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

IEEE Standards Coordinating Committee 32

Sponsored by the
IEEE Standards Coordinating Committee 32 on
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Approved 20 March 2003

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The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

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Abstract: The exchange of vital traffic management data and data to support traffic management decisions, between the Traffic Management Center and other agencies involved in transportation-related events, through common incident management message sets, is addressed in this standard. Those events include incidents, emergencies, accidents, planned roadway closures, special events and disasters caused by humans or natural events. Those events include any such event that impacts transportation systems, or that causes a report to be received by an emergency management system, whether or not the event actually affects a transportation system, and whether or not a response is required. Message sets specified are consistent with the National Intelligent Transportation Systems Architecture and are described using Abstract Syntax Notation One (ASN.1) syntax. This standard comprises one companion volume of the family of incident management standards centered around a base standard: IEEE Std 1512™-2000, IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers. Other members of that family include a companion volume specifying incident management message sets for cargo, contents, and hazardous materials (IEEE Std 1512.3™-2002), and a forthcoming companion volume specifying message sets for public safety (IEEE P1512.2). Collectively, that family of standards shall be referred to as the “IEEE 1512 family of standards.” The goal of that family of standards is to support efficient communication for the real-time, interagency management of transportation-related events.

Keywords: 911, ASN.1, ATMS, CAD, center-to-center, commercial vehicles, data exchange, EMC, emergency services, emergency response, EMS, Hazmat, incidents, incident response, incident management, incident management system, intelligent transportation systems, message sets, public safety, traffic incidents, traffic incident management, traffic management, TMC, and transportation system management

Introduction

[This introduction is not part of IEEE Std 1512.1-2003, IEEE Standard For Traffic Incident Management Message Sets for Use by Emergency Management Centers.]

The Incident Management Working Group was formed from a cross-section of Intelligent Transportation Systems (ITS) and incident management (IM) practitioners in 1997 to address the problems and concerns of dispatching traffic management centers interacting with each other and other agencies involved in the resolution of (primarily) roadway services disruptions (and certain other events on the highway)—generically referred to as incidents. The primary objective of this Working Group is to advance the greater coordination of these centers and their cross servicing over various jurisdictional boundaries.

This document is one of several related standards in this area and deals primarily with the communication of vital traffic management data and data to support traffic management decisions. It is a companion volume to a base standard: IEEE Std 1512™-2000, IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers. Other categories of communication, having to do with public safety, and cargo, contents, and hazardous materials, are or will be addressed in other companion volumes generated by the Working Group. The base standard, this volume, and other companion volumes together comprise what shall be known as the IEEE 1512 family of standards.

IEEE Std 1512-2000 includes more general introductory material for the IEEE 1512 family of standards, including the other companion volumes and the relationship between the family of standards, other ITS standards, and the National ITS Architecture. That material will not be repeated here. Rather, the remainder of this introduction will present a statement of the problem this standard is to address, and its goal.

Problem statement

In the course of a transportation-related event, information on traffic flows, infrastructure damage, traffic control assets, and management plans for traffic, evacuation, and infrastructure, all can figure importantly in managing the incident. That wide variety of information needs to be exchanged between the traffic management center (TMC) and the several other agencies involved in managing the incident. Yet in the course of an incident, that information may be complex, disorganized, spatially scattered, and partial. So incident management should be supported where possible by distributing and managing that information.

To restate the problem in decision-support terms: often, there are large gaps between the available information and what the incident commander and involved agencies need to know in order to best manage the incident with regard to traffic, infrastructure, and assets. In the ITS world, those gaps will often be able to be spanned by exchanges of information of five kinds:

- 1) Traffic-related information: collected from those other agencies for collation and analysis to support the second exchange.
- 2) Current and predicted traffic conditions: made available to the many agencies that may be involved in the incident—in particular, route information for routing traffic and response vehicles.
- 3) The need for cleanup, repair and replacement of damaged infrastructure: to support responses to carry out that cleanup, repair, and replacement.
- 4) Plans for traffic management, evacuation management and infrastructure cleanup, repair and replacement.
- 5) Asset management information: to coordinate traffic control assets between agencies.

That presents us with the basis for stating the goal of this companion volume as follows.

Goal of this companion volume

Supporting the incident commander and involved agencies with all available information concerning traffic, infrastructure, and traffic control assets will require that the TMC collect data from several agencies and its own resources, analyze that data, then disseminate plans and management information back out to perhaps several different agencies. Managing the operational complexities of collecting the data, collating and analyzing it, then disseminating the results as necessary, is a task for the local implementation. The goal of this companion volume is to provide the framework for communication among the TMC and other agencies, to provide a flexible basis for that complex decision support process.

In more detail, the purpose of this standard is to support the communication necessary to take the directly observable and sensor information concerning traffic and infrastructure, exchange that information among the data collecting agencies and the TMC, then exchange the results of the analysis of that information and corresponding traffic management, evacuation management, and infrastructure plans back out the several involved agencies, to best support the incident commander and the involved agencies in managing the event. That calls for messages to communicate whatever information is available, often quite partial, among the involved agencies, to accomplish four decision-support functions, corresponding, though not one-to-one, to the five kinds of information exchange listed previously in the problem statement:

- *Function 1:* To disseminate information about current and future traffic flows in the transportation grid, including in particular impacts of an incident and particular route information, to assist in the real-time interagency management of a transportation-related incident or event.
- *Function 2:* To support the management of traffic to assist in the real-time interagency management of a transportation-related incident or event, including establishing reverse links and the use of priority/preemption technologies.
- *Function 3:* To support the management of TMC assets and other assets, as necessary to manage traffic, to assist in the real-time interagency management of a transportation-related incident or event.
- *Function 4:* To support the cleanup, repair, and replacement of damaged infrastructure, treating that operation as part of another incident, or as a separate incident itself.

Companion volumes

This document provides information on additional messages, data frames, and data elements beyond those appearing in the base standard (IEEE Std 1512-2000). In order to make full use of this information, the base standards and other references to ITS and industry standards may also need to be employed. Particularly in the area of message set reuse where the contents of various elements have been taken from well-established practices both within and outside that of the ITS and transportation industries.

The standard and use with data registries

The standard was developed in conjunction with entries made into the ITS data registry. The following information may be useful to persons wishing to track the data structures described in this standard with those entries or in other similar registries.

In each of the data structures found in Clause 5 through Clause 7 of this standard, the following metadata fields are used and are equivalent to the named fields in the ITS registry. The mapping between these fields is as follows. The specific clause numbering and name of an entry is also the DESCRIPTIVE NAME of that entry in the registry (the part which follows after the “:” is the name used). The one or more paragraphs that then follow, headed “Use,” forms the DESCRIPTION entry. The final one or more paragraphs, headed “Remarks,” forms the REMARKS entry. The section headed “Used by,” contains linkages to other data structures that in turn refer to this one. In the ITS registry the fields RELATED DATA CONCEPT and RELATIONSHIP TYPE may be used to convey this information along with other relationships. The section

headed by “ASN.1 Representation,” contains all the ASN.1 defining code. In the ITS registry this information is broken up among the fields: ASN.1 NAME, DATA TYPE, VALID VALUE RULE, and BODY. The ASN.1 NAME contains the formal ASN.1 Type Definition name of the object. The DATA TYPE contains the base type from which it is defined. The VALID VALUE RULE, or the BODY, then contains the various constraints, declared constants, enumerations values, and comments of the rest of the definition. In the case of data element entries, this information is found in the VALID VALUE RULE, while in the case of data frames and messages, this information is placed into the BODY field.

Other fields used in the ITS registry (such as UNITS or FORMULA) are typically not provided with content from this standard, or are self evident and constant in nature. The SOURCE field is an example of this, and its value for all entries from this standard is IEEE Std 1512.1-2003.

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The IEEE 1512 family of standards is dedicated to the memory of those who lost their lives responding to the tragic events of September 11, 2001. The Working Group honors the men and women who continue to maintain vigilance in protecting freedom and security. It is our hope and expectation that these standards will enhance multi-jurisdictional communications.

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

1. Overview

This standard provides a framework for exchange of data in message sets for use by centers involved in transportation-related incident management, specific to traffic management communications, in particular, for exchanges of data between a traffic management center (TMC) and other involved agencies.

This standard supplements IEEE Std 1512TM-2000¹, henceforth called the “base standard” for the family of incident management message sets. The overview, scope, and purpose of IEEE Std 1512-2000 will not be repeated in this standard.

In the course of managing many transportation-related incidents, there is a need for distributing and managing the often complex and partial information about the traffic flows, infrastructure, and traffic management assets involved in an incident. Often there are large gaps between the available information and what the incident commander and other involved agencies need to know in order to best manage the incident with regard to traffic management and infrastructure. In the intelligent transportation systems (ITS) world, those gaps will often be able to be spanned by exchanges of information of five kinds:

- a) Traffic-related information: collected from those other agencies for collation and analysis to support the second exchange.
- b) Current and predicted traffic conditions: made available to the many agencies that may be involved in the incident—in particular, route information for routing traffic and response vehicles.
- c) The need for cleanup, repair, and replacement of damaged infrastructure: to support responses to carry out that cleanup, repair, and replacement.
- d) Plans for traffic management, evacuation management and infrastructure cleanup, repair, and replacement.
- e) Asset management information: to coordinate traffic control assets between agencies.

Managing the operational complexities of collecting the data, collating and analyzing it, then disseminating the results as necessary, is a task for the local implementation. The task for this standard is to provide the framework for communication among the TMC and other agencies to provide a flexible basis for the five types of information exchange listed here.

1.1 Scope

This standard is a companion volume for IEEE Std 1512-2000, referred to here as the “base standard.” This standard specifies messages, data frames, and data elements for communicating information about traffic and infrastructure management in support of real-time interagency transportation-related incident management. The base standard specifies messages, data frames, and data elements to describe an incident and form the message infrastructure for communication involved in real-time interagency transportation-related incident management. Refer to the base standard for specification of the scope of the combination of the base standard and companion volumes such as this one. Together, the base standard and companion volumes shall be referred to as the “IEEE 1512 family of standards.”

¹Information on references can be found in Clause 2.

1.2 Purpose

This standard is part of the IEEE 1512 family of standards. The purpose of that family of standards as a whole is presented in the base standard, and will not be repeated here.

The purpose of this standard is to take the real-world, available-information situation confronting the incident commander and the several involved agencies, then support the exchange of that information among agencies, to make further information available to the incident commander and involved agencies, to best support them in managing the event. That calls for messages to communicate whatever information is available, often quite partial, among the several involved agencies, to accomplish four decision-support functions, corresponding to the five kinds of information exchange listed earlier in this clause:

- *Function 1:* To disseminate information about current and future traffic flows in the transportation grid, including in particular impacts of an incident and particular route information, to assist in the real-time interagency management of a transportation-related incident or event.
- *Function 2:* To support the management of traffic to assist in the real-time interagency management of a transportation-related incident or event, including establishing reverse links and the use of priority/preemption technologies.
- *Function 3:* To support the management of TMC assets and other assets, as necessary to manage traffic, to assist in the real-time interagency management of a transportation-related incident or event.
- *Function 4:* To support the cleanup, repair, and replacement of damaged infrastructure, treating that operation as part of another incident, or as a separate incident itself.

2. References

The following documents shall be used, when applicable, in the process of populating and developing the message sets of this standard. The specific revision and issued date stated below shall be used for each document. When the following documents are superseded by an approved revision, the revised version shall be reviewed for applicability.

The references cited below shall be included in the references of the other companion volumes of this standard unless specifically excepted.

IEEE Std 1488TM-2000, IEEE Trial-Use Standard for Message Set Template for Intelligent Transportation Systems.^{2, 3}

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

IEEE Std 1512-2000, IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers.

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

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

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.

ITE TCIP-IM, Transit Communications Interface Profiles—Standard on Incident Management Objects, NTCIP 1402v01.02, December 2000.⁵

ITE TMDD, Standard for Functional Level Traffic Management Data Dictionary (TMDD), Standard TM1.03, Amendment 1, March 2001.

SAE J2313, On-Board Land Vehicle Mayday Reporting Interface, September 1999.⁶

SAE J2353, Data Dictionary For Advanced Traveler Information Systems (ATIS), October 1999.

SAE J2354, Message Sets for Advanced Traveler Information System (ATIS), November 1999.

SAE J2369, Standards for ATIS Message Sets Delivered Over Reduced Bandwidth Media, March 2000.

SAE J2540, Messages for Handling Strings and Look-Up Tables in ATIS Standards, July 2002.

SAE J2540-1, RDS Phrase Lists, July 2002.

SAE J2540-2, ITIS Phrase Lists (International Traveler Information Systems), February 2002.

SAE J2540-3, National Names Phrase List, January 2002.

SAE J2630, Converting ATIS Message Standards From ASN.1 To XML, Draft of July 2002.⁷

Other documents defined in IEEE Std 1512-2000 remain as cited and are included herein by reference.

3. Definitions, acronyms, and abbreviations

For the purposes of this IEEE 1512 family of standards, the following definitions, abbreviations, and acronyms apply. *The Authoritative Dictionary of IEEE Standards Terms* [B3]⁸ should be referenced for terms not defined in this clause. If the terms do not exist in *The Authoritative Dictionary of IEEE Standards Terms*, consult the latest edition of *Merriam-Webster's Collegiate® Dictionary* [B6].

The terms, abbreviations and acronyms cited in this clause shall be a part of the terms of the other companion volumes of this standard unless specifically cited otherwise.

⁵ITE Standards are available from the Institute of Transportation Engineers, 1099 14th Street NW, Suite 300 West, Washington, DC 20005-3438, USA (<http://www.ite.org/standards/index.html>).

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

⁷As this standard goes to press, SAE J2630 is not yet published. The draft standard is, however, available from the IEEE. Contact the IEEE Standards Department at +1 732 562 3800 for status information.

⁸The numbers in brackets correspond to those of the bibliography in Annex D.

3.1 Definitions

3.1.1 911 or 9-1-1: Pronounced “nine-one-one,” not “nine-eleven.” A telephone number providing access to a public safety access point (PSAP).

3.1.2 advanced traveler information systems (ATIS): In the context of this standard, one of the major message sets of intelligent transportation systems (ITS) which contains a number of message structures used to convey information to the public at large. This standard makes reuse of portions of this work. It is available, in several volumes, from the Society of Automotive Engineers (SAE).

3.1.3 agency data: In the context of this standard, any data which are created by the center or its assets or come under the control of the center as per local data agreements and operating practices.

3.1.4 alternate route: A route identified to the driving public with signs, traffic routing devices, flaggers and/or media announcements as an optional alternative to a congested route. Distinguished from a diversion route, which is mandatory.

3.1.5 arrow board: A large board with lights that can be lit in patterns indicating a left arrow, right arrow (arrow panels are also required to be able to display this pattern of 4 dots; for a more complete description, see section 6F-53 of MUTCD [B7]), or arrows in both direction. Used to direct traffic. Refer to Figure 1.



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Figure 1—Example of an arrow board

3.1.6 asset: In the context of this standard, an asset is any entity that can be dispatched or designated to fulfill a traffic management and/or incident management role. An asset can be a vehicle and its associated team of people, a team of people without a vehicle, a mobile or a fixed piece of equipment, or an individual person (see physical asset). An asset can also be a data stream or data set, such as the video feed from a closed-circuit television (CCTV) camera, or a data file containing loop data (see data asset).

3.1.7 automatic incident detection: An algorithm, or set of algorithms, designed to automatically detect and alarm the onset of highway conditions that could indicate the presence of an incident. Algorithms typically use volumes and occupancies as triggering parameters. Algorithms must be carefully tuned to avoid excessive false alarm rates, while maintaining acceptable detection rates.

3.1.8 changeable message sign (CMS): A display device, either mobile or fixed, that can display text or graphics in a large format for reading by the driving public. The text or graphics can be changed by programming signals that are either local to the sign or transmitted to the sign from a remote controller. Other such signs include variable message sign (VMS) and dynamic message sign (DMS).

3.1.9 data asset: An asset (*see: asset*) that is in particular a data stream or data file, as opposed to a physical asset. Examples include the video feed from a closed-circuit television (CCTV) camera, and a data file containing loop data.

3.1.10 dedicated short range communications (DSRC): A communication systems developed for use between the roadside and vehicles and between vehicles while mobile used to communicate a wide variety of intelligent transportation systems (ITS) related information. Chief among these is message content dealing with “public safety” type messages. In this context public safety is meant to cover the sending of caution and alert messages to the traveling public about the transportation network (for example: bridge icing, construction zones, train present, ambulance ahead, route diversion, etc.). Towed variable message sign (VMS) type devices are envisioned to be equipped with the ability to send these message to allow for a rapid drag and drop deployment at incidents. Motorists are expected to acquire receiver devices from a need for toll tags as well as a desire to receive this and other data sources. Technically, the modulation is a variant of the IEEE 802.11a format in a band authorized by the Federal Communications Commission (FCC) at 5.9 GHz for this application (there is a nearby “uni” band for consumer use) and the message content is derived from the Society of Automotive Engineers-Advanced Traveler Information Systems (SAE-ATIS) message set. The original stimulus to send such messages, especially in the event of an incident, is the IEEE 1512 standard of messages. Often the “header” or IDX messages can be converted directly for such use (see subsequent clauses for further details). The capacity of this band is also shared with message such as commercial business transactions, toll tag exchanges, and traveler ATIS messages. Another band at 4.9 GHz is allocated as a tactical channel for use by responding public agencies and their designated vehicles. It is envisioned that responder vehicles such as a squad car will be equipment with a multi-band device capable of transmitting warnings to the public on one band, while engaged in tactical operational exchanges on another. Refer to IEEE P1512.2 [B4] for further information in this area.

3.1.11 diversion route: A route identified to the driving public with signs, traffic routing devices, flagger and/or media announcements as a mandatory alternative to a congested or closed route. Distinguished from an alternative route, which is optional.

3.1.12 dynamic message sign (DMS): *See: changeable message sign.*

3.1.13 E911: Enhanced 911, implying the additional functionality over “basic” 911 to take the calling number ID and map it to a database of physical location and owner of record. E911 technology is being extending in a number of ways (both mandated and voluntary) to cover the need to determine the position/location of wireless callers.

3.1.14 egress route: A route designated for leaving an incident site or any area associated with an incident, such as a staging area.

3.1.15 emergency medical service: A system represented by one or more agencies that provide mobile emergency medical care for incidents, including both ambulances and the system of hospitals and treatment centers to which an ambulance would transport an injured person.

3.1.16 evacuation: The operation of systematically removing the public from an area for reasons of their own safety. It can involve any form of direction, including media announcements, traffic management assets, and/or public safety assets. It can include actively transporting members of the public using public vehicles. It can include local evacuation of small areas immediately surrounding an incident, or larger areas.

3.1.17 evacuation plan: A plan for managing an evacuation. It can be written and/or transmitted and displayed by electronic means. It can be a plan generated in anticipation of an incident, or it can be a plan generated in the course of an incident.

3.1.18 evacuation route: One of possibly several routes used in carrying out an evacuation.

3.1.19 flagger: Public safety or traffic management personnel assigned to direct traffic with their presence, arm signals, or other devices such as signs or flares.

3.1.20 greenwave: A centrally-directed system for granting priority to an emergency vehicle that works by timing signal lights to form a special “pulse” of green lights propagating down a route such that a vehicle can travel within that pulse and traverse a grid more rapidly than it would without the greenwave. Can be designed to minimize disruption in the rest of the grid. Distinguished from changing signal light patterns to favor a route for all vehicles.

3.1.21 highway advisory radio (HAR): A radio announcement or a series of announcements to the public advising about traffic congestion, recommending alternative routes, and/or describing diversion routes. Typically HAR is implemented as a low power AM broadcast originating from equipment mounted near the roadside and consisting of short analog recordings cyclically repeated. It is typically accompanied by a sign board telling the public where to tune. A few locations use FM broadcast technology, and a few use FM data technology [Radio Data System (RDS) modulation] to send digital messages. It is envisioned that once dedicated short range communications (DSRC) begin to be deployed that they will offer encoding messages with much broader content and that such transmission points will be often found in conjunction with HAR and changeable message sign (CMS) technologies (as well as being mounted on mobile work zone equipment).

3.1.22 incident response: In the context of this standard, the response from public safety agencies to an incident. As distinguished from the response from traffic agencies. It can include a response to an incident that occurs at a planned road closure or special event.

3.1.23 incident response vehicle: A vehicle to assist in the mitigation and clearance of incidents. Incident response vehicles may be equipped with towing capability, automatic vehicle location, a sign board, a changeable message sign (CMS), other traffic control devices and/or mobile closed-circuit television (CCTV) equipment. Typically vehicles are held at strategic locations for a specific response action. These vehicles and their associated programs go by different names in different regions. *See also:* **service patrol vehicle**.

3.1.24 infrastructure: In the context of this standard, infrastructure is any fixed piece of transportation-related road or roadside equipment, or roadway. Examples include light poles, signs and guard rails.

3.1.25 infrastructure cleanup, repair, replacement plan: A plan to clean up, repair, or replace infrastructure, generated in response to identifying infrastructure in need of cleanup, repair, or replacement.

3.1.26 ingress route: A route designated for entering an incident site or any area associated with an incident, such as a staging area.

3.1.27 international traveler information system (ITIS): The term commonly associated with the standard for incident phrases developed by the Society of Automotive Engineers (SAE) Advanced Traveler Information Systems (ATIS) Committee in conjunction with ITE TMDD TM1.01.4 and other standards. This work contains a wide variety of standard phrases to describe incidents and is expected to be used throughout the intelligent transportation systems (ITS) industry. The codes found there can be used for sorting and classifying types of incident events, as well as creating uniform human readable phrases. In the capacity of classifying incident types, international traveler information system (ITIS) phrases are recommended for use in many areas. ITIS phrases can also be freely mixed with text and used to describe many incidents.

3.1.28 lane number: Number to identify lane. Numbered in each direction, with 1 at the median or the left-most lane if one-way in this standard. Note that this definition matches Transit Communications Interface Profiles (TCIP) and Traffic Management Data Dictionary (TMDD) usage but that some states do not follow this numbering.

3.1.29 lane percent blocked: A measure of link impedance defined as: 100 minus (current throughput as a percentage of unimpeded throughput), therefore 100 = completely blocked, 0 = completely unblocked (clear). Note that this definition matches Transit Communications Interface Profiles (TCIP) usage.

3.1.30 level of service: A standardized system of letters, A through F, defining the degree to which traffic flow matches unimpeded flow. “A” is completely unimpeded; “F” is completely impeded (“stop and go”).

3.1.31 micrometeorology: The meteorology of a small area. Used in particular for plume modeling for hazardous or visually-impeding plumes. Typically includes wind direction and speed, temperature, and relative humidity.

3.1.32 occupancy: The number of vehicles in a lane divided by the ability of that lane to carry vehicles.

3.1.33 physical asset: An asset (*see: asset*) that is physical as opposed to a data asset.

3.1.34 planned event: Any event that is planned in advance, as opposed to one precipitated by an unplanned event such as a roadway accident. In the context of this standard, a planned event can include either an event such as a sporting event, or a planned road closure.

3.1.35 preemption, preemption technology: A technology that forces a signal light to go green or stay green specifically in the direction of an emergency vehicle approaching an intersection. Distinguished from priority technology which changes the timing of lights in favor of a vehicle or set of vehicles, but only by increasing the priority for the direction and route of that vehicle or set of vehicles.

3.1.36 pre-planned event: *See: planned event.*

3.1.37 priority technology: A technology that changes the timing of signal lights in favor of a vehicle or set of vehicles, by increasing the priority for the direction and route of that vehicle or set of vehicles. Distinguished from preemption technology which forces a signal light to go green or stay green specifically in the direction of an emergency vehicle approaching an intersection.

3.1.38 private data: In the context of this standard, any data which an issuing or possessing center does not wish to share with others.

3.1.39 public data: In the context of this standard, any data suitable for release to the general public (which may not be the same as the local media or to other allied agencies inside the IEEE 1512 deployment or outside of it). This determination needs to be made in light of the data creator, the data owner, and the needs of other agencies on a local level. *See also: agency data and private data.*

3.1.40 public safety: In the context of this standard, the set of agencies that carry out incident response related to the safety of the involved persons, involved traffic, and the public surrounding an incident. Includes law enforcement, fire and rescue, and emergency medical agencies. Does not include transportation and purely traffic control agencies.

3.1.41 ramp meter system (RMS): A traffic control device that meters traffic on a freeway on-ramp according to a time-of-day or traffic-responsive algorithm. An RMS can be locally- or centrally-controlled. An RMS can be used to limit traffic upstream of an incident site as part of an incident response plan.

3.1.42 remote surveillance asset: Any asset that collects data remotely that can be used to observe an incident or traffic. Examples include closed-circuit television (CCTV) cameras and loop sensors.

3.1.43 response plan: A plan for carrying out the response to an incident. Can include a plan generated in anticipation of an incident, or a plan generated in the course of an incident.

3.1.44 reverse flow, reverse flow link: The operation of reversing the traffic flow on a traffic link, for either of two purposes: 1) to provide ingress or egress to an incident site, in which case the reverse access is only granted to emergency vehicles; or 2) to provide an alternate or diversion route, in which case the reverse access is granted to all vehicles including private vehicles.

3.1.45 sensor: A device for sensing traffic, weather or other road-related data.

3.1.46 sensor data, sensor data asset: The data generated by a sensor (see sensor).

3.1.47 service patrol vehicles: Primarily exist to assist motorists, typically constantly patrolling a given roadway network, but typically also have some incident clearance capability such as push bumpers and basic traffic control devices such as arrow boards and cones—they constantly patrol, looking for motorists who have problems. These vehicles and their associated programs go by numerous names in different regions. *See also:* **incident response vehicle**. Refer to Figure 2.



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Figure 2—Example of a service patrol vehicle

3.1.48 stringify: The process of converting an internal computer value used to reference a data object to a human readable-printable string which can be viewed and exchanged. A term common in common object request broker architecture (CORBA) and other object referencing systems. Often used to exchange a reference between different types of systems.

3.1.49 traffic channelization devices: Devices such as cones, barriers, barrels, and arrow trucks and changeable message signs (CMSs) to force or guide traffic into particular temporary channels or routes.

3.1.50 traffic control plan: In the context of this standard, a plan for traffic control and routing as part of incident management. From section 6B.01 of the Manual on Uniform Traffic Control Devices (MUTCD) [B7], the control of road users through a temporary traffic control zone shall be an essential part of highway construction, utility work, maintenance operations, and incident management.

3.1.51 traffic incident: An incident where the primary impacts are on road traffic. A traffic incident may have a traffic-related cause or it may not. For example, a building fire that causes significant road traffic congestion is a traffic incident.

3.1.52 traffic incident management: The process of real-time command and control of a traffic incident response, including asset management, the assignment of tasks to those assets, and the monitoring and communication of situation status.

3.1.53 traffic management: The process of real-time control of traffic flows by means of traffic monitoring devices and traffic control devices such as traffic signals, metering lights, variable message signs, arrow trucks, barriers, cones, flares and traffic direction personnel. Traffic management can include the management of routine traffic as well as traffic related to an event, i.e., an incident, a planned road closure, or a special event. It can include traffic in the vicinity of an event as well as traffic at some distance from an event. It can include detours and evacuations.

3.1.54 traffic management data dictionary: In the context of this standard, one of the major message sets of intelligent transportation systems (ITS) which contains a number of message structures used to convey information to the transportation professionals and to control roadside devices. This standard makes reuse of portions of this work. It is available, in several volumes, from the Institute of Transportation Engineers (ITE) and the American Association of State Highway and Transportation Officials (AASHTO).

3.1.55 traffic management plan: *See: traffic control plan.*

3.1.56 traffic routing devices: *See: traffic channelization devices.*

3.1.57 transportation grid: A common alternative term for the transportation network.

3.1.58 transportation system management: The management of the transportation system, as opposed to traffic itself. It primarily involves the planning, deployment, monitoring, and maintenance of traffic infrastructure, including traffic control infrastructure.

3.1.59 transportation-related incident: Either one of two types of events: 1) a non-recurring event, such as a motor vehicle accident, other unplanned road closure, planned road closure, or planned special event (such as a parade, sporting event, or demonstration) that affects transportation services (and so, e.g., could be a structural fire, because the incident response affects the traffic grid); or 2) any transportation-related event reported to a public safety access point (PSAP) (where 9-1-1 and other incident-reporting calls are received), whether or not a response is required, and whether or not the event actually affects transportation services.

3.1.60 variable message sign: *See: changeable message sign (CMS).*

3.1.61 vehicle detection system: A sensor, or set of sensors, that detect the flow of vehicles past a fixed point, either along freeway mainlines, freeway connectors, or arterial highways.

3.1.62 work zone: An area where infrastructure maintenance and/or construction work is being conducted, where that work impacts the transportation system.

3.1.63 XML (eXtensible markup language): A common method of exchanging messages made up of tags and values organized in a data structure and typically transported over common Internet formats such as hypertext transfer protocol (HTTP). XML is a markup language, a clearly defined way to structure, describe, and interchange data. It is a subset of standard generalized markup language (SGML). It uses user-defined tags. With a document type definition (DTD) or a schema to define the data, XML is designed to be self-descriptive. XML has a growing number of supporters due to its ability to be implemented in the types of heterogeneous systems often found in public safety. It is possible to express and exchange the IEEE Std 1512-2000 message set using this method. Commentary on the implementation of IEEE 1512 using this methodology is provided in Annex C of this standard.

3.2 Acronyms and abbreviations

AASHTO	American Association of State Highway and Transportation Officials
AID	automatic incident detection
AVL	automatic vehicle location
BS	base standard, in this case IEEE Std 1512-2000
CMS	changeable message sign
CORBA	common object request broker architecture
DMS	dynamic message sign
DSRC	dedicated short range communications
ERM	event reporting message
ETA	expected time of arrival
HAR	highway advisory radio
IC	incident commander
ID	identification
ICP	intelligent clearance practices
IEEE	Institute of Electrical and Electronics Engineers, Inc.
ISO	International Standards Organization
ITE	Institute of Transportation Engineers
ITIS	international traveler information systems
LOS	level of service
MUTCD	Manual on Uniform Traffic Control Devices
POC	point of contact
RMS	ramp meter system
SAE	Society of Automotive Engineers
VDS	vehicle detection system (or station)
VMS	variable message sign
WZ	work zone
XML	extendable markup language

4. Structure of the standard

4.1 Requirements

4.1.1 Scope of requirements

The scope of these requirements, and so of IEEE Std 1512.1-2003, shall extend to the exchange of information supporting real-time interagency transportation-related incident management, between transportation agencies, and between any of those agencies and any other agencies or centers included in incident-management communications. This standard is intended for interagency aspects of that exchange, though that does not prevent its use in information exchange within any one agency.

The term *transportation-related incident*, for purposes of defining the scope of these requirements, includes, and only includes, the following two types of events:

- a) A non-recurring event, such as a motor vehicle accident, other unplanned road closure, planned road closure, or planned special event (such as a parade, sporting event or demonstration), or any other event that affects transportation services. For example, a structural fire could be a transportation-related incident, since the response to that fire could affect the traffic grid;
- b) Any transportation-related event reported to a public safety access point (PSAP) (where 9-1-1 and other incident-reporting calls are received), whether or not a response is required, and whether or not the event actually affects transportation services.

For convenience, the term *transportation-related incident* will be shortened to *incident* in this standard.

4.1.2 Conformance with this standard

Communications systems in conformance with this standard shall:

- a) When sending information specified in this standard, send that information using the formats specified in this standard, as extended by local agreement as specified in this standard.
- b) Be able to receive any of the information specified in this standard, using the formats specified in this standard, without impairing other communications.
- c) Comply with the ASN.1 productions found in this standard, in accordance with ASN.1:1997 [B1].

In addition, for any communications systems in conformance with this standard, any data element defined in this standard with the ASN.1 term “OPTIONAL” shall be determined to be optional or mandatory depending on the functional requirements specified in this standard.

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.

4.1.3 Structure of the remainder of this requirements clause

In 4.2 through 4.9 of this standard, the specific requirements are presented in the form of explanatory text and tables. The requirements and tables are arranged so that each table corresponds to a message, and each row in a table corresponds to a data element or data frame within that message.

Subclauses 4.2 through 4.9 are summarized in Table 1. Table 1 introduces acronyms for each of the following tables. Those acronyms provide a summary way to refer to each table and any corresponding message.

Table 1—Subclauses and tables specifying requirements

Subclause	Table	Acronym	Requirement
4.2			Request and share information about work zones
4.2.1	2	RZD	Request work zone description
4.2.2	3	WZD	Work zone description
4.3	4	RTC	Request local traffic control
4.4	5	DTC	Describe local traffic control plan
4.5			Share information about ingress/egress routes, and request route services
4.5.1	6	RRA	Request route advice/services
4.5.2	7	ORA	Offer route advice/services
4.6			Share location/priority/preemption information on a response vehicle
4.6.1	8	RLP	Request location/priority/preemption information on a response vehicle
4.6.2	9	SLP	Share location/priority/preemption information on a response vehicle

Table 1—Subclauses and tables specifying requirements (continued)

Subclause	Table	Acronym	Requirement
4.7			Information on cleanup or infrastructure repair: the need for it and plans
4.7.1	10	NCI	Need for cleanup/infrastructure repair
4.7.2	11	CRP	Cleanup/infrastructure repair plan
4.8	12	RNC	Request information on network conditions or route status
4.9			Share information on asset management
4.9.1	13	AFA	Ask for assets
4.9.2	14	RPA	Respond to poll for assets
4.9.3	15	RAS	Request asset status
4.9.4	16	AST	Asset status

4.2 Request and share information about work zones

Work zones can be an important consideration in the management of incidents nearby. Work zones close to another incident can impact local traffic, and may be taken into account in managing the incident because of their impacts on local traffic, and implications for routes associated with the incident: ingress, egress, detour, alternative, and evacuation routes. Requesting and sharing information about work zones facilitates improved coordination of incident management activities and helps prevent conflicts. To better define the requirements for the information to be requested and shared, 4.2.1 and 4.2.2 describe the operational activities of requesting, then sharing, information about work zones.

4.2.1 Request information about work zones

Any agency involved in managing an incident shall be able to ask if there are any work zones that might affect the management of the incident, and if so, that they be described. The requester shall be able to specify the area of interest: circle, polygon or route. The requester shall be able to broadcast the request, or direct it to one or more specific agencies.

The information that is shared when requesting information about work zones shall include the following:

- Message name, acronym: Request work zone description, RZD

Table 2—Information for requesting information about work zones

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Area of interest	Area within which the requester is interested in hearing about work zones. Can be a circle around the incident, a polygon or a route, using Location Reference Message Set (LRMS) profiles.

4.2.2 Describe work zones

An agency that has information about one or more work zones that may be significant for managing an incident shall be able to describe those work zones to other agencies involved in managing that incident. The agency may describe a work zone in response to a request such as the one specified in 4.2.1, or it may choose to broadcast or send the description on its own initiative, either in response to an incident, or simply according to a schedule.

The information that is shared when describing a work zone shall include the following:

- Message name, acronym: Work zone description, WZD

Table 3—Shared information describing a work zone

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
ID of work zone	Unique identifier of the work zone, which could be a previously-assigned identifier for the zone as a planned road closure.
Work zone description	Physical description of the zone in terms of a local traffic plan: lane-by-lane closures/restrictions (including ramps and side streets), length of each closure/restriction, detour route. Beginning and ending times for each closure/restriction/detour. This could simply be the local traffic plan information described in 4.4, which would also cover all the information in the remaining rows of this table. This could also simply be a previously broadcast description of the zone as a planned road closure.
Restrictions	Vertical, horizontal and/or weight restrictions to passage of vehicles through the work zone.
Descriptive text	Freetext description of the work zone, to cover cases not adequately described by other data items, and to provide an alternative means to describe the work zone.
Descriptive graphic	Link to a graphic, perhaps generated during the incident, to illustrate the work zone. For example: computer-aided dispatch (CAD) plots, layout plots, though take care that layout plot is as-built-that-day, as opposed to simply as-planned.
Descriptive image	Link to a digital image of the work zone, or parts of the work zone.

4.3 Request local traffic control

An agency involved in managing an incident shall be able to request local traffic control services of another agency, such as a TMC or local law enforcement. That request shall include both a request for local traffic control services and a description of the traffic control plan the traffic control agency intends to execute.

The information that is shared when requesting local traffic control, and a description of a local traffic control plan, shall include the following:

- Message name, acronym: Request local traffic control, RTC

Table 4—Information for requesting local traffic control

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Special instructions	Freetext description of special instructions: can range from “I’m closing the right lane on link EBxyz,” to “Close the right lane on link EBxyz,” to “Stop all traffic on link BothWaysxyz,” to “Close ramp z,” to “Reverse link EBxyz.” If this entry is blank, it means “Do whatever is called for based on the incident as described in the incident description (IDX) message specified in the base standard.”
Constraints	Freetext description of constraints. Examples: “Leave Route 85 open,” “Leave at least one lane open,” “avoid routes past the school at xxx.”
Pre-planned plan	Pre-planned incident management plan name(s).
Descriptive graphic	Link to a graphic to illustrate the incident and/or local traffic situation.
Descriptive image	Link to a digital image of the incident and/or local traffic situation.

4.4 Describe Local Traffic Control Plan

An agency involved in providing local traffic control services for an incident shall be able to describe the local traffic control plan that it intends to execute. That description may be sent or broadcast in response to a request for local traffic control as presented in 4.3, or it may be sent or broadcast on the agency’s own initiative.

The information that is shared when describing a local traffic control plan shall include the following:

- Message name, acronym: Describe local traffic control plan, DTC

Table 5—Shared information describing a local traffic control plan

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Lane-by-lane description	Lane-by-lane (and shoulders and ramps) description of: whether or not closed, where closed, distance closed, when closed, for how long closed, and/or criteria by which will be reopened, how closed (taper, merge, cones, flares, barrels, arrowboard, staffed/unstaffed, if staffed, by whom, etc.); same list of parameters for section of alternating traffic; same list of parameters for section of reversed traffic (plus reason for reversal—ingress/egress vs diversion/detour); same list of parameters for section where lane is restricted, plus parameters of restriction (vertical clearance, horizontal clearance, weight, speed, vehicle type, e.g., truck); and point of contact (POC)—who is in charge.
Detour routes	When routine route is blocked or restricted, so traffic must take the detour route. For each route: route; estimated time to establish the route; estimated duration route will be in place; units assigned to establish it; and POC—who is in charge.
Alternate routes	When routine route is not blocked or restricted, but use of the alternate route is advised. For each route: route; estimated time to establish the route; estimated duration route will be in place; units assigned to establish it; and POC—who is in charge.

Table 5—Shared information describing a local traffic control plan (continued)

Data items	Description
Evacuation routes	A managed route to facilitate evacuation. For each route: route; estimated time to establish the route; estimated duration route will be in place; units assigned to establish it; upon whose authority the evacuation would be initiated; and POC—who is in charge.
Variable message sign (VMS) information	For each VMS: location; message; when message placed; duration of message, or on what criterion it is to be taken down; what unit assigned; what organization is in charge. Note that VMSs are managed as assets with asset management messages specified later in this clause, and they are controlled by Traffic Management Data Dictionary (TMDD) messages. This data item specifies how VMSs are to be used as part of the description of the traffic control plan.
Highway advisory radio (HAR) information	For each HAR: broadcast range; message; when message placed; duration of message, or on what criterion it is to be taken down; what organization is in charge. As with VMSs, this data item is part of the description of the traffic control plan.
Special tasks	Freetext to specify special tasks.
Pre-planned IM plan ID	Pre-planned incident management plan name and/or ID number.
IM plan text	Freetext plan description instead of or to supplement pre-planned IM plan.
Pre-planned traffic management plan ID	Pre-planned local traffic management plan name and/or ID number.
Traffic management plan text	Freetext plan description instead of or to supplement pre-planned local traffic management plan.
Descriptive graphic	Link to a graphic to illustrate the incident, the local traffic situation, and/or the traffic control plan.
Descriptive image	Link to a digital image of the incident and local traffic situation.
Video of incident	Link to a video of the incident site.
Pre-planned IM plan	The actual incident management plan, as opposed to simply its name and/or ID number.
Pre-planned traffic control plan	The actual local traffic management plan, as opposed to simply its name and/or ID number.

4.5 Share information about ingress/egress routes, and request route services

Ingress and egress routes are important considerations in incident management. Different agencies involved in incident management may seek advice from other agencies as to the best ingress and egress routes—while other agencies, primarily TMCs, provide that advice. Other route information involves asking for a reverse-direction link for ingress, egress or other uses, sharing the fact that such a link has been set up, asking for priority or preemption for particular vehicles and routes, and sharing the fact that such priority or preemption has been set up. Some agencies, in particular law enforcement, do not wish to seek advice on routes or use routes selected by another agency, and in fact want to keep route information about their vehicles from being disseminated. Nothing in this standard forces those agencies to seek advice or disclose route information. To better define the requirements for the information to be requested and shared, and route services to be requested, 4.5.1 and 4.5.2 describe the operational activities of requesting information and services concerning ingress and egress routes, then sharing information about those routes.

4.5.1 Request advice and services concerning ingress and egress routes

Any agency involved in managing an incident shall be able to:

- a) Request advice as to the best ingress and egress routes to use with an incident.
- b) Request that a reverse-direction link be set up for ingress, egress or other uses.
- c) Request priority or preemption for one or more vehicles for any route or a particular route.

Requesting the information and services just listed shall include the following:

- Message name, acronym: Request route advice/services, RRA

Table 6—Information and services concerning ingress and egress routes

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Vehicle for which request is made	Specifies the vehicle(s) for which the request is made. That can be: —a single response vehicle, —a list of response vehicles requesting the same route/services (e.g., several vehicles from one fire station); or —all public vehicles, for which an agency is requesting the best detour route, and/or signal-light priority for an or any recommended detour route. For either of the two explicitly-identified response vehicle cases, each response vehicle is specified with four attribute types: —ID character string, —vehicle type and subtype, —vehicle limitations on turning radius, height, width, weight, and speed, and —reason for requesting the route for that vehicle (approaching site, removing injured to hospital, etc.), including freetext.
Origin	Unit's base, incident site, staging area, etc.
Destination	Unit's base, incident site, staging area, care facility, etc.
Time needed	When the route is needed.
Duration needed	Estimation of how long the route will be needed.
Request reverse flow	Request to establish a reverse flow link, including the reason, a description of that link, and beginning and ending times. Reasons can include ingress, resolving gridlock.
Request priority	Request for priority treatment/preemption, including the reason/justification. Either the TMC may ration use without physically controlling priority/preemption, or it may enable/disable vehicle-roadside systems or, for the detour case, reset signal timing to favor the detour route.
Priority route desired	Description of route for which priority treatment/preemption is being requested. If no route specified, assume the request is for a recommended route, whether or not priority/preemption is requested.
Plan names	Related pre-planned IM plan or local traffic management plan names.
Descriptive graphic	Link to a graphic to illustrate the route situation.

4.5.2 Offer ingress/egress route advice and/or notify that route services have been set up

An agency that has information about the best ingress or egress routes shall be able to describe those routes to agencies requesting route advice, or to broadcast those routes to all involved agencies. An agency that can set up priority or preemption for a route, or a route/vehicle combination, shall be able to notify the agency requesting that priority or preemption that service has been set up, and for what time period, or that the request was denied. An agency that can set up a reverse-flow link shall be able to notify all involved agencies that the reverse-flow link has been set up, and for what time period, or to notify the requesting agency that the request was denied. It shall also be able to notify other agencies that reverse-flow link has been set up (and for what time period).

The information that is shared when offering ingress/egress route advice and/or notifying that ingress/egress route services have been set up shall include the following:

- Message name, acronym: Offer route advice/services, ORA

Table 7—Information for ingress/egress route advice, and/or notifying about route services

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Requesting message	ID of requesting message this message is in response to (known to the communication system, so no need for an explicit data element). Note that vehicle ID information is contained in the requesting message.
Route	ID, description of route that is the advised route.
Start time	Start time when route service is to be active, or when route advice applies.
Duration	Duration of time when route service is to be active, or when route advice applies.
Reverse-flow link grant/deny	Flag designating that request for reverse-flow link has been granted or denied.
Priority/preempt grant/deny	Flag designating that request for priority/preemption has been granted or denied.
Priority/preempt route	Route for which priority/preemption granted, if different from the requested route.
Priority/preempt technology	Priority/preemption technology being used, along with any codes necessary to use that technology.
Plan names	Related pre-planned IM plan or local traffic management plan names.
Current IM plan	IM plan being generated in real time in the course of managing the current incident.
Descriptive graphic	Link to a graphic to illustrate the route situation.

4.6 Share location/priority/preemption information on a response vehicle

In incident management, it can be important to keep track of what vehicles are using what priority/preemption technologies, where and on what routes. While the current base standard supports the communication of which vehicles are dispatched to which incidents on what routes, that information is sourced from the dispatching agency. The additional requirements specified here are to support the requesting and sharing of

location/priority/preemption information, with the capability of that information being sourced from a TMC, based on information from its network of sensors, including in particular its capability to detect where a vehicle is and what priority/preemption technology it is using by monitoring signals received by roadside devices. In addition, requirements specified in this subclause include the sharing of automatic vehicle location (AVL) information from response vehicles en route to and from an incident. To restate a point made previously: some agencies may not want location information on their vehicles to be disseminated. Nothing in this standard forces those agencies to have that information disseminated—local implementations can decide to not disseminate that information.

Four functions are supported by the requirements specified in 4.6:

- a) Interagency exchange of detected location information for response vehicles en route.
- b) Interagency exchange of detected location information for response vehicles not associated with an incident.
- c) Interagency tracking of use of priority/preemption technologies.
- d) Interagency tracking of unauthorized use of priority/preemption technologies.

The last two of those functions are of use to TMCs for flow management and so are part of real-time incident management.

4.6.1 Request location/priority/preemption information on a response vehicle

Requests for location/priority/preemption information on a response vehicle can originate from the owner of the vehicle, the IC, or any other agency.

The information that is shared when requesting the information and services just listed shall include the following:

- Message name, acronym: Request location/priority/preemption information, RLP

Table 8—Information for requesting response vehicle location/priority/preemption information

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Password	Local implementations could restrict the dissemination of location/priority/preemption information to agencies having a password, which could be reset for each incident.
Vehicle ID	ID of the vehicle that is the subject of the request.
Assigned-resource submessage	The base standard defines an assigned-resource submessage that can be included in this request. That submessage specifies the currently-known information about the vehicle dispatch, including dispatch details, response unit ID and type, status, location, estimated time of arrival (ETA), estimated time of departure from scene, route, and response plan information. This data item is not necessary if the receiver has already received the current version of that submessage.

4.6.2 Share location/priority/preemption information on a response vehicle

Location/priority/preemption information can originate from the TMC, based on location information it has detected, or it could originate from the vehicle's agency, based on AVL or any other source.

Location/priority/preemption information shall include the following:

- Message name, acronym: Share location/priority/preemption information, SLP

Table 9—Shared location/priority/preemption information

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Requesting message	ID of requesting message this information is in response to (known to the communication system, so no need for an explicit data element). Note that vehicle ID information is contained in the requesting message.
Vehicle ID	ID of the vehicle that is the subject of this information. Not necessary if the requesting message is specified
Assigned-resource submessage	The base standard defines an assigned-resource submessage that can be included here. That submessage specifies the currently-known information about the vehicle dispatch, including dispatch details, response unit ID and type, status, location, ETA, estimated time of departure from scene, route, and response plan information. This data item is not necessary if the receiver has already received the current version of that submessage.
Vehicle location	Vehicle location, including confidence area (the area within which the vehicle could be expected to actually be with a specified probability, e.g., circle with radius 300m at 80%), and technology used to ascertain that location.
Technology	What priority/preemption technology is being used for that vehicle, if any.
Associated incident	Denotes that this vehicle is not associated with any currently active incident, or if it is associated with an incident, that incident number. This is as known to the center creating this information. So if that center has no records matching that vehicle ID to an incident, this data item specifies that fact.
Authorization	A flag denoting that this vehicle is not authorized to be using the priority/preemption technology it is using. This flag would be set if the center creating this information has access to who has been "granted" use of the priority/preemption technology detected on the route detected, and finds that vehicle ID has not been granted use of that technology. A center equipped to set this flag may be a different center than the originator of most of this information. In that case the authorization-checking center could simply be included in the exchanges of location/priority/preemption information, and remain silent until an unauthorized use is detected.

4.7 Information on cleanup or infrastructure repair: the need for it and plans

Cleanup and infrastructure repair is an important part of incident management. Cleanup or infrastructure repair caused by an incident is part of that incident. An instance of need for cleanup or infrastructure repair is itself an incident, whether or not it is associated with a traffic incident. TMCs often try to repair infrastructure while lanes are still closed for an incident, to minimize total time of closure, so there is a tendency to

start that repair as soon as possible, while the incident is still active. This subclause concerns sharing that information between agencies, for example: a non-TMC agency reporting in to a TMC on the need for infrastructure repair, then that TMC reporting its corresponding infrastructure repair plans out to other agencies. While the goal of this standard is to support that information sharing between agencies, there is nothing to prevent its use supporting that information sharing within agencies as well. Examples of infrastructure that might be involved: signals, signs, guard rails, bridge abutments, illumination, malfunctioning equipment.

4.7.1 Report on the need for cleanup or infrastructure repair

This information would be reported to a TMC by an agency on an incident scene, or by an agency discovering a need for cleanup or infrastructure damage or failure. This information is focused on describing the need for cleanup and/or infrastructure repair. If there is a need to also request traffic control associated with that cleanup/infrastructure repair, it shall be handled by a separate message as specified in 4.3.

The information that is shared when reporting the need for cleanup and/or infrastructure repair shall include the following:

- Message name, acronym: Need for cleanup/infrastructure repair, NCI

Table 10—Information for reporting on the need for cleanup or infrastructure repair

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Cleanup needs	A list: a location (location data items for a point or an area, with freetext supplement) and for each location: the cleanup operation needed (enumerated list with freetext supplement), current status (impeding traffic, etc.) and the estimated time duration of that cleanup.
Infrastructure repair needs	A list: a location (location data items with freetext supplement) and for each location: the infrastructure unit needing repair/replacement (enumerated list with freetext supplement), its current status (operational or not, etc.), and the desired time for that repair/replacement to be completed.
Time observed	The time the problem was observed, as that can differ from the timestamp of a communication.
POC	Point-of-contact information on the person reporting this information.
Urgency	Freetext description of the effects of the cleanup or infrastructure situation, indicating the urgency that should be applied in resolving it.

4.7.2 Share information on a cleanup plan and/or an infrastructure repair plan

This information shall originate from a TMC. It may be in response to one or more reports on the need for cleanup or infrastructure repair, or it may be initiated by the TMC. This information is focused on describing a cleanup and/or infrastructure repair response. If there is a need to describe a traffic control operation associated with that cleanup and infrastructure repair response, it shall be handled by a separate message as specified in 4.4.

The information that is shared in specifying a cleanup plan or infrastructure repair plan shall include the following:

- Message name, acronym: Cleanup/infrastructure repair plan, CRP

Table 11—Shared information on a cleanup plan and/or infrastructure repair plan

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Cleanup plan	A list: a location (location data items for a point or an area, with freetext supplement) and for each location: what cleanup units have been dispatched to that location (enumerated list with freetext supplement), ETAs and the estimated time duration of that cleanup.
Repair plan	A list: a location (location data items with freetext supplement) and for each location: what infrastructure repair/replacement units have been dispatched (enumerated list with freetext supplement), ETAs and the estimated time duration of that repair/replacement operation.
POC	Point-of-contact information on the person in charge of the cleanup and/or infrastructure repair response.

4.8 Request information on network conditions or route status

Incident management often needs to be informed of the network conditions on the broader traffic network surrounding the incident. That information is useful for designating ingress, egress, alternative and diversion routes, and for planning and executing traffic control. While messages specified in a TMDD standard (specified in Clause 2) will share information on network conditions and route status, there are significant communication and information processing benefits to being able to request subsets of the entire computer file of network conditions. Those subsets can include geographic areas, summary parameters, and subsets of the complete set of parameters available. Some areas can be designated and named, such as the area around a hospital. Other geographic areas and routes can be designated and named specific to an incident, such as the area within a specified radius of the incident, and routes (ingress, egress, alternative, diversion, evacuation) specified for that incident. Also, in anticipation of cases where photo stills and video will be available from the TMC, requests for that information shall be accommodated, also.

The information that is shared when requesting information on network conditions or route status shall include the following:

- Message name, acronym: Request network conditions, RNC

Table 12—Information for requesting information on network conditions or route status

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Changes only	Flags requesting that only changes from previous network conditions be sent, or only unusual road conditions (e.g., construction, not unusual traffic) be sent, or only unusual traffic be sent, or any combination of those conditions be sent, all as screened by the focus data item that follows.
Focus	Area of interest and/or routes of interest, including pre-designated areas and routes of interest such as ingress/egress route.
Summary	Network summary requested, e.g., travel-time map, speed map, road closures and route diversions, any locally-identified network summaries that have been pre-specified and named.
Parameters	Parameters of interest. All available parameters or a subset: —lane-by-lane: LOS, speed, lane occupancy, traverse time, veh/hr volume, actual/theoretical capacity, pavement condition (traction—wet, frozen, salted), restrictions (height, width, weight, speed); —all lanes in one direction on a link: all the above parameters applied to all lanes taken together, and static information such as number of lanes/lane configuration/dimensions and weight and speed restrictions on that link. —weather: visibility (fog), wind speed and direction, precip/snow, temp, dew point, light, traction, icing alarms, flooding, local plumes (smoke, hazardous material).
Period	Time period for which request is made.
Photos	Request photo stills, with what they would be stills of, format.
Videos	Request video, with what it would be a video of, format.

A message sent in response to a Request Network Conditions message, i.e., a Network Conditions message, relies heavily on data structures defined and controlled in the TMDD standards effort as well as ones found in the Advanced Traveler Information Systems (ATIS) and Transit Communications Interface Profiles (TCIP) standards.

4.9 Share information on asset management

Asset management is a key operation in many incident management situations. Subclauses 4.9.1 through 4.9.4 specify an information vocabulary for physical asset management. Data asset management shall be supported by TMDD messages. That vocabulary is predicated on a very general view of a range of asset management concepts of operations. Subclauses 4.9.1 and 4.9.2 concern a physical-asset management dialog that can take place in four steps or two steps. The four-step version is as follows:

- *Step 1:* An agency polls other agencies to find out the availability of an asset it is interested in using (4.9.1).
- *Step 2:* Other agencies respond to that poll with availability information for that asset (4.9.2).
- *Step 3:* The requesting agency then requests that one particular supplying agency dispatch that asset (4.9.1).
- *Step 4:* The supplying agency confirms that dispatch will take place or has taken place (4.9.4).

In the two-step version, only the last two steps are carried out, based on static information the requesting agency has on asset availability. Any discrepancies between the static asset-availability information and current reality can be managed by repeating, “trial and error,” cycles of the third and fourth steps. Subclauses 4.9.3 and 4.9.4 concern the dialog on requesting and providing information on physical-asset status. Note that 4.9.4 specifies information for two functions: 1) to respond to a request to dispatch an asset, and 2) to respond to a request for information on asset status.

The information specified here for asset management applies to all agencies in an incident management communications network using this standard, including public safety agencies. This standard specifies the information requirements and asset lists particular to traffic management. A forthcoming companion volume concerning public safety, IEEE P1512.2 [B4], will specify asset lists particular to public safety.

4.9.1 Request information on physical-asset availability

As explained above, this information covers both the situation where a requesting agency is polling for availability of an asset, and also where that agency is specifically requesting the dispatch of an asset. Portable VMSs are treated here as physical assets, as portable equipment that has to be moved and installed, though the management of them as traffic information devices shall be supported by TMDD messages.

The requestor shall be able to specify a desired asset in terms of the function that is desired. For example, if a requestor simply knows that vehicles are losing traction due to slippery conditions, but does not have the expertise to be able to specify whether a sand truck or a salt truck is the best way to manage that situation, the requestor shall be able to specify simply that, e.g., “traction control” is called for, perhaps with other descriptive data concerning temperature, precipitation, etc. The agency receiving that message can then exercise its informed judgment as to what asset(s) should be dispatched to control traction. In Table 13, this requirement appears as the last entry under “Asset type.”

The information that is shared when requesting asset availability information shall include the following:

- Message name, acronym: Ask for assets, AFA

Table 13—Information for requesting physical-asset availability information

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Poll/request	Specifies that this message is asking only for availability, or if the asked agency should dispatch in response to this message.
Asset type	Asset type requested, including: —physical assets: code list for vehicle, team, equipment including portable VMSs, and material. Several notes: —portable VMSs to be controlled via TMDD messages; —can include towing, rotator, and size requirements for either one; —can include Freeway Service Patrol; —a need or function desired: e.g., traction control, with a description of temperature, precipitation, etc.
Asset	Which asset in particular (specified by asset ID or location/area), if the requester has some reason to restrict the request in that way.

Table 13—Information for requesting physical-asset availability information (*continued*)

Data items	Description
Intended use	Intended use, and specifications re what is required that is not already specified in “asset” data item, e.g., training/certification/equipment required for a team, how heavy a truck needs to be towed. While this can include the intended use of a VMS, and could actually include the message(s) desired, the actual control of a VMS shall be handled by TMDD messages.
Time of use	Intended time of use, start and estimated finish. Note that could be for a planned closure/event, and so could be for a start time other than as soon as possible.
Location of use	To what location: which incident, where, the staging area there, or another area, or the precise location, e.g., of a VMS;
Management	Whether or not the requesting agency desires management of the asset.
Logistics	Any logistical details of how the asset and/or the management of the asset would be transferred (freetext).

4.9.2 Share information on physical-asset availability

As explained above, this information covers the situation where an asset-supplying agency is responding to a poll for availability of an asset.

The information that is shared concerning physical-asset availability shall include the following:

- Message name, acronym: Respond to poll for assets, RPA

Table 14—Shared information on physical asset availability

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Requesting message	ID of requesting message this information is in response to, if any (known to the communication system, so no need for an explicit data element).
Asset ID	Particular ID, description, and location if different from or more specific than what polled for.
Availability	Whether or not it is available, ETA, for what time duration.
Management	Whether or not the source agency will transfer management of the asset to the requester, independent of what the requester asks regarding who manages the asset.
Logistics	Logistical details of transfer if different from or more specific than the polled-for or requested logistics.

4.9.3 Request information on physical-asset status

This information may be requested by an agency owning, managing, or awaiting the arrival of an asset, from whatever agency would know the asset status.

The information that is shared when requesting physical-asset status information shall include the following:

- Message name, acronym: Request asset status, RAS

Table 15—Information for requesting physical-asset status

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Key	Security string, establishing that the requesting center is authorized to receive this information.
Asset ID	Description of the asset of interest. Could be simply an ID number, or since the current state of practice may involve asset designations such as “the truck you dispatched to us,” this could simply cite the message that finalized the dispatch. That would apply whether the center sending this request is the source or the requester of the asset.

4.9.4 Share information on physical-asset status

This information can be generated in response to a request for asset status or a request that an asset be dispatched, or it can be sent or broadcast periodically.

The information that is shared concerning physical-asset status shall include the following:

- Message name, acronym: Asset status, AST

Table 16—Shared information on physical-asset status

Data items	Description
Header	Header information specified in the base standard, including the ID of the incident concerned.
Requesting message	ID of requesting message this information is in response to, if any (known to the communication system, so no need for an explicit data element).
Key	Security string, as part of an encryption process.
Asset ID	Description of the asset of interest. Could be simply an ID number, or since the current state of practice may involve asset designations such as “the truck you dispatched to us,” this could simply cite the message that finalized the dispatch. That would apply whether the center sending this request is the source or the requester of the asset. Optionally expanded to include other ID information the center sending this information may have. If message is broadcast (not in response to a request), it shall use some universally-known ID.

Table 16—Shared information on physical-asset status (*continued*)

Data items	Description
Location status	Specifying status such as: at its base station, en route with ETA, on scene and involved, on scene and available, returning to base.
Location	Geographic location, if available.
Plan	Operational plan: what it intends to do, starting when, completing by when.
Current op	Current operation: What it is doing now, whether functioning or malfunctioning.
POC	Contact information of team manager.

5. Message sets and data frames

Incident management (IM) message sets for this TRANSPORTATION volume use shall consist of the following message sets and data frames as well as those messages found in the base standard and other volumes as provided below. Each shall be further divided into specific messages and elements 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).

Definitions for these messages are presented in 5.1 through 5.26. The specifications shall be expressed in ASN.1 syntax as per ISO/IEC 8824-1:1998 and ISO/IEC 8824-2:1998. One style change in the ASN.1 listing should be noted. In former documents of the IEEE 1512 family of standards it was common to add a comment line stating where a foreign data element was taken from. This has been superseded by the use of module definitions where groups of elements taken from a single standard are all placed in a similar module. For example, in the listing that follows the concept of date and time is taken from the ATIS work. Citations of these elements have the phrase “ATIS.” before them, as in “ATIS.DateTimePair” in the code. Similar abbreviations are used for TMDD and TCIP. In addition, the ASN is presented in a section called “ASN.1 Representation;” formally this section was called “Format.” In a similar manner, the equivalent eXtensible markup language (XML) expression is presented in a section called “XML Representation” which follows the translation rule set cited in SAE J2630.

5.1 Message: MSG_RequestWorkZoneData

Use: This message can be sent to another center to request a reply with all known events that meet the search criteria. In this context, “work zone” is used to indicate any event on or nearby the roadway that is pre-planned or known to the center receiving the request. It is typically used to gather information about pre-planned events, categorized using ITIS codes. It may be used in routine operations to understand another center’s current plans, or as needed (such as when an incident occurs and there is a need to learn about possible roadwork in the area nearby).

If no date-time values are provided, the reply message should return all known events from the time of the query forward to a locally established period in the future (such as 6 months). Note that no incident number is used in the header section of the message when sending this message.

This structure is used to meet the requirements outlined in 4.2.1 and Table 2.

ASN.1 Representation:

```

RequestWorkZoneData ::= SEQUENCE {
    header      Header,
    basics      Basics OPTIONAL,
    types       SEQUENCE (SIZE(1..16)) OF ITIS.ITIScodes,
                -- the type of events desired,
                -- made up of ITIS codes
                -- such as roadwork, parades, etc...
    onlyActive  BOOLEAN OPTIONAL,
                -- is set to true return only currently active events
    whenStart   ATIS.DateTimePair OPTIONAL,
                -- the beginning time period to search over
    whenStop    ATIS.DateTimePair OPTIONAL,
                -- the ending time period to search over
    where       LRMS.LocationReference OPTIONAL,
                -- the geographical area to search
    ...
}

```

Remarks: Note that this message allows users to create rather complex searching keys (such as: all parades and bridge repairs occurring between 3PM next Wednesday and Midnight Dec 31, 2010 located with 500 meters of Town Hall). Local deployments may need to limit by mutual local agreements of the level of such complexity supported. Local deployments may also wish to limit how far backward from current time they will allow a search to request, if at all.

5.2 Message: MSG_WorkZoneData

Use: This message contains information on pre-planned events such as but not limited to a work zone. It may occur because the issuing center wished to send it, or (more likely) as a reply to a request for such data after a MSG_RequestWorkZoneData was received. A sequence of these messages is likely to be sent, representing all such events that meet the requested criteria.

This structure is used to meet the requirements outlined in 4.2.2 and Table 3.

ASN.1 Representation:

```

WorkZoneData ::= SEQUENCE {
    -- this is in sync with recent SAE changes which provide a
    -- strong "consumer" work zone message to start from
    header      Header,
    basics      Basics OPTIONAL,
    eventID     IncidentRef OPTIONAL,
                -- a number for the event itself used in the CAD
    currentlyActive  BOOLEAN OPTIONAL,
                -- when true the event is currently taking place
                -- the precise meaning of this may require local agreements
    currentEventID  SubMessageRefNum OPTIONAL,
                -- some CAD use a dual numbering system for
                -- active events, if this is the case this field will
                -- hold the active value, while the above will hold the
                -- the long-term value
    description   ATIS.EventInformation,
                -- a complex summary of the event from SAE
                -- note that it also includes the complex lane description
                -- frame taken from this std
}

```

```

restrictions      RestrictionSet OPTIONAL,
                  -- a sequence of various link restrictions, which
                  -- exist over the links of the event
descriptiveText  FreeText  OPTIONAL,
                  -- other data that needs to be conveyed in a free text format
liveImage        URL-Link  OPTIONAL,
                  -- a URL/URI for any live image data feeds
graphicOverview  URL-Link  OPTIONAL,
                  -- link to a file or to a URI/URL to carry any
                  -- explanatory graphic file for this message
...
}

```

5.3 Message: MSG_ReqTrafficCntrlPlan

Use: The sender of this message may be requesting of the receiving center either that a traffic control response plan be created incorporating the given details about the event they are sending, or it may be requesting to be informed about an event they know little about (in which case they are not likely to be providing details on items such as lane conditions). The header will contain links to the active incident (if one is present).

If no incident is present (and no event details) this message may be used to request pre-established response plans from the other center by name or number. Note that the ability to send things like images or current lane blockage conditions can also be sent in the IDX message for any established incident. If these fields are blank (and formulating a response plan is required), the most recent IDX message data should be considered.

The response to this message will be a traffic control plan message. However, many details of that plan and the actual status of various assets during its execution, will be contained in IDX messages related to the event. If the incident was not declared and given a set of assigned numbering values in the CAD, then this will likely occur if needed. Over the course of the event, the IDX message will have updates to such information. This message would not be updated in a similar way unless another request for it was received.

This structure is used to meet the requirements outlined in 4.3 and Table 4.

ASN.1 Representation:

```

ReqTrafficControlPlan ::= SEQUENCE {
    header          Header,
    basics          Basics                                OPTIONAL,
    planName        TMDD.Event-response-plan             OPTIONAL,
    planText        TMDD.Event-ResponsePlanText          OPTIONAL,
    planNumber      TMDD.Event-response-plan-identifier  OPTIONAL,
    conditions      FreeText                              OPTIONAL,
    sceneSketch     URL-Link                              OPTIONAL,
                  -- descriptive graphic by way of a url
    sceneImage      URL-Link                              OPTIONAL,
                  -- scene image by way of a url
    laneConditions  SEQUENCE (SIZE(1..24)) OF SEQUENCE {
        laneLocation LRMS.LocationReference              OPTIONAL,
        -- the LRMS within the event when the next lane pertains to
        lane LaneDescription                             OPTIONAL
        -- note that this lane description is what is wrong ,
        -- not what we will do about it (which is in the reply)
        -- restrictions (axle, size, weight, etc...) from event
    },
    vehicleTypes    TMDD.Event-IncidentVehiclesInvolved OPTIONAL,
}

```

```

vehicleCount    TMDD.Event-IncidentVehiclesInvolvedCount OPTIONAL,
onSceneContact  UTF8String(SIZE(1..200))                OPTIONAL,
-- on scene personnel contact data (may be the IC)
radioContact    UTF8String(SIZE(1..200))                OPTIONAL,
-- preliminary radio contact data
...
}

```

5.4 Message: MSG_TrafficCntrlPlan

Use: The traffic control plan message is sent in reply to a request for a traffic control plan. Local embodiments may decide to reply with an IDX message containing the same information in its various submessages, if such information is in fact known in a very short period of time and an incident had been previously declared for the event. This would typically be the case if the request message was being employed to ask about pre-planned responses. This message is a one-time event, that is, it would not be updated and resent unless another request for it was received.

This structure is used to meet the requirements outlined in 4.4 and Table 5.

ASN.1 Representation:

```

TrafficControlPlan ::= SEQUENCE {
    header          Header,
    basics          Basics OPTIONAL,
-- the header/basics will have the normal IDX numbering
-- and summary codes for the event and location
-- the incident plan
imPlanName        TMDD.Event-response-plan            OPTIONAL,
imPlanType        TMDD.Event-response-plan-type        OPTIONAL,
imPlanNumber      TMDD.Event-response-plan-identifier  OPTIONAL,

-- the traffic plan
trafficPlanName   TMDD.Event-response-plan            OPTIONAL,
trafficPlanType   TMDD.Event-response-plan-type        OPTIONAL,
trafficPlanNumber TMDD.Event-response-plan-identifier  OPTIONAL,

-- various further information
currentStaus      Event-IncidentStatus                OPTIONAL,
conditions        FreeText                            OPTIONAL,
specialInstructions FreeText                            OPTIONAL,
constraints       FreeText                            OPTIONAL,
sceneSketch       URL-Link                            OPTIONAL,
-- Descriptive graphic by way of a url
sceneImage        URL-Link                            OPTIONAL,
-- Scene image by way of a url
laneConditions    SEQUENCE (SIZE(1..24)) OF SEQUENCE {
    laneLocation   LRMS.LocationReference              OPTIONAL,
-- the LRMS within the event when the next lane pertains to
    lane           LaneDescription                    OPTIONAL
-- Note that this lane description is from the
-- perspective of the center sending out the plan
-- it may have aspects of what will be done about the
-- event (such as determining to close lanes)
    },
vehicleType       TMDD.Event-IncidentVehiclesInvolved  OPTIONAL,
vehicleCount      TMDD.Event-IncidentVehiclesInvolvedCount OPTIONAL,

```

```

onSceneContact FreeText OPTIONAL,
-- on scene personnel contact data (may be the IC)
-- on behalf of the center sending this message
-- this person may be on the way to the event
-- rather than on scene in some cases
radioContact FreeText OPTIONAL,
-- Preliminary radio contact data for above
impactSummary SEQUENCE (SIZE(1..32)) OF Impact OPTIONAL,
-- The IDX submessage from the base standard which
-- conveys lane data as well as multiple route sets
-- for detour and alt route use
evacuations SEQUENCE (SIZE(1..32)) OF Evacuation OPTIONAL,
-- The IDX submessage from the base standard which
-- conveys evacuation information including routes
staging SEQUENCE (SIZE(1..32)) OF Scene-Staging OPTIONAL,
-- The IDX submessage from the base standard which
-- conveys staging area locations and use directions
vmsUse VMS-UsePlan OPTIONAL,
dsrUse DSRC-UsePlan OPTIONAL,
harUse HAR-UsePlan OPTIONAL,
additionalText FreeText OPTIONAL,
relatedMsgs SEQUENCE (SIZE(1..32)) OF SubMessageRefNum OPTIONAL,
...
}

```

Remarks: This message should be viewed as the “opening game” response to a request and need for a traffic control plan. It relates to the other center everything that can be quickly known about the response. As the event develops and is managed, the IDX submessages provides the preferred means to update and add information on the individual sections of this message (staging, routes, TMDD devices). The IDX structure also provides a means to update individual asset status for personnel and mobile devices responding to the event.

5.5 Message: MSG_RequestRouteAdvice

Use: This message is used to request a route over the surface transportation grid (including various signal preemptions and potentially reversed lanes flows) for one or more vehicles with various restrictions. It is typically used to establish a route for time critical equipment to reach the location of an incident or a nearby staging scene. The estimated duration of the requested route, the need for on-scene personnel to flag traffic and control access, and provisions for credentialing vehicles for signal preemptions are provided.

This structure is used to meet the requirements outlined in 4.5.1 and Table 6.

ASN.1 Representation:

```

RequestRouteAdvice ::= SEQUENCE {
    header          Header,
    basics          Basics          OPTIONAL,
    vehicleID       VehicleId,
-- requesting vehicle or group
    vehicleMakeup   VehicleSummary OPTIONAL,
-- some very complex ways to describe all the restrictions
-- such as weight, width, axle as well as
-- agency type (police, tow, local LE, ITIS list)
-- preempt technology it/ they have
-- sequence of vehicle ID to link to IDX resources messages
    rational        FreeText OPTIONAL,
-- reason for the requested route
}

```

```

origin          LRMS.LocationReference OPTIONAL,
                -- if known
destination     LRMS.LocationReference OPTIONAL,
                -- link to staging areas or event if so desired
whenStart       ATIS.DateTimePair    OPTIONAL,
whenEnd         ATIS.DateTimePair    OPTIONAL,
reqReverseFlow  BOOLEAN OPTIONAL,
                -- the requester would like to use reversed lane
                -- flow for ingress or egress if this is possible and
                -- saves time
reqPriority      INTEGER (0..5) OPTIONAL,
                -- relative priority of this request over others in the event
priRational     FreeText OPTIONAL,
                -- reason for the requested priority
suggestedRoute  ATIS.Route    OPTIONAL,
                -- a suggestion of the major route point that
                -- the requester would like to use
planId          TMDD.PlanID OPTIONAL,
                -- event pre-planned name if applicable
planName        TMDD.PlanName OPTIONAL,
                -- event pre-planned name if applicable
graphicOverview URL-Link OPTIONAL,
                -- link to a file or to a URI/URL to carry any
                -- explanatory graphic file for this message
...
}

```

5.6 Message: MSG_RouteAdvice

Use: This message provides a complex set of routing instructions suitable for use in public safety response. Besides the turn-by-turn directions of the recommended route itself, this message also provides data on the unusual conditions often needed in the response to an incident. These include routing down the wrong side of street, right of ways, data regarding height and weight restrictions of the links (needed for oversize equipment), and priority and preemption issues effecting the roadside signal control devices.

This structure is used to meet the requirements outlined in 4.5.2 and Table 7.

ASN.1 Representation:

```

RouteAdvice ::= SEQUENCE {
    header          Header,
    basics          Basics                                OPTIONAL,
    requestorIdent  RequestIdent                          OPTIONAL,
                -- message, center, and seat
    routeName       RouteName                            OPTIONAL,
                -- the id by which this offered route will be known
    route           ATIS.Route,
                -- the route itself , as per SAE work
    whenStart       ATIS.DateTimePair                    OPTIONAL,
    whenEnd         ATIS.DateTimePair                    OPTIONAL,
    linkFlow        SEQUENCE (SIZE(1..16)) OF FlowType   OPTIONAL,
                -- enum of flow type data here, such as reversed lanes
    requestGrant    SEQUENCE (SIZE(1..16)) OF PreemptGrant OPTIONAL,
                -- note that preempt and priority uses are both allowed here
    signalTechnology SEQUENCE (SIZE(1..16)) OF PreemptTech OPTIONAL,
                -- an enum of the technology to be used.
    secString       SecString                            OPTIONAL,
}

```

```

    prePlanName      -- any password or security string to be used in this route
                     PlanName                                OPTIONAL,
    planName          -- if this route is related to a pre-plan, link it here
                     PlanName                                OPTIONAL,
    graphicOverview   -- current (active) plan this route is related to
                     URL-Link                                OPTIONAL,
                     -- link to a file or to a URI/URL to carry any
                     -- explanatory graphic file for this message
    routeStatus       RouteStatus                            OPTIONAL,
                     -- status of route
                     -- (enum or proposed,planned,setting up, active, teardown, close
                     closed)
    relatedMsgs       SEQUENCE (SIZE(1..32)) OF SubMessageRefNum OPTIONAL,
    ...
}

```

Remarks: The actual turn-by-turn route information structures are shared with that used by the ATIS message set for consumer routing. However, for the most part the routing messages found in ATIS presume “safe and sane” driving on the streets in a normal fashion, and also support multi-modal trip planning uses. Commercial routing databases do not normally support reversed lane driving and may not be able to reflect the link restrictions needed here. Many states have such information on major roadways for their permitting databases to handle processing commercial oversized load permits. Consider integrating these functions. If your deployment requires supporting people evacuation, such as mass busing services, then the other routing and scheduling messages found in TCIP and ATIS should be considered as well.

5.7 Message: MSG_RequestPreemptionUserData

Use: This message is used to request information about a vehicle engaged in using the local priority/preemption network. It may be sent by the vehicle’s owning center or by the owner of a priority/preemption network. The essential purpose of this message is to ask for the status of the subject vehicle. The owner of a priority/preemption network may reply with various information regarding if the subject vehicle is authorized to use the system (which may be further limited to certain places and times) and the vehicle’s last known location in the network. The vehicle’s owning center will reply with a message containing the current resource assignment for the vehicle. Other centers requesting this information from either center may or may not receive any information (or a subset of the information) depending on the local data sharing agreements.

This structure is used to meet the requirements outlined in 4.6.1 and Table 8.

ASN.1 Representation:

```

RequestPreemptionUserData ::= SEQUENCE {
    header          Header,
    basics          Basics                                OPTIONAL,
    password        FreeText                             OPTIONAL,
    vehicleID       VehicleId,
    -- a reference to the vehicle
    assignedResourceSubMessage Asgn-Resrc                OPTIONAL,
    -- this definition of the resource (vehicle)
    -- comes from the base std
    ...
}

```

Remarks: A priority/preemption network owner may wish to exchange passwords and other use credentials between the two centers. The method used to convey these and how (as needed) they are sent to the using vehicle is not covered in this standard. However, it is acceptable to use the message structures of the IEEE 1512 family of standards to perform such exchanges.

5.8 Message: MSG_PreemptionUserData

Use: This message is used to relate information about a vehicle engaged in using the local priority/preemption network. It may be sent by the vehicle's owning center to relate current information about the vehicle (such as its location or intended plan of action when it arrives, or its current ETA). It may be sent by the owner of a priority/preemption network to indicate that the vehicle has just entered or attempted to use such a network. It may be sent as a reply to the MSG_RequestPreemptionUserData message.

By exchanging this message between centers the monitoring and validation of use of the priority/preemption network can be achieved. Note that this does not address the technologies employed to build such a network. If the overall systems design concept involves using this message as a part of a request/grant dialog to gain access to actually authorize the preemption of a signal system, then the overall latencies of message traffic should be considered as well. Note that while this message was intended to be used with a vehicle, it can also be used as a means for tracking the access of individuals and other objects.

This structure is used to meet the requirements outlined in 4.6.2 and Table 9.

ASN.1 Representation:

```
PreemptionUserData ::= SEQUENCE {
    header          Header,
    basics          Basics                               OPTIONAL,
    password        FreeText                             OPTIONAL,
    vehicleID       VehicleId,
    -- the reference of the vehicle object
    assignedResourcesSubMessage Asgn-Resrc              OPTIONAL,
    -- defined from base std
    technology      SEQUENCE (SIZE(1..16)) OF PreemptTech OPTIONAL,
    -- this is the tech used by the vehicle over the route
    relatedEvent    IncidentRef                         OPTIONAL,
    -- the IDX incident number of the incident the
    -- vehicle is assigned to
    authorizationValue PreemptAuthorization            OPTIONAL,
    -- an enum or yes/no/not here/ not present, etc
    ...
}
```

5.9 Message: MSG_InfrastructureReport

Use: This message can be used to send information to another center regarding its infrastructure and report damage or otherwise out of normal operations. The report is received by another center who may do anything with it as they wish (including discard it entirely). It is intended to be used during the course of an incident event to report damage to another center. In this capacity, the message can be very helpful in starting the repair and restoration process early.

Some deployments may find it useful to restrict the use of this message to only other centers who can reasonably be expected to provide "quality" information, while others may determine that they will allow reports of such things as tires in the median and malfunctioning signal lights to be input to the system from unverified public callers. This is another deployment subject for local implementations to decide on a group. The quality metrics in the reporting person section allows a range of qualifications regarding the reporting person. Privacy of the public can also be preserved in these fields.