APPENDIX D TECHNOLOGY ASSESSMENT SOURCES

This appendix provides a list of technical sources and the URL's of web sites that were used to obtain information on the systems evaluated in Section 7.5. This information is intended to facilitate more in-depth study of the systems and to provide up-to-date technical, availability, and price information. Whenever possible, information for direct contact with the companies involved will also be provided. As a general rule, ITS America's World Wide Web site, **http://www.itsa.org/**, is a major source of information, however it is restricted to ITS America membership.

D.1 Wireless

Wireless has seen in recent times an explosion of new books, making it almost impossible to track the wealth of information now available. As a compromise, reference will be made only to those works that endure the test of time, though still providing enough timely information to be useful.

D.1.1 MAN's

Due to their proprietary nature, there is little existing information on MAN's, especially on those using the ISM band. Therefore, only WWW references can be provided at this time.

Company	URL
Metricom, Inc. 980 University Avenue Los Gatos, CA 95030 (408) 399-8200	http://www.metricom.com/metricom.html
Tetherless Access Ltd. 930 E. Arques Ave. Sunnyvale CA 94086 (408) 523-8000	http://www.tetherless.net/home.html

D.1.2 Land Mobile Systems

General Sources:

1. *Wireless Information Networks*, K. Pahlavan, A. Levesque, John Wiley & Sons, 1995
2. *Wireless Data Networking*, N.J. Muller, Artech House, 1995
3. *Wireless Personal Communications - The Future of Talk*, R. Schneiderman, IEEE Press, 1994
4. *Cellular Radio Systems*, D.M. Balston, R.C.V. Macario, Eds., Artech House, 1993
5. *Mobile Information Systems*, J. Walker, Ed., Artech House, 1990

GSM Sources:

1. *The GSM System for Mobile Communications*, M. Mouly, M.-B. Pautet, self-published, 1992
2. *An Introduction to GSM*, S.M. Redl, M.K. Weber, M.W. Oliphant, Artech House, 1995
3. *Mobile Radio Communications*, R. Steele, Ed., Pentech Press Publishers, London, 1992

WWW sites and contacts:

Company	**URL**
Omnipoint Corporation 1365 Garden of the Gods Road Colorado Springs, CO 80907 (719) 548-1200	http://www.omnipoint.com/
Northern Telecom Ltd.	http://www.nortel.com/english/wireless/omnipnt.html
RAM Mobile Data Woodbridge, NJ 908-602-5500	http://www.ram-wireless.com/
BellSouth Mobile Data, Inc. 1100 Peachtree Street, NE, Room 5D09 Atlanta, GA 30309-4599 (404) 249-4744	http://www.data-mobile.com/
Ericsson Mobile Communications AB	Mobitex http://www.ericsson.com/mobitex/ http://www.ericson.nl/EPI/BR/2mobitex.html D-AMPS 1900 http://www.ericsson.com/systems/D-AMPS_1900/
ARDIS Lincolnshire, IL 708-913-1215	http://www.ardis.com/ardis_hp/website2.htm
IBM Wireless 700 Park Office Road, Highway 54 Building 662 Research Triangle Park, NC 27709 (919) 543-7708	http://www.raleigh.ibm.com/cel/celinfo.html
Nextel Communications Inc. Rutherford, NJ	
Geotek Communications Inc. 20 Craig Road, Montvale, NJ 07645 (201) 930-9305	http://www.geotek.com/
SkyTel Corp.	http://www.skytel.com/ http://www.skytel.com/Products/2way/

Motorola	http://www.mot.com/MIMS/WDG/ http://www.mot.com/MIMS/PPG/org/amg/products/tango/
QUALCOMM Incorporated 6455 Lusk Boulevard San Diego, CA 92121-2779 (619) 587-1121	http://www.qualcomm.com/QualHome.html/

CDPD Sources:

Company	URL
IBM Corp. Wireless Headquarters	http://www.raleigh.ibm.com/cel/celinfo.html
AT&T Wireless Services	http://www.airdata.com/index.html
CDPD Forum Inc.	http://www.cdpd.org/
Northern Telecom Ltd.	http://www.nortel.com/english/wireless/cdpd_net.html
Pacific Communication Sciences Inc.	http://www.pcsi.com/html/pr_cdpd.html
Tellabs Wireless Inc.	http://steinbrecher.com/architecture.html http://steinbrecher.com/compare.html
Rockwell International Corp.	http://www.nb.rockwell.com/pb/cdpd.html http://www.nb.rockwell.com/wcd/wireless.html
Sierra Wireless Inc.	http://www.sierrawireless.ca/products.htm
Cincinnati Microwave	http://www.cnmw.com/ http://www.cnmw.com/product/cdpd/cdpdhm.htm
Motorola	http://www.mot.com/MIMS/WDG/Technology/CelTAC/

CDPD Service Providers

Company	Service Name	Deployed
Ameritech Cellular Services Hoffman Estates, IL 708-248-2000	Wireless Packet Service	Chicago, Detroit/Ann Arbor, Gary,IN, Cincinnati, Columbus,OH, Milwaukee Data
Bell Atlantic Mobile Corp. Bedminster, NJ 908-306-7000	Airbridge Packet Service	Charlotte, NC; New London,CT; Northern New Jersey; Philadelphia; Phoenix; Pittsburgh; Washington,DC/ Baltimore; Hartford, CT
Comcast Cellular Communications Inc. Wayne, PA 610-995-5000		Philadelphia; Delaware; New Jersey
GTE Mobilnet Atlanta, GA 404-391-8000	CDPD Service	Houston, San Francisco, San Jose/ Oakland, Cleveland, Indianapolis, Memphis, Nashville, Tampa/ St. Petersburg
AT&T Wireless (ex-McCaw Cellular Communications Inc.) Kirkland, WA 206-803-4000	Airdata	Dallas, Las Vegas, Miami, New York, Seattle, Denver, Jacksonville, Orlando, Tampa/ St. Petersburg, West Palm Beach, Kansas City, Minneapolis, Oklahoma City, Pittsburgh, Portland, OR, Sacramento, Salt Lake City, San Antonio, San Jose
Nynex Mobile Communications Co. Orangeburg, NY 914-365-7200		Boston; New York
Sprint Cellular Co. Chicago 312-399-2275		New Mexico; Las Vegas, Greensboro/Winston-Salem, Norfolk

GSM/PCS 1900 Sources, and Service Providers

Company	URL
VODAFONE	http://www.vodafone.co.uk/n3/index/indhome
Northern Telecom Ltd.	http://www.nortel.com/english/wireless/pcs_1900.html
Sprint Spectrum L.P.	http://www.sprint.com/home/product/spectrum.html

D.1.3 Satellite Mobile Systems

In compiling the information on Satellite systems, two major sources were used:

1. *Satellite Communication Systems - Mobile and Fixed Services*, M.J. Miller, B. Vucetic, L. Berry, Eds., Kluwer Academic Publs., 1993
2. *Digital Satellite Communications Systems and Technologies - Military and Civil Applications*, A.N. Ince, Ed., Kluwer Academic Publs., 1992

In addition, extensive use was made of the WWW to track the most recent information on the proposed systems and to obtain the graphics relating to the systems' characteristics, mainly their orbits and coverage.

Company	URL
Iridium	http://leonardo.jpl.nasa.gov/msl/QuickLooks/iridiumQL.html
Teledesic	http://leonardo.jpl.nasa.gov/msl/QuickLooks/teledesicQL.html
Odyssey	http://leonardo.jpl.nasa.gov/msl/QuickLooks/odysseyQL.html
ICO Global Communications	http://www.i-co.co.uk/index-page.html
Orbcomm	http://leonardo.jpl.nasa.gov/msl/QuickLooks/orbcommQL.html
Skycell	http://www.azstarnet.com/public/commerce/satellite/
MSAT	http://www.radiosat.com/radiostar/msat.htm
OmniTRACS	http://www.qualcomm.com/ProdTech/Omni/
INMARSAT	http://www.inmarsat.org/inmarsat/
COMSAT	http://www.comsat.com/
GPS	http://leonardo.jpl.nasa.gov/msl/Programs/gps.html
DGPS	http://www.inforamp.net/~pinpoint/
Differential Corrections Inc. 10121 Miller Ave Cupertino, CA 95014 408-446-8350	http://www.dgps.com/
Omnistar, Inc. 8200 Westglen Houston, TX 77063 713-785-5850	http://www.omnistar.com/
Glonass	http://leonardo.jpl.nasa.gov/msl/QuickLooks/glonassQL.html
Mike's Spacecraft Library (@ JPL)	http://leonardo.jpl.nasa.gov/msl/home.html

D.1.4 Meteor Burst Systems

Main sources:

1. *Meteor Burst Communications - Theory and Practice*, D.L. Schilling, Ed., John Wiley & Sons, 1993
2. *Meteor Burst Communications*, J.Z. Schanker, Artech House, 1990

D.1.5 Broadcast Systems

An interesting article appeared recently in the IEEE Spectrum Magazine, covering most aspects of digital broadcasting:

1. "Broadcasting with Digital Audio", Robert Braham, Ed., IEEE Spectrum, March 1996

D.1.5.1 FM Subcarrier

Similar pages exist for other cities in the country:

City	URL
San Diego, CA	http://www.scubed.com/caltrans/sd/big_map.shtml
Los Angeles, CA	http://www.scubed.com/caltrans/la/la_big_map.shtml
Seattle, WA	http://www.wsdot.wa.gov/regions/northwest/NWFLOW/
Houston, TX	http://herman.tamu.edu/traffic.html
Chicago, IL	http://www.ai.eecs.uic.edu/GCM/CongestionMap.html

D.1.5.2 DAB

Company	URL
EuroDAB Newsletter	http://www.ebu.ch/dep_tech/eurodab.html
Digital Radio Research Inc. (DRRI)	http://radioworks.cbc.ca/radio/digital-radio/drri.html
USA Digital Radio	http://www.usadr.com/techieam.html

D.1.6 Short-Range Communications

ITS America's World Wide Web site, **http://www.itsa.org/** is the main source of short-range communications information, since it maintains a data base of all related information.

D.1.6.1 DSRC Communications

Company	Home Page
Hughes	http://www.hughes.com/

D.1.6.2 Vehicle-to-Vehicle Communications

AHS is still quite a new area, and information of interest can be found almost exclusively in trade magazines and in academic publications. A good example of the latter is the *IVHS Journal*, now *ITS Journal*, where a few papers have focused on this issue.

D.2 Wireline Communications

Sources in this area abound. Here are just a few ones that we think are more appropriate given their emphasis on performance:

1. *Advances in Telecommunications Networks*, W.S. Lee, D.C. Brown, Artech House, 1995
2. *FDDI and FDDI-II: Architecture, Protocols, and Performance*, B. Albert, A.P. Jayasumana, Artech House, 1994
3. *SMDS: Wide-Area Data Networking with Switched Multi-megabit Data Service*, R.W. Klessig, K. Tesink, Prentice-Hall, 1995
4. *Asynchronous Transfer Mode Networks: Performance Issues*, R.O. Onvural, Artech House, 1994

As for service contacts, all RBOC's and major telecommunication companies offer wireline services of all kinds.

APPENDIX E POTENTIAL USERS ACCORDING TO USER SERVICE GROUP

In order to enhance the understanding of the data loads generated by ITS services, the analyses were performed for seven distinct user service groups, each with its own population, message set, peak period definition, and message frequency of use. The user service groups include private vehicles, CVO-Local vehicles, CVO-long haul vehicles, travelers (PIAS users), transit management, emergency management, and probes.

The number of potential users that might buy a service was determined for each of the nine scenarios through the use of national statistics. The analysis used in the derivation is shown below, using the 1997 Urbansville scenario as an example. The same derivation was used for each of the other eight scenarios, working from the total population and number of household vehicles of the scenario region in that time frame. The theory is that the number of vehicles of all types can be related to the population, as long as the scenario regions all have the same services available. The lack of a particular service (e.g. fixed route transit in the rural scenario) was handled later in the data loading models with the lack of an entry in the database table of market packages of services for that scenario, preventing messages related to that service from being included in the message set for that scenario.

In the case of the Thruville scenario, the added traffic traveling completely through the entire scenario region must be added to the models shown here. This was accomplished by increasing the number of private vehicles and CVO long haul vehicles shown here by one-third. The other user service groups do not travel through the scenario region by definition.

The number of potential users was derived for the peak period defined for that particular user service group. The number of potential users for the off-peak period was then defined as a fraction of the peak period number.

E.1 Private Vehicle Service Group Users – Urbansville, 1997

The peak period for this user service group is defined as the two, three-hour periods of 6 am to 9 am, and 4 PM to 7 PM. This two-peak model may not be very pronounced over the traffic which occurs between the peaks in many urban areas, but the peaks are present. The number of household vehicles in the Urbansville region is defined in the Urbansville Scenario Guide for the five-year time frame as 1,688,970[1]. The average daily number of miles driven per household vehicle in the Urbansville region was derived from the average number of household vehicle miles traveled per year in the US (1.4096×10^{12})[2] divided by the total number of household vehicles in the US (1.6522×10^{8})[3]. This result (8531.6 miles per year) is divided by 365 to obtain the average household vehicle miles traveled per day (23.374). There is little error in the assumption that the miles driven are equal for every day of the week. The distribution of person trips by day of the week shows little variation between week days and weekend days[4]. The daily household vehicle miles traveled (23.374) is multiplied by the number of household vehicles in the Urbansville region (1,688,970) to obtain the Daily Vehicles Miles Traveled (DVMT) for Urbansville.

DVMT = 39,478,000 miles

Since we are principally interested in the peak period traffic, we must then obtain the DVMT in the peak period, consisting of the two, three-hour periods. The fraction of traffic found in one study to consistently occur during the peak periods was 45%[5]. The number of weekday trips in the peak periods was found by survey to be 41.3% of the daily trips[6]. A CALTRANS study found that the traffic counts during the peak periods were 37.6% of the daily traffic on their freeway system[7]. Using an rounded up average fraction of 42%, and multiplying DVMT by that peak-period fraction (0.42), results in the peak-period DVMT (PDVMT):

PDVMT = 16,700,000 miles

Dividing PDVMT by the average trip length during the peak period will result in the number of trips during the peak period. The trip length used is 11 miles[8]. Since 95% of the household travel

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[1] Urban Scenario Guide, Urbansville, Phase II, March 13, 1995.

[2] Summary of Travel Trends, 1990 National Personal Transportation Survey, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory, Oak Ridge TN, 1993, page 6.

[3] Summary of Travel Trends, 1990 National Personal Transportation Survey, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory, Oak Ridge TN, 1993, page 6.

[4] NPTS Databook, National Personal Transportation Survey, Volume I, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory, Oak Ridge TN, 1993, page 4-103.

[5] Hanks, J. W., and T. J. Lomax, Roadway Congestion in Major Urban Areas 1982 to 1988, Texas Transportation Institute, College Station, Texas, 1990, page D-5.

[6] NPTS Databook, National Personal Transportation Survey, Volume I, Center for Transportation Analysis, Energy Division, Oak Ridge National Laboratory, Oak Ridge TN, 1993, page 4-108.

[7] Perrin, C., California Department of Transportation, private communications, 1994.

[8] National Transportation Statistics, Annual Report, September 1993, Historical Compendium, 1960-1992, Department of Transportation, 1993, page 198.

during the AM commute time is commuter travel[9], and the average trip length for all trips is 9.0 miles[10], there is little error in using the 11 mile trip length for all trips in the peak periods. The resulting number of peak-period trips in the peak period defined (consisting of two, three-hour periods) is 1,520,000 trips. This result is divided by two to obtain the number of peak period trips occurring in each of the two three-hour periods, and is equal to 760,037 trips. Since we know that 95% of these trips are commuting trips (with normally a work day on the order of eight hours), and the average length of the commute is 11 miles, which is close to one-half of the average household vehicle miles traveled per day (23.374), it is assumed that each vehicle makes one trip during each of the two, three-hour peak periods in a day. This allows the translation of the number of trips to the number of vehicles which are potential users of the private vehicle user service group.

NUMBER OF POTENTIAL USERS FOR PRIVATE VEHICLE USER SERVICE GROUP: **760,037**

E.2 CVO - Long-Haul Service Group Users

The number of long-haul trucks was obtained from the US Census Bureau[11], by adding up those truck-type categories that fit the definition of long-haul trucks. The total number that fit the definition is 1 million nationwide, for the 1987 survey. Using the US population for 1987 (242,804,000)[12], this is one truck for every 242.8 people. It was assumed that these trucks spend one-half of their work day within a metropolitan area, resulting in 500,000 trucks within metropolitan areas, or one truck for every 485.6 people. Trucks are assigned to the Urbansville metropolitan region as a proportion of its population to that of the entire US, so that the Urbansville region population (2,814,950)[13] is divided by 485.6 to arrive at the number of long-haul trucks within the Urbansville region.

NUMBER OF POTENTIAL USERS FOR LONG-HAUL CVO SERVICE GROUP: **5,797**

E.3 CVO - Local Service Group Users

The number of short-haul trucks was obtained from the US Census Bureau[14], by adding up those truck-type categories that fit the definition of short-haul trucks. The total number that fit the definition is 7 million nationwide, for the 1987 survey. This group includes short-haul trucks, taxis, and automobile fleets. Using the US population for 1987 (242,804,000)[15], this is one short-haul vehicle for every 34.7 people. Vehicles are assigned to the Urbansville metropolitan region

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[9] Urban Scenario Guide, Urbansville, October 5, 1993, Integration Simulation Parameter, page 11.

[10] National Transportation Statistics, Annual Report, September 1993, Historical Compendium, 1960-1992, Department of Transportation, 1993, page 198.

[11] Truck Inventory and Use Survey, Census of Transportation, US Bureau of the Census, 1987, page 29.

[12] Statistical Abstract of the United States: 1993, US Bureau of the Census, 1993, page 8.

[13] Urban Scenario Guide, Urbansville, Phase II, March 13, 1995.

[14] Truck Inventory and Use Survey, Census of Transportation, US Bureau of the Census, 1987, page 29.

[15] Statistical Abstract of the United States: 1993, US Bureau of the Census, 1993, page 8.

as a proportion of its population to that of the entire US, so that the Urbansville region population (2,814,950)[16] is divided by 34.7 to arrive at the number of short-haul trucks within the Urbansville region.

NUMBER OF POTENTIAL USERS FOR LOCAL CVO SERVICE GROUP: **81,155**

E.4 Traveler Information Service Group Users

This group of users includes those accessing information from personal computers at the home or office, and those accessing information from portable computers while traveling. This includes both wireless and wireline access. The number of users is related then to the number of personal computers in the region. The number was taken from the Evaluatory Design Document.

NUMBER OF POTENTIAL USERS OF TRAVELER INFORMATION SERVICES: **200,750**

E.5 Public Transportation Management Service Users

There were 93,232 local transit vehicles of all types, including buses, light rail, heavy rail, trolleys, and ferries in the US in 1991[17]. Dividing by the US metropolitan-area population (1990 data) of 197,467,000, where bus systems are available, results in 472 such vehicles per million metropolitan area residents. The number of local transit vehicles in the Urbansville area is obtained by multiplying this number by the Urbansville population (resulting in 1329 transit vehicles). To account for the paratransit vehicles, it is assumed that the number of paratransit vehicles is equal to 25% of the transit vehicle number. This gives a total for the transit category of 1329 multiplied by 1.25:

NUMBER OF POTENTIAL USERS OF TRANSIT MANAGEMENT SERVICES: **1,661**

E.6 Emergency Response Vehicles Management Services

The number of emergency response vehicles is provided in the Urban Scenario Guide, in the Integration simulation parameters section as 0.25% of vehicles[18].

NUMBER OF POTENTIAL USERS OF EMERGENCY RESPONSE MANAGEMENT SERVICES: **4,444**

E.7 Probes

The goal is to provide a uniform distribution of probe vehicles throughout the region studied. The limited access highways and arterial surface streets need coverage throughout the day. In order to determine a data loading model, a scenario was developed for optimizing the distribution of probe vehicles in the region: Assuming that there are 225 miles of limited-access highways and 1701 miles of arterial surface streets to be covered, and a desired probe spacing of one mile in each direction of travel, a total of 3852 probe vehicles are required. Adjusting this number by

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[16] Urban Scenario Guide, Urbansville, Phase II, March 13, 1995.

[17] National Transportation Statistics, Annual Report, September 1993, Historical Compendium, 1960-1992, Department of Transportation, 1993, page 29.

[18] Urban Scenario Guide, Urbansville, Phase II, March 13, 1995.

a factor of two to allow for traffic density variations and variations in local directional flow results in a total of 7704 probe vehicles required. In order to maximize the probe density uniformity, a probe acceptance scheme was assumed, where probes are accepted for participation based on as uniform a distribution as possible. In this scheme potential probe vehicle owners would sign up to participate in the probe program, receiving some financial benefit, or additional service benefits, such as en-route route guidance updates. When leaving on a trip the probe vehicle reports its location and destination to the TMS. The TMS may then accept the vehicle as a probe on that trip if the data is desired. If so, a probe-specific route message is sent to the probe indicating the route and the way point where the probe is to report in. At that way point, the probe vehicle may also receive a new route and a way point for reporting in again.

NUMBER OF PROBES: **7,704**

APPENDIX F MESSAGE DEFINITIONS AND DATA LOADING MODELS

The complete definitions of the message sets for each scenario and time frame are provided in this appendix. Models are sorted by physical source and sink. The definition of the message is provided, along with the user penetration for that message, frequency of message use, size, and link rate for that message.

The order of the models in the table is: 1997 results appear first, then 2002 results, and finally 2012 results. Within each year the scenario regions are ordered with Urbansville first, Thruville next, and finally Mountainville results. Within the scenario region the models for the user service groups are ordered private vehicle, travelers (PIAS users), CVO-local, CVO-long haul, transit, emergency management, and finally probes. If a model does not appear for a scenario and time frame it is because there were no market packages, and therefore data flows deployed for that scenario/time frame.

The columns of the models are defined as follows. The first column contains the physical architecture source for the message. The second column contains the sink for the message. The data flow name from the logical architecture, which is also the name of the message is shown in the next column. The contents column shows the size of the data flow (in bytes, without the 18-bit message_id header) if it is a PEL (primitive element) in the logical architecture, or the column lists the subflows within the data flow if the data flow is not a PEL. The direction of message flow is shown next, with the forward direction being defined as the direction away from the center. In cases of messages flowing between vehicles, the flow has been defined as a reverse direction flow to provide a worst-case analysis on contention-based reverse channels. The penetration column shows the penetration for that particular message for that particular scenario. It is based on the penetration for the market package to which the message belongs. The frequency of use is defined as the number of uses of that message per user for the entire peak period of a day. For private vehicles, travelers, and probes this is a total of six hours. For CVO this is 12 hours. For emergency management and transit this is 13 hours. Frequencies of use are based on the best engineering judgment for the average user of that market package. The “freq” column contains the product of the message frequency of use times the penetration times the u1t fraction. The explanation for the frequency of use is shown in the next column. In some cases the explanation will differ from the “freq” column by exactly the factor explained earlier in the body of this document as the fraction of the number of users of this message that are assigned to the wireless interface, where users are split between wireless and wireline, or another communications interface. The size column shows the size of the message in bits. An 18-bit message_id header has been added to the logical data flow size at this point. The final columns contain the average peak period data rate that results from the particular message on the wide area wireless interface in bits per second per user.

Table F-1 Data Loading Models for the Wide-Area Wireless Two-Way (u1t) Interface.

Private Vehicle, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.01	0.01	one request per vehicle per peak period	0	290		1.34E-04
							TOTALS (b/s/user):			**1.20E-07**	**1.43E-04**

Traveler, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.05	1E-05	one emergency per 2000 users in peak period	26	0	1.50E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.01	3E-05	one request per 20 pias per peak period	3578	0	4.14E-06	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.05	1E-05	one emergency per 2000 users in peak period	0	370		2.14E-07
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.01	0.005	one request per pias per peak period	0	250		5.79E-05
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.01	3E-04	one request per 20 pias per peak period	0	250		2.89E-06
							TOTALS (b/s/user):			**4.16E-06**	**6.10E-05**

CVO-Local, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.25	0.5	average fleet vehicle requests two routes per peak period	0	154		1.78E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.25	1	average vehicle requests 4 routes per peak period	0	1234		2.86E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.25	0.025	one in ten vehicles per peak period	0	26		1.50E-05
CVS	FMS	cv_static_route_data	=256	r	0.25	1	four routes per vehicle per peak period	0	2066		4.78E-02
EM	VS	emergency_request_driver_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	3.01E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	3.01E-08	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.25	0.5	twice per vehicle per peak period	5082	0	5.88E-02	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.25	1	average vehicle requests four routes per peak period	3042	0	7.04E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.25	1	average vehicle requests four routes per peak period	1226	0	2.84E-02	
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	0	530		3.07E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	0	530		3.07E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.25	0.05	twice per vehicle per peak period	0	1234		1.43E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.25	0.1	four times per vehicle per peak period	0	1354		3.13E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	530	0	3.07E-05	

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ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	530	0	3.07E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.25	0.05	twice per vehicle per peak period	3034	0	3.51E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.25	0.1	four times per vehicle per peak period	3154	0	7.30E-03	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	282		3.26E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	3354		3.88E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.01	0.02	two requests per vehicle per peak period	0	290		1.34E-04
							TOTALS (b/s/user):			**1.68E-01**	**8.29E-02**

CVO-Long Haul, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.25	0.25	average fleet vehicle requests one route per peak period	0	154		8.91E-04
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.25	0.5	average vehicle requests 2 routes per peak period	0	1234		1.43E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.25	0.025	one in ten vehicles per peak period	0	26		1.50E-05
CVS	FMS	cv_static_route_data	=256	r	0.25	0.5	two routes per vehicle per peak period	0	2066		2.39E-02
EM	VS	emergency_request_driver_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	3.01E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.05	5E-05	one emergency per 1000 vehicles per peak period	26	0	3.01E-08	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.25	0.25	once per vehicle per peak period	5082	0	2.94E-02	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.25	0.5	average vehicle requests two routes per peak period	3042	0	3.52E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.25	0.5	average vehicle requests two routes per peak period	1226	0	1.42E-02	
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	0	530		3.07E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	0	530		3.07E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.25	0.025	once per vehicle per peak period	0	1234		7.14E-04
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.25	0.05	twice per vehicle per peak period	0	1354		1.57E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	530	0	3.07E-05	

CVO-Long Haul, 1997, Urbansville

ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	530	0	3.07E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.25	0.025	once per vehicle per peak period	3034	0	1.76E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.25	0.05	twice per vehicle per peak period	3154	0	3.65E-03	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	282		3.26E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.05	5E-05	one emergency per 1000 vehicles per peak period	0	3354		3.88E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.01	0.02	two requests per vehicle per peak period	0	290		1.34E-04
							TOTALS (b/s/user):			**8.43E-02**	**4.16E-02**

Transit, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.01	0.032	average of one use per transit user per peak period = 32 per transit vehicle	0	98		6.70E-05
RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.01	0.006	one in five transit users = 6.4 per transit vehicle per peak period	0	66		9.03E-06
RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.01	0.032	average of one use per transit user per peak period = 32 per transit vehicle	0	58		3.97E-05
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	0.66	0.066	one corrective message per ten vehicles per peak period	8210	0	1.16E-02	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	0.66	8.58	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	1.91E-01	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	0.66	8.58	one correction per hour during the peak period	17260	0	3.16E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	0.66	34.32	update every 15 minutes during the peak period	7786	0	5.71E+00	
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	0.66	8.58	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		4.77E-03
TRVS	TRMS	transit_conditions_request	=2	r	0.66	0.066	one corrective message per ten vehicles per peak period	0	34		4.79E-05
TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	0.66	2.112	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		8.39E-03

Transit, 1997, Urbansville

TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	0.33	4.29	updated every 60 minutes during the peak period	0	1042		9.55E-02
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	0.66	34.32	update every 15 minutes during the peak period	0	274		2.01E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	0.33	51.48	updated every 5 minutes during the peak period	0	234		2.57E-01
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	17.16	updated every 15 minutes during the peak period	0	250		9.17E-02
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	17.16	updated every 15 minutes during the peak period	0	250		9.17E-02
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	4.29	updated every 60 minutes during the peak period	0	250		2.29E-02
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	0.33	17.16	updated every 15 minutes during the peak period	0	274		1.00E-01
							TOTALS (b/s/user):			**9.08E+00**	**8.74E-01**

Emergency Management, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	0.5	6.5	average one driver output per vehicle per hour during the peak period	1042	0	1.45E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	0.5	13	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		7.22E-03
EVS	EM	emergency_driver_status_update	=16	r	0.5	13	average one status update per vehicle per 1/2 hour during the peak period	0	146		4.06E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	0.5	6.5	average one driver input per vehicle per hour during the peak period	0	530		7.36E-02
							TOTALS (b/s/user):			**1.45E-01**	**1.21E-01**

Probes, 1997, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

CVO-Local, 1997, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.25	0.5	average fleet vehicle requests two routes per peak period	0	154		1.78E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.25	1	average vehicle requests 4 routes per peak period	0	1234		2.86E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.25	0.025	one in ten vehicles per peak period	0	26		1.50E-05
CVS	FMS	cv_static_route_data	=256	r	0.25	1	four routes per vehicle per peak period	0	2066		4.78E-02
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.25	0.5	twice per vehicle per peak period	5082	0	5.88E-02	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.25	1	average vehicle requests four routes per peak period	3042	0	7.04E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.25	1	average vehicle requests four routes per peak period	1226	0	2.84E-02	
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	0	530		3.07E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	0	530		3.07E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.25	0.05	twice per vehicle per peak period	0	1234		1.43E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.25	0.1	four times per vehicle per peak period	0	1354		3.13E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	530	0	3.07E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.25	0.003	one in ten of vehicles interact once with an intermodal carrier	530	0	3.07E-05	

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ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.25	0.05	twice per vehicle per peak period	3034	0	3.51E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.25	0.1	four times per vehicle per peak period	3154	0	7.30E-03	
							TOTALS (b/s/user):			**1.68E-01**	**8.28E-02**

CVO-Long Haul, 1997, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.25	0.25	average fleet vehicle requests one route per peak period	0	154		8.91E-04
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.25	0.5	average vehicle requests 2 routes per peak period	0	1234		1.43E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.25	0.025	one in ten vehicles per peak period	0	26		1.50E-05
CVS	FMS	cv_static_route_data	=256	r	0.25	0.5	two routes per vehicle per peak period	0	2066		2.39E-02
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.25	0.25	once per vehicle per peak period	5082	0	2.94E-02	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.25	0.5	average vehicle requests two routes per peak period	3042	0	3.52E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.25	0.5	average vehicle requests two routes per peak period	1226	0	1.42E-02	
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	0	530		3.07E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	0	530		3.07E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.25	0.025	once per vehicle per peak period	0	1234		7.14E-04

CVO-Long Haul, 1997, Thruville

FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.25	0.05	twice per vehicle per peak period	0	1354		1.57E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	530	0	3.07E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.25	0.003	one in ten vehicles interacts once with an intermodal carrier	530	0	3.07E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.25	0.025	once per vehicle per peak period	3034	0	1.76E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.25	0.05	twice per vehicle per peak period	3154	0	3.65E-03	
							TOTALS (b/s/user):			**8.43E-02**	**4.14E-02**

Transit, 1997, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	0.66	0.066	one corrective message per ten vehicles per peak period	8210	0	1.16E-02	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	0.66	8.58	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	1.91E-01	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	0.66	8.58	one correction per hour during the peak period	17260	0	3.16E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	0.66	34.32	update every 15 minutes during the peak period	7786	0	5.71E+00	
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	0.66	8.58	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		4.77E-03
TRVS	TRMS	transit_conditions_request	=2	r	0.66	0.066	one corrective message per ten vehicles per peak period	0	34		4.79E-05
TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	0.66	2.112	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		8.39E-03
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	0.33	4.29	updated every 60 minutes during the peak period	0	1042		9.55E-02
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	0.66	34.32	update every 15 minutes during the peak period	0	274		2.01E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	0.33	51.48	updated every 5 minutes during the peak period	0	234		2.57E-01
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	17.16	updated every 15 minutes during the peak period	0	250		9.17E-02
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	17.16	updated every 15 minutes during the peak period	0	250		9.17E-02

Transit, 1997, Thruville

TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	0.33	4.29	updated every 60 minutes during the peak period	0	250		2.29E-02
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	0.33	17.16	updated every 15 minutes during the peak period	0	274		1.00E-01
							TOTALS (b/s/user):			**9.08E+00**	**8.74E-01**

Emergency Management, 1997, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	0.5	6.5	average one driver output per vehicle per hour during the peak period	1042	0	1.45E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	0.5	13	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		7.22E-03
EVS	EM	emergency_driver_status_update	=16	r	0.5	13	average one status update per vehicle per 1/2 hour during the peak period	0	146		4.06E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	0.5	6.5	average one driver input per vehicle per hour during the peak period	0	530		7.36E-02
							TOTALS (b/s/user):			**1.45E-01**	**1.21E-01**

Probes, 1997, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

Private Vehicle, 2002, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.1	0.1	one set of data per peak period	6146	0	2.85E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.1	0.01	one yellow pages advisory per 10 vehicles per peak period	10802	0	5.00E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vs uses per peak period	146	0	4.73E-05	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.1	1E-04	one vehicle per 1000 per peak period	178	0	8.24E-07	

Private Vehicle, 2002, Urbansville

PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		1.31E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		1.55E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.1	1E-04	one user per 1000 users per peak period	0	632.4		2.93E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.1	1E-04	one user per 1000 users per peak period	0	642		2.97E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.1	one request per vehicle per peak period	0	290		1.34E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.07	0.14	two acceptances per peak period	0	34		2.20E-04
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.1	0.01	one yellow pages advisory per ten vehicles per peak period	0	674		3.12E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.1	1E-04	one vehicle per 1000 per peak period	0	50		2.31E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.1	5E-05	one user per 1000 users per peak period	0	514		1.19E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.1	5E-05	one vehicle per 1000 per peak period	0	26		6.02E-08
							TOTALS (b/s/user):			**3.35E-02**	**1.90E-03**

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PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.1	3E-05	one emergency per 2000 users in peak period	26	0	3.01E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.1	3E-04	one request per 20 pias per peak period	3578	0	4.14E-05	
ISP	PIAS	traveler_guidance_route	=route_identity+traveler_route+traveler_identity	f	0.07	0.004	one route per day per pias	18306	0	2.97E-03	
ISP	PIAS	traveler_personal_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+stored_credit+traveler_identity+traveler_total_trip_cost	f	0.1	0.005	one payment per 10 pias per peak period	818	0	1.89E-04	
ISP	PIAS	traveler_personal_transaction_confirmation	=credit_identity+traveler_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.1	0.005	one confirmation per 10 pias per day	650	0	1.50E-04	
ISP	PIAS	traveler_personal_yellow_pages_data	=traveler_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.1	0.05	one yellow pages response per pias per peak period	1140	0	2.64E-03	
LocData	PIAS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten pias uses per peak period	146	0	4.73E-05	
PayInstr	PIAS	fpi_traveler_personal_input_credit_identity	=credit_identity	f	0.1	0.005	one transaction per 10 pias per day	178	0	4.12E-05	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.1	3E-05	one emergency per 2000 users in peak period	0	370		4.28E-07
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.1	0.05	one request per pias per peak period	0	250		5.79E-04
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.1	0.003	one request per 20 pias per peak period	0	250		2.89E-05

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PIAS	ISP	traveler_personal_current_condition_request	=traveler_identity	r	0.1	0.05	one request per pias per peak period	0	210		4.86E-04
PIAS	ISP	traveler_personal_payment_information	=credit_identity+parking_space_details+ride_segments+stored_credit+toll_segments+traveler_identity	r	0.1	0.005	one payment per 10 pias per peak period	0	1130		2.62E-04
PIAS	ISP	traveler_personal_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.1	0.005	one request per 10 pias per peak period	0	402		9.31E-05
PIAS	ISP	traveler_personal_yellow_pages_information_request	=1	r	0.1	0.05	one yellow pages request per pias per peak period	0	26		6.02E-05
PIAS	PayInstr	tpi_debited_payment_at_personal_device	=4	r	0.1	0.005	one transaction per 10 pias per day	0	50		1.16E-05
PIAS	TRMS	transit_services_portables_request	=destination+origin+traveler_identity	r	0.1	0.005	one request per 10 pias per peak period	0	466		1.08E-04
TRMS	PIAS	transit_services_for_portables	=traveler_identity+2*(transit_services_for_output)	f	0.1	0.002	one request per 20 pias per peak period	2530	0	1.93E-04	
							TOTALS (b/s/user):			**6.27E-03**	**1.63E-03**

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PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	1	average fleet vehicle requests two routes per peak period	0	154		3.56E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	2	average vehicle requests 4 routes per peak period	0	1234		5.71E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	2	four routes per vehicle per peak period	0	2066		9.56E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	1	twice per vehicle per peak period	5082	0	1.18E-01	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	2	average vehicle requests four routes per peak period	3042	0	1.41E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	2	average vehicle requests four routes per peak period	1226	0	5.68E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05

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FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.1	twice per vehicle per peak period	0	1234		2.86E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.2	four times per vehicle per peak period	0	1354		6.27E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.1	twice per vehicle per peak period	3034	0	7.02E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.2	four times per vehicle per peak period	3154	0	1.46E-02	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	5.42E-07	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	5.42E-07	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.1	0.2	two sets of data per peak period	6146	0	2.85E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.1	0.01	one yellow pages advisory per 10 vehicles per peak period	10802	0	2.50E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vehicles uses once per peak period	146	0	2.37E-05	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.1	1E-04	one vehicle per 1000 per peak period	178	0	4.12E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06

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VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.1	1E-04	one user per 1000 users per peak period	0	632.4		1.46E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.1	1E-04	one user per 1000 users per peak period	0	642		1.49E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.2	two requests per vehicle per peak period	0	290		1.34E-03
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.1	0.01	one yellow pages advisory per 10 vehicles per peak period	0	674		1.56E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.1	1E-04	one vehicle per 1000 per peak period	0	50		1.16E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.1	5E-05	one user per 1000 users per peak period	0	514		5.95E-07
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.1	5E-05	one vehicle per 1000 per peak period	0	26		3.01E-08
							TOTALS (b/s/user):			**3.68E-01**	**1.67E-01**

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PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.5	5E-05	one out of 1000 vehicles per peak period	482	0	5.58E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.5	0.005	one out of 10 vehicles	410	0	4.75E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.5	0.05	once per vehicle per peak period	26	0	3.01E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.5	0.05	once per vehicle per peak period	170	0	1.97E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.05	once per vehicle per peak period	346	0	4.00E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.5	0.005	request info on one in ten vehicles	0	554		6.41E-05
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.5	5E-04	one report per 100 vehicles per peak period	0	3362		3.89E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

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CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	0.5	average fleet vehicle requests one route per peak period	0	154		1.78E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.5	0.5	once per vehicle per peak period	0	330		3.82E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.5	0.5	once per vehicle per peak period	0	98		1.13E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	1	average vehicle requests 2 routes per peak period	0	1234		2.86E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	1	two routes per vehicle per peak period	0	2066		4.78E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.5	0.05	once per vehicle per peak period	0	402		4.65E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	0.5	once per vehicle per peak period	5082	0	5.88E-02	

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FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.5	0.25	one out of two vehicles require info. per peak period	82	0	4.75E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.5	once per vehicle per peak period	346	0	4.00E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	1	average vehicle requests two routes per peak period	3042	0	7.04E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	1	average vehicle requests two routes per peak period	1226	0	2.84E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.05	once per vehicle per peak period	0	1234		1.43E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.1	twice per vehicle per peak period	0	1354		3.13E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.5	0.05	once per enrollment	0	50		5.79E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.05	once per vehicle per peak period	3034	0	3.51E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.1	twice per vehicle per peak period	3154	0	7.30E-03	

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ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	5.42E-07	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.1	1E-04	one user per 1000 users per peak period	234	0	5.42E-07	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.1	0.1	one set of data per peak period	6146	0	1.42E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.1	0.01	one yellow pages advisory per 10 vehicles per peak period	10802	0	2.50E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vehicles uses once per peak period	146	0	2.37E-05	
PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.5	0.05	once per enrollment = once per cv per peak period	114	0	1.32E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.1	1E-04	one vehicle per 1000 per peak period	178	0	4.12E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.1	1E-04	one user per 1000 users per peak period	0	632.4		1.46E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.1	1E-04	one user per 1000 users per peak period	0	642		1.49E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.2	two requests per vehicle per peak period	0	290		1.34E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.07	0.14	two acceptances per peak period	0	34		1.10E-04

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VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.1	0.01	one yellow pages advisory per 10 vehicles per peak period	0	674		1.56E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.1	1E-04	one vehicle per 1000 per peak period	0	50		1.16E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.1	5E-05	one user per 1000 users per peak period	0	514		5.95E-07
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.1	5E-05	one vehicle per 1000 per peak period	0	26		3.01E-08
							TOTALS (b/s/user):			**1.95E-01**	**9.93E-02**

Transit, 2002, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
ISP	RTS	advanced_tolls_and_charges_roadside_confirm	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag	f	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	426	0	2.91E-06	
ISP	RTS	traveler_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+kiosk_identity+stored_credit+traveler_total_trip_cost	f	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	666	0	4.55E-06	
ISP	RTS	traveler_transaction_confirmation	=credit_identity+kiosk_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	498	0	3.41E-06	
ISP	RTS	traveler_yellow_pages_data	=kiosk_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	987.7	0	6.75E-06	

Transit, 2002, Urbansville

PayInstr	RTS	fpi_confirm_fare_payment_at_roadside	=confirmation_flag	f	0.1	0.064	one in five transit users = 6.4 per transit vehicle per peak period	26	0	3.56E-05	
PayInstr	RTS	fpi_transit_roadside_tag_data	=credit_identity	f	0.1	3E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-06	
PayInstr	RTS	fpi_transit_user_roadside_input_credit_identity	=credit_identity	f	0.1	3E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-06	
PayInstr	RTS	fpi_traveler_roadside_input_credit_identity	=credit_identity	f	0.1	3E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-06	
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
RTS	EM	emergency_request_kiosk_traveler_details	=date+time+traveler_personal_emergency_request	r	1	0.003	one emergency per 1000 transit users per peak period, or 0.032/transit vehicle	0	370		2.53E-05
RTS	ISP	advanced_tolls_and_charges_roadside_request	=0.6*(advanced_charges)+0.6*(advanced_tolls)	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	738		5.05E-06
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.1	0.32	average of one use per transit user per peak period = 32 per transit vehicle	0	98		6.70E-04
RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.1	0.064	one in five transit users = 6.4 per transit vehicle per peak period	0	66		9.03E-05

Transit, 2002, Urbansville

RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.1	0.32	average of one use per transit user per peak period = 32 per transit vehicle	0	58		3.97E-04
RTS	ISP	traveler_payment_information	=credit_identity+kiosk_identity+parking_space_details+ride_segments+stored_credit+toll_segments	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	978		6.69E-06
RTS	ISP	traveler_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	402		2.75E-06
RTS	ISP	traveler_trip_confirmation	=paratransit_service_confirmation+traveler_identity+traveler_rideshare_confirmation	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	858		5.87E-06
RTS	ISP	traveler_trip_request	=trip_request+traveler_identity+traveler_rideshare_request	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	1434		9.81E-06
RTS	ISP	traveler_yellow_pages_information_request	=1	r	0.1	3E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	26		1.78E-07
RTS	PayInstr	tpi_debited_fare_payment_at_roadside	=4	r	0.1	0.064	one in five transit users = 6.4 per transit vehicle per peak period	0	50		6.84E-05
RTS	PayInstr	tpi_debited_transit_user_payment_at_roadside	=4	r	0.1	0.032	one in ten transit users = 3.2 per transit vehicle per peak period	0	50		3.42E-05
RTS	PayInstr	tpi_debited_traveler_payment_at_roadside	=4	r	0.1	3E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	50		3.42E-07
RTS	PayInstr	tpi_request_fare_payment_at_roadside	=2	r	0.1	3E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	34		2.32E-07
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	1	0.1	one corrective message per ten vehicles per peak period	8210	0	1.75E-02	

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TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	other_services_vehicle_response	=traveler_identity+credit_identity+other_services_data	f	0.1	0.003	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	2418	0	1.65E-04	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	1	13	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	2.89E-01	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_operator_request_acknowledge	=2	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	34	0	2.32E-05	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	1	13	one correction per hour during the peak period	17260	0	4.79E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	1	52	update every 15 minutes during the peak period	7786	0	8.65E+00	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	
TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	

Transit, 2002, Urbansville

TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	other_services_vehicle_request	=traveler_identity+credit_identity+other_services_data	r	0.1	0.003	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	2418		1.65E-04
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	1	13	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		7.22E-03
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_conditions_request	=2	r	1	0.1	one corrective message per ten vehicles per peak period	0	34		7.26E-05
TRVS	TRMS	transit_emergency_details	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_emergency_information	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_operator_emergency_request	=128	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	1042		7.12E-05
TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	1	3.2	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		1.27E-02

Transit, 2002, Urbansville

TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_advanced_payment_request	=advanced_charges+advanced_tolls+transit_vehicle_location	r	0.1	0.003	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	1450		9.91E-05
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	1	13	updated every 60 minutes during the peak period	0	1042		2.89E-01
TRVS	TRMS	transit_vehicle_collected_trip_data	=transit_vehicle_passenger_loading+transit_vehicle_running_times	r	1	13	every hour for each transit vehicle per peak period	0	1826		5.07E-01
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	1	52	update every 15 minutes during the peak period	0	274		3.04E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	1	156	updated every 5 minutes during the peak period	0	234		7.80E-01
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	1	13	updated every 60 minutes during the peak period	0	250		6.94E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	1	52	updated every 15 minutes during the peak period	0	274		3.04E-01
							TOTALS (b/s/user):			**1.43E+01**	**3.45E+00**

Emergency Management, 2002, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**

Probes, 2002, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

Private Vehicle, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vs uses per peak period	146	0	4.73E-05	
PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		1.31E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		1.55E-05
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.1	one request per vehicle per peak period	0	290		1.34E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.07	0.14	two acceptances per peak period	0	34		2.20E-04
							TOTALS (b/s/user):			**4.84E-05**	**1.58E-03**

Traveler, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.1	3E-05	one emergency per 2000 users in peak period	26	0	3.01E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.1	3E-04	one request per 20 pias per peak period	3578	0	4.14E-05	
ISP	PIAS	traveler_guidance_route	=route_identity+traveler_route+traveler_identity	f	0.07	0.004	one route per day per pias	18306	0	2.97E-03	
LocData	PIAS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten pias uses per peak period	146	0	4.73E-05	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.1	3E-05	one emergency per 2000 users in peak period	0	370		4.28E-07
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.1	0.05	one request per pias per peak period	0	250		5.79E-04
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.1	0.003	one request per 20 pias per peak period	0	250		2.89E-05
							TOTALS (b/s/user):			**3.06E-03**	**6.08E-04**

CVO-Local, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	1	average fleet vehicle requests two routes per peak period	0	154		3.56E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	2	average vehicle requests 4 routes per peak period	0	1234		5.71E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	2	four routes per vehicle per peak period	0	2066		9.56E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	1	twice per vehicle per peak period	5082	0	1.18E-01	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	2	average vehicle requests four routes per peak period	3042	0	1.41E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	2	average vehicle requests four routes per peak period	1226	0	5.68E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05

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FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.1	twice per vehicle per peak period	0	1234		2.86E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.2	four times per vehicle per peak period	0	1354		6.27E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.1	twice per vehicle per peak period	3034	0	7.02E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.2	four times per vehicle per peak period	3154	0	1.46E-02	
LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vehicles uses once per peak period	146	0	2.37E-05	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.2	two requests per vehicle per peak period	0	290		1.34E-03
							TOTALS (b/s/user):			**3.37E-01**	**1.67E-01**

CVO-Long Haul, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.5	5E-05	one out of 1000 vehicles per peak period	482	0	5.58E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.5	0.005	one out of 10 vehicles	410	0	4.75E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.5	0.05	once per vehicle per peak period	26	0	3.01E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.5	0.05	once per vehicle per peak period	170	0	1.97E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.05	once per vehicle per peak period	346	0	4.00E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.5	0.005	request info on one in ten vehicles	0	554		6.41E-05
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.5	5E-04	one report per 100 vehicles per peak period	0	3362		3.89E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

CVO-Long Haul, 2002, Thruville

CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	0.5	average fleet vehicle requests one route per peak period	0	154		1.78E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.5	0.5	once per vehicle per peak period	0	330		3.82E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.5	0.5	once per vehicle per peak period	0	98		1.13E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	1	average vehicle requests 2 routes per peak period	0	1234		2.86E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	1	two routes per vehicle per peak period	0	2066		4.78E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.5	0.05	once per vehicle per peak period	0	402		4.65E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	0.5	once per vehicle per peak period	5082	0	5.88E-02	

CVO-Long Haul, 2002, Thruville

FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.5	0.25	one out of two vehicles require info. per peak period	82	0	4.75E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.5	once per vehicle per peak period	346	0	4.00E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	1	average vehicle requests two routes per peak period	3042	0	7.04E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	1	average vehicle requests two routes per peak period	1226	0	2.84E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.05	once per vehicle per peak period	0	1234		1.43E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.1	twice per vehicle per peak period	0	1354		3.13E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.5	0.05	once per enrollment	0	50		5.79E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.05	once per vehicle per peak period	3034	0	3.51E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.1	twice per vehicle per peak period	3154	0	7.30E-03	

CVO-Long Haul, 2002, Thruville

LocData	VS	From_Location_Data_Source	=16	f	0.07	0.007	one in ten vehicles uses once per peak period	146	0	2.37E-05	
PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.5	0.05	once per enrollment = once per cv per peak period	114	0	1.32E-04	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.1	0.2	two requests per vehicle per peak period	0	290		1.34E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.07	0.14	two acceptances per peak period	0	34		1.10E-04
							TOTALS (b/s/user):			**1.78E-01**	**9.91E-02**

Transit, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.1	0.32	average of one use per transit user per peak period = 32 per transit vehicle	0	98		6.70E-04
RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.1	0.064	one in five transit users = 6.4 per transit vehicle per peak period	0	66		9.03E-05

Transit, 2002, Thruville

RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.1	0.32	average of one use per transit user per peak period = 32 per transit vehicle	0	58		3.97E-04
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	1	0.1	one corrective message per ten vehicles per peak period	8210	0	1.75E-02	
TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	1	13	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	2.89E-01	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	1	13	one correction per hour during the peak period	17260	0	4.79E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	1	52	update every 15 minutes during the peak period	7786	0	8.65E+00	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	
TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	

Transit, 2002, Thruville

TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	1	13	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		7.22E-03
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_conditions_request	=2	r	1	0.1	one corrective message per ten vehicles per peak period	0	34		7.26E-05
TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	1	3.2	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		1.27E-02
TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	1	13	updated every 60 minutes during the peak period	0	1042		2.89E-01
TRVS	TRMS	transit_vehicle_collected_trip_data	=transit_vehicle_passenger_loading+transit_vehicle_running_times	r	1	13	every hour for each transit vehicle per peak period	0	1826		5.07E-01
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	1	52	update every 15 minutes during the peak period	0	274		3.04E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	1	156	updated every 5 minutes during the peak period	0	234		7.80E-01
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02

Transit, 2002, Thruville

TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	1	13	updated every 60 minutes during the peak period	0	250		6.94E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	1	52	updated every 15 minutes during the peak period	0	274		3.04E-01
							TOTALS (b/s/user):			**1.43E+01**	**3.45E+00**

Emergency Management, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**

Probes, 2002, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

Private Vehicle, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	1.20E-07	
PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		1.31E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		1.55E-05
							TOTALS (b/s/user):			**1.06E-06**	**1.68E-05**

Traveler, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.1	3E-05	one emergency per 2000 users in peak period	26	0	3.01E-08	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.1	3E-05	one emergency per 2000 users in peak period	0	370		4.28E-07
							TOTALS (b/s/user):			**3.01E-08**	**4.28E-07**

CVO-Local, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	1	average fleet vehicle requests two routes per peak period	0	154		3.56E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	2	average vehicle requests 4 routes per peak period	0	1234		5.71E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	2	four routes per vehicle per peak period	0	2066		9.56E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	1	twice per vehicle per peak period	5082	0	1.18E-01	

CVO-Local, 2002, Mountainville

FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	2	average vehicle requests four routes per peak period	3042	0	1.41E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	2	average vehicle requests four routes per peak period	1226	0	5.68E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	0	530		6.13E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.1	twice per vehicle per peak period	0	1234		2.86E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.2	four times per vehicle per peak period	0	1354		6.27E-03
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten of vehicles interact once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.1	twice per vehicle per peak period	3034	0	7.02E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.2	four times per vehicle per peak period	3154	0	1.46E-02	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
							TOTALS (b/s/user):			**3.37E-01**	**1.66E-01**

CVO-Long Haul, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.5	5E-05	one out of 1000 vehicles per peak period	482	0	5.58E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.5	0.005	one out of 10 vehicles	410	0	4.75E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.5	0.05	once per vehicle per peak period	26	0	3.01E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.5	0.05	once per vehicle per peak period	170	0	1.97E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.5	0.025	one out of two vehicles require info. per peak period	3818	0	2.21E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.05	once per vehicle per peak period	346	0	4.00E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.5	0.005	request info on one in ten vehicles	0	554		6.41E-05
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.5	5E-04	one report per 100 vehicles per peak period	0	3362		3.89E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

CVO-Long Haul, 2002, Mountainville

CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.5	0.5	average fleet vehicle requests one route per peak period	0	154		1.78E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.5	0.5	once per vehicle per peak period	0	330		3.82E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.5	0.5	once per vehicle per peak period	0	98		1.13E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.5	1	average vehicle requests 2 routes per peak period	0	1234		2.86E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.5	0.05	one in ten vehicles per peak period	0	26		3.01E-05
CVS	FMS	cv_static_route_data	=256	r	0.5	1	two routes per vehicle per peak period	0	2066		4.78E-02
EM	FMS	cf_hazmat_request	=16	f	0.1	1E-05	once per 1000 vehicles per peak period	146	0	3.38E-08	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.1	1E-04	one emergency per 1000 vehicles per peak period	26	0	6.02E-08	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.5	0.05	once per vehicle per peak period	0	402		4.65E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.5	0.05	once per vehicle per peak period	0	414		4.79E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.5	0.05	once per vehicle per peak period	0	3498		4.05E-03
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.5	0.5	once per vehicle per peak period	5082	0	5.88E-02	

CVO-Long Haul, 2002, Mountainville

FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.5	0.25	one out of two vehicles require info. per peak period	82	0	4.75E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.5	0.5	once per vehicle per peak period	346	0	4.00E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.5	1	average vehicle requests two routes per peak period	3042	0	7.04E-02	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.5	1	average vehicle requests two routes per peak period	1226	0	2.84E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.1	1E-05	once per 1000 vehicles per peak period	0	3754		8.69E-07
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.1	1E-05	once per 1000 vehicles per peak period	0	242		5.60E-08
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	0	530		6.13E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.5	0.05	once per vehicle per peak period	0	1234		1.43E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.5	0.1	twice per vehicle per peak period	0	1354		3.13E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.5	0.05	once per enrollment	0	50		5.79E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.5	0.005	one in ten vehicles interacts once with an intermodal carrier	530	0	6.13E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.5	0.05	once per vehicle per peak period	3034	0	3.51E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.5	0.1	twice per vehicle per peak period	3154	0	7.30E-03	

CVO-Long Haul, 2002, Mountainville

PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.5	0.05	once per enrollment = once per cv per peak period	114	0	1.32E-04	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	282		6.53E-07
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.1	1E-04	one emergency per 1000 vehicles per peak period	0	3354		7.76E-06
							TOTALS (b/s/user):			**1.78E-01**	**9.77E-02**

Transit, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	

Transit, 2002, Mountainville

TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
							TOTALS (b/s/user):			**5.14E-01**	**6.23E-01**

Emergency Management, 2002, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**

Private Vehicle, 2012, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	2.17E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	2.17E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.2	0.2	one set of data per peak period	6146	0	5.69E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	1.00E-02	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vs uses per peak period	146	0	2.03E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	1.65E-06	
PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		3.92E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		4.66E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		5.86E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		5.94E-06

Private Vehicle, 2012, Urbansville

VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.2	one request per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		9.44E-04
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per ten vehicles per peak period	0	674		6.24E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		4.63E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		2.38E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		1.20E-07
							TOTALS (b/s/user):			**6.71E-02**	**4.32E-03**

Traveler, 2012, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.3	8E-05	one emergency per 2000 users in peak period	26	0	9.03E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.2	5E-04	one request per 20 pias per peak period	3578	0	8.28E-05	
ISP	PIAS	traveler_guidance_route	=route_identity+traveler_route+traveler_identity	f	0.3	0.015	one route per day per pias	18306	0	1.27E-02	
ISP	PIAS	traveler_personal_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+stored_credit+traveler_identity+traveler_total_trip_cost	f	0.2	0.01	one payment per 10 pias per peak period	818	0	3.79E-04	
ISP	PIAS	traveler_personal_transaction_confirmation	=credit_identity+traveler_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.01	one confirmation per 10 pias per day	650	0	3.01E-04	
ISP	PIAS	traveler_personal_yellow_pages_data	=traveler_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.2	0.1	one yellow pages response per pias per peak period	1140	0	5.28E-03	
LocData	PIAS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten pias uses per peak period	146	0	2.03E-04	
PayInstr	PIAS	fpi_traveler_personal_input_credit_identity	=credit_identity	f	0.2	0.01	one transaction per 10 pias per day	178	0	8.24E-05	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.3	8E-05	one emergency per 2000 users in peak period	0	370		1.28E-06
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.2	0.1	one request per pias per peak period	0	250		1.16E-03
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.2	0.005	one request per 20 pias per peak period	0	250		5.79E-05

Traveler, 2012, Urbansville

PIAS	ISP	traveler_personal_current_condition_request	=traveler_identity	r	0.2	0.1	one request per pias per peak period	0	210		9.72E-04
PIAS	ISP	traveler_personal_payment_information	=credit_identity+parking_space_details+ride_segments+stored_credit+toll_segments+traveler_identity	r	0.2	0.01	one payment per 10 pias per peak period	0	1130		5.23E-04
PIAS	ISP	traveler_personal_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.01	one request per 10 pias per peak period	0	402		1.86E-04
PIAS	ISP	traveler_personal_yellow_pages_information_request	=1	r	0.2	0.1	one yellow pages request per pias per peak period	0	26		1.20E-04
PIAS	PayInstr	tpi_debited_payment_at_personal_device	=4	r	0.2	0.01	one transaction per 10 pias per day	0	50		2.31E-05
PIAS	TRMS	transit_services_portables_request	=destination+origin+traveler_identity	r	0.2	0.01	one request per 10 pias per peak period	0	466		2.16E-04
TRMS	PIAS	transit_services_for_portables	=traveler_identity+2*(transit_services_for_output)	f	0.2	0.003	one request per 20 pias per peak period	2530	0	3.87E-04	
							TOTALS (b/s/user):			**1.94E-02**	**3.26E-03**

CVO-Local, 2012, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	1.6	average fleet vehicle requests two routes per peak period	0	154		5.70E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	3.2	average vehicle requests 4 routes per peak period	0	1234		9.14E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	3.2	four routes per vehicle per peak period	0	2066		1.53E-01
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	1.6	twice per vehicle per peak period	5082	0	1.88E-01	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	3.2	average vehicle requests four routes per peak period	3042	0	2.25E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	3.2	average vehicle requests four routes per peak period	1226	0	9.08E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05

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FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.16	twice per vehicle per peak period	0	1234		4.57E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.32	four times per vehicle per peak period	0	1354		1.00E-02
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.16	twice per vehicle per peak period	3034	0	1.12E-02	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.32	four times per vehicle per peak period	3154	0	2.34E-02	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.2	0.4	two sets of data per peak period	6146	0	5.69E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	5.00E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	0	1.01E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05

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VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		2.93E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		2.97E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	0	674		3.12E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		2.31E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		1.19E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		6.02E-08
							TOTALS (b/s/user):			**6.01E-01**	**2.68E-01**

CVO-Long Haul, 2012, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.85	9E-05	one out of 1000 vehicles per peak period	482	0	9.48E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.85	0.009	one out of 10 vehicles	410	0	8.07E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.85	0.085	once per vehicle per peak period	26	0	5.12E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.85	0.085	once per vehicle per peak period	170	0	3.34E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.085	once per vehicle per peak period	346	0	6.81E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.85	0.009	request info on one in ten vehicles	0	554		1.09E-04
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.85	9E-04	one report per 100 vehicles per peak period	0	3362		6.62E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

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CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	0.8	average fleet vehicle requests one route per peak period	0	154		2.85E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.85	0.85	once per vehicle per peak period	0	330		6.49E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.85	0.85	once per vehicle per peak period	0	98		1.93E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	1.6	average vehicle requests 2 routes per peak period	0	1234		4.57E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	1.6	two routes per vehicle per peak period	0	2066		7.65E-02
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.85	0.085	once per vehicle per peak period	0	402		7.91E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	0.8	once per vehicle per peak period	5082	0	9.41E-02	

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FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.85	0.425	one out of two vehicles require info. per peak period	82	0	8.07E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.85	once per vehicle per peak period	346	0	6.81E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	1.6	average vehicle requests two routes per peak period	3042	0	1.13E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	1.6	average vehicle requests two routes per peak period	1226	0	4.54E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.08	once per vehicle per peak period	0	1234		2.29E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.16	twice per vehicle per peak period	0	1354		5.01E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.85	0.085	once per enrollment	0	50		9.84E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.08	once per vehicle per peak period	3034	0	5.62E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.16	twice per vehicle per peak period	3154	0	1.17E-02	

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ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.2	0.2	one set of data per peak period	6146	0	2.85E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	5.00E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	0	1.01E-04	
PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.85	0.085	once per enrollment = once per cv per peak period	114	0	2.24E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		2.93E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		2.97E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		4.72E-04

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VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	0	674		3.12E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		2.31E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		1.19E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		6.02E-08
							TOTALS (b/s/user):			**3.20E-01**	**1.61E-01**

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PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
ISP	RTS	advanced_tolls_and_charges_roadside_confirm	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	426	0	5.83E-06	
ISP	RTS	traveler_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+kiosk_identity+stored_credit+traveler_total_trip_cost	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	666	0	9.11E-06	
ISP	RTS	traveler_transaction_confirmation	=credit_identity+kiosk_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	498	0	6.81E-06	
ISP	RTS	traveler_yellow_pages_data	=kiosk_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	987.7	0	1.35E-05	

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PayInstr	RTS	fpi_confirm_fare_payment_at_roadside	=confirmation_flag	f	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	26	0	7.11E-05	
PayInstr	RTS	fpi_transit_roadside_tag_data	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	RTS	fpi_transit_user_roadside_input_credit_identity	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	RTS	fpi_traveler_roadside_input_credit_identity	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
RTS	EM	emergency_request_kiosk_traveler_details	=date+time+traveler_personal_emergency_request	r	1	0.003	one emergency per 1000 transit users per peak period, or 0.032/transit vehicle	0	370		2.53E-05
RTS	ISP	advanced_tolls_and_charges_roadside_request	=0.6*(advanced_charges)+0.6*(advanced_tolls)	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	738		1.01E-05
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	98		1.34E-03
RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	0	66		1.81E-04

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RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	58		7.93E-04
RTS	ISP	traveler_payment_information	=credit_identity+kiosk_identity+parking_space_details+ride_segments+stored_credit+toll_segments	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	978		1.34E-05
RTS	ISP	traveler_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	402		5.50E-06
RTS	ISP	traveler_trip_confirmation	=paratransit_service_confirmation+traveler_identity+traveler_rideshare_confirmation	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	858		1.17E-05
RTS	ISP	traveler_trip_request	=trip_request+traveler_identity+traveler_rideshare_request	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	1434		1.96E-05
RTS	ISP	traveler_yellow_pages_information_request	=1	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	26		3.56E-07
RTS	PayInstr	tpi_debited_fare_payment_at_roadside	=4	r	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	0	50		1.37E-04
RTS	PayInstr	tpi_debited_transit_user_payment_at_roadside	=4	r	0.2	0.064	one in ten transit users = 3.2 per transit vehicle per peak period	0	50		6.84E-05
RTS	PayInstr	tpi_debited_traveler_payment_at_roadside	=4	r	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	50		6.84E-07
RTS	PayInstr	tpi_request_fare_payment_at_roadside	=2	r	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	34		4.65E-07
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	1	0.1	one corrective message per ten vehicles per peak period	8210	0	1.75E-02	

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TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	other_services_vehicle_response	=traveler_identity+credit_identity+other_services_data	f	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	2418	0	3.31E-04	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	1	13	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	2.89E-01	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_operator_request_acknowledge	=2	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	34	0	2.32E-05	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	1	13	one correction per hour during the peak period	17260	0	4.79E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	1	52	update every 15 minutes during the peak period	7786	0	8.65E+00	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	
TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	

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TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	other_services_vehicle_request	=traveler_identity+credit_identity+other_services_data	r	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	2418		3.31E-04
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	1	13	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		7.22E-03
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_conditions_request	=2	r	1	0.1	one corrective message per ten vehicles per peak period	0	34		7.26E-05
TRVS	TRMS	transit_emergency_details	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_emergency_information	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_operator_emergency_request	=128	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	1042		7.12E-05
TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	1	3.2	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		1.27E-02

Transit, 2012, Urbansville

TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_advanced_payment_request	=advanced_charges+advanced_tolls+transit_vehicle_location	r	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	1450		1.98E-04
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	1	13	updated every 60 minutes during the peak period	0	1042		2.89E-01
TRVS	TRMS	transit_vehicle_collected_trip_data	=transit_vehicle_passenger_loading+transit_vehicle_running_times	r	1	13	every hour for each transit vehicle per peak period	0	1826		5.07E-01
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	1	52	update every 15 minutes during the peak period	0	274		3.04E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	1	156	updated every 5 minutes during the peak period	0	234		7.80E-01
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	1	13	updated every 60 minutes during the peak period	0	250		6.94E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	1	52	updated every 15 minutes during the peak period	0	274		3.04E-01
							TOTALS (b/s/user):			**1.43E+01**	**3.46E+00**

Emergency Management, 2102, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**

Probes, 2012, Urbansville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

Private Vehicle, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vs uses per peak period	146	0	2.03E-04	
PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		3.92E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		4.66E-05
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.2	one request per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		9.44E-04
							TOTALS (b/s/user):			**2.04E-04**	**3.68E-03**

Traveler, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.3	8E-05	one emergency per 2000 users in peak period	26	0	9.03E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.2	5E-04	one request per 20 pias per peak period	3578	0	8.28E-05	
ISP	PIAS	traveler_guidance_route	=route_identity+traveler_route+traveler_identity	f	0.3	0.015	one route per day per pias	18306	0	1.27E-02	
LocData	PIAS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten pias uses per peak period	146	0	2.03E-04	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.3	8E-05	one emergency per 2000 users in peak period	0	370		1.28E-06
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.2	0.1	one request per pias per peak period	0	250		1.16E-03
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.2	0.005	one request per 20 pias per peak period	0	250		5.79E-05
							TOTALS (b/s/user):			**1.30E-02**	**1.22E-03**

CVO-Local, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	1.6	average fleet vehicle requests two routes per peak period	0	154		5.70E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	3.2	average vehicle requests 4 routes per peak period	0	1234		9.14E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	3.2	four routes per vehicle per peak period	0	2066		1.53E-01
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	1.6	twice per vehicle per peak period	5082	0	1.88E-01	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	3.2	average vehicle requests four routes per peak period	3042	0	2.25E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	3.2	average vehicle requests four routes per peak period	1226	0	9.08E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05

CVO-Local, 2012, Thruville

FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.16	twice per vehicle per peak period	0	1234		4.57E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.32	four times per vehicle per peak period	0	1354		1.00E-02
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.16	twice per vehicle per peak period	3034	0	1.12E-02	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.32	four times per vehicle per peak period	3154	0	2.34E-02	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	0	1.01E-04	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
							TOTALS (b/s/user):			**5.39E-01**	**2.68E-01**

CVO-Long Haul, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.85	9E-05	one out of 1000 vehicles per peak period	482	0	9.48E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.85	0.009	one out of 10 vehicles	410	0	8.07E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.85	0.085	once per vehicle per peak period	26	0	5.12E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.85	0.085	once per vehicle per peak period	170	0	3.34E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.085	once per vehicle per peak period	346	0	6.81E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.85	0.009	request info on one in ten vehicles	0	554		1.09E-04
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.85	9E-04	one report per 100 vehicles per peak period	0	3362		6.62E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

CVO-Long Haul, 2012, Thruville

CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	0.8	average fleet vehicle requests one route per peak period	0	154		2.85E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.85	0.85	once per vehicle per peak period	0	330		6.49E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.85	0.85	once per vehicle per peak period	0	98		1.93E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	1.6	average vehicle requests 2 routes per peak period	0	1234		4.57E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	1.6	two routes per vehicle per peak period	0	2066		7.65E-02
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.85	0.085	once per vehicle per peak period	0	402		7.91E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	0.8	once per vehicle per peak period	5082	0	9.41E-02	

CVO-Long Haul, 2012, Thruville

FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.85	0.425	one out of two vehicles require info. per peak period	82	0	8.07E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.85	once per vehicle per peak period	346	0	6.81E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	1.6	average vehicle requests two routes per peak period	3042	0	1.13E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	1.6	average vehicle requests two routes per peak period	1226	0	4.54E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.08	once per vehicle per peak period	0	1234		2.29E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.16	twice per vehicle per peak period	0	1354		5.01E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.85	0.085	once per enrollment	0	50		9.84E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	
ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.08	once per vehicle per peak period	3034	0	5.62E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.16	twice per vehicle per peak period	3154	0	1.17E-02	

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LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	0	1.01E-04	
PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.85	0.085	once per enrollment = once per cv per peak period	114	0	2.24E-04	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		4.72E-04
							TOTALS (b/s/user):			**2.86E-01**	**1.61E-01**

Transit, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	98		1.34E-03
RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	0	66		1.81E-04
RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	58		7.93E-04
TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	1	0.1	one corrective message per ten vehicles per peak period	8210	0	1.75E-02	
TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	1	13	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	2.89E-01	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	1	13	one correction per hour during the peak period	17260	0	4.79E+00	

Transit, 2012, Thruville

TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	1	52	update every 15 minutes during the peak period	7786	0	8.65E+00	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	
TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	1	13	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		7.22E-03
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_conditions_request	=2	r	1	0.1	one corrective message per ten vehicles per peak period	0	34		7.26E-05

Transit, 2012, Thruville

TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	1	3.2	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		1.27E-02
TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	1	13	updated every 60 minutes during the peak period	0	1042		2.89E-01
TRVS	TRMS	transit_vehicle_collected_trip_data	=transit_vehicle_passenger_loading+transit_vehicle_running_times	r	1	13	every hour for each transit vehicle per peak period	0	1826		5.07E-01
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	1	52	update every 15 minutes during the peak period	0	274		3.04E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	1	156	updated every 5 minutes during the peak period	0	234		7.80E-01
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	1	13	updated every 60 minutes during the peak period	0	250		6.94E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	1	52	updated every 15 minutes during the peak period	0	274		3.04E-01
							TOTALS (b/s/user):			**1.43E+01**	**3.46E+00**

Emergency Management, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**

Probes, 2012, Thruville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
VS	ISP	vehicle_guidance_probe_data	=route_segment_identity+vehicle_identity	r	1	12	average of 12 probe reports per vehicle per peak period	0	314		1.74E-01
							TOTALS (b/s/user):			**0.00E+00**	**1.74E-01**

Private Vehicle, 2012, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	3.61E-07	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	2.17E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	2.17E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.2	0.2	one set of data per peak period	6146	0	5.69E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	1.00E-02	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vs uses per peak period	146	0	2.03E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	1.65E-06	
PayInstr	VS	fpi_transit_user_vehicle_input_credit_identity	=credit_identity	f	1	1E-04	one in 10000 vehicles uses this flow per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		3.92E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		4.66E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		5.86E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		5.94E-06

Private Vehicle, 2012, Mountainville

VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.2	one request per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		9.44E-04
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per ten vehicles per peak period	0	674		6.24E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		4.63E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		2.38E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		1.20E-07
							TOTALS (b/s/user):			**6.71E-02**	**4.32E-03**

Traveler, 2012, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	PIAS	emergency_request_personal_traveler_acknowledge	=confirmation_flag	f	0.3	8E-05	one emergency per 2000 users in peak period	26	0	9.03E-08	
ISP	PIAS	transit_deviations_for_portables	=traveler_identity+list_size+TRANSIT_SEGS*(transit_vehicle_identity+transit_vehicle_achieved_time+transit_route_segment_number)	f	0.2	5E-04	one request per 20 pias per peak period	3578	0	8.28E-05	
ISP	PIAS	traveler_guidance_route	=route_identity+traveler_route+traveler_identity	f	0.3	0.015	one route per day per pias	18306	0	1.27E-02	
ISP	PIAS	traveler_personal_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+stored_credit+traveler_identity+traveler_total_trip_cost	f	0.2	0.01	one payment per 10 pias per peak period	818	0	3.79E-04	
ISP	PIAS	traveler_personal_transaction_confirmation	=credit_identity+traveler_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.01	one confirmation per 10 pias per day	650	0	3.01E-04	
ISP	PIAS	traveler_personal_yellow_pages_data	=traveler_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.2	0.1	one yellow pages response per pias per peak period	1140	0	5.28E-03	
LocData	PIAS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten pias uses per peak period	146	0	2.03E-04	
PayInstr	PIAS	fpi_traveler_personal_input_credit_identity	=credit_identity	f	0.2	0.01	one transaction per 10 pias per day	178	0	8.24E-05	
PIAS	EM	emergency_request_personal_traveler_details	=date+time+traveler_personal_emergency_request	r	0.3	8E-05	one emergency per 2000 users in peak period	0	370		1.28E-06
PIAS	ISP	traffic_data_portables_request	=traffic_data_request+traveler_identity	r	0.2	0.1	one request per pias per peak period	0	250		1.16E-03
PIAS	ISP	transit_deviations_portables_request	=traveler_identity+transit_vehicle_deviation_request+transit_route_number	r	0.2	0.005	one request per 20 pias per peak period	0	250		5.79E-05

Traveler, 2012, Mountainville

PIAS	ISP	traveler_personal_current_condition_request	=traveler_identity	r	0.2	0.1	one request per pias per peak period	0	210		9.72E-04
PIAS	ISP	traveler_personal_payment_information	=credit_identity+parking_space_details+ride_segments+stored_credit+toll_segments+traveler_identity	r	0.2	0.01	one payment per 10 pias per peak period	0	1130		5.23E-04
PIAS	ISP	traveler_personal_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.01	one request per 10 pias per peak period	0	402		1.86E-04
PIAS	ISP	traveler_personal_yellow_pages_information_request	=1	r	0.2	0.1	one yellow pages request per pias per peak period	0	26		1.20E-04
PIAS	PayInstr	tpi_debited_payment_at_personal_device	=4	r	0.2	0.01	one transaction per 10 pias per day	0	50		2.31E-05
PIAS	TRMS	transit_services_portables_request	=destination+origin+traveler_identity	r	0.2	0.01	one request per 10 pias per peak period	0	466		2.16E-04
TRMS	PIAS	transit_services_for_portables	=traveler_identity+2*(transit_services_for_output)	f	0.2	0.003	one request per 20 pias per peak period	2530	0	3.87E-04	
							TOTALS (b/s/user):			**1.94E-02**	**3.26E-03**

CVO-Local, 2012, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	1.6	average fleet vehicle requests two routes per peak period	0	154		5.70E-03
CVS	FMS	cf_on_board_vehicle_data	=cv_on_board_data+cv_general_output_message+vehicle_location_for_cv	r	0.1	0.2	two times per vehicle per peak period for an average over all vehicles	0	2106		9.75E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	3.2	average vehicle requests 4 routes per peak period	0	1234		9.14E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	3.2	four routes per vehicle per peak period	0	2066		1.53E-01
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	1.6	twice per vehicle per peak period	5082	0	1.88E-01	
FMS	CVS	cf_request_on_board_vehicle_data	=2	f	0.1	0.4	four times per vehicle per peak period for an average over all vehicles	34	0	3.15E-04	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	3.2	average vehicle requests four routes per peak period	3042	0	2.25E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	3.2	average vehicle requests four routes per peak period	1226	0	9.08E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07

CVO-Local, 2012, Mountainville

FMS	ImFrght D	To_Intermodal_Freight_ Depot	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_ Shipper	=64	r	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	0	530		9.81E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.16	twice per vehicle per peak period	0	1234		4.57E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.32	four times per vehicle per peak period	0	1354		1.00E-02
ImFrghtD	FMS	From_Intermodal_Freig ht_Depot	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ImFrghtS	FMS	From_Intermodal_Freig ht_Shipper	=64	f	0.8	0.008	one in ten of vehicles interact once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.16	twice per vehicle per peak period	3034	0	1.12E-02	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.32	four times per vehicle per peak period	3154	0	2.34E-02	
ISP	VS	advanced_fares_and_c harges_response	=confirmation_flag+credit_identity+parking_lot_cost +stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advanced_tolls_and_far es_response	=confirmation_flag+credit_identity+stored_credit+tol l_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_fo r_advisories+prediction_data_for_advisories+transit _services_for_advisories+transit_running_data_for_ advisories	f	0.2	0.4	two sets of data per peak period	6146	0	5.69E-02	
ISP	VS	yellow_pages_advisory_ data	=yellow_pages_data_for_advisories+yellow_pages_ cost+yellow_pages_dining_reservation_confirmatio n+yellow_pages_lodging_reservation_confirmation+ yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	5.00E-03	
LocData	VS	From_Location_Data_S ource	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	0	1.01E-04	

CVO-Local, 2012, Mountainville

PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		2.93E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		2.97E-06
VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	0	674		3.12E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		2.31E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		1.19E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		6.02E-08
							TOTALS (b/s/user):			**6.01E-01**	**2.78E-01**

CVO-Long Haul, 2012, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
CVAS	CVCS	cv_credentials_database_update	=cv_credentials_details+cv_credentials_status_code+cv_trip_classification_data	f	0.85	9E-05	one out of 1000 vehicles per peak period	482	0	9.48E-07	
CVAS	CVCS	cv_credentials_information_response	=cv_credentials_details+cv_credentials_status_code	f	0.85	0.009	one out of 10 vehicles	410	0	8.07E-05	
CVAS	CVCS	cv_safety_database_update	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles	410	0	9.49E-06	
CVAS	CVCS	cv_safety_information_response	=cv_credentials_details+cv_roadside_safety_data	f	1	0.001	one out of 100 vehicles are transmitted	410	0	9.49E-06	
CVAS	FMS	cf_clearance_enrollment_confirm	=confirmation_flag	f	0.85	0.085	once per vehicle per peak period	26	0	5.12E-05	
CVAS	FMS	cf_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cf_enrollment_payment_confirmation	=cv_route_number+cv_account_number+cv_amount_billed	f	0.85	0.085	once per vehicle per peak period	170	0	3.34E-04	
CVAS	FMS	cv_enrollment_information	=cv_route_number+cv_taxes_and_duties+route+route_type	f	0.85	0.043	one out of two vehicles require info. per peak period	3818	0	3.76E-03	
CVAS	FMS	cv_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.085	once per vehicle per peak period	346	0	6.81E-04	
CVCS	CVAS	cv_credentials_information_request	=cv_credentials_details+cv_credentials_request_type+cv_credentials_request_identity+cv_roadside_facility_identity	r	0.85	0.009	request info on one in ten vehicles	0	554		1.09E-04
CVCS	CVAS	cv_roadside_daily_log	=cv_roadside_facility_identity+date++cv_archived_safety_data+cv_archived_inspection_data+cv_screening_record	r	0.85	9E-04	one report per 100 vehicles per peak period	0	3362		6.62E-05
CVCS	CVAS	cv_safety_information_request	=cv_credentials_details+cv_safety_information_request_identity+cv_safety_information_request_type+cv_roadside_facility_identity	r	1	0.01	request info on one in ten vehicles	0	554		1.28E-04
CVCS	CVAS	cv_update_safety_problems_list	=cv_credentials_details+cv_roadside_facility_identity+cv_roadside_safety_data	r	1	0.001	one out of 100 vehicles are on the list per peak period	0	538		1.25E-05

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CVS	FMS	cf_driver_route_instructions_request	=cv_driver_number+cv_route_number	r	0.8	0.8	average fleet vehicle requests one route per peak period	0	154		2.85E-03
CVS	FMS	cf_on_board_vehicle_data	=cv_on_board_data+cv_general_output_message+vehicle_location_for_cv	r	0.1	0.2	two times per vehicle per peak period for an average over all vehicles	0	2106		9.75E-03
CVS	FMS	cv_driver_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number	r	0.85	0.85	once per vehicle per peak period	0	330		6.49E-03
CVS	FMS	cv_driver_enrollment_request	=cv_cargo_class+cv_route_number+cv_vehicle_class+cv_weight_class	r	0.85	0.85	once per vehicle per peak period	0	98		1.93E-03
CVS	FMS	cv_driver_route_request	=trip_request+route_type	r	0.8	1.6	average vehicle requests 2 routes per peak period	0	1234		4.57E-02
CVS	FMS	cv_driver_storage_request	=cv_route_number	r	0.8	0.08	one in ten vehicles per peak period	0	26		4.81E-05
CVS	FMS	cv_static_route_data	=256	r	0.8	1.6	two routes per vehicle per peak period	0	2066		7.65E-02
EM	FMS	cf_hazmat_request	=16	f	0.5	5E-05	once per 1000 vehicles per peak period	146	0	1.69E-07	
EM	VS	emergency_request_driver_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
EM	VS	emergency_request_vehicle_acknowledge	=1	f	0.3	3E-04	one emergency per 1000 vehicles per peak period	26	0	1.81E-07	
FMS	CVAS	cf_enroll_clearance_data	=cv_credentials_details	r	0.85	0.085	once per vehicle per peak period	0	402		7.91E-04
FMS	CVAS	cf_enrollment_payment_request	=cf_manager_credit_identity+cv_account_number+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cf_enrollment_request	=cv_route_data+cv_credentials_details+cv_route_number+cv_trip_classification_data+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03
FMS	CVAS	cv_enrollment_payment_request	=cv_account_number+cv_driver_credit_identity+cv_route_number+1.5*(cv_taxes_and_duties)	r	0.85	0.085	once per vehicle per peak period	0	414		8.15E-04
FMS	CVAS	cv_enrollment_request	=cv_route_data+cv_credentials_details+cv_trip_classification_data+cv_route_number+route_type	r	0.85	0.085	once per vehicle per peak period	0	3498		6.88E-03

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FMS	CVS	cf_driver_route_instructions	=cf_driver_route+cf_driver_load_details	f	0.8	0.8	once per vehicle per peak period	5082	0	9.41E-02	
FMS	CVS	cf_request_on_board_vehicle_data	=2	f	0.1	0.2	two times per vehicle per peak period for an average over all vehicles	34	0	1.57E-04	
FMS	CVS	cv_driver_enrollment_information	=cv_route_number+cv_taxes_and_duties	f	0.85	0.425	one out of two vehicles require info. per peak period	82	0	8.07E-04	
FMS	CVS	cv_driver_enrollment_payment_confirmation	=cv_account_number+cv_amount_billed+cv_driver_credit_identity+cv_route_number	f	0.85	0.85	once per vehicle per peak period	346	0	6.81E-03	
FMS	CVS	cv_driver_route_data	=cv_route_data+route_type+cv_route_number	f	0.8	1.6	average vehicle requests two routes per peak period	3042	0	1.13E-01	
FMS	CVS	cv_static_route_request	=origin+destination+departure_time+desired_arrival_time+preferences+constraints	f	0.8	1.6	average vehicle requests two routes per peak period	1226	0	4.54E-02	
FMS	EM	cf_hazmat_route_information	=cv_route_number+route	r	0.5	5E-05	once per 1000 vehicles per peak period	0	3754		4.34E-06
FMS	EM	cf_hazmat_vehicle_information	=28	r	0.5	5E-05	once per 1000 vehicles per peak period	0	242		2.80E-07
FMS	ImFrghtD	To_Intermodal_Freight_Depot	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ImFrghtS	To_Intermodal_Freight_Shipper	=64	r	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	0	530		9.81E-05
FMS	ISP	cf_route_request	=trip_request+cv_route_number	r	0.8	0.08	once per vehicle per peak period	0	1234		2.29E-03
FMS	ISP	cv_route_request	=trip_request+vehicle_identity	r	0.8	0.16	twice per vehicle per peak period	0	1354		5.01E-03
FMS	PayInstr	tpi_debited_commercial_manager_payment	=4	r	0.85	0.085	once per enrollment	0	50		9.84E-05
ImFrghtD	FMS	From_Intermodal_Freight_Depot	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	

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ImFrghtS	FMS	From_Intermodal_Freight_Shipper	=64	f	0.8	0.008	one in ten vehicles interacts once with an intermodal carrier	530	0	9.81E-05	
ISP	FMS	cf_route	=cv_route_data+cv_route_number	f	0.8	0.08	once per vehicle per peak period	3034	0	5.62E-03	
ISP	FMS	cv_route	=cv_route_data+vehicle_identity	f	0.8	0.16	twice per vehicle per peak period	3154	0	1.17E-02	
ISP	VS	advanced_fares_and_charges_response	=confirmation_flag+credit_identity+parking_lot_cost+stored_credit+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advanced_tolls_and_fares_response	=confirmation_flag+credit_identity+stored_credit+toll_cost+transit_fare	f	0.2	2E-04	one user per 1000 users per peak period	234	0	1.08E-06	
ISP	VS	advisory_data	=traffic_data_for_advisories+predicted_incidents_for_advisories+prediction_data_for_advisories+transit_services_for_advisories+transit_running_data_for_advisories	f	0.2	0.2	one set of data per peak period	6146	0	2.85E-02	
ISP	VS	yellow_pages_advisory_data	=yellow_pages_data_for_advisories+yellow_pages_cost+yellow_pages_dining_reservation_confirmation+yellow_pages_lodging_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	10802	0	5.00E-03	
LocData	VS	From_Location_Data_Source	=16	f	0.3	0.03	one in ten vehicles uses once per peak period	146	**0**	1.01E-04	
PayInstr	FMS	fpi_commercial_manager_input_credit_identity	=12	f	0.85	0.085	once per enrollment = once per cv per peak period	114	0	2.24E-04	
PayInstr	VS	fpi_driver_vehicle_input_credit_identity	=credit_identity	f	0.2	2E-04	one vehicle per 1000 per peak period	178	0	8.24E-07	
VS	EM	emergency_request_driver_details	=date+driver_personal_emergency_request+time	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	282		1.96E-06
VS	EM	emergency_request_vehicle_details	=date+time+vehicle_emergency_request	r	0.3	3E-04	one emergency per 1000 vehicles per peak period	0	3354		2.33E-05
VS	ISP	advanced_fares_and_charges_request	=0.6*(advanced_fare_details)+0.6*(advanced_parking_lot_charges)	r	0.2	2E-04	one user per 1000 users per peak period	0	632.4		2.93E-06
VS	ISP	advanced_tolls_and_fares_request	=0.6*(advanced_fare_details)+0.6*(advanced_tolls)	r	0.2	2E-04	one user per 1000 users per peak period	0	642		2.97E-06

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VS	ISP	advisory_data_request	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity	r	0.2	0.4	two requests per vehicle per peak period	0	290		2.69E-03
VS	ISP	vehicle_guidance_route_accepted	=route_identity	r	0.3	0.6	two acceptances per peak period	0	34		4.72E-04
VS	ISP	yellow_pages_advisory_requests	=advisory_data_scope+vehicle_location_for_advisories+transit_route_number+transit_vehicle_identity+yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	0.02	one yellow pages advisory per 10 vehicles per peak period	0	674		3.12E-04
VS	PayInstr	tpi_debited_driver_payment_at_vehicle	=4	r	0.2	2E-04	one vehicle per 1000 per peak period	0	50		2.31E-07
VS	PMS	advanced_parking_lot_charges_request	=credit_identity+parking_lot_identity+parking_space_details+stored_credit+vehicle_identity	r	0.2	1E-04	one user per 1000 users per peak period	0	514		1.19E-06
VS	PMS	parking_lot_payment_confirmation	=confirmation_flag	r	0.2	1E-04	one vehicle per 1000 per peak period	0	26		6.02E-08
							TOTALS (b/s/user):			**3.20E-01**	**1.71E-01**

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PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
ISP	RTS	advanced_tolls_and_charges_roadside_confirm	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	426	0	5.83E-06	
ISP	RTS	traveler_payment_confirmation	=advanced_tolls_confirm+advanced_fares_confirm+advanced_parking_lot_charges_confirm+credit_identity+kiosk_identity+stored_credit+traveler_total_trip_cost	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	666	0	9.11E-06	
ISP	RTS	traveler_transaction_confirmation	=credit_identity+kiosk_identity+transaction_number+yellow_pages_cost+yellow_pages_lodging_reservation_confirmation+yellow_pages_dining_reservation_confirmation+yellow_pages_ticket_purchase_confirmation	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	498	0	6.81E-06	

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ISP	RTS	traveler_yellow_pages_data	=kiosk_identity+0.01*(yellow_pages_general_information+yellow_pages_specific_information+yellow_pages_transaction_information)	f	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	987.7	0	1.35E-05	
PayInstr	RTS	fpi_confirm_fare_payment_at_roadside	=confirmation_flag	f	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	26	0	7.11E-05	
PayInstr	RTS	fpi_transit_roadside_tag_data	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	RTS	fpi_transit_user_roadside_input_credit_identity	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	RTS	fpi_traveler_roadside_input_credit_identity	=credit_identity	f	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	2.43E-06	
PayInstr	TRVS	fpi_confirm_fare_payment_on_transit_vehicle	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
PayInstr	TRVS	fpi_transit_vehicle_tag_data	=credit_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	178	0	1.22E-04	
RTS	EM	emergency_request_kiosk_traveler_details	=date+time+traveler_personal_emergency_request	r	1	0.003	one emergency per 1000 transit users per peak period, or 0.032/transit vehicle	0	370		2.53E-05
RTS	ISP	advanced_tolls_and_charges_roadside_request	=0.6*(advanced_charges)+0.6*(advanced_tolls)	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	738		1.01E-05
RTS	ISP	traffic_data_kiosk_request	=kiosk_identity+traffic_data_request	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	98		1.34E-03

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RTS	ISP	transit_deviation_kiosk_request	=kiosk_identity+transit_vehicle_deviation_request	r	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	0	66		1.81E-04
RTS	ISP	traveler_current_condition_request	=kiosk_identity	r	0.2	0.64	average of one use per transit user per peak period = 32 per transit vehicle	0	58		7.93E-04
RTS	ISP	traveler_payment_information	=credit_identity+kiosk_identity+parking_space_details+ride_segments+stored_credit+toll_segments	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	978		1.34E-05
RTS	ISP	traveler_transaction_request	=yellow_pages_dining_reservation+yellow_pages_lodging_reservation+yellow_pages_ticket_purchase	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	402		5.50E-06
RTS	ISP	traveler_trip_confirmation	=paratransit_service_confirmation+traveler_identity+traveler_rideshare_confirmation	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	858		1.17E-05
RTS	ISP	traveler_trip_request	=trip_request+traveler_identity+traveler_rideshare_request	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	1434		1.96E-05
RTS	ISP	traveler_yellow_pages_information_request	=1	r	0.2	6E-04	one use per 1000 transit users per peak period, or 0.032/transit vehicle	0	26		3.56E-07
RTS	PayInstr	tpi_debited_fare_payment_at_roadside	=4	r	0.2	0.128	one in five transit users = 6.4 per transit vehicle per peak period	0	50		1.37E-04
RTS	PayInstr	tpi_debited_transit_user_payment_at_roadside	=4	r	0.2	0.064	one in ten transit users = 3.2 per transit vehicle per peak period	0	50		6.84E-05
RTS	PayInstr	tpi_debited_traveler_payment_at_roadside	=4	r	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	50		6.84E-07
RTS	PayInstr	tpi_request_fare_payment_at_roadside	=2	r	0.2	6E-04	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	34		4.65E-07

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TRMS	TRVS	approved_corrective_plan	=transit_route_corrections+transit_changes_in_stops+transit_changes_in_speed	f	1	0.1	one corrective message per ten vehicles per peak period	8210	0	1.75E-02	
TRMS	TRVS	confirm_vehicle_fare_payment	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	
TRMS	TRVS	other_services_vehicle_response	=traveler_identity+credit_identity+other_services_data	f	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	2418	0	3.31E-04	
TRMS	TRVS	paratransit_transit_driver_instructions	=128	f	1	13	dispatch message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	1042	0	2.89E-01	
TRMS	TRVS	request_transit_user_image	=8	f	1	0.032	one image for 1000 users = 0.032 uses per transit vehicle per peak period	82	0	5.61E-05	
TRMS	TRVS	transit_operator_request_acknowledge	=2	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	34	0	2.32E-05	
TRMS	TRVS	transit_services_for_corrections	=list_size+1*(2/NUM_TRANSIT_ROUTES)*(transit_services)	f	1	13	one correction per hour during the peak period	17260	0	4.79E+00	
TRMS	TRVS	transit_services_for_eta	=transit_route_number+transit_route_segment_list+transit_route_stop_list	f	1	52	update every 15 minutes during the peak period	7786	0	8.65E+00	
TRMS	TRVS	transit_services_for_vehicle_fares	=transit_route_fare_data	f	1	1	update daily during peak period	16826	0	3.60E-01	
TRMS	TRVS	transit_vehicle_advanced_payment_response	=advanced_charges_confirm+advanced_tolls_confirm+confirmation_flag+transit_vehicle_identity	f	1	0.032	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	554	0	3.79E-04	
TRMS	TRVS	transit_vehicle_fare_data	=transit_fares	f	1	1	updated once per peak period per transit vehicle	922	0	1.97E-02	
TRMS	TRVS	transit_vehicle_fare_payment_debited	=confirmation_flag	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	26	0	1.78E-02	

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TRMS	TRVS	transit_vehicle_fare_payment_request	=transit_fare	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	PayInstr	tpi_debited_payment_on_transit_vehicle	=4	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	50	0	3.42E-02	
TRVS	PayInstr	tpi_request_fare_payment_on_transit_vehicle	=2	f	1	32	average of one use per transit user per peak period = 32 per transit vehicle	34	0	2.32E-02	
TRVS	TRMS	other_services_vehicle_request	=traveler_identity+credit_identity+other_services_data	r	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	2418		3.31E-04
TRVS	TRMS	paratransit_transit_vehicle_availability	=1	r	1	13	avail. message every 15 min. during peak period=48/4(ratio of paratr/tr veh)	0	26		7.22E-03
TRVS	TRMS	request_vehicle_fare_payment	=credit_identity+transit_fare+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+traveler_identity	r	1	32	average of one use per peak period per transit user = 32 per transit vehicle	0	466		3.19E-01
TRVS	TRMS	transit_conditions_request	=2	r	1	0.1	one corrective message per ten vehicles per peak period	0	34		7.26E-05
TRVS	TRMS	transit_emergency_details	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_emergency_information	=transit_driver_emergency_request+transit_user_emergency_request+transit_vehicle_location	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	282		1.93E-05
TRVS	TRMS	transit_operator_emergency_request	=128	r	1	0.003	emergency for one in 10000 transit users=0.0032 per transit vehicle per peak	0	1042		7.12E-05

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TRVS	TRMS	transit_services_for_eta_request	=transit_vehicle_identity+transit_route_number+transit_route_schedule_number	r	1	3.2	average of one use per 10 transit users per peak period= 3.2 per transit vehicle	0	186		1.27E-02
TRVS	TRMS	transit_user_vehicle_image	=JPEG*(ftu_transit_user_vehicle_image)	r	1	0.011	20 images per metro area per peak period=20/1788 transit vehicles	0	73746		1.73E-02
TRVS	TRMS	transit_vehicle_advanced_payment_request	=advanced_charges+advanced_tolls+transit_vehicle_location	r	0.2	0.006	one data set for 1000 users = 0.032 uses per transit vehicle per peak period	0	1450		1.98E-04
TRVS	TRMS	transit_vehicle_arrival_conditions	=128	r	1	13	updated every 60 minutes during the peak period	0	1042		2.89E-01
TRVS	TRMS	transit_vehicle_collected_trip_data	=transit_vehicle_passenger_loading+transit_vehicle_running_times	r	1	13	every hour for each transit vehicle per peak period	0	1826		5.07E-01
TRVS	TRMS	transit_vehicle_deviations_from_schedule	=32	r	1	52	update every 15 minutes during the peak period	0	274		3.04E-01
TRVS	TRMS	transit_vehicle_eta	=transit_vehicle_identity+transit_vehicle_time+transit_route_number	r	1	156	updated every 5 minutes during the peak period	0	234		7.80E-01
TRVS	TRMS	transit_vehicle_fare_payment_confirmation	=confirmation_flag	r	1	32	average of one use per transit user per peak period = 32 per transit vehicle	0	26		1.78E-02
TRVS	TRMS	transit_vehicle_location	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_deviation	=transit_vehicle_identity+transit_vehicle_location_data	r	1	52	updated every 15 minutes during the peak period	0	250		2.78E-01
TRVS	TRMS	transit_vehicle_location_for_store	=transit_vehicle_identity+transit_vehicle_location_data	r	1	13	updated every 60 minutes during the peak period	0	250		6.94E-02
TRVS	TRMS	transit_vehicle_passenger_data	=transit_passenger_numbers+transit_route_number+transit_route_segment_number+transit_route_use_time+transit_user_category+transit_vehicle_identity	r	1	52	update every 15 minutes during the peak period	0	242		2.69E-01
TRVS	TRMS	transit_vehicle_schedule_deviation	=32	r	1	52	updated every 15 minutes during the peak period	0	274		3.04E-01
							TOTALS (b/s/user):			**1.43E+01**	**3.46E+00**

Emergency Management, 2012, Mountainville

PA Source	PA Sink	Data Flow	Contents	Direc.	Penetration	freq	Freq. Explain	Fwd bits	Rev bits	Fwd rate (b/s/u)	Rev rate (b/s/u)
EM	EVS	emergency_vehicle_driver_outputs	=128	f	1	13	average one driver output per vehicle per hour during the peak period	1042	0	2.89E-01	
EVS	EM	emergency_driver_dispatch_acknowledge	=1	r	1	26	average one dispatch acknowledge per vehicle per 1/2 hour during the peak period	0	26		1.44E-02
EVS	EM	emergency_driver_status_update	=16	r	1	26	average one status update per vehicle per 1/2 hour during the peak period	0	146		8.11E-02
EVS	EM	emergency_vehicle_driver_inputs	=64	r	1	13	average one driver input per vehicle per hour during the peak period	0	530		1.47E-01
							TOTALS (b/s/user):			**2.89E-01**	**2.43E-01**