

## TRAFFIC SAFETY

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## 11-1.00 INTRODUCTION

### 11-1.01 Purpose

Safety is a core value embraced by the Department and included in the Agency's mission statement. Although traffic safety is an abstract topic, it includes many of the products and services MnDOT provides to the traveling public. Items such as winter maintenance operations, well maintained roadways with pavement markings, and roads designed to move traffic swiftly while meeting driver's expectations are all part of providing a safe transportation network.

The traffic engineer's role in safety is to prevent or mitigate crashes involving motor vehicles and other roadway users. Addressing crashes involving the loss of life or substantial injury is the top priority in terms of traffic safety - and is supported by the Highway Safety Improvement Program's (HSIP) objective of reducing fatal and life altering crashes. Opportunities to make general improvements reducing all crashes should be pursued in conjunction with other programs and funding opportunities.

### 11-1.02 Chapter Organization

This chapter is organized around improving traffic safety on Minnesota roads. Each section contains a list of resources the traffic engineer may find useful.

- Section 2 is a list of acronyms/
- Section 3 discusses the importance of strategic planning to create a coordinated, systematic approach to safety in a region.
- Section 4 describes the crash reporting process from an incident through officer reporting to a centralized database.
- Section 5 describes crash data with regard to data practices, data sources, and data requests.
- Section 6 walks through the resources and techniques in the safety project process, from network screening and analysis to project selection to evaluation.
- Section 7 outlines the Highway Safety Improvement Program (HSIP) and other funding options.

## 11-2.00 LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
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<a href="#">4Es</a>	Major focus areas to reduce traffic injuries and fatalities: <ol style="list-style-type: none"> <li>1. Education,</li> <li>2. Enforcement,</li> <li>3. Engineering,</li> <li>4. Emergency Medical &amp; Trauma Services</li> </ol>
A Injury	Incapacitating injury
<a href="#">AASHTO</a>	American Association of State Highway and Transportation Officials
ADT	Average Daily Traffic
<a href="#">BCA</a>	Bureau of Criminal Apprehension
<a href="#">CMF</a>	Crash Modification Factor
CR	Total Crash Rate (see Section <a href="#">11-6.01.03 Crash Rate</a> )
<a href="#">CRF</a>	Crash Reduction Factor

DOT	Department of Transportation
<a href="#">DPS</a>	Minnesota Department of Public Safety
<a href="#">DVS</a>	Minnesota Department of Public Safety, Driver Vehicle Services Division
FAR	Fatal (K) and incapacitating injury (A) crash rate (see Section <a href="#">11-6.01.03 Crash Rate</a> )
<a href="#">FHWA</a>	Federal Highway Administration
<a href="#">HSM</a>	AASHTO Highway Safety Manual
<a href="#">HSIP</a>	Highway Safety Improvement Program
<a href="#">LRRB</a>	Minnesota Local Road Research Board
<a href="#">LTAP</a>	Minnesota Local Technical Assistance Program
<a href="#">MnCMAT</a>	Minnesota Crash Mapping Analysis Tool
<a href="#">NCHRP</a>	National Cooperative Highway Research Program
<a href="#">OTST</a>	Office of Traffic, Safety, and Technology
<a href="#">RSA</a>	Road Safety Audit
<a href="#">SALT</a>	State Aid for Local Transportation
<a href="#">SHSP</a>	Minnesota Strategic Highway Safety Plan
<a href="#">TRB</a>	Transportation Research Board
<a href="#">TZD</a>	Minnesota Toward Zero Deaths
VMT	Vehicle miles traveled

### 11-3.00 TRAFFIC SAFETY PLANNING

#### 11-3.01 Toward Zero Deaths (TZD)

Embracing the spirit of the [HSIP](#) program, MnDOT employs the [Toward Zero Deaths \(TZD\)](#) approach. Zero deaths is based on the belief that even one traffic-related death on Minnesota roads is unacceptable. The idea was first adopted in Sweden in 1997 as "[Vision Zero](#)". Since then, several state DOTs, including Minnesota, have identified zero deaths as a core objective in their Strategic Highway Safety Plans.

Minnesota TZD is the cornerstone of the state's traffic safety program, employing an interdisciplinary approach to reducing traffic crashes, injuries, and deaths on Minnesota roads. TZD uses a data-driven approach that targets areas for improvement and employs proven countermeasures that integrate education, enforcement, engineering, and emergency medical & trauma services (the "[4Es](#)").

While individual disciplines have a long history of successful traffic safety programs, TZD aims to tie these together with a common vision and mission for even greater success. A combination of strategies from different focus areas is often most effective for solving a particular problem. Often the tendency is to jump to roadway deficiencies as potential solutions to improving roadway safety. Whenever possible, a 4E approach should be the first step in assessing how to improve roadway safety.

The TZD program uses data to target areas for improvement and employ proven countermeasures. Each district has staff assigned to support and promote TZD. These resources should be used to the maximum extent possible when working on safety related items.

The TZD team works in partnership with community and corridor groups to improve the traffic safety of a designated area. Toward Zero Deaths provides technical assistance, materials, and guidance to local groups that are committed to reducing crashes and the fatalities and incapacitating injuries that result from them – both at an infrastructure programming level as well as a community engagement level.

### 11-3.02 Strategic Highway Safety Plan (SHSP)

The [Minnesota Strategic Highway Safety Plan \(SHSP\)](#) is a policy plan that sets an overall direction for future safety strategies and presents a framework for selecting strategies. The plan provides insight and direction on how to reduce traffic-related crashes that involve motor vehicles on all Minnesota roads. It describes how many, where, what type, and to whom motor vehicle crashes occur. The plan prioritizes key focus areas and strategies and wherever possible, highlights opportunities for collaboration.

The SHSP is a policy plan based on data and trends that affect traffic safety. It was developed in consultation with safety stakeholders from across the [4Es](#) and other disciplines.

The SHSP is tightly integrated with the goals and objectives of the [TZD](#) program. Like the TZD program, the SHSP takes a holistic 4Es approach to traffic safety. Performance measures are outlined to chart progress toward a goal of zero deaths on Minnesota roads. By providing benchmarks and measures, decisions can be made to support the various statewide and district projects or programs.

The development of the SHSP is a requirement of the Federal Highway Administration. The plan is intended to be updated frequently. As a living document, it reflects the priorities and practices of the Department, especially for how it intends to operate in coordination with the [Highway Safety Improvement Program \(HSIP\)](#). This resource provides a vast array of data and relationships that can be of assistance when approaching a traffic safety topic.

### 11-3.03 Regional and Local Planning

Regional and local organizations are encouraged to incorporate safety into their long-term planning. The plans should take into account statewide initiatives through the [TZD](#) program or [SHSP](#) as well as local crash trends and stakeholder input.

Preparing roadway safety plans should answer three fundamental questions that are essential to developing safety projects for the [HSIP](#):

- 1. What are the priority crash types?**

Analyze data to identify specific safety focus areas, i.e. crash types that represent the greatest opportunity for reduction.

- 2. What are the priority safety strategies?**

Identify a comprehensive list of effective safety strategies to address the focus areas. Convene a workshop to identify a short list of implementation strategies at specific high-priority locations.

- 3. What are the priority locations where projects should be implemented?**

Conduct a system-wide risk assessment to identify the high-priority candidate locations for safety investment.

MnDOT's OTST staff has extensive experience developing road safety plans and systemic risk assessment, including District and County Road Safety Plans. For more information or assistance in developing a safety plan, contact [OTST](#).

## 11-4.00 CRASH REPORTING

### 11-4.01 Statutes

Minnesota Statutes, Section 169.09, Subdivision 7 ([Minn. Stat. Sec 169.09, Subd. 7](#)) states that the driver shall forward a written report of the accident to the Commissioner of Public Safety within 10 days if involved in a crash resulting in bodily injury to or death of any individual, or total property damage to an apparent extent of \$1,000 or more.

Minnesota Statutes, Section 169.09, Subdivision 8 ([Minn. Stat. Sec 169.09, Subd. 8](#)) states that the investigating law enforcement officer shall submit a report to the Department of Public Safety (DPS) within 10 days of a crash resulting in injury, death, or total property damage in excess of \$1,000.

### 11-4.02 Motor Vehicle Crash Report Form

[Figure 11.1](#), [Figure 11.2](#), and [Figure 11.3](#) are copies of the Law Enforcement Accident Report form and its overlay sheets. This form is used by all law enforcement agencies when reporting a crash to [DPS](#). This report together with the citizen report ([Minnesota Motor Vehicle Crash Report Form](#)) are the sole sources of crash data in the state of Minnesota. A new electronic data entry system for reporting crashes will be released in 2016 as the new crash database is deployed.

### 11-4.03 Crash Report Processing

#### 11-4.03.01 Receipt of Crash Reports

Crash reports are received by the [Driver & Vehicle Services Division \(DVS\)](#) at [DPS](#). Over 90 percent of all crash reports are submitted electronically. Currently, paper forms can also be submitted; however, by 2016 only electronic records will be accepted. Many law enforcement agencies retain a copy of the police report form.

#### 11-4.03.02 Encoding Crash Reports

All reports received by DPS are assigned a unique nine-digit crash number. Major participants of a crash that are not licensed Minnesota drivers, e.g. pedestrians, bicyclists, out-of-state drivers, and property owners, are cataloged on an application housed at the Bureau of Criminal Apprehension.

Individual crashes are coded and geographically located at DPS based on the reference point system. Crashes occurring at or near an interchange are additionally coded using interchange element numbers. Element numbers denote where, within an interchange, the crash occurred, e.g. entrance ramp, flyover, bridge, etc. A typical interchange element sketch is shown in [Figure 11.4](#). As MnDOT updates the linear referencing system, the element sketch component will likely become obsolete.

The process of encoding crash records will be updated with the deployment of a new crash database at DPS. Deployment is anticipated in 2016. This new system is designed to improve the accuracy, validity, and timeliness of reported crash data.

#### 11-4.03.03 Electronic Imaging of Reports

Once encoded, all crash files are scanned or electronically imaged by DVS. Access to the imaged crash files is made available to all government agencies for crash analysis per [Minn. Stat. 169.09, Subd. 13](#).

#### 11-4.03.04 National Definitions

Due to the complexity of factors involved in a crash, Minnesota has established rules for crash reporting. A motor vehicle crash is defined according to the national standard as published in the [Manual on Classification of Motor Vehicle Traffic Accidents, Seventh Edition, ANSI D16.1-2007](#). Variables collected for each crash comply with [Model Minimum Uniform Crash Criteria \(MMUCC\), 4th Edition](#) standards.

## 11-5.00 CRASH DATA

### 11-5.01 Data Practices

#### 11-5.01.01 *Appropriate Use*

The Driver and Vehicle Services Division ([DVS](#)) at the Department of Public Safety ([DPS](#)) collects and maintains all motor vehicle crash reports for the state of Minnesota. Crash reports contain non-public data and are to be used for crash analysis purposes. Caution must be exercised to maintain the confidential status of individual reports as provided in [Minn. Stat. 169.09, Subd. 13](#).

Authorized traffic safety personnel may access motor vehicle crash reports for crash analysis purposes. Crash reports are available from DVS via a web portal. MnDOT personnel may contact the [OTST](#) Safety section for information on receiving access to these scanned crash reports. Non-MnDOT personnel must contact the [Data Practices Office](#) at DVS.

#### 11-5.01.02 *Data Sharing*

Online data privacy training is required by DVS. Additionally, the user must complete an agreement acknowledging the restricted use of crash reports.

No private or confidential data collected, maintained, or used shall be disseminated except as provided in [Minn. Stat. 169.09, Subd. 13](#). Crash reports may not be shared with anyone who is not performing crash analysis. Crash reports requested for crash analysis use by traffic safety personnel at the county or city level must be redacted of the non-public data.

#### 11-5.01.03 *Retention and Security*

Electronic and/or paper copies of motor vehicle crash reports may be kept on a temporary basis while needed for crash analysis. Electronic files must be stored on a secure MnDOT networked computer accessible by employee active directory (AD) accounts only, i.e. on the user's personal network drive.

Paper copies of motor vehicle crash reports must be secured in a locked cabinet or locked room so they are not accessible to employees or others who are not using them for crash analysis.

It is recommended that private data be redacted from any printed crash report whenever feasible. Crash reports are to be securely disposed of by shredding when they are no longer needed for crash analysis.

#### 11-5.01.04 *Citation of Sources*

A suite of tools has been developed to work with crash data. Each tool has its own particular strengths and weaknesses depending on the needs of the analysis. As data become more integrated, a time stamp becomes necessary to record when, during the continuous loading cycle of the data, the export of particular crash data was completed.

To ensure that results can be replicated, always record (1) the data source and (2) date of export. A note of any filters that have been applied may be useful if the analysis needs to be repeated.

#### 11-5.01.05 *Editing Crash Data*

The Crash Application is the primary editing environment for crash, safety section, and interchange/intersection data for MnDOT. Select data are available for immediate export. In addition, the application provides an interface for modifying those data field MnDOT updates:

- Roadway System
- Route Number

- Reference Point
- Element Code
- County
- City
- Intersection Relation
- Crash Diagram
- Crash Type
- Individual Vehicle Direction

The Crash Application allows editing of the statewide interchange, intersection, and section files. These files are used to create the Traffic Crash Toolkit and other statewide analyses of trunk highways.

Crash data that have been located by DPS and any changes made over time are imported every 24 hours from DPS. All changes made through the Crash Application will affect downstream systems, e.g. databases, dashboards, etc. Contact [OTST](#) for access.

## 11-5.02 Data Sources

### 11-5.02.01 Motor Vehicle Crash Reports

As an aid to crash analysis, authorized MnDOT employees may access motor vehicle crash reports via secure login to a DVS server. Requests for access to crash reports must be made to the DVS business contact person within the [OTST](#).

Access to motor vehicle crash reports is only available via a MnDOT networked computer via the DVS website. The MnDOT network is secured by a MnDOT issued personal login tied to active directory (AD) accounts; the password for AD accounts must be updated every 90 days. Access to the DVS website is secured by a DVS authorized personal login; this password must be updated every 60 days.

Non-MnDOT personnel may contact the [Data Practices Office](#) at DVS for policy on access to crash reports.

### 11-5.02.02 Minnesota Crash Mapping Analysis Tool (MnCMAT)

[MnCMAT](#) is an online mapping based tool updated quarterly through the MnDOT State Aid office. Spatial selection and filters provide both high-level trends and detailed drill-down. Exports include crash data, maps, charts, and reports. At this time, the application provides many but not all data fields for filtering; those crashes with a valid location are mapped to the roadway network. For access, request approval from a MnDOT Traffic Engineer, a County Engineer, or City Engineer and complete an online form available on the [MnCMAT webpage](#).

### 11-5.02.03 Oracle BI

Oracle BI is an online tool that allow users to query, analyze, and trend crash data with interactive dashboards, reports, and analyses. This tool is especially useful in monitoring safety metrics and ad hoc analyses. Currently accessible only via MnDOT's intranet, contact [OTST](#) for access.

### 11-5.02.04 Minnesota Motor Vehicle Crash Facts

Researchers at the Office of Traffic Safety (OTS) at DPS annually produce [Minnesota Motor Vehicle Crash Facts](#). This detailed report summarizes a variety of information related to crashes: who, what, where, when, and why. In addition, the report breaks out information regarding the following: alcohol, seat belt use, motorcycles, trucks, pedestrians, bicycles, school buses, and trains.

The reports contain a discussion of crash trends as well as graphical and tabular displays of crash data. The purpose is to provide detailed summary information about motor vehicle crashes primarily at a statewide level.

#### *11-5.02.04 Fatality Analysis Reporting System (FARS)*

[FARS](#) is a national dataset maintained by National Highway Traffic Safety Administration ([NHTSA](#)) of fatal traffic crashes. The database contains 143 different elements to characterize a crash; certain fields are available in FARS data that are too resource intensive to maintain for all crash severities. No personal identifying information is recorded. All FARS data is publicly available.

### **11-5.03 Data Requests**

Requests for crash information are received frequently by traffic personnel. Data requested may involve specific areas of study, from annual reports prepared by a traffic office for distribution, to site-specific information on crash rates and numbers.

Any request for information concerning a specific location on the trunk highway system, regardless of the source, should be directed to the appropriate [District Traffic Engineer](#). General requests for statewide or system wide data should be referred to the safety section within [OTST](#).

Any request concerning information relating to the local system, regardless of the source, should be directed to the local road authority for processing. This guarantees the local government agency will have full knowledge of all information being provided to the requester. District, State Aid, or OTST assistance may be provided if requested.

Regardless of system, a Data Practices Request Form must be completed for all requests originating from legal professionals. This form and other related information can be found on MnDOT's [Data Practices Information](#) webpage.

## **11-6.00 SAFETY ANALYSIS**

### **11-6.01 Network Screening**

#### *11-6.01.01 Traffic Crash Toolkit*

Identification of hazardous locations is essential to the allocation of resources and to improving safety on our roads. The Office of Traffic, Safety, and Technology provides a screening Toolkit for intersections and segments of trunk highways.

The Toolkit spreadsheet details crash history and roadway characteristics for each site. Sites in the sections Toolkit are segmented at logical breaks, e.g. district or county boundaries, speed limit changes. Sites in the intersection Toolkit do not comprise all trunk highway intersections in the state. Rather, all trunk-trunk intersections, signalized intersections, and hand-selected sites with known crash problems are tracked. OTST anticipates expanding the scope of this analysis to all sites utilizing a new linear referencing system in the future.

Copious amounts of data are available through the Toolkit including crash frequency, injury severity, crash rates, traffic volumes, and estimated loss (costs). The Toolkit is intended to be an objective network screening tool that facilitates the identification of locations for further investigation. There are a variety of methods supported by the Toolkit, each with their relative strengths and weaknesses. The most typical uses of the Toolkit are highlighted below. Additional support in using the Toolkit is available by contacting [OTST](#).

### 11-6.01.02 Ranking

In the past, total crash costs were used as the basis for creating a list of the worst intersections in Minnesota. This method is not ideal and can lead to skewing. The large number of property damage crashes that occur at high volume signalized intersections are overrepresented by crash costs. Furthermore, these sites are significantly different from locations where large numbers of fatal or other injury or crashes are occurring. The FAR index is a key metric in identifying locations where strategies can be implemented to move Toward Zero Deaths.

### 11-6.01.03 Crash Rate

There is a positive correlation between crash frequency and traffic volume, the literature confirms this trend. Crash rates measure the number of crashes controlling for this exposure. For intersections, exposure is defined as entering vehicles; for segments, exposure is defined as vehicle miles traveled (VMT).

$$\text{Intersection Crash Rate: } \frac{\text{Crashes}}{\text{Days} \times \text{Entering Volume}} \times 1,000,000$$

$$\text{Entering Volume} = \frac{1}{2} (\text{ADT}_{\text{leg1}} + \text{ADT}_{\text{leg2}} + \dots)$$

$$\text{Segment Crash Rate: } \frac{\text{Crashes}}{\text{VMT}} \times 1,000,000$$

$$\text{VMT} = \text{Days} \times \text{ADT} \times \text{Length}$$

The total crash rate (CR) is defined as the number of crashes per million vehicle miles traveled (or entering vehicles). The fatal and A injury crash rate (FAR) is defined as the number of fatal and incapacitating injury crashes per 100 million vehicle miles traveled (or entering vehicles for intersections).

Crash rates are benchmarked against other similar locations. However, a location that has a crash rate exceeding the average crash rate for similar locations should not be interpreted as having a safety issue. Instead, other measures that accommodate the fluctuation in crashes should be used to assess the relative safety of a location.

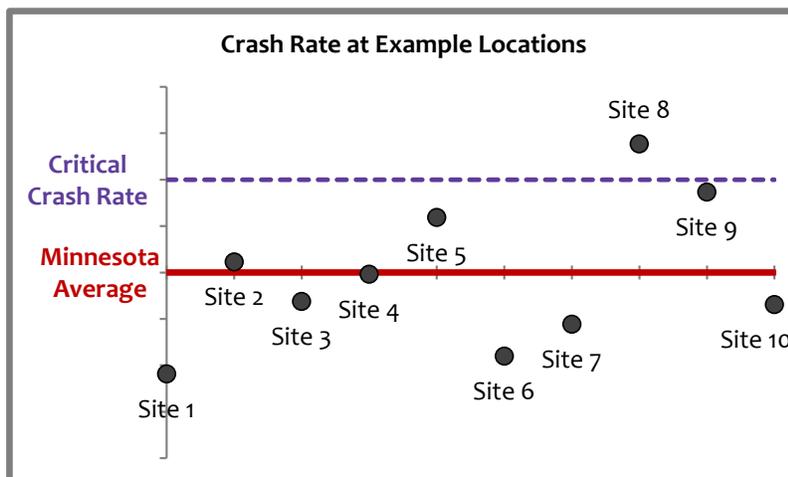
### 11-6.01.04 Critical Crash Rate

Critical crash rates provide a statistical threshold for screening sites. The critical rate is calculated by weighting the average crash rate for similar intersections or segments across Minnesota by the existing traffic volume. The critical CR is calculated at a 99.5% confidence interval ( $K = 2.576$ ); the critical FAR is calculated at a 90.0% confidence interval ( $K = 1.282$ ).

$$\text{Critical Crash Rate: } \text{Statewide Average} + K \times \sqrt{\frac{\text{Statewide Average}}{\text{Exposure}}} + \frac{0.5}{\text{Exposure}}$$

$$\text{Intersection Exposure: } \frac{\text{Days} \times \text{Entering Volume}}{1,000,000}$$

$$\text{Segment Exposure: } \frac{\text{VMT}}{1,000,000}$$



The preceding example illustrates critical rate screening.

#### 11-6.01.05 Critical Index

A critical index is reported as the ratio of the observed crash rate to the critical crash rate. A critical index exceeding 1.00 indicates there may be a safety concern at the site. When analyzing the critical index, a value at or below 1.00 implies that the site does not deviate significantly from statewide trends, i.e. it is performing within expectations.

**CR Index:**  $\frac{\text{Total Crash Rate (CR)}}{\text{Critical CR}}$

**FAR Index:**  $\frac{\text{Severe Crash Rate (FAR)}}{\text{Critical FAR}}$

To facilitate network screening, the Toolkit contains the critical index for filtering of problem locations. The CR Index is the total crash rate (CR) divided by the critical crash rate for total crashes. Similarly, the FAR Index is the fatal and A injury crash rate (FAR) divided by the critical crash rate for fatal and A injury crashes. These two measures are best suited to quantify the safety of a particular stretch of road.

Locations that have a high FAR index are good candidate locations for investments from HSIP; locations with a high CR index should be considered for improvements as funding opportunities become available.

#### 11-6.01.06 Crash Costs

Crash costs are based on the value of single life recommended by the US DOT and adjusted to include other related costs, e.g. loss of productivity, vehicle damage, etc. The standard values also account for all of the injuries involved in a typical crash. For example, most fatal crashes in Minnesota involve more than one person, thus the crash value of a K crash is the average cost of all injuries per crash. The injury statistics are based on Minnesota crash data for the years 2006 to 2008 and are adjusted annually for inflation.

As mentioned previously, using crash costs as the basis to conduct network screening is not recommended. However, crash costs are a vital component to assessing the magnitude of the safety improvement so that it is justified based on the crashes that are occurring. Ideally, the benefit, value of crashes reduced, is much more than the costs of the improvement over its expected life span. In some instances, other factors are incorporated into the benefit cost calculations that go beyond safety such as travel-time savings, emissions, etc. Each program throughout the department considers what factors go into the benefit cost calculations.

For purposes of the Highway Safety Improvement Program, the benefit-cost calculations should only quantify the savings from crash reductions. Due to the great discrepancy between the cost of a fatal crash versus a serious injury crash (approximately \$10 million versus \$500,000) a value of two times the A injury cost is substituted for a fatal crash for conducting benefit cost calculations for HSIP.

#### *11-6.01.07 Other Screening Measures*

Other data are available in the toolkit to do exploratory investigations including the ability to sort the data by the total number of crashes and crashes per mile. These measures can provide the basis to determine frequency of crashes however, no inference on the magnitude of the problem can be made due to the lack of a normalizing factor such as traffic volume.

### **11-6.02 Analytical Tools**

#### *11-6.02.01 Selecting an Appropriate Time Period*

In general, a five year time period should be used when conducting network screening. Typically, traffic patterns and geometric conditions are stable within this window of time. Five years provides an adequate time period for patterns to emerge from the data while minimizing the potential for one year's worth of crash history to skew the results.

Shorter or longer time periods can be considered on a case-by-case basis. For example, if significant development has occurred, or a drastic jump in traffic volume has occurred near the intersection in question, a three year time period might be appropriate. Conversely, if the roadway environment has not changed for quite some time and the traffic volume has been relatively stable, a 10 year time period may be appropriate.

#### *11-6.02.02 Intersection Collision Diagram*

An intersection collision diagram is a tool used to graphically represent crashes at a specific intersection. Collision diagrams help identify crash patterns and may help identify potential problem areas. See [Figure 11.5](#) for how a typical collision diagram may look.

Each recorded crash should be located near where the crash occurred in relation to the intersection. Include a summary of the number of crashes by severity for the entire intersection. Only data from crash reports should be diagrammed, do not include other sources.

Each located crash should summarize at least the following information:

- 1) Date of crash,
- 2) Time of crash,
- 3) Lighting conditions,
- 4) Weather,
- 5) Surface conditions,
- 6) Crash severity,
- 7) Crash diagram,
- 8) Crash type, and
- 9) Relevant notes.

#### *11-6.02.03 Road Safety Audits*

A Road Safety Audit ([RSA](#)) is the formal or informal traffic safety examination of an existing or future roadway by an independent, multidisciplinary team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements. The emphasis usually focuses on reducing fatal and serious

injury crashes. The State of Minnesota works with the FHWA, local jurisdictions, and Tribal governments to perform RSAs on existing roads and intersections and may also perform these functions during the project development process for new roads and intersections. RSAs are also encouraged during reconstruction, rehabilitation, and resurfacing projects.

Road Safety Audits should be performed keeping crash trends (statewide (e.g. SHSP) and local) and traffic operations in mind. Often, individual segments and intersections may lack certain types of crashes or severities, however, in a broader context, the facility may be just as high risk as those similar facilities with fatal and A injury and/or frequent crashes.

Road Safety Audits consist of three main components: Pre-Audit, Audit, and Post-Audit.

1. Pre-Audit

This phase typically consists of gathering all the appropriate data. This may include crash history, traffic volumes, turning count movements, vehicle classifications, peak hours and traffic flow characteristics, land use planning (past, present, and future), and bike/pedestrian usages. The pre-audit may include meeting with transportation officials, local citizens, politicians, and stakeholders to understand previous efforts and perceived issues.

2. Audit

During the audit, an independent multidisciplinary team performs a field review of the particular location or stretch of roadway. All members of the team should have the pre-audit information on hand. Those leading the audit should be careful not to imply or direct certain strategies, but rather, let ideas occur “naturally” for discussion among the team. Segments and intersections should be discussed both as individual facilities and in the context of the entire corridor. Locations with frequent crashes should not be the only areas of focus. All discussions should be recorded by a designated person for later use in the development of the final report.

3. Post-Audit

In this phase, everything is brought together and written into a final document. A presentation is provided to the stakeholders and owners of the road. The report includes recommendations ranging in costs, implementation time, and public acceptance.

For more information on road safety audits, see the [RSA](#) section on the OTST website, or the [RSA](#) section on the FHWA website.

### **11-6.03 Project Selection**

#### *11-6.03.01 Estimating the Safety Benefit of a Countermeasure*

Once a location has been identified through a critical rate calculation or a systemic risk assessment, an appropriate countermeasure must be identified to help mitigate the root cause of the crashes.

While no countermeasure can provide a 100 percent reduction in crashes, implemented countermeasures will change the frequency of a specific crash type. By matching specific countermeasures to the relevant crashes, an estimate for the safety benefit can be calculated. In general, estimated benefits can be obtained through crash modification factors or models. Crash prediction models and functions are powerful tools that incorporate a variety of countermeasures in their calculations.

#### *11-6.03.02 Crash Modification Factor*

One of the best tools for evaluating options for projects in regards to traffic safety is the use of Crash Modification Factors (CMF). The use of CMF's can be an easy tool to evaluate the overall effectiveness of a given strategy. However, other factors must still be considered, e.g. feasibility, cost, right-of-way impacts, local traffic conditions, public input, etc.

**CMF**

< 1.00	Expect number of crashes to be lower than current conditions.
1.00	Expect number of crashes to remain the same as current conditions.
> 1.00	Expect number of crashes to be greater than the current conditions.

The closer the value is to zero, the greater the anticipated reduction in crashes. Conversely, the greater the number above 1.00, the greater increase in the number of anticipated crashes. A CMF of 2.00 would represent a doubling of the number of crashes.

Example of how a CMF can aid in selecting an appropriate safety strategy:

An intersection has 12 crashes over three years. Two options are being considered: Option A with a CMF of 0.50, and Option B with a CMF of 1.50. Over the next three years, one would expect 2 crashes per year with Option A and 6 crashes per year with Option B. Based on crash performance, Option A would be the better option.

$$\text{Option A: } \frac{12 \text{ crashes}}{3 \text{ years}} \times 0.50 = 2.0 \text{ crashes/year}$$

$$\text{Option B: } \frac{12 \text{ crashes}}{3 \text{ years}} \times 1.50 = 6.0 \text{ crashes/year}$$

*11-6.03.03 Crash Reduction Factor*

The crash reduction factor (CRF) is the expected reduction in crashes after implementation of a given countermeasure. It should be viewed as intrinsically related to the CMF.

$$\text{CRF} = 1.00 - \text{CMF}$$

*11-6.03.04 Crash Modification Factors Clearinghouse*

The [CMF Clearinghouse](#) is one of the largest and most comprehensive set of crash modification factors currently in use. The website is managed by the Federal Highway Administration (FHWA) and includes high-level summaries of CMFs and links to the actual research papers detailing how the CMF was developed. Currently, nearly anyone can submit a potential CMF to the website. Once received, the submissions are reviewed and appropriate values are assigned to the reductions. The CMF is also given a star quality ranking that indicates the quality or confidence in the results of the study submitted. More stars indicate a higher quality CMF (five is the most, zero the least). OTST recommends using a CMF of at least three stars.

*11-6.03.05 Highway Safety Manual*

The [Highway Safety Manual \(HSM\)](#) was developed by AASHTO and released in 2010. The HSM has several models for calculating the expected number of crashes for various types of segments and intersections. Several of these models have been calibrated for Minnesota conditions. In addition to the models, the HSM has a large number of CMFs that can be used. These CMFs are typically only applicable to the specific model that they are assigned to, making these very reliable when used correctly.

In addition to CMFs related to individual models, the HSM manual contains a number of additional generic CMFs that may be used (see Appendix D of the manual). Some of the CMFs listed can also be found on the [CMF Clearinghouse](#) website.

*11-6.03.06 NCHRP 500 Series*

The National Cooperative Highway Research Program (NCHRP) is a part of the Transportation Research Board (TRB) of the National Academies. The program conducts research in problem areas that affect highway planning, design, construction, maintenance, operations, and safety. The [NCHRP 500](#) series is a set of publications that primarily focuses on traffic safety and countermeasures that can be used to address specific

issues. Though CMFs are not provided specifically, the proposed countermeasures are given a designation of “Proven”, “Tried”, and “Experimental”.

### Proven

Strategies that have been used in one or more locations and for which rigorous evaluation has shown them to be effective.

### Tried

Strategies that have been implemented at a number of locations and may even be accepted as standards, but for which no rigorous evaluations have been found.

### Experimental

Strategies representing suggested ideas that at least one agency has considered sufficiently promising to try as an experiment in at least one location. These strategies should be considered only after others have been determined not to be appropriate or feasible.

#### 11-6.03.07 Additional Sources

There are a wide variety of sources for Crash Modification Factors. Universities and other academic institutions, local technical assistance programs (LTAP), the Minnesota Local Road Research Board ([LRRB](#)), MnDOT, and many local transportation/highway agencies often conduct, evaluate, and study many different types of countermeasures. Depending on the sample size, time in place, and type of statistical analysis, these CMFs can provide a realistic understanding of the expected crash modification.

## 11-6.04 Project Evaluation

### 11-6.04.01 Evaluation Design

Countermeasure evaluations are utilized to determine the impact of an implemented safety improvement. Evaluations are not normally made until at least one year of crash data after installation has accrued; three years of after data is preferred. In a typical before-after study, the year of installation is excluded from the analysis.

Similar to safety projects, there are many factors for consideration in designing a robust evaluation. Additional factors, including analysis complexity and intended outcome should be weighed. The following table summarizes some common evaluation designs. The number of stars provides a relative scale for how robust the results are.

Evaluation Design	Comparative Rigor	Analysis Considerations		
		Target Crashes	Control Group	Retrospective
Simple Before-After	-			
Before-After with Target Crashes	★	★		
Before-After with Experimental & Control Groups	★		★	
Retrospective Experimental & Control Groups	★★		★	★
Retrospective Experimental & Control Groups, Targeted	★★★	★	★	★

Before-after studies evaluate the change in a selected metric, e.g. fatal and serious injury crashes, before and after the implementation of a specific countermeasure. While this straightforward method provides a CRF, until a large body of studies have been completed, findings may be difficult to reproduce.

Analyzing only crashes that would be impacted by a safety improvement, i.e. Target Crashes, provides added focus to the evaluation. Comparing the treatment site(s) to a similar selection of sites, i.e. Control Group, accounts for variation across designs. A retrospective tracks changes in crashes through time rather than categorizing before and after periods; this helps address variation over time.

#### *11-6.04.02 Evaluation Services Provided*

Research and evaluation allows us to explore new ways to address existing problems and evaluate the effectiveness of our countermeasures, projects, and programs. Evaluation helps ensure that MnDOT invests in effective and efficient safety countermeasures, projects, and programs.

The Office of Traffic, Safety, and Technology (OTST) support this process in three ways: in house professional evaluations, MnDOT supported professional evaluations, and support and review for developing evaluation projects. The [OTST Traffic Safety](#) section website provides more information about research and regularly posts existing studies.

OTST monitors and evaluates projects that were programmed with HSIP funds; however, several safety enhancements are programmed outside of the HSIP program. A partnership with the districts and OTST, safety staff is needed so that safety evaluations are exhaustive of all safety deployments and not just the HSIP program. Whenever possible, location details, installation dates, and countermeasures implemented should be recorded and shared with OTST safety staff on an annual basis.

## **11-7.00 FUNDING AND PROJECT ELIGIBILITY**

### **11-7.01 Highway Safety Improvement Program (HSIP)**

#### *11-7.01.01 HSIP Project Priority*

[HSIP](#) is a federal-aid funding program designed to reduce traffic fatalities and serious injuries on all public roads. Locations must have a significant crash history that includes a fatal or serious injury crashes. The critical crash rate will be used to determine if a significant crash history either fatal, serious, or a combination of both, exists at a particular location. Five years of crash data should be used for this calculation; however, three or 10 years may be considered on a case-by-case basis in consultation with OTST. Additionally, low cost, high impact improvements identified through a risk analysis (e.g. systemic safety plans) will also be considered for HSIP funding. It is anticipated that a balance of risk mitigation and historical crash consideration will be part of HSIP in the foreseeable future.

Two types of projects are candidates for HSIP funding: 1) reactive or sustained crash locations, and 2) systemic, risk-based projects. Sustained crash locations are areas where, statistically, there are higher number of crashes associated with a particular location when compared to other similar locations throughout the state. Sustained crash locations greatly exceed statewide averages and can be determined by using a critical crash rate to establish if a location has a sustained crash problem. Systemic projects tend to apply known risk factors to address high frequency but very low density crashes. These projects deploy cost-effective strategies across many miles of roadway to be effective.

Three critical crash rates (total crash rate, fatal crash rate, and fatal plus serious injury crash rate) are available to measure if a roadway segment and intersection meets the requirements of a sustained crash location. If a location has a crash rate that exceeds the associated critical crash rate, a benefit cost ratio should be completed to determine the amount of safety impact that can be considered at this particular location compared to the safety investment under consideration.

### *11-7.01.02 Incidental Safety Improvements*

HSIP is not the only source of funding for safety projects and improvements. Districts should be spending an amount equal to or greater than their HSIP goal each year on safety improvements included in larger projects. These types of minor safety improvements shall be installed on each project undertaken on the trunk highway network. The intention of these projects is that they are incidental to the overall scope of the project. In some instances, they are required by a standard or policy in place for the Department. No HSIP funding will be used to offset the costs of these incidental improvements.

### *11-7.01.03 HSIP Programming*

HSIP projects should be programmed four years in advance. If Year One and Year Two funds are left unallocated after solicitation, then those funds will go to a project or District that can deliver in the necessary time frame.

## **11-7.02 Safety Set-Aside Funds**

Safety is an integral part of any transportation program. Having specific resources for safety allows programs to be financially effective by taking take advantage of cost-effective scheduling. For example, turn lanes may be an appropriate addition to a mill-and-overlay project rather than as a separate project. Whenever possible, larger program funds should be used to fund safety improvements, particularly when they are a relatively small portion of the overall project budget.

Practices vary among the districts regarding set-aside funds to implement improvements. Districts can allocate specific money from their construction funds for safety improvements as identified by the District Traffic Engineer. OTST supports a district set-aside to ensure that the priority safety items outside the HSIP program have an opportunity to be funded.

Some districts have already opted into this safety investment and have been pleased with the results. This structure provides consistent leadership in a core agency without pitting traffic safety against other projects and while better utilizing the district's HSIP allocation. By creating set-aside funds specifically for safety, districts can more efficiently invest in agency and regional priorities.

PS-32003-10 LOCAL CASE NO.		AMENDED ?		<b>STATE OF MINNESOTA - DEPARTMENT OF PUBLIC SAFETY</b>										PAGE _____ OF _____		FOR DPS USE ONLY																			
HIT-AND-RUN ?		PUB PROP ?		VEHICLES #		KILLED #		INJURED #		\$ MIN ?		MONTH		DATE			YEAR		DAY		MILITARY TIME														
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FACTOR 2		NAME (FIRST, MIDDLE, LAST)										DATE OF BIRTH		FACTOR 2			NAME (FIRST, MIDDLE, LAST)										DATE OF BIRTH								
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VEH USE		CITY, STATE, ZIP										PULLING UNIT		DIRECT		VEH USE		CITY, STATE, ZIP										PULLING UNIT		DIRECT					
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INSURANCE		POLICY NUMBER										INSURANCE (UNIT 2)		POLICY NUMBER																					
CARGO BDY TYPE		HAZ MAT PLAC		WAIVED		INSPECTION #		INSP BADGE #		IF ACCIDENT INVOLVED A COMMERCIAL MOTOR VEHICLE, SCHOOL BUS, OR HEAD START BUS REMEMBER TO NOTIFY THE STATE PATROL (required under MS 169.783 and 169.4511).										WAIVED		HAZ MAT PLAC		CARGO BDY TYPE											
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OWNER OF OTHER DAMAGED PROPERTY AND DESCRIPTION OF DAMAGED PROPERTY AND/OR YELLOW TAG NUMBER(S)										DAMAGED PROPERTY / YELLOW TAG NUMBER																									
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LOC OF CRASH/WZ														WEATHER 2																					
WORKERS PRESENT														LIGHT																					
RDESGN														PHOTOS TAKEN																					
RD SURF														DIAGRAM																					
RD CHAR																																			
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PLEASE SEND COMPLETED REPORT WITHIN 10 DAYS TO: DVS / ACCIDENT RECORDS 445 MINNESOTA STREET SUITE 181 ST. PAUL, MN 55101-5181

Text Ref.: 11-4.02

**FACTOR 1 & FACTOR 2 - APPARENT CONTRIBUTING FACTORS (UP TO TWO PER DRIVER)**  
(NOTE: PLEASE INDICATE PRIMARY FACTOR IN THE BOX MARKED FACTOR 1)

1- NO CLEAR CONTRIBUTING FACTOR	9- IMPROPER PARKING/START/STOP	16- DRIVER INEXPERIENCE	32- VISION OBSCURED -SUN/HEADLIGHTS	46- SKIDDING
2- FAILURE TO YIELD RIGHT OF WAY	10- IMPROPER TURN	17- NON-MOTORIST VIOLATION / ERROR	33- OTHER VISION FACTOR	50- OTHER VEHICLE DEFECT FACTOR*
3- ILLEGAL/UNSAFE SPEED	11- UNSAFE BACKING	18- CHEMICAL IMPAIRMENT	41- DEFECTIVE BRAKES	61- WEATHER
4- FOLLOWING TOO CLOSELY	12- IMPROPER/NO SIGNAL	19- FAILURE TO USE LIGHTS	42- DEFECTIVE TIRE OR TIRE FAILURE	90- OTHER CONTRIBUTING FACTOR*
5- DISREGARDED TRAFFIC CONTROL DEVICE	13- OVER-CORRECTING	20- DRIVER ON CAR PHONE/CB/2WAY RADIO	43- DEFECTIVE LIGHTS	99- UNKNOWN
6- DRIVING LEFT OF ROADWAY CENTER, NOT PASSING	14- IMPEDING TRAFFIC	21- OTHER HUMAN CONTRIBUTING FACTOR*	44- INADEQUATE WINDSHIELD GLASS	
7- IMPROPER PASSING/OVERTAKING	15- DRIVER INATTENTION/DISTRACTION	31- VISION OBSCURED-WINDSHIELD GLASS	45- OVERSIZE/OVERWEIGHT VEHICLE	
8- IMPROPER/UNSAFE LANE USE				

**MANUEVER - PRE-CRASH BY VEHICLE**

1- GOING STRAIGHT AHEAD FOLLOWING ROADWAY	6- MAKING LEFT TURN	15- OVERTAKING/PASSING
2- WRONG WAY INTO OPPOSING TRAFFIC	7- MAKING U-TURN	16- MERGING
3- RIGHT TURN ON RED	8- STARTING FROM PARKED POSITION	17- BACKING
4- LEFT TURN ON RED	9- STARTING IN TRAFFIC	18- STALLED ON ROADWAY
5- MAKING RIGHT TURN	10- SLOWING IN TRAFFIC	
	11- STOPPED IN TRAFFIC	
	12- ENTERING PARKED POSITION	
	13- AVOID UNIT/OBJECT IN ROAD	
	14- CHANGING LANES	

**PARKED VEHICLES**

21- PARKED LEGALLY	35- CROSSING IN A MARKED CROSSWALK
22- PARKED ILLEGALLY	36- CROSSING (NO SIGNAL OR CROSSWALK)
23- VEHICLE STOPPED OFF ROADWAY	37- FAIL TO YIELD R/W TO TRAFFIC

**BY PEDESTRIAN**

31- CROSSING WITH SIGNAL	38- INATTENTION/DISTRACTION	45- PUSHING/WORKING ON VEHICLE
32- CROSSING AGAINST SIGNAL	39- WALKING/RUNNING IN ROAD WITH TRAFFIC	46- WORKING IN ROADWAY
33- DARTING INTO TRAFFIC	40- WALKING/RUNNING IN ROAD AGAINST TRAFFIC	47- PLAYING IN ROADWAY
34- OTHER IMPROPER CROSSING	41- STANDING/LYING IN ROAD	48- NOT IN ROADWAY
35- CROSSING IN A MARKED CROSSWALK	42- EMERGING FROM BEHIND PARKED VEHICLE	
36- CROSSING (NO SIGNAL OR CROSSWALK)	43- CHILD GETTING ON/OFF SCHOOL BUS	
37- FAIL TO YIELD R/W TO TRAFFIC	44- PERSON GETTING ON/OFF VEHICLE	

**PHYSCL - APPARENT PHYSICAL CONDITION**

2- UNDER THE INFLUENCE	5- HAD BEEN TAKING DRUGS	8- PHYSICALLY CHALLENGED	90- OTHER*
3- HAD BEEN DRINKING	6- AGGRESSIVE	9- ILL	98- NOT APPLICABLE
4- COMMERCIAL DRIVER OVER .04 BAC	7- FATIGUED/ASLEEP		99- UNKNOWN

**RCOMND - RECOMMENDATIONS FOR DRIVER**

1- NONE	3- DRIVER EXAM
2- PHYSICAL EXAM	4- BOTH

**VEN TYPE - VEHICLE TYPE**

1- PASSENGER CAR	4- VAN OR MINI-VAN	8- BUS (16+ SEATS PLUS DRIVER)	12- MOTORSCOOTER / MOTORBIKE	32- 3 OR MORE AXLE SINGLE UNIT TRUCK	36- TRUCK TRACTOR W/DOUBLE TRAILERS	52- SKATER
2- PICKUP	5- MOTORHOME/CAMPER/RV	9- SNOWMOBILE	13- MOPED/MOTORIZED BIKE	33- SINGLE UNIT TRUCK W/TRAILER	37- TRUCK TRACTOR W/TRIPLE TRAILERS	53- BICYCLIST
3- SPORT UTILITY VEHICLE	6- LIMOSINE	10- ATV	14- FARM EQUIPMENT	34- TRUCK TRACTOR W/NO TRAILER	38- HEAVY TRUCK OF UNKNOWN TYPE	54- OTHER NON-MOTORIST
	7- BUS (7-15 SEATS PLUS DRIVER)	11- MOTORCYCLE	31- 2 AXLE, 6 TIRE SINGLE UNIT TRUCK	35- TRUCK TRACTOR W/SEMI-TRAILER	51- PEDESTRIAN	90- OTHER*
						99- UNKNOWN

**VEH USE - SPECIAL VEHICLE USE**

2- TAXICAB	6- HIT & RUN VEHICLE	8- POLICE DEPT VEHICLE - LIGHTS/SIRENS OPERATING	10- FIRE DEPT VEHICLE - LIGHTS/SIRENS NOT OPERATING	14- SNOWFLOW- IN TRANSIT	90- OTHER VEHICLE USE*
3- SCHOOL BUS	7- POLICE DEPT VEHICLE - LIGHTS/SIRENS NOT OPERATING	9- FIRE DEPT VEHICLE - LIGHTS/SIRENS NOT OPERATING	11- AMBULANCE - LIGHTS/SIREN NOT OPERATING	15- OTHER MAINT VEH- WORKING	98- NOT APPLICABLE
4- BUS (OTHER THAN SCHOOL)			12- AMBULANCE - LIGHTS/SIREN OPERATING	16- OTHER MAINT VEH- IN TRANSPORT	99- UNKNOWN VEHICLE USE
5- MILITARY VEHICLE			13- SNOWFLOW- WORKING	17- OTHER PUBLICLY OWNED VEH*	

**DM LOC - PRINCIPAL DAMAGE AREA(S) OF VEHICLE**

1- FRONT	3- RIGHT CENTER	5- REAR	7- LEFT CENTER	9- TOP	11- MULTIPLE AREAS	90- OTHER*
2- RIGHT FRONT	4- RIGHT REAR	6- LEFT REAR	8- LEFT FRONT	10- BOTTOM-UNDERCARRIAGE		98- NOT APPLICABLE
						99- UNKNOWN

**DMG SEV - DAMAGE SEVERITY**

1- NONE	3- MODERATE	5- TOTAL	90- OTHER*
2- LIGHT	4- SEVERE		98- NOT APPLICABLE
			99- UNKNOWN

**CARGO BODY TYPE -**

1- VAN/ENCLOSED BOX	3- LIQUID BULK	5- FLATBED OR PLATFORM	7- CONCRETE MIXER	9- GARBAGE/REFUSE	11- SPECIAL PERMIT LOAD	13- POLE	90- OTHER*
2- DRY BULK CARGO TANK	4- GAS BULK CARGO TANK	6- DUMP	8- AUTO TRANSPORTER	10- COMBINATION	12- GRAIN/CHIPS/GRAVEL		98- NOT APPLICABLE
							99- UNKNOWN

**IF ACCIDENT INVOLVED A COMMERCIAL MOTOR VEHICLE, SCHOOL BUS, OR HEAD START BUS, REMEMBER TO NOTIFY THE STATE PATROL (required under MS 169.783 and 169.4511).**

**ACC TYP - ACCIDENT TYPE BY 1ST HARMFUL EVENT**

1- MOTOR VEHICLE IN TRANSPORT	21- CONSTRUCTION EQUIPMENT	32- MEDIAN SAFETY BARRIER	51- OVERTURN/ROLLOVER
2- PARKED MOTOR VEHICLE	22- TRAFFIC SIGNAL	33- CRASH CUSHION	52- SUBMERSION
3- ROADWAY EQUIPMENT - SNOWFLOW	23- RR CROSSING DEVICE	34- GUARDRAIL	53- FIRE/EXPLOSION
4- ROADWAY EQUIPMENT - OTHER	24- LIGHT POLE	35- FENCE (NON-MEDIAN BARRIER)	54- JACKKNIFE
5- TRAIN	25- UTILITY POLE	36- CULVERT/HEADWALL	55- LOSS/SPILLAGE NON-HAZ MAT
6- PEDALCYCLE	26- SIGN STRUCTURE	37- EMBANKMENT/DITCH/CURB	56- LOSS/SPILLAGE HAZ MAT
7- PEDESTRIAN	27- MAILBOXES	38- BUILDING/WALL	64- NON-COLLISION OF OTHER TYPE
8- DEER	28- OTHER POLES	39- ROCK OUTCROPS	65- NON-COLLISION OF UNKNOWN TYPE
9- OTHER ANIMAL	29- HYDRANT	40- PARKING METER	90- OTHER ACCIDENT TYPE*
10- UNDERRIDE - REAR	30- TREE/SHRUBBERY	41- OTHER FIXED OBJECT*	99- UNKNOWN ACCIDENT TYPE
11- UNDERRIDE - SIDE	31- BRIDGE PIERS	42- UNKNOWN FIXED OBJECT	
12- COLLISION WITH OTHER TYPE OF NON-FIXED OBJECT			
13- OTHER COLLISION TYPE*			
14- UNKNOWN COLLISION TYPE			

**COLLISION WITH FIXED OBJECT**

**NON-COLLISION**

**DEVICE - TRAFFIC CONTROL DEVICE**

1- TRAFFIC SIGNAL	11- RR CROSSING- FLASHING LIGHTS
2- OVERHEAD FLASHERS	12- RR CROSSING- STOP SIGN
3- STOP SIGN - ALL APPROACHES	13- RR OVERHEAD FLASHERS
4- STOP SIGN - NOT ALL APPROACHES	14- RR OVERHEAD FLASHERS/GATE
5- YIELD SIGN	15- RR CROSSBUCK
6- OFFICER/FLAG PERSON/ SCHOOL PATROL	90- OTHER*
7- SCHOOL BUS STOP ARM	98- NOT APPLICABLE
8- SCHOOL ZONE SIGN	99- UNKNOWN
9- NO PASSING ZONE	
10- RR CROSSING GATE	

**SCHOOL BUS INVOLVED**

1- YES, INVOLVED DIRECTLY	2- YES, INVOLVED INDIRECTLY	3- NO	99- UNKNOWN
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**LOCATH - LOCATION OF FIRST HARMFUL EVENT (SEE EXAMPLE OF TRAFFIC WAY)**

1- ON ROADWAY	2- ON SHOULDER	4- ON ROADSIDE	6- PARKING LOT	8- OUTSIDE OF TRAFFICWAY (ALLEY DRIVEWAY, ETC)	3- ON MEDIAN	5- ON SEPARATOR	7- PRIVATE PROPERTY	90- OTHER*	99- UNKNOWN
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**TYPE OF WZ - WORK ZONE**

1- LANE CLOSURE	5- MOVING WORK ZONE	1- BEFORE 1ST WARNING SIGN	5- TERMINATION AREA
2- LANE SHIFT/CROSSOVER	90- OTHER*	2- ADVANCE WARNING AREA	90- OTHER*
3- WORK ON SHOULDER/MEDIAN	98- NOT APPLICABLE	3- TRANSITION AREA	98- NOT APPLICABLE
4- INTERMITTENT	99- UNKNOWN	4- ACTIVITY AREA	99- UNKNOWN

**LOCATION OF CRASH RELATIVE TO THE WORK ZONE**

**RDESGN - ROAD DESIGN**

1- FREEWAY - MAIN LINE	4- ONE-WAY STREET	7- 5 LANES UNDIVIDED (CENTER LEFT TURN LANE)	10- ROAD ON PRIVATE PROPERTY
2- FREEWAY - RAMPS	5- 4-6 LANES UNDIVIDED (2-3 LANES EACH WAY)	8- 2-LANES (1 LANE EACH WAY)	90- OTHER*
3- OTHER DIVIDED HIGHWAY	6- 3 LANES UNDIVIDED	9- ALLEY/DRIVEWAY	99- UNKNOWN

**RD SURF - ROAD SURFACE CONDITIONS**

1- DRY	3- SNOW	5- ICE PACKED SNOW	7- MUDDY	9- OILY	90- OTHER*
2- WET	4- SLUSH	6- WATER (STANDING/MOVING)	8- DEBRIS		99- UNKNOWN

**RD CHAR - ROADWAY CHARACTER**

1- STRAIGHT & LEVEL	3- STRAIGHT AT HILLCREST	5- CURVE & LEVEL	7- CURVE AT HILLCREST	90- OTHER*
2- STRAIGHT & GRADE	4- STRAIGHT AT SAG	6- CURVE & GRADE	8- CURVE AT SAG	99- UNKNOWN

**WORKING - WAS SIGNAL WORKING PROPERLY?**

1- SIGNAL WORKING PROPERLY	3- SIGNAL WORKING IN MODIFIED FASHION	90- OTHER*
2- SIGNAL NOT WORKING PROPERLY	4- SIGNAL OBSCURED/ DAMAGED	98- NOT APPLICABLE
		99- UNKNOWN

**INT REL - RELATIONSHIP TO INTERSECTION/JUNCTION**

1- NOT AT INTERSECTION/JUNC	4- 4 LEGGED INTERSECTION	9- AT SCHOOL X-ING	22- INTERCHANGE ALL OTHERS
2- INTERSECTION	5- 5 OR MORE POINT INTERSECTION	10- RR X-ING	
3- Y INTERSECTION	6- TRAFFIC CIRCLE OR ROUND ABOUT	11- RECREATIONAL X-ING	
	7- INTERSECTION RELATED	20- INTERCHANGE ON RAMP	90- OTHER*
	8- ALLEY OR DRIVEWAY ACCESS	21- INTERCHANGE OFF RAMP	99- UNKNOWN

**WEATHER - WEATHER CONDITION #1 AND #2**

1- CLEAR	3- RAIN	5- SLEET/HAUL/FREEZING RAIN	8- SEVERE CROSSWINDS
2- CLOUDY	4- SNOW	6- FOG/SMOG/SMOKE	90- OTHER*
		7- BLOWING SAND/DUST/SNOW	99- UNKNOWN

**LIGHT - LIGHTING**

1- DAY LIGHT	3- AFTER SUNSET	6- DARK (NO STREET LIGHTS)	90- OTHER*
2- BEFORE SUNRISE	4- DARK (STREET LIGHTS ON)	7- DARK (UNKNOWN LIGHTING)	99- UNKNOWN
	5- DARK (STREET LIGHTS OFF)		

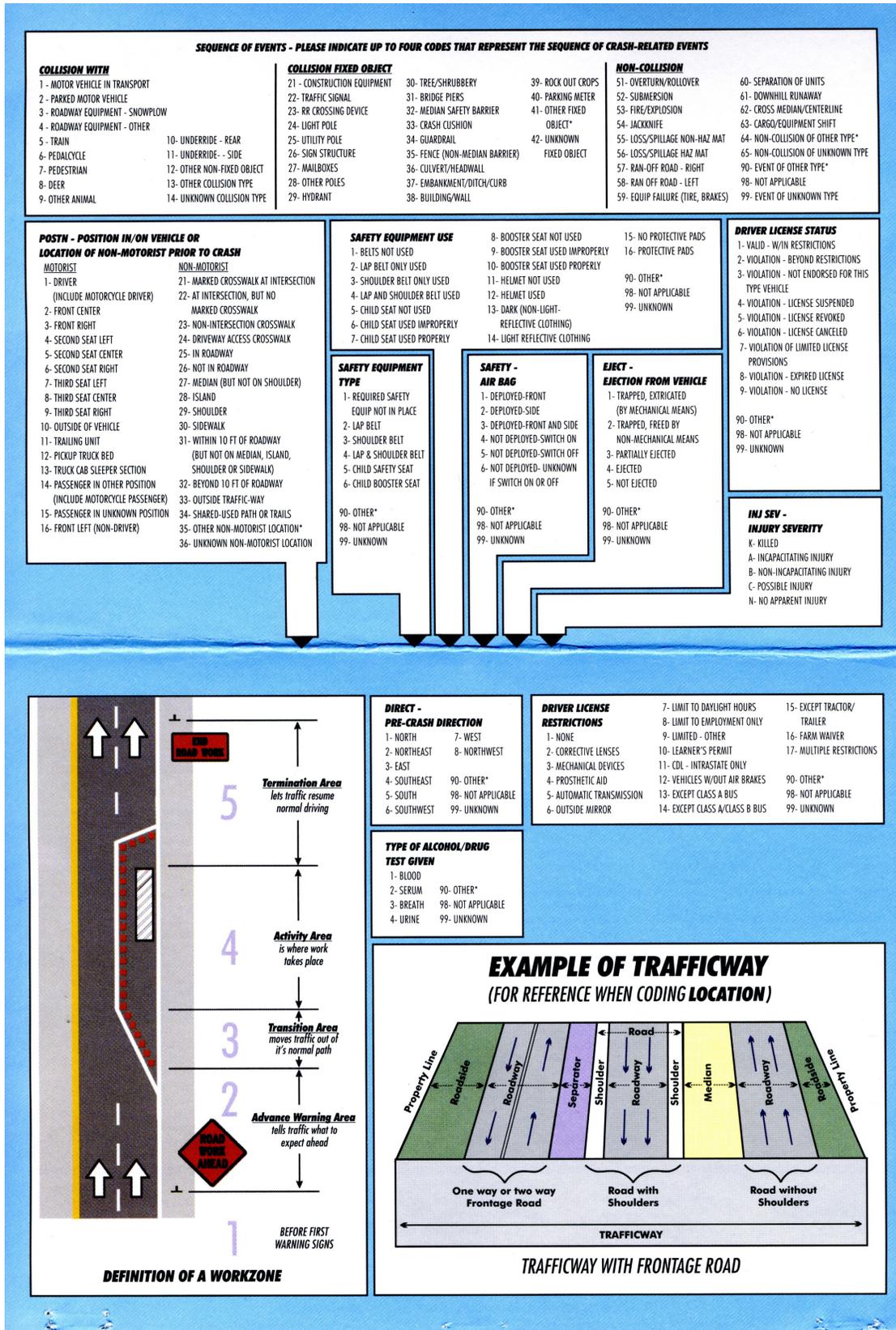
**DIAGRAM - VEHICULAR RELATIONSHIPS WHICH LED TO IMPACT**

1- REAR END	3- LEFT TURN	6- RIGHT TURN	90- OTHER*
2- SIDESWIPE - SAME DIRECTION	4- RAN OFF ROAD - LEFT SIDE	7- RAN OFF ROAD - RIGHT SIDE	98- NOT APPLICABLE
	5- RIGHT ANGLE	8- HEAD ON	99- UNKNOWN
		9- SIDESWIPE - OPPOSING	

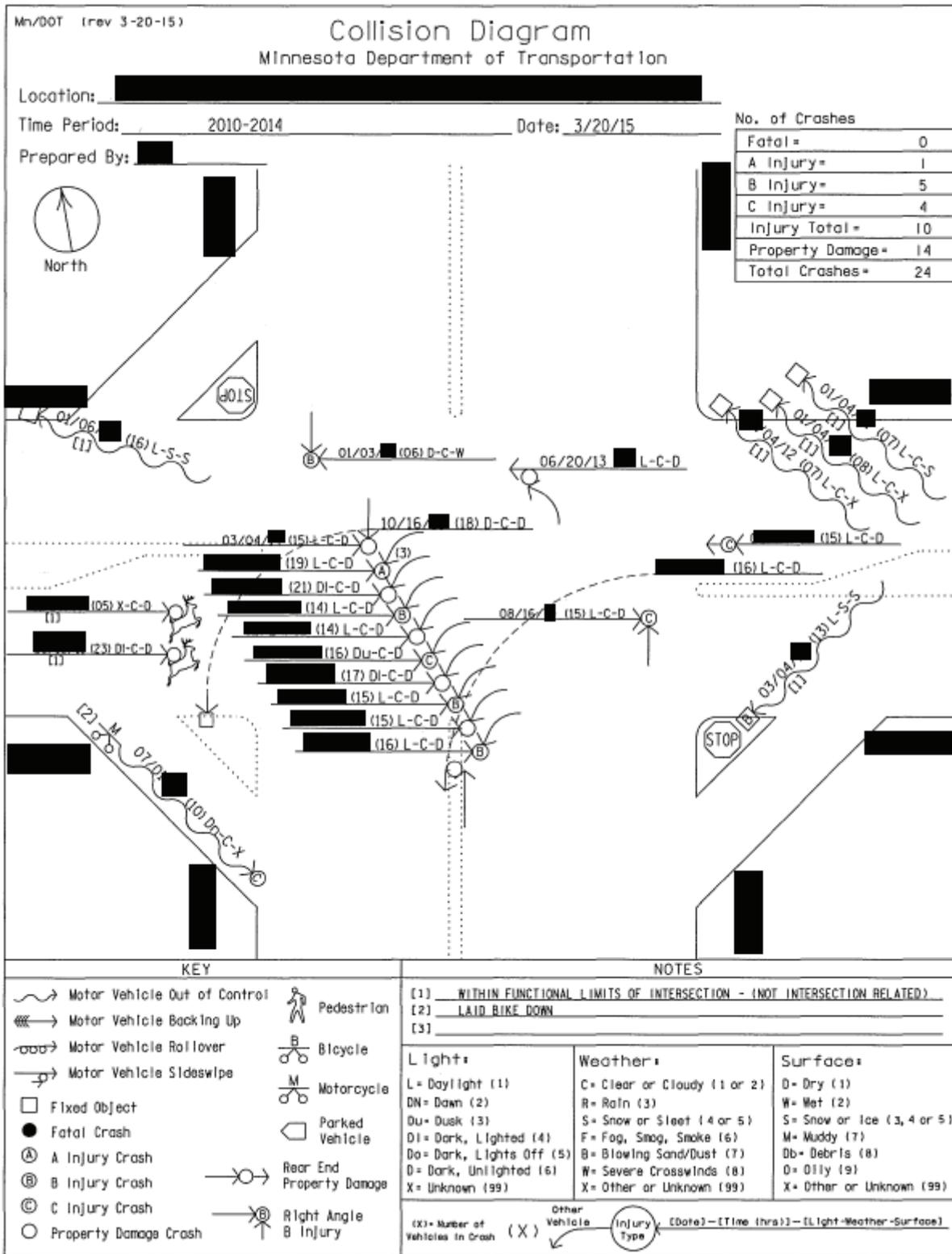
**STATE OF MINNESOTA TRAFFIC ACCIDENT REPORT (LAW ENFORCEMENT ONLY)**

ANY BOXES WITH QUESTION MARKS ANSWER WITH ONE OF THE FOLLOWING:  
Y - YES, N - NO, I - INAPPLICABLE, X - UNKNOWN  
\* DESCRIBE IN NARRATIVE

Text Ref.: 11-4.02







Text Ref.: 11-6.02.02