

A Recommended Standard of the Joint Committee on the NTCIP

NTCIP 1213 version v03.37c

National Transportation Communications for ITS Protocol Object Definitions for Electrical and Lighting Management Systems (ELMS)

Publish Date: January 25, 2023

Published by

American Association of State Highway and Transportation Officials (AASHTO)

555 12th Street NW, Suite 1000
Washington, D.C. 20004

Institute of Transportation Engineers (ITE)

1627 I ("Eye") Street, NW, Suite 550
Washington, D.C. 20006

National Electrical Manufacturers Association (NEMA)

1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209-3801

© 2022 AASHTO / ITE / NEMA All rights reserved.

NOTICES

Copyright Notice

© 2022 by the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). All intellectual property rights, including, but not limited to, the rights of reproduction, translation, and display are reserved under the laws of the United States of America, the Universal Copyright Convention, the Berne Convention, and the International and Pan American Copyright Conventions. Except as licensed or permitted, you may not copy these materials without prior written permission from AASHTO, ITE, or NEMA. Use of these materials does not give you any rights of ownership or claim of copyright in or to these materials.

Visit www.ntcip.org for other copyright information, for instructions to request reprints of excerpts, and to request reproduction that is not granted below.

PDF File License Agreement

To the extent that these materials are distributed by AASHTO / ITE / NEMA in the form of an Adobe® Portable Document Format (PDF) electronic data file (the "PDF file"), AASHTO / ITE / NEMA authorizes each registered PDF file user to view, download, copy, or print the PDF file available from the authorized Web site, subject to the terms and conditions of this license agreement:

- a) you may download one copy of each PDF file for personal, non-commercial, and intraorganizational use only;
- b) ownership of the PDF file is not transferred to you; you are licensed to use the PDF file;
- c) you may make one more electronic copy of the PDF file, such as to a second hard drive or burn to a CD;
- d) you agree not to copy, distribute, or transfer the PDF file from that media to any other electronic media or device;
- e) you may print one paper copy of the PDF file;
- f) you may make one paper reproduction of the printed copy;
- g) any permitted copies of the PDF file must retain the copyright notice, and any other proprietary notices contained in the file;
- h) the PDF file license does not include (1) resale of the PDF file or copies, (2) republishing the content in compendiums or anthologies, (3) publishing excerpts in commercial publications or works for hire, (4) editing or modification of the PDF file except those portions as permitted, (5) posting on network servers or distribution by electronic mail or from electronic storage devices, and (6) translation to other languages or conversion to other electronic formats;
- i) other use of the PDF file and printed copy requires express, prior written consent.

Data Dictionary and MIB Distribution Permission

To the extent that these materials are distributed by AASHTO / ITE / NEMA in the form of a Data Dictionary ("DD") or Management Information Base ("MIB"), AASHTO / ITE / NEMA extend the following permission:

You may make or distribute unlimited copies, including derivative works, of the DD or MIB, including copies for commercial distribution, provided that:

- a) each copy you make or distribute includes the citation "Derived from NTCIP 0000 [insert the standard number]. Copyright by AASHTO / ITE / NEMA. Used by permission.";

- b) the copies or derivative works are not made part of the standard publications or works offered by other standard developing organizations or publishers or as works-for-hire not associated with commercial hardware or software products intended for field implementation;
- c) use of the DD or MIB is restricted in that the syntax fields may only be modified to define: 1) a more restrictive subrange; or 2) a subset of the standard enumerated values; or 3) a set of retired and defined enumerated values for systems supporting multiversion interoperability;
- d) the description field may be modified but only to the extent that: 1) the more restrictive subrange is defined; and 2) only those bit values or enumerated values that are supported are listed.

These materials are delivered “AS IS” without any warranties as to their use or performance.

AASHTO / ITE / NEMA and their suppliers do not warrant the performance or results you may obtain by using these materials. AASHTO / ITE / NEMA and their suppliers make no warranties, express or implied, as to noninfringement of third party rights, merchantability, or fitness for any particular purpose. In no event will AASHTO / ITE / NEMA or their suppliers be liable to you or any third party for any claim or for any consequential, incidental or special damages, including any lost profits or lost savings, arising from your reproduction or use of these materials, even if an AASHTO / ITE / NEMA representative has been advised of the possibility of such damages.

Some states or jurisdictions do not allow the exclusion or limitation of incidental, consequential, or special damages, or the exclusion of implied warranties, so the above limitations may not apply to a given user.

Use of these materials does not constitute an endorsement or affiliation by or between AASHTO, ITE, or NEMA and the user, the user's company, or the products and services of the user's company.

If the user is unwilling to accept the foregoing restrictions, he or she should immediately return these materials.

PRL and RTM Distribution Permission

To the extent that these materials are distributed by AASHTO / ITE / NEMA in the form of a Profile Requirements List (“PRL”) or a Requirements Traceability Matrix (“RTM”), AASHTO / ITE / NEMA extend the following permission:

- a) you may make or distribute unlimited copies, including derivative works of the PRL (then known as a Profile Implementation Conformance Statement (“PICS”)) or the RTM, provided that each copy you make or distribute contains the citation “Based on NTCIP 0000 [insert the standard number] PRL or RTM. Used by permission. Original text © AASHTO / ITE / NEMA.”;
- b) you may only modify the PRL or the RTM by adding: 1) text in the Project Requirements column, which is the only column that may be modified to show a product's implementation or the project-specific requirements; and/or 2) additional table columns or table rows that are clearly labeled as ADDITIONAL for project-unique or vendor-unique features; and
- c) if the PRL or RTM excerpt is made from an unapproved draft, add to the citation “PRL (or RTM) excerpted from a draft standard containing preliminary information that is subject to change.”

This limited permission does not include reuse in works offered by other standards developing organizations or publishers, and does not include reuse in works-for-hire, compendiums, or electronic storage devices that are not associated with procurement documents, or commercial hardware, or commercial software products intended for field installation.

PICS is a Profile Requirements List that is completed to indicate the features that are supported in an implementation. Visit www.ntcip.org for information on electronic copies of the MIBs, PRLs, and RTMs.

Content and Liability Disclaimer

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

AASHTO, ITE, and NEMA standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and seeks out the views of persons who have an interest in the topic covered by this publication. While AASHTO, ITE, and NEMA administer the process and establish rules to promote fairness in the development of consensus, they do not write the document and they do not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in their standards and guideline publications.

AASHTO, ITE, and NEMA disclaim liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. AASHTO, ITE, and NEMA disclaim and make no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of your particular purposes or needs. AASHTO, ITE, and NEMA do not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, AASHTO, ITE, and NEMA are not undertaking to render professional or other services for or on behalf of any person or entity, nor are AASHTO, ITE, and NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

AASHTO, ITE, and NEMA have no power and do not undertake to police or enforce compliance with the contents of this document. AASHTO, ITE, and NEMA do not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to AASHTO, ITE, or NEMA and is solely the responsibility of the certifier or maker of the statement.

Trademark Notice

NTCIP is a trademark of AASHTO / ITE / NEMA. All other marks mentioned in this standard are the trademarks of their respective owners.

ACKNOWLEDGEMENTS

NTCIP 1213 v03 was prepared by the NTCIP ELMS Working Group under the auspices of the NTCIP Joint Committee. It is one of many NTCIP documents developed under a cooperative agreement among the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the Transportation Management Systems and Associated Control Devices Section of the National Electrical Manufacturers Association (NEMA). The NTCIP development effort is guided by the NTCIP Joint Committee, which consists of six representatives from each of the above organizations.

When NTCIP 1213 v03 was prepared, the following individuals were members of the NTCIP ELMS Working Group:

- Reed Bradford
- Karl Burkett
- Christopher Delmonico
- Norm Dittmann
- James Frazer
- Dave Gamboa
- Gonzalo Gomez
- Manny Insignares (Co-Chair)
- Greg Jones
- Rick Kauffman
- Becky Rainer
- William Saville
- Bruce Schopp
- Edward Seymour
- James Sterling
- Jeffrey Unick
- Kenneth Vaughn
- Andrew Wale
- Jeff Walters
- Larry Williams
- Sue Zarling (Co-Chair)

Other individuals providing input include:

- Carl Anderson
- Tom Baker
- Chris Bates
- Robert Blalock
- John Boehm
- Eric Brose
- George Brown
- John Brown
- Roy Butillo
- Lance Carriere
- Alex Cheng
- Anmed Darrat
- Mark Dean
- Dan Delong
- Jean-Francois Duquette
- Robert Fugerer
- David Futkos

- Ron Gibbons
- Clifton Gray
- Joseph Gullo
- Laszlo Ilyes
- Ditzler Jones
- Bill Lawyer
- Larry Leetzow
- Michael Lomanaco
- Martin Mercier
- Jason Jon Michael
- Brian Miller
- Tim Miller
- Gregory Miller
- James Mirra
- Paul Molitor
- Denise Morelock
- Steve Mosing
- Siva Narla
- Shawn Nichols
- Orlando Nova
- Edmund Nowicki
- Elena Paul
- William Pino
- Tim Prell
- Blake Redfield
- Omar Rivera
- Tod Rosinbum
- Daniel Sanchez
- Kurt Sato
- Vicki Schofield
- Steve Sill
- Edward Smalley
- Gary Steinberg
- Richard Stark
- Laura Stuchinsky
- Ken Taillon
- Lonnie Tebow
- Frank Van Pelt
- James Wade
- Scott Wentworth

In addition to the many volunteer efforts, recognition is also given to those organizations that supported the efforts of the NTCIP ELMS Working Group by providing comments and resources for development, including:

- U.S. Department of Transportation, ITS Joint Program Office
- Alaska Department of Transportation
- Arizona Department of Transportation
- Brevard County, FL
- California Department of Transportation
- City of Atlanta, GA
- City of Bellevue, WA
- City of Birmingham, WA

- City of Bremerton, WA
- City of Coral Gables, FL
- City of Daytona Beach, FL
- City of East Hartford, FL
- City of Eugene, OR
- City of Fresno, CA
- City of Gainesville, FL
- City of Greensboro, NC
- City of Honolulu, HI
- City of Kent, WA
- City of Lenexa, KS
- City of Lincoln, NE
- City of Little Rock, AR
- City of Los Angeles Department of Street Lights
- City of Loveland, CO
- City of Milford, CT
- City of Minneapolis Department of Public Works—Street Light Division
- City of Nashville, TN
- City of New Orleans, LA
- City of New York
- City of Norfolk, NE
- City of Oakland, California Department of Public Works
- City of Providence, RI
- City of San Clemente, CA
- City of San Diego, CA
- City of San Jose, CA
- City of Seattle, WA
- City of St. Charles, MO
- City of Tampa, FL
- City of Waco, TX
- City of White Plains, NY
- Clark County, NV
- Colorado Department of Transportation
- ConSysTec
- County of Miami-Dade, FL
- Dane County, WI
- Florida Department of Transportation
- Illuminating Engineering Society of North America (IESNA)
- International Municipal Signal Association (IMSA)
- Iowa Department of Transportation
- Madison County, IL
- Maryland Department of Transportation
- Michigan Department of Transportation
- Minnesota Department of Transportation
- Monterey County, CA
- Montgomery County, VA
- National Institute of Standards and Technology (NIST), Smart Grid Interoperability Standards Project
- New Hampshire Department of Transportation
- New York State Department of Transportation
- North Carolina Department of Transportation
- Okaloosa County, FL
- Pennsylvania Department of Transportation
- Stearns County, MN

- Tennessee Department of Transportation
- Texas Department of Transportation
- U.S. Department of Energy
- Washington Department of Transportation

Currently in preview, click buy full version

FOREWORD

NTCIP 1213 v03 defines the generic reference model and conformance requirements for traffic management centers (TMCs) that wish to provide interfaces to external centers. NTCIP 1213 v03 defines requirements that are applicable to all NTCIP TMCs, and contains optional and conditional sections that are applicable to specific environments for which they are intended.

NTCIP 1213 v03 defines the Electrical and Lighting Management System (ELMS) data element objects that are supported by the NTCIP. An ELMS is defined as any system capable of monitoring, controlling, and communicating certain electrical and lighting system parameters using NTCIP.

The effort to develop an NTCIP ELMS standard began with the International Technology Exchange Program's European Road Lighting Technologies scan tour in April of 2001 (Report FHWA-PL-01-034 dated September 2001). This technology and implementation plan was further developed by the AASHTO Task Force for Highway Lighting and is being implemented as the Master Lighting Plan in the AASHTO publication entitled *Roadway Lighting Design Guide*. The Task Force's original desire was to define the features, functionality, and point of interoperability for ELMS equipment.

NTCIP 1213 v03 defines data elements in ASN.1 using the SNMP Object Type Macro to field devices that monitor and control electrical and lighting systems.

NTCIP 1213 v03 is an NTCIP Device Data Dictionary Standard. Device Data Dictionary Standards define management information in terms of objects (data elements, data frames, and messages) for use within NTCIP systems.

The following keywords apply to NTCIP 1213 v03: AASHTO, ITE, NEMA, NTCIP, ELMS, data logger, electrical service, branch circuit, luminaire, data elements.

For more information about NTCIP standards, visit the NTCIP website at www.ntcip.org.

User Comment Instructions

The term "User Comment" includes any type of written inquiry, comment, question, or proposed revision, from an individual person or organization, about any part of this technical publication's content. A "Request for Interpretation" is also classified as a User Comment. User Comments are solicited at any time. In preparation of this NTCIP technical publication, input of users and other interested parties was sought and evaluated.

All User Comments are referred to the committee responsible for developing and/or maintaining this technical publication. The committee chairperson, or their designee, may contact the submitter for clarification of the User Comment. When the committee chairperson or designee reports the committee's consensus opinion related to the User Comment, that opinion will be forwarded to the submitter. The committee chairperson may report that action on the User Comment may be deferred to a future committee meeting and/or a future revision of the technical publication. Previous User Comments and their disposition may be available for reference and information at www.ntcip.org.

A User Comment should be submitted to this address:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209-3801
email: ntcip@nema.org

A User Comment should be submitted in the following form:

Technical Publication Number and Version:
Page:
Section, Paragraph, or Clause:
Comment:
Editorial or Substantive?:
Suggested Alternative Language:

Please include your name, organization, and address in your correspondence.

Approvals

NTCIP 1213 v03 was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved NTCIP 1213 v03 as the following standard type, as of the date:

AASHTO—Standard Specification; June 2022
ITE—Software Standard; July 2022
NEMA—Standard; July 2022

History

In 1992, the NEMA Transportation Management Systems and Associated Control Devices Section (3TS) began development of the NTCIP. The Transportation Section's purpose was in response to user needs to include standardized systems communication in the NEMA TS 2 standard, *Traffic Controller Assemblies*. Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an Intelligent Transportation Systems (ITS) network.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standard. In 2002, the Joint Committee on the NTCIP accepted the invitation from Karl Burkett (Texas DOT) to transfer the initial work of an ad hoc committee of the Illuminating Engineering Society of North America (IESNA), and formed the NTCIP ELMS Working Group to further develop the control objects based on NTCIP. The NTCIP ELMS Working Group's first meeting was in April 2003.

NTCIP 1213 v02 development started in 2002 under funding provided by the FHWA, and was published in June 2010.

NTCIP 1213 v03 development initiated in 2014, to reflect lessons learned and to support new identified user needs and other new systems engineering elements.

Compatibility of Versions

To distinguish NTCIP 1213 v03 (as published) from previous drafts, NTCIP 1213 v03 also includes NTCIP 1213 v03.XX on each page header. All NTCIP technical publications have a major and minor version number for configuration management. The version number syntax is "v00.00a," with the major version number before the period, and the minor version number and edition letter (if any) after the period.

NTCIP 1213 v03 is designated, and should be cited as, NTCIP 1213 v03. Anyone using NTCIP 1213 v03 should seek information about the version number that is of interest to them in any given circumstance.

The MIB, the PRL, and the PICS should all reference the version number of the technical publication that was the source of the excerpted material.

Compliant systems based on later, or higher, version numbers MAY NOT be compatible with compliant systems based on earlier, or lower, version numbers. Anyone using NTCIP 1213 v03 should also consult NTCIP 8004 v02 for specific guidelines on compatibility.

< This page is intentionally left blank. >

CONTENTS

| | Page |
|---|-------------|
| Section 1 General [Informative] | 1 |
| 1.1 Scope | 1 |
| 1.2 References | 1 |
| 1.2.1 Normative References | 2 |
| 1.2.2 Other References..... | 2 |
| 1.2.3 Contact Information..... | 2 |
| 1.3 General Statements | 3 |
| 1.4 Terms | 3 |
| 1.5 Abbreviations..... | 8 |
| Section 2 Concept of Operations [Normative] | 9 |
| 2.1 Tutorial [Informative]..... | 9 |
| 2.2 Current Situation and Problem Statement [Informative] | 10 |
| 2.2.1 Problem Statement | 11 |
| 2.2.2 Current Situation | 11 |
| 2.3 Reference Physical Architecture [Informative] | 11 |
| 2.4 Architectural Needs | 16 |
| 2.5 Features | 16 |
| 2.5.1 Operational User Needs | 16 |
| 2.5.2 Functional User Needs | 18 |
| 2.5.3 Backward Compatibility Features | 23 |
| 2.6 Security | 23 |
| 2.7 Operational Policies and Constraints..... | 24 |
| 2.8 Relationship to the ITS National Architecture [Informative] | 24 |
| Section 3 Functional Requirements [Normative] | 26 |
| 3.1 Tutorial [Informative]..... | 26 |
| 3.2 Scope of the Interface [Informative] | 27 |
| 3.3 Protocol Requirements List (PRL)..... | 27 |
| 3.3.1 Notation [Informative]..... | 27 |
| 3.3.2 Instructions for Completing the PRL [Informative] | 28 |
| 3.3.3 Protocol Requirements List (PRL) Table | 29 |
| 3.4 Architectural Requirements | 47 |
| 3.5 Data Exchange and Operational Environment Requirements | 47 |
| 3.5.1 Provide Live Data..... | 47 |
| 3.5.2 Provide Off-Line Log Data | 47 |
| 3.5.3 Manage Exception Reporting..... | 50 |
| 3.5.4 Configure ELMS Device..... | 55 |
| 3.5.5 Control Device..... | 70 |
| 3.5.6 Monitor Device Status..... | 73 |
| 3.5.7 Backward Compatibility Requirements | 76 |

| | |
|--|------------|
| Section 4 Dialogs [Normative] | 77 |
| 4.1 Tutorial [Informative]..... | 77 |
| 4.2 Specified Dialogs..... | 80 |
| 4.2.1 Configure Luminaire for Scheduled Operations..... | 81 |
| 4.2.2 Configure Electrical Service for Scheduled Operations..... | 81 |
| 4.2.3 Configure Branch Circuit for Scheduled Operations..... | 82 |
| 4.2.4 Configure Devices in Zone for Scheduled Operations..... | 82 |
| 4.2.5 Schedule ELMS Device Event | 82 |
| 4.2.6 Retrieve a Schedule..... | 84 |
| 4.2.7 Configure Luminaire Dim Level..... | 85 |
| 4.2.8 Configure Electrical Service Dim Level..... | 85 |
| 4.2.9 Configure Branch Circuit Dim Level..... | 86 |
| 4.2.10 Configure Dim Level for Devices in Zone | 86 |
| 4.2.11 Configure Branch Circuit Ground Fault Detector | 87 |
| 4.2.12 Control Luminaire in Timed Override | 87 |
| 4.2.13 Control Electrical Service in Timed Override | 88 |
| 4.2.14 Control Branch Circuit in Timed Override | 88 |
| 4.2.15 Control Devices in Zone in Timed Override..... | 89 |
| 4.2.16 Configure Reporting/Logging Service | 89 |
| 4.2.17 Retrieve Logged Data | 90 |
| 4.2.18 Manage Tables | 91 |
| 4.2.19 Configure Luminaire Switch State Log | 92 |
| 4.2.20 Configure Luminaire Condition Log | 93 |
| 4.2.21 Configure Luminaire Burn Condition Log..... | 93 |
| 4.2.22 Configure Periodic Luminaire Burn Time Log..... | 94 |
| 4.2.23 Configure Luminaire Temperature Log..... | 96 |
| 4.2.24 Configure Luminaire Pole Condition Log | 96 |
| 4.2.25 Configure Relay Switch State Log | 97 |
| 4.2.26 Configure Energy Meter Switch State Log..... | 98 |
| 4.2.27 Configure Periodic Energy Meter Measurement Log..... | 99 |
| 4.2.28 Configure Energy Meter Condition Log | 102 |
| 4.2.29 Configure Ground Fault Switch State Log | 102 |
| 4.2.30 Configure Periodic Ground Fault Measurement Log | 103 |
| Section 5 Management Information Base (MIB) [Normative] | 105 |
| 5.1 MIB Header | 105 |
| 5.2 Data Elements..... | 107 |
| 5.3 Schedule | 107 |
| 5.3.1 Number of Schedule Events | 107 |
| 5.3.2 Schedule Action Table | 107 |
| 5.4 Luminaire..... | 110 |
| 5.4.1 Luminaire Table | 110 |
| 5.5 Electrical Service..... | 125 |
| 5.5.1 Electrical Service Table | 125 |
| 5.6 Branch Circuit..... | 136 |
| 5.6.1 Branch Circuit Table | 136 |
| 5.7 Zone | 157 |
| 5.7.1 Zone Table | 157 |
| 5.8 Zone Parameters..... | 162 |
| 5.8.1 Maximum Number of Zones Per Device | 162 |
| 5.8.2 Maximum Number of Devices Per Zone | 163 |

| | | |
|---------|---|-----|
| 5.9 | Zone Logical Device Identifier Table | 163 |
| 5.9.1 | Zone Logical Device ID Table | 163 |
| 5.10 | Photocell..... | 165 |
| 5.10.1 | Photocell State | 165 |
| 5.10.2 | Photocell Display Name | 165 |
| 5.10.3 | Photocell Table | 165 |
| 5.11 | Astronomical Clock..... | 168 |
| 5.11.1 | Latitude of Installation | 168 |
| 5.11.2 | Longitude of Installation | 168 |
| 5.11.3 | Date..... | 168 |
| 5.11.4 | Sunrise Time | 168 |
| 5.11.5 | Sunset Time | 169 |
| 5.12 | Connected Vehicle Sensor Information..... | 169 |
| 5.12.1 | Connected Vehicle Speed | 169 |
| 5.12.2 | Connected Vehicle Direction..... | 169 |
| 5.12.3 | Connected Vehicle Location | 170 |
| 5.12.4 | Connected Vehicle Ambient Light Level | 170 |
| 5.12.5 | Connected Vehicle Headlight Status | 171 |
| 5.12.6 | Connected Vehicle Road Friction | 171 |
| 5.12.7 | Connected Vehicle Speed Setpoint | 171 |
| 5.12.8 | Connected Vehicle Direction Setpoint | 172 |
| 5.12.9 | Connected Vehicle Latitude High Setpoint | 172 |
| 5.12.10 | Connected Vehicle Latitude Low Setpoint | 172 |
| 5.12.11 | Connected Vehicle Longitude High Setpoint | 172 |
| 5.12.12 | Connected Vehicle Longitude Low Setpoint | 172 |
| 5.12.13 | Connected Vehicle Altitude High Setpoint | 173 |
| 5.12.14 | Connected Vehicle Altitude Low Setpoint..... | 173 |
| 5.12.15 | Connected Vehicle Ambient Light Level Setpoint..... | 173 |
| 5.12.16 | Connected Vehicle Headlight Status Setpoint | 173 |
| 5.12.17 | Connected Vehicle Road Friction Setpoint | 174 |
| 5.13 | Electric Vehicle Charger Information..... | 174 |
| 5.13.1 | Electric Vehicle Charger Table | 174 |
| 5.14 | Energy Automatic Demand Response Information | 180 |
| 5.14.1 | Electricity Price..... | 180 |
| 5.14.2 | Energy Price..... | 181 |
| 5.14.3 | Demand Charge..... | 182 |
| 5.14.4 | Control Bid Price | 183 |
| 5.14.5 | Control Energy Storage | 184 |
| 5.14.6 | Load Dispatch | 185 |
| 5.14.7 | Load Control Capacity | 186 |
| 5.14.8 | Load Control Offset..... | 186 |
| 5.14.9 | Load Control Setpoint | 186 |
| 5.14.10 | Load Control Percent Offset | 187 |
| 5.15 | Ground Fault Interrupter..... | 187 |
| 5.15.1 | Ground Fault Interrupter Setpoint | 187 |
| 5.15.2 | Ground Fault Status | 187 |
| 5.16 | Power Outage Message..... | 188 |
| 5.17 | Adaptive Operation..... | 188 |
| 5.18 | Energy Meter Accuracy | 189 |

| | |
|---|------------|
| Annex A Requirements Traceability Matrix (RTM) [Normative] | 190 |
| A.1 Notation [Informative] | 190 |
| A.1.1 Functional Requirement Columns..... | 190 |
| A.1.2 Dialog Column..... | 190 |
| A.1.3 Object Columns..... | 190 |
| A.1.4 Additional Specifications | 191 |
| A.2 Instructions for Completing the RTM [Informative]..... | 191 |
| A.3 Requirements Traceability Matrix (RTM) Table | 191 |
| Annex B Object Tree [Informative] | 235 |
| Annex C Test Procedures [Normative] | 236 |
| Annex D Documentation of Revisions [Informative] | 237 |
| Annex E User Requests | 238 |
| Annex F Other Annexes | 239 |
| Annex G SNMP Interface [Normative] | 240 |
| G.1 Generic SNMP Get Interface | 240 |
| G.2 Generic SNMP GetNext Interface | 240 |
| G.3 Generic SNMP Set Interface..... | 241 |
| G.4 Variable Binding List Structure..... | 242 |
| G.5 Additional Requirements | 243 |
| G.5.1 Grouping of Objects in a Request..... | 243 |
| G.5.2 Support of Get..... | 243 |
| G.5.3 Support of GetNext | 243 |
| G.5.4 Support of Set | 243 |
| G.5.5 Performance..... | 243 |

FIGURES

| | Page |
|---|-------------|
| Figure 1 Reference Architecture—ELMS Device with SNMP Agent..... | 12 |
| Figure 2 Data Logger with SNMP Agent Example Configuration..... | 13 |
| Figure 3 Luminaire with SNMP Agent Example Configuration | 14 |
| Figure 4 SNMP Agent with Zones Example Configuration..... | 15 |
| Figure 5 NTCIP 1213 as Part of the Roadside Lighting Service in National ITS Architecture | 24 |
| Figure 6 NTCIP 1213 as Part of the Electric Charging Station Management Service in National ITS Architecture..... | 25 |
| Figure 7 Sample Sequence Diagram for Schedule Feature..... | 78 |
| Figure 8 Sample VOPC Diagram for Schedule Feature..... | 79 |
| Figure 9 ISO Tree Structure | 235 |
| Figure 10 SNMP Get Interface | 240 |
| Figure 11 SNMP GetNext Interface | 241 |
| Figure 12 SNMP Set Interface..... | 241 |
| Figure 13 SNMP Interface—View of Participating Classes..... | 242 |

TABLES

| | Page |
|-----------------------------------|-------------|
| Table 1 Status Symbols..... | 27 |
| Table 2 Predicate Notations | 28 |
| Table 3 Support Entries..... | 28 |

Section 1 General [Informative]

1.1 Scope

Communication between an ITS Management Center or portable computer and an Electrical and Lighting Management System (ELMS) is accomplished by using the NTCIP Application Layer services to convey requests to access or modify values of ELMS data elements resident in the device via an NTCIP network. An NTCIP message consists of a specific Application Layer service and a set of data elements. An NTCIP message may be conveyed using any NTCIP defined class of service that has been specified to be compatible with the Simple Transportation Management Framework (STMF).

The scope of NTCIP 1213 v03 is limited to the functionality related to ELMS within a transportation environment.

The remainder of NTCIP 1213 v03 includes the following sections, and each section builds on the previous section(s):

- a) Concept of Operations (Section 2)—providing a description of user needs (needs for features and needs related to the operational environment) applicable to ELMS devices
- b) Requirements (Section 3)—defining the functional requirements that address the user needs identified in the Concept of Operations, and including a Protocol Requirements List (PRL) that defines conformance requirements, thereby allowing users to select the desired options for a particular project
- c) Dialog Specifications (Section 4)—describing how each functional requirement is fulfilled (the dialogs define the standardized procedure for a Traffic Management Center to exchange data with an ELMS device)
- d) ELMS Object Definitions (Section 5)—defining the data exchanged during communications; some of the definitions are included via reference to another standard
- e) Requirements Traceability Matrix (Annex A)—providing a table that associates each requirement to a dialog, and its associated list of data
- f) Object Tree (Annex B)—provides a graphical representation of the branch and tree structure for objects and the organization of the data defined in NTCIP 1213 v03
- g) Astronomical Clock Support (Annex C)—including object definition modifications needed to support astronomical clock

Note: Test procedures needed for each functional requirement are not included in NTCIP 1213 v03, although they may be added in a future version.

Section 2 and Section 3 are presented at a high level and are of interest to most readers; Section 3 and Section 5 address more detailed design issues that are of interest to implementers, integrators, and testers.

1.2 References

Normative references contain provisions that, through reference in this text, constitute provisions of NTCIP 1213 v03. Other references in NTCIP 1213 v03 might provide a complete understanding of the entire protocol and the relations between all parts of the protocol. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard listed.