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Connected Corridors: I-210 Pilot Integrated Corridor Management System

System Requirements Data Dictionary

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1. INTRODUCTION

This document provides the data dictionary for the Connected Corridors ICM system.

Note: This is a preview draft of the data dictionary. Typically, the data dictionary would be the result of system requirements, high-level design, subsystem requirements, and detailed design, with continuous updates as the system progresses through its lifecycle. With the size and complexity of the Connected Corridors ICM system, substantial changes can be expected from this initial draft. The primary purpose of this initial document is to create an initial framework from which the system data dictionary can be developed as the system is defined, developed, and implemented.

This initial draft accomplishes the following:

- Establishes the Transportation Management Data Dictionary (TMDD) as a standard for describing data transfer both with systems that provide information and within subsystems of the ICM system whenever applicable
- Provides an initial specification of the TMDD elements that are expected to be required for Connected Corridors
- Identifies a limited number of initial extensions to TMDD that will be necessary from the initial system requirements document
- Identifies types of data (from a review of the initial system requirements document) for which TMDD will not be appropriate, along with other specifications that may be more suitable for each type of data identified. Note that this document does not yet choose specific standards or specifications outside of TMDD, but rather recommends possible alternatives. As the system requirements and design process progresses, and more detail becomes available, it will then be appropriate to select from possible alternatives and provide additional detail regarding implementation of those standards and specifications.

The changes that can be expected as the system requirements and design processes continue include:

- Selection and identification of the specific standards and specifications for information not related to TMDD
- Details of implementation of those selected standards and specifications
- Additional data formatting and type information
- Subsystem data definition implementation details, where differences between subsystems may exist
- References to source system data specifications, where available
- References to target system data specifications, where available
- Details of data definition mappings between systems that provide or consume information to/from the ICM system

The Connected Corridors ICM system is fundamentally a data-driven system, with a significant volume of information from multiple systems located in multiple jurisdictions being received by the system for processing, decision support, traffic state determination, traffic prediction, status monitoring, control, storage, and system management. This data will include:

1. Corridor asset inventory describing the physical road, infrastructure such as intersection signals and ramp meters, sensors available, and organizational assets such as decision authorities and incidence response assets.
2. Corridor asset state information, indicating the current state of the corridor assets such as road condition, signal plans currently being implemented, and availability of incidence response assets.
3. Traffic data, characterizing the current state of traffic, including sensor data.
4. ICM traffic state and traffic forecast information.
5. ICM response plan information, including response plans developed, response plans implemented, response plan workflow and approval information, response plan execution results.
6. System rules used for creation, analysis, and implementation of response plans.
7. Corridor and system metrics and analysis results.
8. System information, such as system security data (users, roles, permissions), system maintenance data, data archives, system and user configuration information, system configuration management, and system activity logs.

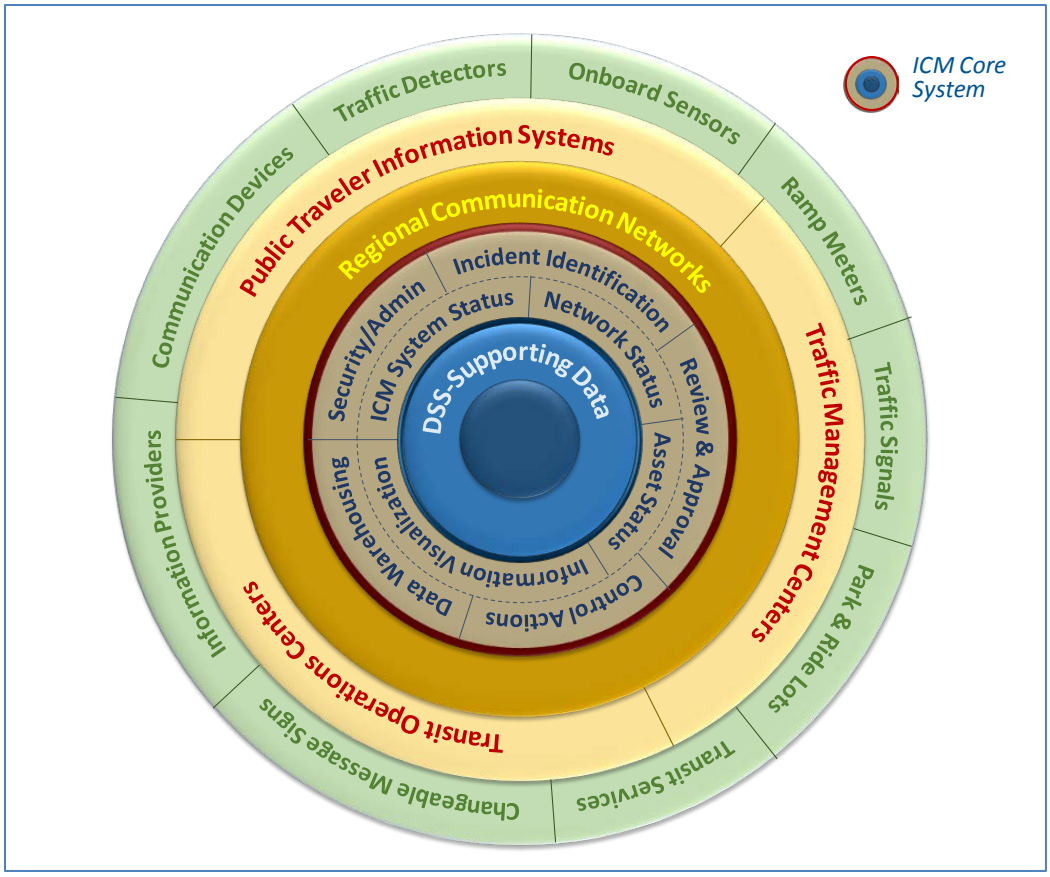

Figure 1 – High-Level ICM System Conceptual Diagram

Figure 1 provides a high-level concept view of the Connected Corridors ICM system. The ICM system consists of an ICM Core System that contains incident detection, corridor state/status functions, traffic state determination and prediction, system management functions, information visualization and reporting, decision support functions, data management functions, system management functions, response plan development, and corridor control functions.

The ICM Core System is part of the larger ICM Environment, which contains the primary systems that provide information to the ICM Core System and that consume the response plans from the ICM Core System. These ICM Environment elements include regional and local transportation communication networks and transportation management systems, public traveler information systems, the transportation network elements connected to those systems (sensors, ramp meters, intersection signals, organizational assets, changeable message signs, etc.), parking resources, and transit systems.

This document provides the following information for data within the ICM Core System and the ICM Environment:

1. Defines TMDD as the standard for data elements and Application Programming Interfaces (APIs) whenever applicable.
2. Defines which TMDD messages are required for system operation.
3. Lists and defines data classes and their attributes to be stored within the data hub (currently attributes for TMDD classes and expected extensions only).
4. Provides an inventory of current known sources of information for the system.

Note: This is a preliminary version of the document and is subject to revision as the design and development of the system progresses. It is expected that as the requirements and design process continues, significant additions and revisions will be required.

1.1. DOCUMENT ORGANIZATION

This document is organized into two primary sections:

- **Data Inventory**—The Data Inventory (section 2) lists, at a high level, the assets which are used in the I-210 Connected Corridors ICM project. Assets consist of elements such as physical roads, freeway sensors, changeable message signs, intersection signals, ramp meters, arterial traffic sensors, road maintenance crews, emergency personnel, and organizations.

- **Data Dictionary**—The Data Dictionary (section 3) specifies the data format specifications for data, the data elements and types, and the descriptions and definition of data elements within the system. The data classes, types, and their elements are organized in this document by a set of data layers that are distinguished by the function they perform within the system and the frequency by which the information is provided to or updated within the system. The Data Dictionary section provides information about the TMDD messages that are applicable to the specific data layer and the data contained within those messages. As the system requirements and design process continues, additional information about other types of data required, their specifications, and data storage details will be provided as well.

1.2. DATA LAYERS

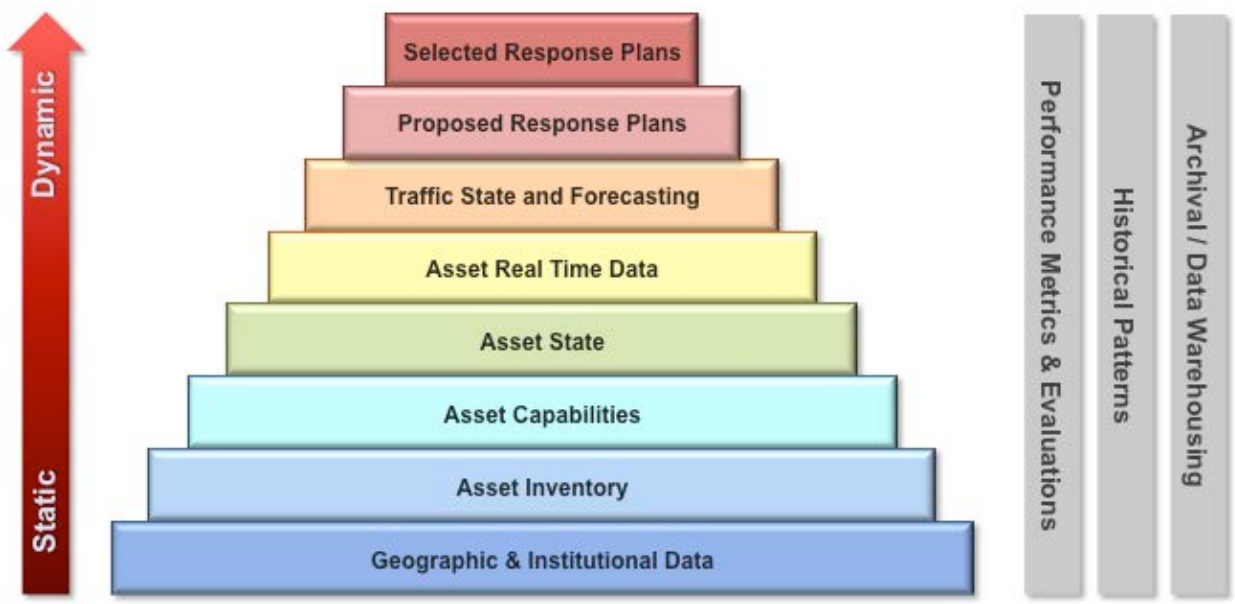

Figure 2 - Data Layers

To assist with categorization of the data, different types of data can be categorized into the data layers shown in Figure 2 and listed below, starting with the most static data and becoming progressively more dynamic. Primary data layers include the Geographic and Institutional Data, Asset Inventories, Asset Capabilities, Asset State, Asset Real-Time Data, Traffic State and Forecasting data, Proposed Response Plans, and Selected Response Plans. Cross-cutting and supporting data layers include those on the right of Figure 2, including Performance Metrics and Evaluations, Historical Pattern data, and Archive and Data Warehouse information.

1.2.1. Primary Data Layers

1.2.1.1. Geographic and Institutional Data

This layer includes base map information, geographic and geospatial information, political information, jurisdictional information, and organizational information at the highest institutional level.

1.2.1.2. Asset Inventory: Transportation Networks, Physical Infrastructure, Departments

This layer contains the transportation networks (roadways, transit, pedestrian) in the corridor and the assets (signals, ramp meters, sensors, etc.) within those networks. The assets are summarized by type in the inventory section of this document. Organizational Departmental Information is also contained in this layer.

1.2.1.3. Asset Capabilities: Signal Plans, Ramp Plans, Organizational Availability, and Traveler Behavior Information

This layer contains signal plan and ramp plan data associated with the assets in the physical infrastructure layer. It also contains traveler behavior information for the transportation networks: fundamental diagrams, demands and split ratios. It also contains working hours for response crews and other organizational assets.

1.2.1.4. Asset States

This layer contains the current status of each asset listed in the inventory, such as road closures or devices that are not working, or response crew availability.

1.2.1.5. Asset Real-Time Data

This layer contains the real-time data reported by each device or asset such as the data contained in the PeMS and IEN data feed, and requests to control assets in the corridor.

1.2.1.6. Traffic State and Traffic Forecasts

This layer contains the traffic state estimation and traffic forecast data.

1.2.1.7. Proposed Response Plans

This layer includes details of the proposed response plans, including the properties of each plan and model prediction results.

1.2.1.8. Selected Response Plan

This layer includes details of the selected response plan, regardless of whether the plan is implemented or not. It also includes the real-time implementation results of any deployed response plan.

1.2.2. Cross-cutting Layers

There are three categories of system data that cross multiple data layers: performance metrics and evaluation, historical patterns, and archival and data warehousing.

Note: These three layers, and in particular the historical patterns and archival data and warehousing are highly dependent and duplicative of the data in the other layers. As requirements and design processes for the ICM system development progress, additional sections will be added to this document to provide specifications for these layers. At this time, however, these layers are not being specified in this document.

1.2.2.1. Performance Metrics and Evaluations

In order to evaluate how well a selected response plan worked, performance metrics will be defined and stored in the system. The metrics of the selected response plan as well as the other proposed response plans can be evaluated and compared to each other and to the actual traffic that resulted after implementing the selected response plan. This layer will also include the information necessary for post-incident analysis as well as overall system performance analysis, either quarterly or annually.

1.2.2.2. Historical Patterns

Historical traffic patterns can be used to assist in developing scenarios for estimation, particularly in the areas of demands and split ratios.

1.2.2.3. Archival and Data Warehousing

The data warehouse will store the data coming into the ICM system. This data will feed the Decision Support System and will be used for the performance metrics and historical patterns described above. It can also be used for reporting and other analysis as needed.

1.3. ADDITIONAL LAYERS AND INFORMATION

There are additional sections in this document that describe both common base data elements (Global Data Elements) that are used throughout the different layers, and data classes that are used by the system itself (System Data Classes) and do not represent traffic entities.

2. DATA INVENTORY

This section identifies the data sources that may be used to support the operation of the ICM System.

Data Category	Data Type	Source Agency	Source System/Individual
Incidents and Events	Incident Reports	CHP	• Computer Aided Dispatch (CAD) System • Traffic Incident Information Webpage (Sigalerts)
		FSP	• ???
		County Sheriff	• ???
		Pasadena PD	• Pasadena Traffic Record System
		Arcadia PD	• ???
		Monrovia PD	• ???
		Duarte PD	• ???
		Verdugo Fire Communications Center	• Verdugo Fire Communications CAD
		Waze?	• *Crowdsourced reported incidents???*
	Lane closures/ Special events	Caltrans	• Lane Closure System (LCS)
		LA County	• *None*
		Pasadena	• *None*
		Arcadia	• *None*
		Monrovia	• *None*
		Duarte	• *None*
Traffic Counts	Freeway traffic counts	Caltrans	• PeMS
	Intersection Approach/turning counts	Caltrans	• TSMSS
		LA County	• KITS Traffic Management System
		Pasadena	• i2 Traffic Management System • QuickNet Traffic Management System • SCATS Traffic Management System
		Arcadia	• TransSuite Traffic Management System
		Monrovia	• LA County's KITS Traffic Management System
		Duarte	• LA County's KITS Traffic Management System
Travel Times	Travel time measurements	Caltrans	• *None*
		LA County	• *None*
		Pasadena	• Digiwest BlueMAC Bluetooth sensor network
		Arcadia	• Iteris Vantage Velocity Bluetooth

Data Category	Data Type	Source Agency	Source System/Individual
			sensor network
		Monrovia	• *None*
		Duarte	• *None*
	Travel time estimates	Caltrans	• PeMS
Speed	Average link speeds	Metro/SCAG	• INRIX database
	Point measurements	HERE	• HERE vehicle tracking data
Route Patterns	Vehicle tracking	HERE	• HERE vehicle tracking data
		Google/Waze?	• Vehicle tracking system?
Traffic Signals	Signal operational status (active plan/phase, cycle length, offset, etc.)	Caltrans	• TSMSS
		LA County	• KITS Traffic Management System
		Pasadena	• i2 Traffic Management System • QuickNet Traffic Management System • SCATS Traffic Management System
		Arcadia	• TransSuite Traffic Management System
		Monrovia	• LA County KITS Traffic Management System
		Duarte	• LA County KITS Traffic Management System
	Ramp metering plan/rates	Caltrans	• ATMS
Video Data	CCTV Feeds	Caltrans	• ATMS
		LA County	• 1 camera (COHU)
		Pasadena	• COHU Videowise Management Software
		Arcadia	• TransCore video web application
		Monrovia	• *2 cameras*
		Duarte	• *None*
Messaging	CMS status	Caltrans	• Caltrans ATMS
		LA County	• *None*
		Pasadena	• *McCain (4 signs)* • *Skyline (1 sign)* • *Daktronics (Future signs)*
		Arcadia	• *None*
		Monrovia	• *None*
		Duarte	• *None*
Transit Data	Transit Operations	Metro	• Metro Bus CAD/AVL • Metro Rail CAD/AVL
		Foothill Transit	• Foothill Transit CAD/AVL
		Pasadena Transit	• Pasadena Transit CAD/AVL

Data Category	Data Type	Source Agency	Source System/Individual
Parking Data	Parking Occupancy		• *Any facility?*
Weather Data	Weather Information		• Weather stations installed within I-210 corridor • *Data from which weather system?*

TSMSS – Traffic Signal Management and Surveillance Systems

3. DATA DICTIONARY

This data dictionary provides basic data class descriptions for ICM data objects. It is broken down by the layers described in Figure 2 - Data Layers. Generic data elements that are frequently referenced as data types within the primary classes are included in a section for Global Data Elements.

3.1. GLOBAL DATA ELEMENTS

The Global Data elements provide a set of base data elements that are often referenced in multiple data layers and provide common data elements such as time, person, or location information for different data classes.

3.1.1. DateTimeZone

This data frame is used to describe date and time information, including time zone information. This is the same as the DateTimeZone data frame described in TMDD 3.3.10.1.

Attribute Name	Type/Element	Reference
Date	Element	
Time	Element	
Offset	Element	

3.1.2. ContactDetails

This data frame contains contact information for a specific person but it can also be used for a group.

This is the same as the ContactDetails data frame described in TMDD 3.3.16.1.

Attribute Name	Type/Element	Reference
Contact-Id	Element	
Person-Name	Element	
Person-Title	Element	
Phone-Number	Element	
Phone-Alternate	Element	
Mobile-Phone-Number	Element	
Mobile-Phone-Id	Element	
Fax-Number	Element	
Pager-Number	Element	

Attribute Name	Type/Element	Reference
Pager-Id	Element	
Email-Address	Element	
Radio-Unit	Element	
Address-Line1	Element	
Address-Line2	Element	
City	Element	
State	Element	
Zip-Code	Element	
Country	Element	

3.1.3. GeoLocation

This data frame specifies the geographic location of a device, building or any other object.

This is the same as the GeoLocation data frame described in TMDD 3.6.9.4.

Attribute Name	Type/Element	Reference
Latitude	Element	
Longitude	Element	
Horizontal-Datum	Element	
Height	Type: Height	TMDD 3.6.9.5

3.1.4. Height

This data frame specifies the height of an object and is the same as the Height data frame described in TMDD 3.6.9.5.

Attribute Name	Type/Element	Reference
Altitude	Element	
Verticaldatum	Element	
Verticallevel	Element	

3.1.5. UrlReference

This data frame specifies a uniform resource locator and is the same as the UrlReference data frame described in TMDD 3.3.10.2.

Attribute Name	Type/Element	Reference
Url-Reference	Element	
Url-Reference-Medium	Element	

3.1.6. BoundingBox

This is an extended data frame which contains the dimensions of a bounding box as well-known text. It is used to define a zone-of-influence for an event per System Requirements specs 8.4.5, 8.4.4 and 8.5.2.4.

Attribute Name	Type/Element	Reference
Bounding-Box-Wkt	Element: well-known-text	

3.1.7. LinkRestrictions

This is an extended data frame which contains additional attributes for a link.

Attribute Name	Type/Element	Reference	Description
Time-Restrictions	Type: TBD	System Requirements spec 8.5.2.3	Times during which links are not available for detours such as when children are walking to/from schools or arterials are heavily travelled by buses.
HOV-Lane-Count	Element: Number of HOV lanes	System Requirements spec 8.7.1.2	For freeway segment, on-ramp or freeway-to-freeway connector
HOV-Restriction-Type	Element: 2+ or 3+ occupants	System Requirements spec 8.7.1.2	For freeway segment, on-ramp or freeway-to-freeway connector

Attribute Name	Type/Element	Reference	Description
HOV-Time-Restrictions	Type: TBD	System Requirements spec 8.7.1.2	For freeway segment, on-ramp or freeway-to-freeway connector: Periods during which HOV restriction is in effect

3.2. LAYER: GEOGRAPHIC AND INSTITUTIONAL DATA

Geographic and Institutional data includes information regarding:

- Geographic and institutional boundaries
- Organizational information, including listings and details regarding organizations and individuals
- Ownership information
- Map- and location-based information

Figure 3 - Geographic & Institutional Layer

3.2.1. Data Messages

TMDD Message Dialogs include the following:

Name	Reference	Description
dlOrganizationInformationRequest	TMDD 3.1.15.1	Request for Organization and Center Information
dlOrganizationInformationSubscription	TMDD 3.1.15.2	Request for subscription to updates to Organization and Center Information

Other messaging dialogs required include the following:

Name	Reference	Description
Maps API	Google Maps API (https://developers.google.com/maps/documentation/javascript/reference?hl=en) or HERE Maps API (https://developer.here.com/documentation)	Requests for mapping tile and map based information for display
Map Information	Map information subscription	Downloaded updates for map and geospatial information required for Decision Support System

3.2.2. Data Class Descriptions

Data Class Descriptions include data elements for basic objects. Classes may be referenced within other classes (parent classes), and may be referenced in multiple parent classes. These do not represent database structures, but instead are based primarily on TMDD, or are structured similarly. Database design is expected to occur during system design.

3.2.2.1. Organization Class

3.2.2.1.1. OrganizationCenterInformation

This provides information for an organization center and is the same as the OrganizationCenterInformation data frame in TMDD 3.3.16.2.

Attribute Name	Type/Element	Reference
Center-Id	Element	
Center-Name	Element	
Center-Location	Type: GeoLocation	TMDD 3.6.9.4
Center-Description	Element	
Center-Type	Element	

Attribute Name	Type/Element	Reference
Center-Contact-Details	Type: Contact Details	TMDD 3.3.16.1

3.2.2.1.2. OrganizationInformation

The organization class can specify organizations, departments, teams, crews, etc. An organization can also specify a parent organization so that a hierarchy can be defined.

This provides basic Organization information and is similar to the OrganizationInformation data frame in TMDD 3.3.16.3 with the addition of the Parent-Organization element.

Attribute Name	Type/Element	Reference
Organization-Id	Element	
Organization-Name	Element	
Organization-Location	Element	
Organization-Function	Element	
Organization-Contact-Details	Type: Contact Details	TMDD 3.3.16.1
Center-Contact-List	Type: Sequence of "Organization Center Information" types	TMDD 3.3.16.3
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Parent-Organization	Element	

3.3. LAYER: ASSET INVENTORY

Asset Inventory includes the following:

- Road inventory
- Transit inventory, including types and routes
- Pedestrian walkways and thoroughfares
- Ramp meters
- Intersection signals
- Dynamic Message Signs
- Environmental Sensors?
- Gates
- CCTV/Video assets
- HAR Radio assets
- Physical sensors
- Organizational assets – organizational departments and their assets, including groups, service vehicles, maintenance crews, incident response crews, traffic engineers, control centers, emergency and first responders

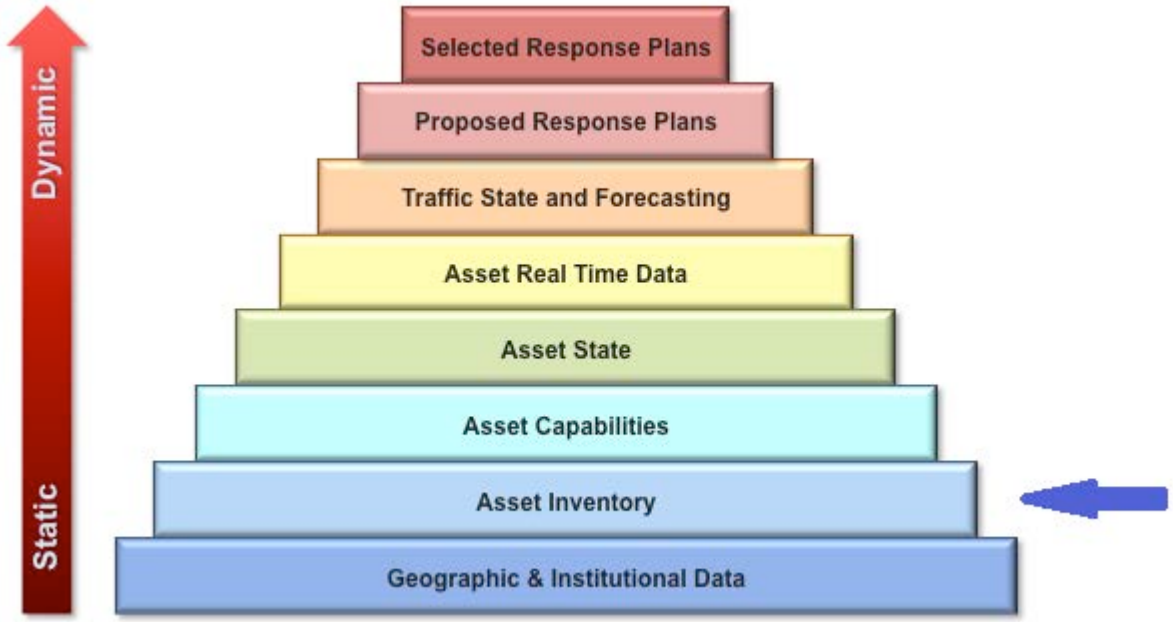

Figure 4 - Asset Inventory Layer

3.3.1. Data Messages

TMDD Message Dialogs include the following:

Name	Reference	Description
dlCCTVInventoryRequest	TMDD 3.1.2.1	Request for inventory of CCTVs
dlDetectorInventoryRequest	TMDD 3.1.4.1	Request for inventory of detectors and sensors
dlDeviceInformationSubscription	TMDD 3.1.5.3	Request for updates for device inventory
dlDMSInventoryRequest	TMDD 3.1.6.1	Request for inventory of dynamic message signs
dlESSInventoryRequest	TMDD 3.1.7.1	Request for inventory of environmental sensors
dlHARInventroyRequest	TMDD 3.1.10.1	Request for inventory of highway advisory radios
dlIntersectionSignalInventoryRequest	TMDD 3.1.11.1	Request for inventory of intersection signals
dlLCSInventoryRequest	TMDD 3.1.12.1	Request for inventory of lane control signals
dlLinkInventoryRequest	TMDD 3.1.13.1	Request for traffic network links
dlNodeInventoryRequest	TMDD 3.1.14.1	Request for traffic network nodes
dlOrganizationInformationRequest	TMDD 3.1.15.1	Request for Organization and Center Information
dlOrganizationInformationSubscription	TMDD 3.1.15.2	Request for subscription to updates to Organization and Center Information
dlRampMeterInventoryRequest	TMDD 3.1.16.1	Request for ramp meter inventory
dlRouteInventoryRequest	TMDD 3.1.17.1	Request for traffic route inventory
dlTrafficNetworkInformationSubscription	TMDD 3.1.19.1	Request for subscription to information updates for network links, nodes, and routes
dlVideoSwitchInventoryRequest	TMDD 3.1.20.1	
dlCCTVInventoryUpdate	TMDD 3.1.21.1	
dlDetectorInventoryUpdate	TMDD 3.1.23.1	
dlDMSInventoryUpdate	TMDD 3.1.24.1	
dlESSInventoryUpdate	TMDD 3.1.25.1	
dlHARInventoryUpdate	TMDD 3.1.28.1	
dlIntersectionSignalInventoryUpdate	TMDD 3.1.29.1	
dlLCSInventoryUpdate	TMDD 3.1.30.1	
dlOrganizationInformationUpdate	TMDD 3.1.31.1	
dlRampMeterInventoryUpdate	TMDD 3.1.32.1	
dlLinkInventoryUpdate	TMDD 3.1.34.1	
dlNodeInventoryUpdate	TMDD 3.1.35.1	
dlRouteInventoryUpdate	TMDD 3.1.36.1	
dlVideoSwitchInventoryUpdate	TMDD 3.1.37.1	

Other messaging dialogs required include the following:

Name	Reference	Description
PARKING FACILITY	APTA TCIP-S-001 4.1.1 * or ISO/TS 18234-7:2013 **	Inventory for parking facilities including capacity, location, facility operator, whether a parking availability monitoring system is used. System Requirements specs 8.2.3, 8.2.6, 8.7.1.2
TRANSIT	APTA TCIP-S-001 4.1.1 *	Inventory for transit services

* American Public Transportation Association Standard for Transit Communications Interface Profiles

** Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format -- Part 7: Parking information (TPEG1-PKI)

3.3.2. Data Class Descriptions

3.3.2.1. CCTV Class

3.3.2.1.1. CCTVInventory

This provides information for a CCTV asset and is the same as the CCTVInventory data frame in TMDD 3.3.2.3.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Cctv-Requests-Supported-List	Element: Sequence of "Cctv-request-command" types	
Cctv-Image-List	Element	
Cctv-Titling-Text	Element	
Cctv-Camera-Type	Element	
Cctv-Camera-Pan-Left-Limit	Element	
Cctv-Camera-Pan-Right-Limit	Element	
Cctv-Camera-Tilt-Up-Limit	Element	
Cctv-Camera-Tilt-Down-Limit	Element	
Cctv-Camera-Zoom-Limit	Element	
Cctv-Camera-Focus-Limit	Element	
Cctv-Camera-Iris-Limit	Element	
Cctv-Camera-Environmental	Element	

3.3.2.2. ConnectionManagement Class

3.3.2.2.1. Authentication

This provides authentication information and is the same as the Authentication data frame in TMDD 3.3.3.1.

Attribute Name	Type/Element	Reference
User-Id	Element	
Password	Element	
Operator-Id	Element	

3.3.2.3. Detector Class

3.3.2.3.1. DetectorInventory

This provides detector information and is the same as the DetectorInventory data frame in TMDD 3.3.4.4.

Attribute Name	Type/Element	Reference
Detector-Station-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Detector-Inventory-List	Type: Sequence of "DetectorInventoryDetails" types	TMDD 3.3.4.5

3.3.2.3.2. DetectorInventoryDetails

This provides detector detail for a single detector and is based on the DetectorInventoryDetails data frame in TMDD 3.3.4.5.

Attribute Name	Type/Element	Reference	Description
Detector-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8	
Detector-Type	Element		
Detection-Lanes	Element: Sequence of "Link-lane-number" types		
Is-Detector-Speed-Trap-Flag	Element		
Vehicle-Classification-Bin1	Element		

Attribute Name	Type/Element	Reference	Description
Vehicle-Classification-Bin2	Element		
Vehicle-Classification-Bin3	Element		
Vehicle-Classification-Bin4	Element		
Vehicle-Classification-Bin5	Element		
Vehicle-Classification-Bin6	Element		
Reporting-System	Element: Name of reporting system	System Requirements spec 8.7.1.2	For devices used to monitor traffic flow or travel time data, this is the name of the reporting system to which the sensor is connected.

3.3.2.3.3. DetectorMaintenanceHistory

This provides detector maintenance information and is the same as the DetectorMaintenanceHistory data frame in TMDD 3.3.4.6.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Detector-History-List	Type: Sequence of "DetectorMaintenance HistoryDetail" types	TMDD 3.3.4.7

3.3.2.3.4. DetectorMaintenanceHistoryDetail

This provides detector maintenance detail information and is the same as the DetectorMaintenanceHistoryDetail data frame in TMDD 3.3.4.7.

Attribute Name	Type/Element	Reference
Station-Id	Element	
Detector-Id	Element	
Detector-Type	Element	
Detector-Installation-Date	Type: DateTimeZone	TMDD 3.3.10.1
Detector-Calibration-Date	Type: DateTimeZone	TMDD 3.3.10.1
Detector-Calibration-Method	Element	
Detector-Last-Operational-Date	Type: DateTimeZone	TMDD 3.3.10.1
Detector-Last-Non-Operational-Date	Type: DateTimeZone	TMDD 3.3.10.1
Detector-Repair-Description	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.3.2.3.4.1. PeMSStation

The freeway detector station data is stored in the data warehouse in a table called PEMS_VD_STATIONS which has one record for each station.

PEMS_VD_STATIONS table layout:

Column Name	Data Type	Description of stored value
ID	BigInt	The unique ID for this PEMS VDS Station
FWY_NUM	Integer	Numeric value for the freeway that this detector is located on.
DIRECTION	Character	A one byte char value indicating a cardinal heading.
DISTRICT	Numeric	The caltrans distric number.
COUNTY	Numeric	The numeric value of the county as defined is the FIPS county table.
CITY	Numeric	The numeric value of the city as defined is the FIPS city table.
STATE_PM	Numeric	The State Post Miles. The postmile starts at zero at the western or southern end of the route or at the western or southern boundary of the county through which the route is traveling.
STATE_PM_CODE	Character Varying	The State Post Miles Code.
ABS_PM	Numeric	The State Post Miles. This number normally represents the distance from the freeway or highway origination or from the border of the state.
LATITUDE	Numeric	Latitude in decimal degrees.
LONGITUDE	Numeric	longitude in decimal degrees.
ADJ_LATITUDE	Numeric	The *ADJUSTED* latitude in decimal degrees.
ADJ_LONGITUDE	Numeric	The *ADJUSTED* longitude in decimal degrees.
DET_LENGTH	Numeric	The length of the detector
DET_TYPE	Character	Type of detector eg: ML, OR, FR
LANES	Numeric	Number of lanes this detector covers.
DET_NAME	Character Varying	This is generally the exit ramp street from the freeway
USER_ID_1	Character Varying	User Defined Data
USER_ID_2	Character Varying	User Defined Data
USER_ID_3	Character Varying	User Defined Data
USER_ID_4	Character Varying	User Defined Data
PEMS_REV_DATE	Date	

Column Name	Data Type	Description of stored value
GEOM	Geometry	The spatial location POINT(x,y,z) that is detector is located.
ADJ_GEOM	Geometry	The * ADJUSTED* spatial location POINT(x,y,z) that is detector is located.

The database also contains two reference tables for the cities and counties in the corridor. Each city name is associated with a unique numeric ID that is stored in the PEMS_VD_STATIONS_CITIES table. Similarly, Each county name is associated with a unique numeric ID that is stored in the PEMS_VD_STATIONS_COUNTIES table. When station data is stored in the PEMS_VD_STATIONS table the numeric ID's of the city and county are stored instead of the city and county names.

PEMS_VD_STATIONS_CITIES table layout:

Column Name	Data Type	Description of stored value
ID	Numeric	Unique ID for a city in the corridor
NAME	Character Varying	Name of the city

PEMS_VD_STATIONS_COUNTIES table layout:

Column Name	Data Type	Description of stored value
ID	Numeric	Unique ID for a county in the corridor
NAME	Character Varying	Name of the county

3.3.2.4. DMS Class

3.3.2.4.1. DMSInventory

This provides dynamic message sign device information and is based on the DMSInventory data frame in TMDD 3.3.6.6.

Attribute Name	Type/Element	Reference	Description
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8	
Dms-Sign-Type	Element		
Signtechnology	Element		
Signheightpixels	Element		
Signwidthpixels	Element		
Signheight	Element		
Signwidth	Element		

Attribute Name	Type/Element	Reference	Description
Charheightpixels	Element		
Charwidthpixels	Element		
Dms-Beacon-Type	Element		
Dms-Vertical-Border	Element		
Dms-Horizontal-Border	Element		
Dms-Vertical-Pixel-Pitch	Element		
Dms-Horizontal-Pixel-Pitch	Element		
Dms-Max-Pages	Element		
Dms-Max-Message-Length	Element		
Dms-Color-Scheme	Element		
Dms-Multi-Tag-Support	Element		
Display-Line-Count	Element: Number of display lines	System Requirements spec 8.7.1.2	For each fixed CMS that may be used by the ICM system to disseminate information to travelers
Character-Per-Line-Count	Element: Total number of characters that can be displayed per line	System Requirements spec 8.7.1.2	For each fixed CMS that may be used by the ICM system to disseminate information to travelers

3.3.2.5. ESS Class

3.3.2.5.1. ESSInventory

This provides environmental sensor device information and is the same as the ESSInventory data frame in TMDD 3.3.7.4.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Ess-Inventory-List	Type: Sequence of "ESSInventoryDetails" types	TMDD 3.3.7.5

3.3.2.5.2. ESSInventoryDetails

This provides details of environmental sensor inventory for a single sensor and is the same as the ESSInventoryDetails data frame in TMDD 3.3.7.5.

Attribute Name	Type/Element	Reference
Ess-Sensor-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Lane-Number	Element	
Sensor-Location-Elevation	Element	
Sensor-Location-Height	Element	
Sensor-Type	Element	
Sensor-Operation-Type	Element	
Sensor-Mobility-Type	Element	
Ess-Sensor-Inventory-Header	Element	

3.3.2.5.3. ESSDataCollectorInformation

This provides environmental sensor collector metadata and is the same as the ESSDataCollectorInformation data frame in TMDD 3.3.7.2.

Attribute Name	Type/Element	Reference
Data-Collector-Description	Element	
Data-Collector-Installation-Date	Type: DateTimeZone	TMDD 3.3.10.1
Data-Collector-Manufacturer	Element	
Data-Collector-Product-Name	Element	
Data-Collector-Model-Number-Software-Version	Element	

3.3.2.5.4. ESSSiteMetadataDetail

This provides environmental site metadata is the same as the ESSSiteMetadataDetail data frame in TMDD 3.3.7.14.

Attribute Name	Type/Element	Reference
Site-Id	Element	
Site-Description	Element	
Site-Directions-Description	Element	
Site-Representativeness	Element	
Site-Obstructions-Description	Element	
Site-Landscape-Description	Element	
Site-Has-Access-Control-Flag	Element	
Site-Roadway-Name	Element	

Attribute Name	Type/Element	Reference
Site-Roadway-Linear-Reference	Element	
Site-Roadway-Linear-Reference-Version	Element	
Site-Roadway-Linear-Reference-Units	Element	
Site-Roadway-To-Station-Distance	Element	
Site-Roadway-To-Station-Elevation	Element	
Site-Jurisdiction-Name	Element	
Site-State-Code	Element	
Site-Country-Code	Element	
Site-Slope-Angle	Element	
Site-Grade-Direction	Element	
Site-Wind-Roughness-From-North	Element	
Site-Wind-Roughness-From-South	Element	
Site-Wind-Roughness-From-East	Element	
Site-Wind-Roughness-From-West	Element	
Site-Soil-Description	Element	
Site-Soil-Percent-Sand	Element	
Site-Soil-Percent-Silt	Element	
Site-Soil-Percent-Clay	Element	

3.3.2.5.5. ESSStationMetadataDetail

This provides environmental sensor station metadata and is the same as the ESSStationMetadataDetail data frame in TMDD 3.3.7.15.

Attribute Name	Type/Element	Reference
Station-Category	Element	
Station-Id	Element	
Station-Location	Type: GeoLocation	TMDD 3.6.9.4
Station-Elevation	Element	
Station-Description	Element	
Station-Type	Element	
Station-Horizontal-Datum	Element	
Station-Vertical-Datum	Element	
Station-Power-Source	Element	
Station-Door-Status	Element	
Station-Battery-Status	Element	
Station-Line-Volts	Element	
Station-Maintenance-Group-Name	Element	
Station-Maintenance-Contact-Information	Type: Contact Details	TMDD 3.3.16.1
Station-Maintenance-Frequency	Element	
Station-Maintenance-Calibration-Frequency	Element	
Station-Maintenance-Status	Element	

Attribute Name	Type/Element	Reference
Station-Installation-Date	Type: DateTimeZone	TMDD 3.3.10.1
Station-Number-Of-Devices	Element	
Station-Comm-Method	Element	
Station-Telephone-Number	Element	
Station-Ip-Address	Element	
Station-Manufacturer	Element	
Station-Observation-Collection-Frequency	Element	
Station-Observation-Collection-Offset	Element	
Station-Transmission-Frequency	Element	
Station-Transmission-Offset	Element	
Station-Transmission-Format	Element	

3.3.2.5.6. ESSSensorMetadataDetail

This provides environmental sensor metadata and is the same as the ESSSensorMetadataDetail data frame in TMDD 3.3.7.12.

Attribute Name	Type/Element	Reference
Station-Id	Element	
Sensor-Id	Element	
Sensor-Description	Element	
Sensor-Information-Distribution-Group	Element	
Sensor-Installation-Date	Element	
Ess-Observation-Type	Element	
Sensor-Min-Value-Range	Element	
Sensor-Max-Value-Range	Element	
Sensor-Manufacturer	Element	
Sensor-Model-Number	Element	
Sensor-Index	Element	
Sensor-Rate-Of-Change-Interval	Element	
Sensor-Max-Positive-Rate-Of-Change	Element	
Sensor-Max-Negative-Rate-Of-Change	Element	
Sensor-Persistence-Interval	Element	
Sensor-Persistence-Threshhold	Element	
Sensor-Like-Instrument-Threshhold	Element	
Sensor-Maintenance-Calibration-Date	Element	
Sensor-Last-Maintenance-Date	Element	
Sensor-Serial-Number	Element	
Sensor-Resolution	Element	
Sensor-Accuracy	Element	
Sensor-Min-Value-Output	Element	
Sensor-Max-Value-Output	Element	
Sensor-To-Station-North-South-Offset	Element	
Sensor-To-Station-East-West-Offset	Element	

Attribute Name	Type/Element	Reference
Sensor-To-Station-Elevation-Offset	Element	
Sensor-To-Surface-Elevation-Offset	Element	
Sensor-Embedded-Material-Description	Element	
Sensor-Output-Average-Interval	Element	
Sensor-Output-Internal-Units	Element	
Sensor-Last-Out-Of-Service-Begin-Date-Time	Element	
Sensor-Last-Out-Of-Service-End-Date-Time	Element	
Sensor-Sampling-Interval	Element	

3.3.2.6. HAR Class

3.3.2.6.1. HARInventory

This provides HAR attribute information is the same as the HARInventory data frame in TMDD 3.3.11.4.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Device-Beacon	Element	
Har-Characteristics	Element	
Har-Frequency-Description	Element	
Har-Call-Sign	Element	

3.3.2.7. IntersectionSignal Class

3.3.2.7.1. IntersectionSignalInventory

This provides information for a single intersection signal device and is based on the IntersectionSignalInventory data frame in TMDD 3.3.12.5.

Attribute Name	Type/Element	Reference	Description
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8	
Intersection-Name	Element		
Controller-Master-Id	Element		
Intersection-Link-List	Type: Sequence of "IntersectionSignal InventoryLinkList" types	TMDD 3.3.12.6	

Attribute Name	Type/Element	Reference	Description
Movement-List	Type: Sequence of "IntersectionSignalMovement" types	TMDD 3.3.12.8	
Phase-List	Type: Sequence of "IntersectionSignal InventoryPhase" types	TMDD 3.3.12.7	
Overlap-Phase-List	Type: Sequence of "IntersectionSignalOverlapPhase" types	TMDD 3.3.12.9	
Ring-List	Type: Sequence of "IntersectionSignalRing" types	TMDD 3.3.12.14	
Special-Functions-List	Type: Sequence of "IntersectionSignal SpecialFunctions" types	TMDD 3.3.12.17	
Time-Reference-Code	Element		
Pattern-Sync-Reference	Element		
Signal-Controller-Type	Element: Type of signal controller used	System Requirements specs 8.7.1.2 and 8.7.1.3	For each signalized intersection under ICM management
Signal-Controller-Firmware	Element: Name of controller firmware	System Requirements spec 8.7.1.2	For each signalized intersection under ICM management

3.3.2.7.2. IntersectionSignalInventoryLinkList

This provides the intersection signal link information and is the same as the IntersectionSignalInventoryLinkList data frame in TMDD 3.3.12.6.

Attribute Name	Type/Element	Reference
Link-Id	Element	
Link-Direction	Element	

3.3.2.7.3. IntersectionSignalInventoryPhase

This provides intersection signal phase information and is the same as the IntersectionSignalInventoryPhase data frame in TMDD 3.3.12.7.

Attribute Name	Type/Element	Reference
Phase-Identifier	Element	
Coordinated-Phase	Element	
Concurrent-Phases-List	Element: Sequence of "NTCIP.PhaseNumber" types	
Active-Movements-List	Element: Sequence of "Organization-resource-identifier" types	

3.3.2.7.4. IntersectionSignalMovement

This provides intersection signal movement information and is the same as the IntersectionSignalMovement data frame in TMDD 3.3.12.8.

Attribute Name	Type/Element	Reference
Movement-Identifier	Element	
Approach-Link-Id	Element	
Departing-Link-Id	Element	
Crossing-Point	Type: GeoLocation	TMDD 3.6.9.4
Approach-Vector	Element	
Turning-Movement-Code	Element	
Turning-Movement-Lanes	Element: Sequence of "Organization Center Information" types	
Turning-Movement-Text	Element	

3.3.2.7.5. IntersectionSignalOverlapPhase

This provides intersection signal overlap phase information and is the same as the IntersectionSignalOverlapPhase data frame in TMDD 3.3.12.9.

Attribute Name	Type/Element	Reference
Overlap-Identifier	Element	
Overlap-Included-Phases	Element: Sequence of "NTCIP.PhaseNumber" types	
Active-Movements-List	Element: Sequence of "Organization-resource-identifier" types	

3.3.2.7.6. IntersectionSignalRing

This provides intersection signal ring information and is the same as the IntersectionSignalRing data frame in TMDD 3.3.12.14.

Attribute Name	Type/Element	Reference
Ring-Identifier	Element	
Ring-Phase-Assignment	Element: Sequence of "NTCIP.PhaseNumber" types	

3.3.2.7.7. IntersectionSignalSequenceData

This provides intersection signal ring phase sequence information and is the same as the IntersectionSignalSequenceData data frame in TMDD 3.3.12.16.

Attribute Name	Type/Element	Reference
Ring-Identifier	Element	
Sequence-Data	Element: Sequence of "NTCIP.PhaseNumber" types	

3.3.2.7.8. IntersectionSignalSpecialFunctions

This provides intersection signal controller special functions and is the same as the IntersectionSignalSpecialFunctions data frame in TMDD 3.3.12.17.

Attribute Name	Type/Element	Reference
Special-Function-Identifier	Element	
Special-Function-Description	Element	

3.3.2.8. LCS Class

3.3.2.8.1. LCSInventory

This provides information for an LCS device in the LCS inventory is the same as the LCSInventory data frame in TMDD 3.3.13.3.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Controlled-Lane-Number	Element	
Link-Lane-Count	Element	

3.3.2.9. Link Class

3.3.2.9.1. LinkInventory

This provides information for the inventory of road network links. This is the same as the LinkInventory data frame in TMDD 3.3.14.2.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Link-Inventory-List	Type: Sequence of "LinkInventoryList" types	TMDD 3.3.14.3

3.3.2.9.2. LinkInventoryList

This provides information for a single link within the link inventory. This is based on the LinkInventoryList data frame in TMDD 3.3.14.3.

Attribute Name	Type/Element	Reference	Description
Network-Id	Element		
Network-Name	Element		
Link-Id	Element		
Link-Name	Element		
Alternate-Link-Name	Element		
Link-Route-Designator	Element		
Secondary-Link-Route-Designator	Element		
Link-Type	Element		
Link-Begin-Node-Id	Element		

Attribute Name	Type/Element	Reference	Description
Link-Begin-Node-Location	Type: GeoLocation	TMDD 3.6.9.4	
Link-End-Node-Id	Element		
Link-End-Node-Location	Type: GeoLocation	TMDD 3.6.9.4	
Linear-Reference	Element		
Linear-Reference-Version	Element		
Link-Length	Element		
Link-Capacity	Element		
Link-Speed-Limit	Element		
Link-Speed-Limit-Truck	Element		
Link-Speed-Limit-Units	Element		
Link-Jurisdiction	Element		
Link-Owner	Element		
Left-Shoulder-Width	Element		
Right-Shoulder-Width	Element		
Lane-Separator	Element		
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1	
Link-Restrictions	Type: LinkRestrictions	Custom type; see Global Data Elements	Times during which links are not available for detours such as when children are walking to/from schools or arterials are heavily travelled by buses.
Left-Turn-Bay-Length	Element: Length of turn bay	System Requirements spec 8.7.1.2	For approach to a signalized intersection under ICM management
Right-Turn-Bay-Length	Element: Length of turn bay	System Requirements spec 8.7.1.2	For approach to a signalized intersection under ICM management

3.3.2.10. Node Class

3.3.2.10.1. NodeInventory

This provides information for the inventory of road network nodes. This is the same as the NodeInventory data frame in TMDD 3.3.15.1.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5

Attribute Name	Type/Element	Reference
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Node-Inventory-List	Type: Sequence of "NodeInventoryList" types	TMDD 3.3.15.2

3.3.2.10.2. NodeInventoryList

This provides information for a single node within the node inventory. This is the same as the NodeInventoryList data frame in TMDD 3.3.15.2.

Attribute Name	Type/Element	Reference
Network-Id	Element	
Network-Name	Element	
Node-Id	Element	
Node-Name	Element	
Node-Description	Element	
Node-Route-Designator	Element	
Node-Direction	Element	
Linear-Reference	Element	
Linear-Reference-Version	Element	
Node-Type	Element	
Node-Location	Type: GeoLocation	TMDD 3.6.9.4
Node-Links-Number	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.3.2.11. Organization Class

3.3.2.11.1. OrganizationInformationRequest

This provides information for the request of organization information. This is the same as the OrganizationInformationRequest data frame in TMDD 3.3.16.4.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Organization-Information-Type	Element	
Organization-Id	Element	
Center-Id-List	Element	

3.3.2.12. RampMeter Class

3.3.2.12.1. RampMeterInventory

This provides information on a single ramp meter device. This is the same as the RampMeterInventory data frame in TMDD 3.3.17.4.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Metered-Inventory-List	Type: RampMeterInventoryDetails	TMDD 3.3.17.5

3.3.2.12.2. RampMeterInventoryDetails

This provides details on a single ramp meter device. This is based on the RampMeterInventoryDetails data frame in TMDD 3.3.17.5.

Attribute Name	Type/Element	Reference	Description
Metered-Lane-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8	
Ramp-Exit-Roadway-Name	Element		
Lane-Number	Element		
Lane-Type	Element		
Associated-Detectors	Element: Sequence of "Organization-resource-identifier" types		
Absolute-Minimum-Metering-Rate	Element		
Absolute-Maximum-Metering-Rate	Element		
System-Minimum-Metering-Rate	Element		
System-Maximum-Metering-Rate	Element		
Signal-Controller-Type	Element: Type of signal controller used	System Requirements specs 8.7.1.2	For each metered on-ramp or freeway-to-freeway connector under ICM management

Attribute Name	Type/Element	Reference	Description
Signal-Controller-Metering-Program	Element: Ramp metering program installed in controller	System Requirements spec 8.7.1.2	For each metered on-ramp or freeway-to-freeway connector under ICM management
Queue-Sensor-Distance	Element: Distance of queue sensors from ramp metering stop line	System Requirements spec 8.7.1.2	For each metered on-ramp or freeway-to-freeway connector under ICM management

3.3.2.13. Route Class

3.3.2.13.1. RouteInventory

This provides information for a list of routes. This is the same as the RouteInventory data frame in TMDD 3.3.18.1.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Route-Inventory-List	Type: Sequence of "RouteInventoryList" types	TMDD 3.3.18.2

3.3.2.13.2. RouteInventoryList

This provides information for an individual route. This is the same as the RouteInventoryList data frame in TMDD 3.3.18.2.

Attribute Name	Type/Element	Reference
Network-Id	Element	
Network-Name	Element	
Route-Id	Element	
Route-Link-Id-List	Element: Sequence of "Transportation-network-identifier" types	

Attribute Name	Type/Element	Reference
Route-Type	Element	
Route-Name	Element	
Alternate-Route-Name-List	Element: Sequence of "Transportation-network-name" types	
Route-Length	Element	
Route-Node-Id-List	Element: Sequence of "Transportation-network-identifier" types	
Route-Url	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.3.2.14. Section Class

3.3.2.14.1. SectionStatus

This provides information for an organizational section status. This is the same as the SectionStatus data frame in TMDD 3.3.19.7.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Section-Id	Element	
Section-Name	Element	
Node-Id-List	Element: Sequence of "Organization-resource-identifier" types	
Section-Control-Mode	Element	
Timing-Pattern-Id	Element	
Timing-Pattern-Name	Element	
Cycle-Time	Element	
Operator-Id	Element	
Event-Id	Element	
Response-Plan-Id	Element	
Last-Comm-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.3.2.15. VideoSwitch Class

3.3.2.15.1. VideoSwitchInventory

This provides information for an individual video switch. This is the same as the VideoSwitchInventory data frame in TMDD 3.3.21.3.

Attribute Name	Type/Element	Reference
Device-Inventory-Header	Type: DeviceInventoryHeader	TMDD 3.3.5.8
Input-Channel-List	Type: Sequence of "VSVideoChannelData" types	TMDD 3.3.21.5
Output-Channel-List	Type: Sequence of "VSVideoChannelData" types	TMDD 3.3.21.5
Input-Channel-Count	Element	
Output-Channel-Count	Element	
Request-Supported-Type	Element	

3.3.2.15.2. VSVideoChannelData

This provides information for a single video channel for a video switch device. This is the same as the VSVideoChannelData data frame in TMDD 3.3.21.5.

Attribute Name	Type/Element	Reference
Channel-Id	Element	
Channel-Name	Element	
Channel-Titling-Text	Element	

3.4. LAYER: ASSET CAPABILITIES

Asset Capabilities includes the following:

- Intersection signal plans
- Ramp meter plans
- Transit schedules, trips and routes
- Response Plans
- Dynamic Message Signs Display options
- Traveler characterizations
- Organizational assets – employees, including people, service vehicles, maintenance crews, incident response crews, traffic engineers, control centers, emergency and first responders

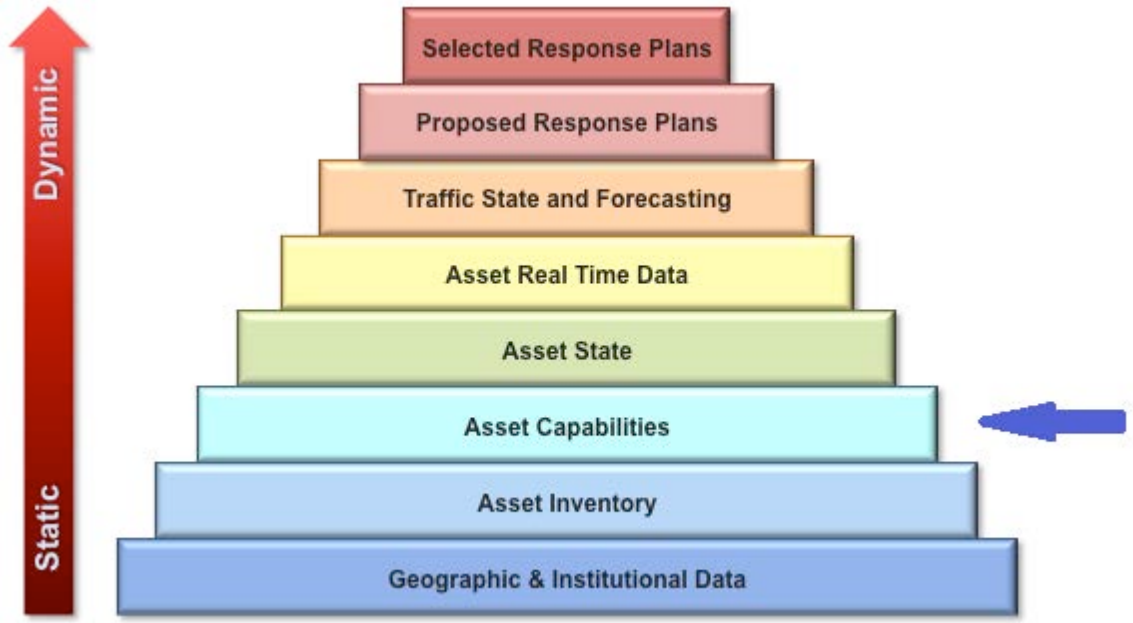

Figure 5 - Asset Capabilities Layer

3.4.1. Data Messages

TMDD Data messages include the following:

Name	Reference	Description
dlDMSMessageInventoryRequest	TMDD 3.1.6.3	Request for inventory of dynamic message sign messages
dlDMSMessageInventorySubscription	TMDD 3.1.6.4	Request for inventory updates of dynamic message sign messages

Name	Reference	Description
dlDMSMessageFontTableRequest	TMDD 3.1.6.6	
dlHARMessageInventoryRequest	TMDD 3.1.10.2	Request for inventory of highway advisory radio messages
dlIntersectionSignalTiming PatternInventoryRequest	TMDD 3.1.11.3	Request for inventory of intersection signal timing patterns
dlIntersectionSignalTiming PatternInventorySubscription	TMDD 3.1.11.4	Request for inventory of intersection signal timing patterns
dlRampMeterControlScheduleRequest	TMDD 3.1.16.4	Request for ramp meter control schedules
dlRampMeterPlanInventoryRequest	TMDD 3.1.16.6	Request for ramp meter plan inventories
dlRampMeterPlanInventorySubscription	TMDD 3.1.16.7	Request for ramp meter plan inventory updates
dlSectionSignalTimingPatternInventoryRequest	TMDD 3.1.18.6	Request for organizational section timing pattern inventory
dlSectionSignalTimingPatternInventorySubscription	TMDD 3.1.18.7	Request for organizational section timing pattern inventory updates
dlDMSMessageInventoryUpdate	TMDD 3.1.24.2	
dlHARMessageInventoryUpdate	TMDD 3.1.28.2	
dlIntersectionSignalTimingPatternInventoryUpdate	TMDD 3.1.29.2	
dlIntersectionSignalControlScheduleUpdate	TMDD 3.1.29.4	
dlLCSControlScheduleUpdate	TMDD 3.1.30.3	
dlRampMeterControlScheduleUpdate	TMDD 3.1.32.3	
dlRampMeterPlanInventoryUpdate	TMDD 3.1.32.4	
dlSectionControlScheduleUpdate	TMDD 3.1.33.2	
dlSectionSignalTimingPatternInventoryUpdate	TMDD 3.1.33.3	

Other messaging dialogs required include the following:

Name	Reference	Description
TRANSIT	GTFS * or APTA TCIP-S-001 4.1.1 **	Schedules, trips, routes and fares for transit services

* General Transit Feed Specification

** American Public Transportation Association Standard for Transit Communications Interface Profiles

3.4.2. Data Class Descriptions

3.4.2.1. ConnectionManagement

3.4.2.1.1. ErrorReport

This provides an error response to an individual request. This is the same as the ErrorReport data frame in TMDD 3.3.3.4.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Error-Code	Element	
Error-Text	Element	

3.4.2.2. Device Class

3.4.2.2.1. DeviceControlScheduleHeader

This is the header information for a device control request. This is the same as the DeviceControlScheduleHeader data frame in TMDD 3.3.5.4.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Time-Base-Schedule-Number	Element	
Time-Base-Schedule-Month	Element	
Time-Base-Schedule-Day	Element	
Time-Base-Schedule-Date	Element	
Time-Base-Schedule-Day-Plan	Element	
Day-Plan-Hour	Element	
Day-Plan-Minute	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.2.2. DeviceInformationRequest

This provides the information regarding a request for device inventory, status, schedule, or timing plan information. This is the same as the DeviceInformationRequest data frame in TMDD 3.3.5.6.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Type	Element	
Device-Information-Type	Element	
Device-Filter	Type: DeviceInformationRequestFilter	TMDD 3.3.5.7

3.4.2.2.3. DeviceInformationRequestFilter

This is used to provide filters for a device information request. This is the same as the DeviceInformationRequestFilter data frame in TMDD 3.3.5.7.

Attribute Name	Type/Element	Reference
Device-Id-List	Element: Sequence of "Organization-resource-identifier" types	
Network-Id-List	Element: Sequence of "Transportation-network-identifier" types	
Link-Id-List	Element: Sequence of "Transportation-network-identifier" types	
Link-Designator-List	Element: Sequence of "Link-route-designator" types	
Linear-Reference	Type: LinearReferenceRange	TMDD 3.3.14.1
Section-Id-List	Element: Sequence of "Organization-resource-identifier" types	
Pattern-Id-List	Element: Sequence of "Organization-resource-identifier" types	
Center-Id-List	Element: Sequence of "Organization-resource-identifier" types	

3.4.2.2.4. DeviceInventoryHeader

This is the header for a device inventory response.This is the same as the DeviceInventoryHeader data frame in TMDD 3.3.5.8.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Device-Location	Type: GeoLocation	TMDD 3.6.9.4
Device-Name	Element	
Device-Description	Element	
Device-Control-Type	Element	
Controller-Description	Element	
Network-Id	Element	
Node-Id	Element	
Node-Name	Element	
Link-Id	Element	
Link-Name	Element	
Link-Direction	Element	
Linear-Reference	Element	
Linear-Reference-Version	Element	
Route-Designator	Element	
Device-Url	Type: UrlReference	TMDD 3.3.10.2
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.3. DMS Class

3.4.2.3.1. DMSCharacterTableEntry

This provides information regarding a DMS character table entry. This is the same as the DMSCharacterTableEntry data frame in TMDD 3.3.6.1.

Attribute Name	Type/Element	Reference
Character-Number	Element	
Character-Width	Element	
Character-Bitmap	Element	

3.4.2.3.2. DMSFontTable

This provides information for a DMS device font table. This is the same as the DMSFontTable data frame in TMDD 3.3.6.4.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Defaultfont	Element	
Fontnumber	Element	
Fontheight	Element	
Fontcharspacing	Element	
Fontlinespacing	Element	
Fontversionid	Element	
Fontstatus	Element	
Charactertable	Type: Sequence of "DMSCharacterTableEntry" types	TMDD 3.3.6.1
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.3.3. DMSFontTableRequest

This provides information required for a DMS font table request. This is the same as the DMSFontTableRequest data frame in TMDD 3.3.6.5.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformation Request	TMDD 3.3.5.6
Fontnumber	Element	

3.4.2.3.4. DMSMessageAppearance

This provides the message appearance characteristics for a DMS device. This is the same as the DMSMessageAppearance data frame in TMDD 3.3.6.7.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Dms-Sign-Type	Element	
Signheightpixels	Element	

Attribute Name	Type/Element	Reference
Signwidthpixels	Element	
Signheight	Element	
Signwidth	Element	
Charheightpixels	Element	
Charwidthpixels	Element	
Dms-Vertical-Border	Element	
Dms-Horizontal-Border	Element	
Dms-Vertical-Pixel-Pitch	Element	
Dms-Horizontal-Pixel-Pitch	Element	
Dms-Max-Pages	Element	
Dms-Max-Message-Length	Element	
Dms-Color-Scheme	Element	
Dms-Multi-Tag-Support	Element	

3.4.2.3.5. DMSMessageAppearanceRequest

This is the information required for a request of a DMS message appearance attributes. This is the same as the DMSMessageAppearanceRequest data frame in TMDD 3.3.6.8.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformation Request	TMDD 3.3.5.6
Dms-Message-Appearance	Type: dMSMessage AppearanceRequestType	TMDD 3.3.6.9

3.4.2.3.6. DMSMessageAppearanceRequestType

This provides the choices for a DMS message appearance request. This is the same as the dMSMessageAppearanceRequestType data frame in TMDD 3.3.6.9.

Attribute Name	Type/Element	Reference
Dms-Message	Element	
Message-Number	Element	
Return-Current-Message-Snapshot	Element	

3.4.2.3.7. DMSMessageInventory

This provides the DMS message library for a single DMS device. This is the same as the DMSMessageInventory data frame in TMDD 3.3.6.10.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Message-Memory-Type	Element	
Message-Number	Element	
Message	Element	
Message-Owner-Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Enable-Beacon-Flag	Element	
Message-Run-Time-Priority	Element	
Message-Status	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.3.8. DMSMessageInventoryRequest

This is the information required for a request of a DMS message inventory. This is the same as the DMSMessageInventoryRequest data frame in TMDD 3.3.6.11.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformation Request	TMDD 3.3.5.6
Message-Number	Element	
Message-Memory-Type	Element	

3.4.2.4. HAR Class

3.4.2.4.1. HARMessageInventory

This provides the message library for a single HAR device. This is the same as the HARMessageInventory data frame in TMDD 3.3.11.5.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3

Attribute Name	Type/Element	Reference
Device-Id	Element	
Message-Number	Element	
Current-Message	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.5. IntersectionSignal Class

3.4.2.5.1. IntersectionSignalControlSchedule

This provides the control schedule for a single intersection signal device. This is the same as the IntersectionSignalControlSchedule data frame in TMDD 3.3.12.4.

Attribute Name	Type/Element	Reference
Device-Control-Schedule-Header	Type: DeviceControlScheduleHeader	TMDD 3.3.5.4
Request-Control-Mode	Element	
Timing-Pattern-Id	Element	

3.4.2.5.2. IntersectionSignalTimingPatternInventory

This provides the signal timing pattern for a center's intersection signal timing pattern inventory. This is the same as the IntersectionSignalTimingPatternInventory data frame in TMDD 3.3.12.19.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Timing-Pattern-Id	Element	
Timing-Pattern-Name	Element	
Cycle-Length	Element	
Offset-Time	Element	
Phase-Tp-List	Type: IntersectionSignalTP InventoryPhase	TMDD 3.3.12.21
Sequence-Information	Type: IntersectionSignalSequenceData	TMDD 3.3.12.16
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.5.3. IntersectionSignalTimingPatternInventoryRequest

This provides the information necessary to request an intersection signal timing pattern inventory. This is the same as the IntersectionSignalTimingPatternInventoryRequest data frame in TMDD 3.3.12.20.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformationRequest	TMDD 3.3.5.6
Timing-Pattern-Id	Element	

3.4.2.5.4. IntersectionSignalTPInventoryPhase

This provides the phase attributes of a timing pattern. This is the same as the IntersectionSignalTPInventoryPhase data frame in TMDD 3.3.12.21.

Attribute Name	Type/Element	Reference
Phase-Identifier	Element	
Coordinated-Phase	Element	
Split-Mode	Element	
Phase-Split	Element	
Maximum-Green-Duration	Element	
Minimum-Green-Duration	Element	
Vehicle-Clearance-Duration	Element	
Vehicle-Red-Duration	Element	
Minimum-Walk-Duration	Element	
Pedestrian-Clearance-Duration	Element	
Steady-Dont-Walk-Duration	Element	

3.4.2.6. LCS Class

3.4.2.6.1. LCSControlSchedule

This provides a schedule for a lane control device. This is the same as the LCSControlSchedule data frame in TMDD 3.3.13.2.

Attribute Name	Type/Element	Reference
Device-Control-Schedule-Header	Type: DeviceControlScheduleHeader	TMDD 3.3.5.4
Lane-Request-Command	Element	

3.4.2.7. Link Class

3.4.2.7.1. LinearReferenceRange

This defines the range of linear reference values for which a request is valid. This is the same as the LinearReferenceRange data frame in TMDD 3.3.14.1.

Attribute Name	Type/Element	Reference
Linear-Reference-Start	Element	
Linear-Reference-End	Element	

3.4.2.8. Organization Class

3.4.2.8.1. OrganizationCenterInformation

This is the information that describes a single organization center. This is the same as the OrganizationCenterInformation data frame in TMDD 3.3.16.2.

Attribute Name	Type/Element	Reference
Center-Id	Element	
Center-Name	Element	
Center-Location	Type: GeoLocation	TMDD 3.6.9.4
Center-Description	Element	
Center-Type	Element	
Center-Contact-Details	Type: ContactDetails	TMDD 3.3.16.1

3.4.2.8.2. OrganizationInformation

The organization class can specify organizations, departments, teams, crews, etc. An organization can also specify a parent organization so that a hierarchy can be defined.

This is similar to the OrganizationInformation data frame in TMDD 3.3.16.3 with the addition of the Parent-Organization element.

Attribute Name	Type/Element	Reference
Organization-Id	Element	
Organization-Name	Element	

Attribute Name	Type/Element	Reference
Organization-Location	Element	
Organization-Function	Element	
Organization-Contact-Details	Type: ContactDetails	TMDD 3.3.16.1
Center-Contact-List	Type: Sequence of "Organization Center Information" types	TMDD 3.3.16.3
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Parent-Organization	Element	

3.4.2.8.3. Restrictions

This describes restrictions for forwarding organization center information. This is the same as the Restrictions data frame in TMDD 3.3.16.5.

Attribute Name	Type/Element	Reference
Organization-Information-Forwarding-Restrictions	Element	

3.4.2.9. RampMeter Class

3.4.2.9.1. RampMeterControlSchedule

This provides the ramp meter control schedule for an individual ramp meter. This is the same as the RampMeterControlSchedule data frame in TMDD 3.3.17.3.

Attribute Name	Type/Element	Reference
Device-Control-Schedule-Header	Type: DeviceControlScheduleHeader	TMDD 3.3.5.4
Metered-Lane-Identifier	Element	
Action-Number	Element	
Meter-Action-Control	Element	
Meter-Requested-Plan	Element	
Meter-Requested-Rate	Element	
Meter-Vehicles-Per-Green	Element	
Min-Meter-Rate	Element	
Max-Meter-Rate	Element	
Meter-Lane-Usage-Mode	Element	

3.4.2.9.2. RampMeterPlanInventory

This provides an entry in a center's ramp meter plan inventory. This is the same as the RampMeterPlanInventory data frame in TMDD 3.3.17.8.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Meter-Plan	Element	
Meter-Level	Element	
Meter-Rate	Element	
Flow-Rate-Threshhold	Element	
Occupancy-Threshhold	Element	
Speed-Threshhold	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.10. Section Class

3.4.2.10.1. SectionControlSchedule

This provides information for a centers traffic signal control schedule for an individual section. This is the same as the SectionControlSchedule data frame in TMDD 3.3.19.4.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Section-Id	Element	
Time-Base-Schedule-Number	Element	
Time-Base-Schedule-Month	Element	
Time-Base-Schedule-Day	Element	
Time-Base-Schedule-Date	Element	
Time-Base-Schedule-Day-Plan	Element	
Day-Plan-Hour	Element	
Day-Plan-Minute	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Node-Id-List	Element: Sequence of "Organization-resource-identifier" types	
Request-Control-Mode	Element	
Timing-Pattern-Id	Element	

3.4.2.10.2. SectionTimingPatternInventory

This provides information for an entry in a sections timing pattern inventory. This is the same as the SectionTimingPatternInventory data frame in TMDD 3.3.19.8.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Ection-Id	Element	
Section-Timing-Pattern-Id	Element	
Section-Timing-Pattern-Name	Element	
Section-Cycle-Length	Element	
Intersection-Tp-List	Type: Sequence of "SectionSignalTiming PatternInventory" types	TMDD 3.3.19.10
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.4.2.10.3. SectionSignalTimingPatternInventoryRequest

This is a request for a section signal timing pattern inventory. This is the same as the SectionSignalTimingPatternInventoryRequest data frame in TMDD 3.3.19.9.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformationRequest	TMDD 3.3.5.6
Section-Timing-Pattern-Id	Element	

3.4.2.10.4. SectionSignalTimingPatternInventory

This is information for a single traffic signal in a signal section timing pattern inventory. This is the same as the SectionSignalTimingPatternInventory data frame in TMDD 3.3.19.10.

Attribute Name	Type/Element	Reference
Intersection-Id	Element	
Cycle-Length	Element	
Offset-Time	Element	
Phase-Tp-List	Type: Sequence of "IntersectionSignalTPInventoryPhase" types	TMDD 3.3.12.21
Sequence-Information	Type: Sequence of "IntersectionSignalSequenceData" types	TMDD 3.3.12.16

3.4.2.11. TransportationNetwork Class

3.4.2.11.1. TransportationNetworkInformationRequest

This is the information required to request an inventory or status of network links, nodes, or routes. This is the same as the TrafficNetworkInformationRequest data frame in TMDD 3.3.20.1.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Network-Information-Type	Element	
Network-Identifiers	Element: Sequence of "Transportation-network-identifier" types	
Roadway-Network-Id-List	Element: Sequence of "Transportation-network-identifier" types	

3.4.2.12. Transit Class

These objects are defined by files in GTFS (General Transit Feed Specification) and are included per System Requirements specs 8.2.2, 8.2.6 and 8.7.1.2.

3.4.2.12.1. Agency

This is the layout of the Agency.txt GTFS file which defines one or more transit agencies that provide the data in this feed.

Attribute Name	Type/Element	Reference
Agency_Id	Element	
Agency_Name	Element	
Agency_Url	Element	
Agency_Timezone	Element	
Agency_Lang	Element	
Agency_Phone	Element	
Agency_Fare_Url	Element	

3.4.2.12.2. Stops

This is based on the layout of the stops.txt GTFS file which defines individual locations where vehicles pick up or drop off passengers.

Attribute Name	Type/Element	Reference	Description
Stop_Id	Element		
Stop_Code	Element		
Stop_Name	Element		
Stop_Desc	Element		
Stop_Lat	Element		
Stop_Lon	Element		
Zone_Id	Element		
Stop_Url	Element		
Location_Type	Element		
Parent_Station	Element		
Stop_Timezone	Element		
Wheelchair_Boarding	Element		
Park_And_Ride_Facility_Exists	Element: Yes/No	System Requirements spec 8.7.1.2	Indicates presence of park-and-ride facility at each station

3.4.2.12.3. Routes

This is the layout of the routes.txt GTFS file which defines transit routes. A route is a group of trips that are displayed to riders as a single service.

Attribute Name	Type/Element	Reference
Route_Id	Element	
Agency_Id	Element	
Route_Short_Name	Element	
Route_Long_Name	Element	
Route_Desc	Element	
Route_Type	Element	
Route_Url	Element	
Route_Color	Element	
Route_Text_Color	Element	

3.4.2.12.4. Trips

This is the layout of the trips.txt GTFS file which defines trips for each route. A trip is a sequence of two or more stops that occurs at specific time.

Attribute Name	Type/Element	Reference
Route_Id	Element	
Service_Id	Element	
Trip_Id	Element	
Trip_Headsign	Element	
Trip_Short_Name	Element	
Direction_Id	Element	
Block_Id	Element	
Shape_Id	Element	
Wheelchair_Accessible	Element	
Bikes_Allowed	Element	

3.4.2.12.5. Stop_Times

This is the layout of the stop_times.txt GTFS file which defines times that a vehicle arrives at and departs from individual stops for each trip.

Attribute Name	Type/Element	Reference
Trip_Id	Element	
Arrival_Time	Element	
Departure_Time	Element	
Stop_Id	Element	
Stop_Sequence	Element	
Stop_Headsign	Element	
Pickup_Type	Element	
Drop_Off_Type	Element	
Shape_Dist_Traveled	Element	
Timepoint	Element	

3.4.2.12.6. Calendar

This is the layout of the calendar.txt GTFS file which defines dates for service IDs using a weekly schedule. Specify when service starts and ends, as well as days of the week where service is available.

Attribute Name	Type/Element	Reference
Service_Id	Element	
Monday	Element	
Tuesday	Element	
Wednesday	Element	
Thursday	Element	
Friday	Element	
Saturday	Element	
Sunday	Element	
Start_Date	Element	
End_Date	Element	

3.4.2.12.7. Calendar_Dates

This is the layout of the calendar_dates.txt GTFS file which defines exceptions for the service IDs defined in the calendar.txt file. If calendar_dates.txt includes ALL dates of service, this file may be specified instead of calendar.txt.

Attribute Name	Type/Element	Reference
Service_Id	Element	
Date	Element	
Exception_Type	Element	

3.4.2.12.8. Fare_Attributes

This is the layout of the fare_attributes.txt GTFS file which defines fare information for a transit organization's routes.

Attribute Name	Type/Element	Reference
Fare_Id	Element	
Price	Element	
Currency_Type	Element	
Payment_Method	Element	
Transfers	Element	
Transfer_Duration	Element	

3.4.2.12.9. Fare_Rules

This is the layout of the fare_rules.txt GTFS file which defines rules for applying fare information for a transit organization's routes.

Attribute Name	Type/Element	Reference
Fare_Id	Element	
Route_Id	Element	
Origin_Id	Element	
Destination_Id	Element	
Contains_Id	Element	

3.4.2.12.10. Shapes

This is the layout of the shapes.txt GTFS file which defines rules for drawing lines on a map to represent a transit organization's routes.

Attribute Name	Type/Element	Reference
Shape_Id	Element	
Shape_Pt_Lat	Element	
Shape_Pt_Lon	Element	
Shape_Pt_Sequence	Element	
Shape_Dist_Traveled	Element	

3.4.2.12.11. Frequencies

This is the layout of the frequencies.txt GTFS file which defines headway (time between trips) for routes with variable frequency of service.

Attribute Name	Type/Element	Reference
Trip_Id	Element	
Start_Time	Element	
End_Time	Element	
Headway_Secs	Element	
Exact_Times	Element	

3.4.2.12.12. Transfers

This is the layout of the transfers.txt GTFS file which defines rules for making connections at transfer points between routes.

Attribute Name	Type/Element	Reference
From_Stop_Id	Element	
To_Stop_Id	Element	
Transfer_Type	Element	
Min_Transfer_Time	Element	

3.4.2.12.13. Feed_Info

This is the layout of the feed_info.txt GTFS file which defines additional information about the feed itself, including publisher, version, and expiration information.

Attribute Name	Type/Element	Reference
Feed_Publisher_Name	Element	
Feed_Publisher_Url	Element	
Feed_Lang	Element	
Feed_Start_Date	Element	
Feed_End_Date	Element	
Feed_Version	Element	

3.5. LAYER: ASSET STATE

This layer contains the current status of each asset listed in the inventory, such as road closures or devices that are not working, or response crew availability.

Figure 6 - Asset State Layer

3.5.1. Data Messages

TMDD Data Message Dialogs include the following:

Name	Reference	Description
dlCCTVStatusRequest	TMDD 3.1.2.2	Request for CCTV status
dlCenterActiveVerificationRequest	TMDD 3.1.3.1	Request for Center Active/Not Active Status
dlCenterActiveVerificationSubscription	TMDD 3.1.3.2	Request for Subscription to Center Active/Not Active Status
dlDetectorStatusRequest	TMDD 3.1.4.2	Request for Detector status
dlDetectorMaintenanceHistoryRequest	TMDD 3.1.4.5	Request for Detector Maintenance History
dlDeviceControlStatusRequest	TMDD 3.1.5.2	Request for Status of Device Control Request
dlDMSStatusRequest	TMDD 3.1.6.2	Request for DMS status
dlESSStatusRequest	TMDD 3.1.7.2	Request for environmental sensor status

Name	Reference	Description
dlHARStatusRequest	TMDD 3.1.10.3	Request for HAR status
dlIntersectionSignalStatusRequest	TMDD 3.1.11.2	Request for Intersection Signal status
dlLCSStatusRequest	TMDD 3.1.12.2	Request for LCS status
dlLinkStatusRequest	TMDD 3.1.13.2	Request for Link status
dlNodeStatusRequest	TMDD 3.1.14.2	Request for Node status
dlRampMeterStatusRequest	TMDD 3.1.16.2	Request for Ramp Meter status
dlRouteStatusRequest	TMDD 3.1.17.2	Request for Route status
dlSectionStatusRequest	TMDD 3.1.18.1	Request for Organizational Section status
dlSectionControlStatusRequest	TMDD 3.1.18.2	Request for status of section control request
dlVideoSwitchStatusRequest	TMDD 3.1.20.2	Request for Video Switch status
dlCCTVStatusUpdate	TMDD 3.1.21.2	Request for CCTV status update
dlDetectorStatusUpdate	TMDD 3.1.23.2	Request for Detector status update
dlDMSStatusUpdate	TMDD 3.1.24.3	Request for DMS status update
dlESSStatusUpdate	TMDD 3.1.25.2	Request for ESS status update
dlHARStatusUpdate	TMDD 3.1.28.3	Request for HAR status update
dlIntersectionSignalStatusUpdate	TMDD 3.1.29.3	Request for Intersection Signal status update
dlLCSStatusUpdate	TMDD 3.1.30.2	Request for LCS status update
dlSectionStatusUpdate	TMDD 3.1.33.1	Request for Organizational Section status update
dlLinkStatusUpdate	TMDD 3.1.34.2	Request for Link status update
dlNodeStatusUpdate	TMDD 3.1.35.2	Request for Node status update
dlRouteStatusUpdate	TMDD 3.1.36.2	Request for Node status update
dlVideoSwitchStatusUpdate	TMDD 3.1.37.2	Request for Video Switch status update

Other messaging dialogs required include the following:

Name	Reference	Description
PARKING FACILITY	APTA TCIP-S-001 4.1.1 * or ISO/TS 18234-7:2013 **	State of parking facilities, including available spaces and occupancy rate.
TRANSIT	APTA TCIP-S-001 4.1.1 *	State of transit services.
FREIGHT	FRATIS ***	State of freight services.

* American Public Transportation Association Standard for Transit Communications Interface Profiles

** Intelligent transport systems -- Traffic and travel information via transport protocol experts group, generation 1 (TPEG1) binary data format -- Part 7: Parking information (TPEG1-PKI)

*** The standards used in the Freight Advanced Traveler Information Systems (FRATIS) bundle of applications.

3.5.2. Data Class Descriptions

Data Class Descriptions include data elements for basic objects. Data classes may be referenced in other data classes (parent classes), and may be referenced in multiple parent classes. These do not represent database structures, but instead are based primarily on TMDD, or are structured similarly. Database design is expected to occur during system design.

3.5.2.1. CCTV Class

3.5.2.1.1. CCTVStatus

This provides the CCTV status of a single CCTV device. This is the same as the CCTVStatus data frame in TMDD 3.3.2.4.

Attribute Name	Type/Element	Reference
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Cctv-Error	Element	
Cctv-Image-List	Element: Sequence of "Cctv-image-supported" types	
Cctv-Position-Preset	Element	
Cctv-Position-Pan	Element	

Attribute Name	Type/Element	Reference
Cctv-Position-Tilt	Element	
Cctv-Position-Zoom-Lens	Element	
Cctv-Position-Iris-Lens	Element	
Cctv-Position-Focus-Lens	Element	
Cctv-Environmental-Status	Element	

3.5.2.2. Connection Management Class

3.5.2.2.1. CenterActiveVerificationRequest

This is the information required to request active status of a center. This is the same as the CenterActiveVerificationRequest data frame in TMDD 3.3.3.2.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3

3.5.2.2.2. CenterActiveVerificationResponse

This is the information provided to indicate whether a center is active or not. This is the same as the CenterActiveVerificationResponse data frame in TMDD 3.3.3.3.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Center-Id	Element	
Center-Name	Element	

3.5.2.3. Detector Class

3.5.2.3.1. DetectorMaintenanceHistoryRequest

This is a request for detector maintenance history for a list of detector devices. This is the same as the DetectorMaintenanceHistoryRequest data frame in TMDD 3.3.4.8.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformationRequest	TMDD 3.3.5.6
Detector-Station-Id	Element	

3.5.2.3.2. DetectorStatus

This is the status for an individual detector. This is the same as the DetectorStatus data frame in TMDD 3.3.4.9.

Attribute Name	Type/Element	Reference
Detector-Station-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Detector-Status-List	Type: Sequence of "DetectorStatusDetails" types	TMDD 3.3.4.10

3.5.2.3.3. DetectorStatusDetails

This provides the details for the status of an individual sensor or station. This is the same as the DetectorStatusDetails data frame in TMDD 3.3.4.10.

Attribute Name	Type/Element	Reference
Detector-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Detector-Lane-Number	Element	
Lane-Direction	Element	
Detector-Outputmode	Element	

3.5.2.4. Device Class

3.5.2.4.1. DeviceControlResponse

This is the confirmation or rejection of a device control request. This is the same as the DeviceControlResponse data frame in TMDD 3.3.5.3.

Attribute Name	Type/Element	Reference
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Request-Id	Element	
Operator-Id	Element	
Operator-Lock-Id	Element	
Request-Status	Element	
Operator-Last-Revised	Type: DateTimeZone	TMDD 3.3.10.1

3.5.2.4.2. DeviceControlStatusRequest

This is the information required to request the status of a previous device control request. This is the same as the DeviceControlStatusRequest data frame in TMDD 3.3.5.5.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Request-Id	Element	

3.5.2.4.3. DeviceStatusHeader

This is the header information included with all device status information. This is the same as the DeviceStatusHeader data frame in TMDD 3.3.5.13.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Device-Status	Element	
Center-Id	Element	
Device-Comm-Status	Element	
Operator-Id	Element	

Attribute Name	Type/Element	Reference
Event-Id	Element	
Response-Plan-Id	Element	
Last-Comm-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.5.2.5. DMS Class

3.5.2.5.1. DMSStatus

This is the status of an individual dms device. This is based on the DMSStatus data frame in TMDD 3.3.6.13.

Attribute Name	Type/Element	Reference	Description
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13	
Current-Message	Element		
Message-Number	Element		
Message-Time-Remaining	Element		
Message-Source-Mode	Element		
Message-Beacon	Element		
Location-When-Not-In-Use	Element: Location where device is normally stored when not used	System Requirements spec 8.7.1.2	For each fixed CMS that may be used by the ICM system to disseminate information to travelers

3.5.2.6. ESS Classes

3.5.2.6.1. ESSSensorStatusDetails

This provides the status of a single environmental sensor. This is the same as the ESSSensorStatusDetails data frame in TMDD 3.3.7.13.

Attribute Name	Type/Element	Reference
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13

3.5.2.6.2. ESSStatus

This provides the status of a single environmental sensor station. This is the same as the ESSStatus data frame in TMDD 3.3.7.16.

Attribute Name	Type/Element	Reference
Ess-Station-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Ess-Sensor-List	Type: Sequence of "ESSSensorStatusDetails" types	TMDD 3.3.7.13

3.5.2.7. HAR Class

3.5.2.7.1. HARStatus

This provides the status of a single highway advisor radio device. This is the same as the HARStatus data frame in TMDD 3.3.11.7.

Attribute Name	Type/Element	Reference
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Har-Current-Message	Element	
Message-Beacon	Element	
Message-Number	Element	

3.5.2.8. IntersectionSignal Class

3.5.2.8.1. IntersectionSignalOverlapStatusGroup

This provides the active signal indications for a group of overlap phases for a single intersection signal. This is the same as the IntersectionSignalOverlapStatusGroup data frame in TMDD 3.3.12.10.

Attribute Name	Type/Element	Reference
Overlap-Status-Group-Number	Element	
Overlap-Status-Group-Greens	Element	
Overlap-Status-Group-Yellows	Element	
Overlap-Status-Group-Reds	Element	

3.5.2.8.2. IntersectionSignalPhaseSplit

This describes the time in tenths of a second that a intersection signal phase is allowed to receive. This is the same as the IntersectionSignalPhaseSplit data frame in TMDD 3.3.12.11.

Attribute Name	Type/Element	Reference
Phase-Identifier	Element	
Phase-Duration	Element	

3.5.2.8.3. IntersectionSignalPhaseStatusGroup

This provides the active signal indications for a group of phases for an intersection signal. This is the same as the IntersectionSignalPhaseStatusGroup data frame in TMDD 3.3.12.12.

Attribute Name	Type/Element	Reference
Phase-Status-Group-Number	Element	
Phase-Status-Group-Greens	Element	
Phase-Status-Group-Yellows	Element	
Phase-Status-Group-Reds	Element	
Phase-Status-Group-Walks	Element	
Phase-Status-Group-Pedclears	Element	
Phase-Status-Group-Dontwalks	Element	

3.5.2.8.4. IntersectionSignalRingStatus

This provides that status of the phases of a signal ring. This is the same as the IntersectionSignalRingStatus data frame in TMDD 3.3.12.15.

Attribute Name	Type/Element	Reference
Ring-Identifier	Element	
Ring-Status	Element	

3.5.2.8.5. IntersectionSignalStatus

This provides the status for a single intersection signal. This is based on the IntersectionSignalStatus data frame in TMDD 3.3.12.18.

Attribute Name	Type/Element	Reference	Description
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13	
Signal-Control-Source	Element		
Planned-Signal-Timing-Mode	Element		
Current-Signal-Timing-Mode	Element		
Section-Id	Element		
Planned-Signal-Timing-Mode-Description	Element		
Timing-Pattern-Id-Current	Element		
Timing-Pattern-Description	Element		
Actuation-Mode	Element		
Timing-Phase-Plan-Mode	Element		
Cycle-Length-Planned	Element		
Cycle-Length-Current	Element		
Cycle-Length-Previous	Element		
Cycle-Length-Master	Element		
Cycle-Counter	Element		
Cycle-Counter-Master	Element		
Offset-Reference	Element		
Offset-Time-Planned	Element		
Offset-Time-Current	Element		
Offset-Time-Previous	Element		
Controller-Timestamp	Type: DateTimeZone	TMDD 3.3.10.1	
Phase-Split-List	Type: Sequence of "IntersectionSignalPhaseSplit" types	TMDD 3.3.12.11	
Ring-Status-List	Type: Sequence of "IntersectionSignalRingStatus" types	TMDD 3.3.12.15	
Phase-Status	Type: Sequence of "IntersectionSignalPhaseStatusGroup" types	TMDD 3.3.12.12	

Attribute Name	Type/Element	Reference	Description
Overlap-Status	Type: Sequence of "IntersectionSignal OverlapStatusGroup " types	TMDD 3.3.12.10	
Active-Special-Functions-List	Element: Sequence of "Organization-resource-identifier" types		
Preempt-Priority-Description	Element		
Operation-Agency	Element: Agency responsible for the operation of the intersection	System Requirements spec 8.7.1.3	For each signalized intersection under ICM management
Maintenence-Agency	Element: Agency responsible for maintenance of the intersection	System Requirements spec 8.7.1.3	For each signalized intersection under ICM management
Prohibited-Right-On-Red	Element: Yes/No	System Requirements spec 8.7.1.3	For each signalized intersection under ICM management. Indicates whether right turns on red movements are prohibited.
Operation-Alteration-Authorization	Element: TBD	System Requirements spec 8.5.2.2	Will indicate whether changes to the operation of this signalized intersection are authorized.

3.5.2.9. LCS Class

3.5.2.9.1. LCSStatus

This provides the status of a single lane control system device. This is the same as the LCSStatus data frame in TMDD 3.3.13.4.

Attribute Name	Type/Element	Reference
Device-Status-Header	Element	
Lane-Current-State	Element	
Link-Direction	Element	

3.5.2.10. Link Class

3.5.2.10.1. LinkStatus

This provides the status of a list of links. This is the same as the LinkStatus data frame in TMDD 3.3.14.4.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Link-Inventory-List	Type: Sequence of "LinkStatusList" types	TMDD 3.3.14.5

3.5.2.10.2. LinkStatusList

This provides the status of an individual link. This is the same as the LinkStatusList data frame in TMDD 3.3.14.5.

Attribute Name	Type/Element	Reference
Network-Id	Element	
Link-Id	Element	
Link-Name	Element	
Link-Status	Element	
Link-Direction	Element	
Lanes-Number-Open	Element	
Priority-Type	Element	
Restriction-Axle-Count	Element	
Restriction-Height	Element	
Restriction-Length	Element	
Restriction-Weight	Element	
Restriction-Width	Element	
Restriction-Weight-Axle	Element	
Restriction-Units	Element	
Surface-Condition	Element	
Saturation-Flag	Element	
Oversaturated-Threshold	Element	
Level-Of-Service	Element	
Lane-Numbers	Element: Sequence of "Link-lane-number" types	
Link-Data-Stored	Element	
Detection-Method	Element	
Link-Traffic-Data-Algorithm	Element	
Stops	Element	

Attribute Name	Type/Element	Reference
Delay	Element	
Alternate-Route-Delay	Element	
Headway	Element	
Travel-Time	Element	
Capacity-Existing	Element	
Travel-Time-Increase	Element	
Speed-Average	Element	
Speed-Vehicle-Estimated	Element	
Speed-Limit	Element	
Advisory-Speed-Limit	Element	
Truck-Speed-Limit	Element	
Speed-Limit-Units	Element	
Density	Element	
Occupancy	Element	
Volume	Element	
Event-Description-Time	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.5.2.11. Node Class

3.5.2.11.1. NodeStatus

This provides the status of a list of nodes. This is the same as the NodeStatus data frame in TMDD 3.3.15.3.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Node-Status-List	Type: Sequence of "NodeStatusList" types	TMDD 3.3.15.4

3.5.2.11.2. NodeStatusList

This provides the status of an individual node. This is the same as the NodeStatusList data frame in TMDD 3.3.15.4.

Attribute Name	Type/Element	Reference
Network-Id	Element	
Network-Name	Element	
Node-Id	Element	
Node-Name	Element	

Attribute Name	Type/Element	Reference
Node-Status	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.5.2.12. Ramp Meter Classes

3.5.2.12.1. RampMeterLaneStatusDetails

This is the status of an individual ramp meter lane. This is based on the RampMeterLaneStatusDetails data frame in TMDD 3.3.17.7.

Attribute Name	Type/Element	Reference	Description
Metered-Lane-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13	
Meter-Implemented-Action	Element		
Requested-Meter-Command-Source	Element		
Implemented-Meter-Command-Source	Element		
Meter-Implemented-Plan	Element		
Meter-Implemented-Rate	Element		
Meter-Implemented-Vehicles-Per-Green	Element		
Meter-Requested-Action	Element		
Meter-Requested-Plan	Element		
Meter-Requested-Rate	Element		
Meter-Requested-Vehicles-Per-Green	Element		
Operational-Min-Meter-Rate	Element		
Operational-Max-Meter-Rate	Element		
Meter-Demand-Detector-Status	Element		
Meter-Passage-Detector-Status	Element		
Meter-Queue-Detector-Status	Element		
Meter-Cycle-Count	Element		
Metered-Lane-Vehicle-Count	Element		
Meter-Queue-Detected-Flag	Element		
Metered-Lane-Violation-Count	Element		
HOV-Allow-Meter-Bypass	Element: Yes/No	System Requirements spec 8.7.1.2	Indicates whether HOV vehicles are allowed to bypass the ramp meter

3.5.2.12.2. RampMeterStatus

This is the status of a single ramp meter device. This is based on the RampMeterStatus data frame in TMDD 3.3.17.10.

Attribute Name	Type/Element	Reference	Description
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13	
Metered-Status-List	Type: Sequence of "RampMeterLaneStatusDetails" types	TMDD 3.3.17.7	
Mainline-Flow-Rate	Element		
Mainline-Vehicle-Occupancy	Element		
Mainline-Vehicle-Speed	Element		
Operation-Alteration-Authorization	Element: TBD	System Requirements spec 8.5.2.2	Will indicate whether metering changes are authorized.

3.5.2.13. Route Class

3.5.2.13.1. RouteStatus

This provides the status of a list of routes. This is the same as the RouteStatus data frame in TMDD 3.3.18.3.

Attribute Name	Type/Element	Reference
Network-Id	Type: Restrictions	TMDD 3.3.16.5
Route-Id	Type: OrganizationInformation	TMDD 3.3.16.3
Route-Status	Type: Sequence of "RouteStatusList" types	TMDD 3.3.18.4

3.5.2.13.2. RouteStatusList

This provides the status of an individual route. This is the same as the RouteStatusList data frame in TMDD 3.3.18.4.

Attribute Name	Type/Element	Reference
Network-Id	Element	

Attribute Name	Type/Element	Reference
Route-Id	Element	
Route-Status	Element	
Route-Name	Element	
Detour-Route-In-Effect-Flag	Element	
Surface-Condition	Element	
Route-Capacity	Element	
Level-Of-Service	Element	
Saturation-Flag	Element	
Route-Data-Stored-Type	Element	
Route-Traffic-Data-Algorithm	Element	
Delay	Element	
Alternate-Route-Delay	Element	
Headway	Element	
Travel-Time	Element	
Travel-Time-Increase	Element	
Volume	Element	
Speed-Average	Element	
Density	Element	
Occupancy	Element	
Current-Speed-Advisory	Element	
Speed-Limit-Units	Element	
Event-Description-Time	Element	
Last-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.5.2.14. Section Class

3.5.2.14.1. SectionControlResponse

This provides the acceptance or rejection of a section control request. This is the same as the SectionControlResponse data frame in TMDD 3.3.19.3.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Section-Id	Element	
Request-Id	Element	
Operator-Id	Element	
Request-Status	Element	
Operator-Last-Revised	Type: DateTimeZone	TMDD 3.3.10.1
Request-Control-Mode	Element	
Timing-Pattern-Id	Element	

3.5.2.14.2. SectionControlStatusRequest

This contains the information describing the control status of an individual traffic signal section. This is the same as the SectionControlStatusRequest data frame in TMDD 3.3.19.5.

Attribute Name	Type/Element	Reference
Authentication	Type: Restrictions	TMDD 3.3.16.5
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Section-Id	Element	
Request-Id	Element	

3.5.2.15. VideoSwitch Class

3.5.2.15.1. VideoSwitchDeviceStatus

This provides the status of an individual video switch. This is the same as the VideoSwitchDeviceStatus data frame in TMDD 3.3.21.2.

Attribute Name	Type/Element	Reference
Device-Status-Header	Type: DeviceStatusHeader	TMDD 3.3.5.13
Switched-Channel-List	Type: Sequence of "VSSwitchedChannelData" types	TMDD 3.3.21.4

3.5.2.15.2. VSSwitchedChannelData

This provides the I/O channel assignments for a video switch. This is the same as the VSSwitchedChannelData data frame in TMDD 3.3.21.4.

Attribute Name	Type/Element	Reference
Input-Channel-Id	Element	
Output-Channel-Id	Element	
Channel-Titling-Text	Element	

3.6. LAYER: ASSET REAL-TIME DATA

This layer contains the real-time data reported by each device or asset such as the data contained in the PeMS and IEN data feed, and requests to control assets in the corridor. It is likely that during system design that system performance requirements, coupled with the

high data volume and throughput requirements, will be the primary drivers of data transmission, persistence, and retrieval methods and formats. Actual formats may be significantly different than those listed in this section.

Figure 7 - Asset Real-Time Data Layer

3.6.1. Data Messages

TMDD Data Message Dialogs include the following:

Name	Reference	Description
dlDetectorDataRequest	TMDD 3.1.4.3	Request for detector data
dlDetectorDataSubscription	TMDD 3.1.4.4	Request for Subscription to detector data
dlDMSMessageAppearanceRequest	TMDD 3.1.6.5	Request for Status of Device Control Request
dlESSObservationMetadataRequest	TMDD 3.1.7.3	Request for ESS Observation Metadata
dlESSObservationReportRequest	TMDD 3.1.7.4	Request for ESS Observation Report
dlFullEventUpdateRequest	TMDD 3.1.8.1	Request for update on all events
dlEventIndexRequest	TMDD 3.1.8.2	Request for index of events
dlFullEventUpdateSubscription	TMDD 3.1.8.4	Request for subscription to event updates
dlEventIndexSubscription	TMDD 3.1.8.5	Request for subscription to event idex
dlDetectorDataUpdate	TMDD 3.1.23.3	Request for detector data update
dlESSObservationReportUpdate	TMDD 3.1.25.3	Request for ESS observations
dlFullEventUpdateUpdate	TMDD 3.1.26.1	Event Update

Name	Reference	Description
dlEventIndexUpdate	TMDD 3.1.26.2	EventIndexUpdate

Other messaging dialogs required include the following:

Name	Reference	Description
TRANSIT	APTA TCIP-S-001 4.1.1 *	Contains location information for transit assets. May also contain ridership and rider capacity data if available.
FREIGHT	FRATIS **	Contains location information for freight assets.
PROBES	Dependent upon data provider(s) selected	Contains probe data including probe identity (anonymous), geospatial location, and speed.

* American Public Transportation Association Standard for Transit Communications Interface Profiles

** The standards used in the Freight Advanced Traveler Information Systems (FRATIS) bundle of applications.

3.6.2. Data Class Descriptions

Data Class Descriptions include data elements for basic objects. Classes may be referenced in other classes (parent classes), and may be referenced in multiple parent classes. These do not represent database structures, but instead are based primarily on TMDD, or are structured similarly. Database design is expected to occur during system design.

3.6.2.1. Detector Class

3.6.2.1.1. DetectorData

This provides the data for a single detector station or sensor. This is the same as the DetectorData data frame in TMDD 3.3.4.1.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Detector-Data-List	Type: Sequence of "DetectorDataDetail" types	TMDD 3.3.4.2

3.6.2.1.2. DetectorDataDetail

This provides the detail information for an individual detector or station. This is the same as the DetectorDataDetail data frame in TMDD 3.3.4.2.

Attribute Name	Type/Element	Reference
Station-Id	Element	
Detector-Id	Element	
Detection-Time-Stamp	Type: DateTimeZone	TMDD 3.3.10.1
Vehicle-Count	Element	
Vehicle-Occupancy	Element	
Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Detector-Data-Type	Element	
Vehicle-Speed	Element	
Queue-Length	Element	
Vehicle-Stops	Element	
Vehicle-Count-Bin1	Element	
Vehicle-Count-Bin2	Element	
Vehicle-Count-Bin3	Element	
Vehicle-Count-Bin4	Element	
Vehicle-Count-Bin5	Element	
Vehicle-Count-Bin6	Element	
Vehicle-Count-Bin7	Element	
Detector-Status	Element	

3.6.2.1.3. DetectorDataRequest

This provides information required for a request for detector data for one or more sensors or stations. This is the same as the DetectorDataRequest data frame in TMDD 3.3.4.3.

Attribute Name	Type/Element	Reference
Device-Information-Request-Header	Type: DeviceInformationRequest	TMDD 3.3.5.6
Detector-Station-Id	Element	
Detector-Data-Type	Element	

3.6.2.2. Device Class

3.6.2.2.1. DeviceReference

This provides a reference to a device via an identifier and type. This is the same as the DeviceReference data frame in TMDD 3.3.5.12.

Attribute Name	Type/Element	Reference
Device-Id	Element	
Device-Type	Element	

3.6.2.3. ESS Class

3.6.2.3.1. ESSClimateRecordDetail

This provides the monthly average low and high for a specific environmental sensor site. This is the same as the ESSClimateRecordDetail data frame in TMDD 3.3.7.1.

Attribute Name	Type/Element	Reference
Climate-Observation-Month	Element	
Climate-Observation-Month-Min-Value	Element	
Climate-Month-Max-Value	Element	

3.6.2.3.2. ESSImageInformation

This provides the metadata for an ESS image. This is the same as the ESSImageInformation data frame in TMDD 3.3.7.3.

Attribute Name	Type/Element	Reference
Image-Description	Element	
Image-Url	Element	

3.6.2.3.3. ESSObservationDataSetMetadataDetail

This provides the ESS metadata for a specific station, sensor, climate record and site. This is the same as the ESSObservationDataSetMetadataDetail data frame in TMDD 3.3.7.6.

Attribute Name	Type/Element	Reference
Ess-Data-Set-File-Name	Element	
Ess-Data-Set-File-Directory-Path	Element	
Ess-Data-Set-File-Access-Protocol	Element	
Ess-Data-Set-File-Access-Address	Element	
Ess-Data-Set-File-Access-Port-Address	Element	
Ess-Observation-Collection-Frequency	Element	
Ess-Observation-Collection-Offset	Element	
Ess-Host-Server-Offset-Minutes	Element	
Ess-Host-Server-Time-Zone	Element	
Ess-Host-Server-Daylight-Savings-In-Effect-Flag	Element	
User-Id	Element	
Password	Element	

3.6.2.3.4. ESSObservationMetadata

This provides the metadata for a individual ESS device. This is the same as the ESSObservationMetadata data frame in TMDD 3.3.7.7.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Ess-Observation-Data-Set-Metadata	Type: ESSObservationDataSet MetadataDetail	TMDD 3.3.7.6
Ess-Collector-Configuration	Type: Sequence of "ESSObservation MetadataItem" types	TMDD 3.3.7.8
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Ess-Sensor-Metadata-List	Type: Sequence of "ESSSensorMetadataDetail" types	TMDD 3.3.7.12
Site-Information	Type: ESSSiteMetadataDetail	TMDD 3.3.7.14
Station-Information	Type: ESSStationMetadataDetail	TMDD 3.3.7.15
Climate-Record-Information	Type: ESSClimateRecordDetail	TMDD 3.3.7.1
Data-Collector-Information	Type: ESSDataCollectorInformation	TMDD 3.3.7.2
Image-Information	Type: ESSImageInformation	TMDD 3.3.7.3

3.6.2.3.5. ESSObservationMetadataItem

This provides an observation positional order, name, units, and scaling factor. This is the same as the ESSObservationMetadataItem data frame in TMDD 3.3.7.8.

Attribute Name	Type/Element	Reference
Ess-Observation-Positional-Order	Element	
Ess-Observation-Label	Element	
Ess-Observation-Type	Element	
Ess-Observation-Null-Value	Element	
Ess-Observation-Units	Element	
Ess-Observation-Decimal-Scaling-Factor	Element	

3.6.2.3.6. ESSObservationReport

This provides the ESS observation reports for a specific set of devices. This is the same as the ESSObservationReport data frame in TMDD 3.3.7.9.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Station-Id	Element	
Ess-Data-List	Type: Sequence of "ESSObservationReportDetail" types	TMDD 3.3.7.10

3.6.2.3.7. ESSObservationReportDetail

This provides the ESS observation report detail information for an individual device. This is the same as the ESSObservationReportDetail data frame in TMDD 3.3.7.10.

Attribute Name	Type/Element	Reference
Ess-Sensor-Id	Element	
Ess-Observation-Timestamp	Type: DateTimeZone	TMDD 3.3.10.1
Ess-Observation-Type	Type: ESSObservationType	TMDD 3.3.7.11

3.6.2.3.8. ESSObservationType

This provides a block of ESS observation data, either weather, pavement, or subsurface. This is the same as the ESSObservationType data frame in TMDD 3.3.7.11.

Attribute Name	Type/Element	Reference
Weather-Data	Type: EssWeatherBlock	TMDD 3.6.4.6
Pavement-Data	Type: EssPavementBlock	TMDD 3.6.4.29
Subsurface-Data	Type: EssSubSurfaceData	TMDD 3.6.4.30

3.6.2.3.9. EssWeatherBlock

This provides a block of ESS weather data provided in an OER encoded string. This is the same as the EssWeatherBlock in TMDD 3.6.4.6.

Attribute Name	Type/Element	Reference
EssWeatherBlock	Element	

3.6.2.3.10. EssPavementBlock

This provides a block of ESS pavement data provided in an OER encoded string. This is the same as the EssPavementBlock in TMDD 3.6.4.29.

Attribute Name	Type/Element	Reference
EssPavementBlock	Element	

3.6.2.3.11. EssSubSurfaceData

This provides a block of ESS subsurface data provided in an OER encoded string. This is the same as the EssSubSurfaceData in TMDD 3.6.4.30.

Attribute Name	Type/Element	Reference
EssSubSurfaceData	Element	

3.6.2.4. Event Class

3.6.2.4.1. AdditionalText

This provides additional event information, notes, comments, etc. This is the same as the AdditionalText data frame in TMDD 3.3.8.2.

Attribute Name	Type/Element	Reference
Description	Element	
Language	Element	
Report-Medium	Element	

3.6.2.4.2. AlternateRouteDetail

This provides an alternate route for an event. This is based on the AlternateRouteDetail data frame in TMDD 3.3.8.3.

Attribute Name	Type/Element	Reference	Description
Alternate-Route-Type	Element		
Destination	Type: LandmarkLocation	TMDD 3.3.8.33	
Location-On-Alternate-Route	Type: Sequence of "LinkLocation" types	TMDD 3.3.8.34	
Vehicle-Type	Element: Text	System Requirements specs 8.7.1.6 and 8.5.3	Specifies whether the alternate route is for passenger cars, trucks or buses

3.6.2.4.3. AreaLocation

This provides area and location information for an event. This is the same as the AreaLocation data frame in TMDD 3.3.8.4.

Attribute Name	Type/Element	Reference
Area-Id	Element	
Area-Name	Element	
Location-Rank	Element	
Upward-Area-Reference	Type: AreaLocation	TMDD 3.3.8.4

3.6.2.4.4. DataExtent

This provides information regarding the spatial qualities of the event. This is the same as the DataExtent data frame in TMDD 3.3.8.5.

Attribute Name	Type/Element	Reference
Length-Affected	Element	
Proportion-Affected	Element	
Above-Altitude	Element	
Below-Altitude	Element	

3.6.2.4.5. DataIncidentDetails

This provides vehicle and human injury/fatalities associated with the event. This is the same as the DataIncidentDetails data frame in TMDD 3.3.8.6.

Attribute Name	Type/Element	Reference
Vehicles-Involved-Count	Element	
Cars-Involved-Count	Element	
Trucks-Involved-Count	Element	
Buses-Involved-Count	Element	
Human-Fatalities-Count	Element	
Human-Injuries-Count	Element	
Human-Major-Injuries-Count	Element	
Human-Minor-Injuries-Count	Element	

3.6.2.4.6. DataLinkRestrictions

This provides vehicle and speed restrictions on a road link. This is the same as the DataLinkRestrictions data frame in TMDD 3.3.8.7.

Attribute Name	Type/Element	Reference
Speed-Limit-Advisory	Element	
Speed-Limit	Element	
Speed-Limit-Truck	Element	
Restriction-Length	Element	
Restriction-Height	Element	
Restriction-Width	Element	
Restriction-Weight-Vehicle	Element	
Restriction-Weight-Axle	Element	
Restriction-Axle-Count	Element	

3.6.2.4.7. DataLinkState

This provides the current state of a road link. This is the same as the DataLinkState data frame in TMDD 3.3.8.8.

Attribute Name	Type/Element	Reference
Delay	Element	
Peak-Delay	Element	
Alternate-Route-Delay	Element	
Alternate-Route-Peak-Delay	Element	
Headway	Element	
Travel-Time	Element	
Capacity-Existing	Element	
Travel-Time-Increase	Element	
Speed-Average	Element	
Speed-Vehicle-Estimated	Element	
Description-Time	Element	
Density	Element	
Occupancy	Element	
Volume	Element	

3.6.2.4.8. DataParking

This provides the current state of parking. This is the same as the DataParking data frame in TMDD 3.3.8.9.

Attribute Name	Type/Element	Reference
Parking-Spaces	Element	
Parking-Occupancy	Element	

3.6.2.4.9. DataRoadWeather

This provides the current state of weather. This is the same as the DataRoadWeather data frame in TMDD 3.3.8.10.

Attribute Name	Type/Element	Reference
Avg-Wind-Direction	Element	
Avg-Wind-Speed	Element	

Attribute Name	Type/Element	Reference
Avg-Wind-Gust-Speed	Element	
Air-Temperature	Element	
Dewpoint-Temp	Element	
Max-Temp	Element	
Min-Temp	Element	
Relative-Humidity	Element	
Atmospheric-Pressure	Element	
Precip-Rate	Element	
Snowfall-Accum-Rate	Element	
Visibility	Element	
Uv-Index	Element	
Probability	Element	

3.6.2.4.10. DataSurfaceConditions

This provides the current state of surface conditions. This is the same as the DataSurfaceConditions data frame in TMDD 3.3.8.11.

Attribute Name	Type/Element	Reference
Water-Depth	Element	
Adjacent-Snow-Depth	Element	
Roadway-Snow-Depth	Element	
Roadway-Snow-Pack-Depth	Element	
Ice-Thickness	Element	
Surface-Temperature	Element	
Pavement-Temperature	Element	
Surface-Water-Depth	Element	
Surface-Salinity	Element	
Surface-Freeze-Point	Element	
Mobile-Friction	Element	

3.6.2.4.11. EventAdvice

This provides information regarding advisories associated with the event. This is the same as the EventAdvice data frame in TMDD 3.3.8.12.

Attribute Name	Type/Element	Reference
Suggestion	Element	
Warning	Element	
Instruction-Recommendation	Element	
Instruction-Mandatory	Element	

Attribute Name	Type/Element	Reference
Alternate-Route	Element	

3.6.2.4.12. EventComments

This provides event comment information. This is the same as the EventComments data frame in TMDD 3.3.8.13.

Attribute Name	Type/Element	Reference
Event-Comment	Element	
Operator-Id	Element	
Operator-Comment	Element	
Language	Element	

3.6.2.4.13. EventDescription

This is the same as the EventDescription data frame in TMDD 3.3.8.14.

Attribute Name	Type/Element	Reference
Phrase	Type: EventType	TMDD 3.3.8.29
Cause	Type: EventType	TMDD 3.3.8.29
Advice	Type: EventAdvice	TMDD 3.3.8.12
Qualifier	Type: EventQualifier	TMDD 3.3.8.23
Quantity	Type: EventQuantity	TMDD 3.3.8.24
Related-Landmark	Type: LandmarkLocation	TMDD 3.3.8.33
Detour	Type: AlternateRouteDetail	TMDD 3.3.8.3
Additional-Text	Type: AdditionalText	TMDD 3.3.8.2
Qualifier-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.6.2.4.14. EventElementDetail

This is based on the EventElementDetail data frame in TMDD 3.3.8.15.

Attribute Name	Type/Element	Reference	Description
Element-Id	Element		
Schedule-Element-Id	Element		
Event-Category	Element		
Event-Source	Type: EventSource	TMDD 3.3.8.26	
Event-Descriptions	Type: Sequence of "EventDescription" types	TMDD 3.3.8.14	

Attribute Name	Type/Element	Reference	Description
Event-Locations	Type: Sequence of "EventLocation" types	TMDD 3.3.8.21	
Event-Times	Type: EventTimes	TMDD 3.3.8.27	
Event-Name	Element		
Event-Lanes	Type: Sequence of "EventLane" types	TMDD 3.3.8.20	
Event-Transit-Locations	Type: Sequence of "EventTransitLocation" types	TMDD 3.3.8.28	
Event-Hazmat-Details	Type: Sequence of "Hazmat" types	TMDD 3.3.8.32	
Confidence-Level	Element		
Access-Level	Element		
Event-Zone-Of-Influence	Type: BoundingBox	Custom type; see Global Data Elements	Contains well-known-text coordinates of region covering the zone of influence.

3.6.2.4.15. EventFilterRequest

This is the same as the EventFilterRequest data frame in TMDD 3.3.8.16.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Request-Header	Type: RequestHeader	TMDD 3.3.8.41
Request-Type	Type: RequestType	TMDD 3.3.8.44
Request-Filters	Type: Sequence of "RequestFilter" types	TMDD 3.3.8.40
Request-Locations	Type: Sequence of "RequestLocation" types	TMDD 3.3.8.42
Request-Times	Type: RequestTimes	TMDD 3.3.8.43

3.6.2.4.16. EventHeadline

This is the same as the EventHeadline data frame in TMDD 3.3.8.17.

Attribute Name	Type/Element	Reference
Headline	Type: EventType	TMDD 3.3.8.29
Headline-Element	Element	

3.6.2.4.17. EventIndex

This is the same as the EventIndex data frame in TMDD 3.3.8.18.

Attribute Name	Type/Element	Reference
Feu-Url	Type: UrlReference	TMDD 3.3.10.2
File-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Event-Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Event-Id	Element	
Event-Update	Element	
Status	Element	

3.6.2.4.18. EventIndicator

This is the same as the EventIndicator data frame in TMDD 3.3.8.19.

Attribute Name	Type/Element	Reference
Status	Element	
Duration-Exceeded-Flag	Element	
Priority-Level	Element	
Severity	Element	
Impact-Level	Element	
Active-Flag	Element	
Planned-Event-Class	Element	

3.6.2.4.19. EventLane

This is the same as the EventLane data frame in TMDD 3.3.8.20.

Attribute Name	Type/Element	Reference
Lanes-Type	Element	
Link-Direction	Element	
Lanes-Total-Original	Element	
Lanes-Total-Affected	Element	
Event-Lanes-Affected	Element: Sequence of "Link-lane-number" types	
Lanes-Status	Element	

3.6.2.4.20. EventLocation

This is the same as the EventLocation data frame in TMDD 3.3.8.21.

Attribute Name	Type/Element	Reference
Area-Location	Type: AreaLocation	TMDD 3.3.8.4
Location-On-Link	Type: LinkLocation	TMDD 3.3.8.34
Landmark	Type: LandmarkLocation	TMDD 3.3.8.33
Geo-Location	Type: GeoLocation	TMDD 3.6.9.4

3.6.2.4.21. EventPeriod

This is the same as the EventPeriod data frame in TMDD 3.3.8.22.

Attribute Name	Type/Element	Reference
Days-Of-The-Week	Element	
Effective-Period-Qualifier	Element	
Holiday-Day	Element	

3.6.2.4.22. EventQualifier

This is the same as the EventQualifier data frame in TMDD 3.3.8.23.

Attribute Name	Type/Element	Reference
Qualifier-Generic	Element	
Location-Generic	Element	
Lane-Roadway	Element	
Transit-Mode	Element	
Vehicle-Group-Affected	Element	
Traveler-Group-Affected	Element	
Responder-Group-Affected	Element	
Incident-Response-Equipment	Element	
Transit-Locations	Element	
Incident-Response-Status	Element	

3.6.2.4.23. EventQuantity

This is the same as the EventQuantity data frame in TMDD 3.3.8.24.

Attribute Name	Type/Element	Reference
Extent	Element	
Link-State	Element	
Incident-Details	Element	
Road-Weather	Element	
Parking-Data	Element	
Surface-Conditions	Element	
Link-Restrictions	Element	

3.6.2.4.24. EventReference

This is the same as the EventReference data frame in TMDD 3.3.8.25.

Attribute Name	Type/Element	Reference
Event-Id	Element	
Event-Update	Element	
Response-Plan-Id	Element	
Update-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.6.2.4.25. EventSource

This is the same as the EventSource data frame in TMDD 3.3.8.26.

Attribute Name	Type/Element	Reference
Information-Source	Type: OrganizationInformation	TMDD 3.3.16.3
Event-Detection-Method	Element	

3.6.2.4.26. EventTimes

This is the same as the EventTimes data frame in TMDD 3.3.8.27.

Attribute Name	Type/Element	Reference
Update-Time	Type: DateTimeZone	TMDD 3.3.10.1
Valid-Period	Type: ValidPeriod	TMDD 3.3.8.45

Attribute Name	Type/Element	Reference
Schedule-Element-Ids	Element: Sequence of "Event-schedule-element-identifier" types	
Sequence-Time	Type: DateTimeZone	TMDD 3.3.10.1
Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
Alternate-Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
Alternate-End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Expected-Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
Expected-End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Recurrent-Times	Type: Sequence of "RecurrentTime" types	TMDD 3.3.8.39
Planned-Event-Continuous-Flag	Element	

3.6.2.4.27. EventTransitLocation

This is the same as the EventTransitLocation data frame in TMDD 3.3.8.28.

Attribute Name	Type/Element	Reference
Transit-Route-Id	Element	
Transit-Direction	Element	
Transit-Stop-Detail	Element	
Transit-Location-Text	Element	

3.6.2.4.28. EventType

This is the same as the EventType data frame in TMDD 3.3.8.29.

Attribute Name	Type/Element	Reference
Traffic-Conditions	Element	
Accidents-And-Incidents	Element	
Closures	Element	
Roadwork	Element	
Obstruction	Element	
Delay-Status-Cancellation	Element	
Unusual-Driving	Element	
Mobile-Situation	Element	
Device-Status	Element	
Restriction-Class	Element	
Incidentresponsestatus	Element	
Disasters	Element	
Disturbances	Element	

Attribute Name	Type/Element	Reference
Sporting-Events	Element	
Special-Events	Element	
Parking-Information	Element	
System-Information	Element	
Weather-Conditions	Element	
Precipitation	Element	
Winds	Element	
Visibility-And-Air-Quality	Element	
Temperature	Element	
Pavement-Conditions	Element	
Winter-Driving-Restrictions	Element	
Winter-Driving-Index	Element	
Suggestionadvice	Element	
Warningadvice	Element	
Adviceinstructionsrecommendations	Element	
Adviceinstructionsmandatory	Element	
Laneroadway	Element	
Alternateroute	Element	
Transitmode	Element	
Vehiclegroupaffected	Element	
Travelergroupaffected	Element	
Respondergroupaffected	Element	
Incidentresponseequipment	Element	
Transitoperations	Element	
Transitincident	Element	
Transitconstruction	Element	

3.6.2.4.29. FullEventUpdate

This is the same as the FullEventUpdate data frame in TMDD 3.3.8.30.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Message-Header	Type: MessageHeader	TMDD 3.3.8.35
Event-Reference	Type: EventReference	TMDD 3.3.8.25
Project-References	Type: Sequence of "ProjectReference" types	TMDD 3.3.8.38
Event-Indicators	Type: Sequence of "EventIndicator" types	TMDD 3.3.8.19
Other-References	Type: Sequence of "OtherReference" types	TMDD 3.3.8.36
Event-Headline	Type: EventHeadline	TMDD 3.3.8.17
Event-Element-Details	Type: Sequence of "EventElementDetail" types	TMDD 3.3.8.15
Event-Comments	Type: EventComments	TMDD 3.3.8.13
Full-Report-Texts	Type: Sequence of "FullReportText" types	TMDD 3.3.8.31

3.6.2.4.30. FullReportText

This is the same as the FullReportText data frame in TMDD 3.3.8.31.

Attribute Name	Type/Element	Reference
Report-Medium	Element	
Description	Element	
Language	Element	

3.6.2.4.31. Hazmat

This is the same as the Hazmat data frame in TMDD 3.3.8.32.

Attribute Name	Type/Element	Reference
Hazmat-Code	Element	
Placard-Code	Element	
Placard-Displayed-Accuracy	Element	

3.6.2.4.32. LandmarkLocation

This is the same as the LandmarkLocation data frame in TMDD 3.3.8.33.

Attribute Name	Type/Element	Reference
Landmark-Type	Element	
Landmark-Name	Element	
Landmark-Point-Name	Element	
Location-Rank	Element	
Geo-Location	Type: GeoLocation	TMDD 3.6.9.4
Upward-Area-Reference	Type: AreaLocation	TMDD 3.3.8.4

3.6.2.4.33. LinkLocation

This is the same as the LinkLocation data frame in TMDD 3.3.8.34.

Attribute Name	Type/Element	Reference
Link-Ownership	Element	

Attribute Name	Type/Element	Reference
Link-Designator	Element	
Second-Link-Designator	Element	
Link-Id	Element	
Link-Name	Element	
Primary-Location	Type: PointOnLink	TMDD 3.3.8.37
Secondary-Location	Type: PointOnLink	TMDD 3.3.8.37
Link-Direction	Element	
Link-Alignment	Element	
Linear-Reference-Version	Element	
Alternate-Designations	Type: Sequence of "LinkLocation" types	TMDD 3.3.8.34

3.6.2.4.34. MessageHeader

This is the same as the MessageHeader data frame in TMDD 3.3.8.35.

Attribute Name	Type/Element	Reference
Organization-Sending	Type: OrganizationInformation	TMDD 3.3.16.3
Organizations-Receiving	Type: Sequence of "OrganizationInformation" types	TMDD 3.3.16.3
Organizations-Responding	Type: Sequence of "OrganizationInformation" types	TMDD 3.3.16.3
Message-Type-Version	Element	
Message-Number	Element	
Message-Time-Stamp	Type: DateTimeZone	TMDD 3.3.10.1
Message-Expiry-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.6.2.4.35. OtherReference

This is the same as the OtherReference data frame in TMDD 3.3.8.36.

Attribute Name	Type/Element	Reference
Trip-Reference	Element	
Responsible-Event	Type: EventReference	TMDD 3.3.8.25
Related-Event	Type: EventReference	TMDD 3.3.8.25
Previous-Event	Type: EventReference	TMDD 3.3.8.25
Split-Event	Type: EventReference	TMDD 3.3.8.25
Merged-Event	Type: EventReference	TMDD 3.3.8.25
Sibling-Event	Type: EventReference	TMDD 3.3.8.25
Associated-Device	Type: DeviceReference	TMDD 3.3.5.12
Associated-Url	Type: UrlReference	TMDD 3.3.10.2

3.6.2.4.36. PointOnLink

This is the same as the PointOnLink data frame in TMDD 3.3.8.37.

Attribute Name	Type/Element	Reference
Geo-Location	Type: GeoLocation	TMDD 3.6.9.4
Linear-Reference	Element	
Link-Name	Element	
Point-Name	Element	
Cross-Street-Designator	Element: Sequence of "Transportation-network-identifier" types	
Cross-Street-Name	Element: Sequence of "Transportation-network-name" types	
Signed-Destination	Element: Sequence of "Event-signed-destination" types	
Location-Rank	Element	
Landmark-Type	Element	
Upward-Area-Reference	Type: AreaLocation	TMDD 3.3.8.4

3.6.2.4.37. ProjectReference

This is the same as the ProjectReference data frame in TMDD 3.3.8.38.

Attribute Name	Type/Element	Reference
Project-Reference	Element	
Permit-Reference	Element	
Project-Contacts	Type: OrganizationInformation	TMDD 3.3.16.3
Project-Description	Element	

3.6.2.4.38. RecurrentTime

This is the same as the RecurrentTime data frame in TMDD 3.3.8.39.

Attribute Name	Type/Element	Reference
Recurrent-Period	Type: EventPeriod	TMDD 3.3.8.22
Schedule-Times	Element: Sequence of "Event-timeline-schedule-times" types	
Utc-Offset	Element	

3.6.2.4.39. RequestFilter

This is the same as the RequestFilter data frame in TMDD 3.3.8.40.

Attribute Name	Type/Element	Reference
Category	Element	
Priority-Level	Element	
Confidence-Level	Element	
Access-Level	Element	
Action-Request-Flag	Element	
Severity	Element	
Hazmat-Code	Element: Sequence of "Event-hazmat-code" types	
Placard-Code	Element: Sequence of "Event-placard-code" types	
Organizations-Requested	Type: Sequence of "OrganizationInformation" types	TMDD 3.3.16.3
Headline	Type: EventType	TMDD 3.3.8.29

3.6.2.4.40. RequestHeader

This is the same as the RequestHeader data frame in TMDD 3.3.8.41.

Attribute Name	Type/Element	Reference
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Organization-Requesting	Type: Sequence of "OrganizationInformation" types	TMDD 3.3.16.3
Message-Type-Id	Element	
Message-Type-Version	Element	
Message-Number	Element	
Message-Time-Stamp	Type: DateTimeZone	TMDD 3.3.10.1

3.6.2.4.41. RequestLocation

This is the same as the RequestLocation data frame in TMDD 3.3.8.42.

Attribute Name	Type/Element	Reference
Area-Locations	Type: AreaLocation	TMDD 3.3.8.4
Link-Categories	Element	
Link-Designator	Element: Sequence of "Link-route-designator" types	

3.6.2.4.42. RequestTimes

This is the same as the RequestTimes data frame in TMDD 3.3.8.43.

Attribute Name	Type/Element	Reference
Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
End-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.6.2.4.43. RequestType

This is the same as the RequestType data frame in TMDD 3.3.8.44.

Attribute Name	Type/Element	Reference
Request-Focus	Element	
Event-Ids	Element: Sequence of "Organization-resource-identifier" types	
Response-Plan-Ids	Element: Sequence of "Organization-resource-identifier" types	

3.6.2.4.44. ValidPeriod

This is the same as the ValidPeriod data frame in TMDD 3.3.8.45.

Attribute Name	Type/Element	Reference
Expected-End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Estimated-Duration	Element	
Effective-Periods	Type: Sequence of "EventPeriod" types	TMDD 3.3.8.22

3.7. LAYER: TRAFFIC STATE AND FORECASTING DATA

This layer contains the current traffic state and traffic forecast data.

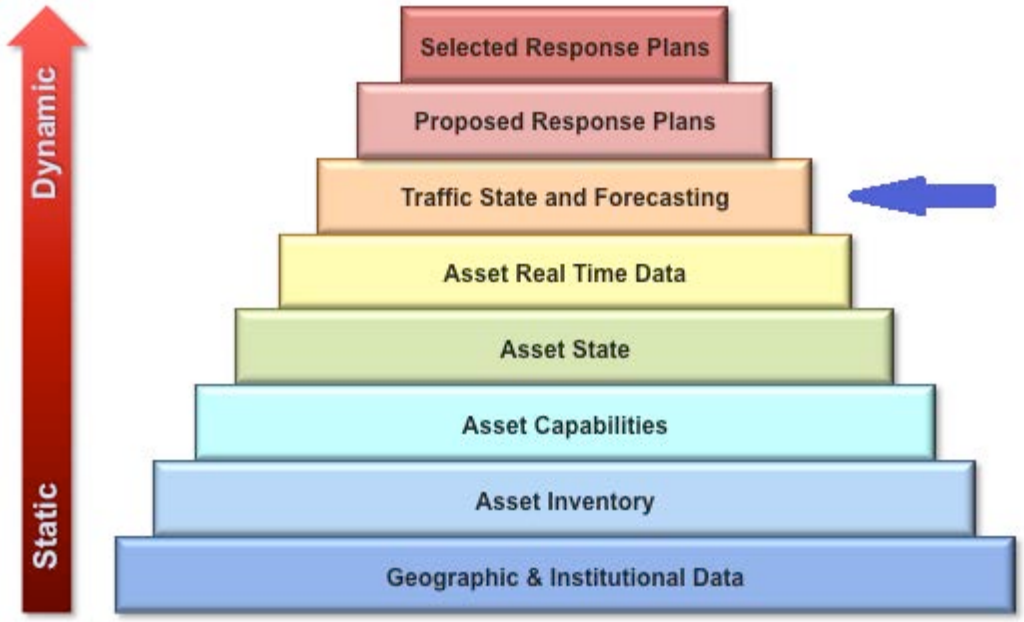

Figure 8 - Traffic State & Forecasting Layer

3.7.1. Data Messages

There are no applicable TMDD data messages. Information that will be contained in this layer include:

Name	Reference	Description
Traffic Current Link State		Includes link identifier, capacity, lanes available, closed lane identifiers, speed, flow, and density, start date/time, duration
Traffic Predicted Link State		Includes link identifier, capacity, lanes available, closed lane identifiers, speed, flow, and density, start date/time, duration
Traffic Current Approach Turn State		Includes approach link identifier, exit link identifiers, start date/time, duration, approach volume, and for each exit link identifier, a turn volume and turn ratio
Traffic Predicted Approach Turn State		Includes approach link identifier, exit link identifiers, start date/time, duration, approach volume, and for each exit link identifier, a turn volume and turn ratio

Name	Reference	Description
Traffic Current State Quality Index		Estimation of the quality of the traffic state estimation
Traffic State Prediction Quality Index		Estimation of the quality of the traffic state prediction
Route Current Delay		Total traveller delay for a specified route and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Routed Predicted Delay		Total traveller delay for a specified route and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specified point in time
Aggregated Current Delay		Total traveller delay for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Aggregated Predicted Delay		Total traveller delay for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specified point in time
Route Current Vehicle Miles Travelled		VMT for a specific route and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Route Predicted Vehicle Miles Travelled		VMT for a specific route and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Aggregated Current Vehicle Miles Travelled		Aggregated VMT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Aggregated Predicted Vehicle Miles Travelled		Aggregated VMT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Route Current Person Miles Travelled		PMT for a specific route and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Route Predicted Person Miles Travelled		PMT for a specific route and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Aggregated Current Person Miles Travelled		Aggregated PMT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on current traffic conditions

Name	Reference	Description
Aggregated Predicted Person Miles Travelled		Aggregated PMT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Route Current Vehicle Hours Travelled		VHT for a specific route and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Route Predicted Vehicle Hours Travelled		VHT for a specific route and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Aggregated Current Vehicle Hours Travelled		Aggregated VHT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Aggregated Predicted Vehicle Hours Travelled		Aggregated VHT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Route Current Person Hours Travelled		PHT for a specific route and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Route Predicted Person Hours Travelled		PHT for a specific route and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time
Aggregated Current Person Hours Travelled		Aggregated PHT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on current traffic conditions
Aggregated Predicted Person Hours Travelled		Aggregated PHT for a specified geographic area (corridor, city, county, region) and mode (total travellers, fleet, automobile, transit) based on predicted traffic conditions at a specific point in time

3.8. LAYER: PROPOSED RESPONSE PLANS

This layer includes details of the proposed response plans, including the properties of each plan and model prediction results.

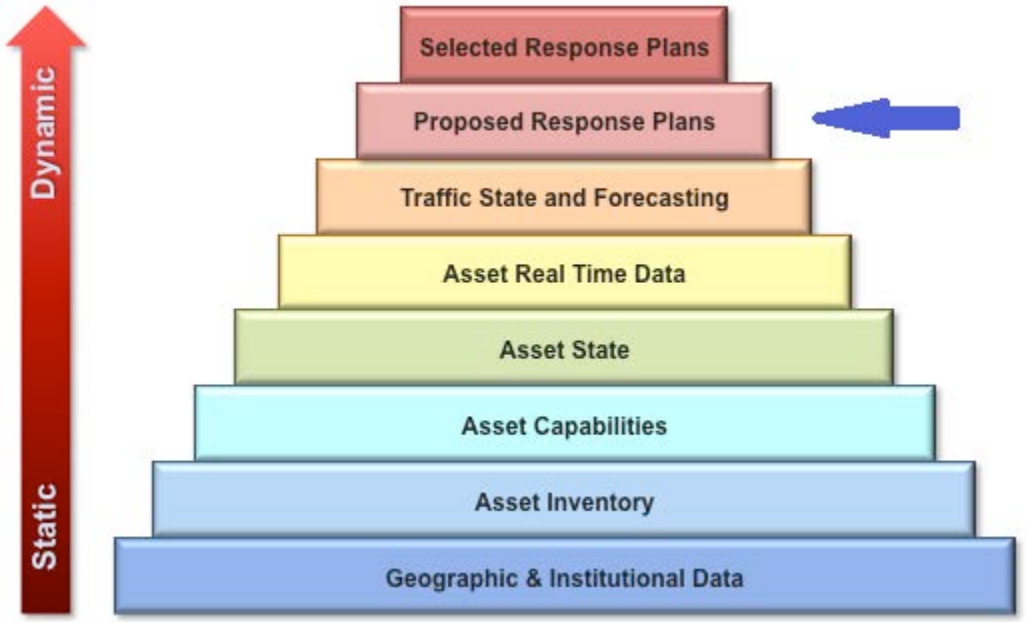

Figure 9 - Proposed Response Plans Layer

3.8.1. Data Messages

TMDD Data Message Dialogs include the following:

Name	Reference	Description
dlDeviceCancelControlRequest	TMDD 3.1.5.1	Request for device control cancellation
dlDMSControlRequest	TMDD 3.1.6.7	Request for Status of Device Control Request
dlDMSPriorityQueueRequest	TMDD 3.1.6.8	Request for DMS priority queue
dlHARControlRequest	TMDD 3.1.10.4	Request for HAR control
dlHARControlScheduleRequest	TMDD 3.1.10.5	Request for HAR Control Schedule
dlHARPriorityQueueRequest	TMDD 3.1.10.6	Request for HAR Priority Queue
dlIntersectionSignalControlRequest	TMDD 3.1.11.5	Request for intersection signal control
dlIntersectionSignalControlScheduleRequest	TMDD 3.1.11.6	Request for intersection signal Control Schedule
dlIntersectionSignalPriorityQueueRequest	TMDD 3.1.11.7	Request for intersection signal Priority Queue

Name	Reference	Description
dlLCSControlRequest	TMDD 3.1.12.3	Request for LCS control
dlLCSControlScheduleRequest	TMDD 3.1.12.4	Request for LCS Control Schedule
dlRampMeterControlRequest	TMDD 3.1.16.3	Request for ramp meter control
dlRampMeterControlScheduleRequest	TMDD 3.1.16.4	Request for ramp meter Control Schedule
dlRampMeterPriorityQueueRequest	TMDD 3.1.16.5	Request for ramp meter Priority Queue
dlSectionControlRequest	TMDD 3.1.18.2	Request for section control
dlSectionControlScheduleRequest	TMDD 3.1.18.3	Request for section Control Schedule
dlSectionPriorityQueueRequest	TMDD 3.1.18.5	Request for section Priority Queue
dlHARControlScheduleUpdate	TMDD 3.1.28.4	HAR Control Schedule update

Other information that will be contained in this layer includes:

Name	Reference	Description
Response Plan Request		Contains request for a response plan and evaluation
Response Plan		Contains response plan summary and details messages
Response Plan Summary		Contains summary of response plan elements
Response Plan Details		Contains details of response plan elements
Response Plan Evaluation Rank		Contains rank information for specific response plan
Proposed Response Plan Traffic Forecast Summary		Contains summary of response plan traffic forecast
Proposed Response Plan Current Traffic State		Contains the current traffic state that was used to initiate the forecast
Proposed Response Plan Traffic Forecast Details		Contains details of response plan traffic forecast
Response Plan Approval Request		Request for approval to implement response plan
Response Plan Modification Request		Contains request to modify a response plan
Response Plan Evaluation Request		Contains request to evaluate/re-evaluate response plan
Response Plan Approval Response		Contains approval or disapproval of response plan
Response Plan Approval Update		Contains request to update state of response plan

3.8.2. Data Class Descriptions

Data Class Descriptions include data elements for basic objects. Classes may be referenced in other classes (parent classes), and may be referenced in multiple parent classes. These do not represent database structures, but instead are based primarily on TMDD, or are structured similarly. Database design is expected to occur during system design.

3.8.2.1. CCTV Class

3.8.2.1.1. CCTVControlDetails

This is the same as the CCTVControlDetails data frame in TMDD 3.3.2.1.

Attribute Name	Type/Element	Reference
Cctv-Position-Preset	Element	
Cctv-Position-Pan	Element	
Cctv-Position-Tilt	Element	
Cctv-Position-Zoom-Lens	Element	
Cctv-Position-Iris-Lens	Element	
Cctv-Position-Focus-Lens	Element	
Cctv-Environment	Element	
Cctv-Text	Element	
Cctv-Lock	Element	

3.8.2.1.2. CCTVControlRequest

This is the same as the CCTVControlRequest data frame in TMDD 3.3.2.2.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Cctv-Request-Command	Element	
Cctv-Command-Parameters	Type: CCTVControlDetails	TMDD 3.3.2.1

3.8.2.2. Device Class

3.8.2.2.1. DeviceCancelControlRequest

This is the same as the DeviceCancelControlRequest data frame in TMDD 3.3.5.1.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Request-Id	Element	

3.8.2.2.2. DeviceControlRequestHeader

This is the same as the DeviceControlRequestHeader data frame in TMDD 3.3.5.2.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Request-Id	Element	
Event-Id	Element	
Response-Plan-Id	Element	
Command-Request-Priority	Element	
Command-Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
Command-End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Command-Request-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.8.2.2.3. DeviceControlResponse

This is the same as the DeviceControlResponse data frame in TMDD 3.3.5.3.

Attribute Name	Type/Element	Reference
Organization-Information	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id	Element	
Request-Id	Element	
Operator-Id	Element	
Operator-Lock-Id	Element	
Request-Status	Element	
Operator-Last-Revised	Type: DateTimeZone	TMDD 3.3.10.1

3.8.2.2.4. DevicePriorityQueueHeader

This is the same as the DevicePriorityQueueHeader data frame in TMDD 3.3.5.9.

Attribute Name	Type/Element	Reference
Restrictions	Type: Restrictions	TMDD 3.3.16.5
Device-Id	Element	
Device-Type	Element	
Current-Device-Priority	Element	
Device-Priority-Queue-List	Type: Sequence of "DevicePriorityQueueItem" types	TMDD 3.3.5.10

3.8.2.2.5. DevicePriorityQueueItem

This is the same as the DevicePriorityQueueItem data frame in TMDD 3.3.5.10.

Attribute Name	Type/Element	Reference
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Command-Request-Priority	Element	
Operator-Id	Element	
Request-Id	Element	
Event-Id	Element	
Response-Plan-Id	Element	
Command-Start-Time	Type: DateTimeZone	TMDD 3.3.10.1
Command-End-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.8.2.2.6. DevicePriorityQueueRequest

This is the same as the DevicePriorityQueueRequest data frame in TMDD 3.3.5.11.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Device-Id-List	Element: Sequence of "Organization-resource-identifier" types	

3.8.2.3. DMS Class

3.8.2.3.1. DMSControlDetails

This is the same as the DMSControlDetails data frame in TMDD 3.3.6.2.

Attribute Name	Type/Element	Reference
Dms-Message	Element	
Message-Number	Element	

3.8.2.3.2. DMSControlRequest

This is the same as the DMSControlRequest data frame in TMDD 3.3.6.3.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Dms-Request-Command	Element	
Dms-Command-Parameters	Type: DMSControlDetails	TMDD 3.3.6.2
Dms-Beacon-Control	Element	

3.8.2.3.3. DMSPriorityQueue

This is the same as the DMSPriorityQueue data frame in TMDD 3.3.6.12.

Attribute Name	Type/Element	Reference
Device-Priority-Queue-Header	Type: DevicePriorityQueueHeader	TMDD 3.3.5.9
Dms-Request-Command	Element	
Dms-Queue-Parameters	Type: DMSControlDetails	TMDD 3.3.6.2

3.8.2.4. HAR Class

3.8.2.4.1. HARControlDetails

This is the same as the HARControlDetails data frame in TMDD 3.3.11.1.

Attribute Name	Type/Element	Reference
Har-Message	Element	
Har-Message-Number	Element	

3.8.2.4.2. HARControlRequest

This is the same as the HARControlRequest data frame in TMDD 3.3.11.2

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Har-Request-Command	Element	
Har-Command-Parameters	Type: HARControlDetails	TMDD 3.3.11.1

3.8.2.4.3. HARControlSchedule

This is the same as the HARControlSchedule data frame in TMDD 3.3.11.3.

Attribute Name	Type/Element	Reference
Device-Control-Schedule-Header	Type: DeviceControlScheduleHeader	TMDD 3.3.5.4
Message-Number	Element	

3.8.2.4.4. HARPriorityQueue

This is the same as the HARPriorityQueue data frame in TMDD 3.3.11.6

Attribute Name	Type/Element	Reference
Device-Priority-Queue-Header	Type: DevicePriorityQueueHeader	TMDD 3.3.5.9
Har-Request-Command	Element	
Har-Queue-Parameters	Type: HARControlDetails	TMDD 3.3.11.1

3.8.2.5. IntersectionSignal Class

3.8.2.5.1. IntersectionSignalControlDetails

This is the same as the IntersectionSignalControlDetails data frame in TMDD 3.3.12.1.

Attribute Name	Type/Element	Reference
Request-Timing-Mode	Element	
Timing-Pattern-Id	Element	
Offset-Adjustment	Element	

3.8.2.5.2. IntersectionSignalControlRequest

This is the same as the IntersectionSignalControlRequest data frame in TMDD 3.3.12.2.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Intersection-Request-Command	Element	
Intersection-Command-Parameters	Type: IntersectionSignalControlDetails	TMDD 3.3.12.1

3.8.2.5.3. IntersectionSignalControlResponse

This is the same as the IntersectionSignalControlResponse data frame in TMDD 3.3.12.3.

Attribute Name	Type/Element	Reference
Device-Control-Response-Header	Type: DeviceControlResponse	TMDD 3.3.5.3
Section-Id	Element	
Request-Control-Mode	Element	
Timing-Pattern-Id	Element	
Offset-Adjustment	Element	

3.8.2.5.4. IntersectionSignalPriorityQueue

This is the same as the IntersectionSignalPriorityQueue data frame in TMDD 3.3.12.13.

Attribute Name	Type/Element	Reference
Device-Priority-Queue-Header	Type: DevicePriorityQueueHeader	TMDD 3.3.5.9
Intersection-Request-Command	Element	
Intersection-Queue-Parameters	Type: IntersectionSignal ControlDetails	TMDD 3.3.12.1

3.8.2.6. LCS Class

3.8.2.6.1. LCSControlRequest

This is the same as the LCSControlRequest data frame in TMDD 3.3.13.1.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Element	
Lcs-Request-Command	Element	

3.8.2.7. RampMeter Class

3.8.2.7.1. RampControlDetails

This is the same as the RampControlDetails data frame in TMDD 3.3.17.1.

Attribute Name	Type/Element	Reference
Meter-Requested-Plan	Element	
Meter-Requested-Rate	Element	

3.8.2.7.2. RampMeterControlRequest

This is the same as the RampMeterControlRequest data frame in TMDD 3.3.17.2.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Metered-Lane-List	Type: RampMeterLaneControlDetails	TMDD 3.3.17.6

3.8.2.7.3. RampMeterLaneControlDetails

This is the same as the RampMeterLaneControlDetails data frame in TMDD 3.3.17.6.

Attribute Name	Type/Element	Reference
Metered-Lane-Identifier	Element	
Meter-Request-Command	Element	
Meter-Command-Parameters	Type: RampControlDetails	TMDD 3.3.17.1

3.8.2.7.4. RampMeterPriorityQueue

This is the same as the RampMeterPriorityQueue data frame in TMDD 3.3.17.9.

Attribute Name	Type/Element	Reference
Device-Priority-Queue-Header	Type: DevicePriorityQueueHeader	TMDD 3.3.5.9
Metered-Lane-Identifier	Element	
Meter-Request-Command	Element	
Meter-Queue-Parameters	Type: RampControlDetails	TMDD 3.3.17.1

3.8.2.8. Section Class

3.8.2.8.1. SectionControlDetails

This is the same as the SectionControlDetails data frame in TMDD 3.3.19.1.

Attribute Name	Type/Element	Reference
Request-Control-Mode	Element	

Attribute Name	Type/Element	Reference
Timing-Pattern-Id	Element	
Section-Offset-Adjustment	Element	

3.8.2.8.2. SectionControlRequest

This is the same as the SectionControlRequest data frame in TMDD 3.3.19.2.

Attribute Name	Type/Element	Reference
Authentication	Type: Authentication	TMDD 3.3.3.1
Organization-Requesting	Type: OrganizationInformation	TMDD 3.3.16.3
Section-Id	Element	
Request-Id	Element	
Section-Request-Command	Element	
Section-Command-Parameters	Type: SectionControlDetails	TMDD 3.3.19.1
Event-Id	Element	
Response-Plan-Id	Element	
Command-Request-Priority	Element	
Command-Begin-Time	Type: DateTimeZone	TMDD 3.3.10.1
Command-End-Time	Type: DateTimeZone	TMDD 3.3.10.1
Command-Request-Time	Type: DateTimeZone	TMDD 3.3.10.1

3.8.2.8.3. SectionPriorityQueue

This is the same as the SectionPriorityQueue data frame in TMDD 3.3.19.6.

Attribute Name	Type/Element	Reference
Device-Priority-Queue-Header	Type: DevicePriorityQueueHeader	TMDD 3.3.5.9
Section-Request-Command	Element	
Section-Queue-Parameters	Type: SectionControlDetails	TMDD 3.3.19.1

3.8.2.9. VideoSwitch Class

3.8.2.9.1. VideoSwitchControlRequest

This is the same as the VideoSwitchControlRequest data frame in TMDD 3.3.21.1.

Attribute Name	Type/Element	Reference
Device-Control-Request-Header	Type: DeviceControlRequestHeader	TMDD 3.3.5.2
Input-Channel-Id	Element	
Output-Channel-Id	Element	
Channel-Titling-Text	Element	
Set-Output-Channel-Lock	Element	
Frames-Per-Second	Element	
Frame-Height-Pixels	Element	
Frame-Width-Pixels	Element	
Video-Format	Element	

3.8.2.10. ResponsePlan Class

This is a new class to handle response plan objects.

3.8.2.10.1. ResponsePlan

This is a new object representing each developed response plan.

Attribute Name	Type/Element	Reference	Description
Event-Id	Element: ID number	System Requirements spec 8.7.1.6	Identification number assigned to the incident or event
Activity-Start-Time	Type: DateTimeZone	TMDD 3.3.10.1 System Requirements spec 8.7.1.6	Time when response planning activities were initiated.
Activity-End-Time	Type: DateTimeZone	TMDD 3.3.10.1 System Requirements spec 8.7.1.6	Time when response planning activities were terminated.
Agency	Type: Sequence of OrganizationInformation types	TMDD 3.3.16.3 System Requirements specs 8.7.1.6 and 8.5.2.4	Agencies involved in the implementation of the response plan

Attribute Name	Type/Element	Reference	Description
Detours	Type: Sequence of AlternateRouteDetail types	TMDD 3.3.8.3 System Requirements specs 8.7.1.6 and 8.5.2.4	Recommended alternate route(s) around the incident or event
Ramp-Metering-Control-Actions	Type: Sequence of RampMeterControlSchedule types	TMDD 3.3.17.3 System Requirements specs 8.7.1.6 and 8.5.2.4	Recommended metering actions at each affected freeway on-ramp
Intersection-Control	Type: Sequence of IntersectionSignalControlSchedule types	TMDD 3.3.12.4 System Requirements specs 8.7.1.6 and 8.5.2.4	Recommended signal timing plan to activate at each affected signalized intersection
DMS-Messages	Type: Sequence of DMSControlDetails types	TMDD 3.3.6.2 System Requirements specs 8.7.1.6 and 8.5.2.4	Information dissemination strategy: Messages to post on fixed and portable DMSs
HAR-Messages	Type: Sequence of HARControlDetails types	TMDD 3.3.11.1 System Requirements specs 8.7.1.6 and 8.5.2.4	Information dissemination strategy: Which HARs to activate and what message to broadcast on them
Informational-Message	Type: Sequence of InformationalMessage types	Custom type; see "Proposed Response Plans" layer System Requirements specs 8.7.1.6 and 8.5.2.4	Information dissemination strategy: Information to disseminate to 511 systems, and information to make available to third-party information providers and mobile travel application developers
Personnel-Deployments	Type: TBD	System Requirements specs 8.7.1.6 and 8.5.2.4	Will include details about personnel requested to be deployed to specific corridor locations
Response-Plan-Evaluation	Type: TBD	System Requirements specs 8.7.1.6 and 8.5.2.5	Will include metrics of the evaluation, the response plan ranking, a risk evaluation and a confidence index

Attribute Name	Type/Element	Reference	Description
Response-Plan-Approval	Type: Sequence of ResponsePlanApproval types	Custom type; see "Selected Response Plans" layer	Only applies to response plans that are selected for implementation
Response-Plan-Implementation	Type: ResponsePlanImplementation	Custom type; see "Selected Response Plans" layer	Only applies to response plans that are selected for implementation

3.8.2.10.2. InformationalMessage

This is a new data frame for information to be disseminated to other systems and parties per Systems Requirements spec 8.7.1.6. It will include information to disseminate to 511 systems and information to make available to third-party information providers and mobile travel application developers.

Attribute Name	Type/Element	Reference	Description
Recipient	Type: OrganizationInformation	TMDD 3.3.16.3	
Informational-Text	Element: Text		Text of informational message

3.9. LAYER: SELECTED RESPONSE PLANS

This layer includes details of the selected response plan, regardless of whether the plan is implemented or not. It also includes the real time implementation results of any deployed response plan.

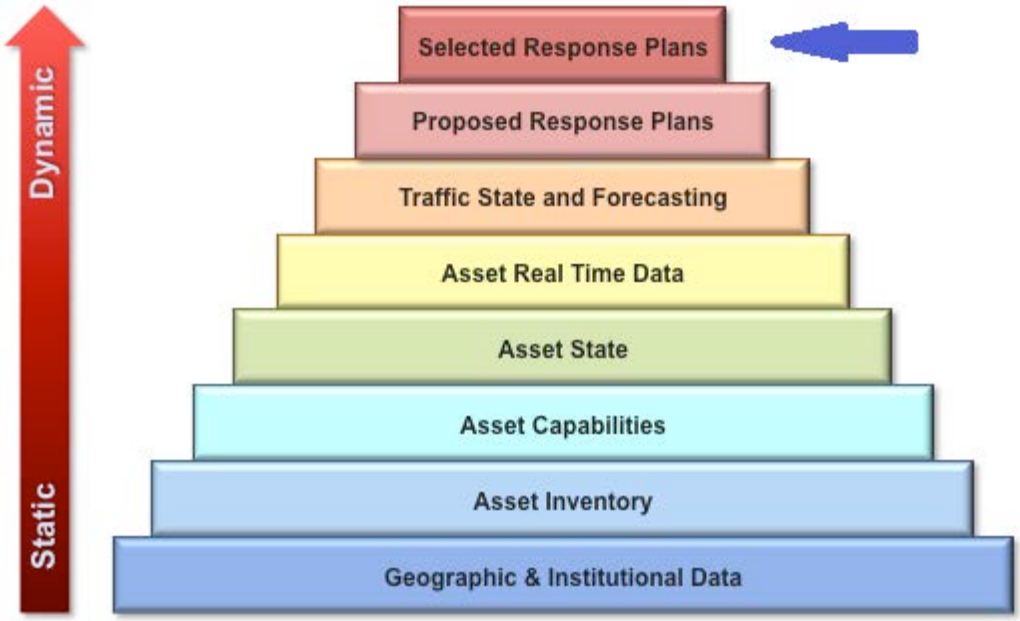

Figure 10 - Selected Response Plans Layer

3.9.1. Data Messages

TMDD Data Message Dialogs include the following:

Name	Reference	Description
dlDeviceCancelControlRequest	TMDD 3.1.5.1	Request for device control cancellation
dlDMSControlRequest	TMDD 3.1.6.7	Request for Status of Device Control Request
dlDMSPriorityQueueRequest	TMDD 3.1.6.8	Request for DMS priority queue
dlHARControlRequest	TMDD 3.1.10.4	Request for HAR control
dlHARControlScheduleRequest	TMDD 3.1.10.5	Request for HAR Control Schedule
dlHARPriorityQueueRequest	TMDD 3.1.10.6	Request for HAR Priority Queue
dlIntersectionSignalControlRequest	TMDD 3.1.11.5	Request for intersection signal control

Name	Reference	Description
dlIntersectionSignalControlScheduleRequest	TMDD 3.1.11.6	Request for intersection signal Control Schedule
dlIntersectionSignalPriorityQueueRequest	TMDD 3.1.11.7	Request for intersection signal Priority Queue
dlLCSControlRequest	TMDD 3.1.12.3	Request for LCS control
dlLCSControlScheduleRequest	TMDD 3.1.12.4	Request for LCS Control Schedule
dlRampMeterControlRequest	TMDD 3.1.16.3	Request for ramp meter control
dlRampMeterControlScheduleRequest	TMDD 3.1.16.4	Request for ramp meter Control Schedule
dlRampMeterPriorityQueueRequest	TMDD 3.1.16.5	Request for ramp meter Priority Queue
dlSectionControlRequest	TMDD 3.1.18.2	Request for section control
dlSectionControlScheduleRequest	TMDD 3.1.18.3	Request for section Control Schedule
dlSectionPriorityQueueRequest	TMDD 3.1.18.5	Request for section Priority Queue
dlHARControlScheduleUpdate	TMDD 3.1.28.4	HAR Control Schedule update

Other information that will be contained in this layer include:

Name	Reference	Description
Response Plan Request		Contains request for a response plan and evaluation
Response Plan		Contains response plan summary and details messages
Response Plan Summary		Contains summary of response plan elements
Response Plan Details		Contains details of response plan elements
Response Plan Evaluation Rank		Contains rank information for specific response plan
Proposed Response Plan Traffic Forecast Summary		Contains summary of response plan traffic forecast
Proposed Response Plan Current Traffic State		Contains the current traffic state that was used to initiate the forecast and a snapshot of each current traffic state captured during response plan execution
Proposed Response Plan Traffic Forecast Details		Contains details of response plan traffic forecast
Response Plan Approval Request		Request for approval to implement response plan
Response Plan Modification Request		Contains request to modify a response plan

Name	Reference	Description
Response Plan Evaluation Request		Contains request to evaluate/re-evaluate response plan
Response Plan Approval Response		Contains approval or disapproval of response plan
Response Plan Implementation Results		Contains the success, partial success of each response plan action, time of action completion, and time of return to normal operations. Also may include descriptive text.
Response Plan Approval Update		Contains request to update state of response plan

3.9.2. Data Class Descriptions

Data Class Descriptions include data elements for basic objects. Classes may be referenced in other classes (parent classes), and may be referenced in multiple parent classes. These do not represent database structures, but instead are based primarily on TMDD, or are structured similarly. Database design is expected to occur during system design.

3.9.2.1. ResponsePlan Class

This is a new class to handle response plan objects.

3.9.2.1.1. ResponsePlanApproval

This is a new data frame for the approval of a selected response plan or periodic response plan updates. There may be multiple rounds of proposed modifications before a response plan is approved.

Attribute Name	Type/Element	Reference	Description
Approval-Decision	Element: Text		Indicates whether the proposed response plan was approved.
Approval-Time	Type: DateTimeZone	TMDD 3.3.10.1 System Requirements spec 8.7.1.6	Time the recommended response plan was approved.

Attribute Name	Type/Element	Reference	Description
Approval-Automation-Level	Type: TBD	System Requirements specs 8.5.3 and 8.5.4	Will include whether recommended response plans should require manual approval or whether the approval can be granted automatically, and periods during which manual approval is required and periods during which automated approval is possible. For periodic response plan updates it will also differentiate between proposed changes from the ICM system vs system users, and the approval setup for each type of control action can be customized separately.
Proposed-Plan-Modification	Type: TBD	System Requirements specs 8.5.2.4 and 8.5.3	Will include requests for specific detours, specific signal control plans, specific ramp metering rates and specific messages to post on DMS's.
Adopted-Service-Deviations	Type: TBD	System Requirements spec 8.5.2.4	Will include bus route modifications, bus stop modifications and service frequency increases/decreases.

3.9.2.1.2. ResponsePlanImplementation

This is a new data frame for the implementation of a selected and approved response plan.

Attribute Name	Type/Element	Reference	Description
Plan-Implementation-Status	Element: Text	System Requirements spec 8.6.6	Indicates status of response plan implementation so that a notification can be sent when the response plan has been implemented in its entirety or if the response plan cannot be implemented.
Implementation-Time	Type: DateTimeZone	TMDD 3.3.10.1 System Requirements spec 8.7.1.6	Time the approved response plan was implemented.

Attribute Name	Type/Element	Reference	Description
Implementation-Termination-Time	Type: DateTimeZone	TMDD 3.3.10.1 System Requirements spec 8.7.1.6	Time the implemented response plan was terminated.
Event-Termination-Status	Element: Text	System Requirements specs 8.4.6 and 8.5.5	Indicates status of event termination, so the Response Plan can be terminated after the event is officially terminated.
Response-Plan-Termination-Approval-Level	Type: TBD	System Requirements spec 8.5.5	Will include whether active response plans can be automatically terminated or whether approval from all agencies involved in its implementation is required before termination, and periods during which manual approval is required and periods during which automated approval is possible.
Response-Plan-Termination-Approval-Status	Type: TBD	System Requirements spec 8.5.5	Authorized users from the agency will specify whether active response plans can be automatically terminated or whether approval from all agencies involved in its implementation is required before termination, and periods during which manual approval is required and periods during which automated approval is possible.
Response-Plan-Termination-Status	Element: Text	System Requirements spec 8.5.5	While a response plan is being terminated this status will indicate the termination is in-process. When all control devices have returned to normal operation then this status will indicate that the response plan termination is officially complete.

3.10. SYSTEM DATA CLASSES

3.10.1. Data Messages

There are no applicable TMDD data messages. Information that will be contained in this layer include:

Name	Reference	Description
Alert	System Requirements spec 8.7.2, 8.4.1 and 8.4.5	Includes source, message (which may be text or may be an object type, for example ContactDetails), priority, severity
Response Plan Activity Log	System Requirements spec 8.7.1.6	Includes ID number of incident or event, time when response planning activities were initiated, time when a recommended response plan was proposed, ID number of recommended response plan, response plan evaluation score, time response plan was approved, time response plan was implemented, time response plan was replaced by another plan or terminated, time when response planning activities were terminated
Maintenance Log	System Requirements spec 8.7.1.8	Includes all maintenance alerts and notifications generated by the ICM system, and all maintenance activity logs entered by participating agencies
Event Log	System Requirements spec 8.4.1	Includes all identified incidents/events

3.10.2. System Data Class Elements

System class elements are classes and types that are used to ensure proper operation of the ICM system. These will include the following:

3.10.2.1. Security and User Data Classes

These class elements describe very high level descriptions of basic security types of information. This list of classes is subject to significant change as security design is developed for the ICM system.

Name	Reference	Description
User		Contains information describing a user, such as their name, contact details, parent organization, title

Name	Reference	Description
Security Group		Contains the information describing a system security group
Security Group Members List		Contains a list of security group members
Security Role		Contains a description of a specific security role
Security Permissions		Contains security privilege information
Security Role Permissions List		Contains a list of permissions belonging to a security role
Security Group Role List		Contains a list of security roles for a specific security group.
Authentication		Contains information regarding the authentication of the user accessing the system
Authorization		Contains information regarding the authorization of the user to perform a specific action or access a specific piece of information
Authentication Provider		Contains information regarding the provider of authentication services for the user
Authorization Provider		Contains information regarding the provider of authorization services for the user
Security Exception Log		Contains a system security exception log information, including name, system application or component owner
Security Exception		Contains a security exception, such as failed login attempt

3.10.2.2. User Activity Log Data Classes

These class elements describe very high level descriptions of basic activity log information. This list of classes is subject to significant change as security design is developed for the ICM system.

Name	Reference	Description
User Activity Log		Contains information describing a user activity log, including name, application, description
User Activity Log Entry Type		Contains information describing a type of user activity
User Activity Log Inventory		Contains a full list of user activities for a specific user
User Activity Log Entry		Contains an individual user activity log entry

3.10.2.3. Systems Description Classes

These class elements describe the system components, primarily for reference by other information classes.

Name	Reference	Description
Application		Contains information describing an application, including name, organizational owner, contact information, application host, application type, description.
Application Component		Contains information describing an application component, including name, organizational owner, contact information, component host, component type, description.
Application Log	`	Contains information describing log information for an application or component, including name, description, location, type

3.10.2.4. Systems State Classes

These class elements describe the system application and component state. These are again, very high level and subject to change based on system design.

Name	Reference	Description
Application State		Contains information describing an application's state, including working status.
Component State		Contains information describing an application component's state, including working status
Application Log Activity		Contains the application or component log activity

3.10.2.5. Systems Maintenance Classes

These class elements describe the system maintenance actions and state. These are again, very high level and subject to change based on system design.

Name	Reference	Description
Application Maintenance Log		Contains information describing an application's maintenance log, including name, description, type, and last date of update
Application Maintenance Activity		Contains information for a specific application or component maintenance activity, including description, type, start date/time, end date/time, result and any error information

Name	Reference	Description
Application Maintenance Activity Result		Contains the details of any application or component maintenance action
Application Maintenance Activity Error		Contains the details of any application or component maintenance error

3.10.2.6. Systems Rules Engine Classes

These class elements describe the system rule engine classes. This is really just a placeholder until a rules engine is selected.

Name	Reference	Description
Rule set		Contains a set of rules.
Rule		Contains an individual rule.
Rule Owner		Contains a record of the owner of a rule
Rule Execution		Contains a rules execution instance
Rule Result		Contains a rules execution instance result

4. DEFINITION OF TERMS

Term	Definition
Alert	Notification sent by the ICM system to individuals or units. Alerts may be displayed on screen, sent by email, sent by text message, sent by radio message, or sent by telephone.
Archive	Data that has been stored for historical purposes and can be retrieved upon request, usually to a location and using a storage method that has large capacity and slower retrieval times.
Area of Impact (area of influence)	The road network elements impacted by an incident or event.
Asset	See *Corridor Asset*.
Asset Inventory	An inventory of corridor assets taken at any point in time. Asset inventory includeslocations of fixed position assets, and types of corridor assets. Can be specified for a type of assets, such as intersection signal asset inventory. Also includes the attributes of each individual asset, such as intersection or ramp meter signal capabilities and currently available signal/ramp meter plans.
Asset State	The condition of a corridor asset at a point in time. This condition includes working state (usually operational, failed, or some degraded operational state), location of mobile assets, signal or ramp meter plan that is in operation at the point in time, and all most recent data received by the asset at the point in time.
Authentication	Verifying a user's identity.
Authorization	Verifying a user's permissions to view specific data elements or perform specific functions.
Availability	A description of whether an asset is available for use in a response plan or not.
Backward Chaining Rules	Rules that are defined so that a specific goal is specified, and the possible alternatives that will achieve that goal are identified by execution of the rule. A potential ICM-related example would be rules that are defined to create a list of alternative routes between two defined points and set limitations on what road links can be used at various times for the route creation. In this example, the goal is a route between the two points. The rules are executed to find all the possible alternatives, essentially working backwards to find solutions that fit the rules given to achieve the goal.
CMS	Changeable message sign. Includes both fixed and mobile devices.
Configuration Management	Maintaining a timeline of changes to an entity, ensuring traceability of changes in time, content, and author of the change.

Term	Definition
Contact Details	Information for a specific individual or organizational unit, including names, phone numbers, email addresses, physical address, specific to the type of contact methods available for the individual or unit.
Corridor Asset	Any corridor element available for use within a response plan or that provides information to the ICM system. Assets include the following types of elements: • Intersection traffic signals • Ramp meters • Organizational units or individuals (people resources) • Equipment • Mobile or stationary CMS elements • Traffic sensors and other measurement devices • Communication elements (511, HAR, third party information providers) • Parking facilities • Transit elements
Corridor State	Information describing the state of the corridor at a specific point in time. State information includes: • Corridor road network closures • Corridor road network lane blockages • Incident information • Event information • Asset inventory • Asset state • Sensor information • Transit information • Transit state • Traffic conditions (density, flow, velocity) on the road network • Response plans currently implemented or in the process of being implemented
Current Traffic State	Determining a value of traffic density, flow, and velocity for each link in the road network at the current time and with the data available at the current time. Also includes values for current turn volumes and ratios at each turn movement within the road network.
Data Hub	A core component of the ICM system which has primary responsibility for receiving, processing, storing, and providing data for all ICM system components.

Term	Definition
Data Quality	A measure of the quality of data being received by the ICM system. Factors considered in data quality of a specific asset or type of assets include: • Percent of working assets • Individual asset state, including level of asset degradation • Percent of time reliable data is provided by the asset • Specific filtering or algorithmic verification of incoming data specific to the asset or asset type
Data Restoration	Restoration of data to service in the event of system or component failure.
Decision Support	A core component of the ICM system, providing traffic conditions, incident and event information, forecasts of traffic, proposed response plans and associated traffic forecasts, asset inventories and asset availability, maintenance information, organizational information, road network conditions, and previous corridor planning and study information to users to support corridor operations and decision making.
Delay	A measure of the typical time a traveler would experience along a route over and above the time the traveler would experience at free-flow traffic conditions.
Demand	A measure of traffic demand (flow) at an entrance to the road network or between specify entry and exit points.
Deterministic	A solution to an algorithm or rule execution for which the execution of the algorithm or rule, given the same input data, will always provide the same answer at any point in time.
Device State	See *Asset State*.
Disaster Recovery Plan	A plan developed that provides procedures, operations, and actions that are taken in the event of system failure or loss of capabilities, including any required system shutdown procedures, data protection actions, system and data recovery actions, procedures for restoration of the system to operational state, and post-event actions to be taken.
DMS	Dynamic Message Sign. This is the same as a *CMS* (see above).
Do Nothing Response	A response plan that includes no changes to any corridor assets' normal, preprogrammed, responses to traffic behavior.
Downtime	The amount of time a system is not fully operational over a specified time interval.
Drill Down	The ability of the user to select an element of information on a display and retrieve additional details related to the information selected.
ESS	Environmental Sensor Station.

Term	Definition
Event	A planned or unplanned occasion or activity occurring within the corridor that is not caused by traffic activity but affects traffic conditions. Examples include road maintenance activity, a major sports event, a public event such as a parade, and a concert or arts activity.
Event-Driven Process	A process or action that is driven by notification or detection of a previous action or set of actions.
Forward Chaining Rules	Rules that are defined to be executed from a set of pre-defined inputs, to achieve an answer by executing the rule against those inputs. An ICM-related example might be a rule that states that any response plan that achieves a delay time improvement over the do-nothing response plan of 25% shall be submitted for selection by the corridor manager.
Geospatial	Relating to location on the earth.
Geospatial Display	Display of information on a map.
GTFS	General Transit Feed Specification. This is a data format used to represent transit routes and schedules on electronic maps.
HAR	Highway Advisory Radio, used for communicating to travelers.
Incident	Traffic-related incident, such as an accident or disabled vehicle.
Incident Confirmation	Positive confirmation within the system of an identified traffic incident.
Incident Identification	Identification of a traffic incident.
Inventory	A collection of assets.
Jurisdiction	Geographic and asset ownership or control by a specific organizational or governmental entity.
Jurisdictional Restriction	A restriction, generally on a corridor asset or road network element, imposed by an organizational or governmental agency.
LCS	Lane Control Signal. Same acronym is also used for Lane Closure System.
Link	A defined section of road.
Node	A point of connection between two or more links, often located at intersections, freeway ramp diversions or ends, changes in lane configuration, or changes in road attributes (such as speed limits).
Non-deterministic	A solution to an algorithm or rule execution for which the execution of the algorithm or rule, given the same input data, will not always provide the same answer at any point in time.
Operational Status	The working state of a corridor asset—generally working, degraded, or not functional, depending upon the capabilities of the asset.
Persistence	Storage of information in a permanent store, such as a database or file system.

Term	Definition
PHT	Person Hours Traveled. The product of the number of travelers (people) and the hours traveled over a specified period of time and within a specified geographic boundary.
Plot-Based Display	Display of information using two- and three-dimensional graphing techniques.
PMT	Person Miles Traveled. The product of the number of travelers (people) and the miles traveled over a specified period of time and within a specified geographic boundary.
Post-event	An event or action taken after a traffic incident and removal or release of response plan elements and after the end of the response plan duration.
Probe Vehicle	A vehicle equipped with sensors allowing them to record the position, speed, and travel direction of the vehicle at regular intervals or when coming into proximity of roadside devices.
Reactive Transitive Query	A type of rules execution where the rule being executed does not find a solution but is still listening to the facts being provided and, upon a change of the facts provided, will re-evaluate automatically and provide a solution if a solution exists. A possible ICM example is a rule that is provided and checks the difference between the current traffic state density and the "historical normal" density on the traffic network. At any time, the difference may not be above a threshold specified by the rule. However, when the difference is updated, the rule will evaluate again without a direction to execute, and if the threshold is exceeded, the rule action (perhaps notification of a potential incident) will be executed.
Real-Time Data	Real-time data denotes information that is delivered immediately after measurement. Depending on the system providing the data, this may include data that was measured a few seconds or a few minutes ago. In transportation systems, this typically means data that 15-minute old or less.
Recovery Point Objective	The maximum amount of time for which data may be lost in the event of a system or component failure. The time measure does not include the recovery time (see *Recovery Time Objective*).
Recovery Time Objective	The maximum amount of time a system or component may be out of service in the event of a system or component failure.
Redundant Capability	A capability of a system function or component to continue operating in the event of loss of a primary dependency or system capability by use of duplicate capacity or function.
Reroute	An alternative route defined within the ICM system chosen for traffic to follow in response to an event or incident.

Term	Definition
Response Crew	Any organizational (human and equipment) assets that respond to an incident or event.
Response Plan	A collection of actions prepared and evaluated by the ICM system for implementation in response to an event or incident. Response plans may be in the following states: • Development - The selection and assembly of response plan elements • Evaluation - System generation of traffic forecast based on the response plan and analysis of the forecast and other response plan components • Proposed - Recommended by the system for implementation based on the evaluation of the plan • Selection - Selection of a plan to be submitted for approval • Active - Approved and in implementation Response plans may include one or more of the following deployment elements: • Recommended traffic reroutes around an incident or event • Intersection traffic signal changes • Ramp meter changes • Organizational asset deployments • Equipment deployments • CMS changes • Communications Required additional supporting elements of a response plan include: • Approval requests and responses (if the response plan is proposed for implementation) • Traffic state at the time of response plan development initiation • Traffic forecast based on the response plan deployment elements • Geographic area of impact (also known as area of influence) • Corridor asset state at the time of response plan development initiation • Initiating incident or event information • Implementation results, including success or failure of each response plan action and traffic state information throughout the response plan duration (if the response plan is deployed)
Response Plan Development	Creation of one or more response plans in response to an incident or event by the ICM system.
Response Plan Implementation	Execution of response plan deployment elements.

Term	Definition
Road Capacity	The maximum number of vehicles a road, road segment, or link is capable of carrying at free-flow speed over a one-hour period.
Route	An interconnected collection of road links that create a single continuous path between any two points in the road network.
Rule	A single element of logic, expressed within a format and dialog that the rules engine can understand and process.
Rule Action	A resulting action from execution of a rule.
Rule Condition	A condition that a rule checks during rule execution.
Rule Dependency	A dependency between two rules, usually enforced by rule categorization, grouping, or priority.
Rule Fact	A collection of information provided for a rule to use in its execution.
Rule set	A collection of rules and any instructions for their execution intended to be executed as a group within the rules engine.
Rules Engine	A core component of the ICM system that includes an off-the-shelf (commercial or open-source) software system that allows users to define, edit, or delete rules that govern specific logic applied to specific processes. The rules engine executes those rules at run time in the context of a process when the process is invoked. A rules engine is specified within the ICM system to allow users to define identification of traffic incidents, when response plans are to be developed, what response plan elements will be included within a response plan, and to allow the logic of these processes to be redefined by the users over the lifetime of the system.
Scheduled-Driven Process	An action or process that is initiated based on a pre-defined time-based schedule.
Sensor	A corridor asset that senses and reports to the ICM system a measurement of the state of the asset or traffic.
Tabular Display	Display of information in tables.
TMDD	Traffic Management Data Dictionary, which is a standard for communications between traffic centers.
Total Delay	The sum of all delay within a road network over a specified period of time.
Traffic Forecast	A prediction of the future state of traffic density, velocity, and flow for each link in the road network.
Traffic State	The current traffic density, velocity, and flow for each link in the road network.
Transit State	The state of one or more transit providers, including the transit inventory in operation, the working state of each asset, and each asset's location.

Term	Definition
Travel Time	The time it takes to travel between two defined points along a specified route on the traffic network. Three types of travel time can be distinguished: • Point travel time—Travel time observed at a given point in time within the road network • Predicted travel time—Expected future travel time along a given route based on a traveler or vehicle starting a trip at the current time and encountering various predicted traffic conditions along his trip • Experienced travel time—Travel time obtained by measuring the time it actually took for a person or vehicle to travel along a given route.
Turn Movement	A split in the traffic flow at a node in the road network. Each possible link pair at the node in the direction of traffic flow is defined as a turn movement.
Turn Ratio	The flow from the input link to one output link of a turn movement divided by the total flow of the input link at a point in time.
Turn Volume	The traffic volume for a specific turn movement at a point in time.
Two-Factor Authentication	Authentication method that requires two forms of identification. A common two-factor authentication method is to use a username/password combination with an additional method, such as an additional hardware key device.
Unbound Rule Arguments	Arguments specified within a rule condition that are data-dependent.
Uptime	The amount of time a system is fully operational divided by the total period time over a specified time interval. For the purposes of the ICM system, fully operational is defined as reporting as working with no asset degradation and as the ICM system being unable to detect any behavior indicating asset failure or degraded operation.
VHT	Vehicle Hours Traveled. The product of the number of vehicles and the hours traveled over a specified period of time and within a specified geographic boundary.
Visualization	The collection and display of information by the system for the user.
VMT	Vehicle Miles Traveled. The product of the number of vehicles and the miles traveled over a specified period of time and within a specified geographic boundary.