Standard Development Report
for
NTCIP 1218 v01
Object Definitions for Roadside Units (RSUs)

December 16, 2019

The following Standard Development Report (SDR) is made in accordance with the Institute of Transportation Engineers (ITE) procedures for National Transportation Communications for ITS Protocols (NTCIP) standards.

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1 Latest Version of the Draft Proposed Standard

Appendix I references Recommended Standard (RS) NTCIP 1218 v01(.35), Object Definitions for Roadside Units (RSUs). RS NTCIP 1218 v01(.35), when Jointly Approved, will be a new NTCIP standard, and will be designated and cited as NTCIP 1218 v01. Jointly Approved means that the standard was balloted and approved separately by the three cooperating standard development organizations (SDOs): the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA).

2 Summary Status

RS NTCIP 1218 v01(.35) was accepted as a Recommended Standard of the NTCIP Joint Committee (JC). NTCIP 1218 v01 specifies the logical interface between an RSU and the controlling management stations, and defines information that may be exchanged across this interface. NTCIP 1218 v01 follows a Systems Engineering Process (SEP) approach, including user needs, requirements, and system design details that enable information exchanges to support those user needs and requirements, including data objects and metadata, including the relative structure of that data, necessary to meet requirements.

RS NTCIP 1218 v01(.35) is distributed to the members of the Institute of Transportation Engineers (ITE), the American Association of State Highway and Transportation Officials (AASHTO), and the National Electrical Manufacturers Association (NEMA) for balloting and approval. After all three standards development organizations (SDOs) have individually approved RS NTCIP 1218 v01(.35); it is a Jointly Approved Standard and published, with the designation (and to be cited as) NTCIP 1218 v01.

3 Status Report

RS NTCIP 1218 v01(.35) was developed following SEP. At three development stages, Concept of Operations (ConOps), Functional Requirements (FR), and System Design Details (SDD), comments (written inputs) were submitted and addressed, a total of 531 comments were received and addressed (or deferred to the User Comment Draft (UCD) stage).

During (and subsequent to) the UCD stage, 123 comments (written inputs) were also submitted and addressed.

The NTCIP RSU WG voted to submit draft NTCIP 1218 v01 to the NTCIP JC for review and acceptance as a Proposed Recommend Standard (pRS). The NTCIP JC accepted draft RS NTCIP 1218 v01(.35) as a Recommended Standard via a vote that closed on December 10, 2019 with a vote of 13 yeas, 0 nays, and 1 abstention. Appendix I references RS NTCIP 1218 v01(.35).

4 Comments Listing

The NTCIP RSU WG comments received and addressed during SEP development stages (Concept of Operations (ConOps), Functional Requirements (FR), and System Design Details (SDD)) for NTCIP 1218 v01 are referenced in Appendix II (in the Excel worksheets named …ConOps, FR, and SDD Inputs). The comments received and addressed during the User Comment Draft (UCD) stage (and later) are referenced in Appendix III.

5 Committee Objectives

NTCIP 1218 v01 has been developed under the oversight of the NTCIP Joint Committee (JC), which is made up of representatives from the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). The work in developing this standard was performed by the NTCIP RSU Working Group, a subordinate unit of the NTCIP JC.
The objective of the NTCIP RSU WG is to develop a standard that specifies the protocols and data definitions to allow a Transportation Management Center (TMC) to:

a) Monitor the operational status of the RSU, including the status of applications and processes;
b) Configure the RSU to interface with other components in a connected vehicle environment, including connected vehicles, a traffic signal controller, the Security Credential Management System (SCMS), and other connected devices (e.g., smart phones);
c) Command the RSU to perform specific functions, such as collecting data or logging events.

6 Committee Members

RS NTCIP 1218 v01(.35) was developed under the oversight of the NTCIP Joint Committee (JC), which is made up of representatives from the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). The work in developing RS NTCIP 1218 v01(.35) was performed by the NTCIP RSU Working Group (WG), a subordinate unit of the NTCIP JC.

NTCIP RSU Working Group

- Applied Information, Inc., Walt Townsend*, Alan Clelland, Alan Luchuk
- City of Anaheim, John Thai* (Co-Chair)
- Econolite Control Products, Inc., Gary Duncan*, Dustin DeVoe, Greg Mizell, Jim Rose
- Florida DOT, Derek Vollmer*, Jeffrey Morgan, Matthew DeWitt, Raj Ponnaluri
- Maricopa County AZ DOT, Faisal Saleem*
- Michigan DOT, Joe Gorman*, Colin Castle
- Parsons, Jon Wyatt* (Co-Chair)
- Siemens Industry, Inc., Wolfgang Buckel*, Michael Venus
- Washington State DOT, Michael Forbis*, Mark Morse

Note: The preceding list includes voting and alternate voting members of the NTCIP RSU WG only. A ‘*’ indicates an RSU WG voting member, with the remainder serving as alternate voting members. In addition, the NTCIP RSU WG includes 14 individuals/6 organizations as observing members, and 52 individuals/38 organizations as additional stakeholders.

NTCIP Joint Committee

- Russ Brookshire, Parsons
- Patrick Chan, Consensus Systems Technologies
- Stephen Dellenback, Southwest Research Institute
- Michael Forbis, WA DOT Washington State DOT
- Jeffrey Morgan, FL DOT Florida DOT
- Bryan Mulligan, Applied Information, Inc.
- Edward Seymour, Texas Transportation Institute
- Brian Simi, CA DOT (CalTrans) Division of Traffic Operations
- Doug Spencer, OR DOT
- Ray Starr, MN DOT Minnesota DOT
- Robert Terry, NYS DOT-Off of Traffic Safety & Mobility
- John Thai, City of Anaheim (Chair)

7 Other Material of Interest

Normative and Other references cited in RS NTCIP 1218 v01(.35) are excerpted and follow.

7.1 NTCIP 1218 v01 Normative References

Normative references contain provisions that, through reference in this text, constitute provisions of NTCIP 1218 v01. Other references in NTCIP 1218 v01 might provide a complete understanding or
provide additional information. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on NTCIP 1218 v01 are encouraged to investigate the possibility of applying the most recent editions of the standards listed.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>3GPP TS 23.285</td>
<td>Architecture Enhancements for V2X Services, 3GPP</td>
</tr>
<tr>
<td>IEEE 802.11-2016</td>
<td>IEEE Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications (IEEE802dot11-MIB in Annex A.3)</td>
</tr>
<tr>
<td>IEEE Provider Service Identified (PSID) Registration Authority</td>
<td>IEEE Provider Service Identified (PSID) Registration Authority</td>
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<td>Note: See <a href="https://standards.ieee.org/products-services/regauth/psid/public.html">https://standards.ieee.org/products-services/regauth/psid/public.html</a></td>
<td></td>
</tr>
<tr>
<td>Libpcap</td>
<td>libpcap v1.9.0</td>
</tr>
<tr>
<td>Note: See <a href="https://www.tcpdump.org/">https://www.tcpdump.org/</a></td>
<td></td>
</tr>
<tr>
<td>UCD-SNMP</td>
<td>UCD-SNMP-MIB.txt - University of California, Davis - ucdavis module, Last updated 200901190000Z. (UCD-SNMP in Annex A.3)</td>
</tr>
<tr>
<td>Note: Referred to as ‘1201v03’ in Annex A.</td>
<td></td>
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<tr>
<td>Note: Referred to as 2103v02 in Annex A.</td>
<td></td>
</tr>
<tr>
<td>RFC 2579</td>
<td>Textual Conventions for SMIv2 (IETF), April 1999.</td>
</tr>
<tr>
<td>RFC 2580</td>
<td>Conformance Statement for SMIv2, Internet Engineering Task Force (IETF), April 1999.</td>
</tr>
<tr>
<td>RFC 3414</td>
<td>User-based Security Model (USM) for version 3 of the Simple Network...</td>
</tr>
</tbody>
</table>
### Identifier | Title
--- | ---
RFC 3635 | Definitions of Managed Objects for the Ethernet-like Interface Types, Internet Engineering Task Force (IETF), September 2003.
SAE J2735_201603 MIB | Dedicated Short Range Communications (DSRC) Message Set Dictionary™, SAE
SAE J2945_201712 | On-Board System Requirements for V2V Safety Communications

### 7.2 Other References

The following documents and standards may provide the reader with a more complete understanding of the entire protocol and the relations between all parts of the protocol. However, these documents do not contain direct provisions that are required by NTCIP 1218 v01. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on NTCIP 1218 v01 are encouraged to investigate the possibility of applying the most recent editions of the standard listed.

### Identifier | Title
--- | ---
U.S. Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), USDOT | Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT), USDOT
FHWA-JPO-17-589 | DSRC Roadside Unit (RSU) Specifications Document v4.1, USDOT, Saxton Transportation Operations Laboratory, published April 28, 2017
Note: Referred to as RSU 4.1 Spec throughout.
ISO/TS 21177:2019 | Intelligent transport systems — ITS station security services for secure session establishment and authentication between trusted devices
NIST SP 800-53 Rev. 5 (Draft) | Security and Privacy Controls for Information Systems and Organizations
Note: This document is undergoing review.
7.3 Contact Information

7.3.1 Internet Documents
Obtain Request for Comment (RFC) electronic documents from several repositories at:

- www.rfc-editor.org
- www.rfc-editor.org/repositories.html
  for FTP sites, read ftp://ftp.isi.edu/in-notes/rfc-retrieval.txt

7.3.2 Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)
The Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) may be viewed online at:

- http://local.iteris.com/arc-it/

ARC-IT is the US ITS reference architecture and includes all content from the (now deprecated) National ITS Architecture v7.1 and the Connected Vehicle Reference Implementation Architecture (CVRIA) v2.2.

7.3.3 FHWA Documents
U.S. Department of Transportation Federal Highway Administration (FHWA) documents (with designations FHWA-JPO–…) are available at the U.S. Department of Transportation National Transportation Library, Repository & Open Science Access Portal (ROSA P):

- https://rosap.ntl.bts.gov/

7.3.4 IEEE Standards
IEEE standards can be purchased on-line in electronic format or printed copy from:

- Techstreet
  Ann Arbor, MI 48108
  www.techstreet.com/ieee

7.3.5 ISO, IEC, and ISO/IEC Standards
ISO, IEC, and ISO/IEC standards can be purchased on-line in electronic format or printed copy from:

- Techstreet
7.3.6 Libpcap Documents
Libpcap documents are available at:
https://www.tcpdump.org/

7.3.7 NTCIP Standards
Copies of NTCIP standards may be obtained from:
NTCIP Coordinator, National Electrical Manufacturers Association
Rosslyn, Virginia 22209-3801
www.ntcip.org
e-mail: ntcip@nema.org

7.3.8 Object Management Group Documents
Copies of OMG standards may be obtained electronically from the Object Management Group at:
www.omg.org

7.3.9 SAE International Documents
Copies of SAE International documents may be obtained from:
SAE International
Warrendale, PA 15096
www.sae.org

7.3.10 3GPP Documents
Copies of 3GPP documents may be obtained electronically from:
http://www.3gpp.org/

8 Declaration Regarding Other Known National and International Standards
This statement confirms that other known national and international standards have been examined with regard to harmonization and duplication of content, and no significant conflicts with other known standards have been identified.

9 Abstract of the Standard
9.1 Purpose
National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP) is a family of standards that provides both the rules for communicating (called protocols) and the vocabulary (called objects) necessary to allow electronic traffic control equipment from different manufacturers to operate with each other as a system. NTCIP standards are a component of an open architecture hardware and software platform that can support a wide variety of Intelligent Transportation Systems (ITS) applications including traffic management, safety, security and other applications. NTCIP standards are developed and maintained under the direction of the NTCIP Joint Committee (JC), which is made up of representatives from the American Association of State Highway and Transportation Officials.
(AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA).

RS NTCIP 1218 v01(.35) specifies the logical interface between an RSU and the controlling management stations, and defines information that may be exchanged across this interface. RS NTCIP 1218 v01(.35) follows a Systems Engineering Process (SEP) approach, including user needs, requirements, and system design details that enable information exchanges to support those user needs, including data objects and metadata, including the relative structure of that data, necessary to meet requirements.

The Cooperative-ITS (C-ITS) environment, also known as connected vehicles, started as a research program led by USDOT to investigate how transportation connectivity potentially enables applications to improve the US’s transportation system in the areas of safety, mobility and the environment. Transportation connectivity can take place between vehicles (vehicle-to-vehicle, V2V) to enable crash prevention; between vehicles and the infrastructure (vehicle-to-infrastructure, V2I) to enable additional safety, mobility and environmental benefits; between personal devices and the infrastructure (personal-to-infrastructure, P2I) to enable safety and mobility benefits; and among vehicles, infrastructure and personal devices (vehicle-to-everything, V2X) to provide continuous real-time connectivity.

The RSU is a key component of the C-ITS environment. The RSU provides an interface: 1) between a traffic management center (TMC) and a connected device (including connected vehicles); and 2) between connected devices and other ITS roadside devices (e.g., a traffic signal controller) through a managed network. The RSU allows transportation managers to exchange information between connected devices and the infrastructure (traffic management centers and ITS roadside devices), collecting data from one component and forwarding that same data to another component. Through this data exchange, managers and applications can use this data to:

a) Improve surface transportation safety by better controlling traffic operations on the roadway and providing directed warnings to travelers
b) Improve mobility by optimizing traffic operations and through warnings and advisories to travelers
c) Improve the environment by more efficiently managing traffic operations to reduce delays, fuel consumption and emissions

While a number of standards define V2V and V2I interfaces, prior to NTCIP 1218 v01, no standard defines the center to RSU interface.

9.2 Overview

NTCIP 1218 v01 addresses the communications interface between a management station and an RSU. USDOT's RSU 4.1 Spec defines:

"The purpose of the RSU is to facilitate communication between transportation infrastructure and vehicles and other mobile devices by exchanging data over DSRC in compliance with industry standards, including but not limited to (IEEE 802.11, IEEE 1609.x, SAE J2735, and SAE J2945). Additionally, the RSU can be integrated with a backhaul system to enable remote management and provide vehicles and other mobile devices with services and applications delivered by back office service providers."

The United States Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) also implies a logical framework of applications and services that are allocated to the RSU. Based on these definitions and through discussions with stakeholders, an RSU system can be viewed as three logical components, as shown by the blue circles in Figure 1.
9.3 Document Organization

NTCIP 1218 v01 consists of the following sections and annexes (appendices):

- Section 1 General [Informative]
- Section 2 Concept of Operations [Normative]
- Section 3 Functional Requirements [Normative]
- Section 4 Dialogs [Normative]
- Section 5 Management Information Base (MIB) [Normative]
- Annex A Requirements Traceability Matrix (RTM) [Normative]
- Annex B Object Tree [Informative]
- Annex C Test Procedures [Normative]
- Annex D Documentation of Revisions [Informative]
- Annex E User Requests [Informative]
- Annex F Generic Concepts and Definitions
- Annex G SNMP Interface [Normative]
Appendices

I  Recommended Standard (RS) NTCIP 1218 v01(.35)

RS NTCIP 1218 v01(.35) is attached as NTCIP 1218v0135 RSU ... toSDOs.pdf (both with and no Revs versions).

II  Adjudicated Working Group Comments on (RS) NTCIP 1218 v01(.35)

The NTCIP RSU WG comments received and addressed during SEP development stages (ConOps, FR, and SDD) of NTCIP 1218 v01 are referenced in NTCIP 1218 v01 PostUCD Consol v13 20191107.xlsx (in the Excel worksheets named …ConOps, FR, and SDD Inputs). (See Attachment)

III  Adjudicated User Comments on User Comment Draft (RS) NTCIP 1218 v01(.35)

The NTCIP RSU WG received and addressed comments during (and subsequent to) the User Comment Draft development stage of NTCIP 1218 v01, which are referenced in NTCIP 1218 v01 PostUCD Consol v13 20191107.xlsx (in the Excel worksheet named PostUCD). (See Attachment)

IV  Development Milestones

<table>
<thead>
<tr>
<th>ITE Standards Development Milestone</th>
<th>Date, Description of Action Taken and Other Background Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Decision Made and Effort Announced</td>
<td>This project was initiated September 2, 2017, under the oversight of the National Transportation Communications for ITS Protocol (NTCIP) Joint Committee (JC).</td>
</tr>
<tr>
<td>2. Committee Formed</td>
<td>The NTCIP RSU Working Group (WG) was formed in October 2017 to develop and maintain NTCIP 1218 v01.</td>
</tr>
<tr>
<td>3. Committee Develops Draft Proposed Standard</td>
<td>Beginning October 2017, the NTCIP RSU WG followed SEP, conducting three walkthroughs (ConOps, FR, and SDD), receiving and addressing RSU WG input, through early May, 2019, yielding Proposed User Comment Draft (pUCD) NTCIP 1218 v01.</td>
</tr>
<tr>
<td>7. Proposed Standard Published to Solicit Comments</td>
<td>UCD NTCIP 1218 v01 was prepared and circulated for user comment for the period July 24-August 23, 2019.</td>
</tr>
<tr>
<td>8. Comments Considered by Committee</td>
<td>The RSU WG addressed comments, with revisions, to produce Proposed Recommended Standard (pRS) NTCIP 1218 v01.</td>
</tr>
<tr>
<td>9. Committee Ballots Revised Proposed Standard</td>
<td>The RSU WG voted to accept pRS NTCIP 1218 v01 on November 7, 2019.</td>
</tr>
<tr>
<td>11. Revised Standard Approved</td>
<td>The NTCIP JC voted to accept Recommended Standard (RS) NTCIP 1218 v01 on December 10, 2019.</td>
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<tr>
<td>12. Intent to Adopt Announced</td>
<td>In process.</td>
</tr>
<tr>
<td>13. ITE Standard Adopted by the ITE Board</td>
<td>In process.</td>
</tr>
<tr>
<td>14. Maintenance of Standard</td>
<td>SDOs maintain the Standard on a five-year review cycle.</td>
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</tbody>
</table>