Michigan 5% Report Methodology 2008 – per Section 148 (c)(1)(D) of SAFETEA-LU

Introduction

This report methodology is prepared by the Michigan Department of Transportation (MDOT), to report on all public roads in the state. The methodology is based on the guidance offered in the April 10, 2006 FHWA 5% Reporting Guidance Document and the subsequent HSIP related web conference held June 20, 2006.

In Michigan, there are approximately 122,000 miles of public roads, of which 92 percent are under local jurisdiction. MDOT does not have any current methodology to conduct statewide surveillance of the road network that includes local roads. As MDOT does not have jurisdiction over local roads, it has not been our practice to develop a statewide list of “hazardous” locations due to the availability of resources to address locations of concern, and the competing priorities of local units of government.

MDOT is in the process of developing new system surveillance tools which will allow review of the entire statewide network. For the purposes of this report a method was developed to make best use of the available information with the objective to identify intersections and segments with the **“most severe safety needs”**.

In Michigan a statewide GIS referencing system is utilized on which all crashes, on all roads, are referenced to. We have good crash data, located such that we can conduct a statewide analysis to determine the most “hazardous” locations. Michigan crash data contains information on the severity of the crash, whether it is a fatal injury (K), incapacitating injury (A), non-incapacitating injury (B), possible injury (C) or property damage (O) crash. We have information on the number of injuries by severity, if any, suffered by all parties involved in a crash.

MDOT does not have accurate traffic volume data for all roads statewide, thus other exposure measures needed to be considered.

Methodology

Crashes were divided into intersection related crashes and segment crashes. Intersection crashes are identified as a focus area in the Michigan Strategic Highway Safety Plan (SHSP). For future reporting, segment crashes could be broken down into subcategories such as lane departure, another focus in the Michigan SHSP. The Michigan SHSP also identifies pedestrian and bicycle crashes as a focus area. The method used for this years report, identified pedestrian crashes as a concern at a number of locations.

Our preference would have been to develop an “index” or some type of ranking tool that would include at least three factors: crash frequency, crash severity, and crash rate based on vehicle miles traveled (VMT). As noted, we do not have the luxury of statewide VMT data, by route, so MDOT has elected to proceed with the available data. The locations that were identified in this method resulted in analysis of data available from crash reports only.

For this years report, Michigan has elected to use K and A incidents to measure safety needs. Rather than have a measure of exposure, we are using a density of crashes per intersection or per one mile segment. Our approach is to develop a combined score for a location (intersection or segment) based on the frequency of K and A crashes and the economic "loss" of K's and A's at a location.

The methodology to identify roadway segments with safety concerns was constrained to examining locations where crashes were reported and located. Unlocated crashes are not included in this analysis. Currently in Michigan this is a relatively small number.

Locations: Intersections

For intersections, statewide crash data for the years 2005-2007 were used. A database containing crashes located within 150 feet of an intersection was created.

The score for an intersection was determined as follows:

The total number of K and A crashes at an intersection was established. Every intersection statewide with at least two reported K or A crashes was included in the analysis. It was felt that locations with a single K or A crash were truly random and were excluded from the analysis. Locations were ranked, in descending order (the worst ranked 1), by the total number of K and A crashes at the location.

To establish a measure for "loss" the number of fatalities and/or A injuries were used. A straight weighting scheme was used where an assigned dollar value for loss for K's and a value for A's was used (2006 values from the National Safety Council website). The number of K's was in turn multiplied by that dollar loss and the number of A's by its respective loss value. The two computed values were added. The value for the variable loss was then ranked with the greatest loss being ranked 1.

Each time a variable was ranked, those locations having the same number of crashes (or alternately the same value for "loss") were all assigned the low ranking value. For example, if intersection locations 3 through 6 had seven crashes, each location would be ranked 3. The next rank assigned would be 7.

A score was assigned to each location and was equal to the sum of the rank for frequency plus the rank for loss. The lower the value of score the "more severe" the location.

Examination of a histogram of the variable score showed that score was not "normally" distributed. Taking the natural log of the variable score allows one to determine the geometric mean, geometric standard deviation and confidence intervals from a "log normal" distribution.

Taking the 99% confidence interval (the mean minus 3 standard deviations) gives the 37 "most severe" locations in the state. Rather than taking 5% of 37 locations we chose to include them all in this report. Two locations were dropped as they were repeats of other locations listed. A third location was dropped due to crashes not belonging to that intersection – they located to an intersection on the list immediately adjacent. A fourth location was dropped as it was a freeway overpass – a "virtual" intersection. Thus, for this year's report 33 intersection locations were included.

Locations: Segments

2003-2007 statewide crash data was used for the segment analysis for all roads.

A study file consisting of crashes indicated as "mid-block" or "interchange" was created for this portion of the analysis. The approach was to accumulate crashes by reference segment number to determine the number of crashes per mile. A score was determined and analyzed for each segment, as described above for intersections.

Once a combined list of segments for local agency and MDOT/trunkline crashes was developed it became evident that interchange crashes heavily weighted the list towards trunkline locations. This being the case, we opted to create two separate databases. The first included trunkline locations only. A second included local locations. From these databases we developed our "most severe" segment locations.

Local Segment Locations:
Taking the 99% confidence interval (the mean minus 3 standard deviations) gives the 31 "most severe" local locations in the state.   The mean minus a fourth standard deviation gives only 6 locations. To balance the time required to visit locations in the field with having a reasonable number of locations we chose to look at the top 20 locations.

MDOT Segment Locations:
Taking the 99% confidence interval (the mean minus 3 standard deviations) gives the 37 "most severe" trunkline locations in the state.   The mean minus a fourth standard deviation gives 19 locations. Again, in an effort to balance time with having a reasonable number of locations we chose to analyze the 19 locations. One segment was dropped due to a high number of mislocated crashes. This left 18 trunkline segment locations in the report.

Following the creation of the list of locations of interest, cursory field reviews were conducted. A number of issues arose in the course of the field review portion of the study. This discussion is presented in the "Issues" section of this report.

It should be noted that presently we do not have a good means to approach the segment analysis. The establishment of segment lengths is somewhat arbitrary and is an artifact of our referencing system. We are looking at ways to improve our segment analysis.

Issues

Our approach to this exercise was to not constrain this analysis any more than necessary. For a number of the locations identified, no correctable crash pattern was identified. Our approach was designed to identify locations that have poor safety performance, not necessarily those with poor safety performance that can be fixed in terms of engineering fixes, or behavioral treatments.

A future approach might include focusing on finding locations with correctable crash patterns such as lane departure crashes.

At some of the locations identified in our methodology the safety treatments have already been applied. It was determined that finding every location statewide that has already had treatments applied and filtering them out is too timely a task to undertake. For now they remain a part of the report.

In many cases a potential treatment at a signalized location is to install a box span signal display. It is now standard in Michigan to install box spans at trunkline intersections where the signal span is to be upgraded. Also, on-going signal optimization projects on all trunklines (to be completed within five years) may mitigate some of the crashes at signalized locations.

Michigan's crash data base system is in good condition. A new system completed in 2004 has a number of features which will allow for the continuous improvement of data quality and accuracy.

Michigan is working to better integrate existing traffic safety databases, and extend the coverage to the entire network. Discussions are under way for the planning of this action. Of primary importance will be the development of plans to collect, or access ADT/VMT data. While many local agencies collect traffic count information in some form, there are no standards in place for collecting and adjusting count information.

We will continue to improve our method of determining our 5%. More work is required on the fundamental approach, and conducting sensitivity analysis. Our application of this methodology suggests that it is sensitive, but consistently yields locations with safety problems.

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