Table 4.1 Requirements for Archived Data from ITS for Multiple (Nonreal-Time) Uses

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Mainline traffic volume	Count of vehicles, during a given time period, past a point on the highway that is not influenced by a traffic control device or intersection. Includes volume counts from Electronic Toll Collection equipment.	Vehicles per unit time	Raw data from field sensors should be stored online for at least one day in the form in which they are received from the field. Data reduction should allow for permanent offline (or online) storage of the raw data. Data reduction should store the data online in multiple levels *for each highway location* where the data are collected: 1) 5-minute summaries by lane and direction -- online storage for at least one month 2) 1-hour summaries by direction -- online storage for at least one year 3) 24-hour summaries by direction -- permanent online storage In performing the aggregation, locally-specified rules for handling missing or erroneous data should be applied. (The rules should be part of the metadata for these data elements.) Volumes in the aggregation are the simple totals for the time period; loop occupancy and density are simple averages; and speed should be the volume-weighted average. For vehicle classification and weights, categories should conform to those in the most recent *Traffic Monitoring Guide*. Both classification and weight data will be stored *for each highway location* where the data are collected. Classification data should be stored as 1-hour summaries for each direction and lane and should be kept online for at least one year. Vehicle weight data should be accumulated online 24-hour intervals, at which time they should be summarized to the same structure as Level 3 of the Long-Term Pavement Performance Traffic Data Base (Appendix B). Permanent offline storage of both classification and weight data received directly from the field should be provided. For vehicle headways, the type of lead and following vehicle should also be indicated.	+/-5%
Traffic control device approach volumes	Count of vehicles during a given time period on the approach to signalized intersections or at ramp meter controls.			+/-5%
Signalized intersection turning movements	Count of vehicles during a given time period for each turning movement at a signalized intersection.			+/-5%
Vehicle speed	Average speed of vehicles past a point on the highway during a given time period	Kilometers per hour		+/-5%; low speeds more important than high speeds
Loop occupancy	Average percent time that inductance loops sense vehicles during a given time period	Percent		+/-5%
Density	Average density of vehicles occupying a segment of highway during a given time period	Vehicles per lane-kilometer		+/-5%
Vehicle headway	The distance between two vehicles in the traffic stream, measured from the front bumper of the lead vehicle to the front bumper of the following vehicle.	Meters		+/-5%
Vehicle classification	Count of vehicles in pre-defined categories during a given time period	Vehicles per unit time by category		+/-10%
Vehicle weight	Weight of individual vehicles, axle groups for individual vehicles, or axles for individual vehicles	Kilograms		+/-10% for total vehicle weight
Traffic control device queue detection	Presence or absence of a queue located at significant setbacks from traffic control devices.	Yes/No	Time and setback from traffic control device should be stored on this record. Data should be stored at the level received from field controllers.	Accurate reading 90% of time
Traffic control device preemptions	Number of times traffic control devices (ramp meters and signals) have their timing preempted by transit, HOV, or emergency vehicles	Number	No special summarization required; save all data in raw form.	95-100% accuracy

Table 4.1 Requirements for Archived Data from ITS for Multiple (Nonreal-Time) Uses

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Traffic control device cycle lengths, phasing, and offsets	Time allocated for each phase (traffic signals only) and cycle (ramp meters and traffic signals). Offsets for traffic signals immediately upstream and downstream of the signal being inventoried.	Seconds	No special summarization required; save all data in raw form.	95-100% accuracy
Visual-based queue length	**Freeways:** Length of a platoon of vehicles where front-to-rear headways between vehicles are less than 25 feet, measured over a given time period. **Nonfreeways:** Length of a platoon of vehicles where front-to-rear headways between vehicles are less than 15 feet, measured over a given time period.	Kilometers	These data are determined from video or still-photography by either image processing or manual coding. Data should be permanently stored for each highway location at time intervals no smaller than 1-minute for signalized intersections and freeway ramps, and no smaller then 5-minutes for freeway mainline segments (requires computing average queue length for each time interval). The data should indicate the downstream point (beginning) and upstream point (end) of the queue using the local standard for location referencing.	+/-500 feet
Locally-derived traffic flow metrics generated by TMCs	Indices and other measurements used by local agencies to define congestion at either points on the highway (volume-to-capacity ratio) or highway segments (travel rate, accessibility index). These types of metrics are calculated from measured data (e.g., spot speeds used to calculate travel times).	Locally determined	Storage of speed and travel time data should follow the recommendations listed under the appropriate entries in this table. Locally-derived metrics should use these as a guide for their storage structure. Metadata must contain definitions and a thorough description of methods used in the calculations.	Unknown
Parking lot utilization	Proportion of parking spaces in use at a given time for a given locations	Percent	Stored data should contain not only the percent utilization but the total number of spaces available at the parking location being inventoried. Stored data should be summarized by 15-minute intervals for each parking location.	+/-10%
Transit vehicle boardings	Number of individuals paying transit fares upon entering a transit vehicle at specific times and locations (applies to both fixed-route and paratransit vehicles)	Number	Data should be permanently stored at the level that they are collected by electronic fare payment systems. Fields for identifying vehicle and route should be included in the structure.	+/-5%
Transit vehicle locations and times	The time that fixed-route transit vehicles arrive at scheduled stops and transfer points	Time	Data should be permanently stored at the level that they are collected by automatic vehicle location technologies. Fields for identifying vehicle and route should be included in the structure. Supplemental data should also include if an advisory for a route deviation was issued.	Unknown
Rideshare requests	The origin and destination of rideshare patrons by time of the request	Prevailing location referencing system	Data should be permanently stored by individual request.	95-100% accuracy

Table 4.1 Requirements for Archived Data from ITS for Multiple (Nonreal-Time) Uses

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Key times for incident specification	Incident start - time the incident occurred Incident notification - time the incident was reported from the field to a central operator Incident verification - time the incident was verified and recorded by a central operator Incident dispatch - time an EV was dispatched to the scene (multiples allowed) Incident scene arrival - time an EV arrived at the incident scene (multiples allowed) Incident lane clearance - time when each lane blocked was re-opened to traffic (for lane blockage incidents; multiples allowed) Incident shoulder clear - time when all shoulders were cleared of the blockage **and** EV Incident return - time each EV left the incident scene (multiples allowed)	Time	Data should be permanently stored for each incident reported from the field, whether they are verified or not. Times should be uniquely keyed to individual incidents. Supplemental data must include whether the times were actually measured/reported or estimated by system operators.	+/-5 minutes
Incident type	Category of incident	Formatted codes	Incident types should include at a minimum: (1) traffic crash, (2) debris (not water), (3) disabled/stalled vehicle (not crash-related), (4) fire on or adjacent to roadway (not related to a crash), (5) flooding or excess water on roadway (6) other weather-related (dust storm, tornado).	95-100% accuracy
Incident extent	Extent of traffic lane and shoulder blockage	Number	Number of lanes and/or shoulders blocked by the incident, including the times the blockage started and ended (to allow for multiple phase incidents).	
Incident hazardous material category	Hazard class and U.N. numbers (where appropriate) from the placard (multiple entries allowed)		Supplemental data on the incident; data should be permanently stored at the level that they are collected from the field.	
Incident hazardous material release	Amount of material released (multiple entries allowed)	Must be specified depending on container type		
Police accident report (PAR) reference	If the incident is a crash, the PAR reference number	Number		
Construction and work zone extent	Number of lanes and shoulders blocked by the construction or work zone activity	Number	Beginning and ending times **and** locations of each activity also need to be specified. Supplemental data could include a description of the activity.	95-100% accuracy
Train arrivals at HRIs	The beginning and ending times that HRIs are blocked by trains	Time	Data should be permanently stored at the level that they are collected from the field.	95-100% accuracy

Table 4.1 Requirements for Archived Data from ITS for Multiple (Nonreal-Time) Uses

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Emergency vehicle dispatch times	EV dispatch - time an EV was dispatched to the scene EV scene arrival - time an EV arrived at the scene EV clear - time emergency personnel reported the case "cleared" EV leave - time an EV left the scene EV destination arrival - time an EV arrived at its return location (e.g., hospital for medical service)	Time	These data are relevant for **all** emergencies, not just incidents. Data are usually collected by individual agencies through computer-aided dispatch systems.	+/-5 minutes
Emergency vehicle locations during response	EV origin - location of the EV when it was dispatched EV destination - location of the case or incident EV intermediate location - location of the EV at selected time intervals between origin and destination	Prevailing location referencing system	These data are used to track the routes taken by EVs in responding to cases or incidents. Intermediate locations should be recorded at 1-minute intervals between the times the vehicle was dispatched and it arrives at the scene. Because of the volume of the data generated, permanent online storage is optional if the data are stored offline.	Unknown
Commercial vehicle cargo type	The SIC code for the type of cargo being transported	SIC code	These data are collected by CVO systems, usually field sensors that detect the passage of individual trucks. The data should include time, location, and a vehicle identification code. Archiving data from every truck would probably not be cost-effective; however, provision to permanently store a sample of data should be made.	90-95% accuracy
Commercial vehicle origin and destination	For the shipment being made by this vehicle, the first point of origin and last destination	Prevailing location referencing system		Unknown
Intermodal container cargo type	The SIC code for the type of cargo being transported and the type of container.	SIC code	Same as for commercial vehicle cargo and O/D.	90-95% accuracy
Commercial vehicle origin and destination	The first point of origin and last destination for the container.	Prevailing location referencing system		Unknown
Hazardous material cargo type	Hazard class and U.N. numbers (where appropriate) from the placard (multiple entries allowed)			95-100% accuracy
Hazardous material pre-planned shipment route	The specified route to be taken for hazardous material shipments that require such treatment	Highway routes (as determined by the issuing agency)		Unknown
Commercial vehicle driver log	Selected locations and dates/times to determine hours of service for drivers	Prevailing location referencing system	These data are collected from on-board safety systems that are downloaded to field sensors. Archiving data from every truck would probably not be cost-effective; however, provision to permanently store a sample of data should be made. Supplemental data include vehicle identification and cumulative vehicle mileage. Privacy concerns may preclude the collection of these data.	95-100% accuracy

Table 4.1 Requirements for Archived Data from ITS for Multiple (Nonreal-Time) Uses

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Commercial vehicle subsystem status	Type of subsystem and status of its operation	(N/A)		Unknown
Roadside emission concentration	Volumetric concentration of pollutants measured by roadside sensors	Grams per unit volume (HC, CO, NO_x, SO_x)	Data should be saved for a minimum of one day online in the form that they are received from the field. These data should be aggregated and permanently stored for 15-minute time intervals (average concentrations for 15-minutes).	Unknown
Roadside temperature	Air temperature	Degrees Celsius	These data are collected by roadside weather sensing equipment. Data should be aggregated to no longer than 15-minute summaries (total precipitation, average temperature, predominant wind direction, average speed of wind in predominant direction) for permanent storage.	Unknown
Roadside precipitation	Type and amount of precipitation	Cubic centimeters (liquid volume)		Unknown
Roadside light conditions	Light level at roadside	At a minimum, should follow the codes specified in the Fatal Accident Reporting System		Unknown
Roadway surface condition	The surface condition of the roadway in terms of amount and type of moisture			Unknown
Roadside wind conditions	Direction and speed of wind	Kilometers per hour (speed)		Unknown
Segment travel times from probe vehicles	The time for a probe vehicle to traverse a given roadway segment	Seconds	For permanent storage, probe information (times at given points on the highway system) should be converted to total seconds. The data should be permanently stored online as 5-minute summaries (total probes counted, average travel time). A supplemental data item for permanent storage is the segment length. The raw probe data may be stored offline if actual vehicle identification is not included.	+/-10%
Transit vehicle times and locations	Data from AVI- or GPS-equipped transit vehicles	Seconds; prevailing location referencing system	For permanent storage, arrival times at pre-determined stops should be recorded along with vehicle and route identification. If transit vehicles are used as general travel time probes, they should be included as a special category under "Segment travel times from probe vehicles".	+/-10%
Traveler message content	Actual text of message displayed on a VMS or to travelers via personal devices.	(N/A)	All VMS messages (along with time and location) should be permanently stored online. Messages to personal devices (e.g., in-vehicle signing) may be sampled prior to permanent storage.	Close to 100% accuracy

Primary Data Element or Record Type	Definition	Units	Internal Data Structure and Data Reduction Cycle	Level of Accuracy
Vehicle trajectories	Time and location of individual vehicles; measured for very short time intervals (1-10 seconds)	Prevailing location referencing system	Vehicle trajectory data can be collected through either GPS or advanced video image processing. The type of vehicle should also be indicated (see scheme under "vehicle classification"). Permanent online storage of both vehicle trajectory and origin/destination data are not recommended because of the sheer volume of data. Therefore, data should be aggregated to locally-defined geographic zones (e.g., traffic analysis zones, Census block groups) by activities. However, data may be accumulated online for short periods of time and stored offline for future use. Origin and destination activities (GPS-collected data) may be either collected directly or inferred from GIS base information (in advanced deployments.)	Unknown
Traveler origins and destinations	Origin - the point at which the trip began Destination - the point at which the trip ended Origin/Destination Activity - type of activity engaged in by the traveler at the origin and destination	Prevailing location referencing system		Unknown
Route guidance	Starting Point - the location of the trip at the time the guidance was given Ending Point - the desired destination Recommended Route - the route segments recommended	Prevailing location referencing system		Unknown
Variable facility pricing	Amount charged for a parking facility or toll for a highway segment where congestion pricing is in effect	Dollars	All recorded changes to pricing should be permanently stored.	Unknown

Notes: *This is a general indication of the desired accuracy.

(1) In addition, metadata in accordance with the principles put forth in Section 4.2 must be specified for each data element.

(2) time and location referencing must be considered in constructing systems around these data elements.

ABBREVIATIONS

HRI: Highway Rail Intersection
EV: Emergency Vehicle
TMC: Traffic Management Center
VMS: Variable Message Sign