TRAFVU

File Description Document

Version 1.2

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Preface

TRAFVU displays and animates the results of traffic simulations. ITT Industries, Inc., Systems Division designed and implemented TRAFVU to obtain simulation data via two separate communication media: data files and sockets. Socket communications were developed primarily to serve the needs of traffic research laboratories where simulation elements are distributed across several computer platforms. The Traffic Research Laboratory (TReL) Graphics Processor Interface Control Document (ICD 5.0) describes the socket interface between TRAFVU and the TReL traffic simulator.

The file interface was developed primarily for stand-alone desktop applications of the CORSIM simulation. However, recent laboratory demonstrations have shown that the file interface can also be employed in distributed configurations as well. This, coupled with the fact that the socket interface has not been fully tested, has promoted the file interface to the primary interface to TRAFVU. This document specifies and describes the TRAFVU file interface.

Along with this document we have compiled and released a Data Description Document (DDD). The DDD is a living document that is updated to accommodate enhancements to CORSIM and TRAFVU. It provides detailed information about the data passed from CORSIM to TRAFVU. However, this document is self-contained. We reference the ICD and DDD only to supply background information concerning message structure and traffic simulation data.

Finally, in those situations where the information supplied by this document deviates from either the ICD or DDD, this document takes precedence in specifying the file interface to TRAFVU.

Version Notes

This version differs from version 1.1 in the incident and link MOE messages:

- For the incident message, the Incident Position is now measured from the link's upstream node, and the Reaction Point Position is now defined as the "distance upstream from the start of the incident at which vehicles begin to react to the incident". These changes were made so that TRAFVU displays the information as entered by the user.

- For the link MOE message, we have added "control delay MOE" for left-, through-, and right- discharging vehicles.

Please keep in mind that the file version identifier has changed as well as the values associated with the symbolic names used in the message descriptions. The version identifier is given in Section 2. The values associated with the symbolic names are given in Appendix A.

Disclaimer

We continue to update and enhance TRAFVU to meet the changing needs of the CORSIM simulation. Some of those enhancements affect the file contents described in this document. Therefore, this document is subject to change without notice.

Furthermore, the files described in this document were designed with the CORSIM simulation in mind. Although we designed TRAFVU to be independent of its source of data, many of the data elements contained in the files are specific to CORSIM. Therefore, ITT Industries, Inc., Systems Division cannot guarantee that files produced outside of the TSIS/CORSIM environment will operate properly with TRAFVU.

1. Introduction

This File Description Document (FDD) defines the file-based communications interface between the TRAFVU graphics processor and the CORSIM traffic simulation. Specifically, this document describes the format and content of the five files used by TRAFVU to animate and display traffic simulation data.

The set of five files includes the CORSIM input file that is designated with the ***.trf*** file extension. TRAFVU obtains all static (time-invariant) and user-specified data from this ASCII format file. The CORSIM input file is described in detail in the CORSIM User's Manual, and will not be described here. The remaining four files are binary data files that convey dynamic (time-varying) data from the simulation to TRAFVU. These data include vehicle state data, signal state data, and measures of effectiveness (MOE) data.

Section 1 of this document describes the format of the two files that contain vehicle and signal data that vary with the simulation time step. Section 2 describes the two files that contain MOE data that vary with the simulation time interval. Section 3 specifies the format of the messages that form the contents of the data files.

2. Time Step Data Files

The time step data files describe the state of the vehicles, incidents, and signals at each time step in the simulation. Consequently, these files can get quite large for simulations that cover a large portion of time or a large network. The names of the two time step data files are based on the root name of the simulation input data file. For example, if the simulation input data file is ***MyNetwork.trf*** the names of the time step data files will be ***MyNetwork.tsi*** and ***MyNetwork.tsd***. Both files are required to animate vehicles and signals. The ***.tsi*** extension denotes the time step index file used to "look up" data in the time step data (***.tsd***) file.

2.1 Time Step Data File

The first 16 bytes of the of the time step data (***.tsd***) file compose the file header. The file header contains two items of information used for maintaining the data interface. The first item, which comprises the first 15 bytes of the header, is an identifier that specifies the version of the interface specification currently used by TRAFVU. If this identifier does not match the identifier in TRAFVU, TRAFVU will not process the file and will issue an error message indicating the mismatched version identifiers. The value of the identifier for the current release of TRAFVU is:

```
5.00_07-APR-00
```

The second item, which occupies the 16th byte of the header, is a byte order key. For PC versions of TRAFVU, the byte order key must be set to the character "L" indicating little endian. For Sun Solaris versions of TRAFVU, the byte order key must be set to the character "B" indicating big endian.

The remainder of the ***.tsd*** file contains ***data*** and ***complete*** messages. ***Data*** messages are sorted first by time, second by type, and third by link. At the end of the set of messages for each type of data, the file contains a ***complete*** message. Section 3 specifies the format and content of these ***data*** and ***complete*** messages. Figure 1 illustrates the layout of the ***.tsd*** file for a traffic network that has ***L*** links and ***N*** time steps. The data messages in this file consist of four types: vehicle, incident, signal, and ramp meter. Of these messages, only the vehicle message is required; the others will exist only if the traffic features they represent are present in the network.

Each vehicle message contains vehicle information for all vehicles on a particular link. Therefore, at a given time step there are multiple vehicle messages (provided there is more than one link in the network). Vehicle messages can vary in size (number of bytes) from one time step to the next depending on the number of vehicles on the specified link at the specified time step. Each incident message contains information for all incidents in the network. Therefore, at a given time step there is only one message for incidents. The incident message will vary in size depending on the number of incidents that occur at the specified time step. Each signal and ramp meter message contains state information for all signals or ramp meters in the network. Therefore, at a given time step there is only one message for signals and one message for ramp meters. The sizes of these messages do not vary from time step to time step.

Vehicle and incident messages are grouped together and are terminated by a single ***complete*** message. Signal and ramp meter messages are grouped together and are terminated by a single ***complete*** message. The entire set of vehicle, incident, ***complete***, signal, ramp meter, and ***complete*** messages is then repeated for each time step.

2.2 Time Step Index File

Because TRAFVU animates both forward and backwards in time and can jump to any point in simulation time, it needs an efficient means for jumping to specific messages within the time step data file. The time step index (***.tsi***) file provides quick access to data within the time step data file. The ***.tsi*** file contains indexes (pointers) to sections of data within the ***.tsd*** file. For each time step, there are two indexes, one for vehicles and one for

signals. These indexes point to the starting byte of the specific messages in the ***.tsd*** file and are illustrated in Figure 1 by the arrows marked with lower case letters. For example, the ***.tsi*** file associated with the ***.tsd*** file illustrated in Figure 1, has the following layout:

a, b, c, d, . . ., y, z.

Each letter in the above sequence represents an index into the ***.tsd*** file. Indexes a and b represent time step 1, c and d represent time step 2, and y and z represent the last time step. Each index is of the C++ type, `streampos,` which is typically (but not necessarily) 4 bytes. If a network contains no signals or ramp meters, the second index for each time step (i.e., b, d, z) is set to zero.

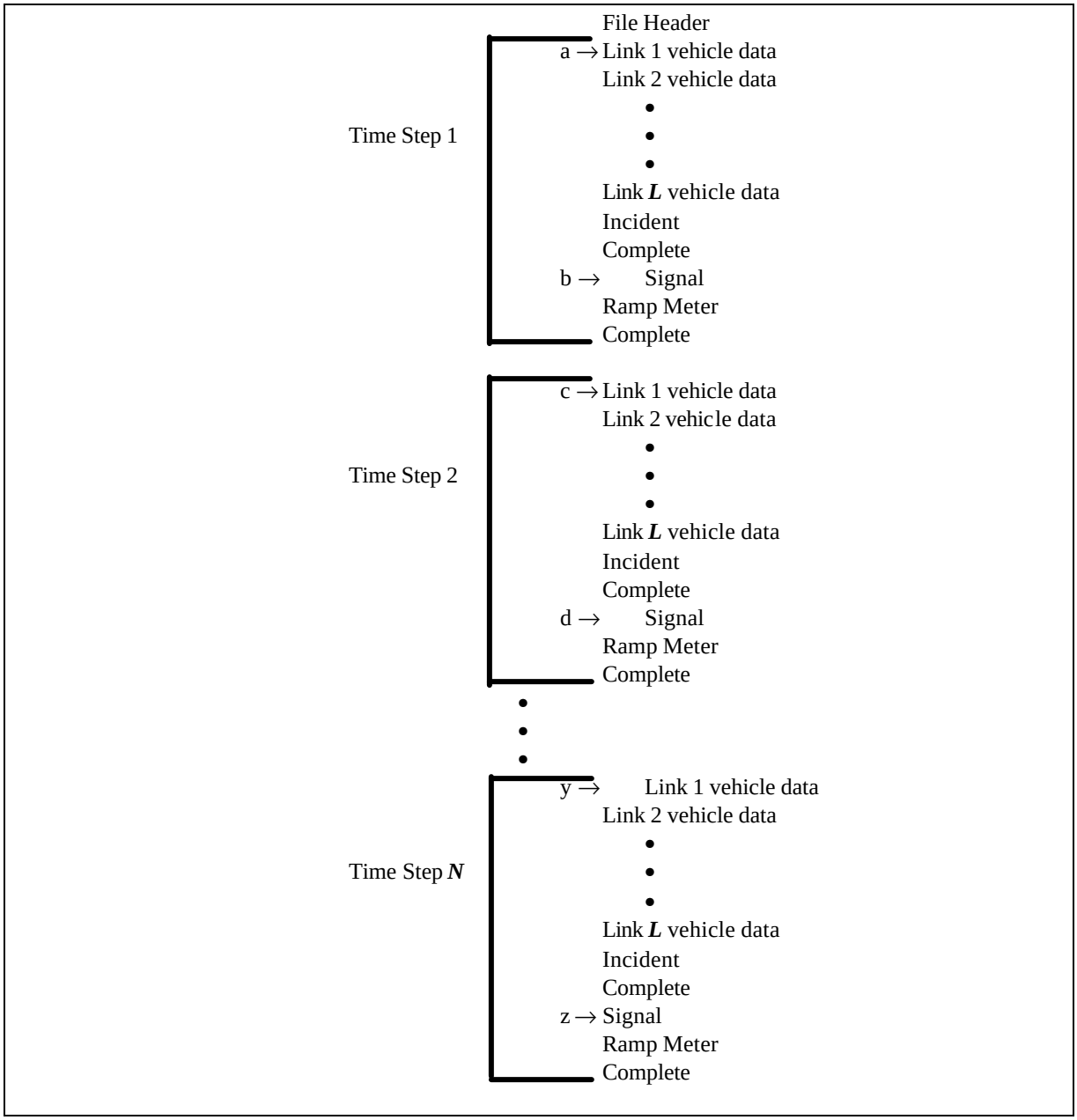

Figure 1. Layout of the time step data file.

3. Time Interval Data Files

The time interval data files contain measures of effectiveness (MOE) data that are generated by CORSIM at the end of each time interval in the simulation. The time interval is a user-specified parameter consisting of an integer number of time steps. The names of the two time interval data files are based on the root name of the simulation input data file. For example, if the simulation input data file is ***MyNetwork.trf*** the names of the time interval data files will be ***MyNetwork.tii*** and ***MyNetwork.tid***. Both files are required to view and animate MOE data. The ***.tii*** extension denotes the time interval index file used to "look up" data in the time interval data (***.tid***) file.

3.1 Time Interval Data File

The first 16 bytes of the of the time interval data (***.tid***) file compose the file header. The file header contains two items of information used for maintaining the data interface. The first item, which comprises the first 15 bytes of the header, is an identifier that specifies the version of the interface specification currently used by TRAFVU. If this identifier does not match the identifier in TRAFVU, TRAFVU will not process the file and will issue an error message indicating the mismatched version identifiers. The value of the identifier for the current release of TRAFVU is:

```
5.00_20-JAN-99
```

The second item, which occupies the 16th byte of the header, is a byte order key. For PC versions of TRAFVU, the byte order key must be set to the character "L" indicating little endian. For Sun Solaris versions of TRAFVU, the byte order key must be set to the character "B" indicating big endian.

The remainder of the ***.tid*** file contains ***data*** and ***complete*** messages. ***Data*** messages are sorted by time. At the end of the data message for a time interval, the file contains a ***complete*** message. Section 3 specifies the format and content of these ***data*** and ***complete*** messages. Figure 2 illustrates the layout of the ***.tid*** file for a traffic network that has ***L*** links and ***M*** time intervals.

There is only one type of time interval data message: link MOE data. Each link MOE data message contains MOE data for all links in the network. Therefore, for a given time interval there is only one message for link MOE data. The size of this message does not vary from time interval to time interval. The link MOE data message is followed by a single ***complete*** message, indicating the end of the time interval.

		File Header
Time Interval 1	a→	Link MOE data: link 1, link 2, . . ., link ***L***
		Complete
Time Interval 2	b→	Link MOE data: link 1, link 2, . . ., link ***L***
		Complete
		•
		•
		•
Time Interval ***M***	z→	Link MOE data: link 1, link 2, . . ., link ***L***
		Complete

Figure 2. Layout of the time interval data file.

3.2 Time Interval Index File

Because TRAFVU animates both forward and backwards in time and can jump to any point in simulation time, it needs an efficient means for jumping to specific messages within the time interval data file. The time interval index (***.tii***) file provides quick access to data within the time interval data file. The ***.tii*** file contains indexes (pointers) to sections of data within the ***.tid*** file. For each time interval, there is an index for the link MOE data message. These indexes point to the starting bytes of the link MOE data messages in the ***.tid*** file and are illustrated in Figure 2 by the arrows marked with lower case letters. For example, the ***.tii*** file associated with the ***.tid*** file illustrated in Figure 2, has the following layout:

a, b, . . ., z

Each index is of the C++ type, `streampos,` which is typically (but not necessarily) 4 bytes.

4. Message Content

Each of the messages described in the preceding sections has a well-defined format and content. The formats of these messages are the same as those used in TRAFVU's socket communications interface. In this section, we describe, in detail, the structure and content of each of the messages. For an understanding of the underlying concepts that led to this message design, please refer to the Traffic Research Laboratory Graphics Processor Interface Control Document (ICD 5.0). ICD 5.0 presents the messages in a generic format; however, in this document we present only the specific message structure and content as it applies to the file interface. Additional information regarding individual fields in the messages can be found in the TRAFVU Data Description Document.

The first three fields of every message specify the name, size and simulation time of the message. The second field specifies the size of the message in bytes, excluding the first three fields (12 bytes).

In the value column of the following tables, we specify certain values using symbolic names rather than actual values. These symbolic names are used by TRAFVU rather than hard-coded values to provide software maintainability. Appendix A provides a cross reference between the symbolic names and their values. Within TRAFVU the symbolic names are specified in C++ header (***.h***) files. Those files are available to anyone coding this file interface. In the following tables, symbolic names are indicated using bold **`Courier`** font.

In all messages specified in this section, Link ID values are formed by multiplying the link's up-stream node ID (USN) by 10,000 and adding the link's down-stream node ID (DSN). That is,

$$\text{Link ID} = \text{USN} * 10000 + \text{DSN}.$$

4.1 Vehicle Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	**LG_Data_GP**
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time in seconds that the data in this message represents
Request Type	unsigned integer	4	**DR_TS_VEHICLE**
Request Handle	unsigned integer	4	1
Class ID	unsigned integer	4	**Link**
Action ID	unsigned integer	2	**UPDATE**
Attribute ID Count	unsigned integer	2	0
Number of Aggregate Classes	unsigned integer	2	1
Class ID	unsigned integer	4	**Vehicle**
Action ID	unsigned integer	2	**SEARCH**
Attribute ID Count	unsigned integer	2	1
Attribute ID	unsigned integer	2	**V_InputAndAnimate**
Number of Aggregate Classes	unsigned integer	2	0
Instance ID Count	unsigned integer	2	1
Instance ID	unsigned integer	4	ID of link containing vehicles for which this message is reporting
Instance ID Count	unsigned integer	2	number of vehicles on the specified link at the specified simulation time
Global Vehicle ID	unsigned integer	4	global vehicle ID of first vehicle in this message
Fleet	unsigned integer	1	0 = Auto, 1 = truck, 2 = carpool, 3 = bus
Vehicle Type	unsigned integer	1	CORSIM vehicle type
Vehicle Length	unsigned integer	1	vehicle length in feet
Driver Type	unsigned integer	1	CORSIM driver type

Lane ID	unsigned integer	1	CORSIM ID of lane in which vehicle is traveling
Vehicle Position	signed integer	4	vehicle's distance from up-stream node of link in feet
Previous USN	unsigned integer	2	up-stream node ID of the previous link the vehicle traveled
Turn Code	unsigned integer	1	vehicle turn code: 0 = left, 1 = through, 2 = right, 3 = left diagonal, 4 = right diagonal, 5 = source emission
Queue Status	unsigned integer	1	0 = vehicle is currently not in queue, 1 = vehicle is currently in queue
Acceleration	signed integer	1	vehicle's instantaneous acceleration in feet/second/second
Velocity	unsigned integer	1	vehicle's instantaneous velocity in feet/second
Lane Change Status	unsigned integer	1	0 = vehicle does not want to change lanes, 1 = vehicle wants to change lanes
Target Lane	unsigned integer	1	CORSIM ID of lane vehicle would like to occupy
Destination Node	unsigned integer	2	node ID of the vehicles destination node
Leader Vehicle ID	unsigned integer	4	global ID of vehicle's leader vehicle
Follower Vehicle ID	unsigned integer	4	global ID of vehicle's follower vehicle
Previous Lane ID	unsigned integer	1	lane ID of lane the lane that the vehicle was previously in
REPEAT PREVIOUS 18 FIELDS FOR EACH VEHICLE IN THIS MESSAGE			

4.2 Incident Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	**LG_Data_GP**
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time in seconds that the data in this message represents
Request Type	unsigned integer	4	**DR_TS_INCIDENT**
Request Handle	unsigned integer	4	1
Class ID	unsigned integer	4	**Incident**
Action ID	unsigned integer	2	**SEARCH**
Attribute ID Count	unsigned integer	2	12
Attribute ID #1	unsigned integer	2	**IN_IncidentId**
Attribute ID #2	unsigned integer	2	**IN_LinkId**
Attribute ID #3	unsigned integer	2	**IN_IncidentType**
Attribute ID #4	unsigned integer	2	**IN_IncidentPosition**
Attribute ID #5	unsigned integer	2	**IN_IncidentLength**
Attribute ID #6	unsigned integer	2	**IN_OccurrenceTime**
Attribute ID #7	unsigned integer	2	**IN_Duration**
Attribute ID #8	unsigned integer	2	**IN_IncidentReactionPointPosition**
Attribute ID #9	unsigned integer	2	**IN_RubberneckFactor**
Attribute ID #10	unsigned integer	2	**IN_ModelType**
Attribute ID #11	unsigned integer	2	**IN_IncidentState**
Attribute ID #12	unsigned integer	2	**IN_AffectedLaneSLT**
Number of Aggregate Classes	unsigned integer	2	0
Instance ID Count	unsigned integer	2	number of incidents in the network at the specified simulation time

Instance ID	unsigned integer	4	ID of first incident in this message
Incident ID	unsigned integer	4	ID of the incident (same value as previous field)
Link ID	unsigned integer	4	ID of link on which the specified incident is occurring
Incident Type	unsigned integer	2	Incident Type: 0 = unknown, 1 = freeway, 2 = long term, 3 = parking, 4 = short term
Incident Position	float (IEEE format)	4	position of incident along link measured in feet from link's up-stream node
Incident Length	float (IEEE format)	4	length of the incident in feet
Occurrence Time	unsigned integer	4	time step at which this incident begins
Duration	unsigned integer	4	number of time steps this incident affects traffic
Reaction Point Position	float (IEEE format)	4	distance upstream from the start of the incident at which vehicles begin to react to the incident
Rubbernecking Factor	float (IEEE format)	4	CORSIM rubbernecking factor in %
Model Type	unsigned integer	2	CORSIM model type: 3 = NETSIM, 8 = FRESIM
Incident State	unsigned integer	2	incident state: 0 = not in progress, 1 = in progress
Number of Affected Lanes	unsigned integer	2	number of lanes affected by the incident (maximum = 11)
Affected Lane ID	unsigned integer	4	CORSIM lane ID of first lane affected by the incident
Incident Code	unsigned integer	2	incident code for first lane: 0 = normal speed, 1 = rubbernecking, 2 = blocked
Affected Lane ID	unsigned integer	4	CORSIM lane ID of second lane affected by the incident
Incident Code	unsigned integer	2	incident code for second lane: 0 = normal speed, 1 = rubbernecking, 2 = blocked
• • •			
Affected Lane ID	unsigned integer	4	CORSIM lane ID of last lane affected by the incident
Incident Code	unsigned integer	2	incident code for last lane: 0 = normal speed, 1 = rubbernecking, 2 = blocked
REPEAT THE PREVIOUS 15 to 35 FIELDS FOR EACH INCIDENT IN THIS MESSAGE			

4.3 Signal Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	**LG_Data_GP**
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time in seconds that the data in this message represents
Request Type	unsigned integer	4	**DR_TS_SIGNAL**
Request Handle	unsigned integer	4	1
Class ID	unsigned integer	4	**Link**
Action ID	unsigned integer	2	**UPDATE**
Attribute ID Count	unsigned integer	2	1
Attribute ID	unsigned integer	2	**LK_MovementCode**
Number of Aggregate Classes	unsigned integer	2	0
Instance ID Count	unsigned integer	2	number of links under signal control
Link ID	unsigned integer	4	ID of first link in the message
Left Turn Code	unsigned integer	2	Signal code for left turns: 0 = red, 1 = yellow, 2 = protected green, 3 = green 4 = none
Through Code	unsigned integer	2	Signal code for through movements
Right Turn Code	unsigned integer	2	Signal code for right turns
Diagonal Turn Code	unsigned integer	2	Signal code for diagonal turns
REPEAT THE PREVIOUS 5 FIELDS FOR EACH SIGNAL IN THIS MESSAGE			

4.4 Ramp Meter Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	**LG_Data_GP**
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time in seconds that the data in this message represents
Request Type	unsigned integer	4	**DR_TS_RAMPMETER**
Request Handle	unsigned integer	4	1
Class ID	unsigned integer	4	**Link**
Action ID	unsigned integer	2	**UPDATE**
Attribute ID Count	unsigned integer	2	1
Attribute ID	unsigned integer	2	**LK_MovementCode**
Number of Aggregate Classes	unsigned integer	2	0
Instance ID Count	unsigned integer	2	number of links with ramp meters
Link ID	unsigned integer	4	ID of first link in the message
Left Turn Code	unsigned integer	2	Signal code for left turns = 4 (none)
Through Code	unsigned integer	2	Signal code for through movements: 0 = red, 2 = protected green
Right Turn Code	unsigned integer	2	Signal code for right turns = 4 (none)
Diagonal Turn Code	unsigned integer	2	Signal code for diagonal turns = 4 (none)
REPEAT THE PREVIOUS 5 FIELDS FOR EACH RAMP METER IN THIS MESSAGE			

4.5 Link Measures Of Effectiveness (MOE) Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	**LG_Data_GP**
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time in seconds that the data in this message represents
Request Type	unsigned integer	4	**DR_TI_LINK**
Request Handle	unsigned integer	4	1
Class ID	unsigned integer	4	**Link**
Action ID	unsigned integer	2	**UPDATE**
Attribute ID Count	unsigned integer	2	0
Number of Aggregate Classes	unsigned integer	2	1
Class ID	unsigned integer	4	**LinkMOE**
Action ID	unsigned integer	2	**SEARCH**
Attribute ID Count	unsigned integer	2	41
Attribute ID #1	unsigned integer	2	**LM_TimeInterval**
Attribute ID #2	unsigned integer	2	**LM_AverageVehicleLength**
Attribute ID #3	unsigned integer	2	**LM_CumulativeStops**
Attribute ID #4	unsigned integer	2	**LM_CumulativeContent**
Attribute ID #5	unsigned integer	2	**LM_CumulativeVehicleDischargeLeft**
Attribute ID #6	unsigned integer	2	**LM_CumulativeVehicleDischargeThrough**
Attribute ID #7	unsigned integer	2	**LM_CumulativeVehicleDischargeRight**
Attribute ID #8	unsigned integer	2	**LM_CumulativeTravelTimeLeft**
Attribute ID #9	unsigned integer	2	**LM_CumulativeTravelTimeThrough**
Attribute ID #10	unsigned integer	2	**LM_CumulativeTravelTimeRight**
Attribute ID #11	unsigned integer	2	**LM_CumulativeTripsLinkLeft**

Attribute ID #12	unsigned integer	2	**LM_CumulativeTripsLinkThrough**
Attribute ID #13	unsigned integer	2	**LM_CumulativeTripsLinkRight**
Attribute ID #14	unsigned integer	2	**LM_CumulativeQueueDelayLeft**
Attribute ID #15	unsigned integer	2	**LM_CumulativeQueueDelayThrough**
Attribute ID #16	unsigned integer	2	**LM_CumulativeQueueDelayRight**
Attribute ID #17	unsigned integer	2	**LM_CumulativeStopDelayLeft**
Attribute ID #18	unsigned integer	2	**LM_CumulativeStopDelayThrough**
Attribute ID #19	unsigned integer	2	**LM_CumulativeStopDelayRight**
Attribute ID #20	unsigned integer	4	**LM_CumulativeLaneChanges**
Attribute ID #21	unsigned integer	2	**LM_CumulativePhaseFailures**
Attribute ID #22	unsigned integer	2	**LM_CumulativeFuelConsumptionAuto**
Attribute ID #23	unsigned integer	2	**LM_CumulativeFuelConsumptionBus**
Attribute ID #24	unsigned integer	2	**LM_CumulativeFuelConsumptionTruck**
Attribute ID #25	unsigned integer	2	**LM_CumulativeEmissionsKMHCO**
Attribute ID #26	unsigned integer	2	**LM_CumulativeEmissionsKMHHC**
Attribute ID #27	unsigned integer	2	**LM_CumulativeEmissionsKMHNOx**
Attribute ID #28	unsigned integer	2	**LM_AverageQueueSLT**
Attribute ID #29	unsigned integer	2	**LM_MaxQueueSLT**
Attribute ID #30	unsigned integer	2	**LM_PersonTrips**
Attribute ID #31	unsigned integer	2	**LM_CumulativeMilesTraversedLeft**
Attribute ID #32	unsigned integer	2	**LM_CumulativeMilesTraversedThrough**
Attribute ID #33	unsigned integer	2	**LM_CumulativeMilesTraversedRight**
Attribute ID #34	unsigned integer	2	**LM_CumulativeMilesTraversedAll**
Attribute ID #35	unsigned integer	2	**LM_BUS_TotalBusesDischarged**
Attribute ID #36	unsigned integer	2	**LM_BUS_TotalPersonTrips**
Attribute ID #37	unsigned integer	2	**LM_BUS_TotalTravelTime**

Attribute ID #38	unsigned integer	2	**LM_BUS_TotalDelayTime**
Attribute ID #39	unsigned integer	2	**LM_BUS_MovingVSTravelTime**
Attribute ID #40	unsigned integer	2	**LM_BUS_MeanSpeed**
Attribute ID #41	unsigned integer	2	**LM_BUS_TotalBusesThatStopped**
Attribute ID #42	unsigned integer	2	**LM_CumulativeControlDelayLeft**
Attribute ID #43	unsigned integer	2	**LM_CumulativeControlDelayThrough**
Attribute ID #44	unsigned integer	2	**LM_CumulativeControlDelayRight**
Number of Aggregate Classes	unsigned integer	2	0
Instance ID Count	unsigned integer	2	number of links contained in this message
Link ID	unsigned integer	4	ID of link containing MOE for which this message is reporting
Number of Time Intervals	unsigned integer	2	1
Time Interval ID	unsigned integer	4	9999 (indicates “current” time interval)
Time Interval Index	unsigned integer	4	index of the time interval
Average Vehicle Length	float (IEEE format)	4	average vehicle length in feet
Cumulative Stops	unsigned integer	4	count of cumulative stops on the link
Cumulative Content	unsigned integer	4	cumulative number of vehicles on the link
Cum. Discharge Left	unsigned integer	4	cumulative number of vehicles that discharged the link turning left
Cum. Discharge Through	unsigned integer	4	cumulative number of vehicles that discharged the link moving through
Cum. Discharge Right	unsigned integer	4	cumulative number of vehicles that discharged the link turning right
Cum. Travel Time Left	float (IEEE format)	4	total time that left-discharging vehicles have been on this link (seconds)
Cum. Travel Time Through	float (IEEE format)	4	total time that through-discharging vehicles have been on this link (seconds)
Cum. Travel Time Right	float (IEEE format)	4	total time that right-discharging vehicles have been on this link (seconds)
Cumulative Trips Left	unsigned integer	4	total number of left-discharging vehicles that have completely traversed the link
Cumulative Trips Through	unsigned integer	4	total number of through-discharging vehicles that have completely traversed the link
Cumulative Trips Right	unsigned integer	4	total number of right-discharging vehicles that have completely traversed the link

Cum. Queue Delay Left	float (IEEE format)	4	cumulative time left-discharging vehicles have been in queue on this link (seconds)
Cum. Queue Delay Through	float (IEEE format)	4	cumulative time through-discharging vehicles have been in queue on this link (seconds)
Cum. Queue Delay Right	float (IEEE format)	4	cumulative time right-discharging vehicles have been in queue on this link (seconds)
Cum. Stop Delay Left	float (IEEE format)	4	cumulative time left-discharging vehicles have been stopped on this link (seconds)
Cum. Stop Delay Through	float (IEEE format)	4	cumulative time through-discharging vehicles have been stopped on this link (seconds)
Cum. Stop Delay Right	float (IEEE format)	4	cumulative time right-discharging vehicles have been stopped on this link (seconds)
Cumulative Lane Changes	unsigned integer	4	cumulative number of lane changes on this link
Cumulative Phase Failures	unsigned integer	4	cumulative number of phase failures on this link
Cum. Fuel Consumption - Auto	float (IEEE format)	4	cumulative fuel consumption by autos
Cum. Fuel Consumption - Bus	float (IEEE format)	4	cumulative fuel consumption by buses
Cum. Fuel Consumption - Truck	float (IEEE format)	4	cumulative fuel consumption by trucks
Cum. Emissions Rate - CO	float (IEEE format)	4	total amount of CO emitted divided by the product of the link length and time since simulation start (kg-mi/hr)
Cum. Emissions Rate - HC	float (IEEE format)	4	total amount of HC emitted divided by the product of the link length and time since simulation start (kg-mi/hr)
Cum. Emissions Rate - NOx	float (IEEE format)	4	total amount of NOx emitted divided by the product of the link length and time since simulation start (kg-mi/hr)
# of Lanes - Average Queue	unsigned integer	2	number of lanes in link for which average queue is being reported
Average Queue Lane 1	float (IEEE format)	4	average queue in lane 1 (vehicles)
Average Queue Lane 2	float (IEEE format)	4	average queue in lane 2 (vehicles)
Average Queue Lane 3	float (IEEE format)	4	average queue in lane 3 (vehicles)
Average Queue Lane 4	float (IEEE format)	4	average queue in lane 4 (vehicles)
Average Queue Lane 5	float (IEEE format)	4	average queue in lane 5 (vehicles)
Average Queue Lane 6	float (IEEE format)	4	average queue in lane 6 (vehicles)
Average Queue Lane 7	float (IEEE format)	4	average queue in lane 7 (vehicles)
Average Queue Lane 8	float (IEEE format)	4	average queue in lane 8 (vehicles)

Average Queue Lane 9	float (IEEE format)	4	average queue in lane 9 (vehicles)
Average Queue Lane 10	float (IEEE format)	4	average queue in lane 10 (vehicles)
Average Queue Lane 11	float (IEEE format)	4	average queue in lane 11 (vehicles)
# of Lanes – Maximum Queue	unsigned integer	2	number of lanes in link for which maximum queue is being reported
Maximum Queue Lane 1	float (IEEE format)	4	maximum queue in lane 1 (vehicles)
Maximum Queue Lane 2	float (IEEE format)	4	maximum queue in lane 2 (vehicles)
Maximum Queue Lane 3	float (IEEE format)	4	maximum queue in lane 3 (vehicles)
Maximum Queue Lane 4	float (IEEE format)	4	maximum queue in lane 4 (vehicles)
Maximum Queue Lane 5	float (IEEE format)	4	maximum queue in lane 5 (vehicles)
Maximum Queue Lane 6	float (IEEE format)	4	maximum queue in lane 6 (vehicles)
Maximum Queue Lane 7	float (IEEE format)	4	maximum queue in lane 7 (vehicles)
Maximum Queue Lane 8	float (IEEE format)	4	maximum queue in lane 8 (vehicles)
Maximum Queue Lane 9	float (IEEE format)	4	maximum queue in lane 9 (vehicles)
Maximum Queue Lane 10	float (IEEE format)	4	maximum queue in lane 10 (vehicles)
Maximum Queue Lane 11	float (IEEE format)	4	maximum queue in lane 11 (vehicles)
Cumulative Person Trips	float (IEEE format)	4	cumulative number of people that have traversed the link
Cum. Miles Traversed Left	float (IEEE format)	4	total number of miles that left-discharging vehicles have traversed on this link
Cum. Miles Traversed Through	float (IEEE format)	4	total number of miles that through-discharging vehicles have traversed on this link
Cum. Miles Traversed Right	float (IEEE format)	4	total number of miles that right-discharging vehicles have traversed on this link
Cum. Miles Traversed All	float (IEEE format)	4	total number of miles that vehicles have traversed on this link
Total Buses Discharged	unsigned integer	4	total number of buses discharged from this link
Total Person Trips – BUS	unsigned integer	4	total number of people that have completely traversed this link in a bus
Total Travel Time – BUS	float (IEEE format)	4	total time discharged buses have traveled on this link
Total Delay Time – BUS	float (IEEE format)	4	total time discharged buses were delayed on this link
Total Moving Time – BUS	float (IEEE format)	4	total time discharged buses were moving on this link
Average Speed – BUS	float (IEEE format)	4	average speed of buses that traversed this link

Total Buses Stopped	unsigned integer	4	total number of buses that stopped at least once on this link
Cum. Control Delay Left	float (IEEE format)	4	cumulative time left-discharging vehicles have been delayed by controls on this link (vehicle-minutes)
Cum. Control Delay Through	float (IEEE format)	4	cumulative time through-discharging vehicles have been delayed by controls on this link (vehicle-minutes)
Cum. Control Delay Right	float (IEEE format)	4	cumulative time right-discharging vehicles have been delayed by controls on this link (vehicle- minutes)
REPEAT PREVIOUS 69 FIELDS FOR EACH LINK IN THIS MESSAGE			

4.6 Complete Message

Field	Type	Size (bytes)	Value
Message Name	unsigned integer	4	LG_Complete_GP = 3003
Message Length	unsigned integer	4	length of this message in bytes, excluding the first three fields
Simulation Time	unsigned integer	4	the simulation time at which this message is sent
Request Type	unsigned integer	4	the Request Type of the data message with which this complete message is associated
Request Handle	unsigned integer	4	1

5. References

Federal Highway Administration, “CORSIM User’s Guide, Version 5.0”, March 2001.

Federal Highway Administration, “CORSIM Reference Manual, Version 5.0”, March 2001.

Kaman Sciences Corporation, “TRAFVU Data Description Document”, Contract No. DTFH61-95-C-00074, 1996, DRAFT.

Kaman Sciences Corporation and Viggen Corporation, “Traffic Research Laboratory Interface Control Document, Version 5.0”, Contract No. DTFH61-95-C-00074, 1996, DRAFT.

Appendix A: Symbolic Name Cross Reference

Message Name Cross Reference

Symbolic Name	Value
LG_Complete_GP	3003
LG_Data_GP	3001

Request Type Cross Reference

Symbolic Name	Value
DR_TI_LINK	13000
DR_TS_INCIDENT	14400
DR_TS_RAMPMETER	14300
DR_TS_SIGNAL	14200
DR_TS_VEHICLE	14000

Class ID Cross Reference

Symbolic Name	Value
Incident	13000
Link	18000
LinkMOE	19000
Vehicle	33000

Action ID Cross Reference

Symbolic Name	Value
CREATE	0
SEARCH	2
UPDATE	1

Attribute ID Cross Reference

Symbolic Name	Value
IN_AffectedLaneSLT	13501
IN_Duration	13106
IN_IncidentId	13100
IN_IncidentLength	13104
IN_IncidentPosition	13103
IN_IncidentReactionPointPosition	13107
IN_IncidentState	13500
IN_IncidentType	13102
IN_LinkId	13101
IN_ModelType	13109
IN_OccurrenceTime	13105
IN_RubberneckFactor	13108
LK_MovementCode	18500
LM_AverageQueueSLT	19454
LM_AverageVehicleLength	19479
LM_BUS_MeanSpeed	19402
LM_BUS_MovingVSTravelTime	19401
LM_BUS_TotalBusesDischarged	19404
LM_BUS_TotalBusesThatStopped	19405
LM_BUS_TotalDelayTime	19406
LM_BUS_TotalPersonTrips	19403
LM_BUS_TotalTravelTime	19407
LM_CumulativeContent	19408
LM_CumulativeControlDelayLeft	19411
LM_CumulativeControlDelayThrough	19412
LM_CumulativeControlDelayRight	19413
LM_CumulativeEmissionsKMHCO	19427
LM_CumulativeEmissionsKMHHC	19428
LM_CumulativeEmissionsKMHNOx	19429
LM_CumulativeFuelConsumptionAuto	19431
LM_CumulativeFuelConsumptionBus	19432
LM_CumulativeFuelConsumptionTruck	19433
LM_CumulativeLaneChanges	19434
LM_CumulativeMilesTraversedAll	19435
LM_CumulativeMilesTraversedLeft	19436

Symbolic Name	Value
LM_CumulativeMilesTraversedRight	19438
LM_CumulativeMilesTraversedThrough	19437
LM_CumulativePhaseFailures	19449
LM_CumulativeQueueDelayLeft	19451
LM_CumulativeQueueDelayRight	19453
LM_CumulativeQueueDelayThrough	19452
LM_CumulativeStopDelayLeft	19461
LM_CumulativeStopDelayRight	19463
LM_CumulativeStopDelayThrough	19462
LM_CumulativeStops	19464
LM_CumulativeTravelTimeLeft	19472
LM_CumulativeTravelTimeRight	19474
LM_CumulativeTravelTimeThrough	19473
LM_CumulativeTripsLinkLeft	19476
LM_CumulativeTripsLinkRight	19478
LM_CumulativeTripsLinkThrough	19477
LM_CumulativeVehicleDischargeLeft	19481
LM_CumulativeVehicleDischargeRight	19483
LM_CumulativeVehicleDischargeThrough	19482
LM_MaxQueueSLT	19455
LM_PersonTrips	19448
LM_TimeInterval	19400
V_InputAndAnimate	33500