
NTCIP 1202 v04 Stakeholder Interview and Questionnaire Report Summary

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Submitted by:

Consensus Systems Technologies Corporation

Table of Contents

1	Introduction	2
2	Activities.....	2
2.1	Review Other Activities for New or Updated User Needs	2
2.1.1	CTI 4501	2
2.1.2	City of Anaheim NTCIP Standards Testing Project	3
2.1.3	NTCIP 9014	3
2.1.4	NTCIP 1202 v03A.....	3
2.2	List of Stakeholders and Subject Matter Experts.....	4
3	Summary of User Needs	4
3.1	ASC WG Meetings	4
3.2	Interviews.....	7
3.3	User Needs Survey	7
3.3.1	User Needs Topic Poll	7
3.3.2	User Needs Topic Poll Results	9
3.3.3	User Needs Topic Poll Comments	10
3.3.4	User Needs - ASC WG Discussion	10

1 Introduction

This report is a deliverable for the "NTCIP 1202 Actuated Signal Controllers Version 4" project by the Institute of Transportation Engineers (ITE) for the United States Department of Transportation (USDOT). This project is being performed under Contract Number 693JJ321D000005, Task Order Number 693JJ322F00212N. This report fulfills the deliverables for Subtask 2.1 – *Review Relevant Prior and Ongoing Research* for this Task Order.

The report is separated into two sections:

- Section 2 presents the activities that were performed under this task order to solicit, derive, formally capture, verify, and validate user needs to be included in the NTCIP 1202 v04 Concept of Operations (ConOps). The activities consist of discussions during Actuated Signal Controller (ASC) Working Group (WG) meetings and interviews with individual stakeholders.
- Section 3 presents the results of those activities, which are proposed changes to the user need contents for NTCIP 1202 v04. This user need content will form the basis for a draft NTCIP 1202 v04 ConOps, which will be reviewed by the NTCIP 1202 Actuated Signal Controllers (ASC) Working Group (WG) and other interested parties in a ConOps walkthrough.

2 Activities

2.1 Review Other Activities for New or Updated User Needs

To identify potential new user needs or potential changes to existing user needs, the consultant reviewed various documents that either involve deploying, validating, or have a potential impact on NTCIP 1202. Several projects were identified to be reviewed in the Performance Work Statement. These projects were:

- Connected Transportation Interoperability (CTI) 4501 – Connected Intersections (CI) Implementation Guide
- City of Anaheim NTCIP Standards Testing project
- NTCIP 9014 – NTCIP Infrastructure Standards Security Assessment (ISSA)

In addition, the consultant reviewed Annex E, User Requests of NTCIP 1202 v03A. This Annex identifies features that were suggested and considered during the development of NTCIP 1202 v03, but were either supported by other mechanisms, or were not included in the NTCIP 1202 v03 standard.

2.1.1 CTI 4501

Connected Transportation Interoperability (CTI) 4501 – Connected Intersections (CI) Implementation Guide v1.00, which was published in September 2021, standardizes the key capabilities and interfaces for a connected intersection. A connected intersection is defined as an infrastructure system that broadcasts signal, phase, and timing (SPaT), mapping information and position correction data to connected vehicles. This document sets the requirements and provides guidance for nationally interoperable connected intersections to support interoperable applications for signalized intersections. Numerous requirements (Section 3) and guidance (Section 4) in the document specifically refer to NTCIP 1202. In addition, Annex A of the document summarizes the discussions and guidance produced by a traffic signal controller vendors subcommittee to address traffic signal controllers issues at a connected intersection.

Finally, the document identified numerous gaps and ambiguities in numerous standards used by connected intersections, including NTCIP 1202. Annex H.2 in the document lists some specific recommendations to the ASC WG to address the gaps and ambiguities defined. Some of these gaps and ambiguities were addressed in Amendment v03B of NTCIP 1202, which is being balloted by the ASC WG at the time this document was produced.

2.1.2 City of Anaheim NTCIP Standards Testing Project

In April 2020, with support from the United States Department of Transportation (USDOT), the City of Anaheim embarked on a project, National Transportation Communications ITS Protocol (NTCIP) 1202 Standard Testing Project, to develop test procedures and software to verify conformance with the NTCIP 1202 Standard. Creating the test procedures and testing controllers with the Compliance Tester exposed errors and ambiguities with the NTCIP 1202 standard that otherwise may not have been found.

An output of the project is a Findings Report. Section 3 of the Report describes issues discovered for NTCIP 1202 and recommendations for how to address them. These issues are categorized as:

- Errors with NTCIP
- Ambiguities with NTCIP
- Gaps in NTCIP
- Usability Improvements for NTCIP

A majority of the findings are related to updates or additions to the requirements and design content of NTCIP 1202 v03. There were no findings related to adding or updating user needs or features in NTCIP 1202 v03.

2.1.3 NTCIP 9014

In 2021, the Base Standards and Profiles 2 (BSP2) Working Group published an informational report, NTCIP 9014. Nearly all NTCIP Center-to-Field (C2F) communications standards were based on Simple Network Management Protocol (SNMP) Version 1 (SNMPv1). However, a shortcoming of SNMPv1 was the lack of security. With the growing concerns associated with cybersecurity attacks and the increased connection of the transportation infrastructure in a connected vehicle environment, it was evident that the current NTCIP Standards do not adequately address security.

NTCIP 9014:

- a) Identifies existing NTCIP Standards that could be affected by moving from SNMPv1 to SNMPv3;
- b) Assesses the impact of migrating from SNMPv1 to SNMPv3 for current NTCIP Standards;
- c) Identifies SNMPv3 references that can be included in NTCIP Standards or other NTCIP documents;
- d) Develops guidance for incorporating SNMPv3 into NTCIP Standards; and
- e) Develops a plan for updating the NTCIP family of Standards.

NTCIP 9014 proposes specific guidance and tasks for NTCIP 1202 v03, including recommendations for proposed changes to the NTCIP 1202 MIB to accommodate SNMPv3.

2.1.4 NTCIP 1202 v03A

As noted earlier, Annex E, User Requests of NTCIP 1202 v03A listed features that were considered during the development of NTCIP 1202 v03, but were not included in the published standard. The consultant

reviewed these features for possible consideration for NTCIP 1202 v04. These features (user needs) include:

- Interval Based Controllers
- Non-Persistent Timing Patterns
- Traffic Adaptive Algorithm
- Peer-to-Peer
- Signal Control Priority
- Additional Support for ADA
- Programmable Logic Gates and Functions
- Advanced Preempt Inputs
- Conflict Monitoring Unit and Channel Support
- Traffic Signal Controller Broadcast Message (TSCBM)
- startTime

Each of the features were not included in NTCIP 1202 v03A for different reasons, such as insufficient time or resources to fully develop requirements or a design; and lack of consensus on the requirements definition.

2.2 List of Stakeholders and Subject Matter Experts

The ASC WG is responsible for the development of the NTCIP 1202 standard and consists of 12 voting members, representing the 3 standards development organizations (SDOs) involved in the development of the NTCIP standards (American Association of State Highway and Transportation Officials (AASHTO), Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA)). The ASC WG are considered key stakeholders and subject matter experts. The ASC WG meetings are open to the public and stakeholders from infrastructure owner operators (IOOs), device manufacturers, systems integrators, application developers, academia and the automotive industry.

In addition to the 12 voting members, 47 other stakeholders participated in the ASC WG meetings during 6 ASC WG meetings. The consultant also asked participants in 6 ASC WG meetings from November 2022 to February 2023 if they were aware of any research projects or deployments involving signalized intersections that may identify new user needs for NTCIP 1202; or if someone specific should be interviewed regarding the user needs for NTCIP 1202. One participant asked to be interviewed for user needs. However, the participants did not identify any other projects or deployments for the consultant to interview.

Since there was no significant feedback from the ASC WG or participants, a user needs survey was developed and distributed to the ASC WG instead of conducting individual interviews. The user needs survey is presented in more detail in Section 3.3.

3 Summary of User Needs

3.1 ASC WG Meetings

This section summarizes the interactions and activities of the consultant to extract and prioritize user needs during the ASC WG meetings from November 2, 2022 to February 15, 2023.

November 2, 2022 ASC WG Meeting

The consultants introduced NTCIP 1202 v04 project to the ASC WG. The consultant then asked if there are any new user needs to be considered for 1202 v04 or if anybody should be interviewed for potential new user needs.

Then Doug Tarico, co-chair of the ASC WG, asked participants to submit any requests or comments about user needs for 1202 v04 by the end of November.

November 16 ASC WG meeting

The consultants and the ASC WG co-chairs reiterated that participants may submit requests for any new user needs or requirements by the end of November.

November 30 ASC WG meeting

The ASC WG discussed expanding the user needs for the proposed NTCIP 1202 v03B amendment to address security for the interface between a traffic signal controller and Connected Vehicle (CV) Roadside Process (e.g., a roadside unit). After the discussion, the ASC WG consensus was to defer that security user need to NTCIP 1202 v04 because of the current activities of the BSP2 WG to address those user needs.

December 14 ASC WG meeting

The consultants reviewed the list of topics that were considered for the NTCIP 1202 v03B amendment, but were tabled for NTCIP 1202 v04. These topics included:

- MAP Consistency Code
- Assured Green Period
- Additional requirements for security (e.g., (D)TLS v1.3).
- Performance requirements around CI latency
- Tie a "virtual detector" in the RSU to an ASC detector input.
- Definition of protected. CTI and the proposed amendment states only steady green arrow is protected. Ped has right of way, a straight vehicle movement next, then a turning vehicle movement. But J2735 states permissive has to yield to conflicting, so it's not clear that thru movement has priority over turning. Send a comment on SAE J2735 V2X Technical Committee
- Movement maneuvers. Some requirements deferred and consider by maneuver by lane
- RTOR for Preemption

Of the topics on the list above, only Assured Green Period is a user need, the other topics are requirements.

January 18, 2023 ASC WG meeting

The consultants again asked the participants if there are any new user needs or people worth interviewing. Frank Provenzano from Iteris asked to be interviewed. A summary of the interview is found in Section 3.2.

The consultants then reviewed with the ASC WG each of the user needs listed in Annex E of NTCIP 1202 v03A, which lists user needs considered during the development of NTCIP 1202 v03A, and asked if the ASC WG would like to prioritize those user needs. Due to time constraints, the ASC WG agreed that the

consultants should start a poll listing the user need topics and the ASC WG and any interested participants can vote on it.

January 25, 2023 ASC WG Co-Chairs meeting

The consultants met with the ASC WG co-chairs on January 25 to discuss several topics, including the contents of the user needs poll; and how to approach the NTCIP 1202 v04 work plan, considering the budget and time constraints (within 2 years). The ASC WG co-chairs agreed:

- to ask the Connected Intersections Phase 2 project to recommend that NTCIP 1202 v03B is the minimum version of NTCIP 1202 to support interoperability in connected intersections;
- if a user need is to be included in NTCIP 1202 v04, there is sufficient time to define the requirements that trace to that user needs, and to develop a consensus design to fulfill those requirements.
- that a user need to be included in NTCIP 1202 v04 will add value to the standard.

January 31, 2023 User Needs Survey

On January 31, ITE distributed a link to a user needs survey to the ASC WG and other interested parties on the ASC WG mailing list, asking for their feedback on user needs that should be addressed in NTCIP 1202 Version 4. Each participant was asked to select a priority for each user need in a list. Each participant was allowed to provide comments if there are additional needs to be considered. The results of the poll can be found in Section 3.3.

February 1, 2023 ASC WG meeting

The consultants presented the initial results and the comments received from the user needs survey to the ASC WG. The ASC WG also discussed the proposed move to support SNMPv3 – SNMPv3 is a design issue, but emphasized the user need for security. The WG created a subgroup to address different models and needs for security.

February 8, 2023 ASC Subgroup on Security meeting

Michael Robinson of Caltrans led the ASC subgroup on security on a discussion on issues around adopting SNMPv3 for NTCIP 1202 v04. Michael presented some slides summarizing the differences between SNMPv1 and SNMPv3. The differences included:

- encryption and authorization options
- packet timestamp for replay protection (so packets cannot be copied and replayed)
- user view access control (can create multiple users, each with different view/write privileges for specific subtrees)
- Unique key with engine ID and password (for authentication purposes)
- Datagram TLS certificate option (the whole packet is encrypted)

February 15, 2023 ASC WG meeting

The ASC WG reviewed the discussion on SNMPv3 and security needs for ASC-RSU Interface. There was consensus by the ASC subgroup on security for NTCIP 1202 v04 to support SNMPv3; and that NTCIP 1202 v04 adopt the TSM/TLS model for security as a mandatory requirement.

The consultant reviewed the final results and the comments received from the user needs survey to the ASC WG. The consultant then reviewed the proposed language for each of the user needs that were considered highest, high/medium or medium priority by the participants. User needs considered a low priority will not be considered for NTCIP 1202 v04.

The consultant noted that Section 2.6 of NTCIP 1202 v03A already defines needs between the manager (e.g., Traffic Management System) and the ASC. Additional user needs may be needed to supplement Section 2.6, particularly the ASC-RSU interface, which may have additional requirements imposed on it by CTI 40041, Roadside Unit Standard or NEMA TS 10 – Connected Vehicle Infrastructure – Roadside Equipment. Proposed language for user needs was reviewed.

The consultant discussed language for a new user need, Manage Assured Green Period, that was previously developed for a NTCIP 1202 v03B amendment, but was deferred because the concept needs additional research. The consultant also reviewed the proposed text for other user needs being considered for inclusion for NTCIP 1202 v04. The other user needs are Manage Pedestrian Support, Monitor External Control Location Application State, Interface with Signal Monitoring Unit, and Manage Peer-to-Peer with Other Devices.

3.2 Interviews

Only one individual interview was performed. An interview with Frank Provenzano, Iteris, occurred on January 31, 2023 at 03:15 PM EDT. Frank is a senior director of product management for BlueTOAD Travel Time and Connected Vehicle products for Iteris. Part of the services Iteris provides is the operations and maintenance of connected vehicle equipment, in particular roadside units, for different department of transportation agencies nationwide.

Iteris has sold, delivered and is installing 1000 C-V2X RSUs this year, mostly at signalized intersections, particularly for signal priority/preemption applications. Applications being deployed include snowplow priority, transit signal priority, and emergency vehicle preemption. So, signal priority and preemption are a big deal – his customers want to do something. Frank noted that NEMA TS 10 requires a vehicle identifier to support priority and preemption.

Frank sees the RSU as basically a managed switch. Frank also noted that DSRC had separate service channel and control channel. Now all the applications are being crammed into one channel.

Regarding controllers, many agencies are interested in pedestrian countdown – currently, most systems start the countdown with the flashing-don't-walk duration from the previous cycle. Would like to see an object that provides the pedestrian countdown (time remaining). It was noted that support for pedestrian countdown timers was discussed during the development of NTCIP 1202 v03 but the ASC WG agreed to defer on the design at the time.

3.3 User Needs Survey

The user needs poll started on January 31, 2023 at 12:18 PM EST and closed February 6, 2023 at 12:00 PM EST.

3.3.1 User Needs Topic Poll

The following is the language used for the user needs topic poll.

On behalf of the ASC Working Group co-chairs, John Thai and Doug Tarico, as discussed at the January 18, 2023 ASC working group meeting, we invite stakeholder to provide feedback on user needs that should be addressed in Version 4 of NTCIP 1202, Object Definition for Actuated Signal Controllers.

Please keep in mind the following:

- The current period of performance ends February 2024. This includes publication of the NTCIP 1202 v04 standard and balloting, so a complete draft (development of user needs, requirements and design) must be completed by November 2023.
- User needs should be beneficial and of value to the traffic signal controller industry. They should be a need, not a want.

The following user needs have been discussed in the past, and are included for consideration. A complete description (Previously considered user needs can be found in referenced section in the proposed NTCIP 1202 v03B amendment (v03.33b)). In addition, stakeholders are encouraged to submit any new user needs not on this list for consideration.

1. **Support for Interval Based Controllers (See Annex E.1.1).** The ASC WG previously considered including support for interval-based controllers. User needs, requirements, and draft design content to fulfill some of the requirements were previously developed.
2. **Non-Persistent Timing Patterns (See Annex E.1.2).** The ASC WG previously considered support for non-persistent traffic patterns. Non-persistent timing patterns are temporary timing patterns that are not retained in the ASC through a power loss. User needs were previously developed.
3. **Peer-to-Peer Communications (See Annex E.1.4).** The ASC WG previously considered support for peer-to-peer communications. Peer-to-peer communications allow an SNMP manager to retrieve and configure the ASC to transmit data to another NTCIP-compliant device based on an event or events. This feature allows the manager to use an event or events at an ASC as an input to another NTCIP-compliant device. User needs, requirements and draft design content were previously developed.
4. **Additional ADA Pedestrian User Needs (See Annex E.1.6).** The ASC WG previously considered support for Accessible Pedestrian Signals (APS). This feature enables an ASC to provide information about pedestrian signal timing to pedestrians via non-visual formats, such as audible tones, verbal messages, and/or vibrating surfaces. User needs, requirements and draft design content were developed to support non-visual formats, but consensus was not reached on the design content.
5. **Programmable Logic Gates and Functions (See Annex E.1.7).** The ASC WG previously considered and developed user needs, requirements, and detailed design to support programmable logic functions and gates. However, the ASC WG agreed to remove this user need because non-NTCIP-standardized objects are still needed and used.
6. **Interfaces with Conflict Monitoring Unit (See Annex E.1.9).** The ASC WG noted that the signal monitoring units, such as a conflict monitoring unit, can provide more functions and information. For example, a user need was considered to allow mapping of channel outputs to a

Conflict Monitoring Unit (CMU) and to allow external devices, such as video detection or audible pedestrian devices, to monitor the CMU for channel status.

7. **External Control Local Applications (ECLA) (See Annex E.1.12).** At intersections where an ECLA, such as an external traffic adaptive system, asserts a higher-level control over the ASC, there is a need to support the communications data exchange between the ASC and the ECLA. Contrary to CTI 4501, the ASC WG believes that the controller needs to provide the SPaT data because the controller ultimately controls the signal phases and timing for the signalized intersection (except for cabinet flash). The ASC WG agreed that exchanging data between the controller and the ECLA are needed to properly support the generation of SPaT data, such as the ECLA providing the minimum and maximum end times.
8. **Assured Green Period in Connected Vehicle Environment (See E.1.15).** CTI 4501 enables support for a Red-Light Violation Warning (RLVW) application by providing an assured Green Period (AGP). This feature allows a manager to configure the ASC to define the parameters to calculate the AGP, establish a RLVW detection zone (RDZ), and the ability to provide an assured green end time (AGET) when the intersection is under actuated signal control.
9. **Security Needs for the ASC – RSU Interface.** The existing security needs in NTCIP 1202 v03A generally addresses the interface between an ASC and a management station, such as a traffic management system or a laptop. There may be additional security needs for this interface.

Please complete the attached poll and rank each user need above as follows:

- **HIGH.** This is a user need that would benefit the industry and can be developed within the current project schedule.
- **MEDIUM.** This is a user need that would benefit the industry but may need more time than the current project schedule allows.
- **LOW.** This is a user need that is nice to have, but can be completed within the current project schedule.

Please feel free to add any comments in the comment section.

3.3.2 User Needs Topic Poll Results

11 participants completed the poll and ranked the priority of each user need topic presented, and provided comments. The following summarizes how each user need topic presented was ranked.

User Need Topics	Low	Medium	High
Support for Interval Based Controllers	7	3	1
Support for Stage Based Controllers	6	4	1
Non-Persistent Timing Patterns	5	6	0
Peer-to-Peer Communications	4	4	3
Additional ADA Pedestrian User Needs	3	3	5
Programmable Logic Gates and Functions	7	2	2
Interfaces with Conflict Monitoring Unit	4	4	3
External Control Local Applications (ECLA)	5	2	4
Assured Green Period in Connected Vehicle Environment	2	3	6

User Need Topics	Low	Medium	High
Security Needs for the ASC – RSU Interface	0	3	8

3.3.3 User Needs Topic Poll Comments

As the user needs survey allowed participants to enter comments, the following comments were received.

- Interfacing CMU may lead to more frequent cabinet flashes. Agencies may not like this idea. It is also noticed that agencies would rather let the technicians go to the intersections and check the MMU (IP version) log than get those information from the office.
- Consideration for CMU localized calibration of current monitoring which allows the CMU to drive the cabinet to fail-flash when it detects a configured loss of current on any signal circuit.
- AGP needs further study as to what is needed and what is to be accomplished. The underlying premise that the vehicle must be able to clear the intersection on Amber ignores the all-red interval - and one has to wonder if there are better ways to meet the need for RLVW warning accuracy and results.
- Need for Performance Requirements that specify how long tasks should take to complete.
- For connected vehicles, UTC time clock synchronization with the CV roadside process (RSU). Provide a way for the controller to tell the RSU its time source. If the controller is using UTC time, the RSU should not adjust time mark ticks.
- Pedestrian controls parallel to vehicle controls (holds, forceoffs, etc)
- Need clarification for correlation between Phases, channels, movements, and SPaT/MAP elements.
- Need clarification for signal preemption functionality for connected vehicle environment.

3.3.4 User Needs - ASC WG Discussion

The user needs topic poll results were shared with the ASC WG at an ASC WG on February 15, 2023. Based on initial discussions with the ASC WG co-chairs, John Thai and Douglas Tarico, the following user need topics were proposed to be addressed in NTCIP 1202 v04.

- Security Needs for the ASC – RSU Interface
- Assured Green Period in Connected Vehicle Environment
- Additional ADA Pedestrian User Needs
- External Control Local Applications (ECLA)
- Interfaces with Signal Monitoring Unit
- Peer to Peer Communications

The ASC WG concurred.