

A Joint Standard of AASHTO, ITE, and NEMA

NTCIP 1400:2000 v01.04

Transit Communications Interface Profiles part of the National Transportation Communications for ITS Protocol TCIP Framework Standard

December 1, 2000

Also referenced as TCIP-FRAME

Published by

American Association of State Highway and Transportation Officials (AASHTO)

444 North Capitol Street, N.W., Suite 249
Washington, D.C. 20001

Institute of Transportation Engineers (ITE)

1099 14th Street, N.W., Suite 300 West
Washington, D.C. 20005-3438

National Electrical Manufacturers Association (NEMA)

1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209-3801

© Copyright 2001 AASHTO / ITE / NEMA. All rights reserved.

© Copyright 2001 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 in whole or in part in any form, translation into other languages and display are reserved by the copyright owners 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 for the electronic Data Dictionary or script, do not copy without written permission of either AASHTO, ITE, or NEMA.

NOTICE AND 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/or 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, nor do they 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.

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

ACKNOWLEDGEMENTS

This publication was prepared by the ITE's TCIP Project Team, and reviewed and recommended by the Joint Committee on the NTCIP. The Joint Committee is organized under a Memorandum of Understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). The Joint Committee on the NTCIP consists of six representatives from each of the standards organizations, and provides guidance for NTCIP development.

In February 1997, the TCIP Technical Working Group organized subgroups to standardize the business area data interface objects. The subgroups drafted, considered, and proposed for approval the TCIP Framework Standard. The result was this document. As a consequence, all the subgroups had a hand in crafting this document.

At the time that this document was prepared, the following individuals were active members of the TCIP Technical Working Group:

- Isaac K. Takyi, New York City Transit Authority; Technical Working Group Chair
- Mark Hickman, Texas Transportation Institute; Subgroup Leader for Passenger Information
- Gloria Stoppenhagen, Houston Transtar; Subgroup Leader for Passenger Information
- Julie Corman, King County METRO; Subgroup Leader for Scheduling/Runcutting/Spatial
- Nancy Neuerburg, King County METRO; Subgroup Leader for Scheduling/Runcutting/Spatial
- Bill Kronenberger, Houston METRO; Subgroup Leader for Onboard/Control Center
- John Swanson, Long Island Railroad; Subgroup Leader for Fare Collection
- Robert Antonisse, Orbital Sciences Corporation; Subgroup Leader for Incident Management
- Colin Rayman, Ontario Ministry of Transport; Subgroup Leader for Traffic Management

Other individuals who provided input to the document include:

- Paula E. Okunieff, ARINC, Incorporated; TCIP Project Technical Manager
- Eva Lerner-Lam, Palisades Consulting Group, Incorporated; TCIP Project Director
- Louis F. Sanders, American Public Transit Association
- Mary Wedler, American Public Transit Association
- Bancroft Scott, Open Systems Solutions

In addition to the many volunteer efforts, recognition is also given to those organizations which supported the efforts of the working group by providing comments and funding for the document, including:

- Federal Highway Administration
- Federal Transit Administration

FOREWORD

This document uses only metric units.

This document is an NTCIP Process, Control, and Information Management document. Process, Control, and Information Management documents define the practices and policies used by the NTCIP Joint Committee in developing and maintaining NTCIP and TCIP standards, documents, and systems. This TCIP Framework Standard was assigned document number NTCIP 1400 to be grouped with the other TCIP documents, rather than a number in the NTCIP 8000-series.

The TCIP family of standards addresses Advanced Public Transportation Systems (APTS) data interfaces, and related automated transit tools and data. The standards also address the business requirements of the APTS data interfaces. In some cases, specialized terms were needed to define general classes of information. For example, different business areas needed to define data elements related to time, date, and footnotes. Special data types were developed so that these data concepts were consistent across business areas, while specific needs were met. These data types are defined in this document.

For more information about NTCIP standards, visit the NTCIP Web site at <http://www.ntcip.org>. For a hardcopy summary of NTCIP information, contact the NTCIP Coordinator at the address below.

In preparation of this NTCIP document, input of users and other interested parties was sought and evaluated. Inquires, comments, and proposed or recommended revisions should be submitted to:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209-3801
fax: (703) 841-3331
e-mail: ntcip@nema.org

Approvals

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

AASHTO – Standard Specification; October 1999
ITE – Software Standard; May 2000
NEMA – Suggested Standard for Future Design; April 2000

History

From 1997 to 1999, this document was referenced as ITE ST-ITS-TCIP-FRAME and/or NEMA TS 3.TCIP-Frame. However, to provide an organized numbering scheme for the NTCIP documents, this document is now referenced as NTCIP 1400. The technical specification of NTCIP 1400 is identical to the former reference, except as noted in the development history below:

TCIP documents version 0.1. Distributed in September 1997 for public review.

TCIP-FRAME Recommended Standard version 01.3, April 16, 1999. Proposed as a Recommended Standard of the Joint Committee on the NTCIP.

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

NTCIP 1400, version 01.3, April 16, 1999. Approved by AASHTO in October 1999, approved by ITE in May 2000, and approved by NEMA in April 2000.

NTCIP 1400 v01.04, December 1, 2000. Summer 2001 printing. Incremented version number and updated date; added and revised front matter; updated references to NTCIP and NEMA document numbers in Clause on References; updated references to NTCIP document numbers in Clause on Conformance; updated references to ITE document numbers; and deleted Annex A Comment Form.

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

INTRODUCTION

This document defines the Framework for the Transit Business Area objects that are supported by the Transit Communications Interface Profiles (TCIP). This document introduces the background, basic concepts, and conformance requirements that apply to all TCIP business area requirements.

There are six annexes to this document.

This document defines requirements that are applicable to all NTCIP and TCIP environments and also contains optional and conditional clauses that are applicable to specific environments for which they are intended.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, and TCIP.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. 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 standards.

In 1997, the ITE, in cooperation with the American Public Transit Association (APTA), the U.S. DOT's Federal Transit Administration, and the U.S. DOT's FHWA, began development of the TCIP. The TCIP Technical Working Group was accepted as another subdivision of the Joint Committee on the NTCIP.

If you are not willing to abide by the following distribution notice, return these materials immediately.

Joint AASHTO, ITE, and NEMA
NTCIP and TCIP Data Dictionary and ASN.1 Script
DISTRIBUTION NOTICE

To the extent and in the limited event these materials are distributed by AASHTO/ITE/NEMA in the form of a Data Dictionary and ASN.1 Script ("DD"), AASHTO/ITE/NEMA extends the following permissions:

- (i) you may make and/or distribute unlimited copies (including derivative works) of the DD, including copies for commercial distribution, provided that each copy you make and/or distribute contains this Notice;
- (ii) use of the DD is restricted in that the syntax field may be modified only to reflect a more restrictive subrange or enumerated values;
- (iii) the description field may be modified but only to the extent that: (a) only those bit values or enumerated values that are supported are listed; and (b) the more restrictive subrange is expressed.

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, OR 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, OR 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 you.

Use of these materials does not constitute an endorsement or affiliation by or between AASHTO, ITE, or NEMA and you, your company, or your products and services.

NTCIP is a trademark of AASHTO/ITE/NEMA.

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

CONTENTS

SECTION 1	GENERAL	1-1
1.1	Scope	1-1
1.2	References	1-1
1.2.1	Normative References	1-1
1.2.2	Informative References	1-2
1.2.3	Contact Information	1-2
SECTION 2	TERMINOLOGY	2-1
2.1	Definitions	2-1
2.2	Abbreviations	2-2
2.3	Acronyms	2-3
2.4	Conventions	2-3
SECTION 3	BASIC CONCEPTS	3-1
3.1	ITS National Architecture/IEEE Data Dictionary and Message Set Template	3-1
3.1.1	National ITS Architecture Data Flows	3-1
3.1.2	Classification Scheme	3-6
3.1.3	Naming Convention	3-7
3.2	Abstract Syntax Notation One Basic Concepts	3-8
SECTION 4	CONFORMANCE	4-1
4.1	Definition of Conformance	4-1
4.2	Level of Conformance	4-1
4.2.1	Conformance Level 1	4-1
4.2.2	Conformance Level 2	4-1
4.2.3	Conformance Level 3	4-1
4.3	Conformance Situations	4-2
4.4	Conformance Criteria	4-2
4.5	Test Methods	4-2
4.6	Conformance Statement	4-2
ANNEX A	DYNAMIC OBJECT MODULE DEFINITION	A-1
ANNEX B	COMMON PUBLIC TRANSPORTATION CONFORMANCE REQUIREMENTS	B-1
B.1	Level One Conformance	B-1
B.2	Level Two Conformance	B-1
ANNEX C	DATA ELEMENT/MESSAGE USE CROSS REFERENCE TABLE	C-1
C.1	Level One Conformance	C-1
C.2	Level Two Conformance	C-1
ANNEX D	PASSENGER INFORMATION CONFORMANCE REQUIREMENTS	D-1
D.1	Level One Conformance	D-1
D.2	Level Two Conformance	D-2
ANNEX E	SCHEDULING/RUNCUTTING CONFORMANCE REQUIREMENTS	E-1
E.1	Level One Conformance	E-1
E.2	Level Two Conformance	E-2
ANNEX F	SPATIAL REPRESENTATION CONFORMANCE REQUIREMENTS	F-1
F.1	Level One Conformance	F-1

F.2 Level Two Conformance.....F-2

Section 1 GENERAL

1.1 SCOPE

The Transit Communications Interface Profiles domain covers the data needs of the functions related to the support of Public Transportation operations, service and planning. This includes all input and output data needed for the following business areas.

- Fare Collection (FC)
- Scheduling/Runcutting (SCH)
- Passenger Information (PI)
- Incident Management (IM)
- Vehicle On-board (OB)
- Transit Control Center (CC)
- Traffic Management (TM).

1.2 REFERENCES

For approved amendments, contact:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, Virginia 22209-3801
fax: (703) 841-3331
e-mail: ntcip@nema.org

For draft revisions or amendments to this document, which may be under consideration by the relevant TCIP Working Group, and for recommended amendments of the NTCIP Joint Committee, visit the World Wide Web at <http://www.ntcip.org> or <http://www.ite.org>.

A copy of the database containing the TCIP data elements and messages for each of the business areas is available. To download a copy of the TCIP database, follow the instructions on either the NTCIP or ITE Websites.

Two types of references are cited in this section. Normative references contain provisions that apply when implementing this standard. Informative references contain rules and guidelines that may provide a more detailed understanding of the data, interface, format, profiles, or application of this standard. Use of informative references is not mandatory in order to conform to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, however, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standard listed below.

1.2.1 Normative References

ISO/IEC 8824: 1994, *Abstract Syntax Notation One (ASN.1)* (ITU-T X.680 – X.690, July 1994)

Draft IEEE P1489/D0.0.7, *Draft Standard for Data Dictionaries for Intelligent Transportation Systems*, Version 0.0.7, October 9, 1997

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

Draft IEEE P1488/D0.0.6, *Draft Standard for Message Set Template for Intelligent Transportation Systems*, Version 0.0.6, October 17, 1997

1.2.2 Informative References

NTCIP 1407, *Transit Communications Interface Profile Standard on Control Center Objects*, Version 1.0, September 1998

NTCIP 1401:2000, *Transit Communications Interface Profile Standard on Common Public Transportation Objects*, Version 01.02, December 2000

Draft NTCIP 1408, *Draft Transit Communications Interface Profile Standard on Fare Collection (FC) Objects*, Version 0.3, March 1998

NTCIP 1403:2000, *Transit Communications Interface Profile Standard on Passenger Information (PI) Objects*, Version 01.02, December 2000

NTCIP 1402:2000, *Transit Communications Interface Profile Standard on Incident Management (IM) Objects*, Version 01.02, December 2000

Draft ST-ITS-TCIP-TM, *Draft Transit Communications Interface Profile Standard on Traffic Management (TM) Objects*, Version 0.2, January 15, 1998

NTCIP 1406, *Transit Communications Interface Profile Standard on On-Board (OB) Objects*, Version 1.0, September, 1998

NTCIP 1404:2000, *Transit Communications Interface Profile Standard on Scheduling (SCH) Objects*, Version 01.02, December 2000

NTCIP 1405:2000, *Transit Communications Interface Profile Standard on Spatial Representation (SP) Objects*, Version 01.02, December 2000

NTCIP 8003, *National Transportation Communications and ITS Protocol (NTCIP) Framework and Classification of Profiles* (Draft Version 97.01.08, November 14, 1997)

SAE J1587 – *Joint SAE/TMC Recommended Practice for Electronic Data Interchange Between Microcomputer Systems in Heavy Duty Vehicle Applications*, August 1992

The National Architecture for ITS, U.S. Department of Transportation Joint Program Office, January 1997.

1.2.3 Contact Information

The American National Standards Institute (ANSI), as the U.S. representative on the ISO/IEC International Standards organization, maintains a register of all ISO/IEC standards.

ANSI
11 West 42nd Street, 13th Floor
New York, New York 10036
(212) 642-4900
www.ansi.org

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

The National Electrical Manufacturers Association (NEMA), the American Association of State Highway and Transportation Officials (AASHTO) and the Institute of Transportation Engineers jointly develop, approve, and maintain the NTCIP standard.

National Electrical Manufacturers Association
1300 North 17th Street, Suite 1847
Rosslyn, VA 22209-3801
(703) 841-3200
www.nema.org

The Society of Automotive Engineers develops and maintains the J1708/J1587 family of standards.

Society of Automotive Engineers
400 Commonwealth Drive
Warrendale, PA 15096
(412) 772-7157
www.sae.org

The Institute of Electrical and Electronics Engineers (IEEE) develops and maintains the IEEE Standard for Data Dictionary and Message Set Template for Intelligent Transportation Systems.

Institute of Electrical and Electronics Engineers
445 Hoes Lane, P.O. Box 1331
Piscataway, NJ 08855-1331
(732) 981-0060
www.ieee.org/ieeestore

The Intelligent Transportation Society of America (ITSA) distributes documents developed by the U.S. DOT Joint Program Office (JPO) on ITS.

Intelligent Transportation Society of America
400 Virginia Avenue, S.W. Suite 800
Washington, DC 20024-2730
(202) 484-4584
www.itsa.org/public/archdocs/national.html
or from Odetics at www.odetics.com/itsarch/

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA

Section 2 TERMINOLOGY

For the purposes of this document and to standardize the terminology in the public transportation industry, the following definitions, abbreviations, acronyms, conventions, and notations apply to this document.

2.1 DEFINITIONS

BYTE and UBYTE	Octet sized (8 bits) integers where BYTE is signed (range -128 to 127) and UBYTE is unsigned (range 0 to 255). (TS 3.2-1996, p. 15).
CHOICE	As defined by ITU-T X.680, Abstract Syntax Notation One Specification of Basic Notation, a choice type is defined by referencing a list of distinct types; each value of the choice type is derived from the value of an object (ITU-T, p. 4).
Component	The closely related functions of a system. A component produces an information product.
Data Dictionary	A listing of data elements (and their characteristics) that meets the information and functional needs of a system.
Data Element	An atomic element of information which is defined within a transit business area. As defined by the IEEE P1489/D0.0.5 (July 14, 1997), a data element is a syntactically formal representation of some information of interest (such as a fact, proposition, observation, etc.) about some entity of interest (e.g., a person, place, process, property, object, concept, association, state, event).
Data Interface	The connection between two or more components through which information (e.g., object or message) is passed.
Dialog	An ordered grouping of messages exchanged between at least two components.
Informative	Non-prescriptive information that provides context to this standard.
LONG and ULONG	Four byte (32 bits) integers where LONG is signed (range—2,147,483,648 to 2,147,483,647) and ULONG is unsigned (range 0 to 4,294,967,295). (TS 3.2-1996, p. 15).
Message	A grouping of data elements, which encapsulate an idea, concept or thing, or convey information. A basic message encapsulates an idea, concept or thing, and a compound message embeds one or more basic messages and other data elements to convey information.
Message Set Catalog	A list of messages and the functional requirements needed to support the exchange of information among components within a system, or between systems.
Message Set Template	The format used to transmit messages among components or between systems.
Normative	The prescriptive requirements for the use of this standard.

Do Not Copy Without Written Permission

© 2000 AASHTO / ITE / NEMA