Work Zone Data Exchange (WZDx) v4.0 - Specification Reference Document

*This PDF is current as of 2/10/2022; for the latest version, see the WZDx Specification repository.

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1. Introduction

The Work Zone Data Exchange (WZDx) Specification aims to make harmonized work zone data provided by infrastructure owners and operators (IOOs) available for third-party use, making travel on public roads safer and more efficient through ubiquitous access to data on work zone activity.

The goal of WZDx is to enable widespread access to up-to-date information about dynamic conditions occurring on roads such as construction events. Currently, many IOOs maintain data on work zone activity. However, a lack of common data standards and convening mechanisms makes it difficult and costly for third parties such as original equipment manufacturers (OEMs) and navigation applications to access and use these data across various jurisdictions. WZDx defines a common language for describing work zone information. This simplifies the design process for producers and the processing logic for consumers and makes work zone data more accessible.

Specifically, WZDx defines the structure and content of several GeoJSON documents that are each intended to be distributed as a data feed. The feeds describe a variety of high-level road work-related information such as the location and status of work zones, detours, and field devices.

2. WZDx Specification Content

The WZDx specification defines the content and structure of several GeoJSON documents, each intended to be distributed as a data feed. Each GeoJSON document (colloquially "feed") contains a single feed root object. WZDx v4.0 defines the following feed objects:

- WZDxFeed: describes high-level information about work zone events occurring on roadways (called "road events") that impact the characteristics of the roadway and involve a change from the default state (such as a lane closure). This is the original work zone data exchange feed and the only feed that WZDx defined until version 4.0.
- RoadRestrictionFeed: describes the location and details of restrictions on roadways.
- SwzDeviceFeed: describes information (location, status, live data) about field devices deployed on the roadway in work zones.

Each feed object contains many layers of child objects. Together all the objects define the WZDx feed. All WZDx objects are located in the objects subdirectory and listed in the Objects section of this document.

The value of certain object properties is restricted to a defined set of values called an enumerated type. Enumerated types are located in the enumerated-types subdirectory and listed in the Enumerated Types section of this document.

Table 1: Data Feeds

Feed Name	Description	Producer	Consumer	Uses	Content
WZDxFeed	Provides high-level information about events occurring on roadways (called "road events"), primarily work zones, that impact the characteristics of the roadway and involve a change from the default state (such as a lane closure). The WZDxFeed is the original work zone data exchange feed.	Agencies responsible for managing roadways and road work, typically state and local DOTs.	Traveling public via third parties such as mapping companies and CAVs.	Route planning; increased awareness; "put work zones on the map".	Work zone and detour road events (see WorkZoneRoadEvent and DetourRoadEvent).
RoadRestrictionFeed	Provides information about sections of roadways that have restrictions. Restriction types described by this specification are listed in the RestrictionType enumerated type.	Transportation Authorities like Tribal, Local, State, or Federal Agencies.	Traveling public via third parties such as mapping companies and CAVs.	Increased awareness; Route planning; Driver, Passenger, and Road-User Safety; Increased Efficiency; Reduced Damage to Infrastructure.	Restriction road events (see RestrictionRoadEvent).
SwzDeviceFeed	Provides information (location, status, live data) about field devices deployed on the roadway in work zones.	Smart work zone equipment manufacturers or vendors.	Agencies responsible for managing roadways and permitting work, typically state and local DOTs. Third parties such as mapping companies and CAVs may also be interested in field device information.	Simplifies design process for agencies wanting to interface with equipment manufacturers; aids in dynamically generating a WZDxFeed with accurate information; reduces effort for manufacturers to conform to different agencies requirements.	Field devices (see FieldDeviceFeature).

3. Feed Level Objects

Each WZDx object is described by a table of properties with following columns:

- Name - The property name.
- Type - The type of data being stored. This can be one of the JSON primitive types (only String, Number, Array are used), Integer, as defined in the [JSON schema validation specification section 6.1 (Draft 07)](#), a formatted string as defined in [JSON schema validation specification section 7 (Draft 07)](#), a WZDx Enumerated Type, a WZDx Object, or a [GeoJSON Object.](#)
- Description - A description of the value of the property.
- Conformance - An indication of the requirement for including the property in a WZDx GeoJSON document. There are three categories of conformance:
  - Required - The property must be included
  - Optional - The property may be omitted
  - Conditional - The property's inclusion depends on the inclusion or value of a separate property
- Notes - Additional comments, guidance, notes for future consideration, or examples.

This section provides a tabular list of all objects used in the WZDx specification.

The following objects are high-level and describe either a WZDx feed or information about a WZDx feed:

Table 2: WZDx Feel Level Object List

Object	Description
FeedDataSource	Information about a specific data source used to build a work zone data feed.
FeedInfo	Information about a WZDx feed such as metadata, contact information, and data sources.
RoadRestrictionFeed	The root (highest-level) object of a **Road Restriction Feed** GeoJSON document.
SwzDeviceFeed	The root (highest-level) object of **Smart Work Zone Device Feed** GeoJSON document.
WZDxFeed	The root (highest-level) object of a **WZDx Feed** GeoJSON document.

3.1 FeedDataSource Object

The FeedDataSource object describes information about a specific data source used to build a work zone data feed. A WZDx feed must contain at least one FeedDataSource, included as an entry in the data_sources array of the FeedInfo object.

Table 3: Feed Data Source Object

Name	Type	Description	Conformance	Notes
data_source_id	String	Unique identifier for the data source organization providing work zone data.	Required	Linked to a road event by the data_source_id property on the road event's core details or a field device by the data_source_id property on the device's core details.
organization_name	String	The name of the organization for the authoritative source of the work zone data.	Required	Example: County DOT
update_date	String; date-time	The UTC date and time when the data source was last updated.	Optional	All date-time formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z
update_frequency	Integer	The frequency in seconds at which the data source is updated.	Optional	
contact_name	String	The name of the individual or group responsible for the work zone data source.	Optional	Example: Jo Help
contact_email	String; email	The email address of the individual or group responsible for the data source.	Optional	
lrs_type (DEPRECATED)	String	*This property is deprecated and will be removed in a future version —* Describes the type of linear referencing system (LRS) used for the milepost measurements.	Optional	Example: Use of milemarkers posted by the roadways. These are registered to a dynamic segmentation of statewide LRS basemap.
lrs_url (DEPRECATED)	String; uri	*This property is deprecated and will be removed in a future version —* A URL where additional information on the LRS information and transformation information is stored.	Optional	Example: https://aaa.bbb.com/lrs

Name	Type	Description	Conformance	Notes
location_verify_method (DEPRECATED)	String	*This property is deprecated and will be removed in a future version; verified locations must use GPS devices as defined in the SpatialVerification enumerated type* — The method used to verify the accuracy of the location information.	Optional	Example: Survey accurate GPS equipment accurate to 0.1 cm

Used by:

Property	Object
data_sources	FeedInfo

3.2 FeedInfo Object

The FeedInfo object describes WZDx feed header information such as metadata, contact information, and data sources. There is one FeedInfo per WZDx GeoJSON document.

Table 4: Feed Info Object

Name	Type	Description	Conformance	Notes
publisher	String	The organization responsible for publishing the feed.	Required	Example: State DOT
version	String	The WZDx specification version used to create the data feed in major.minor format. Note this mandates that all data in a WZDx feed complies to a single version of WZDx.	Required	Examples: 1.1, 2.0
license	String; uri; "https://creativecommons.org/publicdomain/zero/1.0/"	The URL of the license that applies to the data in the WZDx feed. This *must* be the string "https://creativecommons.org/publicdomain/zero/1.0/".	Optional	Data in all public WZDx feeds must be licensed under the Creative Commons - Public Domian License (CC0) which permits consumers to freely publish the enclosed information. This property is currently optional but *will be required in a future release*.
data_sources	Array; [FeedDataSource]	A list of specific data sources for the road event data in the feed.	Required	Length of array must be at least one.

Name	Type	Description	Conformance	Notes
update_date	String; date-time	The UTC date and time when the GeoJSON file (representing the instance of the feed) was generated.	Required	The recency of the value of this property depends on if the feed producer is generating a new feed GeoJSON file for each request or generating the file in advance and making it available for download (WZDx does not mandate a particular distribution method). Note all date-time formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z
update_frequency	Integer	The frequency in seconds at which the data feed is updated.	Optional	Example: 60
contact_name	String	The name of the individual or group responsible for the data feed.	Optional	Example: Jo Help
contact_email	String; email	The email address of the individual or group responsible for the data feed.	Optional	Example: abc@testcity1.gov

Used by:

Property	Object
feed_info	RoadRestrictionFeed
feed_info	SwzDeviceFeed
road_event_feed_info	WZDxFeed

3.3 RoadRestrictionFeed Object (GeoJSON FeatureCollection)

The RoadRestrictionFeed object is the root (highest level) object of a WZDx road restriction feed. There is one RoadRestrictionFeed object per road restriction feed GeoJSON document. The RoadRestrictionFeed is a GeoJSON FeatureCollection. The RoadRestrictionFeed contains information about sections of roadways that have restrictions. Restriction types described by this specification are listed in the RestrictionType enumerated type.

Table 5: Road Restriction Feed Object

Name	Type	Description	Conformance	Notes
feed_info	FeedInfo	Information about the WZDx road restriction feed.	Required	This is a WZDx-specific foreign member and is not part of the GeoJSON specification.
type	String; "FeatureCollection"	The GeoJSON object type. For WZDx, this must be the string FeatureCollection.	Required	This is a GeoJSON property.
features	Array; [RoadEventFeature]	An array of GeoJSON Feature objects which represent WZDx road events.	Required	

Name	Type	Description	Conformance	Notes
bbox	GeoJSON Bounding Box	Information on the coordinate range for all RoadEventFeatures in the WZDx feed. Must be an array of length 2*n where n is the number of dimensions represented in the contained geometries, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of geometries.	Optional	This is a GeoJSON property.

Used by: Road Restriction GeoJSON document (one RoadRestrictionFeed object per file).

3.4 SwzDeviceFeed Object (GeoJSON FeatureCollection)

The SwzDeviceFeed object is the root (highest level) object of a smart work zone device feed. There is one SwzDeviceFeed object per feed GeoJSON document. The SwzDeviceFeed is a GeoJSON FeatureCollection object. The SwzDeviceFeed contains information (location, status, live data) about field devices deployed on the roadway in work zones.

Table 6: SWZ Device Feed Object

Name	Type	Description	Conformance	Notes
feed_info	FeedInfo	Information about the data feed.	Required	This is a WZDx-specific foreign member and is not part of the GeoJSON specification.
type	String; "FeatureCollection"	The GeoJSON object type. For WZDx, this must be the string FeatureCollection.	Required	This is a GeoJSON property.
features	Array; [FieldDeviceFeature]	An array of GeoJSON Feature objects which each represent a field device deployed in a smart work zone.	Required	This is a GeoJSON property.
bbox	GeoJSON Bounding Box	Information on the coordinate range for all FieldDeviceFeatures in the feed. The value must be an array of length 2n where n is the number of dimensions represented in the contained geometries, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of geometries.	Optional	This is a GeoJSON property.

Used by: Road Restriction GeoJSON document (one RoadRestrictionFeed object per file).

3.5 WZDxFeed Object (GeoJSON FeatureCollection)

The WZDxFeed object is the root (highest level) object of a WZDx feed. There is one WZDx feed object per WZDx GeoJSON document. The WZDxFeed is an instance of a GeoJSON FeatureCollection object. The WZDxFeed contains high-level information about events ocurring on roadways (called "road

events"), primarily work zones, that impact the characteristics of the roadway and involve a change from the default state (such as a lane closure). The WZDxFeed is the original work zone data exchange feed.

Table 7: WZDx Feed Object

Name	Type	Description	Conformance	Notes
road_event_feed_info	FeedInfo	Information about the WZDx feed.	Required	This is a WZDx-specific foreign member and is not part of the GeoJSON specification.
type	String; "FeatureCollection"	The GeoJSON object type. For WZDx, this must be the string FeatureCollection.	Required	This is a GeoJSON property.
features	Array; [RoadEventFeature]	An array of GeoJSON Feature objects which represent WZDx road events.	Required	
bbox	GeoJSON Bounding Box	Information on the coordinate range for all RoadEventFeatures in the WZDx feed. Must be an array of length 2n where n is the number of dimensions represented in the contained geometries, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of geometries.	Optional	This is a GeoJSON property.

Used by: WZDx GeoJSON document (one WZDxFeed object per file).

4. Road Events

The following objects are used to describe events occurring on roadways (road events) that impact the characteristics of the roadway and involve a change from the default state:

Table 8: Road Events Object List

Object	Description
DetourRoadEvent	A detour on a roadway.
Lane	An individual lane within a road event.
Relationship	Identification of both sequential and hierarchical relationships between road events and other entities.
Restriction	A restriction on a road event or lane, including type and value.
RestrictionRoadEvent	Describes a section of roadway and the limitations of how that section can be used.

Object	Description
RoadEventCoreDetails	The core details of an event occurring on a roadway (i.e., a road event) that is shared by all types of road events.
RoadEventFeature	The GeoJSON Feature container object for a WZDx road event.
TypeOfWork	A description of the type of work being done in a road event and an indication of if that work will result in an architectural change to the roadway.
WorkerPresence	Information about the presence of workers in the road event area.
WorkZoneRoadEvent	A work zone road event including where, when, and what activities are taking place within a work zone on a roadway.

4.1 DetourRoadEvent Object

The DetourRoadEvent object describes a detour on a roadway. The DetourRoadEvent can be either a segment of a detour (each segment represented by its own DetourRoadEvent) or the entire detour.The DetourRoadEvent is a type of road event; it has a core_details property which contains the RoadEventCoreDetails and exists within a RoadEventFeature.

Table 9: Detour Road Event Object

Name	Type	Description	Conformance	Notes
core_details	RoadEventCore Details	The core details of the road event that are shared by all types of road events, not specific to detours.	Required	
start_date	String; date-time	The UTC time and date when the event begins.	Required	All datetime formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z.
end_date	String; date-time	The UTC time and date when the event ends.	Required	All datetime formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z.
start_date_accuracy	TimeVerification	A measure of how accurate the start date-time is.	Required	
end_date_accuracy	TimeVerification	A measure of how accurate the end date-time is.	Required	
beginning_cross_street	String	Name or number of the nearest cross street along the roadway where the event begins.	Optional	
ending_cross_street	String	Name or number of the nearest cross street along the roadway where the event ends.	Optional	

Name	Type	Description	Conformance	Notes
beginning_milepost	Number	The linear distance measured against a milepost marker along a roadway where the event begins.	Optional	A milepost or mile marker is a surveyed distance posted along a roadway measuring the length (in miles or tenth of a mile) from the south west to the north east. These markers are typically notated on State and local government digital road networks.
ending_milepost	Number	The linear distance measured against a milepost marker along a roadway where the event ends.	Optional	A milepost or mile marker is a surveyed distance posted along a roadway measuring the length (in miles or tenth of a mile) from the south west to the north east. These markers are typically notated on State and local government digital road networks.
event_status	EventStatus	The status of the event.	Optional	

Used by:

Property	Object
properties	RoadEventFeature

4.2 Lane Object

The Lane object describes an individual lane on the roadway within a road event.

Table 10: Lane Object

Name	Type	Description	Conformance	Notes
order	Positive Integer	The position of a lane in sequence on the roadway. This value is used as an index to indicate the order of all WZDx lanes provided for a road event.	Required	A value of 1 must represent the **left-most** lane and an increase in 1 must represent moving a single lane over from the **left**.
type	LaneType	An indication of the type of lane or shoulder.	Required	
status	LaneStatus	Status of the lane for the traveling public.	Required	
restrictions	Array; [Restriction]	A list of zero or more restrictions specific to the lane.	Optional	
lane_number (DEPRECATED)	Positive Integer	*This property is deprecated; use order to indicate lane positions* — The number assigned to the lane to help identify its position. Flexible, but usually used for regular, driveable lanes.	Optional	Assigned by counting from the **left** edge of the improved surface.

Used by:

Property	Object
lanes	WorkZoneRoadEvent
lanes	RestrictionRoadEvent

4.3 Relationship Object

The Relationship object is used to identify both sequential and hierarchical relationships between a road events and other entities. For example, a relationship can be used to link multiple road events to a common "parent", such as a project or phase, or identify a sequence of road events that make up a larger work zone.

Table 11: Relationship Object

Name	Type	Description	Conformance	Notes
first	Array; [String]	Indicates the first (can be multiple) road event in a sequence of road events. All values in this array should be a road event ID—they should match the id property on a RoadEventFeature within the same WZDx GeoJSON document.	Optional	
next	Array; [String]	Indicates the next (can be multiple) road event in a sequence of road events. All values in this array should be a road event ID—they should match the id property on a RoadEventFeature within the same WZDx GeoJSON document.	Optional	
parents	Array; [String]	Indicates entities that the road event with this relationship is a part of, such as a work zone project or phase. Values can but do not have to correspond to a WZDx entity.	Optional	
children	Array; [String]	Indicates entities that are part of the road event with this relationship, such as a detour or piece of equipment. Values can but do not have to correspond to a WZDx entity.	Optional	

Used by: The value of all elements in the Relationship's first or next properties must match the value of the id property of a RoadEventFeature that is included in the same WZDx GeoJSON document.

Property	Object
relationship	RoadEventCoreDetails

4.4 Restriction Object

The Restriction object describes a restriction on a roadway or lane. This object is used by the WorkZoneRoadEvent, RestrictionRoadEvent, and Lane objects.

Table 12: Restriction Object

Name	Type	Description	Conformance	Notes
type	RestrictionType	The type of restriction being enforced.	Required	
value	Number	A value associated with the restriction, if applicable.	Optional	For example, if type is reduced-height, value and unit together would allow indicating what value the height was reduced to.

Name	Type	Description	Conformance	Notes
unit	UnitOfMeasurement	Unit of measurement for the restriction value, if applicable.	Conditional: required if value is not null.	

Used by:

Property	Object
restrictions	WorkZoneRoadEvent
restrictions	Lane
restrictions	RestrictionRoadEvent

4.5 RestrictionRoadEvent Object

The RestrictionRoadEvent object describes one or more restrictions on a section of a roadway. It describes the location of the road section and the limitations on how it can be used.
The RestrictionRoadEvent is a linear road event intended to represent persistent restrictions without a defined start or event date, such as bridge clearances. The RestrictionRoadEvent is a type of road event; it has a core_details property which contains the RoadEventCoreDetails and exists within a RoadEventFeature. For representing restrictions due to road work, see the WorkZoneRoadEvent and WZDxFeed.

Table 13: 5 Restriction Road Event Object

Name	Type	Description	Conformance	Notes
core_details	RoadEventCoreDetails	Describes the basic 14haracteristics of a road event.	Required	
restrictions	Array; [Restriction]	A list of zero or more road restrictions that apply to the roadway segment described by this road event.	Conditional: required if lanes property is not provided.	Restrictions can also be provided on an individual lane.
lanes	Array; [Lane]	A list of individual lanes within a road event (roadway segment).	Conditional: required if restrictions property is not provided.	

Used by:

Property	Object
properties	RoadEventFeature

4.6 RoadEventCoreDetails Object

The RoadEventCoreDetails object represents the core details of an event occurring on a roadway (i.e., a "road event") that is shared by all types of road events, such as work zones (see WorkZoneRoadEvent), detours (see DetourRoadEvent), and road restrictions (see RestrictionRoadEvent).
The RoadEventCoreDetails cannot exist directly in a data feed and on its own does not represent a road event. It is used as the value of core_details property on every specific type of road event, each of which is represented by its own object.

Table 14: Road Event Core Details Object

Name	Type	Description	Conformance	Notes
event_type	EventType	The type/classification of road event.	Required	
data_source_id	String	Identifies the data source from which the road event originates.	Required	The value must match to the data_source_id property of a FeedDataSource included within the same WZDx GeoJSON document.
road_names	Array; [String]	A list of publicly known names of the road on which the event occurs. This may include the road number designated by a jurisdiction such as a county, state or interstate (e.g., I-5, VT 133).	Required	
direction	Direction	The digitization direction of the road that is impacted by the event. This value is based on the standard naming for US roadways and indicates the direction of the traffic flow regardless of the real heading angle.	Required	Example northbound (for I-5 North)
relationship	Relationship	Identifies both sequential and hierarchical relationships between the road events and other entities. For example, a relationship can be used to link multiple road events to a common 'parent', such as a project or phase, or identify a sequence of road events	Optional	
description	String	Short free text description of road event.	Optional	
creation_date	String; [date-time](#)	The UTC time and date when the activity or event was created.	Optional	All datetime formats shall follow [RFC 3339 Section 5.6](#). Example: 2016-11-03T19:37:00Z.
update_date	String; [date-time](#)	The UTC time and date when the activity or event was updated.	Optional	All datetime formats shall follow [RFC 3339 Section 5.6](#). Example: 2016-11-03T19:37:00Z.

Used by:

Property	Object
core_details	DetourRoadEvent
core_details	WorkZoneRoadEvent
core_details	RestrictionRoadEvent

The value of the RoadEventCoreDetails's data_source_id property MUST match the value of the data_source_id property of a [FeedDataSource](#) that is included in the same WZDx GeoJSON document.

4.7 RoadEventFeature Object (GeoJSON Feature)

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The RoadEventFeature object is the container object for a WZDx road event (WorkZoneRoadEvent, DetourRoadEvent, or RestrictionRoadEvent. The RoadEventFeature object is an instance of a GeoJSON Feature.

Table 15: Road Event Feature Object

Name	Type	Description	Conformance	Notes
id	String	A unique identifier issued by the data feed provider to identify the WZDx road event.	Required	This is a GeoJSON property.
type	String; "Feature"	The GeoJSON object type. This MUST be the string Feature.	Required	This is a GeoJSON property.
properties	One of: WorkZoneRoadEvent, DetourRoadEvent, RestrictionRoadEvent	The specific details of the road event.	Required	This is a GeoJSON property.
geometry	GeoJSON Geometry object with type of LineString or MultiPoint	The geometry of the road event. The Geometry object's type property MUST be LineString or MultiPoint. LineString allows specifying the entire road event path and should be preferred. MultiPoint should be used when only the start and end coordinates are known.	Required	This is a GeoJSON property.
bbox	GeoJSON Bounding Box	Information on the coordinate range for this RoadEventFeature. Must be an array of length 2n where n is the number of dimensions represented in the geometry property, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of the geometry.	Optional	This is a GeoJSON property.

Used by:

Property	Object
features	RoadRestrictionFeed
core_details	RestrictionRoadEvent

4.8 TypeOfWork Object

The TypeOfWork object indicates the type of work being done in a road event, if applicable (e.g., typical work zones), as well as optionally noting if the type of work will result in an architectural change to the roadway.

Table 16: Type Of Work Object

Name	Type	Description	Conformance	Notes
type_name	WorkTypeName	A high-level text description of the type of work being done.	Required	

Name	Type	Description	Conformance	Notes
is_architectural_change	Boolean	A flag indicating whether the type of work will result in an architectural change to the roadway.	Optional	

Used by:

Property	Object
types_of_work	WorkZoneRoadEvent

4.9 WorkerPresence Object

The WorkerPresence object contains information on the presence of workers in the [WorkZoneRoadEvent's](#) area.

Table 17: Worker Presence Object

Name	Type	Description	Conformance	Notes
are_workers_present	Boolean	Whether workers are present in the work zone event area. This value should be set in accordance with the definition provided in the definition property if it is provided.	Required	
definition	Array; [WorkerPresenceDefinition]	A list of situations in which workers are considered to be present in the jurisdiction of the data provider.	Optional	
method	WorkerPresenceMethod	Describes the method for how worker presence in a work zone event area is determined.	Optional	
worker_presence_last_confirmed_date	String; date-time	The UTC date and time at which the presence of workers was last confirmed.	Optional	All datetime formats shall follow RFC 3339 Section 5.6.
confidence	WorkerPresenceConfidence	The data producer's confidence in the value of are_workers_present.	Optional	

Used by:

Property	Object
worker_presence	WorkZoneRoadEvent

4.10 WorkZoneRoadEvent Object

The WorkZoneRoadEvent object describes a work zone road event including where, when, and what activities are taking place within a work zone on a roadway. A full "work zone" is represented by one or more WorkZoneRoadEvents. The WorkZoneRoadEvent is a type of road event; it has a core_details property which contains the RoadEventCoreDetails and exists within a RoadEventFeature.

Table 18: Work Zone Road Event Object

Name	Type	Description	Conformance	Notes
core_details	RoadEventCoreDetails	The core details of the road event that are shared by all types of road events, not specific to work zones.	Required	
start_date	String; date-time	The UTC time and date when the event begins.	Required	All datetime formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z.
end_date	String; date-time	The UTC time and date when the event ends.	Required	All datetime formats shall follow RFC 3339 Section 5.6. Example: 2016-11-03T19:37:00Z.
start_date_accuracy	TimeVerification	A measure of how accurate the start date-time is.	Required	
end_date_accuracy	TimeVerification	A measure of how accurate the end date-time is.	Required	
beginning_accuracy	SpatialVerification	Indicates how the beginning coordinate was defined.	Required	
ending_accuracy	SpatialVerification	Indicates how the ending coordinate was defined.	Required	
location_method	LocationMethod	The typical method used to locate the beginning and end of a work zone impact area.	Required	
vehicle_impact	VehicleImpact	The impact to vehicular lanes along a single road in a single direction.	Required	
lanes	Array; [Lane]	A list of individual lanes within a road event (roadway segment).	Optional	
beginning_cross_street	String	Name or number of the nearest cross street along the roadway where the event begins.	Optional	

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Name	Type	Description	Conformance	Notes
ending_cross_street	String	Name or number of the nearest cross street along the roadway where the event ends.	Optional	
beginning_milepost	Number	The linear distance measured against a milepost marker along a roadway where the event begins.	Optional	A milepost or mile marker is a surveyed distance posted along a roadway measuring the length (in miles or tenth of a mile) from the south west to the north east. These markers are typically notated on State and local government digital road networks.
ending_milepost	Number	The linear distance measured against a milepost marker along a roadway where the event ends.	Optional	A milepost or mile marker is a surveyed distance posted along a roadway measuring the length (in miles or tenth of a mile) from the south west to the north east. These markers are typically notated on State and local government digital road networks.
event_status	EventStatus	The status of the event.	Optional	
types_of_work	Array; [TypeOfWork]	A list of the types of work being done in a road event and an indication of if each type results in an architectural change to the roadway.	Optional	
worker_presence	WorkerPresence	Information about whether workers are present in the road event area.	Optional	
reduced_speed_limit_kph	Number	The reduced speed limit posted within the road event, in kilometers per hour. This property only needs to be supplied if the speed limit within the road event is lower than the posted speed limit of the roadway.	Optional	
restrictions	Array; [Restriction]	A list of zero or more road restrictions that apply to the roadway segment described by this road event.	Optional	Restrictions can also be provided on an individual lane.

Used by:

Property	Object
properties	RoadEventFeature

5. Field Devices Objects

The following objects are used to describe deployed roadside ITS devices:

Table 19: Road Events Object List

Object	Description
ArrowBoard	An electronic, connected arrow board which can display an arrow pattern to direct traffic.
Camera	A camera device deployed in the field, capable of capturing still images.
DynamicMessagesSign	An electronic traffic sign deployed on the roadway, used to provide information to travelers.
FieldDeviceCoreDetails	The core details—both configuration and current state—of a field device that are shared by all types of field devices.
FieldDeviceFeature	The GeoJSON Feature container object for a deployed field device.
FlashingBeacon	A flashing beacon light of any form (e.g., trailer-mounted, vehicle), used to indicate something or capture driver attention.
HybridSign	A hybrid sign that contains static text (e.g., on an alumium sign) along with a single electronic message display, used to provide information to travelers.
LocationMarker	Describes any GPS-enabled ITS device that is placed at a point on a roadway to dynamically know the location of something (often the beginning or end of a work zone).
MarkedLocation	Describes a specific location where a LocationMarker is placed, such as the start or end of a work zone road event.
SwzDeviceFeed	The root (highest-level) object of smart work zone device feed GeoJSON document.
TrafficSensor	A traffic sensor deployed on a roadway which captures traffic metrics (e.g., speed, volume, occupancy) over a collection interval.
TrafficSensorLaneData	Data for a single lane within a road event (e.g., WorkZoneRoadEvent) measured by a TrafficSensor deployed on the roadway.

5.1 ArrowBoard Object

The ArrowBoard object describes an electronic, connected arrow board (example image) which can display an arrow pattern to direct traffic. Arrow boards are often placed at the beginning of a lane closure—thus knowing the location of an arrow board can assist in programmatically generating a WZDx road event with verified spatial information. The ArrowBoard is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 20: Arrow Board Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device that are shared by all types of field devices, not specific to arrow boards.	Required	This property appears on all field devices.
pattern	ArrowBoardPattern	The current pattern displayed on the arrow board. Note this includes blank, which indicates that nothing is shown on the arrow board.	Required	
is_moving	Boolean	A yes/no value indicating if the arrow board is actively moving (not statically placed) as part of a mobile work zone operation.	Optional	The is_moving property is optional and should not be provided if it is not known if the arrow board is moving.
is_in_transport_position	Boolean	A yes/no value indicating if the arrow board is in the stowed/transport position (true) or deployed/upright position (false).	Optional	

Used by:

Property	Object
properties	FieldDeviceFeature

5.2 Camera Object

The Camera object describes a camera device deployed in the field, capable of capturing still images. The Camera is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 21: Camera Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device that are shared by all types of field devices, not specific to cameras.	Required	This property appears on all field devices.
image_url	String; uri	A URL pointing to an image file for the camera image still.	Optional	

Name	Type	Description	Conformance	Notes
image_timestamp	String; date-time	The UTC date and time when the image was captured.	Conditional; required if image_url is provided	

Used by:

Property	Object
properties	FieldDeviceFeature

5.3 DynamicMessageSign Object

The DynamicMessageSign object describes a dynamic message sign (DMS)—also known as changeable message sign (CMS) or variable message sign (VMS)—which is an electronic traffic sign deployed on the roadway used to provide information to travelers. The DynamicMessageSign is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 22: Dynamic Message Sign Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device that are shared by all types of field devices, not specific to dynamic message signs.	Required	This property appears on all field devices.
message_multi_string	String	The MULTI (Mark-Up Language for Transportation Information, see NTCIP 1203 v03) formatted string describing the message currently posted to the sign.	Required	If the message is unknown, such as due to an error, the empty string "" can be used.

Used by:

Property	Object
properties	FieldDeviceFeature

5.4 FieldDeviceCoreDetails Object

The FieldDeviceCoreDetails object represents the core details—both configuration and current state—of a field device that are shared by all types of field devices. The FieldDeviceCoreDetails object cannot occur directly in a data feed and does not represent a field device on its own. It is used as the value of the core_details property on every specific type of field device, each represented by its own object.

Table 23: Field Device Core Details Object

Name	Type	Description	Conformance	Notes
device_type	FieldDeviceType	The type of field device.	Required	

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Name	Type	Description	Conformance	Notes
data_source_id	String	Identifies the data source from which the field device data originates.	Required	The value must match to the data_source_id property of a FeedDataSource included within the same SwzDeviceFeed GeoJSON document.
road_names	Array; [String]	A list of publicly known names of the road on which the device is located. This may include the road number designated by a jurisdiction such as a county, state or interstate (e.g., I-5, VT 133).	Required	
device_status	FieldDeviceStatus	The operational status of the field device. The value of this property indicates if the device is ok or in an error or warning state.	Required	
update_date	String; date-time	The UTC time and date when the field device information was updated.	Required	
has_automatic_location	Boolean	A yes/no value indicating if the field device location (parent FieldDeviceFeature's geometry) is determined automatically from an onboard GPS (true) or manually set/23verridden (false).	Required	
name	String	A human-readable name for the field device.	Optional	
description	String	A description of the field device.	Optional	
status_messages	Array; [String]	A list of messages associated with the device's status, if applicable. Used to provide additional information about the status such as specific warning or error messages.	Optional	The content of this property is up to the producer.
road_event_ids	Array; [String]	A list of one or more IDs of a RoadEventFeature that the device is associated with.	Optional	
milepost	Number	The linear distance measured against a milepost marker along a roadway where the device is located.	Optional	
make	String	The make or manufacturer of the device.	Optional	
model	String	The model of the device.	Optional	
serial_number	String	The serial number of the device.	Optional	
firmware_version	String	The version of firmware the device is using to operate.	Optional	

Used by:

Property	Object
core_details	ArrowBoard
core_details	Camera

Property	Object
core_details	DynamicMessageSign
core_details	FlashingBeacon
core_details	HybridSign
core_details	LocationMarker
core_details	TrafficSensor

5.5 FieldDeviceFeature Object

The FieldDeviceFeature object is a [GeoJSON Feature](#) representing a deployed field device. This object contains the specific details of the field device, similar to how the [RoadEventFeature](#) object in a WZDx Feed contains the road event object ([WorkZoneRoadEvent](#) or [DetourRoadEvent](#). Currently, only point devices are supported.

Table 24: Field Device Feature Object

Name	Type	Description	Conformance	Notes
id	String	A unique identifier issued by the data feed provider to identify the field device. It is recommended that this identifier is a Universally Unique Identifier (UUID) as defined in [RFC 4122](#).	Required	This is a GeoJSON property.
type	String; "Feature"	The GeoJSON object type. This MUST be the string Feature.	Required	This is a GeoJSON property.
properties	One of: ArrowBoard, Camera, DynamicMessageSign, FlashingBeacon, HybridSign, LocationMarker, TrafficSensor	The specific details of the field device.	Required	This is a GeoJSON property.
geometry	GeoJSON [Geometry](#) object with type of [Point](#).	The geometry of the field device, indicating its location. The Geometry object's type property MUST be [Point](#).	Required	This is a GeoJSON property.
bbox	GeoJSON [Bounding Box](#)	Information on the coordinate range for this field device. Must be an array of length 2n where n is the number of dimensions represented in the geometry property, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of the geometry.	Optional	This is a GeoJSON property.

Used by:

Property	Object
features	SwzDeviceFeed

5.6 FlashingBeacon Object

The FlashingBeacon object describes a flashing beacon light of any form (e.g., trailer-mounted, vehicle), used to indicate something and capture driver attention. The FlashingBeacon is a type of field device; it has a core_details property which contains the [FieldDeviceCoreDetails](#) and exists within a [FieldDeviceFeature](#).

Table 25: Flashing Beacon Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device that are shared by all types of field devices, not specific to flashing beacons.	Required	This property appears on all field devices.
function	FlashingBeaconFunction	Describes the function or purpose of the flashing beacon, i.e., what it is being used to indicate.	Required	
is_flashing	Boolean	A yes/no value indicating if the flashing beacon is currently in use and flashing.	Optional	The is_flashing property is optional as it should not be provided if the producer does not know if the beacon is flashing (e.g., if it's in error state or similar).

Used by:

Property	Object
properties	FieldDeviceFeature

5.7 HybridSign Object

The HybridSign object describes a hybrid sign that contains static text (e.g., on an aluminum sign) along with a single electronic message display, used to provide information to travelers. This object is intended to be general to represent hybrid signs with multiple functions, such as variable speed limit signs (VSLS), hybrid travel time signs, and other similar systems. The HybridSign is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 26: Hybrid Sign Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device shared by all field devices types, not specific to hybrid signs.	Required	This property appears on all field devices.
dynamic_message_function	HybridSignDynamicMessageFunction	The function the dynamic message displayed (e.g., a speed limit).	Required	
dynamic_message_text	String	A text representation of the message currently posted to the electronic component of the hybrid sign.	Optional	

Name	Type	Description	Conformance	Notes
static_sign_text	String	The static text on the non-electronic component of the hybrid sign.	Optional	

Used by:

Property	Object
properties	FieldDeviceFeature

5.8 LocationMarker Object

The LocationMarker object describes any GPS-enabled ITS device that is placed at a point on a roadway to dynamically know the location of something (often the beginning or end of a work zone). The LocationMarker contains a list of one or more MarkedLocation objects which indicate the type of location (such as the start or end) and optionally the ID of a RoadEventFeature that the location is associated with. The LocationMarker is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 27: Location Marker Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device shared by all field devices types, not specific to the location marker.	Required	This property appears on all field devices.
marked_locations	Array; [MarkedLocation]	A list of locations that the LocationMarker is marking.	Required	

Used by:

Property	Object
properties	FieldDeviceFeature

5.9 MarkedLocation Object

The MarkedLocation object describes a specific location where a LocationMarker is placed, such as the start or end of a work zone road event. The marked location is typically within a road event, but is not required to be.

Table 28: Marked Location Object

Name	Type	Description	Conformance	Notes
type	MarkedLocationType	The type of location (e.g., start or end) that is marked.	Required	
road_event_id	String	The ID of a RoadEventFeature that the MarkedLocation applies to.	Optional	This property is optional because the field device information producer may not always have road event information.

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Used by:

Property	Object
marked_locations	LocationMarker

5.10 SwzDeviceFeed Object (GeoJSON FeatureCollection)

The SwzDeviceFeed object is the root (highest level) object of a smart work zone device feed. There is one SwzDeviceFeed object per feed GeoJSON document. The SwzDeviceFeed is a GeoJSON FeatureCollection object. The SwzDeviceFeed contains information (location, status, live data) about field devices deployed on the roadway in work zones.

Table 29: SWZ Device Feed Object

Name	Type	Description	Conformance	Notes
feed_info	FeedInfo	Information about the data feed.	Required	This is a WZDx-specific foreign member and is not part of the GeoJSON specification.
type	String; "FeatureCollection"	The GeoJSON object type. For WZDx, this must be the string FeatureCollection.	Required	This is a GeoJSON property.
features	Array; [FieldDeviceFeature]	An array of GeoJSON Feature objects which each represent a field device deployed in a smart work zone.	Required	This is a GeoJSON property.
bbox	GeoJSON Bounding Box	Information on the coordinate range for all FieldDeviceFeatures in the feed. The value must be an array of length 2n where n is the number of dimensions represented in the contained geometries, with all axes of the most southwesterly point followed by all axes of the more northeasterly point. The axes order of a bbox follows the axes order of geometries.	Optional	This is a GeoJSON property.

Used by: SwzDeviceFeed GeoJSON document (one SwzDeviceFeed object per file).

5.11 TrafficSensor Object

The TrafficSensor object describes a traffic sensor deployed on a roadway which captures traffic metrics (e.g., speed, volume, occupancy) over a collection interval. The TrafficSensor can describe lane-level traffic data if available and if associated with a road event (e.g., WorkZoneRoadEvent).
The TrafficSensor is a type of field device; it has a core_details property which contains the FieldDeviceCoreDetails and exists within a FieldDeviceFeature.

Table 30: Traffic Sensor Object

Name	Type	Description	Conformance	Notes
core_details	FieldDeviceCoreDetails	The core details of the field device shared by all field devices types, not specific to traffic sensors.	Required	This property appears on all field devices.
collection_interval_start_date	String; date-time	The UTC date and time where the TrafficSensor data began being collected at. The averages and totals contained in the TrafficSensor data apply to the inclusive interval of collection_interval_start_date to collection_interval_end_date.	Required	
collection_interval_end_date	String; date-time	The UTC date and time where the TrafficSensor collection interval ended. The averages and totals contained in the TrafficSensor data apply to the inclusive interval of collection_interval_start_date to collection_interval_end_date.	Required	
average_speed_kph	Integer (>= 0)	The average speed of vehicles across all lanes over the collection interval in kilometers per hour.	Optional	
volume_vph	Integer (>= 0)	The rate of vehicles passing by the sensor during the collection interval in vehicles per hour.	Optional	
occupancy_percent	Integer (>= 0)	The percent of time the roadway section monitored by the sensor was occupied by a vehicle over the collection interval.	Optional	
lane_data	Array; [TrafficSensorLaneData]	A list of objects each describing traffic data for a specific lane— each pointing to a road event lane and indiciating the metrics of that lane.	Optional	Lane-level data can only be provided if the data producer has knowledge of the road event to assign the traffic sensor lane data to.

Used by:

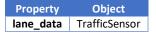| Property	Object
properties	FieldDeviceFeature

5.12 TrafficSensorLaneData Object

The TrafficSensorLaneData object describes data for a single lane within a road event (e.g., WorkZoneRoadEvent) measured by a TrafficSensor deployed on the roadway.

Note this structure allows a single TrafficSensor to provide data across lanes on multiple road events. It does not allow for lane data to be provided when a road event is not known.

Table 31: Traffic Sensor Lane Data Object

Name	Type	Description	Conformance	Notes
road_event_id	String	The ID of a RoadEventFeature which the measured lane occurs in.	Required	
lane_order	Positive Integer	The lane's position in sequence within the road event (specified by road_event_id). The value of this property corresponds to the associated road event's Lane's order property.	Required	
average_speed_kph	Integer (>= 0)	The average speed of traffic in the lane over the collection interval (in kilometers per hour).	Optional	
volume_vph	Integer (>= 0)	The rate of vehicles passing by the sensor in the lane during the collection interval (in vehicles per hour).	Optional	
occupancy_percent	Integer (>= 0)	The percent of time the lane monitored by the sensor was occupied by a vehicle over the collection interval.	Optional	

Used by:

Property	Object
lane_data	TrafficSensor

6. List of Enumerated Types for Road Events

Many object properties are restricted to a finite set of values defined by an enumerated type. The enumerations for each enumerated type as well as what object properties it is used by is described in its own file in the enumerated-types directory. The following enumerated types are used by objects that describe road events:

Table 32: Road Events Enumerated Types

Enumerated Type	Description
Direction	The direction for a road event based on standard naming for US roads.
EventStatus	The status of a road event.
EventType	The type of a WZDx road event.
LaneStatus	The status of a lane for the traveling public.
LaneType	An indication of the type of lane or shoulder.
LocationMethod	The typical method used to locate the beginning and end of a work zone impact area.
RestrictionType	The type of vehicle restriction on a roadway or lane.
SpatialVerification	An indication of how a geographical coordinate was defined.
TimeVerification	A measure of how accurate a date-time is.
UnitOfMeasurement	Unit of measurement (e.g., "pounds", "centimeters").
VehicleImpact	The impact to vehicular lanes along a single road in a single direction.
WorkerPresenceConfidence	High-level description of the feed publisher's confidence in worker presence.

Enumerated Type	Description
WorkerPresenceDefinition	Method of knowing the presence of workers in the road event area.
WorkerPresenceMethod	Methods for how worker presence in a work zone event area is determined.
WorkTypeName	A high-level text description of the type of work being done in a road event.

6.1 Direction Enumerated Type

The direction of a roadway. The values are based on the standard naming for US roadways and indicates the direction the traffic flow regardless of the real heading angle of the roadway.

Table 33: Direction Enumerated Type

Value	Description
northbound	Road flow is in the northbound direction
eastbound	Road flow is in the eastbound direction
southbound	Road flow is in the southbound direction
westbound	Road flow is in the westbound direction

Used by:

Property	Object
direction	RoadEventCoreDetails

The Direction enumerated type values were based on the TMDD Link-alignment Enumeration, which contains the following values: northbound (1); eastbound (2); southbound (3); westbound (4); inner-loop (5); outer-loop (6).

6.2 EventStatus Enumerated Type

The status of a road event.

Table 34: Event Status Enumerated Type

Value	Description
planned	Planned status is associated with overall project or phase timing and locations. Typically, this information is estimated during planning or early design phases. The WZDx will not generally include planned activities.
pending	Pending is used to alert stakeholders that work is scheduled for the near future (e.g., 2-3 weeks). The certainty of starting at this time is greater than 90% (barring weather and other unforeseen circumstances). • Time horizon: approximate begin / end dates Location: coverage area and main road name; path (polyline or geoface) around zone area
active	Used to alert stakeholder that work zone is in place and active.

Value	Description
canceled	Reported cancellation of a proposed or active work zone; the coverage applies to the work zone activity record. When date/time is estimated, the cancellation may be one or more days associated within the reported scheduled datetimes.
completed	Work zone is closed and completed; all work zone impacts are mitigated. This status may be used when a work zone activity is completed earlier than expected.

Used by:

Property	Object
event_status	WorkZoneRoadEvent
event_status	DetourRoadEvent

6.3 EventType Enumerated Type

The type of a WZDx road event.

Table 35: Event Type Enumerated Type

Value	Description
work-zone	An area of a trafficway with highway construction, maintenance, or utility-work activities. A work zone is typically marked by signs, channeling devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or flashing lights on a vehicle to the "End of Road Work" sign or the last traffic control device. A work zone may be for short or long durations and may include stationary or moving activities. Inclusions: 1. Long-term stationary highway construction such as building a new bridge, adding travel lanes to the roadway, and extending an existing trafficway. 2. Mobile highway maintenance such as striping the roadway, median, and roadside grass mowing/landscaping, and pothole repair. 3. Short-term stationary utility work such as repairing electric, gas, or water lines within the trafficway. Exclusions: 1. Private construction, maintenance, or utility work outside the trafficway. *The AASHTO term equivalent to roadway is traveled way. *The AASHTO term equivalent to trafficway is highway, street, or road. Source: https://www.fhwa.dot.gov/publications/publicroads/99mayjun/workzone.cfm
detour	A temporary rerouting of road users onto an existing trafficway to avoid a work zone or other impedance. Source: https://mutcd.fhwa.dot.gov/htm/2009/part6/part6c.htm
restriction	A section of roadway that has limitations of how that section can be used.

Used by:

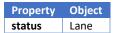| Property	Object
event_type	RoadEventCoreDetails

6.4 LaneStatus Enumerated Type

The status of a lane for the traveling public.

Table 36: Lane Status Enumerated Type

Value	Description
open	The lane is open for travel.
closed	The lane is closed to travel.
shift-left	The lane shifts left from its current bearing and continues.
shift-right	The lane shifts right from its current bearing and continues.
merge-left	The lane gradually tapers while merging into the lane directly to the left.
merge-right	The lane gradually tapers while merging into the lane directly to the right.
alternating-flow	Traffic may travel in either direction, depending on certain conditions. Example conditions include time of day (e.g., reversible lanes), automated controls, or on-site personnel.

Used by:

Property	Object
status	Lane

6.5 LaneType Enumerated Type

A description of the static properties of a section of the roadway, intended to reflect information about its function that is not covered by its status (see LaneStatus).

Table 37: Lane Type Enumerated Type

Value	Description
general	A generic lane type, intended to be used for general purpose travel lanes.
exit-lane	A lane leading towards an egress from the current roadway. An exit-lane usually becomes an exit-ramp after a gore point.
exit-ramp	A lane at an interchange leading away from the current roadway to another roadway.
entrance_lane	A lane leading away from an ingress to the current roadway. An entrance-ramp usually becomes an entrance-lane after a gore point.
entrance-ramp	A lane at an interchange for traffic to ingress from another roadway to the mainline.
sidewalk	A path for pedestrians, usually on the side of the roadway.
bike-lane	A lane on the roadway for use by cyclists only.
shoulder	A portion of the roadway that is outside (either right or left) of the main travel lanes. A shoulder can have many uses but is not intended for general traffic.
parking	A lane used for parking, not allowed for travel.
median	An often unpaved, non-drivable area that separates sections of the roadway. In most cases a median should only be described if it separates lanes in a single direction of travel, as per business rule #1 each direction of travel must be represented by a separate road event.
center-left-turn-lane	A lane in the center of a bidirectional roadway that traffic from both directions uses to make a left turn.

Used by:

Property	Object
type	Lane

The LaneType enumerated type was originally based on the TMDD LaneRoadway Enumeration, which is imported into TMDD from SAE 2540 (ITIS Standard). In later release, other standards were examined for inspiration. These include SAE J2735 and the ISO 20524-1 Geographic Data Files (GDF) standard.

6.6 LocationMethod Enumerated Type

The typical method used to locate the begin and end of a work zone impact area.

Table 38: Location Method Enumerated Type

Value	Description
channel-device-method	Location of first and last channeling device (e.g., cone or barrier) that is part of a "travel impact effect" (taper) or designation of a work zone transition area. *This is the preferred location method.*
sign-method	Location of first and last work zone-related signs.
junction-method	Location of a junction (e.g., a cross street or exit/entrance ramp) before and after a work zone.
other	Location method does not match any of the other options.
unknown	Location method is not known.
center-left-turn-lane	A lane in the center of a bidirectional roadway that traffic from both directions uses to make a left turn.

Used by:

Property	Object
location_method	WorkZoneRoadEvent

6.7 RestrictionType Enumerated Type

The type of vehicle restriction on a roadway.

Table 39: Restriction Type Enumerated Type

Value	Description
local-access-only	Only vehicles accessing addresses along the segment being described are allowed; this includes emergency services, deliveries, and direct property access.
no-trucks	Trucks are prohibited from traveling this part of the network.
travel-peak-hours-only	Travel restricted to travel peak hours only.
hov-3	Travel restricted to high occupancy vehicles of three or more.
hov-2	Travel restricted to high occupancy vehicles of two or more.
no-parking	No parking along the segment being described.
reduced-width	Lane width reduced along the segment being described.
reduced-height	Height restrictions reduced along the segment being described.
reduced-length	Vehicle length restrictions reduced along the segment being described.
reduced-weight	Vehicle weight restrictions reduced along the segment being described.
axle-load-limit	Vehicle axle-load-limit restrictions reduced along the segment being described.
gross-weight-limit	Vehicle gross-weight-limit restrictions reduced along the segment being described.
towing-prohibited	Towing prohibited along the segment being described.
permitted-oversize-loads-prohibited	"Permitted oversize loads" prohibited along the segment being described; this applies to annual oversize load permits.

Used by:

Property	Object
type	Restriction

6.8 SpatialVerification Enumerated Type

An indication of how a geographical coordinate was defined.

Table 40: Spatial Verification Enumerated Type

Value	Description
estimated	Estimated location for the work zone road event geometry. An estimated measurement is based on an approximation of the reported location of a work zone. Approximations of the location can include but are not limited to a point relative to a posted mile maker or cross street, selecting a point on a map, or locations based on project plans.
verified	Verified locations for the work zone road event geometry representing the actual extents of the work zone. A verified measurement is based on actual reported data from a GPS equipped device showing the measured location of the work zone.

Used by:

Property	Object
beginning_accuracy	WorkZoneRoadEvent
ending_accuracy	WorkZoneRoadEvent

6.9 TimeVerification Enumerated Type

A measure of how accurate a date-time is.

Table 41: Time Verification Enumerated Type

Value	Description
estimated	Specific times/dates when work will or is occurring; includes advanced notice of activities or unverified work zone activities. This date/time may be reported in advance, but is not actively verified on day of event.
verified	Actual reported times/dates when work occurs.

Used by:

Property	Object
start_date_accuracy	WorkZoneRoadEvent
start_date_accuracy	DetourRoadEvent
end_date_accuracy	WorkZoneRoadEvent
end_date_accuracy	DetourRoadEvent

6.10 UnitOfMeasurement Enumerated Type

Unit of measurement. This enumerated type is intended for use across the specification and more values can be added in the future if needed.

Table 42: Unit Of Measurement Enumerated Type

Value	Description
feet	Imperial system 'feet'
inches	Imperial system 'inches'
centimeters	Metric system 'centimeters'
pounds	Imperial system 'pounds'
tons	Imperial system 'tons'
kilograms	Metric system 'kilograms'

Used by:

Property	Object
unit	Restriction

6.11 VehicleImpact Enumerated Type

The impact to vehicular lanes along a single road in a single direction.

Table 43: Vehicle Impact Enumerated Type

Value	Description
all-lanes-closed	All lanes are closed.

Value	Description
some-lanes-closed	Some lanes are closed.
all-lanes-open	All lanes are open.
alternating-one-way	The roadway is alternating one way.
some-lanes-closed-merge-left	Some lanes merge to the left.
some-lanes-closed-merge-right	Some lanes merge to the right.
all-lanes-open-shift-left	All lanes are open, shift to the left.
all-lanes-open-shift-right	All lanes are open, shift to the right.
some-lanes-closed-split	Some lanes end and split & merge to the right and left.
flagging	A flagging operation is in effect.
temporary-traffic-signal	A temporary traffic signal is in operation.
unknown	The vehicle impact is unknown.

Used by:

Property	Object
vehicle_impact	WorkZoneRoadEvent

6.12 WorkerPresenceConfidence Enumerated Type

A high-level description of a feed publisher's confidence in the reported value of are_workers_present on the WorkerPresence object.

Table 44: Worker Presence Confidence Enumerated Type

Value	Description
low	Feed publisher is not confident in the reported value, such as when data is manually reported or not updated frequently.
medium	Feed publisher is somewhat confident in the reported value, such as when the value is still manually reported but is being updated in a timely manner, or when worker presence is indirectly inferred from other equipment like smart arrow board.
high	Feed publisher is very confident in the reported value, such as when automated systems with GPS locations are used to generate the value.

Used by:

Property	Object
confidence	WorkerPresence

6.13 WorkerPresenceDefinition Enumerated Type

Situations in which workers may be considered present in a work zone.

Table 45: Worker Presence Definition Enumerated Type

Value	Description
workers-in-work-zone-working	Humans are physically in the work zone event area, doing road work.
workers-in-work-zone-not-working	Humans are physically in the work zone event area but not performing work.

Value	Description
mobile-equipment-in-work-zone-moving	Mobile equipment is moving within the work zone event area, implying the presence of a worker.
mobile-equipment-in-work-zone-not-moving	Mobile equipment is in the work zone event area but is not moving.
fixed-equipment-in-work-zone	Fixed equipment is in the work zone event area.
humans-behind-barrier	Humans are present in the work zone event area but separated from traffic by a barrier.

Used by:

Property	Object
definition	WorkerPresence

6.14 WorkerPresenceMethod Enumerated Type

Describes methods for how worker presence in a work zone event area is determined.

Table 46: Worker Presence Method Enumerated Type

Value	Description
camera-monitoring	Cameras in the work zone event area show workers are present.
arrow-board-present	A GPS-enabled arrow board is located in the work zone event area and broadcasting its location, implying that workers are present.
cones-present	GPS-enabled cones are located in the road event area, implying that workers are present.
maintenance-vehicle-present	A GPS-enabled maintenance vehicle is located in the road event area, implying that workers are present.
wearables-present	Workers wearing wearable detection equipment are present in the work zone.
mobile-device-present	Workers with GPS-enabled mobile device tracking are present in the work zone.
check-in-app	Workers have checked into the work zone via a mobile app.
check-in-verbal	Workers have checked into the work zone via phone or radio to a remote operations center.
scheduled	Workers are scheduled to be in the road event area, but presence has not been confirmed.

Used by:

Property	Object
method	WorkerPresence

6.15 WorkTypeName Enumerated Type

A high-level text description of the type of work being done in a road event.

Table 47: Work Type Name Enumerated Type

Value	Description
maintenance	Work with no impact on the roadway. This includes events such as trash pickup, mowing, landscaping.
minor-road-defect-repair	Pothole repair, road crack repair and sealing, and other small road defect repairs.
roadside-work	Work that is isolated to the side of the road and not in the main travel way, such as repair, replacement, or addition of streetlights, VMS, signs (guide, warning, regulatory, and information signs) in the ground.

Value	Description
overhead-work	Work that occurs above the road, such as repair/replacement of overpasses, overhead VMS, wires, overhead signs, signals, etc. This type of work requires a bucket truck or similar setup rather than being isolated to the side of the road.
below-road-work	Work occurring below the road such as boring or bridge repair.
barrier-work	Repair, replacement, addition, or change of barriers, guardrails, retaining walls, K-barriers, or similar.
surface-work	New resurfacing, such as adding new lanes, moving lanes, or adding or changing connectivity (turn lanes), as well as creation or repair of non-drivable surfaces such as the shoulder or median.
painting	Repainting, re-striping, adding new lanes, moving lanes, adding stop bars/lines, etc. Note: is_architectural_change field should be false when new paint is expected to be within 1 meter of the old paint.
roadway-relocation	Physically relocating the road, such as adding a bridge or removing a sharp curve.
roadway-creation	Adding a new road.

Used by:

Property	Object
type_name	TypeOfWork

7. List of Enumerated Types for Field Devices

The following enumerated types are used in describing deployed roadside ITS devices:

Table 48: Field Devices Enumerated Type

Enumerated Type	Description
ArrowBoardPattern	A list of options for the posted pattern on an ArrowBoard.
FieldDeviceStatus	The operational status of a field device.
FieldDeviceType	The type of a field device.
FlashingBeaconFunction	Describes options for what a FlashingBeacon is being used to indicate.
HybridSignDynamicMessageFunction	Describes options for the function of the dynamic message displayed by the electronic display on a HybridSign.
MarkedLocationType	Describes options for what a MarkedLocation can mark, such as the start or end of a road event.

7.1 ArrowBoardPattern Enumerated Type

The ArrowBoardPattern enumerated type defines a list of options for the posted pattern on an ArrowBoard. If the arrow board pattern does not exactly match one of the values described, the closest pattern should be used.

Table 49: Arrow Board Pattern Enumerated Type

Value	Description
blank	No pattern; the board is not displaying anything.
right-arrow-static	Merge right represented by an arrow pattern (e.g., →) that does not flash or move.

Value	Description
right-arrow-flashing	Merge right represented by an arrow pattern (e.g., →) that flashes on/off.
right-arrow-sequential	Merge right represented by an arrow pattern (e.g., →) that is displayed in a progressing sequence (e.g., > -> → or - -- →).
right-chevron-static	Merge right represented by a pattern of chevrons (e.g., >>>) that does not flash or move.
right-chevron-flashing	Merge right represented by a pattern of chevrons (e.g., >>>) that flashes on/off.
right-chevron-sequential	Merge right represented by a pattern of chevrons that is displayed in a progressing sequence.
left-arrow-static	Merge left represented by an arrow pattern (e.g., ←) that does not flash or move.
left-arrow-flashing	Merge left represented by an arrow pattern (e.g., ←) that flashes on/off.
left-arrow-sequential	Merge left represented by an arrow pattern (e.g., ←) that is displayed in a progressing sequence (e.g., < <- ← or - -- ←).
left-chevron-static	Merge left represented by a pattern of chevrons (e.g., <<<) that does not flash or move.
left-chevron-flashing	Merge left represented by a pattern of chevrons (e.g., <<<) that flashes on/off.
left-chevron-sequential	Merge left represented by a pattern of chevrons that is displayed in a progressing sequence.
bidirectional-arrow-static	Split (merge left or right) represented by arrows pointing both left and right (e.g., ←>) that does not flash or move.
bidirectional-arrow-flashing	Split (merge left or right) represented by arrows pointing both left and right (e.g., ←>) that flashes on/off.
line-flashing	A flashing line or bar (e.g., ---), indicating warning/caution, not a merge.
diamonds-alternating	An alternating display of two diamond shapes (e.g., ◇ ◇), indicating warning/caution, not a merge.
four-corners-flashing	Four dots on the corners of the board which flash, indiciating warning/caution, not a merge.
unknown	The arrow board pattern is not known.

Used by:

Property	Object
pattern	ArrowBoard

7.2 FieldDeviceStatus Enumerated Type

The FieldDeviceStatus enumerated type describes the operational status of a field device. The status indicates the health of the device.

Table 50: Field Device Status Enumerated Type

Value	Description
ok	The device is turned on and working without issue.
warning	The device is functional but is impaired or impacted in a way that is not critical to operation.
error	The device is impaired such that it is not able to perform one or more necessary functions.
unknown	The device's operational status is not known.

Used by:

Property	Object
device_status	FieldDeviceCoreDetails

7.3 FieldDeviceType Enumerated Type

The FieldDeviceType enumerated type enumerates all types of field devices described by the specification.

Table 51: Field Device Type Enumerated Type

Value	Description
arrow-board	An electronic, connected arrow board which can display an arrow pattern to direct traffic.
camera	A camera device deployed in the field, capable of capturing still images.
dynamic-message-sign	An electronic traffic sign deployed on the roadway, used to provide information to travelers.
flashing-beacon	A flashing beacon light of any form, used to indicate caution and capture driver attention.
hybrid-sign	A message sign that contains both static text (e.g., on an aluminum board) along with a variable electronic message sign, used to provide information to travelers.
location-marker	Any GPS-enabled ITS device that is placed at a point on a roadway to mark a location (often the beginning or end of a road event).
traffic-sensor	A device deployed on a roadway which captures traffic metrics such as speed, volume, or occupancy.

Used by:

Property	Object
device_type	FieldDeviceCoreDetails

7.4 FlashingBeaconFunction Enumerated Type

The FlashingBeaconFunction enumerated type describes a list of options for what a FlashingBeacon is being used to indicate.

Table 52: Flashing Beacon Function Enumerated Type

Value	Description
vehicle-entering	Vehicles are entering the roadway.
queue-warning	There is a queue of vehicles.
reduced-speed	There is a reduced speed limit.
workers-present	There are workers present on or near the roadway.

Used by:

Property	Object
type_name	TypeOfWork

7.5 HybridSignDynamicMessageFunction Enumerated Type

The HybridSignDynamicMessageFunction enumerated type describes options for the function of the dynamic message displayed by the electronic display on a HybridSign.

Table 53: Hybrid Sign Dynamic Message Function Enumerated Type

Value	Description
speed-limit	The message is a speed limit.
travel-time	The message is a travel time.
other	The hybrid sign message function is not one of the other options described by this enumerated type.

Used by:

Property	Object
dynamic_message_function	HybridSign

7.6 MarkedLocationType Enumerated Type

The MarkedLocationType enumerated type describes options for what a MarkedLocation can mark, such as the start or end of a road event.

Table 54: Marked Location Type Enumerated Type

Value	Description
afad	An automatic flagger assistance device.
flagger	A human who is directing traffic.
lane-shift	A lane shift.
lane-closure	One or more lanes are closed.
temporary-traffic-signal	A temporary traffic signal.
road-event-start	The start point of a road event.
road-event-end	The end point of a road event.
work-zone-start	The start point of a work zone.
work-zone-end	The end point of a work zone.

Used by:

Property	Object
type	MarkedLocation