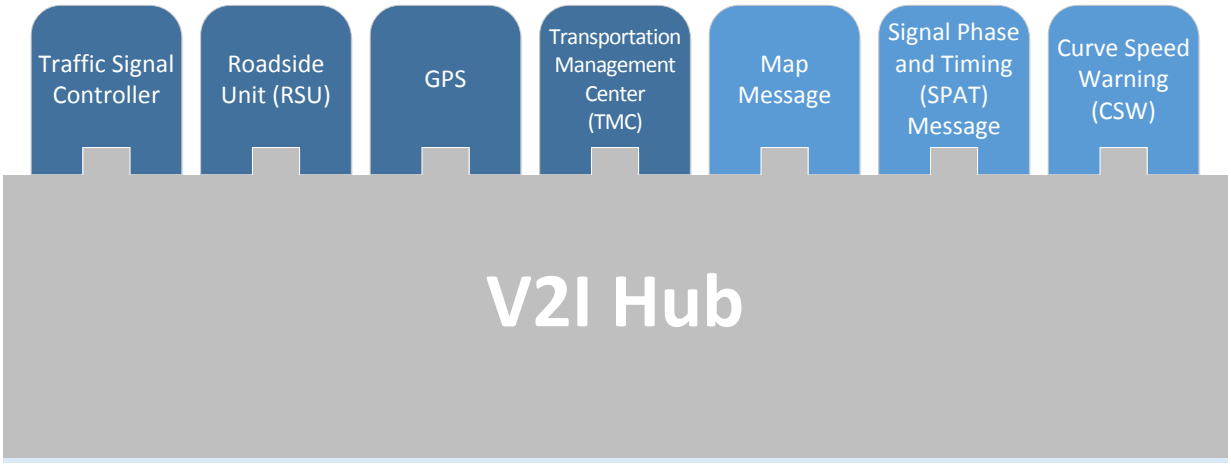
Integrated Vehicle-to-Infrastructure
Prototype (IVP)

V2I Hub Curve Speed Warning (CSW) XML Input File Instructions

Prepared by:
Battelle
505 King Avenue
Columbus, Ohio 43201

Client:
Deborah Curtis
FHWA Office of Operations Research and Development
Turner-Fairbank Highway Research Center

March 2017



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Introduction

V2I HUB

The Integrated Vehicle-to-Infrastructure Prototype (IVP), called V2I Hub, is part of USDOT's Vehicle-to-Infrastructure Program and was developed to support jurisdictions in deploying V2I technology by reducing integration issues and enabling use of their existing transportation management hardware, and systems. V2I Hub is a software platform that utilizes plugins to translate messages between different devices and run connected vehicle safety applications on roadside equipment.

DOCUMENT PURPOSE

The Curve Speed Warning (CSW) plugin uses an XML input file to create the geometry sent in the SAE J2735-201509 Traveler Information Message (TIM) for the curve. The input file contains the speed of the curve, the four (4) zones with their reference point, offsets to create the center line for the zones, and the zone width. Currently, the CSW plugin supports zones containing two (2) points, which create a straight line. The zones are referenced as Zone 1 through Zone 4, with Zone 1 being the closest to the entrance of the curve and Zone 4 the furthest. In the file, Zone 1 is the first region in the region list. As a vehicle approaches the curve, the vehicle will enter Zone 4, Zone 3, Zone 2, and finally, Zone 1. A sample XML file is included along with a description of each node.

TARGET AUDIENCE

The target audience for this document is technical personnel familiar with the infrastructure and the eXtensible Markup Language. The end user will need familiarity with connected vehicle technology.

Instructions

SAMPLE INPUT FILE

```
<?xml version="1.0" encoding="utf-8"?>
<Curve xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
      <Version>1</Version>
      <CurveID>125</CurveID>
      <SpeedLimit>8.491</SpeedLimit>
      <Approaches>
            <Approach>
                  <Regions>
                        <Region>
                              <ReferencePoint>
                                    <Latitude>38.9556187319798</Latitude>
                                    <Longitude>-77.1504409878302</Longitude>
                                    <Elevation>0</Elevation>
                              </ReferencePoint>
                              <Width>335</Width>
                              <DirectionOfUse>Forward</DirectionOfUse>
                              <Nodes>
                                    <Node>
                                          <Eastern>0</Eastern>
                                          <Northern>0</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                                    <Node>
                                          <Eastern>141</Eastern>
                                          <Northern>-206</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                              </Nodes>
                        </Region>
                        <Region>
                              <ReferencePoint>
                                    <Latitude>38.9554328674441</Latitude>
                                    <Longitude>-77.150277082612</Longitude>
                                    <Elevation>0</Elevation>
                              </ReferencePoint>
                              <Width>335</Width>
                              <DirectionOfUse>Forward</DirectionOfUse>
                              <Nodes>
                                    <Node>
                                          <Eastern>0</Eastern>
                                          <Northern>0</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                                    <Node>
                                          <Eastern>173</Eastern>
                                          <Northern>-181</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                              </Nodes>
                        </Region>
                        <Region>
```

```
                              <ReferencePoint>
                                    <Latitude>38.9552698871225</Latitude>
                                    <Longitude>-77.150076690332</Longitude>
                                    <Elevation>0</Elevation>
                              </ReferencePoint>
                              <Width>335</Width>
                              <DirectionOfUse>Forward</DirectionOfUse>
                              <Nodes>
                                    <Node>
                                          <Eastern>0</Eastern>
                                          <Northern>0</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                                    <Node>
                                          <Eastern>256</Eastern>
                                          <Northern>-155</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                              </Nodes>
                        </Region>
                        <Region>
                              <ReferencePoint>
                                    <Latitude>38.9551299660347</Latitude>
                                    <Longitude>-77.1497799675418</Longitude>
                                    <Elevation>0</Elevation>
                              </ReferencePoint>
                              <Width>335</Width>
                              <DirectionOfUse>Forward</DirectionOfUse>
                              <Nodes>
                                    <Node>
                                          <Eastern>0</Eastern>
                                          <Northern>0</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                                    <Node>
                                          <Eastern>382</Eastern>
                                          <Northern>-138</Northern>
                                          <Elevation>0</Elevation>
                                    </Node>
                              </Nodes>
                        </Region>
                  </Regions>
            </Approach>
      </Approaches>
</Curve>
```

CURVE NODE

```
<?xml version="1.0" encoding="utf-8"?>
<Curve xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema">
      <Version>1</Version> ← Version of the curve file
      <CurveID>125</CurveID> ← Curve ID
      <SpeedLimit>8.491</SpeedLimit> ← Speed Limit of Curve in m/s
      <Approaches> </Approaches> ← List of Approach Nodes
</Curve>
```

APPROACH NODE

```
<Approach>
      <Regions> </Regions> ← List of Region Nodes
</Approach>
```

REGION NODE

Each region of the curve XML is information for one of the zones. Each Region should be formatted like the one below, and contain a reference point, width, and node list. Each node contains offset in decimeters from the reference point to create the center line for the region (or zone).

```
<Region>
      <ReferencePoint> ← Used in creating the center line for the region with the nodes
            <Latitude>38.9556187319798</Latitude> ← Latitude in decimal degrees
            <Longitude>-77.1504409878302</Longitude> ← Longitude in decimal
degrees
            <Elevation>0</Elevation> ← Elevation in meters (optional, set to 0 if not used)
      </ReferencePoint>
      <Width>335</Width> ← Width in decimeters (ex 335 = 3.35 meters)
      <DirectionOfUse>Forward</DirectionOfUse> ← Direction of use should always be
forward
      <Nodes>
            <Node>
                  <Eastern>0</Eastern> ← Eastern offset in decimeters for node 1
                  <Northern>0</Northern> ← Northern offset in decimeters for node 1
                  <Elevation>0</Elevation> ← Elevation offset in decimeters for node 1
            </Node>
            <Node>
                  <Eastern>141</Eastern> ← Eastern offset in decimeters for node 2
                  <Northern>-206</Northern> ← Northern offset in decimeters for node 2
                  <Elevation>0</Elevation> ← Elevation offset in decimeters for node 2
            </Node>
      </Nodes>
</Region>
```