

# Proof of Concept(POC) Toolset User Guide for W2X Enabled Work Zone Data Collection Tool

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# POC Toolset User Guide

## 1 Utilizing the POC TMC Website

### 1.1 Website Location

Navigate to the website (currently hosted in an unauthenticated POC website located at [https://neaeraconsulting.com/V2x\\_Home](https://neaeraconsulting.com/V2x_Home) )

### 1.2 Configuration Creator

Create, edit, and publish configuration files

Configuration files hold vital work zone information

#### 1.2.1 Creating a new configuration file

To enter a new configuration file, open the Configuration Creator page and start entering information. The name of the configuration file will be automatically created using the WorkZone Description + RoadName + “.json”

All required data will not be required to save the configuration file, but in order to publish the data the required fields must be entered.

#### Save config file

At any time, the information can be saved by selecting the save button.

#### 1.2.2 Updating a configuration file

Select config file by ID and import

##### 1.2.2.1 Edit file

To edit a configuration file, select any file in the list, see **Error! Reference source not found.**, and select Import.

The screenshot shows a web form for creating or updating a configuration file. At the top, there is a text input field for 'Road Name' containing the value 'road name'. Below it is a text input field for 'Road #' which is currently empty. A label 'File Name (auto generated - WZ description + Road Name.json)' is positioned above a text field that displays 'config--wz-description--road-name.json'. Below this, the text 'Import a configuration file' is displayed. A section titled 'Select an existing configuration file:' contains a list box with three items: 'config-demo-test-1-north-l-25.json', 'config-wz-description-3--road-name.json', and 'config-wz-description-2--road-name.json'. To the right of the list box are two orange buttons: 'Import' and 'DownloadFile'.

Figure 1 Edit configuration file

#### 1.2.2.2 Save file

At any time the data can be saved by selecting the Save button option at the bottom of the configuration creator page.

#### 1.2.2.3 Configuration field descriptions

For a detailed description of each field and field types refer to Appendix A Configuration File Definitions

### 1.2.3 Publishing a configuration file

#### 1.2.3.1 Import config file

Importing a configuration file will download the configuration data and populate the configuration creator fields within the webpage by selecting an item in the published configuration list and clicking Import, see **Error! Reference source not found..**

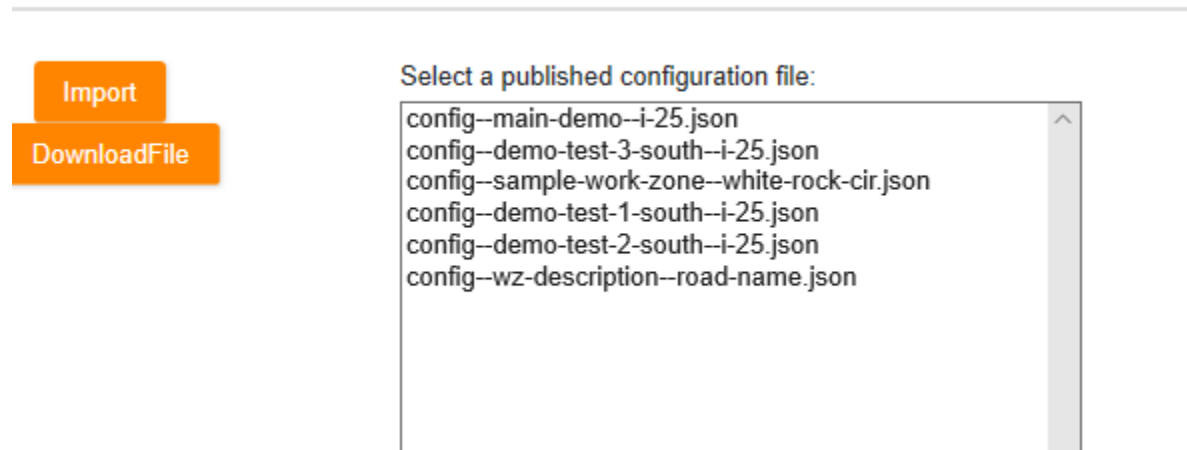


Figure 2 Import Published Configuration File

#### 1.2.3.2 Publish config file

Publishing a configuration file will require all required fields to be populated and then move the configuration file from the in-progress to the published folders in the Cloud. By publishing the configuration file, it will allow the file to be used within the data collection tool.

### 1.3 Upload Page

#### Upload work zone data ZIP archives

If the configuration files, csv and WZDx files were saved from another location (and saved as a zip file) you can select this option to upload the zip file to the published directory. Here, the files will be unzipped in the Cloud and made available in the published directory for the data collection tool to use.

#### 1.3.1 Upload work zone data

Select upload, select ZIP archive, and press upload.

## 1.4 Verification and Visualization page

Verify and visualize mapped work zones for distribution

### Work Zone Verification

**Choose Work Zone to Visualize**

accuracy-test-1--prairie-center-cir  
accuracy-test-2--prairie-center-cir  
accuracy-test-3--prairie-center-cir  
accuracy-test-4--prairie-center-cir

Load Visualization



Figure 1-4 Work Zone Verification

#### 1.4.1 Load visualization of work zone

To view a visualization of the work zone, go to the Work Zone Verification page, select a workzone from the list and select load visualization. Here, 2 maps are displayed (the RSM as a pop-up) and the WZDx.

##### 1.4.1.1 RSM visualization

The RSM map will display in a pop-up window (image shown below). The RSM visualization features an information window on the left side and a map overlay on the right side. The purple dots are vehicle path data points (recorded at 10Hz), and markers indicate features marked in the work zone (reference point, lane closures and the presence of workers).

White lines indicate lane lines, and small black lines perpendicular to lane lines indicate locations of the reduced vehicle path data. Red lines, red shading and traffic cones accompany lane closures and the tapering regions surrounding them. Speed limit signs are also shown on the map next to locations where the speed limit changes, as seen in Figure 3.

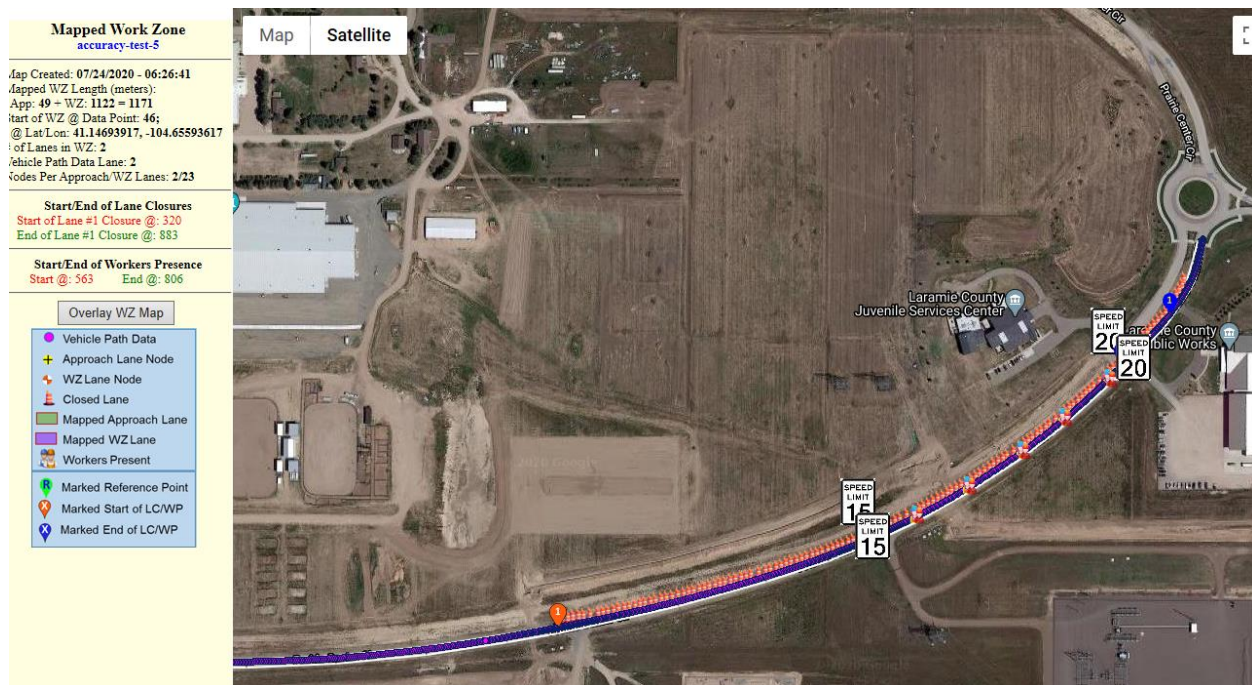


Figure 3 RSM Visualization

#### 1.4.1.2 WZDx visualization

The WZDx visualization is overlaid on a satellite map, in the TMC website page (image below). Hover over the highlighted path to view detailed information associated with that path segment (displayed in the top center of the map) as seen on Figure 4



Figure 4 WZDx Visualization

#### 1.4.2 Verify and publish work zone

After visualizing a work zone, verify for distribution. This will take the selected Work Zone and copy the file to a publish location within Azure and make it available.

## 1.5 Published page

View and download published work zone data, go to the Published Work Zone Data page. Here you can select a published work zone and see the work zone in the map.

**Published Work Zone Data**

---

*Choose Work Zone to Download*

**Choose a work zone and specify messages to download**

accuracy-test-1-prairie-center-cir  
accuracy-test-2-prairie-center-cir  
accuracy-test-3-prairie-center-cir  
accuracy-test-4-prairie-center-cir

Description:  
Road Name:  
Start Date:  
End Date:

☐ Work Zone Data Exchange message (WZDx), type = geojson  
☐ XML Roadside Safety Message (RSM), type = xml  
☐ Binary Roadside Safety Message (RSM), type = uper

Download Work Zone Data




Figure 5 Published Work Zone page

### 1.5.1 Download published work zone data

Select work zone and file types and download any of the file options for this specific published work zone.

## 2 Utilizing the WZDC Tool

### 2.1 GitHub Location

Download and install the tool from <https://github.com/TonyEnglish/V2X-manual-data-collection>

### 2.2 Required hardware

The application required hardware:

- USB GPS
- Laptop/tablet that can run Python

### 2.3 Required environment

- Internet to access the website

### 2.4 Setting up the tool

The Data collection tool is currently written in Python and some additional libraries are needed to run the application



### 2.4.1 Python

Install the latest version of python - <https://www.python.org/downloads/>

Ensure that python is added to your system path.

Install the following python libraries:

- esptool
- azure-storage-blob
- image
- wheel
- serial
- pynmea2
- zipfile
- xmltodict
- tkinter

### 2.4.2 Java

Install java - <http://www.java.com/getjava/>

## 2.5 Initializing the tool

Load configuration file, establish GPS connection, begin data collection

- Open a command prompt and go to the location of the application
- Type in: 'python WZDC\_tool.py' - you should see a window appear as in Figure 6

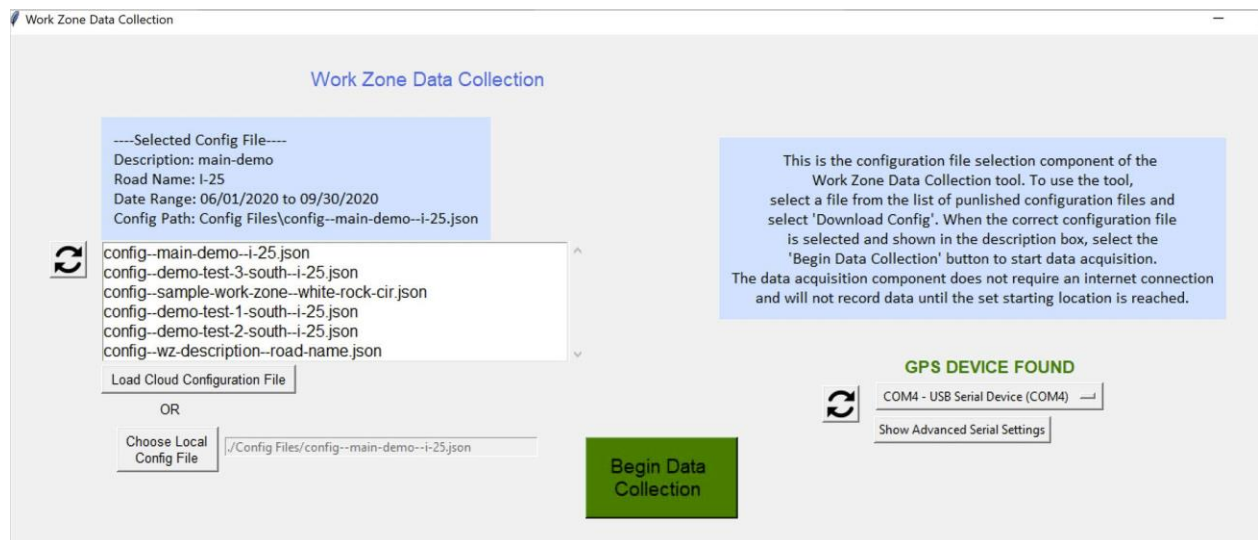


Figure 6 Initialize data collection tool



### 2.5.1 Loading a configuration file

You have a choice to load a configuration file from the cloud or local to your own device.

#### 2.5.1.1 Cloud

Select an item in the list and select Load Cloud Configuration File

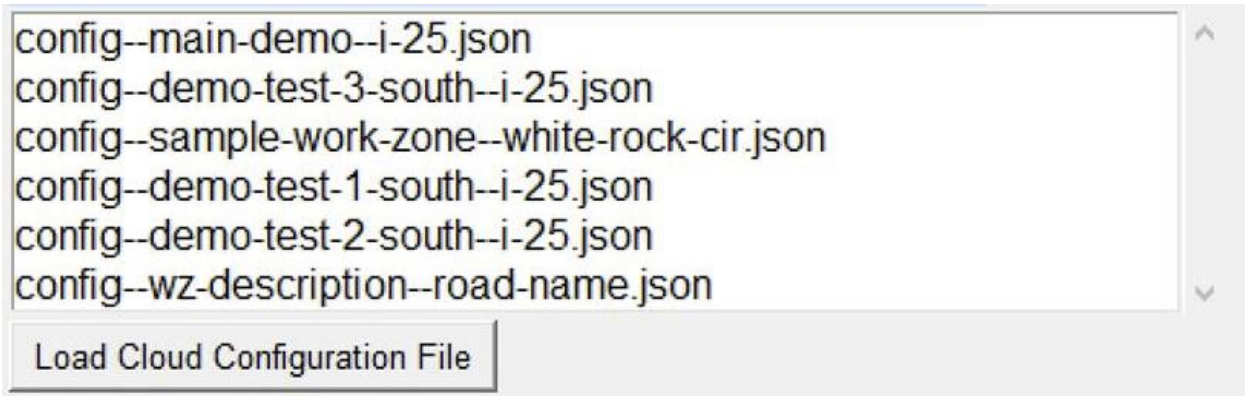


Figure 7 Import Configuration file from Cloud(Azure)

#### 2.5.1.2 Local File

Select the choose Local Config file button and browse to your own .json file to import



Figure 8 Import Configuration File from local file storage

### 2.5.2 Detecting/connecting to GPS device

Plug in USB GPS device and refresh the app (Refresh button next to GPS menu)

To ensure GPS connection, plug in the GPS before starting the application. If you plug in the GPS device after the application has already started, simply refresh the GPS menu. You can select on advanced serial connection settings and see the Baud rate and data rate for the GPS.

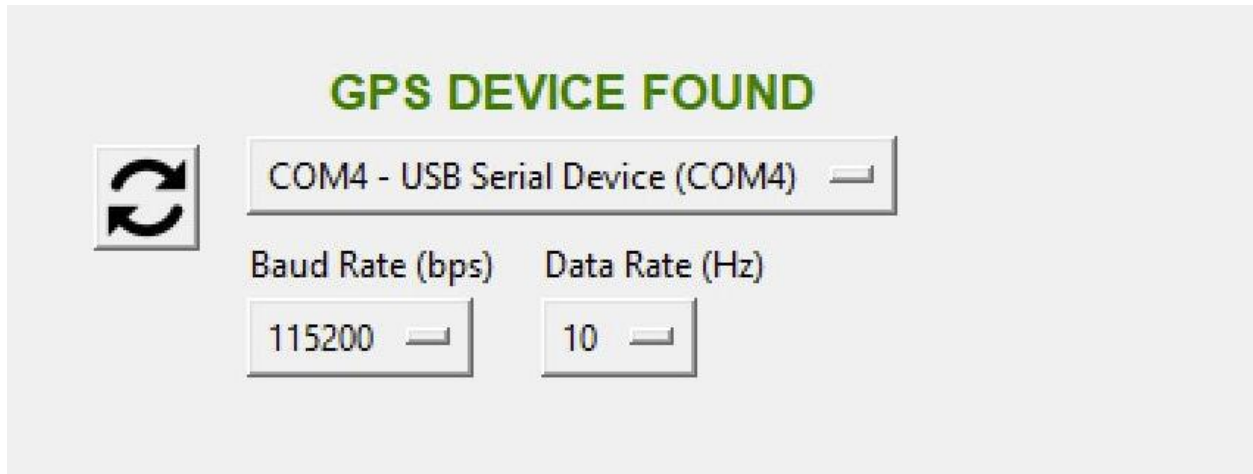


Figure 9 Connecting GPS

## 2.6 Collecting vehicle path data

At the start of the data collection the application will show this screen (and show the correct number of lanes as defined in your configuration file) as in Figure <>

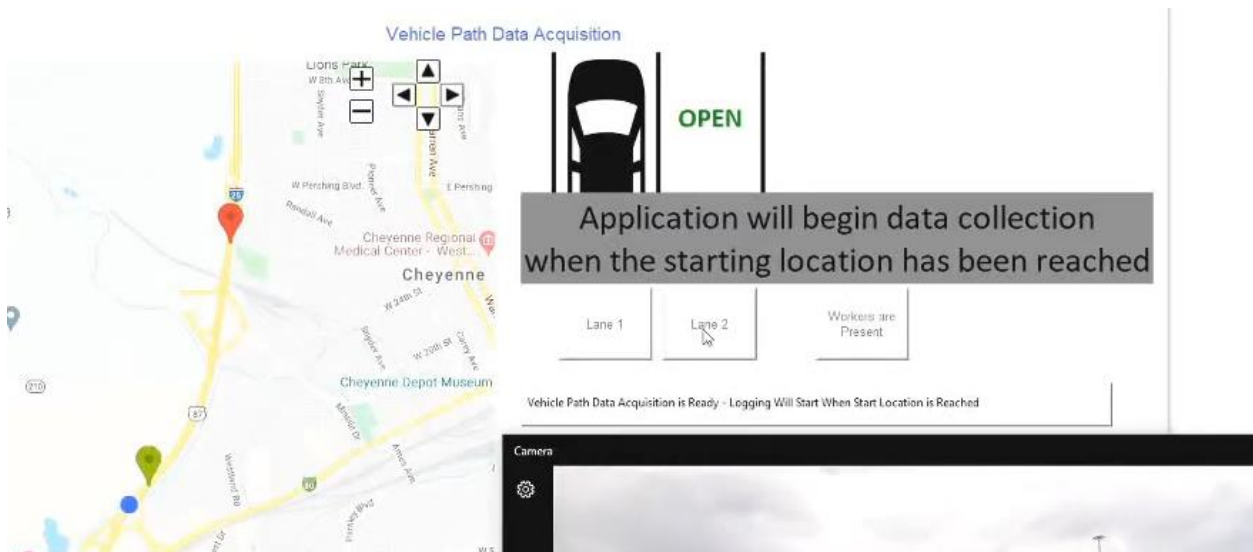


Figure 10 Collecting vehicle path data

The GPS will start collecting data once you have passed the starting point, and should show this notification as in Figure 11

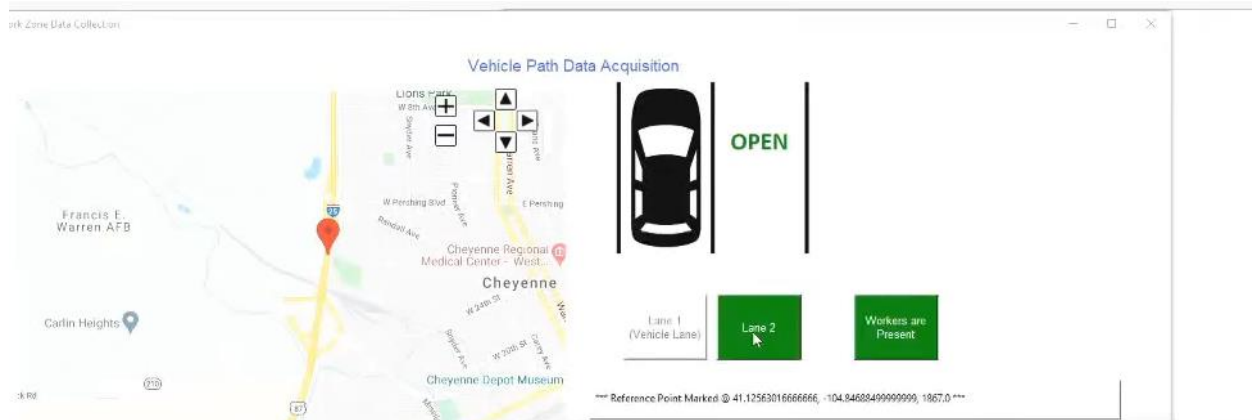


Figure 11 Data collection start configuration

#### 2.6.1.1 Mark features

Features to mark:

- Lane Closures
- Workers Present
- Lane opening

Once you pass the starting location and data collection starts, you may start marking work zone features.

To mark a lane closure/opening, simply click the button labeled 'Lane #'. Mark a lane as closed when the lane starts tapering to closed. Mark a lane as open when the lane starts tapering to open.

To mark the presence/lack of workers, toggle the 'Workers are present'/'Workers no longer present' button.

Once the GPS collection has started (passed the start reference point) you may select any of these features as you drive through the work zone.

#### 2.6.1.2 End of Work Zone

The End of the Work Zone will be defined as the end of the data collection. This will happen automatically (as defined in the configuration file) and will notify the user on the screen that the data collection has completed.

### 2.7 Uploading mapped work zone data

After the data collection has been completed, the application will automatically process the data and try to upload the files to the Azure file storage location. The user will be notified by the Processing Data image on the screen as show in Figure<>



*Figure 12 Processing Data Confirmation*

If there is an internet connection is available, the application will automatically upload the data to the Azure file storage location. If no internet is available once an internet connection is established just select the upload button. If you wish to upload at a later time, close the application and manually upload the work zone (**Section 1.3.1**)



*Figure 13 Upload Data file option*

## Appendix A Configuration File Definitions

Table 1 Configuration file definitions

| JSON Tag                | Field Type             | Description                              |
|-------------------------|------------------------|--|
| DateCreated             | DateTime               | Date and time of file creation in UTC    |
| feed_info_id            | String (GUID)          | Unique WZDx feed identifier              |
| GeneralInfo             | Sequence               | General information                      |
| Description             | String                 | Work zone description                    |
| RoadName                | String                 | Road name                                |
| Roadnumber              | String                 | Road Number                              |
| Direction               | Enumeration            | Direction                                |
| BeginningCrossStreet    | String (optional)      | Beginning cross street                   |
| EndingCrossStreet       | String (optional)      | Ending cross street                      |
| BeginningMilePost       | Decimal (optional)     | Beginning milepost                       |
| EndingMilePost          | Decimal (optional)     | Ending milepost                          |
| EventStatus             | Enumeration (optional) | Event status                             |
| TypesOfWork             | List                   | Types of work list                       |
| WorkType                | Enumeration (optional) | Type of work                             |
| Is_Architectural_Change | Boolean (optional)     | Will result in structural change?        |
| LaneInfo                | Sequence               | Lane-based information                   |
| NumberOfLanes           | Integer                | Number of lanes                          |
| AverageLaneWidth        | Decimal                | Average lane width (meters)              |
| ApproachLanePadding     | Decimal (optional)     | Lane padding of approach region (meters) |
| WorkzoneLanePadding     | Decimal (optional)     | Lane padding of wz (meters)              |
| VehiclePathDataLane     | Integer                | Driven lane                              |
| Lanes                   | List                   | List of lanes                            |
| LaneNumber              | Integer                | Lane number                              |
| LaneType                | Enumeration            | Lane type                                |
| LaneRestrictions        | List                   | Lane restrictions list                   |
| RestrictionType         | Enumeration (optional) | Type of restriction                      |
| RestrictionValue        | Decimal (optional)     | Value of restriction                     |
| RestrictionUnits        | Enumeration (optional) | Units of restriction value               |
| SpeedLimits             | Sequence               | Speed limits                             |
| NormalSpeed             | Integer                | Normal speed limit (mph)                 |
| ReferencePointSpeed     | Integer                | Speed limit at start of wz (mph)         |
| WorkersPresentSpeed     | Integer                | Speed limit when workers present (mph)   |
| CauseCodes              | Sequence               |  |
| CauseCode               | Integer                | Cause code                               |
| SubCauseCode            | Integer                | Sun cause code                           |
| Schedule                | Sequence               |  |

|                           |                    |   |
|---------------------------|--------------------|---|
| StartDate                 | DateTime           | Date and time of file creation in UTC         |
| StartDateAccuracy         | Enumeration        | Accuracy of start date                        |
| EndDate                   | DateTime           | Date and time of file creation in UTC         |
| EndDateAccuracy           | Enumeration        | Accuracy of end date                          |
| DaysOfWeek                | List               | Days of the week that the work zone is active |
| Location                  | Sequence           |   |
| BeginningLocation         | Sequence           | Location of beginning of wz                   |
| Lat                       | Decimal            | Latitude (Deg.)                               |
| Lon                       | Decimal            | Longitude (Deg.)                              |
| Elev                      | Decimal (optional) | Elevation (meters, WGS-84)                    |
| BeginningAccuracy         | Enumeration        | jpo-wzdx(beginning_accuracy)                  |
| EndingLocation            | Sequence           | Location of end of wz                         |
| Lat                       | Decimal            | Latitude                                      |
| Lon                       | Decimal            | Longitude                                     |
| Elev                      | Decimal (optional) | Elevation (meters, WGS-84)                    |
| EndingAccuracy            | Enumeration        | jpo-wzdx(ending_accuracy)                     |
| metadata                  | Sequence           | Metadata for WZDx                             |
| wz_location_method        | Enumeration        | Wz location verification method               |
| lrs_type                  | String             | Linear referencing method                     |
| location_verify_method    | String             | Method used to verify accuracy of locations   |
| datafeed_frequency_update | String             | WZDx feed update frequency                    |
| timestamp_metadata_update | DateTime           | Metadata update timestamp                     |
| contact_name              | String             | WZDx feed contact name                        |
| contact_email             | String             | WZDx feed contact email                       |
| issuing_organization      | String             | WZDx feed issuing organization                |