

NCHRP 20-7 Guide to Benchmarking Operations Performance Measures Incident Duration - Pilot Test Results

4.2 Incident Duration

As incident management systems are maturing in many metropolitan areas, incident duration is emerging as the base metric to determine effectiveness of programs. The pilot study collected examples of incident duration performance measures volunteered from various organizations and compared and contrasted them with each other and against the NTOC definition.

Four state DOTs (Florida, Virginia, Washington, and Maryland) provided samples of their incident duration performance measure reports derived from the data systems supporting their incident management programs. Overland Park, Kansas indicated that they were commencing incident management in 2007, including detailed logging and reporting of incidents on the city road network, but no data were available at the time of pilot testing.

Tables 4.2.1 summarize the incident management programs and incident duration reporting details. Highlights from each location are noted below.

Florida DOT – District 4

Florida District 4 is an early adopter of an incident management system being deployed statewide in Florida. Instituted in 2005, the reporting system is fully web-enabled and automatically generates weekly, monthly, and quarterly reports based on incident management activity logged into the system. Notable aspects include reporting of detection, verification, response, roadway clearance, and incident clearance times using intuitive horizontal stacked bar charts. Incident duration is categorized by time of day, accident severity, event type, and roadway. Benefit Cost Ratio (B/C) and Net Present Value (NPV) are calculated automatically in the quarterly and yearly reports. Also of note is the reporting of incident response statistics for each Road Ranger unit.

Maryland State Highway Administration - MSHA

The Coordinated Highways Action Response Team (CHART) is the highway incident management system of the MSHA. Functional since the mid 1990s, CHART has a well established incident management program and a rich data archive as a result of a unified, well-maintained, statewide data system that supports their incident management system. A yearly evaluation and benefit analysis has been performed based on incident duration performance measures by the University of Maryland. This evaluation uses incident duration statistics to place a monetary value of the benefits provided by the CHART system. Additionally, all CHART incident data is archived in the Regional Integrated Transportation Information System (RITIS) from which custom and pre-defined incident duration reports can be generated on-demand.

Virginia DOT

Virginia DOT currently uses the Virginia Operations Information System (VOIS) as the data source to assess incident duration based on time stamps of entry logs. Individual districts and operations centers use differing data systems to manage incidents. In some cases data is manually entered into both the local system, and VOIS. Incident timeline details may be lost in the process. VDOT is developing a new system that will allow capture of specific milestones in each incident.. Incident duration from VOIS is used to determine the return on investment of VDOT's incident management program.

Washington DOT

The Washington DOT reports incident duration measures quarterly as part of its gray notebook reporting methodology. Unique to Washington DOT is the incorporation of performance management goals in the area of incident management as part of a broader effort called Government Management Accountability and Performance (GMAP). Within the GMAP program, the specified target is a reduction in incident clearance times of 5% for incidents lasting longer than 90 minutes. Washington DOT's clear and consistent reporting since 2002 of improvements in incident duration as a result of its management program has been instrumental in securing funding for continued operation and enhancements.

Implementation of the Incident Duration performance measure was generally consistent with the performance measure definition, but subject to the limitations inherent in the data systems (for example, as noted by the Virginia DOT). Various organizations differentiated themselves not in the method of implementation of the measure, but rather in the reporting and use of the data as highlighted above.

Mean incident duration was reported by all pilot test organizations. The February 2007 workshop suggested the use the median incident duration instead of the mean in order to limit the influence of outliers on the central tendency. The Virginia DOT in their monthly performance report provides a graph of both the mean and median incident duration, a sample of which is shown in Figure 4.2.1. As illustrated in the graph, although the median may limit the influence of outliers, its estimate of expected value of incident duration is artificially low. Median measures perform best on symmetrically distributed data. Incident duration data follows an exponential distribution, yielding itself poorly to median estimates of central tendency.

Incident Duration										
Agency	Program History	Incident Duration Definition		Type and Frequency of Reporting	Duration Reported by:					NOTES
		Start Time	End Time		# of Lanes Blocked	Incident Type	Major Routes	Mean Duration	Median Duration	
Florida DOT - District 4	Since 2005	The time when the first agency is notified	The time when all evidence of the incident is removed from travel and shoulder lanes	Reports are generated weekly and published on the SunGuide web interface (www.smartguide.com)	✓	✓	✓	✓		Tracks and reports number of incidents by individual Road Ranger units. Detailed reporting by time of day, event type, severity, and roadway.
Washington DOT	Since 2002	The time that WSDOT learns of the event	Two Distinct Durations are Reported WSDOT Internal: When the last responder has left the scene Statewide GMAP measure: The time when all disabled vehicles, debris and other blockages have been removed from the lanes and traffic can move again on all lanes	Quarterly reports are generated and published through the gray notebook	✓	✓	✓	✓		Incident duration measures used in statewide GMAP performance management program. Goal is a 5% reduction in incident duration for incident > 90 minutes.
Virginia DOT	???	This system records the duration of the incident log, not the actual times of notification, verification, response and end of incident. The log is date stamped when it is opened and closed by operators. Therefore, the data represent an approximation of actual incident duration. VDOT is developing a new system that will allow capture of these specific milestones in each incident.		Results are published monthly in the systems operations performance report. Some stats are available through the VDOT Dashboard	✓	✓	✓	✓	✓	Various incident management systems are used in different districts. All report data to a central system (called VOIS) from which incident duration is reported, but detail is lost in the process.
Maryland CHART	Since 1997	Incident open time (operator begins to input information)	Incident closed time (scene cleared time)	Yearly report focuses on evaluation and benefit of CHART operations Standard and adhoc reports available on-demand through RITIS	✓	✓	✓	✓		Tracks incident response with and without SHA Patrol assistance Quality of data with system is assessed annually as well

TABLE 4.2.1 Summary of Incident Duration Pilot Test Data

Costs for the implementation of incident duration performance measure were generally lacking in the pilot test data. The incremental cost to compile and report incident duration is minimal compared to the cost of operating an incident management system.

All participants used incident duration information to support some type of cost-benefit analysis of their respective incident management system. In such reports agencies attributed a dollar value to the time saved as a result of the incident management program. This cost-benefit analysis was used to justify and/or expand an incident management system as noted by Washington DOT submittal. Figure 4.2.2 shows an example of average incident duration comparisons with and without response from emergency assistance vehicle. The data for the chart was obtained from a yearly performance evaluation and benefit analysis of the Maryland CHART system performed by the University of Maryland. Reductions in secondary incidents as a result of efficient clearance of initial incidents are also reported as monetary benefits.

Additional resources in the development or enhancement of incident management systems (and related incident duration performance measures) include the National Traffic Incident Management Coalition (NTIMC) and its associated effort of the National Unified Goal (NUG) and the FHWA sponsored focus-state initiative on traffic incident management (TIM) performance measures. NUG is a unified national policy developed by major national organizations representing traffic incident responders, under the leadership of the NTIMC. The NUG encourages state and local transportation and public safety agencies to adopt unified, multi-disciplinary policies, procedures and practices that will dramatically improve the way traffic incidents are managed on U.S. roadways. Additional information is available at www.timcoalition.org. The TIM focus state initiative involves 11 states in two separate (East/West) groups. It identifies measures that participating states can agree upon and initiate to gain experience in actually computing these measures over time. This initiative is ongoing. Once complete, a comprehensive set of recommendations and lessons-learned reports for use by all agencies involved in traffic incident management will be made available. Additional information is available at the FHWA Traffic Incident Management Program website at <http://www.ops.fhwa.dot.gov/incidentmgmt/index.htm>.

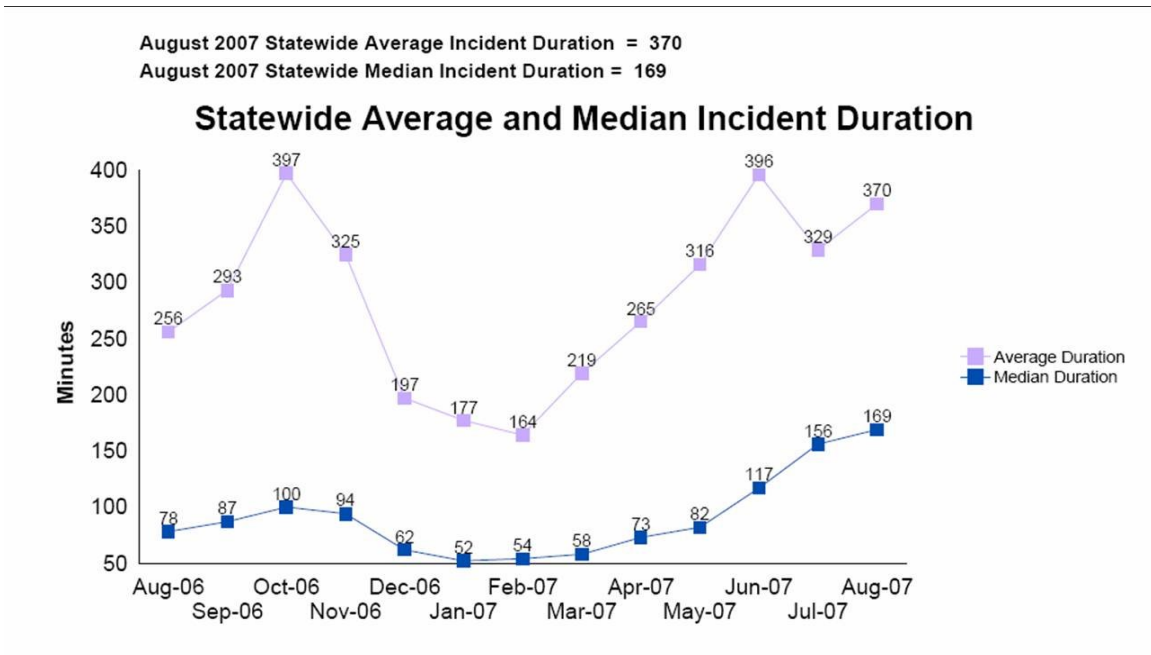


FIGURE 4.2.1 Chart taken from the August 2007 Virginia System Operations Performance Report illustrating the mean and median incident duration are displayed

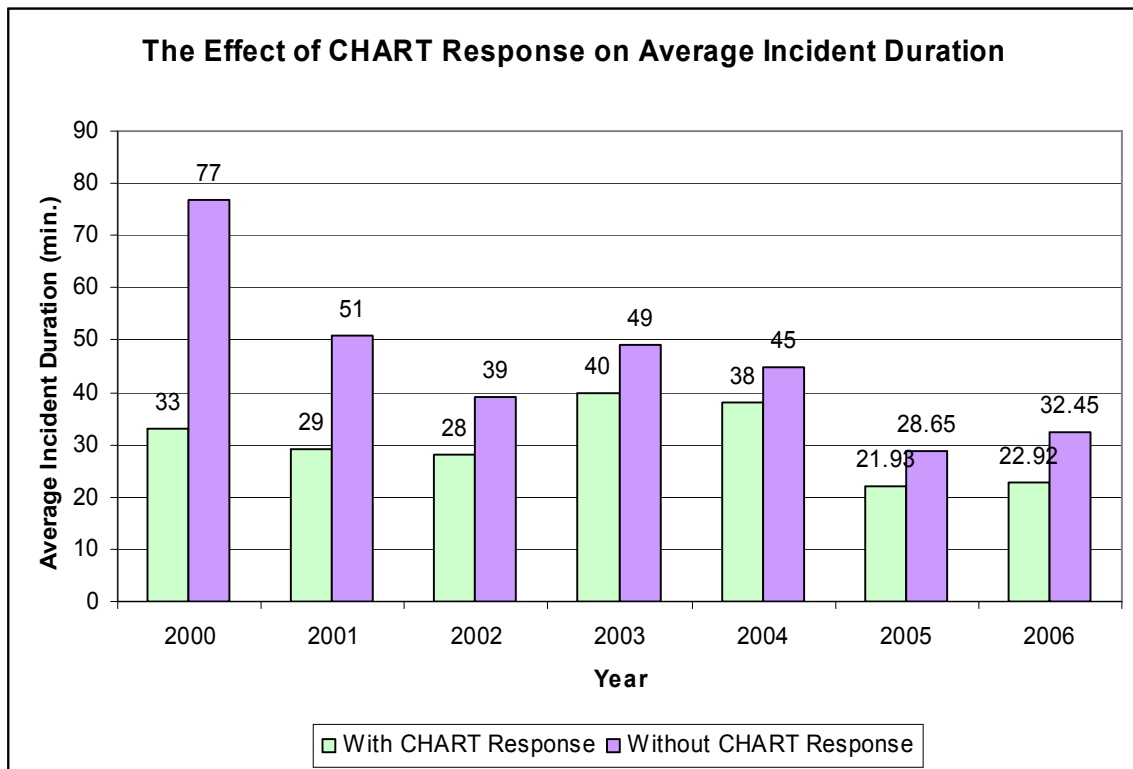


FIGURE 4.2.2 Compiled from data presented in the University of Maryland's 2006 final report to the Maryland State Highway Administration illustrating the average time savings per incident with the assistance of the CHART incident management system

In summary the pilot testing of the incident duration resulted in the following guidelines:

- Effective performance measurement requires well-defined start and end times as noted in the definition.
- Additional metrics for effective and robust incident duration include:
 - Well-documented incident location so it can be tracked, analyzed and easily displayed on a map
 - Type and severity of incident
 - Responder information
 - Lane closure status, which can be a measure of severity
- Track the quality of the incident data as well as duration (completeness of data, percent of fields populated, etc.)
- Use mean duration as opposed to median due to the non-symmetric distribution
- Incident duration is an effective measure to determine monetary benefits of incident management programs

Updated Performance Measure Definition:

Performance Measure: Incident Duration

Definition: The time elapsed from the notification of an incident until all evidence of the incident has been removed or until all response vehicles have left the incident scene, whichever is less. (See Notes 1 and 2)

Includes: Localized incidents occurring on any roadway (freeways and arterials) such as crashes, disabled vehicles and medical emergencies

Excludes: Non-traffic incidents such as building fires and law enforcement actions; Also excludes planned events (parades, sporting events, etc.) and regional weather incidents

Units of Measurement: Mean minutes per incident.

Processing (How to measure):

- Calculate the time difference between incident notification and incident removal
- The mean time of incident duration may be calculated for specific roadway types as the numerical mean of incident duration time for incidents occurring at the locations and the times of interest for the analysis period. Mean incident duration may also be indexed to the number of lanes closed as a result of the incident, and to the type of incident.

Typical Applications: Operations management

Example: Evaluating the effectiveness of service patrol routes and actions of emergency responders on incident duration

Notes:

- (1) Incident notification includes receipt of the fact that an incident has occurred by any public agency personnel (dispatcher, field vehicle, traffic operations center operator, etc.)
- (2) Evidence of the incident includes service vehicles, emergency vehicles, tow trucks, vehicles and individuals involved with the incident and debris resulting from the incident.