



SURFACE VEHICLE STANDARD

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Dedicated Short Range Communications (DSRC) Message Set Dictionary

RATIONALE

This Standard is the fifth edition of the message set dictionary. The changes made from prior editions include revising the content to reflect a uniform use of unaligned packed coding rules, a common message framework, the further refinement of several existing messages due to deployment experience, and the addition of a preliminary Personal Safety Message for use with vulnerable road users. This amendment to the standard was issued in March of 2016 to clarify how positional offsets were calculated in some data frames. Two typographical errors were also corrected at that time.

The document areas affected by this limited scope revision are as follows:

Section 6.82 Data Frame: DF_PathHistory,	Page 79	In the Use section,
Section 6.84 Data Frame: DF_PathHistoryPoint,	Page 80	In the Use section
Section 6.84 Data Frame: DF_PathHistoryPoint,	Page 80	In the ASN.1 Representation section
Section 7.127 Data Element: DE_OffsetLL-B18,	Page 171	In the Use section,
Section 7.195 Data Element: DE_TimeOffset,	Page 202	In the Use section
Section 7.224 Data Element: DE_VertOffset-B12,	Page 214	In the Use section
Section 8.58 Data Element: EXT_ITIS_Codes [ITIS],	Page 240	In the ASN.1
Section 11.8 Lanes, Objects Defined in Intersections and Elsewhere,	Page 263	In the last paragraph on this page.

DEDICATION

This standard is dedicated to the Memory of Broady Cash, who provided leadership and guidance in the evolution of the DSRC standards. His research led to work on the original ASTM DSRC standards, for which Broady pulled together a team of industry stakeholders and subject matter experts. The ASTM standard (E-2213) addressed all of the DSRC communications layers. Mr. Cash was also very active in helping support the establishment of the DSRC spectrum. When the DSRC standards expanded to IEEE and SAE, Broady continued his leadership role in ensuring that the 1609 and 802.11p standards continued to meet the original requirements, and that they would work together to meet the evolving ITS applications requirements. He was often the glue that kept the standards activities on track, as he mediated differences of opinion and personalities among the various contributors to the standards. Broady Cash was born on October 7, 1948, in Amherst, Virginia. He passed away after battling a long illness on November 3, 2008. He is survived by his wife and two children. Many thanks to Broady for his invaluable contributions to DSRC and to the foundation of Connected Vehicle technologies.

FOREWORD

Prepared for use by the DSRC committee of the SAE by SubCarrier Systems Corp ([SCSC](#)).

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1. SCOPE

This SAE Standard specifies a message set, and its data frames and data elements, specifically for use by applications intended to utilize the 5.9 GHz Dedicated Short Range Communications for Wireless Access in Vehicular Environments (DSRC/WAVE, referenced in this document simply as “DSRC”) communications systems. Although the scope of this Standard is focused on DSRC, this message set, and its data frames and data elements, have been designed, to the extent possible, to be of potential use for applications that may be deployed in conjunction with other wireless communications technologies as well. This Standard therefore specifies the definitive message structure and provides sufficient background information to allow readers to properly interpret the message definitions from the point of view of an application developer implementing the messages according to the DSRC Standards.

1.1 Purpose

The purpose of this SAE Standard is to support interoperability among DSRC applications through the use of a standardized message set, and its data frames and data elements. This Standard provides information that is useful in understanding how to apply the various DSRC Standards, along with the message set specified herein, to produce interoperable DSRC applications.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2540 Messages for Handling Strings and Look-Up Tables in ATIS Standards

SAE J2540-2 ITIS Phrase Lists (International Traveler Information Systems)

2.1.2 IEEE Publications

Available from IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE Std 1609.2™-2016 IEEE Standard for Wireless Access in Vehicular Environments—Security Services for Applications and Management Messages

IEEE Std 1609.3™-2016 IEEE Standard for Wireless Access in Vehicular Environments (WAVE)—Networking Services

IEEE Std 1609.4™-2016 IEEE Standard for Wireless Access in Vehicular Environments (WAVE)—Multi-channel Operation

2.1.3 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>

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

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.

2.1.4 RTCM Publications

Available from the Radio Technical Commission For Maritime Services, 1800 N Kent St., Suite 1060, Arlington, VA 22209, www.rtcn.org.

RTCM 10402.3 Recommended Standards for Differential GNSS (Global Navigation Satellite Systems) Service -Version 2.3 Revision 2.3 adopted on August 20, 2001 and its successors.

RTCM Standard 10403.1 for Differential GNSS (Global Navigation Satellite Systems) Services -Version 3 adopted on October 27, 2006 and its successors, including amendments #1~#5 adopted July 1, 2011, and its successors.

2.1.5 NMEA Publication

Available from National Marine Electronics Association, 7 Riggs Ave., Severna Park, MD 21146, www.nmea.org.

NMEA 183 Interface Standard V 3.01, published by the National Marine Electronics Association (NMEA) released January 2002.

2.2 Related Publications

This standard is intended to be independent of the underlying lower layer protocols, though early deployments are expected to use the "DSRC-WAVE" technology operating at 5.9 GHz. For background material, the following standards or information reports are also of value.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1939 Serial Control and Communications Heavy Duty Vehicle Network - Top Level Document

SAE J2630 Converting ATIS Message Standards From ASN.1 To XML

SAE J3067 Candidate Improvements to Dedicated Short Range Communications (DSRC) Message Set Dictionary [SAE J2735] Using Systems Engineering Methods

2.2.2 US Dept. of Transportation, National Transportation Library

Available on-line from the National Transportation Library at <http://ntl.bts.gov>.

Cooperative Intersection Collision Avoidance System Limited to Stop Sign and Traffic Signal Violations (CICAS-V), Task 10 Final Report Dated 09-30-2008 which is available at [http://ntl.bts.gov/lib/38000/38600/38631/Appendix_G_CICAS-V_Task_10_Final_Report_4-29-10_FHWA-JPO-10-068 .pdf](http://ntl.bts.gov/lib/38000/38600/38631/Appendix_G_CICAS-V_Task_10_Final_Report_4-29-10_FHWA-JPO-10-068.pdf)

2.2.3 US Dept. of Transportation, National ITS Architecture

Available on-line at <http://www.iteris.com/itsarch/>.

2.2.4 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM E2158-01 Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer Using Microwave in the 902 to 928 MHz Band

ASTM E2213 -03 Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems - 5 GHz Band Dedicated Short Range Communications (DSRC) Medium Access Control (MAC) and Physical Layer (PHY) Specifications

2.2.5 IEEE Publications

Available from IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE Std 1609.0™-2013 IEEE Guide for Wireless Access in Vehicular Environments (WAVE) – Architecture

IEEE Std 802.11™-2012 Standard for LAN/MAN - Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. (And all published Corrigenda for this standard.)

IEEE Std 1609.12™ Draft IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Identifier Allocations. December 9, 2015 (anticipated publication date)

3. TERMS AND DEFINITIONS

For the purposes of this standard, the following definitions, abbreviations and acronyms apply.

3.1 Definitions

For the purposes of this standard, the following definitions shall apply.

3.1.1 Actors: An entity which has an active role or interest in a use case e.g., driver.

3.1.2 Actuated Operation: A type of traffic control signal operation in which some or all signal phases are operated on the basis of actuation, e.g. detector inputs. A signal without any actuation runs on either fixed time or time of day operation. A signal may be semi-actuated as well.

3.1.3 Application-specific Data Dictionary: A data dictionary specific to a particular implementation of an ITS application. Local deployments which use DSRC may often select a subset of the defined messages meeting their specific needs and create an application-specific data dictionary for that deployment. This document is an example of an Application-specific Data Dictionary intended for DSRC applications.

3.1.4 Approach: All lanes of traffic moving towards an intersection or a midblock location from one direction, including any adjacent parking lane(s). In the context of this standard an approach is an arbitrary collection of lanes used in the flow of traffic proceeding to an intersection or a midblock location. An approach is typically identified by its general flow, i.e. “the east-bound approach”. In this standard an approach consists of one or more motor vehicle lanes of travel as well as possible pedestrian lanes, parking lanes, barriers, and other types of lane objects some of which cross the path of the motor vehicle travel.

3.1.5 Approaching Vehicle: An equipped vehicle whose trajectory will or may intersect the HV as the HV maintains its own trajectory.

3.1.6 Back Office (BO): A Back Office Infrastructure element which consumes data from, or provides data to, the roadside Infrastructure. Often used to communicate to the equipped vehicles using DSRC technology by transferring information to the roadside device (RD) for transmission to or from the HV.

3.1.7 Basic Encoding Rules: Rules laid out by the ASN.1 standard for encoding abstract information into a concrete data stream. The 2009 DSRC message set standard used DER, a variant of BER for its encoding. This is no longer used.

3.1.8 BLOB: Binary Large Object, a term used in software to describe sequences of octets or bytes where any inner encoding or meaning is not visible.

3.1.9 Byte Type Encoding: A type of information encoding where units of information are handled in modular increments of 8 bits (an octet).

3.1.10 Certificate Authority (CA): A Back Office Infrastructure element which interacts with the HV and the RD to enter into a dialog with the HV and provide certification services. A primary goal of the CA is to manage the collection of certificates for DSRC devices.

3.1.11 Commercial Motor Vehicle: Any self-propelled or towed vehicle used on public highways in interstate commerce to transport passengers or property when: 1) The vehicle has a gross vehicle weight rating or gross combination weight rating of 10,001 or more pounds; or 2) The vehicle is designed to transport more than 15 passengers, including the driver; or 3) The vehicle is used in the transportation of hazardous materials in a quantity requiring placarding under regulations issued by the Secretary of Transportation under the Hazardous Materials Transportation Act (49 U.S.C. App. 1801-1813). (49CFR350) (49CFR390)

3.1.12 Computed Lane: A lane drivable by motorized vehicle traffic which shares its path definition with another nearby lane at the same intersection. It is one of several types of basic lanes defined in the message set. The computed lane allows saving of message bytes used to express the geometric path of multiple lanes approaching an intersection with the same general path.

3.1.13 Conflict Monitor: A device used to detect and respond to improper or conflicting signal indications and improper operating voltages in a traffic controller assembly.

3.1.14 Control Channel (CCH): The DSRC radio channel typically used in IEEE 1609 for transmitting service announcements and other control information in WAVE protocol.

3.1.15 Controller Assembly: A complete electrical device mounted in a cabinet for controlling the operation of a highway traffic signal.

3.1.16 Controller Unit: That part of a controller assembly which is devoted to the selection and timing of the display of signal indications.

3.1.17 Crossing Vehicle: An equipped vehicle whose trajectory will or may intersect the HV as the HV changes its own trajectory to make a turning maneuver.

3.1.18 Cycle: One complete sequence of signal indications.

3.1.19 Cycle Length: The duration of one complete sequence of signal indications. The cycle length is not generally fixed at actuated controllers.

3.1.20 Dark Mode: Dark mode indicates that all signal indications are off. Transmission of Dark Mode may commonly be associated with signalized intersections, ramp meters, lane control, beacons, and power shutdown. When using a SPAT message to convey a non-signalized all-way stop intersection, the dark mode indicates that the signage is missing for the particular approach(es).

3.1.21 Data Concept: Any of a group of data dictionary structures defined in this Standard (e.g., data element, data element concept, entity type, property, value domain, data frame, or message) referring to abstractions or things in the natural world that can be identified with explicit boundaries and meaning and whose properties and behavior all follow the same rules.

3.1.22 Data Consumer: Any entity in the ITS environment which consumes data.

3.1.23 Data Dictionary: An information technology for documenting, storing and retrieving the syntactical form (i.e., representational form) and some usage semantics of data elements and other data concepts.

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

3.1.25 Data Frame: A data frame is a collection of two or more other data concepts in a known ordering. These data concepts may be simple (data elements) or complex (data frames). A construct composed entirely of an octet string is considered a data frame if the octet string represents two or more distinct data concepts.

3.1.26 Data Plane: The data plane is the component of an abstract telecommunications architecture containing the entities that exchange protocol data units that contain application data units with their peers at the various layers in the protocol stack.

3.1.27 Data Type: Classification of a data element based upon how value contained is to be interpreted in operations defined for the data element.

3.1.28 Dialog: A sequence of two or more messages which are exchanged in a known sequence and format (typically of a request followed by one or more replies) between the parties.

3.1.29 Disabled Vehicle: An equipped vehicle that has self-declared that it is not performing all designed/intended functions and/or operations. Such a vehicle may be moving or may be stationary.

3.1.30 Distinguished Encoding Rules: A variant of ASN BER encoding used by the 2009 edition of this standard.

3.1.31 Driver: The human operating an equipped vehicle used in any role, typically the start or end point of a use case in which the driver is alerted to an event or takes some action. The precise means of delivery for driver alerts within each vehicle's human-machine interface are beyond the scope of this effort. There is only one driver at any time within one vehicle. At this time, only drivers of equipped vehicles are included, as none of the current use cases requires interaction with non-equipped vehicles or their drivers.

3.1.32 Dual-Arrow Signal Section: A type of signal section designed to include both a yellow arrow and a green arrow.

3.1.33 Egress: Egress is the flow of vehicular or other types of traffic leaving an intersection on one or more of the defined lanes of travel.

3.1.34 Encounter: In the context of this Standard, an encounter is an exchange of messages between two or more DSRC equipped devices (OBUs or RSUs) lasting for a brief period of time.

3.1.35 Entity: Anything of interest (such as a person, place, process, property, object, concept, association, state, event, etc.) within a given domain of discourse (in this case within the ITS domain of discourse).

3.1.36 Entity Type: An abstract type of structure defined in the ITS data registry but no longer used. There are no entity types defined in this standard.

3.1.37 Flashing Mode: A mode of operation in which at least one traffic signal indication (but more typically all signal indications of the entire signalized intersection) in each vehicular signal face of a highway traffic signal is turned on and off repetitively. Refer to MUTCD 2009 for additional information, see <http://mutcd.fhwa.dot.gov/>. Expressed in the terminology of the SPAT message, this is reflected in the descriptions of signal states of the affected lanes (in that movement) being set to red or yellow flashing.

3.1.38 Fleet Vehicle: An equipped vehicle which is part of a collection of vehicles owned or operated by a common entity, public or private.

3.1.39 Full-Actuated Operation: A type of traffic control signal operation in which all signal phases function on the basis of actuation.

3.1.40 Functional-area Data Dictionary (FADD): A data dictionary that is intended to standardize data element syntax, and semantics, within and among application areas within the same functional area. This DSRC Standard is a FADD.

3.1.41 Host Vehicle (HV): The equipped vehicle about which a given use case may be constructed. The Host Vehicle (HV) can be a transmitting vehicle, or a receiving vehicle, or both – this distinction is made clear in the use case description. There is typically only one Host Vehicle in any use case.

3.1.42 Infrastructure: Any roadside device which supports V2V/V2I communications flows (message exchanges), including but not limited to DSRC RSU devices. At this time, the primary V2V uses cases and data flows require only moderate interaction with the Infrastructure for activities such as security.

3.1.43 Ingress: In the context of this Standard, an ingress is a flow of vehicular or other types of traffic approaching an intersection on one or more of the defined lanes of travel.

3.1.44 Intelligent Transportation Systems (ITS): Systems that apply information technology to transportation challenges. Another meaning of the ITS acronym is integrated transportation systems, which stress that ITS systems will often integrate components and users from many domains, both public and private. ITS improves transportation safety and mobility and enhances productivity through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. Intelligent transportation systems (ITS) encompass a broad range of wireless and wire line communications-based information and electronics technologies. - See more at: <http://www.its.dot.gov/faqs.htm#what>

3.1.45 Interoperability: The ability to share information among heterogeneous applications and systems.

3.1.46 Intersection: In the context of this Standard, an intersection is a nexus where two or more approaches meet and vehicles and other types of users may travel between the connecting links. If signalized, the modes of allowed travel are reflected in the signal phases, the geometry of the intersection, and local regulatory environment. This standard conveys some of this information in messages: specifically the MAP message conveys the road geometry, while the SPAT message conveys the current signal indication to control movement in the intersection."

3.1.47 Intersection Control Beacon: A beacon used only at an intersection to control two or more directions of travel.

3.1.48 Interval: In the context of signal timing, the part of a signal cycle during which signal indications are stable and do not change. In the SPAT message the current timing value for the remaining interval time estimate as well as the anticipated interval for yellow change interval is provided for each lane. Because signal interval times commonly change based on triggering events in many types of signaling systems, the value provided in the SPAT message may represent a minimal value that is extended and updated as the message is re-issued each time.

3.1.49 Interval Sequence: The order of appearance of signal indications during successive intervals of a signal cycle.

3.1.50 International Traveler Information Systems (ITIS): The term commonly associated with the SAE J2540-2 standard for incident phrases developed by the SAE ATIS Committee in conjunction with ITE TMDD and other standards. This work contains a wide variety of standard phrases to describe incidents (i.e., a traffic accident) and is used throughout the 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. ITIS phrases can also be freely mixed with text and used to describe incidents, accidents, weather reports, roadway signage, and other content types.

3.1.51 Lane: In the context of this Standard, a lane is a portion of the transportation network (typically a section of roadway geometry) which is being described in terms of its centerline path and various attributes. In the DSRC message set, the *lane object* is used to represent lanes. Lanes consist not only of sections of "drivable" roadway traversed by motor vehicles, but other types of lanes including pedestrian and bicycle walkways, train tracks, transit lanes, and certain types of dividers and barriers. When used in describing an intersection, a lane is often defined for each possible path into and out of the intersection (e.g. within the MAP message). In use, the current signal phase (and therefore the allowed movements) that is applicable to that lane or its approach at a given point in time is provided in the SPAT message.

3.1.52 Lane-Use Control Signal: A signal face displaying signal indications to permit or prohibit the use of specific lanes of a roadway or to indicate the impending prohibition of such use.

3.1.53 Link (RF): A communications channel being used in support of application data transfer needs.

3.1.54 Link (Traffic): A segment of a road network. A highway type of link is generally separated by one data collection node (such as an RSU or a vehicle detector station). Local road links tend to be defined by intersections with cross streets. Other common usages of the word "link," such as those used in telecommunications, may also appear in the document.

3.1.55 Local Deployment: A local deployment is an embodiment of the DSRC message set within a region that implements one or more of the DSRC application groups defined in one or more other standards. Such deployments use the messages of the standard in conformant ways to exchange data. Such deployments may have additional information content defined in the regional extensions of the messages to handle needs which are unique.

3.1.56 Management Plane: The collection of functions performed in support of the communication system operation, but not directly involved in passing application data.

3.1.57 Message: A well structured set of data elements and data frames that can be sent as a unit between devices to convey some semantic meaning in the context of the in the context of pre-defined applications. applications. Within Section 5 of this standard, each sub-section (e.g. 5.1) defines one message. The casual term "message type" often has the same meaning as "message" in this standard.

3.1.58 Message Set: A collection of messages based on the ITS functional area they pertain to. The collection of messages defined in this Standard is a message set.

3.1.59 Nearby Vehicle (NV): Those vehicles within the transmission range of the Host Vehicle and Receiving Vehicle(s), and which can therefore monitor and react to the exchange of DSRC messages between the HV and RV. Such vehicles are considered situationally aware of the use case exchange under consideration. The NV determines whether to address or ignore the primary use case based on its own positional trajectory with respect to the event and/or other data.

3.1.60 Networking Services: The collection of management plane and data plane function at the network layer and transport layer, supporting WAVE communications.

3.1.61 Notification: An indication of an event of interest, sent to an application. Also a term used by lower layers to inform upper layers of an event of interest in a protocol stack.

3.1.62 Offset (Phase): Offset is the time lag for the cycle start of a coordinated signal. Quoting from the FHWA Signal Timing Manual, Chapter 6, Section 6.1 Terminology (Draft 3 version, development currently underway): "The time relationship between coordinated phases [and a] defined reference point and a defined master reference (master clock or sync pulse)." In other words, a local signal controller setting that references the start of the green to a common clock so the beginning of a green can be coordinated along a roadway to speed motorists along at a designed speed.

3.1.63 On-Board Unit: An On-Board Unit (OBU) is a vehicle-mounted DSRC device used to transmit and receive a variety of message traffic to and from other DSRC devices (other OBUs and RSUs). Among the message types and applications supported by this process are vehicle safety messages used to exchange information on each vehicle's dynamic movements for coordination and safety, a primary subject of this standard. An OBU contains a station (STA).

3.1.64 Operator: The human user of infrastructure or a back office, typically the start or end point of a flow or an event in which the operator is informed of some condition. Similar to the vehicle's human-machine interface, the interface of the human operator with the physical equipment is beyond the scope of this effort. It is presumed that there will be multiple operators interfacing to the physical equipment. In most of the current use cases, the operator is passive in the flow of events; however, the use cases and flows support any business use case logic for the operator. Qualifiers such as Road\Roadway\Infrastructure may be added.

3.1.65 Parked Vehicle: An equipped vehicle which is stationary, with a transmission state indicating that it will not move.

3.1.66 Pedestrian Change Interval: An interval during which the flashing UPRAISED HAND (symbolizing "DON'T WALK") signal indication is displayed, often also called the pedestrian clearance time. During this interval the SPAT messages indicates a don't walk state for that pedestrian lane (along with an optional period of time remaining for this state).

3.1.67 Pedestrian Clearance Time: The minimum time provided for a pedestrian crossing in a crosswalk, after leaving the curb or shoulder, to travel to the far side of the traveled way or to a median. During this interval the SPAT message indicates a Flashing Don't Walk indication for that pedestrian lane (along with an optional period of time remaining for this state). The duration for such time intervals comes from MUTCD and is based on a rate of speed of 2 meters per second.

3.1.68 Pedestrian Phase: The time during which a walking figure or word "WALK" is presented and the flashing "DON'T WALK" is presented. The pedestrian phase is the time interval of the pedestrian walk interval and the pedestrian change interval combined.

3.1.69 Pedestrian Walk Interval: An interval during which the WALKING PERSON (symbolizing WALK) signal indication is displayed. When a verbal message is provided at an accessible pedestrian signal, the verbal message is "walk sign." During this interval the SPAT messages indicates a walk state for that pedestrian lane (along with an optional period of time remaining for this state and the subsequent pedestrian clearance state).

3.1.70 Permissive Mode: A mode of traffic control signal operation in which, when a CIRCULAR GREEN signal indication is displayed, left and/or right turns are permitted to be made after yielding to pedestrians and/or oncoming traffic.

3.1.71 Preemption Control: The transfer of normal operation of a traffic control signal to a special control mode of operation.

3.1.72 Pre-timed Operation: A type of traffic control signal operation in which none of the signal phases function on the basis of actuation. When such a signal operation is reflected in the SPAT message, the time intervals given for various signal phases are fixed and do not vary based on any form of actuation. Pre-timed operation may be fixed or based on time of day schedules.

3.1.73 Protected Mode: A mode of traffic control signal operation in which left or right turns are permitted to be made when a left or right GREEN ARROW signal indication is displayed.

3.1.74 Provider Service Context (PSC): A field associated with a PSID containing supplementary information related to the service. PSC is defined in IEEE Std 1609.3.

3.1.75 Provider Service Identifier (PSID): A number that identifies a service provided by an application. PSID is defined in IEEE Std 1609.12.

3.1.76 Public Safety Vehicle: An equipped vehicle actively engaged in Public Safety operations and announcing so to others. When not engaged in Public Safety operations, this role reverts to the behaviors associated with its basic vehicle class and type (typically a passenger vehicle). This type of vehicle is presumed to be equipped with an On-Board Unit specialized for Public Safety ("PSOBUS") device.

3.1.77 Receiving Vehicle (RV): An equipped vehicle receiving DSRC messages from other nearby vehicles or from nearby infrastructure (e.g., an RSU).

3.1.78 Red Clearance Interval: An optional interval that follows a yellow change interval and precedes the next conflicting green interval.

3.1.79 Reference Lane: A reference lane is a lane drivable by motorized vehicle traffic which also contains a detailed path definition of the lane's geometry (a center line path and width) as well as basic attributes (such as the allowed maneuvers) about the lane. The provided path data may optionally be reused with another nearby lane (a "computed lane") in the same intersection. It is one of several basic types of lanes defined in the message set.

3.1.80 Reference Point: A reference point is a complete set of values for latitude – longitude – and height above the reference ellipsoid which is used as an initial starting point for subsequent orthogonal offset X, Y, Z values from that point. All roadway geometry, maps of intersections, lane and curve descriptions, and other geometrical data that are encoded in this Standard use a system of local reference points to index and offset the data that follows. Also called an Anchor Point.

3.1.81 Remote Vehicle (RV): The equipped vehicle (or vehicles) which play supporting roles in the use case by interacting with the Host Vehicle in some way. Each Remote Vehicle (RV) can be a transmitting vehicle, or a receiving vehicle, or both – this distinction is made clear in the use case description. There is typically more than one Remote Vehicle in any use case.

3.1.82 Reporting Vehicle: An equipped vehicle which is providing some form of additional data to other Remote Vehicles or to the roadside Infrastructure.

3.1.83 Reversing Vehicle: An equipped vehicle in which the transmission is engaged to propel the vehicle backwards.

3.1.84 Roadside Device (RD): Any Roadside Infrastructure device which is equipped with an RSU and which is used to communicate with equipped vehicles. Further distinctions among RDs may be made for devices which are co-located or in close communion with other roadside devices (such as an advanced signal controller) for some use cases.

3.1.85 Roadside Unit: A RoadSide Unit (RSU) is a DSRC device used to transmit to, and receive from, DSRC equipped moving vehicles (OBUs). The RSU transmits from a fixed position on the roadside (which may be either a permanent installation or "temporary" equipment brought on-site for a period of time associated with an incident, road construction, or other event). Some RSUs have the ability to transmit signals with greater power than OBUs and some may have connectivity to other nodes or the Internet. An RSU contains a station (STA).

3.1.86 Roles: These are the parts "played" by each actor in a given UML use case scenario, e.g., primary vehicle, nearby vehicle, approaching vehicles.

3.1.87 Semi-Actuated Operation: A type of traffic control signal operation in which at least one, but not all, signal phases function on the basis of actuation.

3.1.88 Service Channel: A DSRC channel used for exchange of information relevant for ITS applications, in contrast to CCH, which carries control information."

3.1.89 Signal Head: An assembly of one or more traffic signal lamps. One or more signal heads may be used to provide complementary indications to one of more approaches, which may cover multiple lanes. The definitive mapping to specific lanes can be determined by examining the SPAT and MAP fragment messages.

3.1.90 Signal Phase: The right-of-way, yellow change, and red clearance intervals in a cycle that are assigned to an independent traffic movement, or combination of movements. Each of these cycles is reflected in the SPAT message for the lanes that are part of the movement(s), along with its expected timing interval (which may be updated in signal systems that vary the time interval based on actuation or other methods).

3.1.91 Signal Section: Two or more traffic control signals operating in signal coordination. Also called a signal system.

3.1.92 Signal Timing: The amount of time allocated for the display of a signal indication, slang.

3.1.93 Slow Moving Vehicle: A vehicle engaged in movement that is slower than the surrounding flow of traffic and thereby presents a hazard, e.g. a tow truck with a load. The SMV can be equipped with an OBE or not, and there may be more than one SMV in a given use case.

3.1.94 SPAT: Signal Phase And Timing (SPAT), is a message type which describes the current state of a signal system and its phases and relates this to the specific lanes (and therefore to movements and approaches) in the intersection. It is used along with the MAP message to describe an intersection and its current and future control states.

3.1.95 Split (Phase): In split phase operations opposing turn lanes are coordinated at differing times. For example, the east and west left turn movements would get green arrows at different times.

3.1.96 Split (Signal): Signal split is a term having to do with coordinated signals. Signal split pertains to time allocated to the coordinated road vs. the cross streets.

3.1.97 Stability Control: A system which operates to prevent a car from sliding sideways under dynamic driving conditions.

3.1.98 Station: Any device that contains an IEEE 802.11 conformant medium access control (MAC) and physical layer (PHY) interface to the wireless medium. Both an RSU and an OBU contain stations (STA).

3.1.99 Stop Line: The stop line is a defined location along the path of the lane type where users (vehicles) are presumed to stop and come to rest, often found at the lane's edge leading to the center of the intersection. The stop line is used as the starting point to define the centerline path of a lane in the messages (with sets of offset points defining the path of the lane proceeding away from the stop line). While stop lines are normally considered for lanes describing motorized vehicle travel, they are also used on other forms of lanes (such as pedestrian walkway lanes) to describe the initial point of the path.

3.1.100 Stopped Vehicle: An equipped vehicle which is stationary but which remains in gear and able to move at any time.

3.1.101 Syntax: The structure of expressions in a language, and the rules governing the structure of a language.

3.1.102 Towing Vehicle: An equipped light passenger vehicle which is towing a trailer.

3.1.103 Transactions: Bi-directional data exchanges between devices (RSUs and OBUs).

3.1.104 Transit Vehicle: An equipped vehicle engaged in Transit operations, e.g., a bus.

3.1.105 Unaligned Packed Encoding Rules: The variant of ASN PER encoding which is used in this edition of the standard.

3.1.106 Unavailable: In the context of this Standard and in the context of a data concept definitions, the term unavailable shall mean that the value of this data concept could not be obtained for use in the message.

3.1.107 Un-equipped Vehicle: A vehicle which is not equipped with an OBU device.

3.1.108 Vehicle: In the context of this standard, all types of motor vehicles, including light passenger vehicles, heavy and freight vehicles, buses, special services vehicles (street sweepers, tow trucks, etc.), those vehicles used in public safety and response roles; and various "alternative" vehicles which may use public roadways, such as motorcycles, off-road heavy equipment, etc. For certain basic use cases in the current scope of work, non-motorized vehicle roles and pedestrian roles are also modeled as vehicles. It is expected that a more detailed breakdown will be required in time.

3.1.109 Vehicle Type: In the context of this Standard, the vehicle type is a data element used to define overall gross size and mass of a vehicle. Observe that this definition differs from the (multiple other) vehicle types defined elsewhere in other standards used in the ITS.

3.1.110 Walk Interval: An interval during which the WALKING PERSON (symbolizing WALK) signal indication is displayed. When a verbal message is provided at an accessible pedestrian signal, the verbal message is "walk sign."

3.1.111 Warning Beacon: A beacon used only to supplement an appropriate warning or regulatory sign or marker.

3.1.112 WAVE device: A Device which is conformant to Wireless Access for Vehicular Environment communication protocol.

3.1.113 WAVE management entity (WME): The set of management functions, as defined in IEEE Std 1609 documents.

3.1.114 XML: 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 HTTP. XML has a number of supporters due to its ability to be implemented in the types of heterogeneous systems often found in ITS deployments. It is possible to express and exchange the DSRC message set using this method.

3.1.115 Yellow Change Interval: The first interval following the green interval during which the yellow signal indication is displayed. In the SPAT message the fixed duration of the yellow change interval is (optionally) provided for each active lane being described.

3.2 Abbreviations and acronyms

The terms, abbreviations and acronyms cited below shall be a part of the terms of this Standard (and of the other companion volumes and guides) unless specifically cited otherwise.

AAMVA	American Association of Motor Vehicle Administrators
ABS	Anti-lock Braking System
ASC	Advanced Signal Controller
ASN	Abstract Syntax Notation revision One, Also: ASN.1
ASTM	American Society for Testing and Materials
ATIS	Advanced Traveler Information Systems
ATMS	Advanced Transportation Management Systems
BER	Basic Encoding Rules
BLOB	Binary Large Object
BSM	Basic Safety Message
BSW	Blind Spot Warning
CAM	Cooperative Awareness Message
CAN	Controller Area Network
CCC	Cooperative Cruise Control
CCH	Control Channel
CER	Canonical Encoding Rules
CICAS-V	Cooperative Intersection Collision Avoidance System – Violation
CLW	Control Loss Warning
CRC	Cyclic Redundancy Code
CSR	Common Safety Request Message
DE	Data Element
DER	Distinguished Encoding Rules
DF	Data Frame
DGPS	Differential GPS (or GNSS)
DNPW	Do Not Pass Warning
DSRC	Dedicated Short Range Communications
DVIN	Driver-Vehicle Interface Notifier
EEBL	Emergency Electronic Brake Lights
EGUI	Engineering Graphical User Interface
ESS	Environmental Sensors Stations
EVA	Emergency Vehicle Alert Message
FCW	Forward Collision Warning
GES	General Estimates System
GID	Geographic Information Description
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System

GPS	Global Positioning System
HMI	Human Machine Interface
HVPP	Host Vehicle Path Prediction
ICA	Intersection Collision Alert Message
IEEE	Institute of Electrical and Electronics Engineers
IM	Incident Management or inter-modal
IMA	Intersection Movement Assist
IP	Internet Protocol
IPv6	Internet Protocol version 6
ISO	International Standards Organization
ITE	Institute of Transportation Engineers
ITIS	International Traveler Information Systems
LCW	Lane Change Warning
LLC	Logical Link Control
LLH	Latitude, Longitude, Height and Above the Ellipsoid
LRMS	Location Referencing Message System
LSB	Least Significant Bit
MAC	Medium Access Control
MAP	Map Data Message
MIB	Management Information Base
MIL	Malfunction Indicator Light (Check Engine Light)
MSB	Most Significant Bit
MSG	Message
NAP	Network Access Point
NEMA	National Electronics Manufacturers Association
NHSTA	National Highway Traffic Safety Administration
NMEA	National Marine Electronics Association
NTCIP	National Transportation Communications for ITS Protocols
NTRIP	Networked Transport of RTCM via Internet Protocol
OBE	On-Board Equipment
OBU	On-Board Unit
OEM	Original Equipment Manufacturer
OTA	Over-The-Air
PDM	Probe Data Management Message
PDU	Protocol Data Unit
PER	Packed Encoding Rules
PH	Path History
PHY	Physical Layer
PP	Path Prediction

PSC	Provider Service Context
PSID	Provider Service Identifier
PSN	Probe Segment Number
PVD	Probe Vehicle Data Message
RSA	RoadSide Alert Message
RSU	RoadSide Unit
RTCM	Radio Technical Commission For Maritime Services or RTCM Corrections Message
RTK	Real Time Kinematics
SAE	Society of Automotive Engineers
SAP	Service Access Point
SC-104	Sub-Committee 104 of the RTCM
SCH	Service Channel
SDH	Sensor Data Handler
SDN	Service Delivery Node
SDO	Standards Developing Organizations or Standards Development Organization
SPAT	Signal Phase And Timing Message
SRM	Signal Request Message
SRS	Safety Restraint System or Supplemental Restraint System
SSM	Signal Status Message
SSP	Service Specific Permissions
STA	Station
TA	Threat Arbitration
TC	Traction Control or Target Classification
TCIP	Transit Communications Interface Profiles
TCP	Transmission Control Protocol
TCS	Traction Control System
TIM	Traveler Information Message
TMDD	Traffic Management Data Dictionary
UDP	User Datagram Protocol
UML	Unified Modeling Language
UPER	Unaligned Packed Encoding Rules
USDOT	United States Department of Transportation
UTC	Universal Coordinated Time
V2I	Vehicle-to-Infrastructure
V2P	Vehicle-to-Pedestrian
V2V	Vehicle-to-Vehicle
V2X	Vehicle to any DSRC equipped object
VIN	Vehicle Identification Number
VSC	Vehicle Safety Communications

VSC-2	Vehicle Safety Communications 2
WAVE	Wireless Access in Vehicular Environments
WME	WAVE Management Entity
WMH	Wireless Message Handler
WSM	WAVE Short Message
WSMP	WSM Protocol
XML	eXtensible Markup Language

4. THE USE OF DSRC MESSAGES IN APPLICATIONS

This Section contains introductory material about this edition of SAE J2735, and background information on the rationale for the Standard and the user needs which it was developed to meet. The general design approach used in the Standard and a selection of topics which provide both informative and normative information about its use can be found in Section 11.

4.1 Introduction to DSRC Goals and Objectives (Informative)

Public sector organizations throughout the world have identified the need to reduce fatalities and serious injuries that result from vehicle crashes, as well as the need to reduce traffic congestion. The use of wireless and computer technologies in vehicles, and on the roadway infrastructure, have been identified as promising areas to provide solutions for these needs. Intelligent Transportation System (ITS) planning in many regions of the world has therefore become focused on supporting applications that utilize a common platform to address three priorities:

1. Safety
2. Mobility
3. Commercial (or Private)

Safety applications, in particular, must be interoperable between vehicles from different manufacturers and between vehicles and roadway infrastructure within all the areas where the vehicle is likely to travel. These requirements for interoperability are also relevant to contemplated mobility applications. This SAE Standard specifies messages, data frames and data elements that allow interoperability at the application layer without the need to standardize applications. This approach supports innovation and product differentiation through the use of proprietary applications, while maintaining interoperability by providing a standard message set that can be universally generated and recognized by these proprietary applications.

The message set specified in this SAE Standard depends upon the lower layers of the DSRC protocol stack (or potentially other wireless communications systems) to deliver the messages from applications at one end of the communication system (for example, in a vehicle) to the other end (for example, in another vehicle). These lower layers of the DSRC protocol stack are defined and specified in standards developed by other Standards Development Organizations (SDOs). In particular, the protocols at the lowest layers are addressed by IEEE Std 802.11, particularly in the sections referring to "Outside the Context of a BSS" or OCB and the middle layer protocols are covered in the IEEE 1609 family of standards for Wireless Access in Vehicular Environments. While other uses of the standards are possible, the DSRC family of standards developed by the various SDOs are designed to operate together in a harmonious fashion. This Standard defines the content and structure of messages exchanged between applications. A given SAE J2735 message is the payload of the next lower layer protocol, e.g. the "WSM data" field defined in IEEE 1609.3. The aggregate content of an over-the-air packet is determined jointly by all the protocols in the stack.

The following subsection provides an overview of the DSRC architecture and protocol stack. The messages themselves are presented in Section 5. The particular message design techniques described in this Standard have allowed for the construction of a dictionary of reusable, relevant data frames and data elements that support interoperability for currently envisioned applications. These techniques are also intended to expedite the development of messages to be defined in the future. The data frames are presented in Section 6 of this Standard, and the data elements are specified in Section 7. Data concepts reused from other areas of ITS work or developed in support of regional needs are presented in Section 8. Data concepts which allow regional deployment to extend the Standard in various ways are found in Section 9.

4.2 DSRC Overview (Informative)

The Wireless Access for Vehicular Environment (WAVE) communications system is designed to enable vehicle-to-vehicle and vehicle-to/from-infrastructure communications in order to provide a common platform to achieve the safety, mobility and commercial priorities described in 4.1. Interoperability is a fundamental requirement of this common platform, and WAVE is designed to provide the required interoperable wireless networking services for transportation. As well, the WAVE system uniquely supports the high-availability, low-latency communications requirements of vehicle safety applications, such as pre-crash collision mitigation, intersection collision avoidance and cooperative collision avoidance.

The physical layer (PHY) and the medium access control (MAC) layer of the WAVE system are specified in IEEE Standard 802.11™, as amended (hereafter IEEE 802.11). The system generally supports a MAC and PHY for each channel on which it operates, i.e., the control channel (CCH) and/or one or more service channels (SCHs). The range of this system is generally considered to be line-of-sight distances of less than 1000 meters. The MAC and PHY protocols have been modified to support usage by vehicles traveling at highway speeds.

The IEEE 1609 family of standards is used along with the IEEE 802.11 medium access control (MAC) and physical (PHY) layer standard to enable safety, mobility and other applications, including many that use the data dictionary in this SAE Standard. IEEE 1609 supports a multi-channel system and includes specifications for channel coordination (1609.4), network and transport layers (1609.3), and data security (1609.2).

Two data exchange options (network and transport layer protocols) are identified in IEEE 1609.3: the Wave Short Message Protocol (WSMP) and IPv6 (with various transport layer protocols). IEEE 1609.3 also specifies services for applications and upper layers that use one or both of these two protocol stacks. WSMP is uniquely specified by IEEE 1609.3, and it supports both broadcast and unicast addressing. IEEE 1609.4 specifies channel coordination options that can be used in conjunction with IEEE 1609.3.

IEEE 1609.2 specifies cryptographic data security services. These services include data signing and verification for authentication and integrity, as well as encryption and decryption using asymmetric public keys. To achieve end-to-end security, applications usually invoke these services directly.

4.3 Philosophy of Message Design (Informative)

The wireless DSRC channels over which SAE J2735 messages are communicated are finite resources, which should be used conservatively in order to achieve good performance in realistic traffic environments. The WAVE Short Message Protocol is designed to operate efficiently over DSRC, using short packets that are frequently broadcast in an unacknowledged delivery mode. Other protocols can be used over DSRC as well, for example to carry a variety of other ITS related information including such things as ATIS information encoded in XML forms. WSMs also support dialogs and transactions, with the general design goal to maximize support for compact messages in order to maximize overall system capacity. To that end, a dense encoding of information is used in defining the messages of this Standard.

This dense encoding uses a three-way approach:

1. The smallest divisions of information content to be standardized are called Data Elements
2. Data Frames are the next, more complex data structures to be standardized in this dense encoding
3. The top level of complexity in the data structure standardization is called Messages

The above data concepts are all described in Abstract Syntax Notation revision One (ASN.1, referred to as ASN hereafter). This process follows the typical style used for message sets defined in ITS standards by SAE and the other SDOs engaged in ITS development. The complete ASN specification of the Standard is available to developers to download at the SAE DSRC support site, see Annex A.

4.4 Message Encoding (Normative)

The ASN specified by this Standard is encoded for transport by the lower layers (the encoded stream of octets becomes the payload of that lower layer). The encoding style required to be used to conform with this Standard when used with the WSMP method of sending shall be UPER. In former editions of the Standard the DER encoding style, which follows an octet-aligned Tag-Length-Value format of BER for ASN, was used. The DER encoding style is no longer used when WSMP is used.

The UPER ASN encoding method is superseded in a few selected places where the normative use case does not involve ASN encoding. In such cases the ASN syntax of this Standard is typically encoded and sent “over the wire” with implicit encoding. In the production of ASN found in this Standard there are OCTET STRING segments defined which are made up of inner content constructed as outlined in ASN comments which are part of the definition. In such cases the OCTET STRING shall be encoded to match the described inner content found in the ASN comments and using the bit and octet numbering and packing order as defined by ASN. When the inner content of a defined OCTET STRING refers to another data frame or data element found in this Standard for its construction the definition of that element shall be used in the place it is referred to. The resulting content of that portion of the OCTET STRING shall be conformant to the definition of the referenced data frame or data element.

4.5 Additional Data Dictionary Constraints (Informative)

The use of the messages, data frames, and data elements defined in this Standard, including the various system performance levels required, can be found in other standards such as J2945/1.

5. MESSAGE SET

This section defines the precise structure of certain data concepts defined by this standard.

All text in this clause is considered normative unless expressly marked otherwise. The definitions for each data concept in this dictionary set are presented in the following sub clauses. The section titled Use provides a general overview of the data concept and broadly explains the informational concept and its intended use. It may also provide illustrative use cases. It may assert normative details regarding such use. In addition, each standard that makes use of the data concept may further constrain aspects of its use (for example defining a minimum accuracy level under given operational conditions). The ASN.1 is presented in a section titled ASN.1 Representation and is also available from SAE in a downloadable format. The ASN defines, at the least, the precise structural details of the data concept, such as precision and range of valid values. The section titled Used By provides a listing and a set of hyperlinks to other places in the document where this data concept is used. The section titled Remarks is used to provide additional information regarding the data concept, often denoting changes made to the concept from prior published editions.

The productions of ASN.1 which follow shall be considered normative in nature. While the majority of the normative content is reflected in the actual syntax of the ASN.1, some entries also have additional statements in the ASN.1 comments which shall be considered normative as well. In addition, the textual commentary provided with each entry (in sections marked "use" and "remarks") may also provide additional normative restrictions on the proper use of the entry being described. Users of this Standard seeking to be in conformance with it shall follow the normative text outlined here.

In this SAE data dictionary all concepts are formally named by combining the basic type (data element (DE), data frame (DF), or message (MSG) and the ASN type definition name. This is the name which appears in the title of the section where the concept is defined. When citing entries for use by other standards the data concepts which follow should be referred to only by their proper names and not by the numerical index which they have, as that value will change over time as other entries are added or removed. As an example, the ASN type definition which is called DSRCmsgID (which is a data element) should be referred to by its formal name which is: DE_DSRC_MessageID.

It should be observed that the MessageFrame entry represents the top most entry of the data dictionary and that all other messages (as well as data frame and data elements) are only sent by being enclosed within that message. The terminology of some protocols, the MessageFrame is the PDU that is exchanged.

5.1 Message: MSG_MessageFrame (FRAME)

Use: The MessageFrame message is used to hold all the defined messages of this standard. Each of the defined messages in this standard has one or more selected locations where additional "regional information" can be inserted into data frames in the message. The methodology used to do this is further described in Section 11.2. The provided set of test messages are intended for testing use only. The message encoding used shall be UPER, however other encoding styles (typically due to reuse from other standards) are encapsulated and supported in various places.

ASN.1 Representation:

```
MessageFrame ::= SEQUENCE {
    messageId    MESSAGE-ID-AND-TYPE.&id({MessageTypes}),
    value        MESSAGE-ID-AND-TYPE.&Type({MessageTypes}{@.messageId}),
    ...
}

MESSAGE-ID-AND-TYPE ::= CLASS {
    &id    DSRCmsgID UNIQUE,
    &Type
} WITH SYNTAX {&Type IDENTIFIED BY &id}

MessageTypes MESSAGE-ID-AND-TYPE ::= {
    { BasicSafetyMessage      IDENTIFIED BY basicSafetyMessage      } |
    { MapData                  IDENTIFIED BY mapData                  } |
    { SPAT                     IDENTIFIED BY signalPhaseAndTimingMessage } |
    { CommonSafetyRequest      IDENTIFIED BY commonSafetyRequest      } |
    { EmergencyVehicleAlert    IDENTIFIED BY emergencyVehicleAlert    } |
    { IntersectionCollision    IDENTIFIED BY intersectionCollision    }
```



```

{ NMEACorrections IDENTIFIED BY nmeaCorrections } |
{ ProbeDataManagement IDENTIFIED BY probeDataManagement } |
{ ProbeVehicleData IDENTIFIED BY probeVehicleData } |
{ RoadSideAlert IDENTIFIED BY roadSideAlert } |
{ RTCMCorrections IDENTIFIED BY rtcMCorrections } |
{ SignalRequestMessage IDENTIFIED BY signalRequestMessage } |
{ SignalStatusMessage IDENTIFIED BY signalStatusMessage } |
{ TravelerInformation IDENTIFIED BY travelerInformation } |
{ PersonalSafetyMessage IDENTIFIED BY personalSafetyMessage } |
{ TestMessage00 IDENTIFIED BY testMessage00 } |
{ TestMessage01 IDENTIFIED BY testMessage01 } |
{ TestMessage02 IDENTIFIED BY testMessage02 } |
{ TestMessage03 IDENTIFIED BY testMessage03 } |
{ TestMessage04 IDENTIFIED BY testMessage04 } |
{ TestMessage05 IDENTIFIED BY testMessage05 } |
{ TestMessage06 IDENTIFIED BY testMessage06 } |
{ TestMessage07 IDENTIFIED BY testMessage07 } |
{ TestMessage08 IDENTIFIED BY testMessage08 } |
{ TestMessage09 IDENTIFIED BY testMessage09 } |
{ TestMessage10 IDENTIFIED BY testMessage10 } |
{ TestMessage11 IDENTIFIED BY testMessage11 } |
{ TestMessage12 IDENTIFIED BY testMessage12 } |
{ TestMessage13 IDENTIFIED BY testMessage13 } |
{ TestMessage14 IDENTIFIED BY testMessage14 } |
{ TestMessage15 IDENTIFIED BY testMessage15 } ,
... -- Expansion to be used only by the SAE J2735 DSRC TC
}

```

```

-- Regional extensions support
REG-EXT-ID-AND-TYPE ::= CLASS {
    &id      RegionId UNIQUE,
    &Type
} WITH SYNTAX {&Type IDENTIFIED BY &id}

RegionalExtension {REG-EXT-ID-AND-TYPE : Set} ::= SEQUENCE {
    regionId      REG-EXT-ID-AND-TYPE.&id( {Set} ),
    regExtValue   REG-EXT-ID-AND-TYPE.&Type( {Set}{@regionId} )
}

```

5.2 Message: MSG_BasicSafetyMessage (BSM)

Use: The basic safety message (BSM) is used in a variety of applications to exchange safety data regarding vehicle state. This message is broadcast frequently to surrounding vehicles with data content as required by safety and other applications. Transmission rates are beyond the scope of this standard, but a rate 10 times per second is typical when congestion control algorithms do not prescribe a reduced rate. Part I data shall be included in every BSM. Part II data items are optional for a given BSM and are included as needed according to policies that are beyond the scope of this standard. A BSM without Part II optional content is a valid message.

ASN.1 Representation:

```

BasicSafetyMessage ::= SEQUENCE {
    -- Part I, Sent at all times with each message
    coreData      BSMcoreData,

    -- Part II Content
    partII        SEQUENCE (SIZE(1..8)) OF
                    PartIIcontent { { BSMpartIIExtension } } OPTIONAL,

    regional      SEQUENCE (SIZE(1..4)) OF
                    RegionalExtension { { REGION.Reg-BasicSafetyMessage } } OPTIONAL,
    ...
}

```

```

}

-- BSM Part II content support
PARTII-EXT-ID-AND-TYPE ::= CLASS {
    &id      PartII-Id UNIQUE,
    &Type
} WITH SYNTAX {&Type IDENTIFIED BY &id}

PartIIContent { PARTII-EXT-ID-AND-TYPE: Set } ::= SEQUENCE {
    partII-Id      PARTII-EXT-ID-AND-TYPE.&id( {Set} ),
    partII-Value   PARTII-EXT-ID-AND-TYPE.&Type( {Set} ){@partII-Id} )
}

PartII-Id ::= INTEGER (0..63)
vehicleSafetyExt      PartII-Id ::= 0  -- VehicleSafetyExtensions
specialVehicleExt     PartII-Id ::= 1  -- SpecialVehicleExtensions
supplementalVehicleExt PartII-Id ::= 2  -- SupplementalVehicleExtensions
-- NOTE: new registered Part II content IDs will be denoted here

-- In a given message there may be multiple extensions present
-- but at most one instance of each extension type.
BSMpartIIExtension PARTII-EXT-ID-AND-TYPE ::= {
    { VehicleSafetyExtensions IDENTIFIED BY vehicleSafetyExt } |
    { SpecialVehicleExtensions IDENTIFIED BY specialVehicleExt } |
    { SupplementalVehicleExtensions IDENTIFIED BY supplementalVehicleExt } ,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.3 Message: MSG_CommonSafetyRequest (CSR)

Use: The Common Safety Request message provides a means by which a vehicle participating in the exchange of the basic safety message can unicast requests to other vehicles for additional information which it requires for the safety applications it is actively running. Responding vehicles will (or may) add this information to the appropriate place in the basic safety message when they broadcast it. Additional operational concepts are explained further in other standards.

Additional information (data elements and data frames) can be requested by this message to be placed into the Part II sections of the basic safety message (Part I contains selected information that is always present in every message without exception).

When a device receives a request for a data element it does not understand or support, or from a vehicle with a spatial position or heading that it may choose to ignore, then that request is simply ignored.

ASN.1 Representation:

```

CommonSafetyRequest ::= SEQUENCE {
    timeStamp      MinuteOfTheYear OPTIONAL,
    msgCnt         MsgCount OPTIONAL,
    id             TemporaryID OPTIONAL, -- targeted remote device
    requests       RequestedItemList,
    -- Note: Above no longer uses the same request as probe management
    regional       SEQUENCE (SIZE(1..4)) OF
                    RegionalExtension {{REGION.Reg-CommonSafetyRequest}} OPTIONAL,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.4 Message: MSG_EmergencyVehicleAlert (EVA)

Use: The Emergency Vehicle Alert message is used to broadcast warning messages to surrounding vehicles that an emergency vehicle (typically an incident responder of some type) is operating in the vicinity and that additional caution is required. The message itself is built on the original ATIS roadside alert message which in turn uses the common ITIS phrase list to both describe the event and provide advice and recommendation for travelers. The Emergency Vehicle Alert message appends to the message some additional data elements regarding the overall type of vehicle involved and other useful data. Note that this message can be used by both private and public response vehicles, and that the relative priority of each (as well as security certificates) is determined in the application layer.

ASN.1 Representation:

```
EmergencyVehicleAlert ::= SEQUENCE {
    timeStamp      MinuteOfTheYear OPTIONAL,
    id              TemporaryID OPTIONAL,
    rsaMsg          RoadSideAlert,
    -- the DSRCmsgID inside this
    -- data frame is set as per the
    -- RoadSideAlert.
    responseType    ResponseType OPTIONAL,
    details          EmergencyDetails OPTIONAL,
    -- Combines these 3 items:
    -- SirenInUse,
    -- LightbarInUse,
    -- MultiVehicleReponse,

    mass            VehicleMass OPTIONAL,
    basicType        VehicleType OPTIONAL,
    -- gross size and axle cnt

    -- type of vehicle and agency when known
    vehicleType      ITIS.VehicleGroupAffected OPTIONAL,
    responseEquip     ITIS.IncidentResponseEquipment OPTIONAL,
    responderType     ITIS.ResponderGroupAffected OPTIONAL,
    regional          SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-EmergencyVehicleAlert}} OPTIONAL,
    ...
}
```

Remarks: The TemporaryID data element shall be sent only if the vehicle is to be identified to others. If a data element value is not known or will not be sent (because its presence is marked OPTIONAL in the ASN) then that data item will not be part of the message. The Road Side Alert message shall be a valid message within the Emergency Vehicle message.

Note: Deployers are cautioned that it is expected the key content of this message will be placed into BSM Part II to support standards which are now under development.

5.5 Message: MSG_IntersectionCollisionAvoidance (ICA)

Use: This message is intended to be used to broadcast to other DSRC devices in the area a warning of a potential collision with a vehicle that is likely to be entering an intersection without the right of way. The sender may be either an equipped vehicle or another source such as the infrastructure.

ASN.1 Representation:

```
IntersectionCollision ::= SEQUENCE {
    msgCnt          MsgCount,
    id              TemporaryID,
    timeStamp        MinuteOfTheYear OPTIONAL,
    partOne          BSMcoreData OPTIONAL,
    path             PathHistory OPTIONAL,
    -- a set of recent path points forming a history
    pathPrediction   PathPrediction OPTIONAL,
```



```

-- the predicted path
intersectionID IntersectionReferenceID,
-- the applicable Intersection
laneNumber ApproachOrLane,
-- the best estimate of the applicable Lane or Approach
eventFlag VehicleEventFlags,
-- used to convey vehicle Panic Events,
-- Set to indicate "Intersection Violation"
regional SEQUENCE (SIZE(1..4)) OF
RegionalExtension {{REGION.Reg-IntersectionCollision}} OPTIONAL,
...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.6 Message: MSG_MapData (MAP)

Use: The MapData message is used to convey many types of geographic road information. At the current time its primary use is to convey one or more intersection lane geometry maps within a single message. The map message content includes such items as complex intersection descriptions, road segment descriptions, high speed curve outlines (used in curve safety messages), and segments of roadway (used in some safety applications). A given single MapData message may convey descriptions of one or more geographic areas or intersections. The contents of this message involve defining the details of indexing systems that are in turn used by other messages to relate additional information (for example, the signal phase and timing via the SPAT message) to events at specific geographic locations on the roadway.

ASN.1 Representation:

```

MapData ::= SEQUENCE {
    timeStamp MinuteOfTheYear OPTIONAL,
    msgIssueRevision MsgCount,
    layerType LayerType OPTIONAL,
    layerID LayerID OPTIONAL,
    intersections IntersectionGeometryList OPTIONAL,
    -- All Intersection definitions
    roadSegments RoadSegmentList OPTIONAL,
    -- All roadway descriptions

    dataParameters DataParameters OPTIONAL,
    -- Any meta data regarding the map contents

    restrictionList RestrictionClassList OPTIONAL,
    -- Any restriction ID tables which have
    -- established for these map entries
    regional SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-MapData}} OPTIONAL,

    -- NOTE:
    -- Other map data will be added here as it is defined
    -- Examples of the type of content to be added include
    -- curve warnings, construction routes, etc.
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.7 Message: MSG_NMEAcorrections (NMEA)

Use: The NMEA Corrections message is used to encapsulate NMEA 183 style differential corrections for GPS/GNSS radio navigation signals as defined by the NMEA (National Marine Electronics Association) committee in its Protocol 0183 standard. Here, in the work of the SAE DSRC Technical Committee, these messages are "wrapped" for transport on the DSRC media, and then can be re-constructed back into the final expected formats defined by the NMEA standard and used directly by GNSS to increase the absolute and relative accuracy estimates produced.

ASN.1 Representation:

```
NMEAcorrections ::= SEQUENCE {
    timeStamp MinuteOfTheYear OPTIONAL,
    rev        NMEA-Revision OPTIONAL,
              -- the specific edition of the standard
              -- that is being sent, 4.x at the time of publication
    msg        NMEA-MessageType OPTIONAL,
              -- the message and sub-message type, as
              -- defined in the revision being used
    -- NOTE The message type is also in the payload expressed as a string,
    wdCount    ObjectCount OPTIONAL,
              -- a count of octets to follow
              -- observe that not all NMEA sentences are limited to 82 characters
    payload    NMEA-Payload,
    regional   SEQUENCE (SIZE(1..4)) OF
              RegionalExtension {{REGION.Reg-NMEAcorrections}} OPTIONAL,
    ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.

Remarks: As a rule NMEA 183 messages (called sentences in the NMEA work) are not used in DSRC due to the inherently large size of expressing the data in a text format. This message primarily has use as an aid in debugging and it is for this reason that it is included in the standard. The NMEA 183 messages provide a means for private vendors to add their own messages (such messages all start with "\$P") and the developer is cautioned that such messages may not be interoperable with different vendors' GNSS devices. The newer NMEA 2000 standard, which involves a denser binary message format, may also be sent using this message. The NMEA 2000 standard operates over an SAE J1939 CAN bus protocol but NMEA does not coordinate its messages with SAE in this regard.

5.8 Message: MSG_PersonalSafetyMessage (PSM)

Use: The Personal Safety Message (PSM) is used to broadcast safety data regarding the kinematic state of various types of Vulnerable Road Users (VRU), such as pedestrians, cyclists or road workers. Data items which are optional are included in a PSM as needed according to policies that are beyond the scope of this standard.

This message is under development, and is included in this standard to support field trials. Changes in the specification of the message and/or its constituent elements may occur in the future.

ASN.1 Representation:

```
PersonalSafetyMessage ::= SEQUENCE {
    basicType    PersonalDeviceUserType,
    secMark      DSecond,
    msgCnt       MsgCount,
    id           TemporaryID,
    position     Position3D, -- Lat, Long, Elevation
    accuracy     PositionalAccuracy,
    speed        Velocity,
    heading      Heading,
    accelSet     AccelerationSet4Way OPTIONAL,
    pathHistory  PathHistory OPTIONAL,
```



pathPrediction	PathPrediction	OPTIONAL,
propulsion	PropelledInformation	OPTIONAL,
useState	PersonalDeviceUsageState	OPTIONAL,
crossRequest	PersonalCrossingRequest	OPTIONAL,
crossState	PersonalCrossingInProgress	OPTIONAL,
clusterSize	NumberOfParticipantsInCluster	OPTIONAL,
clusterRadius	PersonalClusterRadius	OPTIONAL,
eventResponderType	PublicSafetyEventResponderWorkerType	OPTIONAL,
activityType	PublicSafetyAndRoadWorkerActivity	OPTIONAL,
activitySubType	PublicSafetyDirectingTrafficSubType	OPTIONAL,
assistType	PersonalAssistive	OPTIONAL,
sizing	UserSizeAndBehaviour	OPTIONAL,
attachment	Attachment	OPTIONAL,
attachmentRadius	AttachmentRadius	OPTIONAL,
animalType	AnimalType	OPTIONAL,

regional SEQUENCE (SIZE(1..4)) OF
 RegionalExtension {{REGION.Reg-PersonalSafetyMessage}} OPTIONAL,
 ...
 }

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.

Remarks: The optional PathPrediction field is only intended to be included when the PSM sender is traveling along a roadway, e.g. in a bicycle lane.

5.9 Message: MSG_ProbeDataManagement (PDM)

Use: The ProbeDataManagement message is used to control the type of data collected and sent by OBUs to the local RSU (also called a STA in some documents), taken at a defined snapshot event to define RSU coverage patterns such as the moment an OBU joins or becomes associated with an RSU and can send probe data.

ASN.1 Representation:

```
ProbeDataManagement ::= SEQUENCE {
  timeStamp      MinuteOfTheYear OPTIONAL,
  sample         Sample,           -- Identifies the vehicle
                                     -- population affected by this
  directions     HeadingSlice,     -- Applicable headings/directions
  term CHOICE {
    termtime      TermTime,         -- Terminate this management process
                                     -- based on Time-to-Live
    termDistance  TermDistance     -- Terminate management process
                                     -- based on Distance-to-Live
  },
  snapshot CHOICE {
    snapshotTime  SnapshotTime,    -- Collect snapshots based on Time
                                     -- the value 0 indicates forever
    snapshotDistance SnapshotDistance -- Collect snapshots based on combination
                                     -- of vehicle Speed and Distance
  },
  txInterval     SecondOfTime,     -- Time Interval at which to send snapshots
  dataElements   VehicleStatusRequestList OPTIONAL,
                                     -- Control data frames and associated
                                     -- trigger thresholds to be changed
  regional       SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-ProbeDataManagement}} OPTIONAL,
  ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

Remarks: The ProbeDataManagement message originates from the ATMS and its associated infrastructure and is used to control the types of information reported back to meet the needs of the ATMS and private users of the data.

5.10 Message: MSG_ProbeVehicleData (PVD)

Use: The probe vehicle message frame is defined below. The probe vehicle message is used to exchange status about a vehicle with other (typically RSU) DSRC devices to allow the collection of information about typical vehicle traveling behaviors along a segment of road. The exchange of this message as well as the event which caused the collection of various elements defined in the messages is defined elsewhere. In typical use the reporting vehicle has collected one or more snapshots which it will send to receiving RSUs along with information (the vector) about the point in time and space when the snapshot event occurred. Because any sequence of snapshots is related within a limited range of time and space, some data compression is used in the message to reduce redundant information.

ASN.1 Representation:

```
ProbeVehicleData ::= SEQUENCE {
    timeStamp          MinuteOfTheYear OPTIONAL,
    segNum             ProbeSegmentNumber OPTIONAL,
    -- a short term Ident value
    -- not used when ident is used
    probeID            VehicleIdent OPTIONAL,
    -- identity data for selected
    -- types of vehicles
    startVector        FullPositionVector, -- the space and time of
    -- transmission to the RSU
    vehicleType        VehicleClassification, -- type of vehicle,
    snapshots          SEQUENCE (SIZE(1..32)) OF Snapshot,
    -- a seq of name-value pairs
    -- along with the space and time
    -- of the first measurement set
    regional           SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-ProbeVehicleData}} OPTIONAL,
    ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

Remarks: At the time of writing additional probe vehicle messages are being developed that will allow control over what information is gathered and reported in a probe vehicle message. Builders are urged to consider these messages in their development of products using this message.

5.11 Message: MSG_RoadSideAlert (RSA)

Use: This message is used to send alerts for nearby hazards to travelers. Unlike many other messages which use the LRMS profiles to describe the areas affected, this message likely applies to the receiver by the very fact that it is received. In other words, it does not use LRMS. Typically transmitted over the Dedicated Short Range Communications (DSRC) media, this message provides simple alerts to travelers (both in vehicle and with portable devices). Typical example messages would be "bridge icing ahead" or "train coming" or "ambulances operating in the area." The full range of ITIS phrases are supported here, but those dealing with mobile hazards, construction zones, and roadside events are the ones most frequently expected to be found in use.

This message is for alerting about roadway hazards; not for vehicle cooperative communications, mayday, or other safety applications. It is generally presumed that each receiving device is aware of its own position and heading, but this is not a requirement to receive and understand these messages, nor is having a local base map.

The position section of the message gives a simple (and optional) vector for where the hazard is located (fixed or moving) and can be used to filter some messages as being not applicable. Consider a "train approaching" message which indicates the train is in fact traveling away from the receiver. The basic information types themselves are represented in the standard ITIS codes sent only in their integer representation formats. This ITIS list is national in scope, never outdated (items can only be added), and in this use does not allow local additions. Refer to SAE J2540-2 for the complete code list. A priority level for the message is also sent, which may be matched to various other priorities in the cockpit to determine the order and type of message presentation to minimize driver distraction. Message transmission priority is typically handled in the IEEE 1609 standard layer in the application stack and is a function of the application type. A duration field provides a gross level for the range (distance) of applicability for the message over distance. For example, some messages are no longer meaningful to the traveler once the vehicle has moved a distance down the roadway link.

In many cases a complex event will also be explained in the other supporting ATIS messages (available on DSRC service channels), and a linkage value is given in those cases when such data is available.

ASN.1 Representation:

```
RoadSideAlert ::= SEQUENCE {
    msgCnt          MsgCount,
    timeStamp       MinuteOfTheYear OPTIONAL,
    typeEvent       ITIS.ITIScodes,
    -- a category and an item from that category
    -- all ITS stds use the same types here
    -- to explain the type of the
    -- alert / danger / hazard involved
    description     SEQUENCE (SIZE(1..8)) OF ITIS.ITIScodes OPTIONAL,
    -- up to eight ITIS code set entries to further
    -- describe the event, give advice, or any
    -- other ITIS codes
    priority        Priority OPTIONAL,
    -- the urgency of this message, a relative
    -- degree of merit compared with other
    -- similar messages for this type (not other
    -- messages being sent by the device), nor a
    -- priority of display urgency
    heading         HeadingSlice OPTIONAL,
    -- Applicable headings/direction
    extent          Extent OPTIONAL,
    -- the spatial distance over which this
    -- message applies and should be presented
    -- to the driver
    position        FullPositionVector OPTIONAL,
    -- a compact summary of the position,
    -- heading, speed, etc. of the
    -- event in question. Including stationary
    -- and wide area events.
    furtherInfoID   FurtherInfoID OPTIONAL,
    -- an index link to any other incident
    -- information data that may be available
    -- in the normal ATIS incident description
    -- or other messages
    -- 1~2 octets in length
    regional        SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-RoadSideAlert}} OPTIONAL,
    ...
}
```

Used By: This entry is directly used by the following 2 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

MSG [MSG_EmergencyVehicleAlert \(EVA\)](#) [<ASN>](#), and

MSG [MSG_MessageFrame \(FRAME\)](#) [<ASN>](#).

In addition, this item may be used by data structures in other ITS standards.

Remarks: This message is also used as a building block for other DSRC messages. When used in other public safety messages, additional elements may be appended to form new message types.

5.12 Message: MSG_RTCMcorrections (RTCM)

Use: The RTCM Corrections message is used to encapsulate RTCM differential corrections for GPS and other radio navigation signals as defined by the RTCM (Radio Technical Commission For Maritime Services) special committee number 104 in its various standards. Here, in the work of DSRC, these messages are "wrapped" for transport on the DSRC media, and then can be re-constructed back into the final expected formats defined by the RTCM standard and used directly by various positioning systems to increase the absolute and relative accuracy estimates produced.

ASN.1 Representation:

```
RTCMcorrections ::= SEQUENCE {
    msgCnt      MsgCount,
    rev         RTCM-Revision,
               -- the specific edition of the standard
               -- that is being sent
    timeStamp   MinuteOfTheYear OPTIONAL,

    -- Observer position, if needed
    anchorPoint FullPositionVector OPTIONAL,
    -- Precise ant position and noise data for a rover
    rtcHeader   RTCMheader OPTIONAL,

    -- one or more RTCM messages
    msgs        RTCMmessageList,
    regional    SEQUENCE (SIZE(1..4)) OF
               RegionalExtension {{REGION.Reg-RTCMcorrections}} OPTIONAL,
    ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.

Remarks: Observe that the transport layer details (preamble, CRC, etc.) as outlined in RTCM standard 10403.1 version 3.0 clause four are not sent in this message. In a similar fashion, the same framing information found in clause 4.2 of the RTCM standard 10402.3 (version 2.3) is not sent. These would be reconstituted after reception by a mobile device and before sending the resultant message to any positioning device expecting messages in such a format, as outlined in the RTCM recommendations found in clause four of each document. Also observe that the specific bit ordering of the transport message level used in the final message varies between RTCM version 3.x and that of version 2.3.

5.13 Message: MSG_SignalPhaseAndTiming Message (SPAT)

Use: The Signal Phase and Timing (SPAT) message is used to convey the current status of one or more signalized intersections. Along with the MSG_MapData message (which describes a full geometric layout of an intersection) the receiver of this message can determine the state of the signal phasing and when the next expected phase will occur.

The SPAT message sends the current movement state of each active phase in the system as needed (such as values of what states are active and values at what time a state has begun/does begin earliest, is expected to begin most likely and will end latest). The state of inactive movements is not normally transmitted. Movements are mapped to specific approaches and connections of ingress to egress lanes and by use of the SignalGroupID in the MapData message

The current signal preemption and priority status values (when present or active) are also sent. A more complete summary of any pending priority or preemption events can be found in the Signal Status message.

ASN.1 Representation:

```
SPAT ::= SEQUENCE {
    timeStamp      MinuteOfTheYear OPTIONAL,
    name           DescriptiveName OPTIONAL,
                  -- human readable name for this collection
                  -- to be used only in debug mode

    intersections  IntersectionStateList,
                  -- sets of SPAT data (one per intersection)

    -- If PrioritizationResponse data is required, it is found
    -- in the RegionalSPAT entry below

    regional       SEQUENCE (SIZE(1..4)) OF
                  RegionalExtension {{REGION.Reg-SPAT}} OPTIONAL,
    ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.14 Message: MSG_SignalRequestMessage (SRM)

Use: The Signal Request Message is a message sent by a DSRC equipped entity (such as a vehicle) to the RSU in a signalized intersection. It is used for either a priority signal request or a preemption signal request depending on the way each request is set. Each request defines a path through the intersection which is desired in terms of lanes and approaches to be used. Each request can also contain the time of arrival and the expected duration of the service. Multiple requests to multiple intersections are supported. The requestor identifies itself in various ways (using methods supported by the RequestorDescription data frame), and its current speed, heading and location can be placed in this structure as well. The specific request for service is typically based on previously decoding and examining the list of lanes and approaches for that intersection (sent in MAP messages). The outcome of all of the pending requests to a signal can be found in the Signal Status Message (SSM), and may be reflected in the SPAT message contents if successful.

ASN.1 Representation:

```
SignalRequestMessage ::= SEQUENCE {
    timeStamp      MinuteOfTheYear OPTIONAL,
    second         DSecond,
    sequenceNumber MsgCount OPTIONAL,

    requests       SignalRequestList OPTIONAL,
                  -- Request Data for one or more signalized
                  -- intersections that support SRM dialogs

    requestor      RequestorDescription,
                  -- Requesting Device and other User Data
```

```

-- contains vehicle ID (if from a vehicle)
-- as well as type data and current position
-- and may contain additional transit data

regional      SEQUENCE (SIZE(1..4)) OF
               RegionalExtension {{REGION.Reg-SignalRequestMessage}} OPTIONAL,
...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.15 Message: MSG_SignalStatusMessage (SSM)

Use: The Signal Status Message is a message sent by an RSU in a signalized intersection. It is used to relate the current status of the signal and the collection of pending or active preemption or priority requests acknowledged by the controller. It is also used to send information about preemption or priority requests which were denied. This in turn allows a dialog acknowledgment mechanism between any requester and the signal controller. The data contained in this message allows other users to determine their "ranking" for any request they have made as well as to see the currently active events. When there have been no recently received requests for service messages, this message may not be sent. While the outcome of all pending requests to a signal can be found in the Signal Status Message, the current active event (if any) will be reflected in the SPAT message contents.

ASN.1 Representation:

```

SignalStatusMessage ::= SEQUENCE {
    timeStamp      MinuteOfTheYear OPTIONAL,
    second         DSecond,
    sequenceNumber MsgCount OPTIONAL,

    -- Status Data for one of more signalized intersections
    status         SignalStatusList,

    regional      SEQUENCE (SIZE(1..4)) OF
                  RegionalExtension {{REGION.Reg-SignalStatusMessage}} OPTIONAL,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

5.16 Message: MSG_TravelerInformation Message (TIM)

Use: The Traveler Information message is used to send various types of information (advisory and road sign types) to equipped devices. It makes heavy use of the ITIS encoding system to send well known phrases, but allows limited text for local place names. The supported message types specify several sub-dialects of ITIS phrase patterns to further reduce the number of octets to be sent. The expressed messages are active at a precise start and duration period, which can be specified to a resolution of a minute. The affected local area can be expressed using either a radius system or one of the systems of short defined regions, similar to the way roadway geometry is defined in the MAP messages.

ASN.1 Representation:

```

TravelerInformation ::= SEQUENCE {
    msgCnt         MsgCount,
    timeStamp      MinuteOfTheYear OPTIONAL,
    packetID       UniqueMSGID OPTIONAL,
    urlB           URL-Base OPTIONAL,

    -- A set of one or more self contained
    -- traveler information messages (frames)
    dataFrames     TravelerDataFrameList,

```

```

    regional    SEQUENCE (SIZE(1..4)) OF
                  RegionalExtension {{REGION.Reg-TravelerInformation}} OPTIONAL,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.

5.17 Message: MSG_TestMessages

Use: The set of TestMessage messages are used to provide expandable messages for local and regional deployment use. This is intended to support the development new message and information exchanges of their own within the common framework of the overall DSRC Message set and this data dictionary. A few common data elements are provided for consistency, while the reminder of the message content can be defined by the developer using the normal regional methods. It is anticipated that over time the concepts developed in these messages will migrate into the data dictionary and message set itself.

ASN.1 Representation:

```

TestMessage00 ::= SEQUENCE {
    header      Header      OPTIONAL,
    -- All content is added in below data frame
    regional    RegionalExtension {{REGION.Reg-TestMessage00}} OPTIONAL,
    ...
}
TestMessage01 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage01}} OPTIONAL,
    ...
}
TestMessage02 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage02}} OPTIONAL,
    ...
}
TestMessage03 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage03}} OPTIONAL,
    ...
}
TestMessage04 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage04}} OPTIONAL,
    ...
}
TestMessage05 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage05}} OPTIONAL,
    ...
}
TestMessage06 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage06}} OPTIONAL,
    ...
}
TestMessage07 ::= SEQUENCE {
    header      Header      OPTIONAL,
    regional    RegionalExtension {{REGION.Reg-TestMessage07}} OPTIONAL,
    ...
}
TestMessage08 ::= SEQUENCE {
    header      Header      OPTIONAL,

```

```
    regional    RegionalExtension {{REGION.Reg-TestMessage08}} OPTIONAL,
    ...
  }
TestMessage09 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage09}} OPTIONAL,
  ...
}
TestMessage10 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage10}} OPTIONAL,
  ...
}
TestMessage11 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage11}} OPTIONAL,
  ...
}
TestMessage12 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage12}} OPTIONAL,
  ...
}
TestMessage13 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage13}} OPTIONAL,
  ...
}
TestMessage14 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage14}} OPTIONAL,
  ...
}
TestMessage15 ::= SEQUENCE {
  header      Header      OPTIONAL,
  regional    RegionalExtension {{REGION.Reg-TestMessage15}} OPTIONAL,
  ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG_MessageFrame \(FRAME\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

Remarks: Note that developers are free to create sub-message types within each defined message but that no further top level messages will be created. Note that this message set data dictionary provides no coordination between different regional deployments. The possibility of message structure conflict due to overlapping regions is left to the developers to detect and resolve. Like all messages defined in this standard, the end receiver device is under no obligation to decode or understand any message where the internal content is not known. However such reception shall not cause other functionality in the device to break. This is simply a restatement of the conformance rules expressed elsewhere applied to this type of message.

6. DATA FRAMES

This section defines the precise structure of certain data concepts defined by this standard.

All text in this clause is considered normative unless expressly marked otherwise. The definitions for each data concept in this dictionary set are presented in the following sub clauses. The section titled Use provides a general overview of the data concept and broadly explains the informational concept and its intended use. It may also provide illustrative use cases. It may assert normative details regarding such use. In addition, each standard that makes use of the data concept may further constrain aspects of its use (for example defining a minimum accuracy level under given operational conditions). The ASN.1 is presented in a section titled ASN.1 Representation and is also available from SAE in a downloadable format. The ASN defines, at the least, the precise structural details of the data concept, such as precision and range of valid values. The section titled Used By provides a listing and a set of hyperlinks to other places in the document where this data concept is used. The section titled Remarks is used to provide additional information regarding the data concept, often denoting changes made to the concept from prior published editions.

The productions of ASN.1 which follow shall be considered normative in nature. While the majority of the normative content is reflected in the actual syntax of the ASN.1, some entries also have additional statements in the ASN.1 comments which shall be considered normative as well. In addition, the textual commentary provided with each entry (in sections marked "use" and "remarks") may also provide additional normative restrictions on the proper use of the entry being described. Users of this Standard seeking to be in conformance with it shall follow the normative text outlined here.

In this SAE data dictionary all concepts are formally named by combining the basic type (data element (DE), data frame (DF), or message (MSG) and the ASN type definition name. This is the name which appears in the title of the section where the concept is defined. When citing entries for use by other standards the data concepts which follow should be referred to only by their proper names and not by the numerical index which they have, as that value will change over time as other entries are added or removed. As an example, the ASN type definition which is called DSRCmsgID (which is a data element) should be referred to by its formal name which is: DE_DSRC_MessageID.

6.1 Data Frame: DF_AccelerationSet4Way

Use: This data frame is a set of acceleration values in 3 orthogonal directions of the vehicle and with yaw rotation rates, expressed as a structure. The positive longitudinal axis is to the front of the vehicle. The positive lateral axis is to the right side of the vehicle (facing forward). Positive yaw is to the right (clockwise). A positive vertical "z" axis is downward with the zero point at the bottom of the vehicle's tires. The frame of reference and axis of rotation used shall be accordance with that defined in Section 11 of this standard.

ASN.1 Representation:

```
AccelerationSet4Way ::= SEQUENCE {
    long Acceleration,          -- Along the Vehicle Longitudinal axis
    lat  Acceleration,          -- Along the Vehicle Lateral axis
    vert VerticalAcceleration,  -- Along the Vehicle Vertical axis
    yaw  YawRate
}
```

Used By: This entry is directly used by the following 3 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

DF	DF_BSMcoreData	<ASN> , and
DF	DF_VehicleStatus	<ASN> , and
MSG	MSG_PersonalSafetyMessage (PSM)	<ASN> .

In addition, this item may be used by data structures in other ITS standards.

Remarks: In the prior editions of the standard (pre 2015) this was constructed as a BLOB, it has now been converted for UPER use, in the prior editions of the standard, SAE J670 was used to define the frame of reference system.

6.2 Data Frame: DF_AccelSteerYawRateConfidence

Use: The DF_AccelSteerYawRateConfidence data frame combines multiple related values.

ASN.1 Representation:

```
AccelSteerYawRateConfidence ::= SEQUENCE {
    yawRate          YawRateConfidence,
    acceleration      AccelerationConfidence,
    steeringWheelAngle SteeringWheelAngleConfidence
}
```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_ConfidenceSet](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.3 Data Frame: DF_AdvisorySpeed

Use: The DF_AdvisorySpeed data frame is used to convey a recommended traveling approach speed to an intersection from the message issuer to various travelers and vehicle types. Besides support for various eco-driving applications, this allows transmitting recommended speeds for specialty vehicles such as transit buses.

ASN.1 Representation:

```
AdvisorySpeed ::= SEQUENCE {
    type          AdvisorySpeedType,
    -- the type of advisory which this is.
    speed         SpeedAdvice OPTIONAL,
    -- See Section 11 for converting and translating speed
    -- expressed in mph into units of m/s
    -- This element is optional ONLY when superseded
    -- by the presence of a regional speed element found in
    -- Reg-AdvisorySpeed entry
    confidence    SpeedConfidence OPTIONAL,
    -- A confidence value for the above speed
    distance      ZoneLength OPTIONAL,
    -- Unit = 1 meter,
    -- The distance indicates the region for which the advised speed
    -- is recommended, it is specified upstream from the stop bar
    -- along the connected egressing lane
    class         RestrictionClassID OPTIONAL,
    -- the vehicle types to which it applies
    -- when absent, the AdvisorySpeed applies to
    -- all motor vehicle types
    regional      SEQUENCE (SIZE(1..4)) OF
    RegionalExtension {{REGION.Reg-AdvisorySpeed}} OPTIONAL,
    ...
}
```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_AdvisorySpeedList](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.4 Data Frame: DF_AdvisorySpeedList

Use: The AdvisorySpeedList data frame consists of a list of AdvisorySpeed entries.

ASN.1 Representation:

```
AdvisorySpeedList ::= SEQUENCE (SIZE(1..16)) OF AdvisorySpeed
```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_MovementEvent](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.5 Data Frame: DF_AntennaOffsetSet

Use: The DF_AntennaOffsetSet data frame is a collection of three offset values in an orthogonal coordinate system which describe how far the electrical phase center of an antenna is in each axis from a nearby known anchor point in units of 1 cm. When the antenna being described is on a vehicle, the signed offset shall be in the coordinate system defined in section 11.4.

ASN.1 Representation:

```
AntennaOffsetSet ::= SEQUENCE {  
    antOffsetX Offset-B12, -- a range of +- 20.47 meters  
    antOffsetY Offset-B09, -- a range of +- 2.55 meters  
    antOffsetZ Offset-B10 -- a range of +- 5.11 meters  
}
```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_RTCMheader](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

Remarks: In the prior editions of the standard (pre 2015) this was constructed as a BLOB, it has now been converted for UPER use and the ranges reset to conserve bits.

6.6 Data Frame: DF_ApproachOrLane

Use: The ApproachOrLane data frame is used to indicate a single approach or lane of interest. A typical use case would be to relate where a vehicle was located with respect to the indexing system used in a DSRC map. Under many operational conditions the precise lane may be unknown, and it is typical to then indicate the approach. [The relationship between lane indexes and approach indexes is defined in the map.] A value of zero is used when the lane or approach is unknown. See the entries for each data concept for further details.

ASN.1 Representation:

```
ApproachOrLane ::= CHOICE {  
    approach ApproachID,  
    lane LaneID  
}
```

Used By: This entry is used directly by one other data structure in this standard, a MSG called [MSG IntersectionCollisionAvoidance \(ICA\)](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.7 Data Frame: DF_BrakeSystemStatus

Use: The Brake System Status data frame conveys a variety of information about the current brake and system control activity of the vehicle. The structure consist of a sequence of items which provide status flags for any active brakes per wheel, the traction control system, the anti-lock brake system, the stability control system, the brake boost system, and the auxiliary brake system.

ASN.1 Representation:

```
BrakeSystemStatus ::= SEQUENCE {  
    wheelBrakes BrakeAppliedStatus,  
    traction TractionControlStatus,  
    abs AntiLockBrakeStatus,  
    scs StabilityControlStatus,  
    brakeBoost BrakeBoostApplied,  
    auxBrakes AuxiliaryBrakeStatus  
}
```

Used By: This entry is directly used by the following 2 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

DF [DF_BSMcoreData](#) [<ASN>](#), and

DF [DF_VehicleStatus](#) [<ASN>](#).

In addition, this item may be used by data structures in other ITS standards.

Remarks: Note that when the state of a brake or system control changes it will not only be reflected in this data element, but might also be reflected in a flag within the Event Flags data element; for example in Part II of a Basic Safety Message.

6.8 Data Frame: DF_BSMcoreData

Use: The DF_BSMcoreData data frame contains the critical core data elements deemed to be needed with every BSM issued. This data frame's contents are often referred to as the "BSM Part One", although it is reused in other places as well.

ASN.1 Representation:

```
BSMcoreData ::= SEQUENCE {
    msgCnt      MsgCount,
    id          TemporaryID,
    secMark     DSecond,
    lat         Latitude,
    long        Longitude,
    elev        Elevation,
    accuracy    PositionalAccuracy,
    transmission TransmissionState,
    speed       Speed,
    heading     Heading,
    angle       SteeringWheelAngle,
    accelSet    AccelerationSet4Way,
    brakes      BrakeSystemStatus,
    size        VehicleSize
}
```

Used By: This entry is directly used by the following 2 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

MSG [MSG_BasicSafetyMessage \(BSM\)](#) [<ASN>](#), and

MSG [MSG_IntersectionCollisionAvoidance \(ICA\)](#) [<ASN>](#).

In addition, this item may be used by data structures in other ITS standards.

6.9 Data Frame: DF_BumperHeights

Use: The DF Bumper Heights data frame conveys the height of the front and rear bumper of the vehicle or object (can also be used with trailers).

ASN.1 Representation:

```
BumperHeights ::= SEQUENCE {
    front      BumperHeight,
    rear       BumperHeight
}
```

Used By: This entry is directly used by the following 3 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

DF	DF_TrailerUnitDescription	<ASN> , and
DF	DF_VehicleData	<ASN> , and
DF	DF_VehicleStatus	<ASN> .

In addition, this item may be used by data structures in other ITS standards.

6.10 Data Frame: DF_Circle

Use: The Circle data frame used to define a circle centered at a given point and extended to the given radius. It is typically used to describe the location of signs so that the receiving vehicle can determine if the sign applies to them and their current path.

ASN.1 Representation:

```
Circle ::= SEQUENCE {
    center    Position3D,
    radius    Radius-B12,
    units     DistanceUnits
}
```

Used By: This entry is directly used by the following 2 other data structures in this standard (record type, descriptive name, ASN.1, and XML name (if present) of each):

DF	DF_GeometricProjection	<ASN> , and
DF	DF_ValidRegion	<ASN> .

In addition, this item may be used by data structures in other ITS standards.

Remarks: The values km and miles are typically used for wide area weather alert type uses.

6.11 Data Frame: DF_ComputedLane

Use: The DF_ComputedLane data frame is used to contain information needed to compute one lane from another (hence the name). This concept is used purely as a means of saving size in the message payload. The new lane is expressed as an X,Y offset from the first point of the source lane. It can be optionally rotated and scaled. Any attribute information found within the node of the source lane list cannot be changed and must be reused.

ASN.1 Representation:

```
ComputedLane ::= SEQUENCE {
    -- Data needed to created a computed lane
    referenceLaneId    LaneID,
                        -- the lane ID upon which this
                        -- computed lane will be based
    -- Lane Offset in X and Y direction
    offsetXaxis        CHOICE {
                        small    DrivenLineOffsetSm,
                        large    DrivenLineOffsetLg
                        },
    offsetYaxis        CHOICE {
                        small    DrivenLineOffsetSm,
                        large    DrivenLineOffsetLg
                        },
    -- A path X offset value for translations of the
    -- path's points when creating translated lanes
}
```

```

-- The values found in the reference lane are
-- all offset based on the X and Y values from
-- the coordinates of the reference lane's
-- initial path point.

-- Lane Rotation
rotateXY      Angle OPTIONAL,
-- A path rotation value for the entire lane
-- Observe that this rotates the existing orientation
-- of the referenced lane, it does not replace it.
-- Rotation occurs about the initial path point.

-- Lane Path Scale (zooming)
scaleXaxis    Scale-B12 OPTIONAL,
scaleYaxis    Scale-B12 OPTIONAL,
-- value for translations or zooming of the path's
-- points. The values found in the reference lane
-- are all expanded or contracted based on the X
-- and Y and width values from the coordinates of
-- the reference lane's initial path point.
-- The Z axis remains untouched.

regional      SEQUENCE (SIZE(1..4)) OF
               RegionalExtension {{REGION.Reg-ComputedLane}} OPTIONAL,
...
}

```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_NodeListXY](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

Remarks: The specified transformation shall be applied to the reference lane without any intermediary loss of precision (truncation). The order of the transformations shall be: the East-West and North-South offsets, the scaling factors, and finally the rotation.

6.12 Data Frame: DF_ConfidenceSet

Use: A set of various measurement confidence values about the vehicle or a moving DSRC object.

ASN.1 Representation:

```

ConfidenceSet ::= SEQUENCE {
    accelConfidence      AccelSteerYawRateConfidence OPTIONAL,
    speedConfidence      SpeedandHeadingandThrottleConfidence OPTIONAL,
    timeConfidence       TimeConfidence OPTIONAL,
    posConfidence        PositionConfidenceSet OPTIONAL,
    steerConfidence      SteeringWheelAngleConfidence OPTIONAL,
    headingConfidence    HeadingConfidence OPTIONAL,
    throttleConfidence   ThrottleConfidence OPTIONAL,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_VehicleStatus](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.13 Data Frame: DF_ConnectingLane

Use: The DF_ConnectingLane data concept ties a single lane to a single maneuver needed to reach it from another lane. It is typically used to connect the allowed maneuver from the end of a lane to the outbound lane so that these can be mapped to the SPAT message to which both lanes apply.

ASN.1 Representation:

```

ConnectingLane ::= SEQUENCE {
    lane         LaneID,      -- Index of the connecting lane
    maneuver     AllowedManeuvers OPTIONAL
                -- The Maneuver between
                -- the enclosing lane and this lane
                -- at the stop line to connect them
}

```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF Connection](#) <ASN>. In addition, this item may be used by data structures in other ITS standards.

6.14 Data Frame: DF_Connection

Use: The Connection data structure is used in the *ConnectsToList* data frame to provide data about how the stop line at the end of a single lane connects to another lane beyond its stop point. The ConnectingLane entry ties an outbound (egress) lane by its index to a valid single maneuver required to reach that outbound lane. The SignalGroupID maps this to a single SPAT index. (Note that more than one entry can exist for any given lane to handle admmissive and protected conditions). When present, the RestrictionClass can be used to further restrict this information to defined classes of users. The ConnectionID entry is used to provide an index to any dynamic clearance data that may be sent in another message. The entries for ConnectionID, IntersectionID, and RestrictionClassID are not expected to be used in most intersections.

ASN.1 Representation:

```

Connection ::= SEQUENCE {
    -- The subject lane connecting to this lane is:
    connectingLane     ConnectingLane,
                        -- The index of the connecting lane and also
                        -- the maneuver from the current lane to it
    remoteIntersection IntersectionReferenceID OPTIONAL,
                        -- This entry is only used when the
                        -- indicated connecting lane belongs
                        -- to another intersection layout. This
                        -- provides a means to create meshes of lanes

    -- SPAT mapping details at the stop line are:
    signalGroup        SignalGroupID OPTIONAL,
                        -- The matching signal group send by
                        -- the SPAT message for this lane/maneuver.
                        -- Shall be present unless the connectingLane
                        -- has no signal group (is un-signalized)
    userClass          RestrictionClassID OPTIONAL,
                        -- The Restriction Class of users this applies to
                        -- The use of some lane/maneuver and SignalGroupID
                        -- pairings are restricted to selected users.
                        -- When absent, the SignalGroupID applies to all

    -- Movement assist details are given by:
    connectionID       LaneConnectionID OPTIONAL
                        -- An optional connection index used to
                        -- relate this lane connection to any dynamic
                        -- clearance data in the SPAT. Note that
                        -- the index may be shared with other
                        -- connections if the clearance data is common
}

```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_ConnectsToList](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.

Remarks: The assignment of lanes in the *connects To* structure shall start with the leftmost lane from the vehicle perspective (the u-turn lane in some cases) followed by subsequent lanes in a clockwise assignment order. Therefore, the rightmost lane to which this lane connects would always be listed last. Note that this order is observed regardless of which side of the road vehicles use. If this structure is used in the lane description, then all valid lanes to which the subject lane connects shall be listed.

6.15 Data Frame: DF_ConnectionManeuverAssist

Use: The ConnectionManeuverAssist data frame contains information about the the dynamic flow of traffic for the lane(s) and maneuvers in question (as determined by the LaneConnectionID). Note that this information can be sent regarding any *lane-to-lane* movement; it need not be limited to the lanes with active (non-red) phases when sent.

ASN.1 Representation:

```

ConnectionManeuverAssist ::= SEQUENCE {
    connectionID          LaneConnectionID,
                           -- the common connectionID used by all lanes to which
                           -- this data applies
                           -- (this value traces to ConnectsTo entries in lanes)
    -- Expected Clearance Information
    queueLength           ZoneLength OPTIONAL,
                           -- Unit = 1 meter, 0 = no queue
                           -- The distance from the stop line to the back
                           -- edge of the last vehicle in the queue,
                           -- as measured along the lane center line.
    availableStorageLength ZoneLength OPTIONAL,
                           -- Unit = 1 meter, 0 = no space remains
                           -- Distance (e.g. beginning from the downstream
                           -- stop-line up to a given distance) with a high
                           -- probability for successfully executing the
                           -- connecting maneuver between the two lanes
                           -- during the current cycle.
                           -- Used for enhancing the awareness of vehicles
                           -- to anticipate if they can pass the stop line
                           -- of the lane. Used for optimizing the green wave,
                           -- due to knowledge of vehicles waiting in front
                           -- of a red light (downstream).
                           -- The element nextTime in TimeChangeDetails
                           -- in the containing data frame contains the next
                           -- timemark at which an active phase is expected,
                           -- a form of storage flush interval.
    waitOnStop            WaitOnStopline OPTIONAL,
                           -- If "true", the vehicles on this specific connecting
                           -- maneuver have to stop on the stop-line and not
                           -- to enter the collision area
    pedBicycleDetect      PedestrianBicycleDetect OPTIONAL,
                           -- true if ANY ped or bicycles are detected crossing
                           -- the above lanes. Set to false ONLY if there is a
                           -- high certainty that there are none present,
                           -- otherwise element is not sent.
    regional              SEQUENCE (SIZE(1..4)) OF
                           RegionalExtension {{REGION.Reg-ConnectionManeuverAssist}} OPTIONAL,
    ...
}

```

Used By: This entry is used directly by one other data structure in this standard, a DF called [DF_ManueverAssistList](#) [<ASN>](#). In addition, this item may be used by data structures in other ITS standards.