

Effects of a Towaway Reporting Threshold on Crash Analysis Results

WHILE ALL LAW ENFORCEMENT AGENCIES SEEM TO BE DEALING WITH DECLINING RESOURCES and increasing pressures to combat crime, urban police departments seem to be experiencing the greatest difficulty. It is in these agencies where the decline in crash reporting has started. However, State law enforcement has also experienced funding reductions, while also taking on greater responsibilities for crime control. Even though traffic law enforcement and crash investigation are major responsibilities for these agencies, it has become more difficult to perform this role. To combat this reduction in resources, many agencies have begun to raise the reporting threshold for traffic crashes. Some agencies no longer report property-damage-only (PDO) crashes, unless the vehicle is not driveable or must be towed from the scene. Other agencies have raised the threshold to require reports only on crashes involving injury.

Procedures such as problem identification, countermeasure identification, and countermeasure evaluation are commonly conducted by users of crash data when establishing policy, developing programs, and creating new roadway designs to enhance highway safety. Changes in reporting thresholds will alter the data set available to conduct these activities and may create problems for analysis. These problems should be anticipated, and accounted for, in any change of policy regarding crash reporting.

In order to determine the effect of moving to a towaway threshold, certain questions must be addressed:

- ◆ What are the implications of using a higher crash reporting threshold?
- ◆ What are we losing?
- ◆ If we analyze an issue, would we conclude anything differently?
- ◆ By raising the threshold, could we extrapolate back to the complete crash picture?

There are clearly some differences in the reporting practices of the eight HSIS States that make it inappropriate to combine data for many types of analyses. The purpose of this paper is to quantify the expected effects on data analysis capabilities if one or more of the HSIS States convert to a towaway-and-above threshold.

Analysis Methods

HSIS States were candidates for analysis if they identified each crash in which one or more vehicles must be towed from the scene. A review was made of each State's HSIS codes in this regard. Illinois, Michigan, Minnesota, and North Carolina were selected for analysis, since they have a towaway variable in their HSIS files.

The most recent year of crash data from each of the four selected States was used. A crash was identified as "towaway (and above)" if one or more vehicles involved in the crash had to be towed away and/or if an injury or fatality occurred in the crash. Each crash was labeled either PDO and above (i.e., all crashes in the file), towaway and above (i.e., towaway and/or injury and/or fatal), or injury and above (i.e., injury and fatal).

The Highway Safety Information Systems (HSIS) is a multi-State safety data base that contains accident, roadway inventory, and traffic volume data for a select group of States. The participating States, California, Illinois, Maine, Michigan, Minnesota, North Carolina, Utah, and Washington, were selected based on the quality of their data, the range of data available, and their ability to merge data from the various files. The HSIS is used by FHWA staff, contractors, university researchers, and others to study current highway safety issues, direct research efforts, and evaluate the effectiveness of accident countermeasures.



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Distributions of crash frequencies were produced for the three categories listed above by the following variables: overall crashes, roadway class, crash type, type of object struck, and vehicle type. The results are presented in the next section to show what crash variables would be most affected by having only towaway-and-above crashes available for analysis.

Results

Overall Crashes

A sample size of 424,121 crashes was used in the study, including 122,113 crashes from Illinois (1992); 135,215 crashes from Michigan (1994); 71,277 crashes from Minnesota (1994); and 95,516 crashes from North Carolina (1995). Slightly more than half (51.7 percent) of the total crashes in the four States would be included, using a reporting threshold of towaway and above (219,475 crashes). More than half of the crashes would be missed in Illinois and Michigan, while just over a third would be missed in Minnesota and North Carolina.

An injury reporting threshold would capture only 33.7 percent of crashes in the four States (142,794 crashes). Only 25.9 percent of the crashes currently reported in Michigan are injury, compared to 44.5 percent in North Carolina.

Roadway Class

The percentages of total crashes by roadway class that are towaway and above, and injury (i.e., one or more injuries or fatalities) are given in **table 1** for the four States. As expected, towaway crashes generally represent a lower percentage of total crashes on urban roadways compared to rural roadway classes. One notable exception to this is a higher percentage of towaway crashes on Michigan's urban vs. rural two-lane roads. This low percentage of towaway crashes on Michigan's rural two-lane roadway may result from the high proportion of low-severity deer crashes in Michigan's rural areas that are reported, but in which the vehicles remain driveable and injuries to occupants are rare. This analysis reveals that the use of a towaway reporting threshold would result in fewer urban crashes being reported, particularly those on urban two-lane streets and multi-lane (non-freeway) roads. For most road classes, between 40 and 60 percent of the crashes would be lost.

Crash rates within a roadway class between States would become more consistent if a towaway threshold was used instead of the current thresholds. Crash rates by State and roadway class are given in **figure 1** (urban areas). Total and towaway rates are shown for each roadway class. On urban two-lane roads, the total crash rates per 1.61 million vehicle km (1 million vehicle mi) range from 5.41 (Michigan) to 2.09 (North Carolina), a ratio of 2.6, while towaway rates range from 2.01 to 1.34, a ratio of only 1.5. For urban undivided multi-lane roads, the rates of total crashes range from 8.73 (MI) to 2.71 (NC), a ratio of 3.24, which compares to a ratio of 2.25 for towaway crashes. Differences in the ratios for total and towaway rates

	North Carolina		Michigan		Illinois		Minnesota	
	% Tow	% Injury	% Tow	% Injury	% Tow	% Injury	% Tow	% Injury
Rural Multi-lane Divided	67.0	46.8	45.3	27.5	55.7	32.4	68.3	37.5
Rural Multi-lane Undivided	62.3	43.3	45.7	28.7	52.9	35.6	45.6	31.7
Rural Two-Lane	67.8	45.9	33.2	18.0	54.9	33.9	66.1	39.6
Rural Freeway	67.1	40.2	47.5	23.1	63.9	31.8	73.1	27.9
Urban Multi-Lane Divided	59.1	43.0	42.6	27.8	45.6	32.5	60.3	40.4
Urban Multi-Lane Undivided	58.2	42.7	41.9	28.5	42.6	30.6	58.9	42.6
Urban Two-Lane	62.8	44.5	40.2	25.9	45.5	31.1	52.5	34.2
Urban Freeway	59.9	37.4	48.5	29.8	53.2	33.9	66.6	29.4

Table 1. Percent of crashes that are towaway or injury by State and roadway class.

away crashes on Michigan's urban vs. rural two-lane roads. This low percentage of towaway crashes on Michigan's rural two-lane roadway may result from the high proportion of low-severity deer crashes in Michigan's rural areas that are reported, but in which the vehicles remain driveable and injuries to occupants are rare.

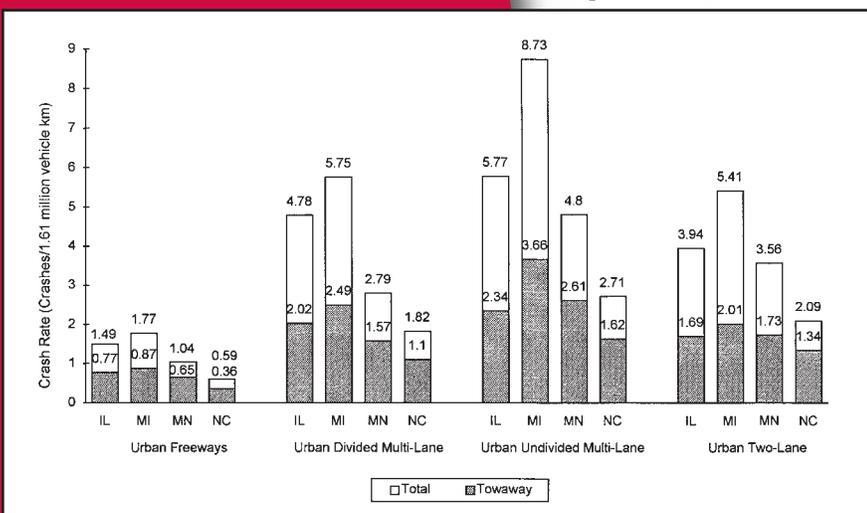


Figure 1. Crash rates for towaway vs. total crashes — urban road classes.

for rural roadway classes (not shown here) are less pronounced than for urban classes.

Crash Type

Figure 2 shows the percentage of crashes and the effect of a toway threshold by crash type for the four States. Using a toway-and-above reporting threshold would have a minimal effect on pedestrian/bicycle crashes and run-off-road rollover crashes, since approximately 85 to 98 percent of those crash types would be included. About 58 to 80 percent of run-off-road fixed-object crashes would be included. The percentage of opposite-direction crashes that are toway has a broader range among the States, from about 45 percent (Michigan) to 92 percent (North Carolina). Only about 40 to 60 percent of crashes involving angle/turning or rear-end/sideswipe same direction would be included with a toway threshold. Most parking/backing and animal crash types would not be included, with only 18 to 32 percent coded as toway and above.

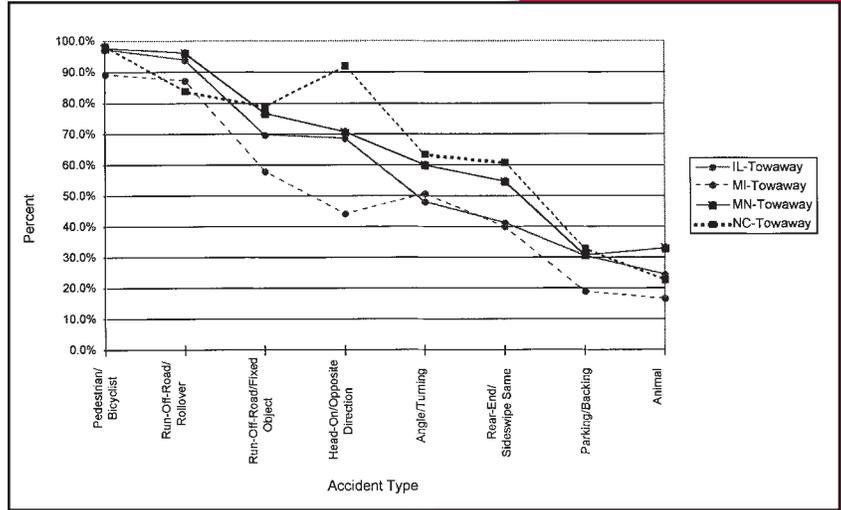


Figure 2. Percent of toway crashes by accident type.

Using an injury crash threshold, pedestrian/ bicycle crashes would be relatively unaffected, but only 55 to 65 percent of run-off-road rollover crashes would be reported. For most other crash types, 25 to 50 percent were injury crashes. Less than 20 percent of parking/backing and animal crashes would be reported. With the exception of pedestrian/bicycle crashes and perhaps rollover crashes, raising the reporting threshold to injury would seriously affect the analyst's ability to study most crash types.

Type of Object Struck

Another common analysis issue involves crash experience for various types of fixed objects, as displayed in **figure 3**. Object types that would be less affected by a toway threshold include ditches/embankments, streetlights and utility poles, trees, and median barriers. Slightly reduced percentages are reported for signs and mailboxes than for other object types based on the toway threshold. An injury threshold would result in reporting between 20 and 60 percent of crashes, depending on the type of object struck and the State.

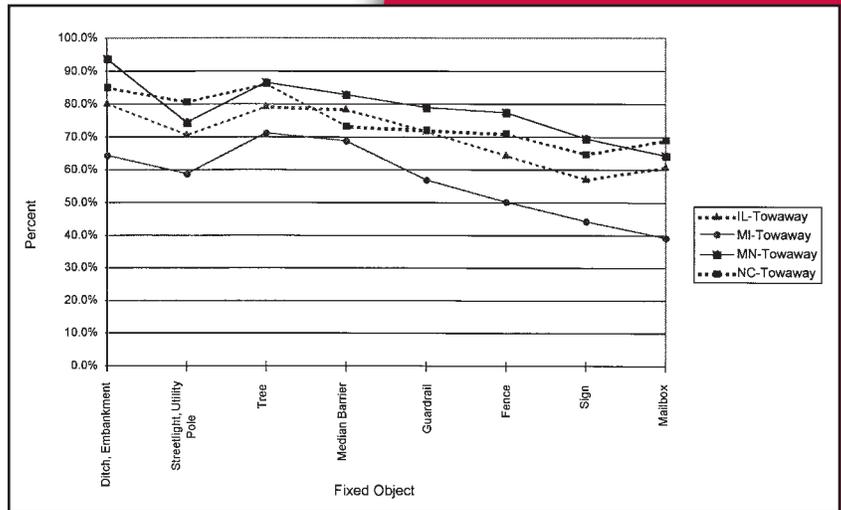


Figure 3. Percent toway by fixed object.

Vehicle Type

This analysis of vehicle type for a toway threshold reveals that the motorcycle/moped crashes are by far the most severe, with 85 to 95 percent classified as toway. For other vehicle types, 30 to 60 percent of total crashes would be included using a toway threshold. Similar trends (with lower percentages) are evident from the injury threshold, with 25 to 50 percent of crashes reported (except motorcycle/moped, with 80 to 90 percent).

Study Implications

Increasing the crash reporting threshold results in both positive and negative outcomes. On the positive side, there are cost-savings asso-

ciated with reporting fewer crashes. For example, approximately 34,100 of the 95,516 crashes in North Carolina in 1995 were PDO. Assuming a savings of \$20/PDO crash not reported, then a cost-savings of \$682,000 would have been realized by not reporting PDO crashes.

Another benefit of increasing the reporting threshold is that there would be somewhat greater consistency of crash rates among States. However, differences still remain in crash rates of towaway-and-above crashes for most roadway classes that cannot be accounted for merely by having a more consistent reporting threshold. Such differences may result from differences in climate, roadway design, vehicle mix, driver behavior, and inconsistencies in the completeness of crash reporting by police agencies within a State.

On the negative side, a motorist involved in a PDO crash that is not reported by a police officer may encounter difficulty in receiving insurance payments in cases where the insurance companies require a copy of the police crash report to process a claim. More important, increasing the reporting threshold to towaway and above would dramatically affect the comprehensiveness of crash records and, hence, the identification and improvement of high-hazard locations, and the ability of researchers to conduct certain types of safety research.

In general, a towaway threshold would exclude more crashes on urban roads than on rural roads. This could result in less knowledge of urban crash problems, which would probably result in the identification of fewer needed urban roadway improvements, and lower overall safety on urban roads in the future. However, several of the rural road classes would also be greatly affected by a towaway threshold. For example, approximately half of the crashes on rural, two-lane roads and rural multi-lane undivided roads do not meet the towaway criteria. This would be of considerable concern in addressing safety issues on such roads, where low crash sample sizes often already exist.

Since half or more of the rear-end and sideswipe crashes will not be known by using a towaway criteria, it will be more difficult to determine whether there is a

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need for such treatments as roadway channelizing devices and lane-designation signs and markings to reduce lane-change crashes. Signal retiming, skid-resistant overlays, and other treatments to reduce rear-end collisions would be under-utilized and many of these collisions will continue to be unknown to law enforcement agencies. As a result, some severe injury or fatal crashes may occur as a result of design problems that would otherwise have been identified and corrected. Furthermore, approximately 40 to 50 percent of angle and turning crashes will be unknown to engineers. Thus, locations in need of separate left-turn phasing (or other modification of signal timing), improvements to intersection sight distance, addition of stop or yield signs, or other related treatments will be overlooked at many locations until serious crashes occur.

Fixed-object types least affected by a towaway threshold include ditch/embankment, streetlights/utility poles, trees, and median barriers, although about 10 to 40 percent of crashes with these fixed objects would go unreported. Crashes involving guardrails, fences, signs, and mailboxes would be affected to a greater degree since 20 to 60 percent go unreported. Thus, using a towaway criteria for crashes would raise serious concerns over one's ability to conduct any meaningful evaluation of roadside appurtenances intended to reduce crash severity, such as guardrails, guardrail end treatments, breakaway signs and poles, crash cushions, and medians.

Many locations with head-on and fixed-object crashes will not be identified and corrected in time to prevent more severe crashes. Countermeasures such as removing trees close to the roadway, relocating poles further from the roadway, converting to breakaway sign posts, and changing alignment will not be implemented at many locations; and fixed-object and head-on crashes will continue to occur on many roadway segments, since they will not be identified and treated.

Most vehicle types would be affected about the same extent except for motorcycle/moped crashes, which typically involve injury and are thus reportable under the towaway threshold. However, future evaluation of vehicle safety

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features (seat belts, airbags) or vehicle types (large combination vehicles, buses, farm vehicles) would be open to question, since the “successes” (crashes resulting in no occupant injury) would be unknown unless the vehicle had to be towed away).

In short, by going to a towaway crash-reporting threshold, some types of crash analyses would be minimally affected, and crash rates between States could tend to be more uniform in some respects. However, crash analyses for certain roadway classes, crash types, and fixed objects struck would be greatly limited. For example, countermeasures intended to reduce crash severity (traffic signals, improved guardrail end treatments, vehicle safety measures) could not be evaluated properly with a towaway criteria.

Strategies for Improving Reporting Thresholds

If the trend toward reduced levels of crash reporting is going to be stopped, or even reversed, strategies must be identified to assist those responsible for collecting and reporting the data. These strategies involve reducing the cost to law enforcement agencies and reducing the demand for sworn police officer time.

There are both technological and institutional means to help reduce the reporting time of more serious crashes, and possibly to reduce the time required to complete PDO crash reports. Data collection for more serious crashes is not threatened by reduced reporting thresholds, but if the time required to report them is substantially reduced, then more investigator time is potentially available for less severe crashes.

Technological Strategies

Technology offers the potential for reducing the time required to collect data. Examples of applicable technologies include:

- ◆ Portable, computer-based data-entry and storage devices.
- ◆ Automated location-coding devices.
- ◆ Automated readers for entering information stored in the form of magnetic stripes, bar codes, or radio-frequency-encoded transponders.
- ◆ Communications linkage to associated central data sources.
- ◆ Electronic measurement devices (e.g., laser-based) connected for direct entry to computer devices.

Institutional and Organizational Strategies

Several institutional and organizational strategies can help maintain adequate thresholds of crash reporting. These include:

- ◆ Re-thinking data collection needs and placing a higher priority on crash data, since it is essential in decision-making.
- ◆ Hiring civilian crash investigators, who are less expensive than using police officers.
- ◆ Using shortened crash form with only key data elements for PDO crashes.
- ◆ Using cost-sharing between agencies for the collection and management of crash data.

More details of these and other strategies are contained elsewhere for improving crash reporting by State and local agencies.^(2,3,4)

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FOR MORE INFORMATION

This research was conducted by Charles V. Zegeer, Herman F. Huang, and J. Richard Stewart of the University of North Carolina Highway Safety Research Center; Ron Pfefer of Northwestern University; and Jun Wang of LENDIS Corporation. The full report, *Effects of a Towaway Reporting Threshold on Crash Analysis Results*, is being published in an upcoming *Transportation Research Board Record*. For more information about HSIS, contact Michael S. Griffith, HSIS Program Manager, HSR-20, at (703) 285-2382, mike.griffith@fhwa.dot.gov.