost	string	Provides the Reference Post (mile marker) for the center of the rest area or interchange.
exitID	string	At interchanges, the designated interchange number is provided. For rest areas and weigh stations that do not have an exit identification the value will be set to null.
directionOfTravel	string	Text indicating the direction(s) of travel that can access the site (Eastbound – E, Westbound – W, Northbound – N and Southbound – S). For sites that can be accessed by either direction of travel, a bidirectional identifier such as “NS” or “EW” can be used.

name	string	Name of facility as text (e.g., Rest Area or Flying J Truck Stop).
location	array	This array contains the seven following data elements about the site's physical location:
latitude	number	The latitude in a float format.
longitude	number	The longitude in a float format.
streetAdr	string	Text based address number and street name.
city	string	Name of city in which the parking area is located. If not in a city, the county name can be used (e.g., Johnson County).
state	string	Abbreviation for state in which the parking area is located.
zip	string	ZIP code of the location
timeZone	string	Time zone in which parking is located. Accepted values: "Eastern" / "Central" / "Mountain" / "Pacific" / "Alaska"
ownership	string	Text used to indicate whether a parking site is privately owned or publicly owned. Accepted values: "PR" / "PU"
capacity	number	Total number of parking spots within the site.
amenities	array of strings	Optional. List of text based amenities descriptions. Data structure would allow a varying number of amenities to be listed.
images	array of strings	Optional. Provides a link to an image file on a server that shows the lot status visually. This is only used if images are being captured and shared from a surveillance camera, otherwise it will be null.
logos	array of strings	Optional. Provides a link to an image file on a server that shows the private truck stop logo or I-10 Corridor Coalition TPAS logo.

Static Public Feed - example

JSON format

[{"siteId":"TX00010IS006192OWGUADALWB","timeStamp":"2021-08-15T20:35:15Z", "relevantHighway":"10IS","referencePost":"619","exitID":null,"directionOfTravel":"W","name":" Guadalupe Co. Safety Rest Area","location":{"latitude":29.616022, "longitude":-97.806300, "streetAdr":null,"city":"Guadalupe County","state":"TX","ZIP":"78155","timeZone":"Central" },"ownership":"PU","capacity":29,"amenities": ["Vending Machines", "Restrooms", "ATM"],"images": ["http://.../image1.jpg","http://.../image2.jpg","http://.../image3.jpg"],"logos": ["http://.../logo1.jpg","http://.../image2.jpg"]}]

Appendix

Location Identifier

Location Identifier (Fixed Length)			
Field Position	Field Size	Field Name	Description
0	2	State	Two letter state abbreviation.
2	5	Route number	Five digits with zeros padded to the left.
7	2	Route type	Two letter abbreviation (e.g., IS for interstate, US for US highway, SH for state highway, etc.).
9	6	Reference Post	Also referred to as Mile Marker. Six-digit number with implied 1/10 decimal point and zeros padded to the left.
15	2	Side of Road	Two letter designation indicating the direction(s) of travel that can access the site. Sites accessed from one direction are identified: “ON”, “OS”, “OE” or “OW”. For sites that can be accessed by either direction of travel, a bi-directional identifier such as “NS” or “EW” can be used.
17	8	Unique Site Designation	Eight characters unique location number or name abbreviation to differentiate between multiple truck stops at the same interchange.

Example: MI00094IS0008450WGALESBRA is the Galesburg Rest Area on westbound I-94 in Michigan near reference post 84.5.

Date and Time Representation

The timestamp follows the standard ISO 8601 extended format and is represented in UTC with a combined date and time representation. Therefore, the date will read yyyy-mm-ddThh:mm:ssZ where:

- yyyy: Four-digit year
- mm: Two-digit month
- dd: Two-digit day
- 'T': marker for Time
- hh: Two-digit hour expressed in 24-hour time
- mm: Two-digit minute
- ss: Two-digit second
- 'Z': represents "Zulu time", which is the zone designator for zero UTC offset

The static data feed contains the time zone where the truck parking area is located for ease of interpretation by the data consumer.

Highway Nomenclature

Following the data standard, the highway nomenclature uses the number, followed by "IS" if it's an interstate, "US" if it is a US highway or "SH" if it is a state highway. There should be no space between the number and roadway type indicator. The order to be used for concurrent highways is Interstate Highways, U.S. Highways, state highways, and finally county roads, and within each class by increasing numerical value.

Trending Calculation

The trend calculation is optional, and is intended to provide more information about the current state of available parking. The thresholds for FILLING and CLEARING should be user adjustable, as individual sites may operate uniquely and require independent adjustments.

The trending state is based on calculating vehicle flow over the past 30 minutes. For each reporting cycle the difference (delta) in availability is divided by capacity to determine a delta percentage. Flow is then calculated by summing the delta percentages over the past 30 minutes. For a system with 5-minute reporting cycles:

Delta and Flow Calculation

$\%Delta_n$ = Availability Delta, expressed as a percentage, where "n" marks the elapsed time since the measured interval in minutes.

$\%Delta_n = [(Availability_n – Availability_{n-5}) / Capacity]$
$\%Delta_0$ = Truck Parking Availability Delta % between now and 5 minutes ago (most recent data point)
$\%Delta_5$ = Truck Parking Availability Delta % between 5 minutes ago and 10 minutes ago

$\%Delta_{10}$ = Truck Parking Availability Delta % between 10 minutes ago and 15 minutes ago
$\%Delta_{15}$ = Truck Parking Availability Delta % between 15 minutes ago and 20 minutes ago
$\%Delta_{20}$ = Truck Parking Availability Delta % between 20 minutes ago and 25 minutes ago
$\%Delta_{25}$ = Truck Parking Availability Delta % between 25 minutes ago and 30 minutes ago

$\%Flow = \%Delta_0 + \%Delta_5 + \%Delta_{10} + \%Delta_{15} + \%Delta_{20} + \%Delta_{25}$

Thresholds

Threshold for the trend states are based on the %Flow calculation. It is recommended that these are adjustable per site, and that each site is observed during the burn-in period to adjust if too much "bouncing" between trending states is occurring. Expressed in terms of %Flow, the recommended defaults are:

"Clearing": Flow $\geq$ 4.5%
"Steady": -4.5% < Flow < 4.5%
"Filling": Flow $\leq$ -4.5%

Example

The below table shows 35 reporting cycles of data, every five minutes, for a facility with a capacity of 50 vehicles:

Time	Availability	Delta	% Delta	%Flow	Flow State
12:00	20				
12:05	18	-2	-4.0%		
12:10	10	-8	-16.0%		
12:15	9	-1	-2.0%		
12:20	8	-1	-2.0%		
12:25	8	0	0.0%		
12:30	9	1	2.0%	-22.0%	Filling
12:35	7	-2	-4.0%	-22.0%	Filling
12:40	3	-4	-8.0%	-14.0%	Filling
12:45	-1	-4	-8.0%	-20.0%	Filling
12:50	-1	0	0.0%	-18.0%	Filling
12:55	0	1	2.0%	-16.0%	Filling
13:00	0	0	0.0%	-18.0%	Filling
13:05	1	1	2.0%	-12.0%	Filling
13:10	1	0	0.0%	-4.0%	Steady

13:15	1	0	0.0%	4.0%	Steady
13:20	1	0	0.0%	4.0%	Steady
13:25	1	0	0.0%	2.0%	Steady
13:30	1	0	0.0%	2.0%	Steady
13:35	2	1	2.0%	2.0%	Steady
13:40	4	2	4.0%	6.0%	Clearing
13:45	6	2	4.0%	10.0%	Clearing
13:50	7	1	2.0%	12.0%	Clearing
13:55	6	-1	-2.0%	10.0%	Clearing
14:00	8	2	4.0%	14.0%	Clearing
14:05	7	-1	-2.0%	10.0%	Clearing
14:10	6	-1	-2.0%	4.0%	Steady
14:15	7	1	2.0%	2.0%	Steady
14:20	7	0	0.0%	0.0%	Steady
14:25	7	0	0.0%	2.0%	Steady
14:30	9	2	4.0%	2.0%	Steady
14:35	12	3	6.0%	10.0%	Clearing
14:40	16	4	8.0%	20.0%	Clearing
14:45	18	2	4.0%	22.0%	Clearing
14:50	22	4	8.0%	30.0%	Clearing

As shown in the table, %Delta is computed beginning with the 2nd reporting cycle. The first %Flow calculation starts with the 7th reporting cycle, utilizing and 5 most recent %Delta values.

For the 12:30 reporting cycle:

$$\%Flow = \%Delta_{12:30} + \%Delta_{12:25} + \%Delta_{12:20} + \%Delta_{12:15} + \%Delta_{12:10} + \%Delta_{12:05}$$
$$= 2.0\% + 0.0\% - 2.0\% - 2.0\% - 16.0\% - 4.0\%$$
$$= -22.0\% \text{ (Filling)}$$

For the 13:55 reporting cycle:

$$\%Flow = \%Delta_{13:55} + \%Delta_{13:50} + \%Delta_{13:45} + \%Delta_{13:40} + \%Delta_{13:35} + \%Delta_{13:30}$$
$$= -2.0\% + 2.0\% + 4.0\% + 4.0\% + 2.0\% + 0.0\%$$
$$= 10.0\% \text{ (Clearing)}$$