## 4.5. BASIC SAFETY MESSAGE (PART I)

**Table 8: Basic Safety Message (Part I) (SAE J2735) Communication Profile**

<table>
<tr><th>Message</th><th colspan="2">Basic Safety Message (BSM) Part I</th></tr>
<tr><td>Applicable Interface(s)</td><td>Interface 7</td><td>Interface 12, Interface 13, Interface 14, Interface 15, Interface 19, Interface 20</td></tr>
<tr><td>Applicable Standards</td><td>• ITS Application Information Layer: Undefined<br>• Application Layer: HTTPS<br>• Session Layer: IETF TLS, IETF DTLS<br>• Transport Layer:IETF UDP, IETF TCP<br>• Network Layer: IETF IPv6<br>• Data Link Layer: LLC and MAC compatible with Physical and Network<br>• Physical Layer: IEEE 802.3 (fiber-optic backhaul)<br>• Security Plane: IEEE 1609.2, IETF TLS, IETF, DTLS</td><td>• ITS Application Information Layer: SAE J2735_201603, Section 5.2<br>• Presentation Layer: ISO ASN.1 UPER<br>• Transport Layer: IEEE 1609.3 WSMP<br>• Network Layer: IEEE 1609.3 WSMP<br>• Data Link Layer: IEEE 1609.4, IEEE 802.11<br>• Physical Layer: IEEE 802.11<br>• Security Plane: IEEE 1609.2<br>See Table 3 in Chapter 2 for the proposed DSRC channel map.</td></tr>
<tr><td>Description</td><td colspan="2">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. Part I data shall be included in every BSM.<br>BSMs are received and logged by the RSU and are periodically sent to the Traffic CV Management System</td></tr>
<tr><td>Required Data</td><td colspan="2">
<table>
<tr><th>Name</th><th>Type</th><th>Description</th><th>Values</th><th>Reference</th></tr>
<tr><td>coreData</td><td>BSMcoreData</td><td>Contains the critical core data elements deemed to be needed with every BSM issued</td><td>N/A (Data Frame)</td><td>SAE J2735_201603, Section 6.8</td></tr>
<tr><td>msgCnt</td><td>MsgCount</td><td>A sequence number within a stream of messages with the same DSRCmsgID and from the same sender.</td><td>INTEGER (0…127)</td><td>SAE J2735_201603, Section 7.104</td></tr>
<tr><td>id</td><td>TemporaryID</td><td>4 octet random device identifier. Changes periodically to ensure the overall anonymity of the vehicle</td><td>OCTET STRING (SIZE(4))</td><td>SAE J2735_201603, Section 7.187</td></tr>
<tr><td>secMark</td><td>DSecond</td><td>Represents the milliseconds within a minute – units of milliseconds</td><td>INTEGER (0…65535)</td><td>SAE J2735_201603, Section 7.39</td></tr>
</table>
</td></tr>
</table>

| Message | Basic Safety Message (BSM) Part I | | | | |
|---|---|---|---|---|---|
| | lat | Latitude | The geographic latitude of an object, expressed in 1/10th integer microdegrees | INTEGER (-900000000... 900000001) | SAE J2735_201603, Section 7.91 |
| | lon | Longitude | The geographic longitude of an object, expressed in 1/10th integer microdegrees | INTEGER (-1799999999.... 1800000001) | SAE J2735_201603, Section 7.95 |
| | elev | Elevation | Geographic position above or below the reference ellipsoid (typically WGS-84). The number has a resolution of 1 decimeter | INTEGER (-4096...61439) | SAE J2735_201603, Section 7.44 |
| | accuracy | PositionalAccuracy | various parameters of quality used to model the accuracy of the positional determination with respect to each given axis | | SAE J2735_201603, Section 6.88 |
| | semiMajor | SemiMajorAxisAccuracy | radius (length) of the semi-major axis of an ellipsoid representing the accuracy which can be expected from a GNSS system in 5 cm steps, typically at a one sigma level of confidence.<br>range 0-12.7 meter, LSB = 0.05m | INTEGER (0...255) | SAE J2735_201603, Section 7.168 |
| | semiMinor | SemiMinorAxisAccuracy | radius of the semi-minor axis of an ellipsoid representing the accuracy which can be expected from a GNSS system in 5 cm steps, typically at a one sigma level of confidence.<br>range 0-12.7 meter, LSB = 0.05m | INTEGER (0...255) | SAE J2735_201603, Section 7.170 |
| | orientation | SemiMajorAxisOrientation | orientate the angle of the semi-major axis of an ellipsoid.<br>relative to true north (0~359.9945078786 degrees)<br>LSB units of 360/65535 deg | INTEGER (0...65535) | SAE J2735_201603, Section 7.169 |
| | transmission | TransmissionState | current state of the vehicle transmission | ENUMERATED{<br>neutral (0),<br>park (1),<br>forwardGears (2),<br>reverseGears (3),<br>unavailable (7)} | SAE J2735_201603, Section 7.201 |
| | speed | Speed | vehicle speed expressed in unsigned units of 0.02 meters per second | INTEGER (0...8191) | SAE J2735_201603, Section 7.179 |

| Message | Basic Safety Message (BSM) Part I | | | | |
|---|---|---|---|---|---|
| | heading | Heading | current heading of the sending device, expressed in unsigned units of 0.0125 degrees from North | INTEGER (0...28800) | SAE J2735_201603, Section 7.53 |
| | angle | SteeringWheelAngle | The angle of the driver's steering wheel, with LSB units of 1.5 degrees<br>+127 to be used for unavailable | INTEGER (-126...127) | SAE J2735_201603, Section 7.185 |
| | accelSet | AccelerationSet4Way | Set of acceleration values in 3 orthogonal directions of the vehicle and with yaw rotation rates | N/A (Data Frame) | SAE J2735_201603, Section 6.1 |
| | long | Acceleration | Signed acceleration of the vehicle along some known axis in units of 0.01 meters per second squared along the Vehicle Longitudinal axis | INTEGER (-2000...2001) | SAE J2735_201603, Section 7.1 |
| | lat | Acceleration | Signed acceleration of the vehicle along some known axis in units of 0.01 meters per second squared along the Vehicle Lateral axis | INTEGER (-2000...2001) | SAE J2735_201603, Section 7.1 |
| | vert | VerticalAcceleration | Signed vertical acceleration of the vehicle along the vertical axis in units of 0.02 G | INTEGER (-127...127) | SAE J2735_201603, Section 7.217 |
| | yaw | YawRate | Yaw Rate of the vehicle, a signed value (to the right being positive) expressed in 0.01 degrees per second | INTEGER (-32767...32767) | SAE J2735_201603, Section 7.229 |
| | brakes | BrakeSystemStatus | Information about the current brake and system control activity of the vehicle | | SAE J2735_201603, Section 6.7 |
| | wheelBrakes | BrakeAppliedStatus | Independently for each of four wheels whether braking is currently active. Set to 1 if brakes are active on that wheel, or to 0 if brakes are inactive on that wheel | BIT STRING {<br>unavailable (0),<br>leftFront (1),<br>leftRear (2),<br>rightFront (3),<br>rightRear (4) } | SAE J2735_201603, Section 7.18 |
| | traction | TractionControlStatus | Status of the vehicle traction control system | ENUMERATED {<br>unavailable (0),<br>off (1), on (2),<br>engaged (3)} | SAE J2735_201603, Section 7.196 |

| Message | Basic Safety Message (BSM) Part I | | | | |
|---|---|---|---|---|---|
| | abs | AntiLockBrakeStatus | Status of the vehicle ABS | ENUMERATED { unavailable (0), off (1), on (2), engaged (3)} | SAE J2735_201603, Section 7.10 |
| | scs | StabilityControlStatus | Current state of the stability control system | ENUMERATED { unavailable (0), off (1), on (2), engaged (3)} | SAE J2735_201603, Section 7.181 |
| | brakeBoost | BrakeBoostApplied | When set to the "on" state, indicates emergency braking | ENUMERATED { unavailable (0), off (1), on (2)} | SAE J2735_201603, Section 7.19 |
| | auxBrakes | AuxilliaryBrakeStatus | status of the auxiliary brakes (sometimes referred to as the parking brake) of the vehicle | ENUMERATED { unavailable (0), off (1), on (2), reserved (3)} | SAE J2735_201603, Section 7.14 |
| | size | VehicleSize | vehicle length and vehicle width | N/A (Data Frame) | SAE J2735_201603, Section 6.149 |
| | width | VehicleWidth | Width of the vehicle expressed in centimeters | INTEGER (0...1023) | SAE J2735_201603, Section 7.214 |
| | length | VehicleLength | Length of the vehicle measured from the edge of the front bumper to the edge of the rear bumper expressed in centimeters, unsigned. | INTEGER (0... 4095) | SAE J2735_201603, Section 7.210 |

*Source: City of Columbus, ARC-IT*

## 4.6. BASIC SAFETY MESSAGE (PART II)

**Table 9: Basic Safety Message (Part II) (SAE J2735) Communication Profile**

| Message | Basic Safety Message (BSM) Part II | |
|---|---|---|
| Applicable Interface(s) | Interface 7 | Interface 15, Interface 19, Interface 20 |
| Applicable Standards | • ITS Application Information Layer: Undefined<br>• Application Layer: HTTPS<br>• Session Layer: IETF TLS, IETF DTLS<br>• Transport Layer: IETF UDP, IETF TCP<br>• Network Layer: IETF IPv6<br>• Data Link Layer: LLC and MAC compatible with Physical and Network<br>• Physical Layer: IEEE 802.3 (fiber-optic backhaul)<br>• Security Plane: IEEE 1609.2, IETF TLS, IETF, DTLS | • ITS Application Information Layer: SAE J2735_201603, Section 5.2<br>• Presentation Layer: ISO ASN.1 UPER<br>• Transport Layer: IEEE 1609.3 WSMP<br>• Network Layer: IEEE 1609.3 WSMP<br>• Data Link Layer: IEEE 1609.4, IEEE 802.11<br>• Physical Layer: IEEE 802.11<br>• Security Plane: IEEE 1609.2<br>*See **Table 3** in **Chapter 2** for the proposed DSRC channel map.* |
| Description | BSM Part II data items are optional for a given BSM and are included as needed, as specified in the System Requirements<br>BSMs are received and logged by the RSU and are periodically sent to the Traffic CV Management System. | |

| Required Data | Name | Type | Description | Values | Reference |
|---|---|---|---|---|---|
| | specialVehicleExt | SpecialVehicleExtensions | various additional optional information elements for special vehicles. For example, a heavy truck sending content about the trailer it was hauling | N/A (Data Frame) | SAE J2735_201603, Section 6.128 |
| | trailers | TrailerData | describe trailers pulled by a motor vehicle and/or other equipped devices | N/A (Data Frame) | SAE J2735_201603, Section 6.135 |

| Message | Basic Safety Message (BSM) Part II | | | | |
|---|---|---|---|---|---|
| | sspRights | SSPindex | Used to control the data elements that follow the occurrence of the index. In the absence of a matching index in the message sender's CERT, the message contents are not valid | INTEGER (0...31) | SAE J2735_201603, Section 7.180 |
| | connection | PivotPointDescription | describes the geometric relationship between a vehicle and a trailer | N/A (Data Frame) | SAE J2735_201603, Section 6.86 |
| | pivotOffset | Offset-B11 | Offset is with respect to the length and tangential to the width of the object in question and is the distance from the edge of the outline measured from the edge of the length of this unit. An 11-bit delta offset in X or Y direction from some known point. a range of ±10.23 meters | INTEGER (-1024...1023) | SAE J2735_201603, Section 7.119 |
| | pivotAngle | Angle | The current angle between the two objects. This is the only dynamic value when the vehicle is underway. Heading and reported positions of the trailers are given with respect to the object in front of them. The current heading of the sending device is expressed in unsigned units of 0.0125 degrees. | INTEGER (0...28800) | SAE J2735_201603, Section 7.7 |
| | pivots | PivotingAllowed | Flag set to true when the described connection point allows pivoting to occur | BOOLEAN | SAE J2735_201603, Section 7.138 |
| | units | TrailerUnitDescriptionList | Sequence of trailer descriptions | SEQUENCE (SIZE(1...8)) OF TrailerUnitDescription | SAE J2735_201603, Section 6.138 |
| | | TrailerUnitDescritption | Provides a physical description for one trailer | N/A (Data Frame) | SAE J2735_201603, Section 6.139 |
| | isDolley | IsDolley | Set to False when false indicates a trailer unit | BOOLEAN | SAE J2735_201603, Section 7.58 |
| | width | VehicleWidth | Trailer Width expressed in centimeters, unsigned. Units are 1 cm | INTEGER (0...1023) | SAE J2735_201603, Section 7.215 |
| | length | VehicleLength | Trailer Width expressed in centimeters, unsigned. Units are 1 cm | INTEGER (0...1023) | SAE J2735_201603, Section 7.210 |

| Message | Basic Safety Message (BSM) Part II | | | | |
|---|---|---|---|---|---|
| | frontPivot | PivotPointDescription | describes the geometric relationship between a vehicle and a trailer | N/A (Data Frame) | SAE J2735_201603, Section 6.86 |
| | pivotOffset | Offset-B11 | Offset is with respect to the length and tangential to the width of the object in question and is the distance from the edge of the outline measured from the edge of the length of this unit. An 11-bit delta offset in X or Y direction from some known point, a range of ± 10.23 meters | INTEGER (-1024...1023) | SAE J2735_201603, Section 7.119 |
| | pivotAngle | Angle | The current angle between the two objects. This is the only dynamic value when the vehicle is underway. Heading and reported positions of the trailers are given with respect to the object in front of them. The current heading of the sending device is expressed in unsigned units of 0.0125 degrees. | INTEGER (0...28800) | SAE J2735_201603, Section 7.7 |
| | pivots | PivotingAllowed | Flag set to true when the described connection point allows pivoting to occur | BOOLEAN | SAE J2735_201603, Section 7.138 |
| | positionOffset | Node-XY-24b | Current Position relative to the hauling Vehicle. A 24-bit node type with offset values from the last point in X and Y. | N/A (Data Frame) | SAE J2735_201603, Section 6.63 |
| | x | Offset-B12 | A 12-bit delta offset in X, Y or Z direction from some known point. A range of ± 20.47 meters | INTEGER (-2048...2047) | SAE J2735_201603, Section 7.120 |
| | y | Offset-B12 | A 12-bit delta offset in X, Y or Z direction from some known point. a range of ± 20.47 meters | INTEGER (-2048...2047) | SAE J2735_201603, Section 7.120 |

*Source: City of Columbus, ARC-IT*