**Michigan Transparency Report Methodology 2010 – 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 only (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 lane departure crashes. Intersection and lane departure crashes are identified as focus areas in the Michigan Strategic Highway Safety Plan (SHSP). Each of these focus areas served as a basis for analysis for this year's report.

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 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 index value for a location (intersection or segment) based on the frequency of K and A crashes and the frequency of K and A injuries at a location.

The methodology to identify intersections and 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 2008-2010 were used. An interim version of the 2010 database was used. At the time the 2010 interim database was created 99.6% of all crashes submitted for processing were located. A database for locations containing crashes located within 150 feet of an intersection was created.

The index 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 most severe ranked 1), by the total number of K and A crashes at the location.

Each location was also ranked by the total number of K and A injuries (the location with the highest total number ranked 1) at that location.

Each time a variable was ranked, those locations having the same number of crashes (or alternately the same value for total K and A injuries) 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.

An index number was assigned to each location and was equal to the sum of the rank for frequency plus the rank for K and A injuries. The lower the value of the variable index the "more severe" the location.

Examination of a histogram of the variable index showed that it was not "normally" distributed. Taking the natural log of the variable index 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 18 "most severe" locations in the state. Rather than taking 5% of 18 locations we chose to include them all in our analysis. Five locations were dropped due to miscoded information on the crash reports. Thus, for this years report 13 intersection locations were included.

**Locations: Segments (Lane Departure)**

2006-2010 statewide crash data was used for the segment analysis for all roads. An interim version of the 2010 database was used. At the time the 2010 interim database was created 99.6% of all crashes submitted for processing were located.

A study file consisting of crashes indicated as "lane departure" 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 preliminary analysis determined that a combined database for MDOT (trunkline) and locally owned locations heavily skewed the analysis toward trunkline locations. Therefore separate databases for trunkline and locally owned locations were created, analyzed and ranked. An index number for each location in each database was determined and analyzed for all segments, as described above for intersections. 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 14 "most severe" local locations in the state. All locations were included in the report.

*MDOT Segment Locations:*
Taking the 99% confidence interval (the mean minus 3 standard deviations) gives the 14 "most severe" trunkline locations in the state. One location was dropped list due to a number of mis-located crashes.

Following the creation of the list of locations of interest, cursory field reviews were conducted for all locations new to the Transparency Report. Repeat locations may not have been field reviewed this year but have been for previous Transparency Reports.

It should be noted that presently we do not have a good means to approach the segment analysis. The establishment of segment length is somewhat arbitrary and is an artifact of our referencing system. We are looking at ways to improve our segment analysis – perhaps through the use of tools that are in development phase.


**Issues**

For several of the locations identified a correctable crash pattern was not 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 countermeasures or behavioral treatments.

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 of the database is too timely a task to undertake. For now they remain a part of the report.

In several cases, locations included in the report are repeat locations from previous year's reports. This does not necessarily mean that the crashes vary widely from previous reports or even include crashes in the newest year of data. These locations remain a part of the report as well.

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. Also, in 2009, the crash database was updated such that if any of the Michigan SHSP focus areas applies to a crash that crash is now flagged (i.e. – lane departure, young driver, impaired driver, etc.) and searchable.

Michigan is working to better integrate existing traffic safety databases, and extend the coverage to the entire network. 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 for use across jurisdictions.

We will continue to improve our method of determining locations to be included in future Transparency Reports. 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 concerns.


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