

## Connected Portable Traffic Signal Deployment Plan



Prepared for the Iowa DOT by



DRAFT March 24, 2021

REVISED January 5, 2022

REVISED March 24, 2023

REVISED May 11, 2023

REVISED September 11, 2023

# Connected Portable Traffic Signal Deployment Plan Iowa DOT

## September 11, 2023

### Introduction

Timely and accurate information on work zone location and status is becoming increasingly important, not only to road authorities, but to other public and private stakeholders involved in managing road construction and maintenance activities.

The challenges in providing this information are:

- Collecting and reporting timely information is time consuming for staff and competes with other project administration duties.
- Road construction and maintenance activities on two lane roads that require lane closures are not always reported to operations staff resulting in inaccurate or no dissemination of information to traveler information systems and the traveling public.
- Stakeholders desire more detailed records on the start time, end time, and location of lane closures for improved post work zone analysis of the transportation management plan (TMP) and performance measurement.

Given the anticipated deployment of connected vehicles, driver notifications of work zone-related lane closures via in-vehicle displays offer opportunities for increased safety, but also increases the need for accurate information about active lane closures.

### Solution

Portable Traffic Signals, both trailer mounted and pedestal designs, are routinely used for one lane two-way operations when lane closures are needed on two lane highways. Application of available technology could report the location and operation of these portable traffic signals without requiring significant time of agency staff.

### Purpose

This plan provides a guide for the development of communication standards for, and deployment of real time Connected Portable Traffic Signals (CPTS) on all Iowa DOT construction and maintenance projects on two-lane highways.

### Scope

This plan focuses on developing a system that provides real-time reporting from CPTS used for one-lane two-way operations during construction and maintenance activities. CPTS include trailer mounted and portable pedestal mounted signals. Pole mounted and span wire mounted temporary traffic signals used to control traffic at an intersection or for haul road applications are not required to provide real-time reporting. This plan does not include post processing of this data for applications such as traveler information, project management, project performance, or analysis.

Connected Portable Traffic Signal Deployment Plan Iowa DOT  
September 11, 2023

## General Needs

All CPTS must meet the requirements found in the Manual on Uniform Traffic Control Devices (MUTCD), 2009, Standard Road Plans TC-215, TC-216, TC-217, and TC-271. Temporary signals currently used on construction projects must also meet [Iowa DOT Specification Article 2528.03.H](#) and be included on the Approved Products are listed in the Materials Approved Products Listing Enterprise ([MAPLE](#)). All traffic signal controllers in Iowa are required to meet NEMA TS5 specifications.

Detailed needs and requirements for CPTS Protocol using GeoJSON which receives data from an intermediary server are included as Attachment 1 of this implementation plan.

## Maintenance Operations

Maintenance equipment is not required to be included on the MAPLE approved projects list and is not required to meet the same specifications as construction contract devices. Even so they will be using the protocol and specifications used for contract operations.

A revised schedule for deployment may be needed to allow for identification of equipment needs and procurement of equipment. This includes:

- Does existing equipment meet operational requirements?
- Can existing equipment be retrofitted to ensure compliance?
- Is replacement of all existing equipment necessary?
- Is funding available to purchase or lease the necessary equipment?

## Future Needs

The implementation of smart arrow boards and CPTS are only the first steps in providing automated data for work zones. There are other technologies and needs, that need to be addressed to provide more complete work zone data.

Connected Portable Traffic Signal Deployment Plan Iowa DOT  
September 11, 2023

Proposed Project Schedule

Year		2021												2022												2023												2024												
Month		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	
1	Establish Needs	Y	Y	G																																														
2	Research Current Methods	Y	Y	G																																														
3	Develop Architecture	Y	Y	G																																														
4	ATSSA Chapter			Y	G	Y	Y	Y	Y	Y	Y	Y		G	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																										
5	Midwest Roundtable					G	Y	Y	Y	Y	Y	G					G	Y	Y	Y	Y	Y	Y	G																										
6	ATSSA Convention and EXPO													G	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y																										
7	RFI to Manufacturers			Y	Y	G																							G	Y																				
8	Manufacturers Comments					Y	Y	G																					Y	Y	G																			
9	WZDx Subgroup												Y	Y	Y	Y	Y	G																																
10	Invitation for Evaluation																																																	
11	Evaluation																																					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	G	R
12	CPTS Specifications																																																	
13	Construction Specifications																																																	
14	Supplemental Specifications																																																	
15	Establish MAPLE																																																	
16	Two Lane Deployment																																																	

Key for color code on schedule:

Y	Activity Period	G	Planned Completion	R	Final Submittal
---	-----------------	---	--------------------	---	-----------------

1. Present schedule and high-level needs to WZMTO Committee January 21, 2021 meeting. Present needs March 2021 meeting. **Complete**
2. Interview the six manufacturers to establish the method used to communicate with existing Portable signals. **Complete**
3. Present architecture and high-level requirements to meet needs and receive agreement from WZMTO Committee March 2021 meeting. **Complete**
4. Provide Iowa DOT with a plan to present to the Iowa ATSSA Chapter members and keep members up to date on progress.
5. Provide information to Iowa DOT for presentation at Midwest Work Zone Roundtable and keep participants up to date.
6. Develop a White Paper so Iowa DOT can meet with manufacturers at National ATSSA Traffic Expo. **Complete**
7. RFI to manufacturers related to Iowa DOT protocols to determine their needs prior to making final recommendations. **Complete**
8. Review manufacturers' comments and make recommendations to Iowa DOT. **Complete**
9. Present proposal to include optional items in the WZDx objects for CPTS and report results to Iowa DOT. **Complete**
10. Develop and send an invitation to provide portable traffic signals, at no cost to the DOT, for evaluation and approval.
11. Conduct field evaluation for system approval.
12. Develop specifications for CPTS for MAPLE approval. (April 23, 2023 deadline)
13. Develop CPTS specifications for construction contracts and present to the Iowa DOT Specification Committee.
14. Work with the Specification Committee to have Supplemental Specifications approved and published (as necessary).
15. Establish CPTS MAPLE list.
16. Allow contractors and traffic control providers to begin conversion of their inventory to CPTS and begin deployment. This deployment will be mandatory on two lane projects in 2025. The RCE should determine the need for a change order on previously let projects with consultation with Traffic Safety Engineer in Construction and Materials.

Connected Portable Traffic Signal Deployment Plan  
Iowa DOT  
May 11, 2023

## Portable Signal Manufacturers

### Street Smart Rental

<https://www.streetSMARTrental.com/>  
888-653-6800  
6811 137th Ave NE  
Columbus, MN 55025  
Attn: Matt Krengel  
([mkrengel@streetSMARTrental.com](mailto:mkrengel@streetSMARTrental.com))

### Horizon Signal

<https://horizonsignal.com/>  
800-852-8796  
5 Corporate Blvd.  
Reading, PA 19608  
Attn: Jay Hunter  
([jhunter@horizonsignal.com](mailto:jhunter@horizonsignal.com))

### John Thomas Inc.

<https://jtitraffic.com/>  
888-447-7263  
1560 Lovett Drive  
Dixon, IL 61021  
Attn: Blake Balzart ([bbalzart@jtitraffic.com](mailto:bbalzart@jtitraffic.com))

### OMJC Signal

<https://www.omjcsignal.com/>  
800-776-5999  
403 Chestnut Street  
Waterloo, IA 50703  
Attn: Allison Beach ([allison@omjcsignal.com](mailto:allison@omjcsignal.com))

### North America Traffic

<https://www.northamericatraffic.com/>  
877-352-4626  
7 Petersburg Circle  
Port Colborne, Ontario  
Attn: Angela Verde  
([angela@northamericatraffic.com](mailto:angela@northamericatraffic.com))

### Ver-Mac

<https://www.ver-mac.com/en>  
888-488-7446  
4590 Scott Trail, Suite 209  
Eagan, MN 55122 USA  
Attn: Todd Foster ([todd.foster@ver-mac.com](mailto:todd.foster@ver-mac.com))

### iCone

<https://www.iconeproducts.com/>  
315-626-6800  
P O BOX 247  
3279 Cottrell Road  
Cato, NY 13033  
Attn: Adam Kovar  
([a.kovar@iconeproducts.com](mailto:a.kovar@iconeproducts.com))

# **Attachment 1**

## **Connected Portable Signal Protocol (CPSP)**

# Iowa CPSP

## *Connected Portable Signal Protocol*

*Version 3.0*

### Iowa DOT

- Prepared by:



- Date: May 11, 2023

# Table of Contents

---

<b><u>Introduction</u></b> .....	<b>1</b>
<u>Problem</u> .....	1
<u>Solution</u> .....	1
<u>Scope</u> .....	1
<u>General Needs</u> .....	2
<u>Document History</u> .....	2
<u>Document Overview</u> .....	2
<u>Disclaimer</u> .....	2
<u>Definitions</u> .....	3
<b><u>CPSP - Protocol Description</u></b> .....	<b>4</b>
<u>JSON Overview</u> .....	4
<u>GeoJSON Overview</u> .....	5
<u>WZDx Overview</u> .....	6
<u>CPSP Overview</u> .....	6
<u>Communication Process</u> .....	6
<u>Structure of a CPSP (JSON) Document</u> .....	7
<u>Example CPSP Document</u> .....	8
<b><u>Appendix A – WZDx References</u></b> .....	<b>9</b>
<b><u>Appendix B - Special Property Values</u></b> .....	<b>10</b>
<u>Timestamp Values</u> .....	10
<u>Identifier Values</u> .....	10
<u>GPS Coordinate Values</u> .....	11

# Introduction

---

## Problem

Timely and accurate information on work zones is increasingly important, not only to road authorities, but to other stakeholders involved with managing road construction and maintenance activities.

The challenges in providing this information are:

Collecting and reporting timely information is time consuming for staff and competes with other project administration duties.

Road construction and maintenance activities are not always reported to operations staff resulting in inaccurate or no dissemination of information to traveler information systems and the traveling public.

Records on the start time, end time, and location of lane closures are not sufficiently detailed for improved post work zone analysis of the transportation management plan (TMP) and performance measurement.

Given the anticipated deployment of connected vehicles, driver notifications of work zone-related lane closures via in-vehicle displays offer opportunities for increased safety, but also increases the need for accurate information about active lane closures.

## Solution

The location and operation of Connected Portable Traffic Signals (CPTS) can be automatically reported using available technology. CPTS, both trailer mounted and pedestal designs, are routinely used to control two-way traffic in a single lane when lane closures are needed on two lane highways. By automatically obtaining their location and operation status, real-time and historical data can be improved without requiring significant time of agency staff.

## Scope

This document is intended for use by CPTS manufacturers, monitoring-software authors, DOT traffic engineers, and CPTS field technicians. It is assumed that the reader has some familiarity with software terms, TCP/IP communication, connected traffic signal terminology, and procedures used for remote monitoring of field devices.

## General Needs

All Iowa connected portable traffic signals must meet the requirements found in the Manual on Uniform Traffic Control Devices (MUTCD), 2009, Section 4D.32 and Standard Road Plans TC-215, TC-216, TC-217, and TC-271. Connected traffic signals currently used on Iowa construction projects must also meet [Iowa DOT Specification Article 2528.03.F](#) and NEMA TS5 specifications.

## Document History

As is common in our industry, terms and standards evolve. The original version of this document described Iowa's "CTTS Temporary Signal Monitoring Protocol". That protocol had two different sub-protocols ("options"). Both of those protocols are now considered obsolete and are replaced by the protocol described by this document.

This is a reworked document intended to be more in line with new terminology and the national WZDx (Work Zone Data Exchange) standard.

## Document Overview

This document describes a communication protocol for near real time monitoring of connected portable traffic signals on Iowa DOT construction and maintenance projects on two-lane highways.

This Connected Portable Signal Protocol (CPSP) uses a subset of the national WZDx standard. It's designed to support collecting CPTS data from an intermediary consolidation server in a format that is easy for custom data collection software to parse and store.

The WZDx standard reference website is large, covers many kinds of devices, and takes a while to understand. This document gives you a framework to understand how WZDx works and then guides you to specific parts of that website, focusing on just the portions of that standard needed for use with connected portable traffic signals.

## Disclaimer

Example CPSP documents provided herein are as accurate and up to date as possible at the time of writing this document. However, WZDx is an evolving standard. We recommend checking the referenced websites and doing your own verification. In any inconsistency between WZDx and this document, this document defers to the WZDx standard.

## Definitions

For brevity, for the remainder of this document:

**Agency:**

Government or educational entity receiving connected traffic signal data for analysis.

**Client:**

Agency software (central-monitoring or TCP-terminal software) which submits queries to one or more CPSP servers and collects the responses.

**Connected Signal Set:**

One or more CPTSs operating as a coordinated group.

**Controller:**

CPTS field controller.

**Consolidation Server:**

Server polled for CPSP info for one-or-more connected signals.

**CPTS:**

Connected Portable Traffic Signal. This is the current term for what was formerly called CTTS (Connected Temporary Traffic Signal) or TTS (Temporary Traffic Signal).

**CPSP:**

Connected Portable Signal Protocol. The protocol described by this document.

**CPSP Document:**

Connected signal data in JSON format returned in response to a CPSP query.

**CPSP Query:**

HTTP request for a CPSP document.

**CPSP Server:**

consolidation server that provides CPSP information.

**GeoJSON:**

A format based on JSON used for encoding a variety of geographic data.

**PrettyPrinted JSON:**

A JSON document with line breaks and indentation.

**Primary & Secondary Traffic Signals:**

Primary controller CPTS and secondary CPTS. (Replaces “master/slave” terminology.)

**Property:**

JSON name/value pair inside a CPSP document.

**Provider:**

CPTS manufacturer or other entity that controls a consolidation server.

**TMC:**

Traffic Management Center.

**Stringified JSON:**

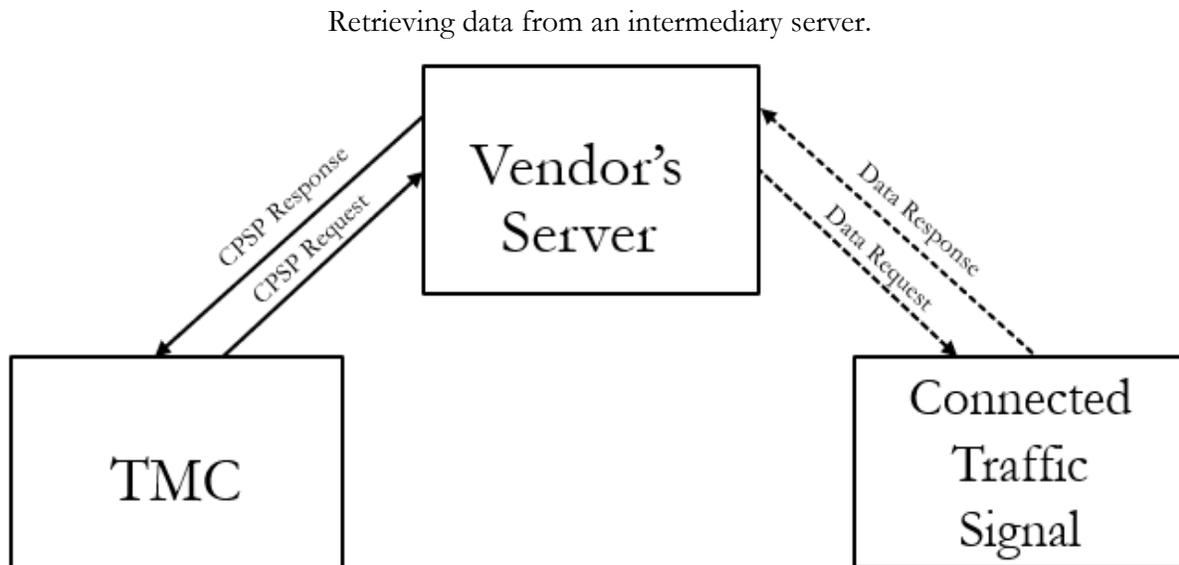
A JSON document with no line breaks or indentation.

**WZDx:**

Work Zone Data Exchange. A national standard for sharing data about work zone conditions and devices. The format for a WZDx data feed is based on GeoJSON.

## CPSP - Protocol Description

---



(Solid arrow lines show CPSP protocol exchange. Dotted lines are manufacturer specified protocol.)

### JSON Overview

JSON is a standard lightweight data-interchange format used to represent structured data in text form.

For purposes of this document, we will use the JSON description available at:

<http://www.json.org/>

Software libraries for manipulating JSON documents exist in many programming languages. A partial (but lengthy) list of available libraries is available at the json.org URL referenced above.

All JSON documents start with a left curly brace, end with a right curly brace, and contain a series of comma-separated JSON properties.

Each property has a name. All property names begin with a letter and are then followed by a combination of letters, digits, and underscores. Property names are always surrounded (on both ends of the string) by double quotes (" = ASCII character 34) and are followed by a colon.

Each property name (with quotes and a trailing colon) is followed by a value. A value is one of the following:

- a number (integer or floating-point number),
- a text string surrounded by double quotes,
- a boolean (true or false),
- an array (a comma separated array of values surrounded by square braces),
- an object (a comma separated collection of properties surrounded by curly braces),
- or a null.

All string values are quoted using double-quote characters. Special characters (some control characters, any backslashes, and any double quotes within a string must be replaced with the appropriate escape sequence. All non-string values are not quoted. (See the [json.org](http://json.org) URL for details.)

The following is a short example JSON document:

```
{
  "aString": "foo",
  "bNumber": 78,
  "cNumber": 62.878,
  "dBoolean": true,
  "eArray": [1, 2, 3, "bar"],
  "fObject": {
    "f1Something": 23,
    "f2SomethingElse": true
  },
  "gNull": null
}
```

(This is not a CPSP document. It just shows how JSON represents some kinds of data.)

## GeoJSON Overview

GeoJSON is JSON with the addition of standardized ways to represent information about geographic features (points, lines, polygons, etc.) along with non-spatial attributes of those features.

The primary document describing GeoJSON is rfc7946. A copy can be found here:

<https://datatracker.ietf.org/doc/html/rfc7946>

More information about how GeoJSON represents GPS coordinates is available at that web address and in the **“Appendix B - Special Property Values”** section of this document.

## WZDx Overview

WZDx (Work Zone Data Exchange) is GeoJSON with data structures, properties, and values defined specifically to encode many kinds of work zone information. It also describes procedures for transferring that information.

The WZDx specification is available on GitHub:

<https://github.com/usdot-jpo-ode/wzdx#readme>

We do **not** recommend trying to read the whole website. This document will provide pointers to parts of that site as needed. That link to the start of the website's documentation is provided as a reference if you want to dig deeper into WZDx after you finish here.

## CPSP Overview

CPSP is “WZDx for Connected Portable Traffic Signals”. It looks like and works like WZDx, but only uses the parts of WZDx needed to monitor connected traffic signals. It is intended primarily as a way for CPTS manufacturers to provide consolidated data from their traffic signals using a unified format and web interface.

## Communication Process

In its simplest form, CPSP communication is a 3-step HTTP process:

1. The client submits an HTTP-GET request to the server using a URL specified by the provider.
2. The server responds with a single CPSP document in the body of the response.
3. When the response is complete, server and client both terminate the HTTP connection.

For additional WZDx communication recommendations, go to the web page noted below and scroll down to the section marked “Data Security Best Practices”. Please note that these are recommendations, not requirements.

[https://github.com/usdot-jpo-ode/wzdx/blob/main/Creating\\_a\\_WZDx\\_Feed.md](https://github.com/usdot-jpo-ode/wzdx/blob/main/Creating_a_WZDx_Feed.md)

## Structure of a CPSP (JSON) Document

Each CPSP document consists of at least three base-level properties. A "feed\_info" property which contains information about the data feed. A "type" property which tells us what type of data follows (usually a "FeatureCollection"). And a "features" property which contains an array of signal sets. Each signal set object contains sub-properties describing the location, mode, and status of the primary signal controller for a set of one or more connected signals.

In a real CPSP document, text shown between < and > brackets in the example will be replaced with the appropriate information described and the < and > brackets will be removed.

Example:

```
{
  "feed_info": {
    <various feed_info properties>,
    "data_sources": [
      {
        <properties for first data_source>
      }
    ]
  },
  "type": "FeatureCollection",
  "features": [
    {
      <properties for the first signal set>
    },
    {
      <properties for the second signal set>
    },
    <And so on until...>
    {
      <properties for the last signal set>
    }
  ]
}
```

In the next section, you will find an example CPSP response document containing information for one data source and one connected signal set.

Note that in addition to containing information about multiple devices, a CPSP data feed may contain information from more than one data source. Each feature property in the features array contains a "data\_source\_id" field that identifies which data source listed in the "data\_sources" array provided information about that device.

Also note that while CPSP only addresses connected traffic signals, some data sources may have a full WZDx data feed available that includes desired information about traffic signals. For this reason, it is recommended that CPSP compatible clients be written to be able to recognize and extract connected portable traffic signal information from a full WZDx data feed.

## Example CPSP Document

The following is an example CPSP document containing information for one connected signal set.

The data in a CPSP document may look like this or may be in raw “serialized JSON” format with no line breaks or indentation. (A long single line of text with no obvious structure.)

The client software that polls a CPSP server is responsible for recognizing CPSP documents in either format and converting the document to a form the receiving agency finds useful.

```
{
  "feed_info": {
    "update_date": "2021-12-06T15:00:00Z",
    "publisher": "TestVendor",
    "contact_name": "Robert Vendor",
    "contact_email": "robert.vendor@testvendor.com",
    "update_frequency": 60,
    "version": "4.2",
    "license": "https://creativecommons.org/publicdomain/zero/1.0/",
    "data_sources": [
      {
        "data_source_id": "f4922e55-002c-43cf-9724-c9c9fa362710",
        "organization_name": "Test Vendor Inc.",
        "contact_name": "Timmy Testor",
        "contact_email": "timmy.testor@testvendor.com",
        "update_frequency": 60,
        "update_date": "2021-12-06T14:54:12Z"
      }
    ]
  },
  "type": "FeatureCollection",
  "features": [
    {
      "id": "c8cbcaa6-0d2f-46b1-a033-afc164a86f9e",
      "type": "Feature",
      "properties": {
        "core_details": {
          "device_type": "traffic-signal",
          "data_source_id": "f4922e55-002c-43cf-9724-c9c9fa362710",
          "road_names": [
            "US 35E"
          ],
          "device_status": "ok",
          "has_automatic_location": true,
          "road_direction": "northbound",
          "name": "Sample Traffic Signal #1",
          "is_moving": false,
          "make": "Vendor #1",
          "model": "Model ABC",
          "update_date": "2021-12-06T14:54:12Z"
        },
        "mode": "flashing-red"
      },
      "geometry": {
        "type": "Point",
        "coordinates": [
          -93.196120,
          44.797554
        ]
      }
    }
  ]
}
```

## Appendix A – WZDx References

---

Overall structure and rules for a CPSP (WZDx) data feed are described in:

[https://github.com/usdot-jpo-ode/wzdx/blob/main/Creating a WZDx Feed.md](https://github.com/usdot-jpo-ode/wzdx/blob/main/Creating%20a%20WZDx%20Feed.md)

Special attention should be paid to the following sections of that web page:

- Feed Format and File Type
- Feed Content: DeviceFeed Object
- Business Rules
- Update Guide \*\*
- Data Security Best Practices
- JSON Schemas

\*\* At the time of writing this document, WZDx v4.2 is the latest version, and all examples included are based on that standard. The “Update Guide” section of the above web page should provide clues as to what the current version is and what may have changed since v4.2.

CPSP property structures and values are described on these web pages:

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/DeviceFeed.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/FeedInfo.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/FeedDataSource.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/FieldDeviceFeature.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/TrafficSignal.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/objects/FieldDeviceCoreDetails.md>

<https://github.com/usdot-jpo-ode/wzdx/blob/main/spec-content/enumerated-types/TrafficSignalMode.md>

Note: Depending on the size of your computer screen, you may need to use a horizontal slider bar that appears near the bottom of those pages (just above the “Used By” section, only appears if needed), to see all five of the Properties columns (Name, Type, Description, Conformance, and Notes).

## Appendix B - Special Property Values

---

The following provides tips for specific technical values included in CPSP documents.

### Timestamp Values

All CPSP timestamps are string values containing date and time. They are formatted using the basic ISO 8601 standard. To avoid issues with configuring connected signals for different time-zones and dealing with daylight savings time switchovers, known CPSP timestamps are always formatted using the Zulu (UTC) time zone. A null value is used to indicate any timestamp that is unknown.

Example:

```
"2012-04-23T18:25:43.500Z"
```

Additional info about formatting timestamp values can be obtained at

[http://en.wikipedia.org/wiki/ISO\\_8601](http://en.wikipedia.org/wiki/ISO_8601)

and

<http://datatracker.ietf.org/doc/html/rfc3339#section-5.6>

### Identifier Values

Data Source IDs (FeedDataSource “data\_source\_id”) and Traffic Signal IDs (FieldDeviceFeature “id”) are unique strings used to identify a data publisher and to identify each field device.

For simplicity, CPSP recommends using UUID (Universally Unique Identifier) strings for both types of identifiers to avoid needing to manually assign a project or owner specific name to each. Since this is only a recommendation, no CPSP implementation should require that either type of identifier conforms to UUID formatting standards (length or content).

Example UUID string:

```
"6d17db66-de16-11ed-b5ea-0242ac120002"
```

Additional info about UUIDs can be obtained at:

<https://www.ietf.org/rfc/rfc4122.txt>

## GPS Coordinate Values

Known GPS coordinates in a CPSP document are represented in a “geometry” object containing a “type” property of “Point” and a “coordinates” property containing an array of two signed decimal GPS coordinates in longitude, latitude order.

Note that this order of values is different from many other uses of GPS coordinates. A small writeup on the subject can be found here:

<https://macwright.com/lonlat/>

Longitude values range from -180.0 to 180.0. Positive longitudes are east of the Prime meridian. Negative longitudes are west of the Prime Meridian. Latitude values range from -90.0 to 90.0. Positive latitude values are above the equator. Negative latitude values are below the equator.

The following is an example of a typical geometry property:

```
"geometry": {
  "type": "Point",
  "coordinates": [
    -93.196120,
    44.797554
  ]
}
```

Unknown GPS coordinates are represented by replacing the geometry object with null:

```
"geometry": null
```

There are other ways sometimes used to represent unknown GPS coordinate in a GeoJSON document, but many of them are not universally accepted by all parsers. We recommend using the notation above as it’s explicitly mentioned in the document that defines GeoJSON.

<https://datatracker.ietf.org/doc/html/rfc7946#autoid-20>

Additional info about decimal GPS coordinates can be obtained at:

[http://en.wikipedia.org/wiki/Decimal\\_degrees](http://en.wikipedia.org/wiki/Decimal_degrees)