

IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers

Sponsor

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Abstract: This standard addresses the exchange of vital data about transportation-related incidents among emergency management centers through common incident management message sets. Message sets specified are consistent with the National Intelligent Transportation Systems Architecture and are described using Abstract Syntax Notation One syntax. This standard comprises the base standard of a family of incident management standards; specific incident management message sets for traffic, public safety, and HAZMAT centers may be found in forthcoming companion volumes which build upon and augment this base standard.

Keywords: Abstract Syntax Notation One, emergency management centers, HAZMAT, incidents, message sets, National Intelligent Transportation Systems Architecture, public safety, traffic.

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Introduction

(This introduction is not a part of IEEE Std 1512-2000, IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers.)

The Incident Management Working Group was formed in 1997 from a cross-section of intelligent transportation systems (ITS), transportation management, public safety, and incident management practitioners, to address problems in the exchange of data among emergency management and related centers and systems resolving transportation disruptions (primarily roadway service disruptions). Those disruptions are identified by various terms, including: incidents, emergencies, accidents, planned roadway closures, special events, and disasters caused by humans and natural disasters. All of those disruptions may be referred to as incidents, events, or incident events in this standard. Subject-matter experts from the American Association of State Highway Transportation Officials (AASHTO) and the Institute of Transportation Engineers (ITE) joined the Working Group to develop this multipart standard. The objective of this standard, when fully implemented, is to minimize the technical barriers associated with data exchange among emergency management and related centers.

Base Standard

This document serves as a base standard for a family of standards in this area and deals primarily with the coordination and exchange of information regarding incidents among emergency management and related centers. More complex data and resource sharing, as well as message flows particular to transportation management, public safety, and hazardous materials, will be addressed in companion volumes to the standard developed by the Working Group. In addition, an Implementation Guide for this standard will provide an overview of the relationships between the messages and further examples of use with other ITS message sets that are not presented in the normative clauses of this standard.

The national ITS architecture standards requirements document identifies the requirements for message sets to exchange data about incidents among emergency management and related centers. Incident or emergency management is one of the ITS services identified with centers that perform functions such as transportation management, emergency management, transit management, and information service provider. The relevant architecture flows of the National ITS Architecture were identified and verified by the National ITS Architecture Team. The following problem statement forms the framework within which the message structures specification was developed.

The problem statement: A wide variety of separate organizations, each independently dispatching their own resources in the form of personnel and equipment, process incidents with a focus centric to their own community requirements. Each has established operational procedures and methods tailored to meet both their industry and local requirements. The communication systems used by such centers are typically not commercial off-the-shelf in nature but rather have been developed to suit each center after an extensive procurement phase. Each center has a response territory, both geographic and administrative, intertwined with other centers' jurisdictions in complex ways. Each center has policies for dealing with the public-private release of information to others in unique ways. A degree of institutional distrust and concern for inadvertent release of information to the public prevents the full sharing of information in most cases.

NOTE—Matters of safeguarding privacy will occur in implementing this base standard, e.g., managing the chain of custody of incident data concerning individuals involved in an accident. Though beyond the scope of this base standard, such incident data concerning individuals should be protected through state and federal laws. Only authorized officials within the chain of custody with a “need to know” should be provided access. All data related to safeguarding privacy should be protected by data security technology and audit procedures of the receiving information system.

All of the above changes dynamically in some localities based on workload and requirements. These conditions vary considerably from state to state and also among local jurisdictional implementations within a state. There is not a uniform model from which such incident management processes are built, making each a unique case. These issues are made more complex with the many communication alternatives among motorists and the mobile public that can report and inform all parties about the occurrence of an incident in real time. This leads to many centers learning about the same event from many sources and requires a coordinated process. The goal of this standard is to provide common incident management message sets in

a uniform and open format that the local implementer can then tailor in a way that best suits its requirements and policies for communicating among those centers.

This standard specifically references a concurrently developed (and evolving) group of ITS standards that address transportation management centers, transit management centers, vehicles reporting Mayday events, and various pre-existing public safety and incident response agencies, each with procedures and standards, e.g., the E911 community. This standard establishes ways for these separate groups to communicate with each other at the emergency management center level, with each continuing to use the primary methodologies already established and accepted among their own constituency groups. Setting up such a communication system may require extant interagency agreements prior to implementing this standard.

Those agreements may establish the communication protocols messaging practices not specified in this standard and the actual messages, data frames, and data elements from this standard that should be used.

NOTE—In addition, it is strongly recommended that this base standard be fully tested through a “real-world” prototype test prior to wide-scale deployment.

Companion Volumes

At the time this base standard was completed, the Working Group had just begun efforts on a set of companion volumes. The purpose of these volumes is to more fully establish the message sets used by various user groups within the realm of transportation management, public safety, and hazardous materials. In addition, a companion volume repositing incident management data elements, exclusive to emergency management was underway. These documents were approved in the IEEE project authorization request (PAR) process as

- IEEE P1512.1, Traffic Incident Management Message Sets for Use by Emergency Management Centers
- IEEE P1512.2, Public Safety Incident Management Message Sets for Use by Emergency Management Centers
- IEEE P1512.3, Hazardous Material Incident Management Message Sets for Use by Emergency Management Centers
- IEEE P1512a, Emergency Management Data Dictionary (EMDD)

Each companion volume to this standard shall specify data frames applicable to that part and may amend the data frames that have been previously published. During the development of each companion volume to this standard, data elements and data frames will be added to the EMDD, which will be available in draft form for ready reference. When all parts of the standard are completed, the EMDD shall be the authoritative source for the data element and data frame definitions for use with the IEEE P1512 message sets. All references to data elements and data frames described in the companion volumes will be coordinated and updated through the periodic IEEE standards review cycle.

Implementers using the base standard are advised to check with IEEE for the development status of the companion volumes.

Participants

At the time this base standard was completed, the Incident Management Working Group of the IEEE Standards Coordinating Committee 32 (SCC 32) on Intelligent Transportation Systems had the following membership:

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When the IEEE-SA Standards Board approved this standard on 21 June 2000, it had the following membership:

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IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers

1. Overview

The need for coordination among response agencies involved in the processing of various emergency or traffic-related incidents is self-evident, but a common set of established procedures and operational methods is required in order to exchange vital data among participating parties in a concise, unambiguous, and rapid fashion. This body of related standards addresses the communication of messages among affected emergency response agencies during and after the occurrence of an emergency incident. Within the duration of an incident, each involved agency has responsibilities that vary over time, based on the type of incident, local custom, and agreed upon responding resource allocations, which are often determined at the incident scene or at dispatching points within each agency. This standard addresses the exchange of information among such centers, and has been carefully developed to allow a wide variation in local implementation, while still using the framework and the concepts of the National Intelligent Transportation System (ITS) Architecture. In addition, the work of prior standards, which this standard references, forms a portion of the messages in this standard.

1.1 Scope

This standard is the base standard for a family of related standards that address the intercommunication needs of emergency management centers and other types of centers engaged in transportation incident management. *Incident* in this standard includes information concerning any transportation-related event that is received by the emergency management system, including planned roadway closures and special events, whether or not the incident actually affects traffic flow, and whether or not a response is required. This standard specifies common incident management message sets to allow vital data exchange for information and coordination. It provides a common mechanism for this data exchange within the defined National ITS Architecture with latitude for local agencies to determine what level of cooperation, and hence message exchanges, best meets their requirements. This standard is independent of communication protocols used in any local implementation. It also assumes that the mechanics of communication, such as addressing, are handled by communication management which is not addressed in this standard.

Other companion standards, herein referred to as companion volumes, will provide specific content and usage guidance for other types of centers that could participate in a local incident management system. Companion volumes dealing with the unique needs of transportation management, public safety, and

hazardous materials centers are under development. In addition, a companion volume repositing incident management data elements (DEs) exclusive to emergency management will be prepared.

1.2 Purpose

This standard provides a framework for the exchange of messages used in incident management between emergency management centers and other types of centers, e.g., transportation management centers (TMCs). A minimum set of messages to be accommodated by compliant systems is dictated. Within the framework, there is ample flexibility, in that many messages are in fact composed of lists of optional DEs, so those lists have the function of “vocabularies” of DEs. That is, the actual DEs specified in a local implementation can be selected from those lists. In addition, within some DEs, where there is a list of possible data values (e.g., possible center types and possible causes for evacuation), there are provisions for local implementers to add their own values. This provides for both a standardized lexicon for describing events, as well as a local derivative list to be used. Because the dispatching systems of each participating center may internally use radically different coding schemes for incidents, events, and resources that it wishes to exchange data about, this standard provides a flexible set of descriptive elements that can be implemented to provide differing levels of local, regional, and national interoperation. It remains the responsibility of participating local agencies to determine what level of interoperation is suitable for their own needs. In a local implementation, conformance with this standard may require extant interagency agreements to exchange particular messages using particular DEs selected from this standard. Those messages have been structured so that centers using different legacy systems, and centers with different data needs, can still use a set of common messages to exchange information with other centers.

Further, this standard shall be implemented in conjunction with related ITS standards that provide other required portions of the entire architecture. The related ITS standards include detailed message formatting with specific center and domain field of use, center-to-center exchange protocols, and messaging processes, including message delivery, security, and gateway functions. This standard acts as a “wrapper,” incorporating such domain-specific knowledge in its own messages to allow exchange of information in each companion volume for each type of center.

2. References

This base standard shall be used in conjunction with the following publications, when applicable, in the process of populating and developing the message sets herein. The specific revision and issued date stated below shall be used for each standard. When the following standards are superseded by an approved revision, the revision shall be reviewed for applicability.

NOTE—The references cited below will be included in the references of the other companion volumes of this standard, unless specifically excepted.

ASN.1:1997, Abstract Syntax Notation One.¹

ISO/IEC 8824-1:1998, Information technology—Abstract Syntax Notation One (ASN.1): Specification of basic notation.²

ISO/IEC 8824-2:1998, Information technology—Abstract Syntax Notation One (ASN.1): Information object specification.

¹ASN.1:1997 is available on the World Wide Web at the following site: <http://asn1.elibel.tm.fr>.

²ISO publications are available from the ISO Central Secretariat, Case Postale 56, 1 rue de Varembe, CH-1211, Genève 20, Switzerland/Suisse (<http://www.iso.ch/>). ISO publications are also available in the United States from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA (<http://www.ansi.org/>).

ISO/IEC 8824-3:1998, Information technology—Abstract Syntax Notation One (ASN.1): Constraint specification.

ISO/IEC 8824-4:1998, Information technology—Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.

IEEE Std 1488-2000, IEEE Trial-Use Standard for Message Set Template for Intelligent Transportation Systems.³

IEEE Std 1489-1999, IEEE Standard for Data Dictionaries for Intelligent Transportation Systems.

ITE TMDD, Standards for Functional Level Traffic Management Data Dictionary (TMDD), Standard No. TM1.01.⁴

ITE.TCIP, Transit Communications Interface Profiles—Standard on Incident Management Objects. Recommended Standard Version 1.0, ST-ITS-IM, February 20, 1998.

NENA-04-002, Issue 1, PSAP Master Clock Standard, prepared by NENA PSAP Standards Sub-Committee, January 28, 1996.⁵

SAE J2313 (Sept. 1999), Surface Vehicle Standard, On-Board Vehicle Mayday Reporting Interface.⁶

SAE J2374 (July 1999), Location Referencing Message Specification.

3. Terms and definitions

For the purposes of this standard, the following terms and definitions apply. If not defined in this clause, English words are used in accordance with their definitions in the latest edition of Webster's New Collegiate Dictionary [B19].⁷ Electrical and electronic terms not defined in this clause or in Webster's New Collegiate Dictionary [B19] are used in accordance with their definitions in the IEEE Standard Dictionary of Electrical and Electronics Terms [B3].

NOTE—The terms, abbreviations, and acronyms cited below will be a part of the terms of the other companion volumes of this standard unless specifically cited otherwise.

3.1 Definitions

3.1.1 asset: A piece of equipment used for incident management. Examples include vehicles, traffic control equipment, and closed-circuit television cameras. It is a narrower term than *resource* in that it does not include teams of response personnel.

3.1.2 advanced traffic management system (ATMS): The hardware and software decision support system that provides the traffic management center its operational functionality. An ATMS system typically

³IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, USA (<http://standards.ieee.org/>).

⁴Institute of Transportation Engineers (ITE) publications are available on the World Wide Web at the following ftp site: <http://www.ite.org/standards/index.html>.

⁵National Emergency Number Association (NENA) publications are available on the World Wide Web at the following ftp site: <http://www.nena9-1-1.org/Committee/Standards.htm>.

⁶SAE publications are available from the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096, USA (<http://www.sae.org/>).

⁷The numbers in brackets correspond to those of the bibliography in Annex A.

manages field devices, collects multiple formats and types of data, generates automated response plans and manages the dissemination of information to interested parties. In a local Intelligent Transportation System (ITS) network environment, the ATMS is an intelligent node and often is the central node for ITS functions.

3.1.3 application profile-common object request broker architecture (AP-CORBA): One of two communications protocols identified by the National Transportation Communications for ITS Protocol (NTCIP) Center-to-Center Working Group as an Intelligent Transportation System (ITS) standard protocol, sometimes more completely referred to as NTCIP AP-CORBA. The other protocol is Application Profile-Data Exchange-ASN.1 (AP-DATEX-ASN).

3.1.4 application profile-data exchange-ASN.1 (AP-DATEX-ASN): One of two communications protocols identified by the National Transportation Communications for ITS Protocol (NTCIP) Center-to-Center Working Group as an intelligent transportation system (ITS) standard protocol, sometimes more completely referred to as NTCIP AP-DATEX-ASN. The other protocol is NTCIP Application Profile-Common Object Request Broker Architecture (NTCIP AP-CORBA).

3.1.5 center: Any point of communication used in the control of resources. Centers can communicate with one another and each have various rights to data access with each other. Centers cross boundaries of infrastructure ownership, response duties, jurisdictional responsibility, etc., in various ways.

NOTE—Facilitating the exchange of messages among centers for coordinating incident management (IM) is the primary task of this standard.

3.1.6 command post: The location where the primary command functions are executed. Designated area at the incident scene that functions as the centralized point for multi-agency coordination, on-scene communication, command and control of resources, and information gathering. The command post may be co-located with the incident base or other incident facilities.

3.1.7 data concepts: Any of a group of data dictionary structures defined by IEEE Std 1489-1999⁸ (e.g., data element, data element concept, entity type, property, value domain, and generic property domain) referring to abstraction or things in the natural world that can be identified with explicit boundaries and meaning, and whose properties and behavior all follow the same rules.

3.1.8 data dictionary: A collection of descriptions and definitions for documenting, storing and retrieving the syntactical form (i.e., representational form) and some semantics of data elements (DEs).

NOTE—Refer to IEEE Std 1489-1999.

3.1.9 data element (DE): A syntactically formal representation of some single unit of information of interest (such as a fact, proposition, observation, etc.) with a singular instance value at any point in time, about some entity of interest (e.g., a person, place, process, property, object, concept, association, state, event). A DE is considered indivisible in a certain context.

3.1.10 data frame (DF): A grouping of data elements (DEs) primarily for the purpose of referring to the group with a single name, and thereby efficiently reusing groups of DEs that commonly appear together (as an ASN.1 sequence, sequence of, set, set of, or choice) in a message body specification. This data concept type may, however, be used to specify groups of DEs for other purposes as well.

3.1.11 dispatch: The operation of asking an agency to perform a specified role concerning a specified incident. In some cases, but not all, the operation includes receiving acknowledgment that that role will be performed.

⁸Information on references can be found in Clause 2.

3.1.12 event: A term covering any of three kinds of events: transportation-related incidents, planned roadway closures, and special events. The term covers any event of the three, including information about which is received by an incident management system, whether or not the event actually affects traffic flow, or whether or not it requires a response.

3.1.13 external message: A message comprised of data elements (DEs) that is imported into a standard by reference to another standard where it is precisely defined.

NOTE—See 4.1.

3.1.14 hand off: The operation of asking a secondary dispatcher or other center to take over a specified management role at a specified incident. In some local implementations, but not all, a hand off includes receiving acknowledgment that that role will be performed.

3.1.15 hazardous material (HAZMAT): A substance or material, which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. The term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials as defined in this section, materials designated as hazardous under the provisions of section 171.101 of this subchapter, and materials that meet the defining criteria for hazard classes and divisions in part of 173 of this subchapter. (This US Department of Transportation definition of hazardous material is found in Title 49, code of Federal Regulations, Section 171.8) [B1].

3.1.16 header: A particular data frame (DF) that is included in every message specified in this standard. It conveys identification information about the incident in question. It uses three data elements (DEs) to provide a means for unambiguous identification of the incident, even among centers that are each identifying the incident in a different way.

3.1.17 incident: Events that are not planned roadway closures or special events, i.e., events about which there is no advance notice, such as emergencies, accidents, disasters caused by humans, and natural disasters.

3.1.18 incident command post (ICP): A (temporary) command site established at or near the scene of the incident where the ranking on-scene authority operates from and establishes local control of assets and resources assigned to the incident. In some jurisdictions, the ICP can function as a dispatch center for a period of time and issue and receive messages as a peer with other centers. In other (and most) environments, the ICP receives messages through an intelligent transportation system (ITS) agency dispatch center and is, therefore, not directly visible to the messages of this standard. Visible or not, the ICP forms a primary collection and dissemination point for information regarding the incident itself. Therefore, re-use of common message formats is desirable.

3.1.19 instance: An individual occurrence of a data element (DE), such as a value. When a DE is used and assigned a value (from its value domain), an instance of that DE is obtained.

3.1.20 issuing authority: (A) The standards development organization (SDO) that is in control of maintaining a given standard which contains a data element (DE) or message cited in this standard for reuse when referring to the messages and DEs used in this standard. Implementers must coordinate (ideally by way of a registry process) to ensure that they are aware of any changes made by the owner (issuing authority) of such a DE. There are a great number of such borrowed DEs in this standard. Implementers are advised to consider local methods to ensure that its DEs remain consistent and current as time passes. (B) Identification of the issuing center of a message (typically an IDX message).

3.1.21 issuing center: The center that has issued or sent the message under consideration. *Syn:* sending center.

3.1.22 lead center: The center with apparent authority over other centers in the case of a specific type of incident. In some communities, lead center determination varies based on the type of incident, the location, or other criteria. In other communities this is never fully resolved.

3.1.23 Mayday: Generic term in the context of the intelligent transportation system (ITS) community that refers to some type of automated vehicle alert system wherein equipment on the vehicle connects with a dispatching center (i.e., private or public 911) after an incident in which it was involved (although manual activation is also possible). Originally from the World War I French phrase “M’aidez” lit, “help me.” In this document, the term is used in mixed case to increase readability. Mayday systems are becoming increasingly popular in new vehicles.

3.1.24 message: A grouping of data elements (DEs) and message attributes, used to convey information.

NOTE—For the purposes of this standard, a message is an abstract description using a message set template, not a specific instance. See IEEE Std 1488-2000 and IEEE Std 1489-1999.

3.1.25 message set: A collection of messages based upon the Intelligent Transportation System (ITS) class names.

3.1.26 participating center: *See: using center.*

3.1.27 preverification: The period of time in the life of an incident when it has been detected but not yet verified. Reports of an incident can originate from the Emergency Telephone System, Mayday systems, the transportation management center (TMC), and other Emergency Management Subsystems. In the preverification phase, before an incident is verified by the Emergency Management Systems (EMS), it is to be treated as simply one or more reports. A key feature of verification, especially in the transportation context, is that often a single incident is reported through a number of reports, often 911 calls. It takes a deliberate verification effort to recognize that a number of 911 calls all refer to the same incident. *See also: verification.*

3.1.28 priority: A condition where the approaching vehicle is given a priority in the signal timing algorithms of the transportation signal ahead, adjusting the normal cycles of the controller. Typically, this results in holding the green cycle longer so that the priority vehicle may pass, or a cycle preemption if an emergency vehicle is involved.

3.1.29 profile: The term used in the location reference message set (LRMS) work to refer to one of numerous ways to express location. Each of the methods is further divided into a number of submessage types, which specify, at the bit level, what the data frames (DFs) are composed of. These profiles were developed to fulfill specific user needs by location for each intelligent transportation system (ITS) application community.

3.1.30 receiving center: The center that has received the message under consideration.

3.1.31 resource: A piece of equipment or teams of response personnel used for incident management. Examples include vehicles, traffic control equipment, closed-circuit televisions (CCTVs), and hazardous material (HAZMAT) cleanup teams. It is a broader term than *asset* in that it includes teams of response personnel.

3.1.32 response: Any action or combination of actions to reduce the impacts an incident.

3.1.33 response team: A specialized inter-disciplinary group of individuals established to provide technical support and response at major roadway incidents.

3.1.34 scene management: The part of incident management that deals with coordination of responding agencies, the supervision of on-scene personnel, and the application of traffic management strategies.

3.1.35 sending center: *See:* **issuing center.**

3.1.36 service provider: An intelligent transportation system (ITS) term for any entity that provides some service.

NOTE—For further context regarding Mayday within the National ITS Architecture, please refer to SAE J2313.

3.1.37 traffic management center (TMC): A state or local government operations center responsible for the monitoring and controlling of field sensors, motorist information devices, and the processing of real-time sensor and incident data; the execution of timely and accurate incident response actions; the archiving of historical traffic data; and the dissemination of incident-related information to coordinating agencies and to the general public. In some communities a TMC is called a transportation management center or otherwise is known as a traffic operations center (TOC) or a traffic control center (TCC).

3.1.38 using center: A center that is using a message or using a specific resource (and that may or may not own or command that resource). *Syn:* **participating center.**

3.1.38.1 value domain: An expression of specific and explicit representational values of some information about something of interest within the intelligent transportation system (ITS) domain.

3.1.39 verification: The operation of establishing that a detection indication (e.g., detection, call to 911) or a set of indications is one incident. Verification can involve anything from simply declaring that a report describes an incident, to dispatching a police officer to the site to determine if it is in fact an incident. The particular process of verification is left to the individual application. In terms of the messaging specified in this standard, verification may involve taking several incident description (IDX) messages and combining them into a single IDX using a merge incident event (MIE) message.

3.2 Abbreviations and acronyms

AHO	available for hand off
ALERT™	Advanced Law Enforcement Response Technology
ASN.1	abstract syntax notation one
ATIS	advanced traveler information system
CAD	computer-ided dispatch
CCP	change center properties
CCTV	closed-circuit television
CIE	close incident event
DCO	disable center on-line
DE	data element
DF	data frame
E911	enhanced 911
ECO	establish center on-line
ECP	establish center properties
GHO	grant hand off
GPS	global positioning system
HAZMAT	hazardous material
ID	identification
IDX	incident description
IM	incident management
ISP	information service provider

ITS	intelligent transportation system
LAN	local area network
LRMS	location reference message set
MIE	merge incident event
NIE	new incident event
NTCIP	National Transportation Communications for ITS Protocol
PHO	poll for hand off
PID	public incident description
PSAP	public safety answering point
RF	radio frequency
RHO	request hand off
RIN	request information
RMS	records management systems
RUI	request unverified incidents
RVI	request verified incidents
SDO	standards development organization
SIE	split incident event
TCC	traffic control center
TCIP	transit communications interface profiles
TMC	traffic management center
T added	traffic management data dictionary
TOC	traffic operations center
VIN	vehicle identification number

4. Structure of the standard

This clause describes how the remaining clauses present the DEs and message elements of the standard, the syntax used in those clauses to describe those DEs and message elements, the conditions of conformance to the standard, and the relationship of this standard to other standards in the IEEE 1512 companion volumes and related standards.

- Subclause 4.1 introduces a methodology and syntax notation used to refer to other messages and DEs in other standards that are referenced in this family of standards.
- Subclause 4.3 outlines what content is contained in the companion volumes and explains in greater detail the concept of volumes for each type of center.
- Clause 5 provides the precise message structures and usage of each message in turn, and defines the elements that make up each message. It provides a modest taxonomy of related message families to introduce the reader to the conceptual grouping of the messages. Based on this formal description, it becomes straightforward to add local message definitions and any supporting DEs and data frames (DFs) needed to handle unique requirements. This is done in each companion volume to focus on the needs of that specific center type. The precise message definitions that result are at times incomplete in that they presume that additional DEs will be provided in the companion volumes. The definitions that are provided are used by every center. For DEs appearing in Clause 5 that are adopted from other functional areas, their source names and standards are referenced directly in Clause 5. A brief explanation of how to read the ASN.1:1997 code used in this clause follows below.
- Clause 6 provides the definition and usage guidelines of those DEs and DFs defined by this standard. Where those DFs include DEs defined by other functional areas, their source names and standards are cited. Implementers shall refer to the cited source standard in each case, which is the definitive issuing authority.

The implementation guide for this standard will outline a number of key concepts and provide implementation advice. It describes additional, useful messages that are not part of this standard to provide a more complete understanding of an implemented message set. It also contains example scenarios that show the message set in operation and is, therefore, useful in understanding how the messages interoperate to effect center-to-center communication.

4.1 Syntax used in the standard

The messages in this standard are defined in accordance with ASN.1:1997, an internationally recognized method for defining message structures independent of the computer languages and transmission encoding rules used in implementation. The ITS community (here composed of both the ANSI community of standards development organizations [SDOs] and the U.S. Federal Government in its position as a treaty member of international standards bodies) has adopted this method for use across the various domains of ITS implementation. This standard makes extensive use of comments to specify a variety of other message elements incorporated by reference into the messages of this standard. Because all of the cited references are not available in an ASN.1 format, it is problematic to include them directly. Therefore, a consistent naming structure and a series of comments to refer to the incorporated message elements in question have been used. A number of standards that claim to be ASN.1:1997 compliant use the underscore character “_” in the message names. In such cases, this standard replaces the underscore character with a dash “-”.

For DEs incorporated by reference into the messages of this standard, the specific DE in the specific source document can be found by referring to the path specified in the bracketed area found in a comment line of the source code. A path approach with an abbreviated name of each source document (established in Clause 2) has been used in conjunction with an unambiguous set of names to refer to the final DE itself. The period character “.” is used to delimit between the taxonomy of names leading to the element.

An additional DE identifier is provided for reference in this standard where available. In the adjacent comments, any additional information is provided that is needed. When the incorporation by reference is to an external message, as opposed to an external DE, it is designated by the colon character “:” used to delimit among the taxonomy of names leading to the message. The path is specified in brackets in a comment line.

DEs specified in this standard (as opposed to those incorporated by reference) are composed of atomic types with generally self-explanatory names such as INTEGER or ENUMERATED (a numbered list of names) or BIT STRING (a logical bit field). The keyword IA5String is the ASN.1 term for an ASCII string; the range of possible lengths is appended. Like most programming languages, new types can be defined from previously defined DFs and given a unique name after which objects of this type can be instantiated into the specification with their own name. An example is the ‘Header’ which is the complex object (defined in detail in Clause 6 and used in message definitions in Clause 5). In the previous example, the specific instance of the ‘Header’ DF is named ‘Header.’ For a more complete discussion of the ASN.1 syntax, consult Clause 2.

4.2 Conformance with the standard

Conforming systems shall receive, process, and transmit all messages specified in this standard, and all DFs and DEs specified in this standard. Conforming systems shall be able to receive, process, and transmit all DFs and DEs specified in this standard that are explicitly described as “OPTIONAL.” The use of the word “OPTIONAL” is in the context of ASN.1 syntax.

This standard is specified using ASN.1:1997 syntax, independent of the underlying communication protocols.

In cases where a conflict exists between the textual description of a message and the ASN.1 syntax of the message, the ASN.1 syntax shall take precedence.

4.3 Relationship with the companion volumes

This base standard sets requirements for all emergency management centers. As Figure 1 indicates, other companion volumes extend the message functionality with additional content and operating requirements as needed. This does not eliminate the need for local agreements and further profiling of the resulting message sets. Rather, it provides implementation insights and requirements that any center of a specific type must follow to remain interoperable with other centers.

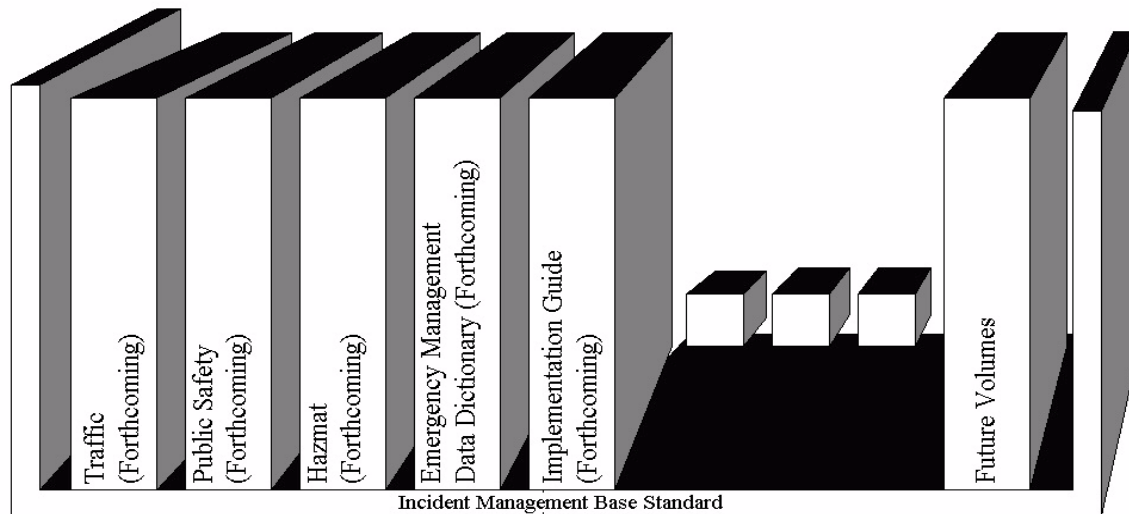


Figure 1 — Concept of related companion volumes for IEEE Std 1512-2000

A related area of interest is the protocol under which the community of centers communicates. Within ITS, there is a standard-making activity referred to as the National Transportation Communications for ITS Protocol (NTCIP) “Center-to-Center” Working Group. That group has defined two distinct protocols for exchanging these messages: NTCIP 2502 [B13] and NTCIP 2501 [B14]. Other approaches could also be defined, but different centers must agree to use the same mechanism if they wish to interoperate. Conceptually, that protocol work fits “below” or “closer to the metal” than the center-to-center end-application message definitions for incident management, which is the subject of this standard. Use of the NTCIP methods is likely to gain wide acceptance among ITS centers. However, there are a wide variety of legacy public safety center computer-aided dispatch (CAD) systems that do not have any awareness of the NTCIP center-to-center efforts and who have little compulsion to adhere to them. Therefore, this standard remains neutral in this specific area to encompass the widest possible accommodation of legacy systems.

The subsequent companion volumes will contain different levels of detail and message content depending on which of three types of centers (i.e., traffic, public safety, or HAZMAT) is involved. The first type of center already has a community forum and has made progress in developing similar standards of its own. In that case, the companion volume will, in general, make use of that prior work (adopting it, referencing it) rather than replicating it.

The ideal case of this first type of center participates in the ITS traffic management community, which is in the process of developing a wide set of encompassing message sets and data dictionary standards related to this standard. Due to the availability of draft versions of the data dictionary, many of the objectives of IEEE Std 1512-2000, when applied specifically to TMCs, were met by including the TMC standards by reference. A TMC (unlike many other types of centers) often shares data with other centers, which stimulated the development of a rich set of pre-existing messages. Incident description (IDX) (the principal information exchanging message) was designed to reuse many of these messages.

An example of the second type of center would be a public safety center, such as where fire dispatch would be located. Larger operations are typically supported by CAD and records management systems (RMS), which tightly integrate these centers with other internal nodes (stations, apparatus, and support and administrative locations). Integration between different systems is much rarer and much more difficult to achieve. While there are established and standardized information exchange practices dealing with external systems, most are concerned with after-the-fact reporting of various types of incident information to higher echelons. The breadth of the collective scope of all of these systems greatly exceeds that of the TMC, as public safety deals not only with the highway and traffic, but also much more formally with persons, places, and things. Some of this subject matter is reusable in ITS. As a result of these factors, the IDX information to be found in the public safety volume may be both larger (more diverse) than the TMC volume, and suitable for inclusion in this volume.

Finally, there is a third general type of center—a HAZMAT center. HAZMAT centers usually operate on a much narrower scope than traffic or public safety centers, and participate from a remote location in a consultative mode.⁹ Voice coordination procedures are well understood and commonly practiced, however, automated HAZMAT information exchange would be new to the community.

This base standard contains some messaging for managing centers on- and off-line (changing operational status) and for coordination of incident numbering. Those features can be used in a local implementation to define a lead agency for any incident, according to practices agreed upon in that local implementation. These message sets are not further profiled in the companion volumes since all centers use them in a similar way.

In summary, each companion volume will include detailed IDX message formats unique to the needs or data content of the centers covered by that volume. If those centers have a prior reference work that can be used and cited, then the companion volume will do so and tailor the messages with further information. If no suitable prior reference work or message sets exist about the community using the message formats, then the companion volume will establish messages as required to fulfill the unique messaging needs of that community in such a way that it will remain interoperable with other centers covered by the other companion volumes of this standard.

4.4 Message structures

In some embodiments, it is useful to enclose the incident management (IM) messages in a wrapper comprised of a “CHOICE” statement in ASN.1:1997. This provides benefits to some users (and is superfluous to others) depending on the underlying communications methods employed by a center. The structure of this IM message is provided in the example message below.

Format:

— Enclosing Message

```
Im-PRIME ::= CHOICE {
    a Im-IDX,
    b Im-PID,
    c Im-RIN,
    d Im-NIE,
    e Im-SIE,
    f Im-MIE,
    g Im-CIE,
```

⁹The primary centers are listed inside the back cover of the North American Emergency Response Guide, and include CHEMTREC and CHEM_TEL (for U.S. HAZMAT incidents). Serving as large information repositories, HAZMAT centers can provide detailed information on demand regarding characteristics of hazardous materials, public hazards, response guidelines, and manufacturer and shipper information [B12].

```

h Im-PHO,
i Im-AHO,
j Im-RHO,
k Im-GHO,
l Im-RVI,
m Im-RUI,
n Im-ECO,
o Im-DCO,
p Im-ECP,
q Im-CCP,
r Im-RCP,
...
}

```

5. Incident management message sets

IM message sets shall consist of the following basic message sets: status message set, IM message set, and center management message set, as shown in Figure 2. Each set shall be further divided into specific messages as defined in this clause. Typically, these messages shall be made up of message content internal to this document (made up of DEs that are either atomic or complex) and message content external to this document (from other functional areas and companion volumes).

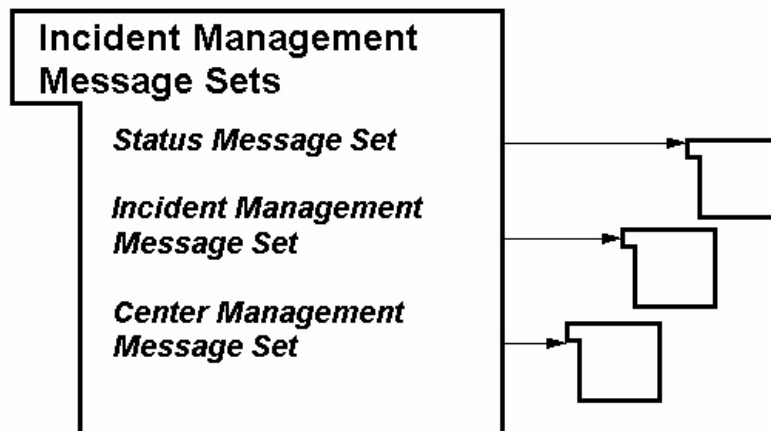


Figure 2—Incident management message sets