Safety Pilot Model Deployment – Sample Data, from Ann Arbor, Michigan

Identification Information

Citation

Citation Information

Originator: Safety Pilot Model Deployment and the members of the test conductor team
Publication Date: 20141028
Title: Safety Pilot Model Deployment – Sample Data
Edition: Version 1
Geospatial Data Presentation Form: Latitude and longitude

Publication Information

Publication Place: Washington, D.C.
Publisher: U.S. Department of Transportation's (USDOT) Intelligent Transportation Systems (ITS) Joint Program Office (JPO)
Online Linkage: https://www.its-rde.net/

Description

Abstract The file contained in this data environment were collected during the Safety Pilot Model Deployment (SPMD). The SPMD is a part of the Connected Vehicle Safety Pilot Program. This program is a research initiative that features real-world implementation of connected vehicle safety technologies, applications, and systems using everyday drivers. The effort will test performance, evaluate human factors and usability, observe policies and processes, and collect empirical data to present a more accurate, detailed understanding of the potential safety benefits of these technologies. This empirical data will support the National Highway Traffic Safety Administration's (NHTSA) decision on vehicle communications for safety. To support this initiative, the SPMD is a comprehensive data collection effort, under real-world conditions, at a test site, with multimodal traffic, hosting approximately 3,000 vehicles equipped with vehicle-to-vehicle (V2V) communication devices.

The goals of the SPMD are:
- Demonstrate connected vehicle technologies in a real-world, multimodal environment
- Determine driver acceptance of vehicle-based safety systems
- Evaluate the feasibility, scalability, security, and interoperability of Dedicated Short-Range Communications (DSRC) technology
- Assess options to accelerate safety benefits

In achieving the goals of the SPMD, a number of different entities are involved in executing this field experiment. These entities include the University of Michigan Transportation Research Institute (UMTRI); the field test conductor, Battelle; Southwest Research Institute; the Crash Avoidance Metrics Partnership (CAMP), in conjunction with Virginia Tech Transportation Institute (VTTI); and Mixon Hill, Inc. The data sets that these entities will provide include basic safety messages (BSM), vehicle trajectories, and various driver-vehicle interaction data, as well as contextual data that describes the circumstances under which the Model Deployment data was collected.

The primary goal of the contextual data collection effort is to supplement the vehicle-based data that has been collected through the SPMD. This data collection effort will provide contextual mobility and

environmental data to further describe the surroundings in which Model Deployment data was collected. These data will include data such as, signal operation and weather information.

Large portion of the data contained in this environment is obtained from on board vehicle devices and roadside units. Onboard devices collected data that not only communicate the vehicle dynamic information such as trajectories, speeds and accelerations but it also those that speak the operation of a few vehicle components, such as the headlights, wipers and brakes, to name a few. Onboard devices collect accurate location data, at a frequency of 10Hz. These collected data includes trajectory information, which includes an individual trip origin and destination. Files containing such information, and other related files, were sanitized – to rid them of such Personally Identifiable Information (PII) before posting them on the RDE. Roadside equipment which also collects trajectory information, albeit for a limited span in time and space, will also be sanitized to eliminate PII.

The file formats included in this environment are mostly flat / comma separated files. Each file is store in one of data sets that are a part of this environment. The name of each file is informed by the data set to which it belongs.

Purpose: The data environment is intended to serve as the preview of the larger SPMD data environment that includes a significant amount of the data that was collected during the entirety of the deployment exercise. This preview is intended to help prepare researchers and application developers to ingest these data to inform their research and development activities.

Supplemental Information:

Documentation provided by Booz | Allen | Hamilton for the Safety Pilot Model Deployment data is provided on the RDE in the file – Safety Pilot Model Deployment Data Handbook.pdf

Time Period of Content

Time Period Information

Range of Dates:
Beginning Date: 20121001
Ending Date: 20130430

Currentness Reference:
Ground condition (i.e., the previous dates refer to the time the information was collected)

Status
Progress: Complete
Maintenance and Update Frequency: None planned

Spatial Domain

Bounding Coordinates
West Bounding Coordinate: -83.91°
East Bounding Coordinate: -83.54°
North Bounding Coordinate: 42.431°
South Bounding Coordinate: 42.17°

Keywords

Theme

Theme Keyword: Basic Safety Message
Theme Keyword: BSM
Theme Keyword: Safety Pilot Model Deployment
Theme Keyword: VAD
Theme Keyword: Vehicle Awareness Device
Theme Keyword: ASD
Theme Keyword: Aftermarket Safety Device
Theme Keyword: ISD
Theme Keyword: Integrated Safety Device
Theme Keyword: TRP
Theme Keyword: Transit Safety Retrofit Package

Place

Place Keyword: Ann Arbor, Michigan

Temporal

Temporal Keyword: April, 11, 2013

Access Constraints:

To access the data set, users must register through the USDOT Research Data Exchange (RDE) portal (https://www.its-rde.net/). The registration process will include a request for contact information and agreement to terms of use for the data What information is optional versus mandatory for registration has not been finalized ; however in order to encourage broad access and use, mandatory information will be kept to a minimum and ease of use maximized. See the RDE Terms of Use and Data Privacy Policy on how registration information is kept secure and for uses only applicable to the RDE administration.

User Constraints:

Those who use data and data processing tools distributed by the Research Data Exchange have the following responsibilities:

1. Where the contributed materials have been utilized to any extent to enable, verify, supplement or validate performance measurement, analysis, research or software development, to fully reference the Research Data Exchange Program and the contributions of the individuals in all subsequent and related publications or public events, specifically:
   a. In publications, reference the Research Data Exchange website and the date accessed, data and/or data processing tools (by name and version number), and the individual contributors identified on the reference template associated with each data and/or data processing tool.
   b. In presentations or other oral communication, by noting the data and/or data processing tool by name and version number, and communicating the address of the Research Data Exchange website.
2. Users are encouraged to accurately post and update within the Research Data Exchange website a description of the project utilizing the data and/or the data processing tools, including:
   a. A description of the project, including a brief statement of the project goals.
   b. A summary of the hypotheses and findings (when available) of the project.

c. Individuals directing and/or substantively participating in the project.
d. The name and version number of the data and/or data processing tools downloaded and utilized in the project.
e. The current state of the project (upcoming, underway, completed).
f. References to published materials (if any).

3. Users are encouraged to report anomalies, errors or other questionable data elements using the Data Forum of the Research Data Exchange website, referencing the specific data or data processing tool by name and version number.

4. To refrain from duplication and dissemination of the data and data processing tools to third parties.

Publication of certain derived information such as location of residence, specific stores visited, purpose of trips, etc. must be cleared with the data set originator prior to publication.

Point of Contact

Contact Information

Contact Organization Primary
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Data Set Credit:

National Highway Traffic Safety Administration (NHTSA) Security Information
Security Classification: Unclassified

Native Data Set Environment:

Documentation: Except for weather data, the data within this environment were collected and stored in pcap files. Data were collected on a number of different devices which included Integrated Safety Device (ISD), Aftermarket Safety Device (ASD) and Vehicle Awareness Device (VAD). The data collected on these devices were then been extracted into a database and then converted into comma separate file format for easy access. In providing data to the RDE, all data files that contained PII, or could be used to uncover PII, were sanitized to protect participants' identity. A series of sanitization algorithms were developed and applied to each file could potentially compromise a participant's identity.

Applying the sanitization algorithms caused the description of a few data elements to be slightly different than its original description. For instance, in trip summary file, the total trip time or distance is not the delta between the true start and end of a trip. These measures are instead reflective of the sanitized portion of the trip (that is "free" of PII).

The data provide in this data environment were organized in five (5) data sets – DAS1, DAS2, BSM, RSE and Weather. The definition of each and their contents are presented in the preceding sections. The following definitions were largely take from or adapted from the J2735 Standard which was developed by

the Society of Automotive Engineers. For additional information on some of the following data elements, readers are asked to consult the J2735 Standard document.

Cross Reference:

None currently

Citation Information

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Title: Safety Pilot Model Deployment
Online Linkage: https://www.its-rde.net/

Data Quality Information

Attribute Accuracy: No accuracy assessment has been performed for the data set. However a number of the data collection devices were tested for conformance to the requirements given in "System Requirement Description, 5.9GHz DSRC …" for RSEs, VADs, ASDs and other such specification.

Completeness Report: The USDOT does not make any claims regarding data completeness. There may be gaps in the data provided.

Lineage

Source Information

Source Citation

Citation Information

Originator: All data were collected and provided by the NHTSA / USDOT
Publication Date: 2014

Process Step

Process Description: A majority of the data with this data environment was recorded and stored in pcap format. FHWA received the data in a database and the convert it into a comma separated file format for ease of manipulation. Once in csv format each file was sanitized by eliminating records and data elements that could lead to compromising a participant's identity.

Process Contact:

Contact Information

Contact Organization Primary

Contact Organization: USDOT FHWA
Contact Person: Gene McHale
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Entity and Attribute Information

Detailed Description for DAS1 Data set

The DAS1 data set contains data that is collected by the Data Acquisition System (DAS) developed by UMTRI. This DAS collects audio and video data as well as text. However, given the presence of (S)PII in the video and audio data, only text-based data are available via the RDE. The DAS1 data set contains 19 comma-separated files. Attribute descriptions for each of the available files are provided below.

DataFrontTargets File

Elements in the DataFrontTargets file are populated with the aid of Mobileye's vision-based Advanced Driver Assistance Systems. This system collects information from the scene in front of the vehicle, and uses a series of algorithms to communicate measures and warnings to drivers as appropriate.

Attribute

Attribute Label: Device (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Trip (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Time (column C)
Attribute Definition: This field contains the time in centiseconds since DAS started, which (generally) starts when the ignition is in the on position.
Attribute Domain Values: Integer

Attribute

Attribute Label: TargetId (column D)
Attribute Definition: This field contains a numeric ID assigned by the Mobileye sensor to distinguish between the different objects being tracked; the closest obstacle is given a TargetId value of 1.
Attribute Domain Values: Integer

Attribute

Attribute Label: ObstacleId (column E)
Attribute Definition: This field contains a numeric ID of new obstacle, as assigned by the Mobileye sensor, and its value will be the last used free ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Range (column F)
Attribute Definition: This field contains the longitudinal position, in meters, of an object, typically the closest object, relative to a reference point on the host vehicle, according to the Mobileye sensor.
Attribute Domain Values: Integer

Attribute

Attribute Label: RangeRate (column G)
Attribute Definition: This field contains the longitudinal velocity, in m/sec, of an object, typically the closest object, relative to the host vehicle, according to the Mobileye sensor.
Attribute Domain Values: Real

Attribute

Attribute Label: Transversal (column H)
Attribute Definition: This field contains the lateral position, in meters, of the obstacle, as determined by the Mobileye sensor.
Attribute Domain Values: Real

Attribute

Attribute Label: TargetType (column I)
Attribute Definition: This field contains the classification of an identified obstacle/target as a car, truck, pedestrian, etc. A value of 0 indicates that the Mobileye sensor has identified an

obstacle/target as a car. A value of 1 indicates that the Mobileye sensor has identified an obstacle/target as a truck. A value of 2 indicates that the Mobileye sensor has identified an obstacle/target as a motorcycle. A value of 3 indicates that the Mobileye sensor has identified an obstacle/target as a pedestrian. A value of 4 indicates that the Mobileye sensor has identified an obstacle/target as a bicycle.
Attribute Domain Values: Integer

Attribute

Attribute Label: Status (column J)
Attribute Definition: This field contains a classification of the motion (kinematic state) of an identified obstacle/target as stopped, moving, etc. A value of 0 indicates that the Mobileye sensor is unable to determine the kinematic state of the identified obstacle/target. A value of 1 indicates that the Mobileye sensor has determined that the identified obstacle/target is standing. A value of 2 indicates that the Mobileye sensor has determined that the identified obstacle/target is stopped. A value of 3 indicates that the Mobileye sensor has determined that the identified obstacle/target is moving. A value of 4 indicates that the Mobileye sensor has determined that the identified obstacle/target is oncoming. A value of 5 indicates that the Mobileye sensor has determined that the identified obstacle/target is parked.
Attribute Domain Values: Integer

Attribute

Attribute Label: CIPV (column K)
Attribute Definition: This field contains an indication of whether an obstacle is the closest in a vehicle's path. A value of 0 indicates that the identified obstacle/target is not the closest in a vehicle's path. A value of 1 indicates that the identified obstacle/target is the closest in a vehicle's path.
Attribute Domain Values: Integer

DataLane File

The *DataLane* file is a log of lane-based information collected by the onboard Mobileye sensor. These data communicate the vehicle's position relative to the lane boundaries of its travel lane. A quality measure associated with the estimated information regarding the vehicle's lane boundaries is also included with this file. This file contains eight fields, which are described below.

Attribute

Attribute Label: Device (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Trip (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Time (column C)
Attribute Definition: This field contains the time in centiseconds since DAS started, which (generally) starts when the ignition is in the on position.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneDistanceLeft (column D)
Attribute Definition: This field contains the distance, in meters, between the left side of the vehicle and the left boundary of the travel lane.
Attribute Domain Values: Real

Attribute

Attribute Label: LaneDistanceRight (column E)
Attribute Definition: This field contains the distance, in meters, between the right side of the vehicle and the right boundary of the travel lane.
Attribute Domain Values: Real

Attribute

Attribute Label: LaneHeading (column F)
Attribute Definition: This field contains the direction, in degrees, in which the vehicle is traveling.
Attribute Domain Values: Real

Attribute

Attribute Label: LaneQualityRight (column G)
Attribute Definition: This field contains the quality of the estimated boundary measure of the travel lane's right boundary.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneQualityLeft (column H)
Attribute Definition: This field contains the quality of the estimated boundary measure of the travel lane's left boundary.
Attribute Domain Values: Integer

DataWsu File

Data from the onboard WSU populates the *DataWsu* file. This file primarily consists of GPS-based data elements and those that are obtained from the vehicle's Contral Area Network (CAN) Bus. In addition to GPS-based data, there are a series of data elements that present vehicle performance information and the state of a few of its components. The *DataWsu* file has the most fields, 27, of any file in the DAS1 data set. Below is a list of the fields in the *DataWsu* file, along with a brief description of each.

Attribute

Attribute Label: Device (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Trip (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Time (column C)
Attribute Definition: This field contains the time in centiseconds since DAS started, which (generally) starts when the ignition is in the on position.
Attribute Domain Values: Integer

Attribute

Attribute Label: GpsValidWsu (column D)
Attribute Definition: This field indicates whether a GPS data point is valid or not. A value of 0 indicates 'false,' that the data point is invalid. A value of 1 indicates 'true,' that the data point is valid.
Attribute Domain Values: Integer

Attribute

Attribute Label: GpsTimeWsu (column E)

Attribute Definition: This field contains the epoch GPS time, in msec, received from the remote vehicle that has been targeted by the host vehicle's WSU.
Attribute Domain Values: Integer

Attribute

Attribute Label: LatitudeWsu (column F)
Attribute Definition: This field contains the latitude, in degrees, from WSU receiver.
Attribute Domain Values: Float

Attribute

Attribute Label: LongitudeWsu (column G)
Attribute Definition: This field contains the longitude from WSU receiver.
Attribute Domain Values: Float

Attribute

Attribute Label: AltitudeWsu (column H)
Attribute Definition: This field contains the altitude, in meters, from WSU receiver.
Attribute Domain Values: Real

Attribute

Attribute Label: GpsHeadingWsu (column I)
Attribute Definition: This field contains the heading, in degrees, from WSU GPS receiver.
Attribute Domain Values: Real

Attribute

Attribute Label: GpsSpeedWsu (column J)
Attribute Definition: This field contains the speed, in m/sec, from WSU GPS receiver.
Attribute Domain Values: Real

Attribute

Attribute Label: HdopWsu (column K)
Attribute Definition: This field contains the horizontal dilution of precision.
Attribute Domain Values: Real

Attribute

Attribute Label: PdopWsu (column L)
Attribute Definition: This field contains the position dilution of precision.
Attribute Domain Values: Real

Attribute

Attribute Label: FixQualityWsu (column M)
Attribute Definition: This field contains the GPS Fix Quality.
Attribute Domain Values: Integer

Attribute

Attribute Label: GpsCoastingWsu (column N)
Attribute Definition: This field contains GPS Coasted.
Attribute Domain Values: Integer

Attribute

Attribute Label: ValidCanWsu (column O)
Attribute Definition: This field contains the Valid Vehicle CAN Bus message to WSU. A value of 0 (False) indicates invalid data from the CAN bus. A value of 1 (True) indicates valid data from the CAN bus.
Attribute Domain Values: Integer

Attribute

Attribute Label: YawRateWsu (column P)
Attribute Definition: This field contains the yaw rate (in deg/sec) from vehicle CAN Bus via WSU.
Attribute Domain Values: Real

Attribute

Attribute Label: SpeedWsu (column Q)
Attribute Definition: This field contains the speed, in kph, from vehicle CAN Bus via WSU.
Attribute Domain Values: Real

Attribute

Attribute Label: TurnSngRWsu (column R)
Attribute Definition: This field contains an indication of the right turn signal from vehicle CAN Bus via WSU. A value of 0 (off) indicates the right turn signal is off. A value of 1 (on) indicates the right turn signal is on.
Attribute Domain Values: Integer

Attribute

Attribute Label: TurnSngLWsu (column R)
Attribute Definition: This field contains an indication of the left turn signal from vehicle CAN Bus via WSU. A value of 0 (off) indicates the left turn signal is off. A value of 1 (on) indicates the left turn signal is on.
Attribute Domain Values: Integer

Attribute

Attribute Label: BrakeAbsTcsWsu (column T)
Attribute Definition: This field contains information on the brake, ABS, and traction control from vehicle CAN Bus via WSU.
Attribute Domain Values: Integer

Attribute

Attribute Label: AxWsu (column U)
Attribute Definition: This field contains the longitudinal acceleration, in m/sec2, from vehicle CAN Bus via WSU.
Attribute Domain Values: Real

Attribute

Attribute Label: PrndlWsu (column V)
Attribute Definition: This field contains the current transmission state (Park, Reverse, Neutral, Drive, Low) from vehicle CAN Bus via WSU. The enumerated values this field can take are the integers 0 – 9, inclusive. The name and description of each of these values is the following: 0 – Shifting - Shifting gears; 1 – Park - Transmission is in the Park position; 2 – Reverse - Transmission is in the Reverse position; 3 – Neutral - Transmission is in the Neutral position; 4 – Drive - Transmission is in the Drive position; 5 – Drive4 - Transmission is in the Drive4 position; 6 – First - Transmission is in the first gear; 7 – Second - Transmission is in the second gear; 8 – Third - Transmission is in the third gear; 9 – Fourth - Transmission is in the fourth gear.
Attribute Domain Values: Integer

Attribute

Attribute Label: VsaActiveWsu (column W)
Attribute Definition: This field indicates stability control active from vehicle CAN Bus via WSU.
Attribute Domain Values: Integer

Attribute

Attribute Label: HeadlampWsu (column X)
Attribute Definition: This field contains the headlamp state from vehicle CAN Bus via WSU.
Attribute Domain Values: Integer

Attribute

Attribute Label: WiperWsu (column Y)
Attribute Definition: This field contains the wiper state from vehicle CAN Bus via WSU.
Attribute Domain Values: Integer

Attribute

Attribute Label: ThrottleWsu (column Z)

Attribute Definition: This field contains the throttle position from vehicle CAN Bus via WSU.
Attribute Domain Values: Real

Attribute

Attribute Label: SteerWsu (column AA)
Attribute Definition: This field contains the steering angle/position, in degrees, from vehicle CAN Bus via WSU.
Attribute Domain Values: Real

DAS1 Trip Summary File

The *Summary* file contains trip-level summaries, from each instrument vehicle, for each trip taken during the selected time period of the Model Deployment. The trip summaries include details such as trip start and end times, distance traveled, and the number of time a driver applied the brakes during the trip. Also captured in the trip summary file is the distance driven while the vehicle speed was greater than 25 mph. This data element is of interest not only because it further details the trip, but also because it provides a sense of the conditions under which data, for a particular trip, were collected. The *Summary* file contains 15 fields; below is a list of these fields and a brief description of each.

Attribute

Attribute Label: DeviceID (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: TripID (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Epoch Start Time (column C)
Attribute Definition: This field contains the epoch start time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.
Attribute Domain Values: Integer

Attribute

Attribute Label: Start Date (column D)
Attribute Definition: The m/d/yyyy on which the trips started.
Attribute Domain Values: Date (m/d/yyyy)

Attribute

Attribute Label: Start Time (column E)
Attribute Definition: This field contains the wall clock time stamp of the start of a trip, in the form of hh:mm:sss.
Attribute Domain Values: Time (hh:mm:ss)

Attribute

Attribute Label: Epoch End Time (column F)
Attribute Definition: This field contains the epoch end time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.
Attribute Domain Values: Integer

Attribute

Attribute Label: End Date (column G)
Attribute Definition: The m/d/yyyy on which the trips ended.

Attribute Domain Values: Date (m/d/yyyy)

Attribute

Attribute Label: End Time (column H)
Attribute Definition: This field contains the wall clock time stamp of the end of a trip, in the form of hh:mm:sss.
Attribute Domain Values: Time (hh:mm:ss)

Attribute

Attribute Label: Total Trip Distance (column J)
Attribute Definition: This field contains the total distance traveled, in miles, covered in a trip
Attribute Domain Values: Real

Attribute

Attribute Label: Distance Travelled w/ Speed >= 25mph (column K)
Attribute Definition: This field contains the distance traveled in a trip but only when the vehicle's speed is greater than or equal to 25 mph.
Attribute Domain Values: Real

Attribute

Attribute Label: Trip Duration (column L)
Attribute Definition: This field contains the total time duration, in seconds, of a trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Average Speed (column M)
Attribute Definition: This field communicates a vehicle's average speed over the entire length of the trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Maximum Speed (column N)
Attribute Definition: This field contains the maximum speed reached during a trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Brake Count (column O)
Attribute Definition: This field contains an indication of the number of times the driver applies the brake during a trip.
Attribute Domain Values: Integer

Attribute

Attribute Label: Wiper Activated (column P)
Attribute Definition: This field indicates whether or not the wipers were activated during a trip.
Attribute Domain Values: String

Detailed Description for DAS2 Data set

The DAS2 data set catalogs the vehicle operation data of Crash Avoidance Metrics Partnership CAMP's 64 vehicles that are equipped with integrated safety devices (ISD) and the data acquisition system developed by Virginia Tech Transportation Institute (VTTI) (DAS2). This DAS serves as the primary means by which vehicle operation data is being collected and stored. Although "DAS2" also captures text- and video-based data, only the text-based data will be available via the Research Data Exchange (RDE), as (Sensitive) Personally Identifiable Information ((S)PII) is in the video (and audio) data. As a result, the following sections will detail only text-based data. The DAS2 data set contains seven individual *.csv files. Below is a list and description the attributes of each of the four files.

HV_Primary File

The *HV_Primary* file is the main file that contains the performance and operation details of vehicles with ISDs. This file contains a number of fields detailing elements such as vehicle position and speed, fidelity measures of GPS-based data elements, and vehicle operation data such as steering and throttles position. The fields of the HV_Primary file as well as a few descriptors for each are listed below.

Attribute

Attribute Label: DeviceID (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Trip (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Time (column C)
Attribute Definition: This field contains the time in centiseconds since DAS started, which (generally) starts when the ignition is in the on position.
Attribute Domain Values: Integer

Attribute

Attribute Label: GPS_Elevation (column D)
Attribute Definition: This field contains the elevation, in meters, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Fix_Quality (column E)
Attribute Definition: This field contains the quality of GPS information. The enumerated values this field can take are the integers 0 – 2, inclusive. The name and description of each of these values is the following: 0 - Invalid ; 1 - GPS fix; 2 - dgps fix.
Attribute Domain Values: Integer

Attribute

Attribute Label: GPS_Hdop (column F)
Attribute Definition: This field contains the Horizontal Dilution of Precision, used to determine position accuracy; the lower the number, the better.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Heading (column G)
Attribute Definition: This field contains the heading, in degrees, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Latitude (column H)
Attribute Definition: This field contains the latitude, in degrees, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Longitude (column I)
Attribute Definition: This field contains the longitude, in degrees, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Number_Satellites (column J)

Attribute Definition: This field contains the number of satellites used in GPS solution.
Attribute Domain Values: Integer

Attribute

Attribute Label: GPS_Pdop (column K)
Attribute Definition: This field contains the Positional Dilution of Precision, used to determine position accuracy; the lower the number, the better.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_Speed (column L)
Attribute Definition: This field contains the speed, in meters/second, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: GPS_UTC_Time (column M)
Attribute Definition: This field contains the UTC Time, in milliseconds, of vehicle according to GPS.
Attribute Domain Values: Integer

Attribute

Attribute Label: GPS_Valid (column N)
Attribute Definition: This field contains an indication of the validity of GPS data. The enumerated values this field can take are the integers 0 – 1, inclusive. The name and description of each of these values is the following: 0 - Valid; 1 - Invalid.
Attribute Domain Values: Integer

Attribute

Attribute Label: DAS_Pitch_Rate (column O)
Attribute Definition: This field contains the vehicle angular velocity, in degrees/second, around the lateral axis.
Attribute Domain Values: Float

Attribute

Attribute Label: DAS_Roll_Rate (column P)
Attribute Definition: This field contains the vehicle angular velocity, degrees/seconds, around the longitudinal axis.
Attribute Domain Values: Float

Attribute

Attribute Label: InVehicle_ABS_State (column Q)
Attribute Definition: This field contains the ABS state of the vehicle. The enumerated values this field can take are the integers 0 – 3, inclusive. The name and description of each of these values is the following: 0 - Unavailable; 1 - Off; 2 – On (but not engaged); 3 – Engaged.
Attribute Domain Values: Character

Attribute

Attribute Label: InVehicle_Brake_Status (column R)
Attribute Definition: This field contains the brake status of the vehicle. The enumerated values this field can take are the integers 0 and 1. The name and description of each of these values is the following: 0 - Not active; 1 - Active.
Attribute Domain Values: Character

Attribute

Attribute Label: InVehicle_Headlight_Status (column S)
Attribute Definition: This field contains the status if headlights are currently in use. The enumerated values this field can take are the integers 0 and 1. The name and description of each of these values is the following: 0 - Not active; 1 - Active.
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Longitudinal_Accel (column T)
Attribute Definition: This field contains the vehicle acceleration, meter /second2, in the longitudinal direction.
Attribute Domain Values: Float

Attribute

Attribute Label: InVehicle_Longitudinal_Speed (column U)
Attribute Definition: This field contains the vehicle speed, in meters/second, sampled from the vehicle network (CAN bus).
Attribute Domain Values: Float

Attribute

Attribute Label: InVehicle_PRNDL (column V)
Attribute Definition: This field contains the vehicle transmission state. The enumerated values this field can take are the integers 0 – 7, inclusive. The name and description of each of these values is the following: 0 - Neutral; 1 - Park; 2 - Drive; 3 - Reverse; 4 – Reserved1; 5 – Reserved2; 6 – Reseved3; 7 – Unavailable.
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Stability_Control_Status (column W)
Attribute Definition: This field contains the vehicle stability control status. The enumerated values this field can take are the integers 0 – 2, inclusive. The name and description of each of these values is the following: 0 - Unavailable; 1 - Off; 2 – On or Active (Engaged).
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Steering_Position (column X)
Attribute Definition: This field contains the vehicle steering wheel position in degrees.
Attribute Domain Values: Float

Attribute

Attribute Label: InVehicle_Throttle_Position (column Y)
Attribute Definition: This field contains the vehicle throttle position.
Attribute Domain Values: Float

Attribute

Attribute Label: InVehicle_Traction_Control_Status (column Z)
Attribute Definition: This field contains Vehicle traction control status.
Attribute Domain Values: Character

Attribute

Attribute Label: InVehicle_Turn_Signal_Left Device (column AA)
Attribute Definition: This field contains the vehicle left turn signal status.
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Turn_Signal_Right (column AB)
Attribute Definition: This field contains the vehicle right turn signal status.
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Wiper_Status (column AC)
Attribute Definition: This field contains the vehicle wiper status. The enumerated values for this field are 0 or 5, and are defined as follows: 0 – Off; 5 – On.
Attribute Domain Values: Integer

Attribute

Attribute Label: InVehicle_Yaw_Rate (column AD)
Attribute Definition: This field contains the vehicle yaw rate, in degrees/second.

Attribute Domain Values: Float

Attribute

Attribute Label: LaneTrack_Crossing_Left (column AE)
Attribute Definition: This field contains an indication if there is an exit on the left side of the road. The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.
Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Crossing_Right (column AF)
Attribute Definition: This field contains an indication if there is an exit on the right side of the road. The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.
Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Distance_Left_Marker (column AG)
Attribute Definition: This field contains the distance, in millimeters, from vehicle centerline to inside of left-side lane marker based on vehicle-based machine vision.
Attribute Domain Values: Float

Attribute

Attribute Label: LaneTrack_Distance_Right_Marker (column AH)
Attribute Definition: This field contains the distance, in millimeters, from vehicle centerline to inside of right-side lane marker based on vehicle-based machine vision.
Attribute Domain Values: Float

Attribute

Attribute Label: LaneTrack_Lane_Width (column AI)
Attribute Definition: This field contains the distance, in millimeters, between the inside edge of the innermost lane marking to the left and right of the vehicle.
Attribute Domain Values: Float

Attribute

Attribute Label: LaneTrack_Probability_Left_Exist (column AJ)
Attribute Definition: This field contains the probability, in percent, that vehicle-based machine vision lane marking evaluation is providing correct data for the left-side lane markings; values from 0-1024, thus 100/1024 = 0.0977% per 1.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTrack_Probability_Right_Exists (column AK)
Attribute Definition: This field contains the probability, in percent, that vehicle-based machine vision lane marking evaluation is providing correct data for the right-side lane markings; values from 0-1024, thus 100/1024 = 0.0977% per 1.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTrack_Shift_Aborted (column AL)
Attribute Definition: This field contains an indication if the driver aborted crossing a line; a line was crossed, then the driver crossed back over it. The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.

Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Shift_Left (column AM)

Attribute Definition: This field contains an indication if the vehicle is crossing a line on the left (cannot be STATUS_RIGHT also). The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.

Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Shift_Right (column AN)

Attribute Definition: This field contains an indication if the vehicle is crossing a line on the right. The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.

Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Shift_Successful (column AO)

Attribute Definition: This field contains an indication if the vehicle lies in the lane between the painted lines. The possible values and associated names for each are as follows: 1 – LANE; 2 – RIGHT; 4 – LEFT; 8 – ABORT; 10 – SHIFT; 20 – CROSS_SOLID; 40 – CALIBRATE; 80 – LOW_SUN; 100 – NIGHTTIME; 200 – EXIT_RIGHT; 400 – EXIT_LEFT; 800 – SCAN_TILT; 1000 – CAM_TILT; 2000 – NO_VIDEO; 4000 – CAM_SKEW; 8000 – CALIBRATE_SKEW.

Attribute Domain Values: BIT

Attribute

Attribute Label: LaneTrack_Type_LeftLane_LeftMarker (column AP)

Attribute Definition: This field contains an indication of the type of left-most marker toward the left of the vehicle. The possible values and associated names for each are as follows: 0 – SOLID; 1 – DASH; 2 – UNSURE; 3 – DARK_SOLID.

Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTrack_Type_LeftLane_RightMarker (column AQ)

Attribute Definition: This field contains an indication of the type of right-most marker toward the left of the vehicle. The possible values and associated names for each are as follows: 0 – SOLID; 1 – DASH; 2 – UNSURE; 3 – DARK_SOLID.

Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTrack_Type_RightLane_LeftMarker (column AR)

Attribute Definition: This field contains an indication of the type of left-most marker toward the right of the vehicle. The possible values and associated names for each are as follows: 0 – SOLID; 1 – DASH; 2 – UNSURE; 3 – DARK_SOLID.

Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTrack_Type_RightLane_RightMarker (column AS)

Attribute Definition: This field contains an indication of the type of right-most marker toward the right of the vehicle. The possible values and associated names for each are as follows: 0 – SOLID; 1 – DASH; 2 – UNSURE; 3 – DARK_SOLID.

Attribute Domain Values: Integer

HV_Radar File

The *HV_Radar* file is populated with data collected from a radar unit that is part of a vehicle's integrated safety device unit. The radar unit performs a number of functions, including estimating the type of object that is in front of the host vehicle, as well as that object's speed and distance location relative to the host vehicle. The fields of the HV_Radar file as well as the associated descriptions are listed below.

Attribute

Attribute Label: Device (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: Trip (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column C)
Attribute Definition: This field contains the start time, in centiseconds, of the trip.
Attribute Domain Values: Integer

Attribute

Attribute Label: Object_Type (column D)
Attribute Definition: This field contains an estimate of the object type, based on the size of the raw RADAR cluster of returns. The enumerated values this field can take are the integers 0 – 5, inclusive. The name and description of each of these values is the following: 0 - Unclassified - The radar unit estimates that there is an unclassified object detected in front of the host vehicle; 1 - Pedestrian - The radar unit estimates that there is a pedestrian object detected in front of the host vehicle; 2 - Bike - The radar unit estimates that there is a bike object detected in front of the host vehicle; 3 - Light_Vehicle - The radar unit estimates that there is an light vehicle object detected in front of the host vehicle; 4 - Heavy_Vehicle - The radar unit estimates that there is an heavy vehicle object detected in front of the host vehicle; 5 - Tractor_Trailor - The radar unit estimates that there is a tractor trailer object detected in front of the host vehicle.
Attribute Domain Values: Integer

Attribute

Attribute Label: Range_X (column E)
Attribute Definition: This field contains the range, in meters, to forward radar target measured longitudinally from the radar.
Attribute Domain Values: Float

Attribute

Attribute Label: Range_Y (column F)
Attribute Definition: This field contains the range, in meters, to forward radar target measured laterally from the radar..
Attribute Domain Values: Float

Attribute

Attribute Label: Speed_X (column G)
Attribute Definition: This field contains the range rate, in meters/second, to forward radar target measured longitudinally from radar.
Attribute Domain Values: Float

Attribute

Attribute Label: Speed_Y (column H)
Attribute Definition: This field contains the range rate, in meters/second, to forward radar target measured laterally from radar.

Attribute Domain Values: Float

Attribute

Attribute Label: Target_InPath (column I)
Attribute Definition: This field contains an indication of a target being in the vehicle's path. A value of 1 indicates that there is a target object in the vehicle's path.
Attribute Domain Values: Integer

Attribute

Attribute Label: Target_Moving (column J)
Attribute Definition: This field contains an indication of whether the object detected is moving or not. A value of 0 indicates the object detected by the host vehicle is not moving. A value of 1 indicates the object detected in front of the host vehicle is moving.
Attribute Domain Values: Integer

DAS2 Trip Summary File

The *Summary* file contains trip-level summaries, from each instrument vehicle, for each trip taken during the selected time period of the Model Deployment. The trip summaries include details such as trip start and end times, distance traveled, and the number of time a driver applied the brakes during the trip. Also captured in the trip summary file is the distance driven while the vehicle speed was greater than 25 mph. This data element is of interest not only because it further details the trip, but also because it provides a sense of the conditions under which data, for a particular trip, were collected. The *Summary* file contains 15 fields; below is a list of these fields and a brief description of each.

Attribute

Attribute Label: DeviceID (column A)
Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.
Attribute Domain Values: Integer

Attribute

Attribute Label: TripID (column B)
Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.
Attribute Domain Values: Integer

Attribute

Attribute Label: Epoch Start Time (column C)
Attribute Definition: This field contains the epoch start time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.
Attribute Domain Values: Integer

Attribute

Attribute Label: Start Date (column D)
Attribute Definition: The m/d/yyyy on which the trips started.
Attribute Domain Values: Date (m/d/yyyy)

Attribute

Attribute Label: Start Time (column E)
Attribute Definition: This field contains the wall clock time stamp of the start of a trip, in the form of hh:mm:sss.
Attribute Domain Values: Time (hh:mm:ss)

Attribute

Attribute Label: Epoch End Time (column F)

Attribute Definition: This field contains the epoch end time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.
Attribute Domain Values: Integer

Attribute

Attribute Label: End Date (column G)
Attribute Definition: The m/d/yyyy on which the trips ended.
Attribute Domain Values: Date (m/d/yyyy)

Attribute

Attribute Label: End Time (column H)
Attribute Definition: This field contains the wall clock time stamp of the end of a trip, in the form of hh:mm:sss.
Attribute Domain Values: Time (hh:mm:ss)

Attribute

Attribute Label: Total Trip Distance (column J)
Attribute Definition: This field contains the total distance traveled, in miles, covered in a trip
Attribute Domain Values: Real

Attribute

Attribute Label: Distance Travelled w/ Speed >= 25mph (column K)
Attribute Definition: This field contains the distance traveled in a trip but only when the vehicle's speed is greater than or equal to 25 mph.
Attribute Domain Values: Real

Attribute

Attribute Label: Trip Duration (column L)
Attribute Definition: This field contains the total time duration, in seconds, of a trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Average Speed (column M)
Attribute Definition: This field communicates a vehicle's average speed over the entire length of the trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Maximum Speed (column N)
Attribute Definition: This field contains the maximum speed reached during a trip.
Attribute Domain Values: Real

Attribute

Attribute Label: Brake Count (column O)
Attribute Definition: This field contains an indication of the number of times the driver applies the brake during a trip.
Attribute Domain Values: Integer

Attribute

Attribute Label: Wiper Activated (column P)
Attribute Definition: This field indicates whether or not the wipers were activated during a trip.
Attribute Domain Values: String

Detailed Description for Basic Safety Message (BSM) Data set

A BSM is one of the messages belonging to the Society of Automotive Engineers (SAE) J2735 Standard. This standard is geared toward supporting the interoperability of DSRC applications through the use of a standardized message set and its data frames and data elements. A BSM, which is at times referred to as a "heartbeat" message, is a frequently transmitted message (usually at

approximately 10Hz) that is meant to increase a vehicle's situational awareness. These messages are intended to be used for a variety of applications to exchange safety data regarding a vehicle's state. As such, they are an integral part of the SPMD and will be instrumental in the evaluation in the various safety applications being examined during model deployment.

A BSM contains up to two parts. Part I, the binary large object (blob), is included in every BSM. It contains the fundamental data elements that describe a vehicle's position (latitude, longitude, elevation) and motion (heading, speed, acceleration). Part II of a BSM contains optional data that is transmitted when required or in response to an event. Typically Part II contains data that serves as an extension of vehicle safety information (path history, path prediction, event flags) and data pertaining to the status of a vehicle's components, such as lights, wipers, and brakes.

The BSM data are collected by WSUs that were installed on all the vehicles that participated in the model deployment. Several different brands of WSUs were employed through the deployment effort, but all data were stored in a single data set. This highlights the interoperability goal set forth by the SAE J2735 Standard. This is unlike the case with the "driving" data, which were stored in two separate data sets: one for data collected by DAS1 and another for DAS2.

Each file in the BSM data set contains a time field, either a "Gentime" or a "StartTime", and "EndTime" field. Entries in the "GenTime" field mark the time stamp at which an event was recorded, while "StartTime" and "EndTime" are the minimum and maximum "GenTime" for a given event. The values for each time entry are informed by the 1609.2 Security Services for Applications and Management Messages layer, a member of the IEEE 1609 family standards for the management and security of networks—vehicle network, specifically. The secured time stamp is an Epoch-based time measurement, measuring the number of milliseconds (or microsecond) elapsed since midnight, January 1, 2004 (2004-01-01-00:00:00). In addition, these timestamps were supposed to be relative to UTC, but due to some inaccuracies in the 1609.2 documentation there is a 35-second offset with respect to UTC (which also includes the recent addition of another leap second during the summer). Timestamps in the BSM data set also include a factor of 1,000,000 that needs to be accounted for in order to use these time stamps.

To convert these timestamps to a more standard format, facilitating their usage with other data sets, the following formula can be used to convert the timestamps to the number of seconds elapsed since January 1, 2004 at 00:00:00.

# of seconds since 2004-01-01 00:00:00 = (Gen/Start/End Time)/1,000,000 - 35

The results from the above formula can then be used to further convert BSM timestamps into Epoch timestamps by adding it to 1072933200 (seconds).

The files, and their names, contained in the BSM data set are based on the data frame dictated by the SAE J2735 Standard. Therefore for additional details for some of the above files, please consult the SAE J2735 Standard.

The BSM data set includes 22 files, which are listed and described below.

BrakeByte1Events File

The *BrakeByte1Events* file is one of 19 files in the BSM data that has the same structure. These files log only the change of a particular data element. This is unlike the aforementioned files that are populated in a time history format. These 19 files end with "events" in their file names (see **Error!**

Reference source not found. above). Some of these files contain BSM data elements that do not change frequently, such as a vehicle's front bumper height or length, while others are empty as they were not populated with their corresponding data element as they change even less frequently (e.g. vehicle type).

The *BrakeByte1Events* file communicates the states of half of the BSM's data elements that describe the overall brake system status of a vehicle. The brake system elements being presented in this file include the brake applied status, the availability of the wheel brakes, and the state of the traction control system. The *BrakeByte1Events* contain six fields, each of which is briefly described in further below.

Note, as mentioned in the BSM Data set Timestamp section, StartTime and EndTime are minimum and maximum values of Gentime—the time at which a vehicle measure changes.

To determine the meaning of the entries in the "Value" field of the *BrakeByte1Events* file, the entries have to first be converted into an 8-bitstring (00000000). This string will then be partitioned in accordance with the J2735 Standard to communicate the relevant information regarding the state of a vehicle's brake system.

From the J2735 Standard, the first 4 bits in the 8-bitstring (00000000) indicate the brake being applied to a particular wheel of a vehicle. The first four bits communicate the *BrakeAppliedStatus*, the terminology used by the J2735 Standard. The bits are assigned wheels Left Front, Right Front, Left Rear, and Right Rear, respectively. If the brakes are applied on a particular wheel, the designated bit will change from 0 to 1. For vehicles with fewer than two front or rear wheels and those with more than two front or rear wheels, the following J2735 excerpt details how the *BrakeAppliedStatus* is communicated in the first four bits.

On a vehicle with only one front wheel, the brake-applied status is represented by the Left Front wheel indicator and the Right Front indicator is always set to zero. Similarly, on a vehicle with only one rear wheel the brake-applied status is represented by the Left Rear wheel indicator and the Right Rear indicator is always set to zero. If a vehicle has more than two front wheels (respectively more than two rear wheels) with independent braking, the collective brake-applied status of these wheels is mapped to the Left Front and Right Front (respectively Left Rear and Right Rear) indicators in a locally defined manner.
—Society of Automotive Engineers J2735 Standard, 2009

The fifth bit (00000000) communicates the availability of brake information. When this bit is set to 1, it represents that data regarding the brake system is currently unavailable. The sixth bit (00000000) is a reserved bit and is set to zero. The last two remaining bits (00000000) communicate the state of the traction control system (TCS). This information in turn informs others if one or more of a vehicle's drive wheels are slipping during acceleration and whether a vehicle is equipped with a traction control system. The four permutations of these two bits are as follows:

      00 –TCS is unavailable – a vehicle is not equipped with TCS/TCS is unavailable
      01 – TCS is off – TCS is available but in the off position
      10 – TCS is on – TCS is on but not engaged
      11 – TCS is engaged – TCS is on and engaged

As an example, if the entry in the "Value" field of the *BrakeByte1Events* file is 2, its 8-bitstring is 00000010. This means that brake is not being applied to any of the wheels of the vehicle (00000010), data regarding the brake system is available (00000010), and the TCS is on but not

engaged (00000010). However, if the entry were 242, its 8-bitstring is 11110010. This string means that brake is being applied to all four wheels of the vehicle, data is available, and the TCS is on but not engaged.

Attribute
Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute
Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: Value (column F)
Attribute Definition: This field contains the current state of specific components of the brake system.
Attribute Domain Values: Integer

BrakeByte2Events File

The *BrakeByte2Events* file is another of 19 files in the BSM data that has the same structure. This file is similar to the *BrakeByte1Events* file as it too communicates the state of some of the component of the vehicle's brake system. The brake system components described in this file include the state of the antilock brakes, the state of the stability control system, the application of the brake boost, and the state of the auxiliary brake system. The six fields of the *BrakeByte2Events* file are briefly described further below.

Similar to the *BrakeByte1Events* file, the meaning of an entry in the "Value" field is also based on the conversion of that entry into an 8-bit string. However this 8-bit string communicates the state of four brake-related components of a vehicle—each using two bits to present the status of the each component. The first two bits in this string (**00**000000) pertain to the state of the vehicle's antilock brake system (ABS), and their permutation is as follows:

00 – ABS is unavailable – a vehicle is not equipped with ABS/ABS is unavailable
01 – ABS is off – ABS is available but in the off position

10 – ABS is on – ABS is on but not engaged
11 – ABS is engaged – ABS is on and engaged

The next two bits (00**00**0000) pertain to state of the vehicle's stability control unit (SCU), with the following permutations:

00 – SCU is unavailable – a vehicle is not equipped with a SCU/SCU is unavailable
01 – SCU is off – ABS is in the off position
10 – SCU is on – ABS is on or engaged

Bits five and six (0000**00**00) communicates whether *BrakeBoost* in being applied. *BrakeBoost* is a part of a system that detects the potential of a situation in which maximum brake power will be required and pre-charges the brake system even before the driver depresses the brake pedal. The application of the *BrakeBoost* indicates a situation that warrants emergency braking. Note, not all vehicles are equipped with *BrakeBoost* capability. The meaning associated with the permutations of the fifth and sixth bits are as follows:

00 – BB is unavailable – a vehicle is not equipped with a BB/BB is unavailable
01 – BB is off – BB is in the off position
10 – BB is on – BB is on/is being applied

The last two bits of the 8-bit string (000000**00**) for the *BrakeByteEvents* file present the state of the auxiliary brake system. The auxiliary brake system is often called the *parking brake*. The permutations of these two bits are presented below:

00 – AuxB is unavailable – vehicle is not equipped with AuxB/AuxB is unavailable
01 – AuxB is off – AuxB is in the off position
10 – AusB is on – AuxB is on/active
11 – BB is reserved

As an example, if the entry in the "Value" field of the BrakeByte2Events file is 144, its 8-bit string is 10010000. This means that the vehicle's ABS is on but not engaged, the SCU is in the off position, and both the vehicle's brake boost and auxiliary brake are either not available and/or the vehicle is not equipped with these features.

Attribute
  Attribute Label: RxDevice (column A)
  Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
  Attribute Domain Values: Integer

Attribute
  Attribute Label: FileID (column B)
  Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
  Attribute Domain Values: Integer

Attribute
  Attribute Label: TxDevice (column C)
  Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
  Attribute Domain Values: Integer

Attribute
  Attribute Label: StartTime (column D)

Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field contains the current state of specific components of the brake system.
Attribute Domain Values: Integer

BsmEventFlag File

The BsmEventFlag file contains "flagged events," which are defined as the occurrence of unusual events. The events logged in this file are communicated through the vehicle's CAN bus, from the vehicle component that initiated the event, to the onboard WSU—which then transmits the message. Once the host vehicle generates and transmits an unusual event, the vehicle receiving this information will in turn process it and produce actions(s) that corresponds to the unusual event. These unusual events range from a vehicle's hazard lights being on to a vehicle's airbag being deployed. There are 13 events defined for the BsmEventFlag file. These events are represented as an enumerated value within the file and are detailed in **Error! Reference source not found.**. In addition to this enumerated field, the BsmEventFlag file has four additional fields. The description of each field is presented below.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: Gentime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EventFlag (column E)
Attribute Definition: This field contains a value that indicates 1 of 13 usual events that have occurred and is transmitted by the host vehicle. The enumerated values this field can take, and associated names and descriptions, are the following: 0 - eventHazardLights - Hazard lights

activated; 1 - eventStopLineViolation - A vehicle anticipates passing the stop line at an intersection without coming to a full stop before reaching it; 2 - eventABSactivated - Anti-locking braking system activated for more than 100ms in duration and active; 4 - eventTractionControlLoss - Traction control system activated for more than 100ms in duration and active; 8 - eventStabilityControlactivated - Stability control system activated for more than 100ms in duration and active; 16 - eventHazardousMaterials - The vehicle is known to be carrying hazardous material and is placarded as such; 32 - eventEmergencyResponse - An authorized public safety vehicle is engaged in a service call and is currently moving (lights and sirens may not be evident); 64 - eventHardBraking - The vehicle has decelerated or is decelerating at a rate of greater than 0.4g; 128 - eventLightsChanged - The external lighting (headlights, park lights) of the vehicle has changed recently; 256 - eventWipersChanged - Status of the front of rear wipers of the vehicle has changed recently; 512 - eventFlatTire - The vehicle has determined that at least one tire has run flat; 1024 - eventDisabledVehicle - Vehicle declaring itself as a disabled vehicle; 4096 - eventAirBagDeployment - At least one airbag has been deployed.
Attribute Domain Values: Integer

BsmMD File

The BsmMD File is the BSM metadata file for the transmitted BSMs from a single vehicle. All transmitted BSMs are embedded in a frame with security and communication layers. The basic function of this file is to be a pointer into the file that contains all the BSMs transmitted by each participating vehicle. The file contains device IDs, certification IDs, and offsets; these elements are a part of the security and communication layer that is required for the V2V/V2I network. As a part of the security layer, the BsmMD file contains a set of randomly generated device IDs that mask the true ID of a transmitting antenna ("TxRandom"). These randomly generated device IDs are also accompanied by the unmasked ID of transmitting antenna and the ID receiving antenna. An additional security layer is attached to a transmitted BSM by way of a certificate ID. The certificate ID (CertID) protects transmitted BSMs throughout the connected vehicle environment and enables connected vehicles (and roadside equipment) to accept only messages of entities with valid certificate IDs. For additional information regarding security measures incorporated into the connect vehicle network, review the Certificate Management Entities for a Connected Vehicle Environment document produced by RITA/USDOT.[1]

In addition to the various security details, the BsmMD file also contains time offset values for the various parts of a BSM as well as the frame offsets to allow BSMs to be synced with associated video recordings. These frame offsets will be of limited value to RDE users as the RDE will not host such recordings. Including the aforementioned data elements of the BSM metadata file, there are a total of 13 fields. Below is a brief overview of each of these fields.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

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[1] Certificate Management Entities for a Connected Vehicle Environment:
http://www.its.dot.gov/connected_vehicle/ cm_connected_ vehicle.htm

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: Gentime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: CertId (column E)
Attribute Definition: This field contains a numeric value attached to BSMs to verify that the source of the message is valid.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxRandom (column F)
Attribute Definition: This field contains the randomly assigned ID to mask the device ID of the transmitting device for security purposes.
Attribute Domain Values: Integer

Attribute

Attribute Label: FrameOffset (column G)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor.
Attribute Domain Values: Integer

Attribute

Attribute Label: FrameSize (column H)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor.
Attribute Domain Values: Integer

Attribute

Attribute Label: BsmPIRelOffset (column I)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor. The units are sec/msec.
Attribute Domain Values: Integer

Attribute

Attribute Label: BsmPIIRelOffset (column J)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor. The units are sec/msec.
Attribute Domain Values: Integer

Attribute

Attribute Label: BsmPIIIRelOffset (column K)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor. The units are sec/msec.
Attribute Domain Values: Integer

Attribute

Attribute Label: GenTimeRelOffset (column L)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor. The units are sec/msec.
Attribute Domain Values: Integer

Attribute

Attribute Label: PsIdByte (column M)
Attribute Definition: This definition is pending input from Safety Pilot Test Conductor.

Attribute Domain Values: Integer

BsmP1 File

The BsmP1 file can be considered as the main BSM file. It contains BSM measures that change frequently, approximately 10 Hz. These measures mainly include motion (speed and acceleration) and location (longitude and latitude) elements. The BsmP1 file contains both Part I and Part II elements of the BSM. The majority of the data elements in this file are defined in Part I of the BSM structure; however, elements such as PathCount, RadiusOfCurvature, and Confidence are defined in Part II of the BSM.

The BsmP1 file primarily gets populated with data that is obtained through the vehicle's CAN bus and then transmitted via an onboard WSU. This file contains a field that communicates elapsed time, "Gentime"; it is important to note that the above discussion regarding BSM timestamps does apply to this measure.

In total there are 19 fields in the BsmP1 file. A brief description of each is given below.

Attribute
Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute
Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: Gentime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: TxRandom (column E)
Attribute Definition: This field contains a randomly assigned ID to mask the device ID of the transmitting device for security purposes.
Attribute Domain Values: Integer

Attribute
Attribute Label: MsgCount (column F)
Attribute Definition: This field contains a message ID that gets incremented by one with each BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: DSecond (column G)
Attribute Definition: This field contains the time in deciseconds since ignition started.
Attribute Domain Values: Integer

Attribute

Attribute Label: Latitude (column H)
Attribute Definition: This field contains the current latitude, in degrees, of the vehicle.
Attribute Domain Values: Float

Attribute

Attribute Label: Longitude (column I)
Attribute Definition: This field contains the current longitude, in degrees, of the vehicle.
Attribute Domain Values: Float

Attribute

Attribute Label: Elevation (column J)
Attribute Definition: This field contains the current elevation, in meters, of vehicle according to GPS.
Attribute Domain Values: Float

Attribute

Attribute Label: Speed (column K)
Attribute Definition: This field contains the vehicle speed in m/sec.
Attribute Domain Values: Real

Attribute

Attribute Label: Heading (column L)
Attribute Definition: This field contains the vehicle heading/direction, in degrees.
Attribute Domain Values: Real

Attribute

Attribute Label: Ax (column M)
Attribute Definition: This field contains the longitudinal acceleration, in m/sec2.
Attribute Domain Values: Real

Attribute

Attribute Label: Ay (column N)
Attribute Definition: This field contains the lateral acceleration, in m/sec2.
Attribute Domain Values: Real

Attribute

Attribute Label: Az (column O)
Attribute Definition: This field contains the vertical acceleration, in m/sec2.
Attribute Domain Values: Real

Attribute

Attribute Label: Yawrate (column P)
Attribute Definition: This field contains the vehicle yaw rate, in deg/sec.
Attribute Domain Values: Real

Attribute

Attribute Label: PathCount (column Q)
Attribute Definition: This field contains a number, between 1 and 23, representing a group of points that communicate a vehicle's position and motion. Each group of points is of non-uniform size.
Attribute Domain Values: Integer

Attribute

Attribute Label: RadiusOfCurve (column R)
Attribute Definition: This field contains an estimate of the radius (in centimeters) of a curve being negotiated, which is derived from a number of systems and sensors. Positive and negative values reflect right and left turns, respectively, and +/- 32767 for straight paths.
Attribute Domain Values: Float

Attribute

Attribute Label: Confidence (column S)

Attribute Definition: This field contains an indication of the accuracy, in percent, and non-steady state and steady state of curvature estimate. In steady state (straight roadways or curves with constant radius of curvature), a high confidence value is reported.

Attribute Domain Values: Integer

ExteriorLightsEvents File

The *ExteriorLightEvents* file communicates the state of all the vehicle's exterior lights. The structure of this file is similar to that of the 19 files in the BSM data set whose titles end with "events." This file has six fields; each is presented below with a brief description.

Attribute

Attribute Label: RxDevice (column A)

Attribute Definition: This field contains the ID (number) of the device that logs a BSM.

Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)

Attribute Definition: This field contains the reference number to locate the source of the data in its original file.

Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)

Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.

Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)

Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)

Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)

Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)

Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)

Attribute Definition: This field contains the current state of specific components of the brake system. This field can take on 10 different values, each a different 8 bit string. These values and associated names and meanings are as follows: 00000000 – allLightsOff - All exterior lights are off; 00000001 – lowBeamHeadLightsOn - Low beam headlights are on; 00000010 – highBeamHeadLightsOn - High beam headlights are on; 00000100 – leftTurnSiganlOn - Left turn signal is on; 00001000 – righTurnSignalOn - Right turn signal is on; 00001100 – hazardSignalOn - Hazard signal is on; 00010000 – automaticLightControlOn - Lights are on due to automatic light control; 00100000 – daytimeRunningLightsOn - Day time running lights are on; 01000000 – fogLightOn - Fog lights are on; 10000000 – parkingLightsOn - Parking lights are on.

Attribute Domain Values: Integer

PosAccurByte1Events File

The PosAccurByte1Events is one of four files that consist of various parameters of quality used to model the accuracy of the positional determination with respect to each given axis. The *PosAccurByte1Events* file communicates a quality measure, reflecting the accuracy of a vehicle's estimated position with respect to the semi-major axis. This accuracy measure aims to reflect the error of a vehicle's position within one standard deviation, 0–12.7m, of the vehicle's true position, and with the least significant bit being equivalent to 0.05m. The structure of this file is also similar to that of the 19 files in the BSM data set whose titles end with "events." This file has six fields; each is presented below with a brief description.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field contains a quality measure, reflecting the positional accuracy with respect to the semi-major axis. This field relates the quality measure of a vehicle position relative to the semi-major axis. The maximum value that entries in the "Value" field can take on is 255. This value represents the unavailability of a measure for the semi-major axis, and therefore an accuracy measure is not able to be obtained for that entry. A value of 254 reflects that the associated accuracy of the estimate of a vehicle's position is equal to or greater than 12.70m. All other values less than 254 represent the accuracy/proximity, between 0m and 12.65m. The vehicle's estimated position is with respect to its actual position.
Attribute Domain Values: Integer

PosAccurByte2Events File

The PosAccurByte2Events is one of four files that consist of various parameters of quality used to model the accuracy of the positional determination with respect to each given axis. The *PosAccurByte2Events* file is very similar to *PosAccurByte1Events*. The difference between these two files is that the former communicates a quality measure, reflecting the accuracy of a vehicle's

estimated position with respect to the semi-minor axis, rather than the semi-major axis. As with the *PosAccurByte1Events* file, this accuracy measure aims to reflect the error of a vehicle's position within one standard deviation, 0m–12.7m, of the vehicle's true position. This file consists of six fields, and their names and descriptions are presented below.

Attribute
Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute
Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: Value (column F)
Attribute Definition: This field contains a quality measure, reflecting the positional accuracy with respect to the semi-minor axis. This field relates the quality measure of a vehicle position relative to the semi-minor axis. The maximum value that entries in the "Value" field can take on is 255. This value represents the unavailability of a measure for the semi-minor axis, and therefore an accuracy measure is not able to be obtained for that entry. A value of 254 reflects that the associated accuracy of the estimate of a vehicle's position is equal to or greater than 12.70m. All other values less than 254 represent the accuracy/proximity, between 0m and 12.65m. The vehicle's estimated position is with respect to its actual position.
Attribute Domain Values: Integer

PosAccurByte3Events File
The PosAccurByte3Events is one of four files that consist of various parameters of quality used to model the accuracy of the positional determination with respect to each given axis. The *PosAccurByte3Events* file communicates the orientation of semi-major axis relative to true north (0~359.9945078786 degrees). To get a sense of the orientation of the semi-major axis, an entry from this file's "Value" Column is combined with a similar entry from the "Value" column from the *PosAccurByte4Events* file. The values from these two files are combined using the formula below to give axis orientation:

AxisOrientation = ((...Byte3Value*256) + ...Byte4Value)*0.0054932479

The structure of this file is also similar to that of the 19 files in the BSM data set whose title end with "events." This has six fields; each is presented below with a brief description.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field contains the orientation measure of semi-major axis relative to true north.   Note that the Least significant bit (LSB) units = 0. 0054932479 and

0 = 0 degrees
1 = 0. 0054932479 degrees
65534 = 359.9945078786 degrees
65535 = orientation unavailable

Therefore, the maximum value that entries in the "Value" field can take on is 65535. This value represents the unavailability of a measure for the orientation of the semi-major axis.
Attribute Domain Values: Integer

PosAccurByte4Events File

The PosAccurByte4Events is one of four files that consist of various parameters of quality used to model the accuracy of the positional determination with respect to each given axis. The *PosAccurByte3Events* file communicates the orientation of semi-major axis relative to true north (0~359.9945078786 degrees). To get a sense of the orientation of the semi-major axis, an entry from this file's "Value" Column is combined with a similar entry from the "Value" column from the *PosAccurByte3Events* file. The values from these two files are combined using the formula below to give axis orientation:

AxisOrientation = ((...Byte3Value*256) + ...Byte4Value)*0.0054932479

The structure of this file is also similar to that of the 19 files in the BSM data set whose title end with "events." This file has six fields; each is presented below with a brief description.

Attribute
Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute
Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute
Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute
Attribute Label: Value (column F)
Attribute Definition: This field contains the orientation measure of semi-major axis relative to true north.   Note that the Least significant bit (LSB) units = 0. 0054932479 and
 0 = 0 degrees
 1 = 0. 0054932479 degrees
 65534 = 359.9945078786 degrees
 65535 = orientation unavailable
Therefore, the maximum value that entries in the "Value" field can take on is 65535. This value represents the unavailability of a measure for the orientation of the semi-major axis.
Attribute Domain Values: Integer

SteerAngleEvents File
The *SteerAngleEvents* is another of 19 files in the BSM data that has the same structure. The file however communicates the angle of the steering wheel, expressed in a signed (to the right being positive) value with units of 1.5. This file consists of six fields; their names and descriptions are presented below.

Attribute
Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field contains a value to be converted to degrees to communicate steer angle. These values have to be converted before the steering wheel angle can be determined. The LSB units = 1.5 degrees and entries in this field have a range of -126 to +127, which facilitates steering angles between -/+189 degrees and a value signifying that the steering angle is unavailable. For example:

> 0 = +1.5 degrees
> -126 = -189 degrees and beyond
> +126 = +189 degrees and beyond
> +127 = unavailable steering angle

More generally, for values between 0 and 126 you simply multiply by 1.5 degrees. However for value between 129 and 255, maskoff the highest bit (which is being used as a sign bit) by doing a bitwise AND with a value of 127. Then swap the remaining bit values by doing a bitwise exclusive OR with a value of 127 and then multiply by -1.5.
Attribute Domain Values: Integer

ThrottlePositionEvents File

The *ThrottlePositionEvents* file presents the relative position of the throttle over a given trip. Throttle position is measured in percent, communicating the displacement of the throttle from its default position to it maximum displacement during a particular trip. This file has six fields; their names and meaning are presented in below.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.

Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field details the relative position of the throttle over a given trip. The LSB units = 0.5, therefore the entries for the "Value" ought to range from 0 to 200, and to get the relative throttle position, multiple each entry by 0.5. However, in exploring of the data, the values only range for 0 to 100. This signifies that the devices that capture the measure, already took into account the 0.5 factor.
Attribute Domain Values: Integer

TransStateEvents File

The *TransStateEvents* file provides the current state of the vehicle's transmission. Similar to the previously presented files ending with "…events," this file has the same structure with the same six fields. The only difference occurs as the meaning of the entries in the "Value" field. Below are the names and meaning of each of the fields.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)
Attribute Definition: This field contains details the current state of specific components of the transmission. The enumerated values this field can take are the integers 0 – 19, inclusive. The name and description of each of these values is the following: 0 - Neutral - Transmission is in the neutral position; 1 - Park - Transmission is in the park position; 2 - Forward - Transmission has engaged one of its forward gears; 3 - Reverse - Transmission has engaged one of its reverse gears; 4 - Reserved1 - Reserved for future use; 5 - Reserved1 - Reserved for future use; 6 - Reserved1 - Reserved for future use; 7 - Unavailable - Unavailable value or not equipped with a transmission.
Attribute Domain Values: Integer

WiperStatusFrontEvents File

The contents of the *WiperStatusFrontEvents* file is intended to communicate whether it is raining or snowing at the vehicle's current location and how hard it is raining it is raining or snowing. If the wipers are in the "On" position, it serves as a proxy for whether or not it is raining or snowing. The wipers' "swipes per minute" also serves as a proxy for how hard it is raining or snowing. Similar to the previously presented files, ending with "…events," this file has the same structure with the same six fields and the only difference being the meaning of the entries in the "Value" field. **Error! Reference source not found.** presents the names and meaning of each of the fields.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logs a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: FileID (column B)
Attribute Definition: This field contains the reference number to locate the source of the data in its original file.
Attribute Domain Values: Integer

Attribute

Attribute Label: TxDevice (column C)
Attribute Definition: This field contains the ID (number) of the device that transmits a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: StartTime (column D)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: EndTime (column E)
Attribute Definition: This field contains a more secure form of Epoch time, in microseconds, which is influenced by 1609.2 of the IEEE 1609 family of standards-related network management and security. (Note to convert to Epoch time: [(Gen/Start/End Time)/1,000,000 – 35] + 1072933200)
Attribute Domain Values: Integer

Attribute

Attribute Label: Value (column F)

Attribute Definition: This field details the current state of vehicle's front wipers. Currently, there are seven values assigned to communicate the state of a vehicle's front wipers. These values and their associated names and values are the following: 0 – Unavailable - The status of the vehicle wiper is unavailable or the vehicle is not equipped with the wiper sensor status. ; 1 – Off - Front wipers are not activated; 2 – Intermittent - Front wipers are operated at an intermittent frequency; 3 – Low - Front wipers are operated at a low frequency; 4 – High - Front wipers are operated at a high frequency; 126 - Washer in use - Wipers are active due to the use of the washer fluid; 127 – AutomaticPresent - The wipers have the ability to be automatically turned on.

Attribute Domain Values: Integer

BSM Trip Summary File

The *Summary* file contains trip-level summaries, from each instrument vehicle, for each trip taken during the selected time period of the Model Deployment. The trip summaries include details such as trip start and end times, and distance traveled. Also captured in the trip summary file is the distance driven while the vehicle speed was greater than 25 mph. This data element is of interest not only because it further details the trip, but also because it provides a sense of the conditions under which data, for a particular trip, were collected. The *Summary* file contains 13 fields; below is a list of these fields and a brief description of each.

Attribute

Attribute Label: DeviceID (column A)

Attribute Definition: This field contains the unique, numeric ID assigned to each DAS. This ID also doubles as a vehicle's ID.

Attribute Domain Values: Integer

Attribute

Attribute Label: TripID (column B)

Attribute Definition: This field contains a count of ignition cycles—each ignition cycle commences when the ignition is in the on position and ends when it is in the off position.

Attribute Domain Values: Integer

Attribute

Attribute Label: Epoch Start Time (column C)

Attribute Definition: This field contains the epoch start time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.

Attribute Domain Values: Integer

Attribute

Attribute Label: Start Date (column D)

Attribute Definition: The m/d/yyyy on which the trips started.

Attribute Domain Values: Date (m/d/yyyy)

Attribute

Attribute Label: Start Time (column E)

Attribute Definition: This field contains the wall clock time stamp of the start of a trip, in the form of hh:mm:sss.

Attribute Domain Values: Time (hh:mm:ss)

Attribute

Attribute Label: Epoch End Time (column F)

Attribute Definition: This field contains the epoch end time stamp, in seconds, of a trip. Epoch time, which is sometimes referred to as Unix time, is the number of seconds that has elapsed since midnight January 1, 1970.

Attribute Domain Values: Integer

Attribute
Attribute Label: End Date (column G)
Attribute Definition: The m/d/yyyy on which the trips ended.
Attribute Domain Values: Date (m/d/yyyy)

Attribute
Attribute Label: End Time (column H)
Attribute Definition: This field contains the wall clock time stamp of the end of a trip, in the form of hh:mm:sss.
Attribute Domain Values: Time (hh:mm:ss)

Attribute
Attribute Label: Total Trip Distance (column J)
Attribute Definition: This field contains the total distance traveled, in miles, covered in a trip
Attribute Domain Values: Real

Attribute
Attribute Label: Distance Travelled w/ Speed >= 25mph (column K)
Attribute Definition: This field contains the distance traveled in a trip but only when the vehicle's speed is greater than or equal to 25 mph.
Attribute Domain Values: Real

Attribute
Attribute Label: Trip Duration (column L)
Attribute Definition: This field contains the total time duration, in seconds, of a trip.
Attribute Domain Values: Real

Attribute
Attribute Label: Average Speed (column M)
Attribute Definition: This field communicates a vehicle's average speed over the entire length of the trip.
Attribute Domain Values: Real

Attribute
Attribute Label: Maximum Speed (column N)
Attribute Definition: This field contains the maximum speed reached during a trip.
Attribute Domain Values: Real

Detailed Description for Roadside Equipment (RSE) Data set

"Roadside Equipment" (RSE) represents the Connected Vehicle roadside devices that are used to send messages to, and receive messages from, nearby vehicles using Dedicated Short Range Communications (DSRC). This device operates from a fixed position and may be permanently deployed or a portable device that is located temporarily in the vicinity of a traffic incident, road construction, or a special event. It includes a processor, data storage, and communications capabilities that support secure communications with passing vehicles, other roadside equipment, and centers that provide back office support.

These devices are intended to support vehicle to infrastructure (V2I) safety communications capability. An RSE device may be installed in conjunction with advanced traffic signal controllers in order to provide and number of different messages including Signal Phase and Timing (SPaT), Traveler Information Messages (TIM), and geographic data (MAP). These message are broadcasted to vehicles; with isolated traffic signal controllers to provide vehicle presence information to the controller for signal actuation; or as stand-alone devices to provide a variety of safety application broadcasts (e.g.: notification of times of reduced speed limits in school zones).

For the Safety Pilot Model Deployment approximately twenty-seven RSEs were installed throughout the network. The proposed locations where these devices were installed included twenty-one signalized intersections, three curve locations, and five freeway locations. The

following section will detail the data elements capture and/or transmitted by RSEs during this study.

BSM File

The BSM file is populated with basic safety messages received from equipped vehicle within the communication range of an RSE. These basic safety messages do not only contain both Part I and Part II elements. These BSMs also contains elements that communicate additional details about the vehicle that is used for vehicle safety applications, and elements that communicate specific items of a vehicle's status that are used in data event snapshots which are gathered and periodically reported to an RSEs or as part of the BSM Part II content.

These BSMs are transmitted at a rate of 10 Hz. Some of the more pertinent data contained in these BSMs include motion (speed and acceleration) and location (longitude and latitude) elements. The RSEs BSM file primarily gets populated with data that is obtained through the vehicle's CAN bus and then transmitted via an onboard WSU.

In total there are 28 fields in the RSE's BSM file. A brief description of each is given below. For a more detailed description of each field / attribute consult the J2735 Standard.

Attribute

Attribute Label: RxDevice (column A)
Attribute Definition: This field contains the ID (number) of the device that logged and sends a BSM.
Attribute Domain Values: Integer

Attribute

Attribute Label: BSMID (column B)
Attribute Definition: This field contains a BSM's ID (number) that is transmitted from an equipped vehicle.
Attribute Domain Values: Integer

Attribute

Attribute Label: DSRCMsgId (column C)
Attribute Definition: The DSRC Message ID is a data element used in each message to define which type of message follows from the message set defined by this Standard. This data element is always the first value inside the message and is used to tell the receiving application how to interpret the remaining bytes (i.e. what message structure has been used). This value is enumerated and the values and corresponding meaning are as follows: 0 – Reserved, 1 – A La Carte Message (ACM), 2 – Basic Safety Message (BSM – heartbeat message), 3 – Basic Safety Message Verbose (BSM used for testing only), 4 – Common Safety Request (CSR), 5 – Emergency Vehicle Alert (EVA), 6 – Intersection Collision Alert (ICA), 7 – Map Data (MAP, GID, intersections), 8 – nmea Corrections (NMEA), 9 – probe Data Management (PDM), 10 – probe Vehicle Data (PVD), 11 – Roadside Alert (RSA), 12 – rtcm Corrections (RTCM), 13 – Signal Phase And Timing Message (SPAT), 14 – Signal Request Message (SRM), 15 – Signal Status Message (SSM), 16 – Traveler Information (TIM)
Attribute Domain Values: Integer

Attribute

Attribute Label: MsgCount (column D)
Attribute Definition: This data element is used to provide a sequence number within a stream of messages with the same DSRCmsgID and from the same sender.
Attribute Domain Values: Integer

Attribute

Attribute Label: TemporaryId (column E)

Attribute Definition: This is the 4 byte random device identifier. This value periodically changes to ensure the overall anonymity of the vehicle.
Attribute Domain Values: Integer

Attribute

Attribute Label: DSeconds (column F)
Attribute Definition: DSeconds is a simple value consisting of integer values from zero to 60999 representing the milliseconds within a minute.
Attribute Domain Values: Integer

Attribute

Attribute Label: Latitude (column G)
Attribute Definition: The geographic latitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 900000001 shall be used when unavailable.
Attribute Domain Values: Float

Attribute

Attribute Label: Longitude (column H)
Attribute Definition: The geographic longitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 1800000001 shall be used when unavailable.
Attribute Domain Values: Float

Attribute

Attribute Label: Elevation (column I)
Attribute Definition: The Elevation data element represents the geographic position above or below the reference ellipsoid (typically WSG-84). The positive range of this element is 0 to 61439 representing 0 to 6143.9 meters (above the reference ellipsoid). And a negative range of - 409.5 to -0.1 meters (below the reference ellipsoid).
Attribute Domain Values: Integer

Attribute

Attribute Label: PositionalAccuracy (column J)
Attribute Definition: The PositionalAccuracy element is a 4 octet field of packed data consisting of various parameters of quality used to model the accuracy of the positional determination with respect to each given axis. Note that because the 3 data elements are packed as one single data object, this is treated as a data frame.PositionalAccuracy ::= OCTET STRING (SIZE(4))
- And the bytes defined as folllows
- Byte 1: semi-major accuracy at one standard dev
- range 0-12.7 meter, LSB = .05m
- 0xFE=254=any value equal or greater than 12.70 meter
- 0xFF=255=unavailable semi-major value
- Byte 2: semi-minor accuracy at one standard dev
- range 0-12.7 meter, LSB = .05m
- 0xFE=254=any value equal or greater than 12.70 meter
- 0xFF=255=unavailable semi-minor value
- Bytes 3-4: orientation of semi-major axis
- relative to true north (0~359.9945078786 degrees)
- LSB units of 360/65535 deg = 0.0054932479
- a value of 0x0000 =0 shall be 0 degrees
- a value of 0x0001 =1 shall be 0.0054932479degrees
- a value of 0xFFFE =65534 shall be 359.9945078786 deg
- a value of 0xFFFF =65535 shall be used for orientation unavailable.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: TransmissionState (column K)

Attribute Definition: This is an enumerated data element that provides the current state of the vehicle transmission. The enumerated states of this data elements and their meaning are as follows: neutral (0), park (1) forward gears (2) reverse gears (3), reserved1 (4), reserved2 (5), reserved3 (6), unavailable (7), vehicle not-equipped or value unavailable
Attribute Domain Values: Integer

Attribute

Attribute Label: Speed (column L)
Attribute Definition: This data element represents the vehicle speed expressed in unsigned units of 0.02 meters per second. The value 8191 indicates that speed is unavailable
Attribute Domain Values: Integer

Attribute

Attribute Label: Heading (column M)
Attribute Definition: The current heading of the sending device, expressed in unsigned units of 0.0125 degrees from North (such that 28799 such degrees represent 359.9875 degrees). North shall be defined as the axis defined by the WSG-84 coordinate system and its reference ellipsoid. Headings "to the east" are defined as the positive direction. A value of 28800 shall be used when unavailable. When sent by a vehicle, this element indicates the orientation of the front of the vehicle.
Attribute Domain Values: Integer

Attribute

Attribute Label: SteeringWheelAngle (column N)
Attribute Definition: The angle of the steering wheel, expressed in a signed (to the right being positive) value with units of 1.5 degrees.
Attribute Domain Values: Integer

Attribute

Attribute Label: LongitudinalAcceleration (column O)
Attribute Definition: A data element representing the signed acceleration of the vehicle along the X axis or the vehicle's direction of travel in parallel with a front to rear centerline, in units of 0.01 meters per second squared. Negative values indicate braking action. A range of over 2Gs is supported.
Attribute Domain Values: Integer

Attribute

Attribute Label: LateralAcceleration (column P)
Attribute Definition: A data element representing the signed acceleration of the vehicle along the Y axis or perpendicular to the vehicle's direction of travel in parallel with a left-to-right centerline, in units of 0.01 meters per second squared. Negative values indicate left turning action and positive values indicate right-turning action. A range of over 2Gs is supported.
Attribute Domain Values: Integer

Attribute

Attribute Label: VerticalAcceleration (column Q)
Attribute Definition: A data element representing the signed vertical acceleration of the vehicle along the vertical axis in units of 0.02 G (where 9.80665 meters per second squared is one G, i.e 0.02 G = 0.1962 meters per second squared). This provides an uneven range of over +1.5 to -3.4G in each direction with some negative values for greater negative ranges as denoted. Of note, least significant bit (LSB) units of 0.02 G steps over a range +1.54 to -3.4G and offset by 50 where Value 50 = 0g and Value 0 = -1G. As further reference a value of +127 = 1.54G, -120 = -3.4G, -121 for ranges -3.4 to -4.4G, -122 for ranges -4.4 to -5.4G, -123 for ranges -5.4 to -6.4G, -124 for ranges -6.4 to -7.4G, -125 for ranges -7.4 to -8.4G, -126 for ranges larger than -8.4G, and -127 for unavailable data
Attribute Domain Values: Integer

Attribute

Attribute Label: YawRate (column R)

Attribute Definition: The Yaw Rate of the vehicle, a signed value (to the right being positive) and expressed in 0.01 degrees per second. The Yaw Rate Element reports the vehicle's rotation in degrees per second.
Attribute Domain Values: Integer

Attribute

Attribute Label: BrakeAppliedStatus (column S)
Attribute Definition: The Brake Applied Status data element indicates independently for each of four wheels whether braking is currently active. The four wheels are designated Left Front, Right Front, Left Rear, and Right Rear. The indicated status of a wheel is set to 1 if brakes are active on that wheel, or to 0 if brakes are inactive on that wheel. On a vehicle with only one front wheel, the brake-applied status is represented by the Left Front wheel indicator and the Right Front indicator is always set to zero. Similarly, on a vehicle with only one rear wheel the brake-applied status is represented by the Left Rear wheel indicator and the Right Rear indicator is always set to zero. If a vehicle has more than two front wheels (respectively more than two rear wheels) with independent braking, the collective brake-applied status of these wheels is mapped to the Left Front and Right Front (respectively Left Rear and Right Rear) indicators in a locally defined manner. The base values for this data element is as follows – allOff (0000) the condition All Off, leftFront (0001) Left Front Active, leftRear (0010) Left Rear Active, rightFront (0100) Right Front Active, rightRear (1000) Right Rear Active. To extract the meaning of this element convert the hexadecimal value to binary and the place value of the "1" illustrates which wheel's brake is on. For instance 0X00 = 0000 – allOff, and 0x0F = 1111 – allOn / all active.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: wheelBrakesUnavailable (column T)
Attribute Definition: This data element communicates the availability of brake system data. When set to one the data regarding the brake system is unavailable.
Attribute Domain Values: Integer

Attribute

Attribute Label: TractionControlState (column U)
Attribute Definition: This data element reflects the status of the vehicle traction system. The element is intended to communicate whether one or more of the vehicle's drive wheels is slipping during an acceleration. The element can also communicate whether or not a vehicle is equipped with a traction control system. If the vehicle is equipped with a traction control system, the element reports whether the system is in an Off, On or Engaged state. The enumerated values for this state is as follows: unavailable (00) Not Equipped with traction control or traction control status is unavailable, off (01) traction control is Off, on (10) traction control is On (but not Engaged), engaged (11) traction control is Engaged. To extract the meaning of this element convert the hexadecimal value to binary, for instance 0X03 = 11 - traction control is engaged.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: AntilockBrakeStatus (column V)
Attribute Definition: This is data element conveys the state of the vehicle's anti-lock braking system. The four defined states are: Vehicle not equipped with anti-lock braking system (00), an anti-lock braking system is off (01), an anti-lock braking system is on but not engaged (10), and an antilock braking system is on and engaged (11). An anti-lock braking system, if available, detects a situation that may indicate loss of control. A report of an engaged anti-lock braking system can be useful in identifying a hazardous situation involving a specific vehicle or road ocation. To extract the meaning of this element convert the hexadecimal value to binary, for instance 0X03 = 11 - antilock braking system is on and engaged.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: StabilityControlStatus (column W)

Attribute Definition: This data element reflects the current state of the stability control system status. The "Stability Control Status" data element is intended to inform users whether the vehicle's stability control unit was engaged. A typical stability control unit uses the vehicle's yaw rate to determine how far off-axis a vehicle is while taking a turn. This data is correlated with wheel speed, steering angle and acceleration position. If the vehicle is determined to be too far off-axis, corrective action is taken by automatically applying braking force to separate wheels independent of the driver's actions. The element also informs the user if the vehicle is not equipped with a stability control system. If the vehicle is equipped with a stability control system, the element reports whether the system is Off, or in an Active state. The enumerated values for this data element is as follows - unavailable (00) Not Equipped with stability control system, or system status is unavailable, system is off (01) Off, and system is on (10) On or active (engaged). To extract the meaning of this element convert the hexadecimal value to binary.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: BrakeBoostApplied (column X)
Attribute Definition: This is a data element which, when set to the "on" state, indicates emergency braking. This data element is an on/off value which indicates engagement of the vehicle's brake boost assist function (as well as an unavailable state). Brake boost assist is available on some vehicles. It detects the potential of a situation requiring maximum braking and pre-charges the brake system even before the driver presses the brake pedal. This situation is detected either by measuring a rapid release of the accelerator pedal or via a forward sensing system. Some systems also apply full braking when the driver presses the pedal, even with a light force. Multiple probe data reports re activation of brake boost at the same location is an indication of an emergency situation on the road and is therefore of use to road authorities. The enumerated values for this data element is as follows - unavailable (00) vehicle not equipped with brake boost of brake boost data is unavailable, vehicle's brake boost is off (01) Off, and vehicle's brake boost is on (10) On. To extract the meaning of this element convert the hexadecimal value to binary.
Attribute Domain Values: Hexadecimal

hduseAttribute

Attribute Label: AuxiliaryBrakeStatus (column Y)
Attribute Definition: This data element conveys the state of the vehicle's Auxiliary Brake system (often also called a parking brake). The three defined states are: Vehicle not equipped (00), Aux Brake not applied (01), and Aux Brake System applied (10). The state 11 is reserved. To extract the meaning of this element convert the hexadecimal value to binary.
Attribute Domain Values: Hexadecimal

Geometry File

The Geometry captures a few descriptive fundamentals of the intersections that were accompanied by RSEs, during the Safety Pilot Model Deployment. This file contains descriptors such as intersection and geometry direction IDs, as well as longitude, latitude, and elevation of the intersection.

Attribute

Attribute Label: IntersectionId (column A)
Attribute Definition: According to the SAE J2735 Standard the IntersectionId element is used to globally and uniquely define an intersection within a country or region. Assignment rules for this value are established elsewhere and may use regional assignment schemas that vary.
Attribute Domain Values: Integer

Attribute

Attribute Label: GeometryDirectionId (column B)
Attribute Definition: The ID indicates the beginning of a structure used to relate one or more motor vehicles lanes for an intersection approach or egress description with any associated pedestrian and special purpose lanes or to describe one or more barriers.
Attribute Domain Values: Integer

Attribute

Attribute Label: Longitude (column C)
Attribute Definition: The geographic longitude of the intersection, expressed in 1/10th integer microdegrees, and with reference to the horizontal datum then in use. The value 1800000001 shall be used when unavailable.
Attribute Domain Values: Integer

Attribute

Attribute Label: Latitude (column D)
Attribute Definition: The geographic latitude of the intersection, expressed in 1/10th integer microdegrees, and with reference to the horizontal datum then in use. The value 900000001 shall be used when unavailable.
Attribute Domain Values: Integer

Attribute

Attribute Label: Elevation (column E)
Attribute Definition: The Elevation data element represents the geographic position above or below the reference ellipsoid (typically WSG-84). This data element has a resolution of 1 decimeter and represents an asymmetric range of positive and negative values. The positive range is 0 to 61439 decimal and represents elevations from 0 to +6143.9 meters, i.e. above the reference ellipsoid. The negative range represents elevations from -409.5 meters to -0.1 meters, i.e. below the reference ellipsoid. An elevation higher than +6143.9 meters is represented 0xEFFF. An elevation lower than -409.5 meters is represented 0xF001. If the sending device does not know its elevation it shall encode the Elevation data element with 0xF000.
Attribute Domain Values: Integer

Lane File

The "Lane" file details the attributes of lanes in the vicinity of the RSE, which is often located at an intersection with multiple (lane) approaches. The primary information that the Lane file communicates are the intersection to which that lane belongs, the numbers of lane and allowable vehicle maneuvers.

Attribute

Attribute Label: LaneId (column A)
Attribute Definition: A value used to identify a lane at given location, such as an intersection.
Attribute Domain Values: Integer

Attribute

Attribute Label: GeometryId (column B)
Attribute Definition: Identifier for a particular geometry (type).
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneNumber (column C)
Attribute Definition: The LaneNumber data element conveys a unique index value for a lane used to refer to that lane by other objects in the intersection map data structure. Lanes may be ingress (inbound traffic) or egress (outbound traffic) in nature, as well as barriers and other types of specialty lanes. All lanes are numbered. The LaneNumber, in conjunction with the intersection ID, forms a regionally unique way to address a specific lane in that intersection.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneTypeId (column D)
Attribute Definition: This is data element communicates the type of lane being traveled along. Lane types supported include motorized vehicle lanes, pedestrian land and dedicated train and transit lanes. The enumerated values for this data element are motorized vehicle lane (1), computed lane (2), pedestrian lane (3), and special purpose lane
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneAttributes (column E)

Attribute Definition: The (Vehicle)LaneAttributes data element relates the allowed (possible) movements from a motorized vehicle lane. Note that in practice these values may be further restricted by vehicle class, local regulatory environment and other changing conditions. There are 17 enumerated values for the Lane Attributes data element. These values are lane provides a two-way travel (0), straight maneuver permitted (1), Left turn maneuver permitted (2), Right turn maneuver permitted (3), Yield (4), No U-turn (5), No turn on red (6), No stopping (7), HOV lane (8), Bus only lane (9), Bus and taxi only lane (10), Shared two-way left turn lane (11), Bike lane (12) Reserved (13-15).

Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: Width (column F)

Attribute Definition: The (Lane) Width data element conveys the width of a lane in LSB units of 1 cm. Maximum value would be a lane of over 327 meters / 32767 cm.

Attribute Domain Values: Integer

Attribute

Attribute Label: ReferenceLaneNumber (column G)

Attribute Definition: 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 shared 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. The Reference Lane Number indicates which lane it parallels.

Attribute Domain Values: Integer

Attribute

Attribute Label: LateralOffset (column H)

Attribute Definition: Lateral offset values are referenced using the Cartesian coordinate system on an intersection with a northern orientation; thus eastern offsets are indicated by a positive value while western offsets are negative. Likewise, northern offsets are positive while southern offsets are negative.

Attribute Domain Values: Integer

Attribute

Attribute Label: NodeAttributes (column I)

Attribute Definition: This data element communicates the attribute of the node that a lane is associated with.

Attribute Domain Values: Integer

Attribute

Attribute Label: ManeuverCode (column J)

Attribute Definition: The (Lane) ManeuverCode data element is used to describe the specific use of a single lane from the point of view of the lane description that contains it. In the use in the "connects to" case this means the way in which the subject lane is used by the lane that is being described. For example, a given lane may represent the lane that a vehicle would enter when making a "left turn" from its current lane. More than one lane may be the "left turn lane" so the use of these values among the set of lanes is not exclusive. However, every lane can be only of one type at a time (from the perspective of the lane description that contains it). This data element has enumerated values and they are unknown (used for N.A. as well) (0), uTurn (1), leftTurn (2), rightTurn (3), straightAhead (4), softLeftTurn (5), softRightTurn (6), and values to 127 is reserved for std (standard) use and values 128 to 255 reserved for local use.

Attribute Domain Values: Integer

LaneNode File

The LaneNode file captures lane descriptors as it relates to a node (a reference point on the ground) which is often times at or near an intersection. The point may also be referring to the location of an RSE or data collection / sensor point. Data elements in this file contains values describing various positions within / along a lane

Attribute

Attribute Label: LaneNodeId (column A)
Attribute Definition: Value representing the point on the ground, often times an intersection, with which the lane in being described is associated.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneId (column B)
Attribute Definition: A value used to identify a lane at given location, such as an intersection.
Attribute Domain Values: Integer

Attribute

Attribute Label: EasternOffset (column C)
Attribute Definition: Lateral offset values are referenced using the Cartesian coordinate system on an intersection with a northern orientation; thus eastern offsets are indicated by a positive value while western offsets are negative. Likewise, northern offsets are positive while southern offsets are negative.
Attribute Domain Values: Integer

Attribute

Attribute Label: NorthernOffset (column D)
Attribute Definition: Lateral offset values are referenced using the Cartesian coordinate system on an intersection with a northern orientation; thus eastern offsets are indicated by a positive value while western offsets are negative. Likewise, northern offsets are positive while southern offsets are negative.
Attribute Domain Values: Integer

Attribute

Attribute Label: ElevationOffset (column E)
Attribute Definition: Positive elevation values indicate a rise in elevation while negative values indicate a drop in elevation relative to the intersections reference point.
Attribute Domain Values: Integer

Attribute

Attribute Label: Width (column F)
Attribute Definition: The (Lane) Width data element conveys the width of a lane in LSB units of 1 cm. Maximum value would be a lane of over 327 meters / 32767 cm.
Attribute Domain Values: Integer

Map File

The intersections map message provides the geometric intersection description (GID) data that defines a digital map of an intersection down to the lane level. The extent of the map in each direction depends on factors such as topology, signal reception, and other intersections in the area. The MAP message provides local geo-referenced coordinates of the intersection, vehicle, pedestrian, and special lane geometry, and permitted navigation maneuvers.

Attribute

Attribute Label: MAPID (column A)
Attribute Definition: Unique ID value to assigned to each map message.
Attribute Domain Values: Integer

Attribute

Attribute Label: IntersectionId (column B)

Attribute Definition: According to the SAE J2735 Standard the IntersectionId element is used to globally and uniquely define an intersection within a country or region. Assignment rules for this value are established elsewhere and may use regional assignment schemas that vary.

Attribute Domain Values: Integer

Attribute

Attribute Label: ContentVersion (column C)

Attribute Definition: The Content Version is used to indicate a change in the message content. It is not an absolute version; rather it is a rolling version number that only has meaning relative to the last message that was broadcast. Applications that notice a change to the content version must parse the message payload; otherwise the message can be ignored. Values range from (0 - 255)

Attribute Domain Values: Integer

Attribute

Attribute Label: MessageAttributes (column D)

Attribute Definition: The Message Attributes data object is a bit-mapped byte that provides information about the format and content of the rest of the MAP message. The bits of the message attributes object are as follows:

0 (LSB)		Elevation data is included.
1		Node offset resolution; 0-centimeter, 1-decimeter.
2		Message contains the intersections geometric data.
3		Message contains navigational movement data.
4		Reserved
5		Reserved
6		Reserved
7		Reserved.

A bit set to a logic one indicates that the described condition is present while a bit set to zero indicates that it is not present.

Attribute Domain Values: Integer

Attribute

Attribute Label: SignalScheme (column E)

Attribute Definition: The signal scheme element is used to select which preempt or priority controller sequence is to be activated to provide service to a list of one or more intersection lanes. This element has either a priority value or a preemption value depending on the setting of the MSB as follows.

Bits 0-3
(0) No defined strategy
(1-7) Desired strategy if available
Bits 4-6
(0) Reserved
(1-6) Desired strategy if available
(7) Cabinet flash
Bit 7
(0) Priority
(1) Preempt.

Attribute Domain Values: Integer

Attribute

Attribute Label: PreemptLaneNumbers (column F)

Attribute Definition: The Priority/Preempt data object is used to relate intersection approach lanes with a numbering system used by an approaching vehicle to assert a priority or preempt service request.

Attribute Domain Values: Integer

Packet File

This file provides the associated details for each packet. Details captured in this file include the PCAP fileID in which the transmitted packet is stored, along with the source and time stamp of the transmitted packet

Attribute

Attribute Label: PacketId (column A)
Attribute Definition: This attribute is a unique identifier for every transmitted/captured packet.
Attribute Domain Values: Integer

Attribute

Attribute Label: PCAPFileId (column B)
Attribute Definition: This field contains the file ID in which the transmitted packet is stored.
Attribute Domain Values: Integer

Attribute

Attribute Label: PacketNumber (column C)
Attribute Definition: This represents the nth packet contained in the respective PCAP file.
Attribute Domain Values: Integer

Attribute

Attribute Label: PacketLocation (column D)
Attribute Definition: Communicates the location of a packet within a PCAP file (or within a blob within a PCAP file).
Attribute Domain Values: Integer

Attribute

Attribute Label: PacketDataLength (column E)
Attribute Definition: This attribute is the number of bytes of packet data captured and saved in the file. The IncludedLength should not exceed OriginalLength or SnapLen (from the PCAP file). (Same as included length)
Attribute Domain Values: Integer

Attribute

Attribute Label: PacketTimestamp (column F)
Attribute Definition: This attribute is the year-month-day-hour-minute-second timestamp when the packet was captured.
Attribute Domain Values: String

Attribute

Attribute Label: TimestampMicroseconds (column G)
Attribute Definition: This attribute is the microsecond offset from PacketTimestamp. Together with PacketTimestamp, the attributes represent when the packet was captured. Given PacketTimestamp provides time to the second, TimestampMicroseconds should not exceed 1 second (1 000 000 microseconds).
Attribute Domain Values: Integer

Attribute

Attribute Label: IncludedLength (column H)
Attribute Definition: This attribute is the number of bytes of packet data captured and saved in the file. The IncludedLength should not exceed OriginalLength or SnapLen (from the PCAP file).
Attribute Domain Values: Integer

Attribute

Attribute Label: OriginalLength (column I)
Attribute Definition: This attribute is the number of bytes of packet data on the network when data was captured. If SnapLen (from the PCAP file) is less than OriginalLength, the IncludedLength saved to file will be smaller than the OriginalLength.
Attribute Domain Values: Integer

Attribute

Attribute Label: SourceIPAddress (column J)
Attribute Definition: This field contains the non-constant IP address of the on-board vehicle unit that transmitted a packet to an RSE.
Attribute Domain Values: Hexadecimal

Attribute

Attribute Label: EtherType (column K)
Attribute Definition: Ethertype is used to indicate which protocol is encapsulated in the payload (of an Ethernet Frame).
Attribute Domain Values: Integer

Attribute

Attribute Label: WSMPVersion (column L)
Attribute Definition: Communicates the Wave Short Message Protocol that being employed within the transmitted packet.
Attribute Domain Values: Integer

Attribute

Attribute Label: Channel (column M)
Attribute Definition: This data element represents channel on which the packet was transmitted.
Attribute Domain Values: Integer

Attribute

Attribute Label: DataRate (column N)
Attribute Definition: The DataRate field presents the amount of data is transmitted per second (i.e. Mb/s) with respect to a given channel.
Attribute Domain Values: Integer

Attribute

Attribute Label: PowerUsed (column O)
Attribute Definition: The amount of power used to transmit a packet in dBm (an abbreviation for the power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW)).
Attribute Domain Values: Integer

Attribute

Attribute Label: PSID (column P)
Attribute Definition: This field contains an ID for the type of message sent. For example 0x20 (32), is the representation for a Basic Safety Message. Other IDs include: 0x8003 (32771) - Traveler Information Message (TIM), 0xBFE0 (49120) and 0x8002 (32770) - Signal Phase and Timing (SpAT), 0xBFF0 (49136) and 0x8002 (32770) - MAP message (aka GID), 0x23 (35) - Security Credential Management and 0xBFE1 (49121) - General IP Data Exchange
Attribute Domain Values: Integer

PCAP File

The PCAP file is populated with packet capture header information, specifying the listening setup used to capture all vehicle to vehicle communications.

Attribute

Attribute Label: PCAPFileID (column A)
Attribute Definition: This attribute is a unique identifier for every packet header.
Attribute Domain Values: Integer

Attribute

Attribute Label: Filename (column B)
Attribute Definition: Name of the PCAP file. The filename contains the name of the manufacturer of the RSE (communication device), the RSE's location ID / name, and date and timestamp.
Attribute Domain Values: String

Attribute

Attribute Label: FileTimeStampDate (column C)
Attribute Definition: This attribute is the month-day-year on which the packet header file was created.
Attribute Domain Values: String

Attribute

Attribute Label: FileTimeStampTime (column D)
Attribute Definition: This attribute is the hour-minute-second time at which the packet header file was created.
Attribute Domain Values: String

Attribute

Attribute Label: VersionMajor (column E)
Attribute Definition: This attribute is the major version number of the PCAP release.
Attribute Domain Values: Integer

Attribute

Attribute Label: VersionMinor (column F)
Attribute Definition: This attribute is the minor version number of the PCAP release.
Attribute Domain Values: Integer

Attribute

Attribute Label: ThisZone (column G)
Attribute Definition: This attribute is the correction time, in seconds, between Greenwich Mean Time and the local time zone of the packets. Timestamps are usually in GMT and ThisZone is therefore usually 0.
Attribute Domain Values: Integer

Attribute

Attribute Label: SigFigs (column H)
Attribute Definition: This attribute is the number of significant figures in the time stamp capture. However, capture tools usually set SigFigs to 0.
Attribute Domain Values: Integer

Attribute

Attribute Label: SnapLen (column I)
Attribute Definition: This attribute contains the maximum length ("snapshot length") of captured packets, in octets – usually 65535.
Attribute Domain Values: Integer

Attribute

Attribute Label: Network (column J)
Attribute Definition: This attribute is the link-layer header type which specifies header types at the beginning of the packet. For example, Network is 1 for Ethernet or 255 for Bluetooth.
Attribute Domain Values: Integer

SPAT File

The SPAT file contains the basics of a SPAT message. This file includes SPAT message and intersection IDs, and the timestamp of the SPAT message.

Attribute

Attribute Label: SPATID (column A)
Attribute Definition: This attribute is a unique identifier for the SPAT message.
Attribute Domain Values: Integer

Attribute

Attribute Label: CurrentVersion (column B)

Attribute Definition: This attribute is used to indicate a change in the message content and only has meaning relative to the last message broadcast. Applications must parse and read a message if CurrentVersion has changed between messages. Otherwise, the message can be ignored.
Attribute Domain Values: Integer

Attribute

Attribute Label: IntersectionId (column C)
Attribute Definition: This attribute is a unique identifier for every intersection. Assignment rules are established regionally.
Attribute Domain Values: Integer

Attribute

Attribute Label: IntersectionStatus (column D)
Attribute Definition: This attribute contains the Advance Traffic Controller status information on the intersection. Data is encoded in hexadecimal. Converting the hexadecimal to binary gives an 8 bit unsigned integer with bits 76543210. Each bit has value 0 or 1 and indicates whether or not a condition is present at an intersection. The conditions/bits are (when present): 0 – manual control is enabled, 1 – Stop Time is activated and all counting/timing has stopped, 2 – Intersection is in the conflict flash state, 3 – Preempt is active, and 4 – Priority is active. Bits 5 through 7 are reserved. A 0 hex value (0x00) and corresponding 0 bit string (00000000) indicates the intersection is operating normally.
Attribute Domain Values: String

Attribute

Attribute Label: MsgTimestamp (column E)
Attribute Definition: This attribute is the year-month-day-hour-second-tenth of second timestamp that indicates when the message was originally generated. Time is in GMT.
Attribute Domain Values: String

SPATMovement File

The SPATMovement file provides the signal phase and timing information for one or more movements at an intersection.

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Attribute

Attribute Label: MovementId (column A)
Attribute Definition: This attribute is a unique identifier for the movement.
Attribute Domain Values: Integer

Attribute

Attribute Label: SPATID (column B)
Attribute Definition: This attribute is a unique identifier for the SPAT message.
Attribute Domain Values: Integer

Attribute

Attribute Label: CurrentState (column C)
Attribute Definition: This attribute defines the current state of a particular known movement and depends on the type of lane that the CurrentState applies to.

For vehicle lanes, CurrentState defines all possible lights relating to a known movement. Data is encoded in hexadecimal, with hex values read as character pairs that directly map to lighting combinations given in the table below.

Green	Yellow	Red	Flashing

Ball	0x00000001	0x00000002	0x00000004	0x00000008
Left Arrow	0x00000010	0x00000020	0x00000040	0x00000080
Right Arrow	0x00000100	0x00000200	0x00000400	0x00000800
Straight Arrow	0x00001000	0x00002000	0x00004000	0x00008000
Soft Left Arrow	0x00010000	0x00020000	0x00040000	0x00080000
Soft Right Arrow	0x00100000	0x00200000	0x00400000	0x00800000
U-Turn Arrow	0x01000000	0x02000000	0x04000000	0x08000000

For example, a vehicle CurrentState of 0x04080200 is read as 0x04000000, indicating a red U-Turn arrow, 0x00080000, indicating a flashing soft left arrow, and 0x00000200, indicating a yellow right arrow. All three of these lighting arrangements are present. A vehicle CurrentState of 0x01 is read as 0x00000001 and indicates a solid green ball.

For pedestrian lanes, CurrentState defines the current signal state of crosswalk indicators for a particular known pedestrian movement. For pedestrian lanes, the CurrentState is always a 2 character hexadecimal string with a leading 0. Possible values are: 0, indicating the CurrentState is unavailable or not equipped; 1, signaling "do not walk;" 2, indicating the crosswalk is flashing and signaling "do not walk;" and 3, signaling "walk."

For special lanes, CurrentState defines the current signal state of a special movement, such as a train crossing. For special lanes, the CurrentState is always a 2 character hexadecimal string. Possible values are: 1, indicating the CurrentState is empty or not in use; 2, indicating the special lane is about to be occupied; 3, indicating the special lane is occupied; and 4, indicating the special line is about to be empty.

Attribute Domain Values: String

Attribute

Attribute Label: MinTimeremaining (column D)
Attribute Definition: This attribute specifies the minimum guaranteed time remaining, in tenths of a second, before the signal phase will change to the next phase. The maximum MinTimeremaining is 1200 (120.0 seconds = 2 minutes). 0 indicates no time remaining. A special value of 1201 indicates indefinite time remaining (greater than 2 minutes) and a special value of 1202 indicates an unknown amount of time remaining. Times are provided relative to the SPAT MsgTimestamp.
Attribute Domain Values: Integer

Attribute

Attribute Label: MaxTimeremaining (column E)
Attribute Definition: This attribute specifies the anticipated maximum time remaining before the signal phase is predicted to change to the next phase. This is not a guaranteed time and is subject to change. Times are provided relative to the SPAT MsgTimestamp. As with MinTimeremaning, range of values are 0 – 1200, with special values of 1201 and 1202 also permitted. MinTimeremaining will equal Maxtimeremaining when the remaining time to the signal change is known to be exact.
Attribute Domain Values: Integer

Attribute

Attribute Label: YellowState (column F)
Attribute Definition: This attribute specifies the next (yellow-only) state of all possible lights pertaining to a known movement. YellowState depends on the type of lane that the movement is applied to.

For vehicle lanes, YellowState indicates the type of yellow light that will be featured after the current state expires. YellowState is only used when the current state is green. The mapping for YellowState is identical to the mapping for CurrentState, but may only have yellow light states.

For example, a YellowState of 0x02000000 indicates that a yellow U-turn arrow will be the next signal phase.

For pedestrian lanes, YellowState indicates the next active state of the crosswalk indicators for a particular known pedestrian movement.   As with CurrentState pedestrian lanes, YellowState is always a 2 character hexadecimal string. Possible values are: 0, indicating the YellowState is unavailable or not equipped; 1, signaling "do not walk" is next; 2, indicating the crosswalk will be flashing and signaling "do not walk" next; and 3, signaling "walk" next.

YellowState does not apply to special lanes.

Attribute Domain Values: String

Attribute

Attribute Label: YellowTime (column G)
Attribute Definition: This attribute specifies the duration of a yellow signal phase in tenths of a second.
Attribute Domain Values: Integer

Attribute

Attribute Label: PedestrianDetect (column H)
Attribute Definition: This attribute indicates the possible presence of pedestrians or other objects in the movements walk area. Possible values are: 0, indicating detection is unavailable; 1, indicating no pedestrians detected; or 2, indicating one or more possible pedestrians detected.
Attribute Domain Values: Integer

Attribute

Attribute Label: VehiclePedestrianCount (column I)
Attribute Definition: This attribute is an estimated count of vehicles (for vehicle lanes) or pedestrians (for pedestrian lanes) within a predefined time period.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneSet (column J)
Attribute Definition: This attribute represents movement within lanes at an intersection. Data is provided in hexadecimal. Each movement/lane pair is provided as a double-octet (four character) hex string. The first two characters represent the movement, while the last two characters represent the lane. The movement is obtained by converting the hexadecimal value to an 8 bit binary string with bits 76543210. A movement is present with a logical 1 for any given bit. Bit 0 represents straight motion, bit 1 represents a left turn, bit 2 represents a right turn, and bit 3 represents a U-turn. No other bits are used. For example, a LaneSet string of 0703 has the movement characters 07, which are written as 00000111 in binary. Bits 0, 1, and 2 are in the logical 1 position, indicating straight, left, and right movement. The string has lane characters 03 which directly indicate lane 3. Therefore, a LaneSet of 0703 indicates straight/left/right movement on lane 3. There is no limit to the number of movement lane/pairs possible. For example, a LaneSet of 08040302 indicates a U-Turn on lane 4 (with movement string 00001000 in binary) and straight/left on lane 2 (with movement string 00000011 in binary).
Attribute Domain Values: String

TIM File

The TIM file is populated with details pertaining to Traveler Information Message (TIM). This message is used to send various types of messages (advisory and road sign types) over the WSM stack to vehicles. 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 bytes 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 a system of short defined regions which is similar to the way roadway geometry is defined in the map fragment messages.

Attribute

Attribute Label: TIMID (column A)

Attribute Definition: Individual messages are either of type "advisory" or "road sign". If it is an advisory, the TIMID consists of a 2-byte Advisory Number. This Advisory Number can be used to connect to additional message content transmitted in the ATIS message format over the IP stack, if available. Even if no additional information is available, an Advisory Number will be present and unique. Otherwise, an OBU could not determine if it is receiving repeated transmissions of the same advisory. If the message is a road sign, the TIMID is a combination of 3D position, direction and an MUTCD code.

Attribute Domain Values: Integer

Attribute

Attribute Label: TIMPacketID (column B)

Attribute Definition: This attribute is a unique identifier for each packet of messages sent by the roadside equipment. The recommended Packet ID structure is an octet string which is a combination of an agency identifier in the most significant byte and timestamp in the subsequent bytes.

Attribute Domain Values: String

Attribute

Attribute Label: URLBase (column C)

Attribute Definition: This attribute is a valid internet style URI / URL in the form of a text string which will form the base of a compound string which, when combined with the URL-Short data element, will link to the designated resource. The string is to be interpreted as case-insensitive. Lower case is recommended. The protocol to be used (such as http) should be given in the string. The very last letter of the string may be used to differentiate multiple URL-Base values in a single system. This allows for a total of up to 26+10 = 36 such base addresses to exist. This last letter is then used to differentiate which base a given short value is to be used with (a matching first letter in the URL-Short value is also used). These letters are stripped from both the base and short data elements before combining to create the final URL/URI value.

Attribute Domain Values: String

Attribute

Attribute Label: MessageIdData (column D)

Attribute Definition: MessageIdData is a compact structure that communicates a number of attributes regarding the transmitted TIM message. Using a tag/type-length-value/data structure, this data element provide the information pertaining to 3D position object, which has latitude, longitude, elevation, heading(slice) and mutcdcode object components. As an example, this hexadecimal string, 0xA0108004193635268104CE183634820209F181020006820102, contains the following mapping:

- 0xA0 10 - Position 3D OBj (80) Len(10 hex)
- 80 04 19363526 - Latitude Obj (80) Len (04) value 19363526
- 81 04 CE183634 - Longitude Obj (81) Len (04) value ce183634
- 82 02 09F1 - Elevation Obj (82) Len (02) value 09f1
- 81 02 0006 - Headingslice Obj (81) Len (02) value 0006 (which defines a set of sixteen 22.5 degree slices of a unit circle (defined as 0~360 degrees of heading) which, when set to one, indicate that travel or motion along that angle is allowed.)
- 82 01 02 - Mutcdcode Obj (82) Len (02) value 02 (which defines what basic MUTCD type a sign expression falls into. none (0) - non-MUTCD information, regulatory (1), - "R" Regulatory signs, warning (2), - "W" warning signs, maintenance (3), - "M" Maintenance and construction, motoristService (4), - Motorist Services, guide (5), - "G" Guide signs, rec (6), - Recreation and Cultural Interest, values to 127 reserved for std use, values 128 to 255 reserved for local use)

Attribute Domain Values: Hexadecimal (string)

Attribute

Attribute Label: FurtherInfoId (column E)
Attribute Definition: This data element provides a link number to other messages (described the DSRC SAE J2735 documentation and in other message set standards) which relate to the same event. Use zero when unknown or not present.
Attribute Domain Values: String

Attribute

Attribute Label: Latitude (column F)
Attribute Definition: The geographic latitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 900000001 shall be used when unavailable. Provides a range of plus-minus 90 degrees.
Attribute Domain Values: Integer

Attribute

Attribute Label: Longitude (column G)
Attribute Definition: The geographic longitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 1800000001 shall be used when unavailable. Provides a range of plus-minus 180 degrees.
Attribute Domain Values: Integer

Attribute

Attribute Label: Elevation (column H)
Attribute Definition: The Elevation data element represents the geographic position above or below the reference ellipsoid (typically WSG-84). The 16-bit number has a resolution of 1 decimeter and represents an asymmetric range of positive and negative values. The encoding is as follows: the range 0x0000 to 0xEFFF (0 to 61439 decimal) are positive numbers representing elevations from 0 to +6143.9 meters, i.e. above the reference ellipsoid. The range 0xF001 to 0xFFFF are negative numbers representing elevations from - 409.5 meters to -0.1 meters, i.e. below the reference ellipsoid. An elevation higher than +6143.9 meters is represented 0xEFFF. An elevation lower than -409.5 meters is represented 0xF001. If the sending device does not know its elevation it shall encode the Elevation data element with 0xF000.
Attribute Domain Values: String

Attribute

Attribute Label: ViewAngle (column I)
Attribute Definition: View Angle data element communicates the same information as the Headingslice data element. This data element define a set of sixteen 22.5 degree slices of a unit circle (defined as 0~360 degrees of heading) which, when set to one, indicate that travel or motion along that angle is allowed. Typically used to indicate a gross direction of travel to which the enclosing message or data frame applies. For example a value of 0x8181 would indicate travel both directions due East and due West. Note:

- Each bit 22.5 degree starting from
- North and moving Eastward (clockwise)
- noHeading HeadingSlice ::= '0000'H
- allHeadings HeadingSlice ::= 'FFFF'H
- from000-0to022-5degrees HeadingSlice ::= '0001'H
- from022-5to045-0degrees HeadingSlice ::= '0002'H
- from045-0to067-5degrees HeadingSlice ::= '0004'H
- from067-5to090-0degrees HeadingSlice ::= '0008'H
- from090-0to112-5degrees HeadingSlice ::= '0010'H
- from112-5to135-0degrees HeadingSlice ::= '0020'H
- from135-0to157-5degrees HeadingSlice ::= '0040'H
- from157-5to180-0degrees HeadingSlice ::= '0080'H

- from180-0to202-5degrees HeadingSlice ::= '0100'H
- from202-5to225-0degrees HeadingSlice ::= '0200'H
- from225-0to247-5degrees HeadingSlice ::= '0400'H
- from247-5to270-0degrees HeadingSlice ::= '0800'H
- from270-0to292-5degrees HeadingSlice ::= '1000'H
- from292-5to315-0degrees HeadingSlice ::= '2000'H
- from315-0to337-5degrees HeadingSlice ::= '4000'H
- from337-5to360-0degrees HeadingSlice ::= '8000'H

Attribute Domain Values: Hexadecimal (string)

Attribute

Attribute Label: MutCDCode (column J)

Attribute Definition: This data element is used to define what basic MUTCD type a sign expression falls into. This attribute can take on the following enumerated values: 0 - none - non-MUTCD information; 1 - regulatory - "R" regulatory signs; 2 - warning - "W" warning signs; 3 - maintenance - "M" maintenance and construction; 4 - motoristService - motorist services; 5 - guide - "G" guide signs; 6 - rec - recreation and cultural interest, values to 127 reserved for std use, and values 128 to 255 reserved for local use..

Attribute Domain Values: Integer

Attribute

Attribute Label: MsgIdCRC (column K)

Attribute Definition: This attribute is a two byte data element calculated over the payload bytes of the message (starting with the initial sequence and ending with the last data element before the CRC itself and including all tag, length, and values bytes found in between). It is always placed as the very last data element in the message. The generating polynomial used is the "CRC-CCITT" commonly expressed as $x^{16} + x^{12} + x^5 + 1$. An initial seed value of zero shall be used. Note that because the first byte of every DSRC message is never zero (it is 0x30), framing errors due to incorrectly clocking initial zero values cannot occur. Note that the MSB byte is always transmitted first, following the typical ASN bytes order. When a well formed DSRC message (including its last two bytes holding the CRC value) is decoded and input to the CRC process, the resulting CRC should always be the value zero.

Attribute Domain Values: String

Attribute

Attribute Label: StartTime (column L)

Attribute Definition: This attribute is found in the data frame header of a traveler information message and indicates the time, in minute of the year format with optional year attribute, that the message will become valid.

Attribute Domain Values: String

Attribute

Attribute Label: Duration (column M)

Attribute Definition: This attribute is found in the data frame header of a traveler information message and indicates the time, in minutes, that the message will be valid after the start time.

Attribute Domain Values: Integer

Attribute

Attribute Label: SignPriority (column N)

Attribute Definition: This attribute indicates the relative importance of the sign, a scale from zero (least important) to seven (most important).

Attribute Domain Values: Integer

Attribute

Attribute Label: AnchorLatitude (column O)

Attribute Definition: The latitude, in one-tenth microdegrees, of a location (in the WSG-84 coordinate system) from which short offsets may then be used to create additional data using a

flat earth projection centered from this point. This attribute is typically used in the description of maps and intersections as well as signs and traveler data. A collection of the two 4 byte lat-long information elements and the one 2 byte elevation used to build a complete 3D position set in 10 bytes. This attribute is expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 900000001 shall be used when unavailable.

Attribute Domain Values: Integer

Attribute

Attribute Label: AnchorLongitude (column P)

Attribute Definition: The longitude, in one-tenth microdegrees, of a location (in the WSG-84 coordinate system) from which short offsets may then be used to create additional data using a flat earth projection centered from this point. This attribute is typically used in the description of maps and intersections as well as signs and traveler data. A collection of the two 4 byte lat-long information elements and the one 2 byte elevation used to build a complete 3D position set in 10 bytes. This attribute is expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 1800000001 shall be used when unavailable.

Attribute Domain Values: Integer

Attribute

Attribute Label: AnchorElevation (column Q)

Attribute Definition: The elevation, in one-tenth microdegrees, of a location (in the WSG-84 coordinate system) from which short offsets may then be used to create additional data using a flat earth projection centered from this point. This attribute is typically used in the description of maps and intersections as well as signs and traveler data. A collection of the two 4 byte lat-long information elements and the one 2 byte elevation used to build a complete 3D position set in 10 bytes.

Attribute Domain Values: Integer

Attribute

Attribute Label: CommonLaneWidth (column R)

Attribute Definition: The attribute conveys the width of a lane in LSB units of 1 cm. The maximum value would be a lane of over 327 meters.

Attribute Domain Values: Integer

Attribute

Attribute Label: DirectionOfUse (column S)

Attribute Definition: This attribute indicates the allowed direction of travel on a street lane or path described by shape points. The presumed (default) direction is outward, away from the initial set of points. However, this data element can be used to overcome that and indicate a reverse direction or both directions as well as the original outward direction. This attribute can take on the following enumerated values: 0 - forward - direction of travel follows node ordering; 1 - reverse - direction of travel is the reverse of node ordering; 2 - both – direction of travel allowed in both directions.

Attribute Domain Values: Integer

Attribute

Attribute Label: URLShort (column T)

Attribute Definition: This attribute presents a valid internet style URI / URL in the form of a text string which will be used as the final portion of a compound string which, when combined with the URL-Base data element, will link to the designated resource. The string is to be interpreted as case-insensitive. Lower case is recommended. The very first letter of the string shall be used to differentiate which one of multiple URL-Base values in a single system is to b used. This allows for a total of up to 26+10= 36 such base addresses to exist. This initial letter is then stripped off and used to differentiate which base a given short value is to be used with.

Attribute Domain Values: String

Attribute

Attribute Label: TIMContentTypeId (column U)
Attribute Definition: Identifier for the type of content in the Traveler Information Message.
Attribute Domain Values: Hexadecimal (String)

Attribute

Attribute Label: ITISCodesAndText (column V)
Attribute Definition: A representation of the ITIS code(s) associated with the message. A code indicates an event or lists an ITS related item. The complete set of ITIS codes can be found in Volume Two of the J2540 Standard and is not listed here.
Attribute Domain Values: Integer

TIMRegion File

This file outline the region for which the TIM is applicable. Thus far, there are 6 regions presented.

Attribute

Attribute Label: TIMRegion (column A)
Attribute Definition: This attribute identifies a given region for which the message is valid. Up to 16 valid regions may be used to geographically define where each message is useful to the driver. Multiple regions are used to describe precise segments of roadway where the message applies, such as east and west bound lanes approaching an intersection or interchange.
Attribute Domain Values: Integer

Attribute

Attribute Label: Direction (column B)
Attribute Definition: The direction of travel for which a message is valid. This data element communicates the same information, View Angle as well as Headingslice. This data element define a set of sixteen 22.5 degree slices of a unit circle (defined as 0~360 degrees of heading) which, when set to one, indicate that travel or motion along that angle is allowed. Typically used to indicate a gross direction of travel to which the enclosing message or data frame applies. For example a value of 0x8181 would indicate travel both directions due East and due West. Note:

- Each bit 22.5 degree starting from
- North and moving Eastward (clockwise)
- noHeading HeadingSlice ::= '0000'H
- allHeadings HeadingSlice ::= 'FFFF'H
- from000-0to022-5degrees HeadingSlice ::= '0001'H
- from022-5to045-0degrees HeadingSlice ::= '0002'H
- from045-0to067-5degrees HeadingSlice ::= '0004'H
- from067-5to090-0degrees HeadingSlice ::= '0008'H
- from090-0to112-5degrees HeadingSlice ::= '0010'H
- from112-5to135-0degrees HeadingSlice ::= '0020'H
- from135-0to157-5degrees HeadingSlice ::= '0040'H
- from157-5to180-0degrees HeadingSlice ::= '0080'H
- from180-0to202-5degrees HeadingSlice ::= '0100'H
- from202-5to225-0degrees HeadingSlice ::= '0200'H
- from225-0to247-5degrees HeadingSlice ::= '0400'H
- from247-5to270-0degrees HeadingSlice ::= '0800'H
- from270-0to292-5degrees HeadingSlice ::= '1000'H
- from292-5to315-0degrees HeadingSlice ::= '2000'H
- from315-0to337-5degrees HeadingSlice ::= '4000'H
- from337-5to360-0degrees HeadingSlice ::= '8000'H

A vehicle physically being within the area described by the shape of the AreaType is not enough to make a message valid for display. If the region is not defined as omni-directional, then the vehicle must also be traveling in a designated direction.
Attribute Domain Values: String

Attribute

Attribute Label: Extent (column C)
Attribute Definition: This attribute describes the spatial distance over which this traveler information message applies and should be presented to the driver. Under certain conditions some messages may never be shown to the driver of a vehicle if they are short in duration and other conflicting needs supersede the display until such time as the subject message is no longer relevant. The attribute can take on the following enumerated values: 0 - use message for an instant only; 1 - use message for 3 meters only; 2 - use message for 10 meters only; 3 - use message for 50 meters only; 4 - use message for 100 meters only; 5 - use message for 500 meters only; 6 - use message for 1000 meters only; 7 - use message for 5000 meters only; 8 - use message for 10,000 meters only; 9 - use message for 50,000 meters only; 10 - use message for 100,000 meters only; 127 - use message forever..
Attribute Domain Values: Integer

Attribute

Attribute Label: TIMAreaTypeId (column D)
Attribute Definition: A description of the region in which the message broadcast is valid. This region may take three different shapes. A circular region is the simplest region. It works well to cover a general area that is not restricted to one specific road segment. It can be quite effective for very large areas. A polygon region can describe complex regions such as an agency's jurisdictional coverage.   The shape point set allows a spline-like representation of a road segment using the same concepts developed for DSRC map fragments and is intended to tightly bind the region to the contour of a particular road. The described segments use a node list to efficiently describe the contour of the roadway center line as well as any changes in width and elevation.
Attribute Domain Values: Integer

Attribute

Attribute Label: Latitude (column E)
Attribute Definition: The geographic latitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 900000001 shall be used when unavailable. Provides a range of plus-minus 90 degrees.
Attribute Domain Values: Integer

Attribute

Attribute Label: Longitude (column F)
Attribute Definition: The geographic longitude of an object, expressed in 1/10th integer microdegrees, as a 32 bit value and with reference to the horizontal datum then in use. The value 1800000001 shall be used when unavailable. Provides a range of plus-minus 180 degrees.
Attribute Domain Values: Integer

Attribute

Attribute Label: Elevation (column G)
Attribute Definition: The Elevation data element represents the geographic position above or below the reference ellipsoid (typically WSG-84). The 16-bit number has a resolution of 1 decimeter and represents an asymmetric range of positive and negative values. The encoding is as follows: the range 0x0000 to 0xEFFF (0 to 61439 decimal) are positive numbers representing elevations from 0 to +6143.9 meters, i.e. above the reference ellipsoid. The range 0xF001 to 0xFFFF are negative numbers representing elevations from - 409.5 meters to -0.1 meters, i.e. below the reference ellipsoid. An elevation higher than +6143.9 meters is represented 0xEFFF. An elevation lower than -409.5 meters is represented 0xF001. If the sending device does not know its elevation it shall encode the Elevation data element with 0xF000.
Attribute Domain Values: Integer

Attribute

Attribute Label: LaneWidth (column H)

Attribute Definition: For a given region in which the message is valid, this attribute conveys the width of a lane in LSB units of 1 cm. Permissible values range from 0 to 32767. The maximum value would be a lane of over 327 meters.

Attribute Domain Values: Integer

Attribute

Attribute Label: DirectionOfUse (column I)

Attribute Definition: This attribute indicates the allowed direction of travel on a street lane or path described by shape points. The presumed (default) direction is outward, away from the initial set of points. However, this data element can be used to overcome that and indicate a reverse direction or both directions as well as the original outward direction. This attribute can take on the following enumerated values: 0 - forward - direction of travel follows node ordering; 1 - reverse - direction of travel is the reverse of node ordering; 2 - both – direction of travel allowed in both directions.

Attribute Domain Values: Integer

Attribute

Attribute Label: RadiusSteps (column J)

Attribute Definition: This attribute indicates one of three possible measures of the radius of the circular area for which the TIM is valid. It is given in unsigned values between 0 and 32767, where the Least Significant Bit is in units of 2.5 cm.

Attribute Domain Values: Integer

Attribute

Attribute Label: Miles (column K)

Attribute Definition: This attribute indicates one of three possible measures of the radius of the circular area for which the TIM is valid. It is given in unsigned values between 1 and 2000, where the units are in miles.

Attribute Domain Values: Integer

Attribute

Attribute Label: Kilometers (column L)

Attribute Definition: This attribute indicates one of three possible measures of the radius of the circular area for which the TIM is valid. It is given in unsigned values between 1 and 5000, where the units are in kilometers.

Attribute Domain Values: Integer

TIMRegionNode File

This file defines the applicable region of a TIM in terms of offsets from a given node, which may be at an intersection or a point on the ground near an RSE.

Attribute

Attribute Label: TIMRegionNodeId (column A)

Attribute Definition: An ID that is used to demarcate the point of a region for which a TIM is applicable.

Attribute Domain Values: Integer

Attribute

Attribute Label: TIMRegionId (column B)

Attribute Definition: This attribute identifies a given region for which the message is valid. Up to 16 valid regions may be used to geographically define where each message is useful to the driver. Multiple regions are used to describe precise segments of roadway where the message applies, such as east and west bound lanes approaching an intersection or interchange.

Attribute Domain Values: Integer

Attribute

Attribute Label: XOffset (column C)

Attribute Definition: For a given node within the shape point set that defines the valid region for a message, this attribute expresses the latitudinal offset from an anchor point of the given node, and can range in value from -32767 to 32767 where the Least Significant Bit is in units of 1.0 cm.

Attribute Domain Values: Integer

Attribute

Attribute Label: YOffset (column D)

Attribute Definition: For a given node within the shape point set that defines the valid region for a message, this attribute expresses the longitudinal offset from an anchor point of the given node, and can range in value from -32767 to 32767 where the Least Significant Bit is in units of 1.0 cm.

Attribute Domain Values: Integer

Attribute

Attribute Label: ZOffset (column E)

Attribute Definition: For a given node within the shape point set that defines the valid region for a message, this attribute expresses the elevation offset from an anchor point of the given node, and can range in value from -32767 to 32767 where the Least Significant Bit is in units of 1.0 cm.

Attribute Domain Values: Integer

Attribute

Attribute Label: Width (column F)

Attribute Definition: For a given node, this attribute conveys the width of a lane in LSB units of 1 cm. Permissible values range from 0 to 32767. The maximum value would be a lane of over 327 meters.

Attribute Domain Values: Integer

TIMRegionXref File

This file maps each traveler information message, via its ID, to the region in which the message is applicable.

Attribute

Attribute Label: TIMID (column A)

Attribute Definition: Individual messages are either of type "advisory" or "road sign". If it is an advisory, the message ID consists of a 2-byte Advisory Number. This Advisory Number can be used to connect to additional message content transmitted in the ATIS message format over the IP stack, if available. Even if no additional information is available, an Advisory Number will be present and unique. Otherwise, an OBU could not determine if it is receiving repeated transmissions of the same advisory. If the message is a road sign, the message ID is a combination of 3D position, direction and an MUTCD code.

Attribute Domain Values: Integer

Attribute

Attribute Label: TIMRegionId (column B)

Attribute Definition: This attribute identifies a given region for which the message is valid. Up to 16 valid regions may be used to geographically define where each message is useful to the driver. Multiple regions are used to describe precise segments of roadway where the message applies, such as east and west bound lanes approaching an intersection or interchange.

Attribute Domain Values: Integer

Detailed Description for Weather Data set

The weather data set consists of a single file containing weather data for the Ann Arbor area. Details associated with this file are presented below.

WeatherData File

The Weather data present archived surface weather as provide by the Nation Oceanic and Atmospheric Administration via the National Climatic data Center. The data presented in the file are collected by a weather station located in Ann Arbor, more precisely at the Ann Arbor Municipal airport. Elements included in this file cover precipitation measures, temperature, cloud cover, and visibility, to name a few.

Attribute

Attribute Label: USAF (column A)
Attribute Definition: This attribute is the Air Force Catalog station number.
Attribute Domain Values: Integer

Attribute

Attribute Label: WBAN (column B)
Attribute Definition: This attribute is the National Climate Data Center WBAN number.
Attribute Domain Values: Integer

Attribute

Attribute Label: YR-MODAHRMN (column C)
Attribute Definition: This attribute is the year-month-day-hour-minute of the weather observation in Greenwich Mean Time.
Attribute Domain Values: Integer

Attribute

Attribute Label: DIR (column D)
Attribute Definition: This attribute is the wind direction in compass degrees. A DIR of 990 is used to report variable wind, while *** is used to report calm air (0 wind speed).
Attribute Domain Values: Integer

Attribute

Attribute Label: SPD (column E)
Attribute Definition: This attribute is the wind speed in miles per hour.
Attribute Domain Values: Integer

Attribute

Attribute Label: GUS (column F)
Attribute Definition: This attribute is the wind gust in miles per hour.
Attribute Domain Values: Integer

Attribute

Attribute Label: CLG (column G)
Attribute Definition: This attribute is the cloud ceiling and represents the lowest opaque layer with 5/8 or greater coverage, in hundreds of feet. A CLG of 722 is used to indicate an unlimited ceiling.
Attribute Domain Values: Integer

Attribute

Attribute Label: SKC (column H)
Attribute Definition: This attribute is the sky cover: CLR is used to represent a clear sky; SCT (scattered) is used for 1/8 – 4/8 coverage; BKN (broken) is used for 5/8 – 7/8 coverage; OVC is used to represent an overcast sky; OBC is used to represent an obscured sky; and POB is used to indicate partial obscuration.
Attribute Domain Values: String

Attribute

Attribute Label: L (column I)
Attribute Definition: This attribute is the low cloud type. The numbers 0-9 are used to represent the cloud type: 0 indicates no low clouds; 1 indicates Cumulus humulis or Cumulus fractus other than of bad weather, or both; 2 indicates Cumulus mediocris or congestus, with or without Cumulus of species fractus or humulis or Stratocumulus, all having bases at the same level; 3

indicates Cumulonimbus calvus, with or without Cumulus, Stratocumulus or Stratus; 4 indicates Stratocumulus cumulogenitus; 5 indicates Stratocumulus other than Stratocumulus cumulogenitus; 6 indicates Stratus nebulosus or Stratus fractus other than of bad weather, or both; 7 indicates Stratus fractus or Cumulus fractus of bad weather, or both (pannus) usually below Altostratus or Nimbostratus; 8 indicates Cumulus and Stratocumulus other than Stratocumulus cumulogenitus, with bases at different levels; and 9 indicates Cumulonimbus capillatus (often with an anvil), with or without Cumulonimbus calvus, Cumulus, Stratocumulus, Stratus or pannus.
Attribute Domain Values: Integer

Attribute

Attribute Label: M (column J)
Attribute Definition: This attribute is the middle cloud type. The numbers 0-9 are used to represent the cloud type: 0 indicates no middle clouds; 1 indicates Altostratus translucidus; 2 indicates Altostratus opacus or Nimbostratus; 3 indicates Altocumulus translucidus at a single level; 4 indicates patches (often lenticular) of Altocumulus translucidus, continually changing and occurring at one or more levels; 5 indicates Altocumulus translucidus in bands, or one or more layers of Altocumulus translucidus or opacus, progressively invading the sky – these Altocumulus clouds generally thicken as a whole; 6 indicates Altocumulus cumulogentis (or cumulonimbogentus); 7 indicates Altocumulus translucidus or opacus in two or more layers, or Altocumulus opacus in a single layer, not progressively invading the sky, or Altocumulus with Altostratus or Nimbostratus; 8 indicates Altocumulus castellanus or floccus; and 9 indicates Altocumulus of a chaotic sky – generally at several levels.
Attribute Domain Values: Integer

Attribute

Attribute Label: H (column K)
Attribute Definition: This attribute is the high cloud type. The numbers 0-9 are used to represent the cloud type: 0 indicates no high clouds; 1 indicates Cirrus fibratus, sometimes uncinus, not progressively invading the sky; 2 indicates Cirrus spissatus, in patches or entangled sheaves, which usually do not increase and sometimes seem to be the remains of the upper part of a Cumulonimbus; or Cirrus castellanus or floccus; 3 indicates Cirrus spissatus cumulonimbogenitus; 4 indicates Cirrus unicinus or fibratus, or both, progressively invading the sky; they generally thicken as a whole; 5 indicates Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively invading the sky – they generally thicken as a whole, but the continuous veil does not reach 45 degrees above the horizon; 6 indicates Cirrus (often in bands) and Cirrostratus, or Cirrostratus alone, progressively invading the sky; they generally thicken as a whole; the continuous veil extends more than 45 degrees above the horizon, without the sky being totally covered; 7 indicates Cirrostratus covering the whole sky; 8 indicates Cirrostratus not progressively invading the sky and not entirely covering it; and 9 indicates Cirrocumulus alone, or Cirrocumulus predominant among the high clouds.
Attribute Domain Values: Integer

Attribute

Attribute Label: VSB (column L)
Attribute Definition: This attribute is the visibility in statute miles, rounded to the nearest tenth of a statute mile. Note that for some weather stations, visibility is reported to a maximum of 7 or 10 miles in metar observations, but to higher values in synoptic observations, which cases the visibility value to fluctuate from one data record to the next. Additionally, values originally reported as 10 may appear as 10.1 due to data being archived in metric units and then being converted back to English units.
Attribute Domain Values: Real

Attribute

Attribute Label: MW (columns M, N, O, and P)
Attribute Definition: These attributes represent the manually observed present weather in a 2 digit code. Weather codes are provided at the end of this section.
Attribute Domain Values: Integer

Attribute

Attribute Label: AW (columns Q, R, S, and T)
Attribute Definition: These attributes represent the auto-observed present weather in a 2 digit code. Weather codes are provided at the end of this section.
Attribute Domain Values: Integer

Attribute

Attribute Label: W (column U)
Attribute Definition: This attribute is the past weather indicator.   The numbers 0-9 are used to represent the specific type of past weather observed: 0 indicates clouds covering 1/2 or less of the sky throughout the appropriate period; 1 indicates clouds covering more than 1/2 of the sky during part of the appropriate period and covering 1/2 or less during part of the period; 2 indicates clouds covering more than 1/2 of the sky throughout the appropriate period; 3 indicates a sandstorm, duststorm or blowing snow; 4 indicates fog or ice fog or thick haze; 5 indicates drizzle; 6 indicates rain; 7 indicates snow, or rain and snow mixed, 8 indicates a shower or showers; and 9 indicates a thunderstorm or thunderstorms with or without precipitation.
Attribute Domain Values: Integer

Attribute

Attribute Label: TEMP (column V)
Attribute Definition: This attribute is the temperature in Fahrenheit.
Attribute Domain Values: Integer

Attribute

Attribute Label: DEWP (column WT)
Attribute Definition: This attribute is the dew point in Fahrenheit.
Attribute Domain Values: Integer

Attribute

Attribute Label: SLP (column X)
Attribute Definition: This attribute is the sea level pressure, in millibars, and recorded to the nearest tenth.
Attribute Domain Values: Real

Attribute

Attribute Label: ATL (column Y)
Attribute Definition: This attribute is the altimeter setting, in inches, and recorded to the nearest hundredth.
Attribute Domain Values: Real

Attribute

Attribute Label: STP (column Z)
Attribute Definition: This attribute is the station pressure, in millibars, and recorded to the nearest tenth.
Attribute Domain Values: Real

Attribute

Attribute Label: MAX (column AA)
Attribute Definition: This attribute is the maximum temperature in Fahrenheit. The time period over which the maximum is measured varies.
Attribute Domain Values: Integer

Attribute

Attribute Label: MIN (column AB)
Attribute Definition: This attribute is the minimum temperature in Fahrenheit. The time period over which the minimum is measured varies.
Attribute Domain Values: Integer

Attribute

Attribute Label: PCP01 (column AC)

Attribute Definition: This attribute represents the amount of liquid precipitation occurring over the last hour, in inches, and recorded to the nearest hundredth of an inch.
Attribute Domain Values: Real

Attribute

Attribute Label: PCP06 (column AD)
Attribute Definition: This attribute represents the amount of liquid precipitation occurring over the last six hours, in inches, and recorded to the nearest hundredth of an inch.
Attribute Domain Values: Real

Attribute

Attribute Label: PCP24 (column AE)
Attribute Definition: This attribute represents the amount of liquid precipitation occurring over the last 24 hours, in inches, and recorded to the nearest hundredth of an inch.
Attribute Domain Values: Real

Attribute

Attribute Label: PCPXX (column AF)
Attribute Definition: This attribute represents the amount of liquid precipitation occurring for a period other than the last 1, 6, or 24 hours. This is usually a 12 hour period for stations outside of the US and a 3 hour period for stations within the US. 0.00T is recorded as the PCPXX observation if only trace amounts of precipitation were recorded.
Attribute Domain Values: Real

Attribute

Attribute Label: SD (column AG)
Attribute Definition: This attribute represents the snow depth in inches.
Attribute Domain Values: Integer

Weather Codes:

00-49 No precipitation at the station at the time of observation

00-19 No precipitation, fog, ice fog (except for 11 and 12), duststorm, sandstorm, drifting or blowing snow at the station at the time of observation or, except for 09 and 17, during the preceding hour

00: Cloud development not observed or not observable
01: Clouds generally dissolving or becoming less developed
02: State of sky on the whole unchanged
03: Clouds generally forming or developing
04: Visibility reduced by smoke, e.g. veldt or forest fires, industrial smoke or volcanic ashes
05: Haze
06: Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation
07: Dust or sand raised by wind at or near the station at the time of observation, but no well-developed dust whirl(s) or sand whirl(s), and no duststorm or sandstorm seen or, in the case of ships, blowing spray at the station
08: Well developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm
09: Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour
10: Mist
11: Patches of shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 meters on land or 10 meters at sea
12: More or less continuous shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 meters on land or 10 meters at sea
13: Lightning visible, no thunder heard

14: Precipitation within sight, not reaching the ground or the surface of the sea
15: Precipitation within sight, reaching the ground or the surface of the sea, but distant, i.e., estimated to be more than 5 km from the station
16: Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station
17: Thunderstorm, but no precipitation at the time of observation
18: Squalls at or within sight of the station during the preceding hour or at the time of observation
19: Funnel cloud(s) (Tornado cloud or waterspout) at or within sight of the station during the preceding hour or at the time of observation

20-29 Precipitation, fog, ice fog or thunderstorm at the station during the preceding hour, but not at the time of observation

20: Drizzle (not freezing) or snow grains not falling as shower(s)
21: Rain (not freezing) not falling as shower(s)
22: Snow not falling as shower(s)
23: Rain and snow or ice pellets not falling as shower(s)
24: Freezing drizzle or freezing rain not falling as shower(s)
25: Shower(s) of rain
26: Shower(s) of snow or of rain and snow
27: Shower(s) of hail (Hail, small hail, snow pellets), or rain and hail
28: Fog or ice fog
29: Thunderstorm (with or without precipitation)

30-39 Duststorm, sandstorm, or blowing snow

30: Slight or moderate duststorm or sandstorm has decreased during the preceding hour
31: Slight or moderate duststorm or sandstorm no appreciable change during the preceding hour
32: Slight or moderate duststorm or sandstorm has begun or has increased during the preceding hour
33: Severe duststorm or sandstorm has decreased during the preceding hour
34: Severe duststorm or sandstorm no appreciable change during the preceding hour
35: Severe duststorm or sandstorm has begun or has increased during the preceding hour
36: Slight or moderate drifting snow generally low (below eye level)
37: Heavy drifting snow generally low (below eye level)
38: Slight or moderate blowing snow generally high (above eye level)
39: Heavy blowing snow generally high (above eye level)

40-49 Fog or ice fog at the time of observation

40: Fog or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer
41: Fog or ice fog in patches
42: Fog or ice fog, sky visible, has become thinner during the preceding hour
43: Fog or ice fog, sky invisible, has become thinner during the preceding hour
44: Fog or ice fog, sky visible, no appreciable change during the preceding hour
45: Fog or ice fog, sky invisible, no appreciable change during the preceding hour
46: Fog or ice fog, sky invisible, has begun or has become thicker during the preceding hour
47: Fog or ice fog, sky invisible, has begun or has become thicker during the preceding hour
48: Fog, depositing rime, sky visible
49: Fog, depositing rime, sky invisible

50-99 Precipitation at the station at the time of observation

50-59 Drizzle

50: Drizzle, not freezing, intermittent, slight at time of observation
51: Drizzle, not freezing, continuous, slight at time of observation
52: Drizzle, not freezing, intermittent, moderate at time of observation
53: Drizzle, not freezing, continuous, moderate at time of observation
54: Drizzle, not freezing, intermittent, heavy (dense) at time of observation
55: Drizzle, not freezing, continuous, heavy (dense) at time of observation
56: Drizzle, freezing, slight
57: Drizzle, freezing, moderate or heavy (dense)
58: Drizzle and rain, slight
59: Drizzle and rain, moderate or heavy

60-69 Rain

60: Rain, not freezing, intermittent, slight at time of observation
61: Rain, not freezing, continuous, slight at time of observation
62: Rain, not freezing, intermittent, moderate at time of observation
63: Rain, not freezing, continuous, moderate at time of observation
64: Rain, not freezing, intermittent, heavy at time of observation
65: Rain, not freezing, continuous, heavy at time of observation
66: Rain, freezing, slight
67: Rain, freezing, moderate or heavy
68: Rain or drizzle and snow, slight
69: Rain or drizzle and snow, moderate or heavy

70-79 Solid precipitation not in showers

70: Intermittent fall of snowflakes, slight at time of observation
71: Continuous fall of snowflakes, slight at time of observation
72: Intermittent fall of snowflakes, moderate at time of observation
73: Continuous fall of snowflakes, moderate at time of observation
74: Intermittent fall of snowflakes, heavy at time of observation
75: Continuous fall of snowflakes, heavy at time of observation
76: Diamond dust (with or without fog)
77: Snow grains (with or without fog)
78: Isolated star-like snow crystals (with or without fog)
79: Ice pellets

80-99 Showery precipitation, or precipitation with current or recent thunderstorm

80: Rain shower(s), slight
81: Rain shower(s), moderate or heavy
82: Rain shower(s), violent
83: Shower(s) of rain and snow mixed, slight
84: Shower(s) of rain and snow mixed, moderate or heavy
85: Show shower(s), slight
86: Snow shower(s), moderate or heavy
87: Shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed, slight
88: Shower(s) of snow pellets or small hail, with or without rain or rain and snow mixed, moderate or heavy
89: Shower(s) of hail (hail, small hail, snow pellets), with or without rain or rain and snow mixed, not associated with thunder, slight
90: Shower(s) of hail (hail, small hail, snow pellets), with or without rain or rain and snow mixed, not associated with thunder, moderate or heavy
91: Slight rain at time of observation, thunderstorm during the preceding hour but not at time of observation

92: Moderate or heavy rain at time of observation, thunderstorm during the preceding hour but not at time of observation
93: Slight snow, or rain and snow mixed or hail (hail, small hail, snow pellets), at time of observation, thunderstorm during the preceding hour but not at time of observation
94: Moderate or heavy snow, or rain and snow mixed or hail (hail, small hail, snow pellets) at time of observation, thunderstorm during the preceding hour but not at time of observation
95: Thunderstorm, slight or moderate, without hail (hail, small hail, snow pellets), but with rain and/or snow at time of observation, thunderstorm at time of observation
96: Thunderstorm, slight or moderate, with hail (hail, small hail, snow pellets) at time of observation, thunderstorm at time of observation
97: Thunderstorm, heavy, without hail (Hail, small hail, snow pellets), but with rain and/or snow at time of observation, thunderstorm at time of observation
98: Thunderstorm combined with duststorm or sandstorm at time of observation, thunderstorm at time of observation
99: Thunderstorm, heavy, with hail (hail, small hail, snow pellets) at time of observation, thunderstorm at time of observation

Detailed Description for (Washtenaw County) Network Data set

The Network data set contains two data files. One of these files presents Annual Average Daily Traffic (AADT) along select roadways in Washtenaw County, Michigan. The data in this file were obtained from the Traffic Count Database System (TCDS). The TCDS is a tool for the traffic engineer or planner to organize an agency's traffic count data. This tool also allows user to upload data from a traffic counter; view graphs, lists and reports of historic traffic count data; search for count data using either the database or the Google map; and print or export data to your desktop. The database can be accessed via http://washtenaw.ms2soft.com/tcds/tsearch.asp?loc=Washtenaw&mod=.   The data range for these data is 01/01/1999 – 01/01/2015.

The second data file in the data set presents traffic count samples collected throughout Washtenaw County over a 24 or 48 hour period. This data was obtained from the Washtenaw Area Transportation Study (http://www.miwats.org/traffic-counts/). These count data are collected by road agencies and used in monitoring the performance and needs of the transportation system. The data range for these data is 08/08/1985 – 06/06/2013.

The data in these files spans 1985 – 2015. Data beyond the years of the Safety Pilot Model Deployment were included to support researchers in having a comprehensive view of the road network in the Ann Arbor / Washtenaw County area. While traffic count data is collected rather infrequently, across the network, having data the spans multiple years, and are collected along different roadways, these data are intended to provide supplemental data to communicate network-wide flow estimates.

In addition to these two files for complementary network data references in terms both a description of the physical network from which the data was collected and additional performance measures detailing the efficiency with which people and goods are transported throughout the system. One of the more detailed repositories of network data in which the Safety Pilot Model Deployment was executed is the website of the Michigan Department of Transportation (MDOT) (http://www.michigan.gov/mdot/). From MDOT's website a detailed functional classification (road) map is available at http://www.miwats.org/s/Appendix-B-Washtenaw-County-NFC-map.pdf. In terms of network performance, MDOT provides a web based, geospatial tool that provides a layer of average daily traffic counts at http://www.mcgi.state.mi.us/ntfa/. Other network performance supplemental data can be obtained

from MDOT's main page as well as the Federal Highway Administration - Highway Statistics Series (http://www.fhwa.dot.gov/policyinformation/statistics.cfm).

NetworkAADTCount File

This data file presents traffic counts from Washtenaw County in Michigan. This data in this file was obtained from The Traffic Count Database System (TCDS). The following sections presents a brief description of each data element in the network file.

Attribute

Attribute Label: Loc Id (column A)
Attribute Definition: This field contains the location's ID number for a given count value.
Attribute Domain Values: String

Attribute

Attribute Label: County (column B)
Attribute Definition: The county where the record resides
Attribute Domain Values: String

Attribute

Attribute Label: Community (column C)
Attribute Definition: The community where the record resides.
Attribute Domain Values: String

Attribute

Attribute Label: On (column D)
Attribute Definition: The street where the record is located.
Attribute Domain Values: String

Attribute

Attribute Label: From (column E)
Attribute Definition: One of the endpoints of the record's link.
Attribute Domain Values: String

Attribute

Attribute Label: To (column F)
Attribute Definition: The other endpoint of the record's link.
Attribute Domain Values: String

Attribute

Attribute Label: Approach (column G)
Attribute Definition: Direction from street, in Column H, that the record resides.
Attribute Domain Values: String

Attribute

Attribute Label: At (column H)
Attribute Definition: Name of the nearest cross street to the record.
Attribute Domain Values: String

Attribute

Attribute Label: Dir (column I)
Attribute Definition: The flow direction of this record (for example, EB, WB, NB, SB).
Attribute Domain Values: String

Attribute

Attribute Label: Latitude (column J)
Attribute Definition: Latitude of the record(er)
Attribute Domain Values: Float

Attribute

Attribute Label: Longitude (column K)

Attribute Definition: Longitude of the record(er).
Attribute Domain Values: Float

Attribute

Attribute Label: Latest (column L)
Attribute Definition: The most recent AADT count data.
Attribute Domain Values: Integer

Attribute

Attribute Label: Latest Date (column M)
Attribute Definition: The most recent count data date.
Attribute Domain Values: Date

NetworkTrafficCount File

This file presents traffic count samples collected throughout Washtenaw County over a 24 or 48 hour period. This data was obtained from the Washtenaw Area Transportation Study (http://www.miwats.org/traffic-counts/). These count data are collected by road agencies and used in monitoring the performance and needs of the transportation system. The data range for these data is 08/08/1985 – 06/06/2013.

Note to readers and users of the data and the definitions below: At the time of publication of this document the Research Data Exchange team did not receive the official definitions for the attributes in this file. The definitions below represents the team's attempt at defining these attributes based on context and experience in the field.

Attribute

Attribute Label: TrafficCountDataID (column A)
Attribute Definition: This field contains a unique ID for each traffic count record.
Attribute Domain Values: Integer

Attribute

Attribute Label: CountID (column B)
Attribute Definition: This field contains an assigned ID for each set of traffic count records collected at the same location on the same date.
Attribute Domain Values: Integer

Attribute

Attribute Label: Count Date (column C)
Attribute Definition: Date on which the traffic count data was collected
Attribute Domain Values: Date

Attribute

Attribute Label: StreetName (column D)
Attribute Definition: The name of the street on which the traffic count was collected.
Attribute Domain Values: String

Attribute

Attribute Label: DirectionFromCross (column E)
Attribute Definition: The direction of the data collection (street) location from the reference / closest cross street.
Attribute Domain Values: String

Attribute

Attribute Label: CrossStreet (column F)
Attribute Definition: Closet or reference cross street to the street on which traffic count data is being collected.
Attribute Domain Values: String

Attribute

Attribute Label: TravelDirection (column G)
Attribute Definition: Corresponding travel direction to traffic count value; for the street that the traffic count data is being collected.
Attribute Domain Values: String

Attribute

Attribute Label: 24HourCount (column H)
Attribute Definition: Number of vehicles detected over a 24-hour period at the data collection location.
Attribute Domain Values: Integer

Attribute

Attribute Label: PeakHourCount (column I)
Attribute Definition: Highest number of vehicles is detected in an hour during the data collection period.
Attribute Domain Values: Integer

Attribute

Attribute Label: PeakHourTime (column J)
Attribute Definition: The specific hour, of the day, during which the highest number of vehicles is detected during the data collection period
Attribute Domain Values: Integer

Attribute

Attribute Label: 5PMCount (column K)
Attribute Definition: The number of vehicles detected in the 5PM hour during the data collection period
Attribute Domain Values: Integer

Attribute

Attribute Label: Source Agency (column L)
Attribute Definition: The agency that collected the corresponding count data
Attribute Domain Values: String

Attribute

Attribute Label 48HourAverage (column M)
Attribute Definition: Indicator as to whether or not an average over a 48 hour period was used to derive the corresponding traffic count value.
Attribute Domain Values: Boolean

Attribute

Attribute Label CityTwp (column N)
Attribute Definition: City / Township in which the data is being collected.
Attribute Domain Values: String

Distribution Information

Distributor

Contact Information

Contact Organization Primary

Contact Organization: Booz Allen Hamilton
Contact Electronic Mail Address: Kandarpa_Ram@bah.com

Metadata Reference Information

Metadata Date: 20141028
Metadata Review Date: 20141028
Metadata Future Review Date: not scheduled

Metadata Contact

Contact Information

Contact Organization Primary

Contact Organization: Booz Allen Hamilton
Contact Person: Dwayne Henclewood
Contact Electronic Mail Address: Henclewood_Dwayne@bah.com
Metadata Standard Name: FGDC Content Standard for Digital Geospatial Metadata
Metadata Standard Version: FGDC-STD-001-1998
Metadata Time Convention: Local time