I-95 VPP2 Interface Guide

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Prepared by:

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<thead>
<tr>
<th>Version</th>
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</tr>
</tbody>
</table>

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Contents

1. Introduction ........................................................................................................................... 4
2. Data Access ............................................................................................................................ 4
   2.1 Data Access Introduction ................................................................................................. 4
   2.2 Access to Traffic Feeds ................................................................................................... 4
   2.3 Access to Static Content ................................................................................................ 5
3. Traffic ML and HERE Map Content ....................................................................................... 6
   3.1 Introduction to Traffic ML ............................................................................................... 6
   3.2 Introduction to TMCs ....................................................................................................... 7
   3.3 TMC Alliance Background ............................................................................................. 7
   3.4 Location Tables ................................................................................................................ 8
   3.5 Shapefiles ........................................................................................................................ 8
   3.6 Linking TMCs to a Map .................................................................................................... 9
   3.7 Traffic ML Flow Features ............................................................................................... 10
   3.8 Traffic ML Flow Advanced Uses .................................................................................... 11
4. HERE Platform APIs .............................................................................................................. 12
   4.1 Overview ........................................................................................................................ 12
   4.2 HERE Platform Components ......................................................................................... 12
5. Iteris iPeMS ............................................................................................................................ 27
6. Project Contact Information .................................................................................................. 35
1. Introduction

The I-95 Implementation Guide is written to assist the I-95 Corridor Coalition and its member agencies to access traffic data, integrate the data into applications, and understand the iPeMS user interface.

In addition to this introduction, there are four other sections of this document:

- Section 2 explains how to access HERE Traffic Feeds, HERE Static Content, HERE APIs, and Iteris’s iPeMS
- Section 3 provides an overview of HERE Traffic Feeds (Traffic ML). It provided the information necessary to access, interpret and reference data provided by HERE
- Section 4 provides an overview of HERE APIs
- Section 5 provides an overview of the Iteris iPeMS tools to visualize and interpret the HERE data
- Section 6 provides Project Contact information

2. Data Access

2.1 Data Access Introduction

Once a member agency has signed the task order, HERE will provide the following access:

Traffic Feeds:
- Real time traffic
- Traffic Incidents

Static content:
- Shapefiles
- Traffic Patterns

Platform APIs
- HERE Maps for JavaScript API
- Traffic REST API
- Map Tile REST API
- Map Image REST API
- Routing REST API
- Geocoder REST API

Iteris will separately provide access to iPeMS

2.2 Access to Traffic Feeds

The HERE Project Manager will provide the Agency Project Manager one login to be shared among users within the agency. The agency will receive one URL per feed, with a username and password that applies to all feeds.
2.3 Access to Static Content

The Agency Project Manager will receive an email from HERE@flexnetoperations.com that contains a link and login information to HERE’s Electronic Data Download site (EDD).

EDD contains Documentation, Traffic Patterns, and the Shapefile.

2.3.1 Documentation

The primary document that will assist users is the Customer Technical Reference Guide (CTRG)

Please note, “Documents & Tools” contains documents for products that I-95 Users may not be using, such as products for Europe or Asia. The CTRG may also be located in “Previous Releases” if there has not been an update to the CTRG in the past two quarters.

NAVSTREETS is located within the CTRG. While an overview of the Shapefile format is provided in Sections 3.5 and 3.6 of this document, NAVSTREETS provides additional details to help users understand the Shapefile format.

2.3.2 Traffic Patterns

The Traffic Patterns product is released quarterly. To find Traffic Patterns within EDD, please follow these steps:

2.3.2.1 Select “Product Categories” on the right to return to the home page. Select Americas under “My Products” and then “Additional Content Americas” under Product Lines

2.3.2.2 Select “current release” to see the most current data sets. Select “previous releases” to see older data.

2.3.2.3 Select and Open Traffic Patterns

The Traffic Patterns download also contains specifications and release notes
Global Specification: The Specification document provides information on the content of the data files and describes each field name in the data files. This specification applies to all countries.

- Relational_NTP: The raw data is contained within this file. The Spec document explains more about this data.
- Release Notes: Release notes provide information on the delivery, including which data files are included, what the data files are named, a map of the coverage area, a history of previous release and listing anything new in the current release

### 2.3.3 Shapefile

The Shapefile includes pertinent attributes as described in the Shapefile specification document for each road segment, which will enable users to relate traffic data to road segments. The Shapefile provides the user the ability to spatially view the roads and data contained in the files. The key attribute that joins all data files together is the Link_ID.

### 2.4 Access to Platform APIs

All users of HERE APIs must obtain authentication and authorization credentials and provide them as values for the parameters app_id and app_code. The credentials are assigned per application.

To obtain the credentials for an application, please visit the following site for more details: [http://developer.here.com/get-started](http://developer.here.com/get-started)

### 2.5 Access to Iteris iPeMS

The iPeMS Traffic Monitoring Website for the I-95 Corridor Coalition provides traffic data storage, data processing, display and visualization platform for I-95 coalition members who acquire HERE traffic data through the Coalition. The iPeMS system collects and processes HERE traffic speed data in real-time and delivers the real-time and archived data to Coalition member agencies through a web-based interface, archive data clearinghouse service and through RESTful API access. The service will be available to member agencies that have signed a DUA agreement with HERE and the University of Maryland via [http://i95.iteris-pems.com](http://i95.iteris-pems.com). Users that apply from an agency account with an approved domain will be automatically approved.

### 3. Traffic ML and HERE Map Content

#### 3.1 Introduction to Traffic ML

**What is TrafficML?**

TrafficML (TML) is a continuously streamed service providing information about traffic conditions on roadways. TML is comprised of flow and incident data that is aggregated and tested from multiple sources including GPS probes, roadway sensors, and live traffic from the HERE National Traffic Operations Center. The data is provided in HERE defined...
XML (Extensible Markup Language) and is accessed via HTTP (Hyper-Text Transfer Protocol).

**How is TML used?**

TML can be used to ascertain current traffic conditions for roadway segments defined by TMC (Traffic Message Channel) locations, or utilizing DLR (Dynamic Location Referencing). The service can be used for map display, route guidance, analysis or any other process requiring real time traffic data.

### 3.2 Introduction to TMCs

TMC codes are a reference system designed to give a unique alpha-numeric code to road segment for the purposes of assigning traffic information to that segment.

These codes are assigned and certified by TISA (Traveler Information Services Association). TMCs are initially delivered in a specific tabular format known as the TMC Location Table or Traffic Table, and are then referenced to HERE map links and delivered as part of the HERE map content.

TMC locations are made up of several elements as described in the table below:

<table>
<thead>
<tr>
<th>Extended Country Code*</th>
<th>Country Code</th>
<th>Table ID</th>
<th>Direction</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>1</td>
<td>06</td>
<td>N(-) or P(+)</td>
<td>01234</td>
</tr>
</tbody>
</table>

Some Country Codes are not unique globally, so the ECC is used to further differentiate.

- Table ID within the country. Some countries have multiple traffic tables (North America has 36).
- Direction of travel. Most location codes define a location that can be traveled in opposite directions. The positive or negative direction determines this and is defined by the location table.
- Specific location. These are defined in the location table as being specific roadways at specific intersections.

* Extended Country code is used in the HERE Traffic Feed to differentiate a handful of countries that have been assigned the same country code. It is not used in the HERE map content.

### 3.3 TMC Alliance Background

The NAVTEQ (HERE) - Tele Atlas (TomTom) Traffic Table Alliance was initiated at the request of early adopters of RDS-TMC referenced traffic services in the United States. During discussions in 2003 it became obvious that the state of affairs at the time, where each map had its own traffic referencing system, was not in the best interests of the growing market for dynamic traffic services. As the only vendors of traffic grade mapping data, HERE and TomTom formed an alliance to provide the industry with a consistent approach to processing and delivering the location of data.

High accuracy digital mapping is a key ingredient in processing probe based speed data. TMC standards support the geometric, location, and statistical framework needed to broadly enable traffic data processing engines that are now widely accepted as both
reliable and cost effective sources for real-time traffic information. TMCs were established and approved as an ISO standard, and have been used to support the marketplace since the 1990s.

3.4 Location Tables

3.4.1 Introduction

The traffic table is delivered as an Excel spreadsheet (.xls) and contains a hierarchical structure of Areas that contain Linear Locations that contain Point Locations, together creating a reference system for dynamic data or connected services on the HERE map. In a simplified description it is a concatenated alphanumeric string that contains the country code, market code, and roadway segment code. Detailed information on the structure of traffic coding within the HERE map, is included in Appendix G of the Navstreets Manual.

3.4.2 Area Reference

Areas can be similar to the Admin structure in the HERE database, Country, State/Province, and County.

3.4.3 Linear Reference

A Linear Location is a path of consecutive Road Elements along a road whose TMC codes correspond to a named road. The extent (defined by the number of traffic locations) of the Linear Location is defined in the traffic table. A typical Linear Location consists of consecutive road elements where the locally known name may be a route number or a local name and this name remains consistent.

Linear Locations are represented in the Location Tables as a 5 digit number. There is only a need to define the road once for both Eastbound and Westbound because the TMC coding of positive or negative accounts for either direction, where the column FIRST_NAME references the road direction in the negative TMC direction and SECOND_NAME references the road direction in the positive TMC direction.

3.4.4 Point Reference

The point reference is what is typically referred to as the TMC location. The purpose of the Point Location is to communicate a specific point in the real world so that a traffic provider can tie incoming information about traffic conditions to the TMC code that will then be transmitted in the HERE traffic feed. Point Locations reference the Linear Location and are tied to other related locations by their associated negative and positive offset locations.

3.5 Shapefiles

3.5.1 Navstreets
Navstreets is the basic map database format of the HERE map. It contains a highly detailed geographic representation of the network of roads along with numerous attributes. For a full detail of the format and available features and attributes additional information is provided in the Customer Technical Reference Guide (CTRG) and the Navstreets Manual.

### 3.5.2 TMC Attribution Shapefile

As part of the I-95 deliverable, HERE will provide a simplified geographic representation of the TMC network with basic attribution including road name and/or number, location description (cross street), road direction (cardinal direction) and start and end latitude and longitude. For users who want a more detailed reference between TMC and the HERE map, please refer to section 3.6 below.

### 3.6 Linking TMCs to a Map

The fundamental segment representing roadways in the HERE map is defined as the LINK_ID. The LINK_ID is defined as a 9-10 digit unique number in the HERE Streets layer. The directional information from the link is defined as “F”, “T” or “B” in the HERE map. This refers to the direction to (“T”) or from (“F”) the reference node. “B” refers to links that can be driven in both directions and are represented as a single line in the HERE map. In order to link TMCs to the HERE map, these segments must be joined to an associated layer called TRAFFIC.

#### 3.6.1 Streets Layer (geography)

In the Streets layer, each road segment is assigned a LINK_ID and a direction (TRAVEL_DIR) equal to ‘T’, ‘F’ or ‘B’. Bi-directional links that are coded as a single digitized link will have direction = ‘B’. In order to associate the TMC code with the streets layer in the correct direction of travel:

A link record should be created for ‘F’ (From) links when DIR_TRAVEL = ‘F’ or ‘B.’

A link record should be created for ‘T’ (To) links DIR_TRAVEL = ‘T’ or ‘B.’

When this is complete, the two layers can be linked using a join or relate method based on the leading character in the TRAFFIC_CD (+ or -) to the DIR_TRAVEL in the Streets layer (‘F’ or ‘T’).

#### 3.6.2 Traffic Layer (table) <join and/or relate>

TMCs are referenced in the HERE map using a Shapefile layer called Traffic. This consists of a table that lists each TMC location (TRAFFIC_CD) and associated LINK_ID from the Streets layer. There is no geography associated with the Traffic layer. In the Traffic Layer the first character of the TRAFFIC_CD (+ or -) refers to the direction of the associated LINK_ID from (F) or to (T) the reference node where + = ‘F’ and - = ‘T’. The remainder of the TRAFFIC_CD refers to the TMC and the direction of travel in the positive or negative direction as defined in the Traffic Location Table.
3.6.3 Concurrent TMCs

TMCs are referenced to specific road names or numbers. In some cases, different defined TMC coded roads (e.g. US-12 and US-20) can share the same road bed. In these cases it is possible for there to be more than one TMC associated with a single map link.

3.7 Traffic ML Flow Features

3.7.1 Specifications

The TrafficML 3.1 Real-time Flow Feed Specification provides detailed information on the XML format.

3.7.2 Update Frequency

Each file will be updated every 60 seconds and the creation of the files will be distributed across every minute. The recommended approach is to poll the file every 10-15 seconds to see if the file has been updated since you previously updated this file. This will ensure that you are minimizing the latency to retrieve the freshest data.

3.7.3 Queue Direction

The queue direction (QD) is the opposite of the travel direction. The queue direction has been historically used to represent traffic incidents with TMC locations because this is the direction of the backup on the roadway. In the HERE Map, the links are referenced to the driving direction so if you want to reference a queue direction to the HERE Map you will need to swap the direction from “+” to “−”, and vice versa.

3.7.4 Free Flow

Free flow speed is a reference speed provided to indicate the speed on each individual TMC segment at which vehicles should be considered to be able to travel without impediment.

3.7.5 Confidence

The “Confidence” field is used to represent the confidence HERE has in the data that is produced by a record. This field can be used if you are interested in only showing real-time data in a feed. If the confidence is 0.70, the data is based on Traffic Patterns. All confidence data 0.71 and above is based on real-time information. If real-time data is no longer available on a road segment, the confidence will decrease from 0.71 to 0.70.

3.7.6 Jam Factor:

The JamFactor is a number between 0 and 10 indicating the expected quality of travel, with 0 indicating free flow and 10 indicating stopped traffic.
3.7.7 Displaying Traffic Data

Users are able to color the roadways based on personal preference. Below is an example of how to use JamFactor thresholds for coloring the roadways. Please note, each metro area may have different tolerances for traffic and may choose to color the roadways based on different thresholds.

- JamFactor 0-3.9999: Green
- JamFactor 4<7.9999: Yellow
- JamFactor 8<10: Red

If Jam Factor=10 and Speed=-1, then Road Closed: Black

3.7.8 Data Filtering

There are many different approaches to displaying traffic data. Some customers want to show traffic in which the data has only real-time sources, some customers want to view all data, and some customers only want to display real-time congestion. This can be a way to distinguish user experience. If users filter data by real-time confidence, HERE recommends a confidence filter of 0.71. If users filter data by congestion, HERE recommends using a congestion JamFactor filter of 4. In addition to these filters, it is always recommended to view the road closures as these are very important customer-facing incidents.

3.7.9 Road Closure

A road closure is represented with a JamFactor of 10 and a Speed of -1. There are occasional situations where traffic is at a standstill but the road is not actually closed, resulting in a JamFactor of 10.

3.8 Traffic ML Flow Advanced Uses

3.8.1 Offsets

If there is a substantial difference in the traffic along a TMC, HERE will create SubSegment elements. The diagram below helps to visualize how the SubSegment is used to represent traffic changes along a TMC. Additional details on properly interpreting these elements is included in the section on “SubSegments” in the TrafficML Real-time 3.1 Specification.
3.8.2 Dynamic Location Referencing (DLR)

Dynamic location referencing is a method to reference locations on the fly without agreed upon TMC Location codes. In order to fill the gap in the road network, HERE is providing DLR messages outside the TMC road network. HERE will only provide DLR messages when there is congestion, sufficient real-time data, and the road is not covered by our TMC messages.

The DLR data will be contained within the TMC table that represents the area in TMC network. For example, all DLR messages in Chicago will be in the A0107 feed file.

3.8.3 SHP Format

The SHP format is how HERE is representing DLR data. This SHP element consists of shape points along the roadway that is representing DLR data. The lat/long records in the SHP element are ordered by driving direction.

3.8.4 Additional Support or Information

HERE Technical Customer Support is available for additional support or information: tcstraffic@here.com.

4. HERE Platform APIs

4.1 Overview

The HERE Platform offers advanced maps and map-related functionality as a holistic solution. It is available for integration into applications, services and platforms through a suite of HERE Platform products which include APIs and on-demand Web services.

The foundation of the HERE Platform is the world’s highest quality and most up-to-date HERE maps, which are constantly updated to reflect real-world changes. The updates include data collected by a global team of geographic analysts as well as anonymous data collected automatically from one of the largest communities of users of commercial geospatial data in the world.

4.2 HERE Platform Components

4.2.1 HERE Platform Background

The HERE Platform consists of a number of core components. Each of them offers a set of functional features along with the relevant content.

The list below summarizes the core components of the HERE Platform:

Maps
The Maps component delivers the highest quality maps with the most up-to-date data and fast rendering. The component supports all aspects of the visual presentation of the map data and on-screen user interaction in multiple resolutions.

**Traffic**
Traffic offers both client- and server-side functionality to retrieve information about traffic conditions and incidents, and to present this information visually.

**Directions**
The Directions component provides traffic-aware route calculation functionality for vehicle routing. Routes for cars, public transport or pedestrians can be calculated between two or more locations; the results include maneuvers (textual navigation instructions). The GetLinkInfo request found in the Enterprise Routing API can be used to determine real-time traffic speeds and travel times at a particular location/road segment.

**Geocoder**
The Geocoder component provides both geocoding (address information retrieval from geographic coordinates) and reverse geocoding (obtaining geographic coordinates on the basis of an address) functionalities, including over 94 million house number points in the United States.

HERE will provide access to several web-based platform APIs, to include the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>API</th>
<th>Primary use for Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maps</td>
<td>HERE Maps for JavaScript</td>
<td>The HERE Maps API for JavaScript is a set of programming interfaces that enable developers to build Web applications with feature rich, interactive HERE Maps at their center.</td>
</tr>
<tr>
<td>Map Tile API</td>
<td>HERE Map Tile API</td>
<td>HERE Map Tile API is a RESTful API that retrieves map tile images for all regions of the world; and returns real-time traffic map tile images amongst other map tile image types)</td>
</tr>
<tr>
<td>Map Image API</td>
<td>HERE Map Image API</td>
<td>HERE Map Image API is a web service API that offers easy and fast access to static map images, to include the display of map markers, heat maps, road signs, etc. It is integrated into the HERE Maps for JavaScript API</td>
</tr>
</tbody>
</table>
### Component API

<table>
<thead>
<tr>
<th>Component</th>
<th>API</th>
<th>Primary use for Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic</td>
<td>Traffic API</td>
<td>Display real-time traffic flow, tiles, traffic incidents, or historical traffic pattern tiles</td>
</tr>
<tr>
<td>Directions</td>
<td>Routing API</td>
<td>Use to determine real-time traffic speeds, congestion factors and travel times at a particular location/road segment.</td>
</tr>
<tr>
<td>Geocoder</td>
<td>Geocoder API</td>
<td>Provides forward and reverse geocoding capabilities; use to make address and location (latitude/longitude) searches</td>
</tr>
</tbody>
</table>

Each API comes with its own API Developer Guide document for comprehensive overview on usage of each API. This implementation guide provides quick start information on only those APIs that are relevant to returning traffic information.

#### 4.2.2 HERE Maps API for JavaScript

The HERE Maps API for JavaScript is a set of programming interfaces that enable developers to build Web applications with feature rich, interactive HERE Maps at their center. The API consists of libraries of classes and methods with which to implement the functionality of an interactive application.

**Why use the Maps API for JavaScript?**

The Maps API for JavaScript offers the following high level features and benefits to developers of Web applications with maps as a core element:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient map rendering</td>
<td>The API is built for HTML5-capable environments to maximize map and map object rendering efficiency on mobile devices and desktops. It also includes support for high-DPI devices to show the best maps wherever possible.</td>
</tr>
<tr>
<td>HERE Maps map data</td>
<td>The API provides full access to world-leading map data and map images, with a choice of view modes and customization options, including three main map types: <em>map</em>, <em>terrain</em> and <em>hybrid</em>.</td>
</tr>
<tr>
<td>Geocoding</td>
<td>The API provides full access to geocoding and reverse geocoding services.</td>
</tr>
<tr>
<td>Routing</td>
<td>The API supports route calculation and display, with a variety of customization options such as <em>public transport routing</em> and others.</td>
</tr>
</tbody>
</table>
Feature | Description
--- | ---
Enterprise routing | The API supports advanced enterprise routing use cases such as *truck routing*.
Custom map objects | The API supports the creation of both interactive and non-interactive map objects:
  - markers with SVG, HTML or bitmap images
  - geo shapes, including polygons, polylines, circles and rectangles
Mouse and touch interaction | The API (via an events extension) supports mouse and touch interaction with the map, including pan, zoom and pinch-to-zoom on a broad range of devices.
Pre-built UI controls | The API offers pre-built, customizable UI controls that allow users to change the base map, zoom in and out smoothly, and display the current map scale. In addition, info bubbles with arbitrary HTML content and SVG images can be placed on the map.
Integrated HERE Street Level | Thorough integration with HERE Street Level imagery, the API offers access to interactive 360° panoramas in covered areas.

**HERE Maps API for JavaScript Modules**

The Maps API for JavaScript is organized into a number of modules. Developers can therefore use the API efficiently by selecting only the modules which their applications require.

The table below outlines the selectable modules of the Maps API for JavaScript.

<table>
<thead>
<tr>
<th>Module name</th>
<th>Module dependencies</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>core (mapsjs-core.js)</td>
<td>none</td>
<td>This module contains the core functionality for rendering maps, map layers and map objects as well as utilities used in other modules. This module forms the core of the API and is a dependency of all other modules.</td>
</tr>
<tr>
<td>service (mapsjs-service.js)</td>
<td>core</td>
<td>This module supports map tile retrieval, routing, geocoding, etc.</td>
</tr>
<tr>
<td>mapevents (mapsjs-mapevents.js)</td>
<td>core</td>
<td>This module provides functionality to enable user-interaction with the map, including map panning and</td>
</tr>
<tr>
<td>Module name</td>
<td>Module dependencies</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>pinch</td>
<td></td>
<td>pinch-to-zoom. The module normalizes various browser event systems (mouse events, touch events, pointer events) to offer unified events that can be used across desktop and mobile environments.</td>
</tr>
<tr>
<td>ui (mapsjs-ui.js + mapsjs-ui.css)</td>
<td>core</td>
<td>This module provides a set of pre-built cross-browser UI components (such as base map settings, zoom control, map scale) that can be added to the map. It also provides functionality to display location-specific info bubbles with arbitrary HTML content on the map.</td>
</tr>
<tr>
<td>clustering (mapsjs-clustering.js)</td>
<td>core</td>
<td>This module provides functionality for marker clustering.</td>
</tr>
<tr>
<td>pano (mapsjs-pano.js)</td>
<td>core, service</td>
<td>This module provides access to HERE StreetLevel imagery on WebGL-enabled devices. It supports switching the map to the StreetLevel rendering mode and navigation through StreetLevel panoramas.</td>
</tr>
</tbody>
</table>

**Traffic**

The Maps API provides a means of retrieving and displaying traffic data on the map for major urban areas around the globe.

**Showing Traffic Flow on the Map**

The example below uses the traffic component in the Maps API to show a map of the Washington DC area, indicating the traffic conditions. Roads where traffic flows freely are marked in green, roads where congestion is moderate are in orange, while those that are congested are shown in red.

The API provides access to map tiles with traffic information through the HERE Map Tile API. It automatically adds layers using traffic map tiles to the default layer collection (accessed through the method `createDefaultLayers()` on the
H.service.Platform instance). The application user can switch the traffic flow information display on and off for the available map types via the MapSettingsControl.

**Map showing traffic flow data**

In addition to traffic flow, the API integrates traffic incident data by providing a marker overlay that can be added to the map.

The code below adds to the map the pre-configured traffic incidents marker layer available in the default layer collection to show traffic incidents.

```javascript
map.addLayer(defaultLayers.incidents);
```

This code assumes that map is a previously instantiated and initialized instance of H.Map.

The MapSettingsControl includes an entry for switching traffic incidents display on and off if the traffic incident layer is detected in the collection of layers passed to the UI.

**Map showing traffic incident data**
4.2.3  Traffic API

HERE Traffic API is a RESTful API that provides traffic flow information and traffic map tiles. To obtain traffic data via the HERE Traffic API, it is necessary to formulate a request that combines the URL and a set of parameters to specify the required response. The HERE Traffic API encompasses services outlined below.

Traffic Incident Data

The API provides aggregated information about traffic incidents in XML or JSON, including the type and location of each traffic incident, status (whether it is still active), start and end time, and other relevant data.

Traffic Map Tile Overlays (Traffic Tiles)

The Traffic API delivers pre-rendered map tile overlays with traffic information, ready to be displayed by mapping applications. You can request map tiles that show traffic trends (patterns) based on historical traffic data for a specific area.

Traffic Flow Data

The service offers access to real-time traffic flow data in XML or JSON, including information on speed and congestion for the region(s) defined in each request, and can deliver additional data such as the geometry of the road segments to which the flow data relate.
Traffic Flow Availability

The service allows client applications to access the general traffic information either specified by a map segment (defined as a map view), or in general for the whole world (without the map view).

Why use the Traffic API?

The Traffic API addresses the following high-level use cases:

- Get real time traffic flow data in XML or JSON
- Get a real-time traffic tile overlay for a map image
  - Filter traffic tile data by TMC table or profile
  - Specify the size of a traffic tile overlay in a mapping application
- Set traffic incident data in XML or JSON formats
  - Filter traffic incident data by TMC table or profile
  - Filter traffic incident data by attributes
- Get traffic flow availability data in XML or JSON

Constructing a Request

A request to the Traffic API includes the basic elements shown in the following table and, in addition, it may contain resource-specific parameters.

<table>
<thead>
<tr>
<th>Element</th>
<th>Value/Example</th>
<th>Purpose</th>
<th>Description/comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path</td>
<td>/traffic/6.0/</td>
<td>For tiles and incidents resource</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Or /traffic/6.1/</td>
<td>For flow and incidents resource</td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Tiles</td>
<td>To obtain traffic map tiles</td>
<td>Name of a resource</td>
</tr>
<tr>
<td></td>
<td>Incidents</td>
<td>To obtain traffic incident data</td>
<td>Only the GET method is supported. Parameters specify request details</td>
</tr>
<tr>
<td></td>
<td>Flow</td>
<td>To obtain flow data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flow availability</td>
<td>To obtain info on traffic flow availability</td>
<td></td>
</tr>
<tr>
<td>Addressing Scheme</td>
<td>Quadkey, [Z]/[X]/[Y], Bounding Box or Proximity</td>
<td>Traffic Flow Data</td>
<td>Geographic area for which to retrieve data; options depend on resource/function.</td>
</tr>
<tr>
<td></td>
<td>Quadkey, [Z]/[X]/[Y]</td>
<td>Traffic Tiles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quadkey, [Z]/[X]/[Y], Bounding Box or Proximity</td>
<td>Traffic Incidents</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Customer Profile or Mapview</td>
<td>Traffic Flow Availability</td>
<td></td>
</tr>
<tr>
<td>Application Code</td>
<td>&amp;app_code=AUKnXv84fjrBr6KHaw50Tg</td>
<td>All requests</td>
<td>Substitute your own unique app_code</td>
</tr>
<tr>
<td>Application ID</td>
<td>&amp;app_id=DemoAppId01082013GAL</td>
<td>All requests</td>
<td>Substitute your own unique app_id.</td>
</tr>
</tbody>
</table>
Request Format

Each request must conform to the format appropriate to the resource (service function) and the addressing scheme (geospatial filter) the request uses to define the area for which to retrieve traffic information.

The supported addressing schemes are:

- **Tile addressing schemes:**
  - \([Z]/[X]/[Y]\) – specifies the map zoom level and the coordinates of the map tile in the tile grid corresponding to that zoom level
  - **quadkey** – an alternative to the \([Z]/[X]/[Y]\) addressing scheme that uses a single value to identify the map tile

- **Area filters:**
  - **bounding box** – defines the area for which to retrieve information as a bounding box (using the parameter bbox, whose value is specified as the latitude and longitude of the top left and bottom right corners of the area, for example: \(bbox=52.516,13.355;52.511,13.400\))
  - **proximity** – defines the area for which to retrieve information as a circle (using the parameter prox, whose value is the latitude and longitude of the search center, followed by the radius of the search area in meters)
  - **corridor** – defines the area for which to retrieve information along a specified path (using the parameter corridor, with path and width. The path is a line along the center of the corridor represented by a series of latitude/longitude pairs. Corridor width is given in meters.)

Once you have determined the resource and the addressing scheme, select the appropriate request format pattern, following the guidelines below (listed according to the API resource, whose name is shown in brackets).

**Traffic Flow Data (flow)**

Traffic flow data can be retrieved using one of the following request patterns, which reflect the addressing scheme

<table>
<thead>
<tr>
<th>Addressing Scheme</th>
<th>URL Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>([Z]/[X]/[Y])</td>
<td>{base-url}/{path}/{zoom}/{column}/{row}/{format}?</td>
</tr>
<tr>
<td>Quadkey</td>
<td>{base-url}/{path}/{resource}.{format}?quadkey={quadkey}</td>
</tr>
<tr>
<td>Bounding box</td>
<td>{base-url}/{path}/{resource}.{format}?bbox={bounding box coordinates}</td>
</tr>
<tr>
<td>Proximity</td>
<td>{base-url}/{path}/{resource}.{format}?prox={proximity coordinates}</td>
</tr>
</tbody>
</table>
Corridor

{base-url}/{path}/{resource}.{format}?corridor={corridor coordinates}

Note [path] in the request patterns above must be /traffic/6.1/.

**Traffic Tile (tiles)**

Traffic tiles can be retrieved using one of the following request patterns, which reflect the addressing scheme:

<table>
<thead>
<tr>
<th>Addressing Scheme</th>
<th>URL Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Z]/[X]/[Y]</td>
<td>{tile-base-url}/(path)/(resource)/zoom)/(column)/(row)/(size)/(format)?</td>
</tr>
<tr>
<td>Quadkey</td>
<td>{tile-base-url}/(path)/(resource)/quadkeytraffic?quadkey={quadkey}</td>
</tr>
</tbody>
</table>

Note that when using the [Z]/[X]/[Y] tile addressing scheme, you can specify tile size and color depth as follows:

- {size}: tile size, can be one the following values 512, 256, or 128.
- {format}: color-depth, can be one of the following png, png8, or png32.

**Traffic Incidents (incidents)**

Traffic incident reports can be retrieved using one of the following request patterns, which reflect the addressing scheme:

<table>
<thead>
<tr>
<th>Addressing Scheme</th>
<th>URL Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Z]/[X]/[Y]</td>
<td>{base-url}/(path)/(resource)/(format)/(zoom)/(column)/(row)?</td>
</tr>
<tr>
<td>Quadkey</td>
<td>{base-url}/(path)/(resource).(format)?quadkey={quadkey}</td>
</tr>
<tr>
<td>Bounding box</td>
<td>{base-url}/(path)/(resource).(format)bbox={bounding box coordinates}</td>
</tr>
<tr>
<td>Proximity</td>
<td>{base-url}/(path)/(resource).(format)prox={proximity coordinates}</td>
</tr>
<tr>
<td>Corridor Coordinates</td>
<td>{base-url}/(path)/(resource).(format)corridor={corridor coordinates}</td>
</tr>
</tbody>
</table>

**Traffic Flow Availability (flowavailability)**

Traffic flow availability information can be retrieved for your profile with an address following the pattern shown below:

<table>
<thead>
<tr>
<th>Addressing Scheme</th>
<th>URL Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile</td>
<td>{base-url}/(path)/(resource).(format)?profile={profile name}</td>
</tr>
</tbody>
</table>
4.2.4 Routing API

The HERE Routing API calculates routes between two or more locations and provides additional route-related information, such as real-time traffic updates. Route information consists of a graphical representation of the route and a detailed turn-by-turn route description. It enables mapping applications to render the geographical representation of the route together with the map data, so that the route is displayed on the map.

The Routing API is customizable so that the route calculation and additional information can be adapted to both consumer and enterprise applications and specific application use cases.

HERE Routing API is a web service API that offers easy and fast routing for several regions in the world.

The Routing API provides the following capabilities:

- Calculate a route for a set of waypoints.
- Update a previously calculated route.
- Calculate a route isoline.

The following static routing attributes are supported in all HERE digital map formats and are available in the Routing API:

- form of way (such as roundabouts, ramps, service roads)
- road numbers
- direction of traffic flow (such as one-way, two-way, divided highway)
- road condition
- network classifications
- blocked passages
- special restrictions
- restricted maneuvers
- toll roads
- speed categories
- built up areas
- carpool lanes (high-occupancy vehicle (HOV) lanes)
- seasonal closures

Constructing a Request

A request to the Routing API includes the basic elements shown in the following table and, in addition, it may contain resource-specific parameters.

<table>
<thead>
<tr>
<th>Element</th>
<th>Value/Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base URL</td>
<td><a href="http://route.nlp.nokia.com">http://route.nlp.nokia.com</a></td>
<td>Production environment</td>
</tr>
<tr>
<td></td>
<td><a href="http://route.st.nlp.nokia.com">http://route.st.nlp.nokia.com</a></td>
<td></td>
</tr>
<tr>
<td>Path</td>
<td>/routing/6.2/</td>
<td></td>
</tr>
</tbody>
</table>
### Get Link Info Request

Use the getlinkinfo resource to return detailed information about a route. The required parameters for this resource are app_id and app_code and a linkids, routeld, quadKey, tmcCodes or waypoint parameter that specifies a particular route.

```
../routing/6.2/getlinkinfo.{format}?<parameter>=<value>...
```

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>app_id</td>
<td>A 20 bytes Base64 URL-safe encoded string used for the authentication of the client Application. You must include an app_id and app_code with every request.</td>
</tr>
<tr>
<td>app_code</td>
<td>A 20 bytes Base64 URL-safe encoded string used for the authentication of the client Application. You must include an app_id and app_code with every request.</td>
</tr>
</tbody>
</table>
| mode          | The routing mode determines how the route is calculated. When used in a getroute request, the mode of transport must be the same as in the original request.  
Type:TransportModes;TrafficMode;Feature  
&mode=fastest;car;traffic:disabled;motorway:-2 |
<p>| requestId     | Clients may pass in an arbitrary string to trace request processing through the system. The RequestId is mirrored in the MetaInfo element of the response structure. |
| metricSystem  | The default is the metric system associated with the language settings. xs:string. Enum[imperial / metric]                                      |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
</table>
| viewBounds      | If the view bounds are given in the request only shapes and links which fit into these bounds will be returned. A common use case for this is the drag and drop scenario where the client is only interested in a rough visual update of the route in the currently visible bounds. Array of BoundingBox.  
  
  $viewbounds=37.7902858, -122.4027371$;  
  $37.7890649, -122.3993039$ |
| resolution      | Integer resolution of the view in meters per pixel, and optional snap resolution in meters per pixel. Snap resolution lets the routing service to pick links with waypoints that are visible in the client display resolution.  
  This information allows the route shape in the response to reflect the client's resolution.  
  
  $resolution=viewresolution:snapresolution$  
  $resolution=300:0.01$ |
| instructionFormat | Defines the representation format of the maneuver's instruction text.  
  $instructionformat=Enum \ [txt \ | \ html \ | \ native]$ |
| language        | A single language from the following list. [en-uk | en-us | fr-fr | de-de | es-es | it-it] |
| jsonAttributes  | Flag to control JSON output. Combine parameters by adding their values.  
  $jsonattributes=2$ |
| representation  | Define which elements are included in the response as part of the data representation of the route.  
  $Enum \ [overview \ | \ display \ | \ dragNDrop \ | \ navigation \ | \ linkPaging \ | \ turnByTurn]$ |
| routeAttributes | Define which attributes are included in the response as part of the data representation of the route. Defaults to waypoints, summary,summaryByCountry legs, lines.  
  
  $Enum \ [waypoints \ | \ summary \ | \ summaryByCountry \ | \ shape \ | \ boundingBox \ | \ legs \ | \ notes]$ |
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>maneuverAttributes</td>
<td>Define which attributes are included in the response as part of the data representation of the route maneuvers. Defaults to position, length, travelTime. Enum [ position</td>
</tr>
<tr>
<td>linkAttributes</td>
<td>Define which attributes are included in the response as part of the data representation of the route links. Defaults to shape, speedLimit, dynamicSpeedInfo, address. Enum [shape</td>
</tr>
<tr>
<td>maxFunctionalClass</td>
<td>Restrict the list of links to those of a particular functional class or less.</td>
</tr>
<tr>
<td>tmcCodes</td>
<td>List of TMC codes of the links to be returned.</td>
</tr>
<tr>
<td>quadKey</td>
<td>All links inside the bounding box are returned. Array of BoundingBox. &amp;quadkey=12023000230220312</td>
</tr>
<tr>
<td>linkIds</td>
<td>Link identifiers for which the detailed information is being requested.</td>
</tr>
<tr>
<td>routeId</td>
<td>Route identifier for which the detailed route information is being requested.</td>
</tr>
<tr>
<td>waypoint</td>
<td>Waypoint of the links to be returned. waypoint=geo!52.5,13.4</td>
</tr>
</tbody>
</table>

**Example Request**

http://route.st.nlp.nokia.com/routing/6.2/getlinkinfo.xml
?app_id=DemoAppId01082013GAL
&app_code=AJKnXv84fjrboKIHawS0Tg
&waypoint=50.05564304861044,8.38889128575724
&linkattributes=all

**Example Response**
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<rtgl:GetLinkInfo xmlns:rtgl="http://www.navteq.com/lbsp/LBSP-Routing-GetLinkInfo/4">
    <Response>
        <MetaInfo>
            <MapVersion>2012Q4</MapVersion>
            <ModuleVersion>0.2</ModuleVersion>
            <InterfaceVersion>4.2</InterfaceVersion>
            <Timestamp>2013-05-29T14:30:51.263Z</Timestamp>
        </MetaInfo>
            <LinkId>-723354753</LinkId>
            <Shape>50.0555916,8.3884697 50.0555916,8.3890696, 50.0555801,8.3905296 50.0555687,8.3919296, 50.0555611,8.3924103</Shape>
            <Length>281.0</Length>
            <SpeedLimit>999.0</SpeedLimit>
            <DynamicSpeedInfo>
                <TrafficSpeed>24.75</TrafficSpeed>
                <TrafficTime>11.4</TrafficTime>
                <BaseSpeed>33.33</BaseSpeed>
                <BaseTime>8.4</BaseTime>
                <JamFactor>2.41</JamFactor>
                <JamFactorTrend>1.0</JamFactorTrend>
                <Confidence>0.87</Confidence>
            </DynamicSpeedInfo>
            <Flags>motorway</Flags>
            <TMCCodes>D01P12165</TMCCodes>
            <FunctionalClass>1</FunctionalClass>
            <Address>
                <Label>A66</Label>
                <Country>DE</Country>
                <State>Hessen</State>
                <County>Main-Taunus-Kreis</County>
                <City>Hochheim am Main</City>
                <Street>Rhein-Main-Schnellweg</Street>
            </Address>
            <RoadNumber>A66</RoadNumber>
            <Timezone>+0200</Timezone>
            <TruckRestrictions>
5. Iteris iPeMS

5.1 iPeMS Introduction

The iPeMS I-95 Corridor Coalition Website for Traffic Monitoring module incorporates speed data from HERE and provides visualizations based on the speed and travel time based data. The speed and travel time data in the website is referenced to TMCs and incorporates sub-TMC data when it is provided and displays the sub-TMC based data in web tools.

Features of the iPeMS Website for Traffic Monitoring include:

- Dashboards with dynamic performance measure gauges
- Maps with speed and anomaly visualizations
- Views of average speeds and travel times
- Charts with the percentage of time below speed thresholds
- Long-term trends of speed and travel time
- Imputation of missing data
- Visualization of data quality
- Selectable links for real-time and historical data
- Savable ad-hoc route creation
- Time of day and comparative measures

In iPeMS, member agencies can run user defined queries and statistical analysis for average speed and travel times. iPeMS processes data in real-time enabling queries of data for the last 5-minute period.

5.2 Access to iPeMS:

The iPeMS Website for Traffic Monitoring will provide password protected web-based tools to view real-time traffic and archived data. The system maintains an audit trail that stores
registered user access permissions and profile details in an internal iPeMS database. Agency logins from agencies that have selected HERE as their data provider will be automatically approved from a list of domains.

5.3 Hosting and Database Services

The website is scalable supported by a cloud-hosted model located on Amazon EC2 servers. The iPeMS system is monitored and tested to ensure continuity of service, application functionality and component function.

5.4 Data Collection and Storage

Data is gathered and transformed into the iPeMS schema and then stored in the database. iPeMS will populate data tables based on the data available from HERE, compute long-term trends from the data, store the link based TMC referenced data from HERE’s real-time data feed (TML), which is an aggregate of traffic data supported by floating GPS vehicle data and provides speeds and travel times that are associated to TMC and HERE’s mapping links.

5.5 Data Processing

The raw data measurements from HERE’s TML are processed to produce real-time and archived data that can be accessed through the website. Data that is stored in the website for monitoring traffic data is aggregated to 5-minute values per link as well as hourly and daily levels. Over space iPeMS aggregates data for defined links, along routes, and to geographical boundaries, like Counties or Districts to support a simplified operational dashboard, real-time monitoring features and link and route based historical reports.

5.6 Monitoring Website Features

The website provides speed data and displays real-time and historical speed and travel time data in a dashboard, map interface and route and link based reports. The website includes a map of the agency’s network showing detailed real-time and archived traffic data collected. The real-time measures and features that are available include average speeds, percentage of time below speed thresholds, long-term trends of speed and travel time, map tiles of traffic speeds, traffic speed anomalies, historical data values, and data quality. The map provides selectable links for real-time and historical data, savable ad-hoc route creation for time of day and comparative measures.

Data on the map includes real-time traffic speed in colored real-time speed tiles, historical speed tiles, and comparative speed tiles. Traffic speed links can be selected for link speed analysis and travel time data is available through a routes feature. The detailed traffic data is available in tables and on maps and reports that show traffic speed data and travel times over time series, time-of-day, and day-of-week reports.

5.7 Map and Report Based Speed Data Views

The following sections include example images displaying HERE based probe speed data that has been incorporated into iPeMS. These images illustrate the types of web tools that are available to agencies that sign up for HERE data through the I-95 Corridor Coalition.
Users of the iPeMS Traffic Monitoring Website will navigate to maps (web-tile overlays) that display real-time and historical views of data displaying different metrics at different time scales on top of the roads. In the web-based application the speeds are displayed on the iPeMS real-time map (5-min summary) and the colors represent the percentage of free-flow speed. Each sub-TMC is selectable on the map where the user can see a popup of current speed overlaid on historical speed averages and monthly ranges. Users can also see speeds on a historical performance map that displays monthly 5-min summary of traffic speeds and anomalies in real-time. The speed anomaly tiles will show the difference between the current speed and the historical speed for each link for the time of day.
TIME OF DAY – AVERAGE SPEED

5.8 Routes

The website includes route features where users can define routes through the transportation network on the fly using the routing service and placing markers on the map. Users can create a route between the markers by dragging the markers to change the route. Once the route is drawn, the user can see the current travel time of the route below the route and can navigate to see historical travel time data by time of day. The routes can be saved for more detailed analysis and shared with others.

ROUTE CREATION AND TRAVEL TIME
ROUTE CREATION VIEW

iPeMS provides a standard set of reports for displaying the real-time and archived data. These include: quantity versus time, versus time-of-day, versus day-of-week, two quantities against each other. As described above, Routes provide the ability to define through the user interface...
I-95 Implementation Guide

routes through the roadway network. iPeMS computes travel time over every route every 5 minutes and displays show plots of travel time versus time, time-of-day. The various ways to view real-time and archived traffic data includes:

- Spatial Analysis: Monthly and Daily Contours
- Plots: Travel time versus time, time of day and day of week. The time of day report includes various travel time reliability metrics.
- Spatial Aggregations: for regions and routes, the fraction of mile-hours spent in congestion (where congestion is based on a user-selectable value).

SPEED TIMESERIES GRAPH

CONTOUR PLOT: SPEEDS
5.9 Data Clearinghouse

To support the website features and services, iPeMS continuously stores HERE 1-minute and aggregated 5-minute speed and travel-time data for each day for each segment and direction. It then exports this to archive data files each night. The archive data will be provided through graphical display in the website and in downloadable data files through the iPeMS clearinghouse. In the clearinghouse, the data provided by HERE is available as exported 1-minute and 5-minute CSV files. The 5-minute data contains aggregated data and 1-minute data contains the raw data from HERE with all the fields contained in the real-time feed. The 5-minute data files contain additional data processed by Iteris. The picture below shows an example of the data clearinghouse that incorporates data from HERE.

IPEMS DATA CLEARINGHOUSE

5.10 Website Dashboards

The iPeMS Website for Traffic Monitoring Data also provides coalition members with a dynamic dashboard to support traffic operations and historical analysis. The real-time dashboard displays gauges, maps and graphs that change in real-time based on the changing conditions of the region that is being monitored.
5.10.1 Dashboard Gauges

iPeMS Dashboard Gauges provide dynamic measurement of traffic that change as the traffic data updates allowing operations staff to track the performance of the roadways in real-time. Each gauge has a background image that represents the historical range and the needle shows the current quantity compared to the historical range. The Bottlenecks graphics also show the worst bottlenecks in the region, the distance of the bottlenecks upon mouse over and the bottlenecks that are due to recurrent congestion and non-recurrent congestion. The dashboard also enables navigation by district or county. When a new region is selected, the map and gauges automatically change to the district and county level as the geography changes.
5.10.2 Time Line Graphs

The Daily Timeline graph lets users track the percentage of freeways with severe congestion compared to the historical range and tracks the amount of incidents historically compared to the current day. The graph includes the 25 and 75 percentile range and the statistic expands on mouse over. All the metrics help users understand how today’s traffic compares to other days.

![Timeline Graph]

**TIMELINE GRAPH**

5.10.3 Dashboard Maps

The iPeMS Dashboard map shows traffic speeds, traffic speed anomalies, traffic data quality and visualization of historical speed. The dashboard map provides automated visualizations with real-time and historical map features and the following pages show samples of the map visualizations and features.

- **Real-time Map**
  - 5-min summary where the colors represent the percentage of free-flow speed.
  - Users can switch layers from speeds to anomalies
  - Show or hide incidents (if they are provided to iPeMS)

- **Speed Animation**
  
  Users can move the historical slider to animate past congestion for +/- 24 hours that show past incidents with congestion (when incidents are provided to iPeMS) and show future congestion predictions.

- **Speed Anomalies**
  
  The real-time map can also display speed anomalies, which is the difference between the current speed and the historical speed for the link for this time of day.
6. Project Contact Information

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