

This report contains the intersection and section High Crash Locations (HCLs) for data years 2003-2007. The HCLs in this report are based on the number of crashes and not the severity of the crashes.

The intersections and sections analyzed in this report include those highways that fall under the Federal Aid highway system.

The table below shows the volume of records that have been received by this Agency for input into the Crash Reporting System (CRS) over the last 16 years. Note the “spike” of crashes in 2002. This increase in the number of reports was a result of improved communication with the law enforcement community coupled with a revised uniform crash report form (UCRF) used by law enforcement to report the crash data.

<u>Year</u>	<u>Crashes in VTrans' Crash Reporting System</u>
1992	7122
1993	6758
1994	6392
1995	5118
1996	4613
1997	4364
1998	3738
1999	3590
2000	3470
2001	3265
2002	10066
2003	13714
2004	13793
2005	14369
2006	14549
2007	14417

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HIGH CRASH LOCATIONS REPORT 2003 to 2007

Introduction

All states collect vehicle Crash records for several reasons. Of particular interest to the Agency of Transportation (VAOT or VTrans) is to identify the high crash locations on Vermont roadways. This information is carefully analyzed and, where possible, corrective action is taken. Action may include improved signage, alignment improvements, changing roadway geometry, and more.

The Vermont Crash Reporting System (CRS) has been undergoing improvements for several years. 23 CFR §924 requires a comprehensive crash data collection and analysis system that covers "all public roads in the State." Further, if all public roads are not covered, FHWA has authority to withhold funding to VTrans.

In 1997, VTrans initiated an ongoing project to develop a comprehensive and coordinated statewide crash location and reporting information system. This system was to provide access to the Department of Motor Vehicles (DMV) and other agencies' systems. It was the VTrans' primary goal to eliminate duplication in data entry, greatly facilitate the sharing of information between agencies, and improve crash report processing and highway safety program management and planning. This system also was to enhance highway improvement program planning, safety of Law Enforcement officers, and the public.

In 1998, the first phase of this effort provided VTrans with a new Graphical User Interface (GUI) which greatly facilitated data entry of the police crash report data. This phase also included the conversion of existing mainframe applications into MS Access for use in the PC environment, and ultimately into an Oracle format. At this time, we also improved the speed and flexibility in our capability to produce reports.

In 2000 we began the second phase of our crash reporting project. This consisted of an improved standard reporting tool and new ad-hoc reporting tool.

Through an effort initiated by Vermont's Traffic Records Coordinating Committee (TRCC), a new Crash report form was developed and distributed for Law Enforcement use in 2002. Implementation of this form created a standard data collection tool that replaced both "long form" and "short form" reporting tools that had been previously used. The process of developing the form, issuing it and training officers in its use started an awareness campaign about the purpose and importance of the collection of meaningful Crash data.

The Department of Public Safety (DPS) and VTrans have collaborated on a Strategic Plan to establish an improved method for warehousing crash records. The Strategic Plan clearly identifies the State's responsibility to reach the goals of improving the quality and quantity of the crash data. The first step in this process was improving the data collection process. This provides the framework for the next step, and that is to implement a project to improve on the quality and quantity of Vermont's crash data. The primary goal as identified by the inter agency committee:

"To improve the quality and quantity of crash data in the Vermont Crash Reporting system in order to reduce the risks faced by the traveling public in Vermont."

In 2004, VTrans contracted with a vendor to build an electronic crash reporting application. This project is a cooperative effort involving the Department of Public Safety including the Vermont State Police, the Department of Information and Innovation, the Burlington Police Department, and included input from statewide local law enforcement departments (including municipal and County Sheriff Departments). The result is a web based application, referred to as Web Crash. This online application was initiated on January 1, 2008. To date (April 2009), all of the Vermont State Police as well as 50 local law enforcement agencies are using Web Crash to electronically report their crash data to the State of Vermont. The law enforcement agencies represent approximately 60% of the volume of reports that are submitted to the State on a yearly basis.

VTrans continues to strive to add the remaining local law enforcement agencies to the Web Crash user list. The ideal goal is 100% electronic reporting to eliminate the paper as well as to provide for more timely access to the data in order to support highway safety initiatives by the various data users.

Federal Functional Classification

The following tables in this report include High Crash Locations (HCLs) on Federal-aid eligible Highways only. Local Minor Collector -r (rural), Local -r, and Local-u (urban) do not fall into the highway Federal Aid eligible category.

The Federal Functional Classification includes the following systems:

Rural:

Interstate (r)
Principal Arterial (r)
Minor Arterial (r)
Major Collector (r)
Minor Collector (r)
Local (r)

Urban:

Interstate (u)
Other Freeways and Expressways (u)
Principal Arterial (u)
Minor Arterial (u)
Collector (u)
Local (u)

The Highway Functional Classification map can be found in Appendix B or online at <http://www.aot.state.vt.us/planning/Documents/HighResearch/Publications/pub.htm>.

Explanation of HCL Report

As noted above, this HCL report includes intersections and sections that involve Federal Aid eligible highways only.

The intersections are analyzed based on predefined intersection limits:

In rural areas, the posted speed limit is used to determine the standard for Stopping Sight Distance (SSD) as identified in the AASHTO handbook. Each leg of an intersection should be identified and the SSD determined for the intersection influence. The SSD length acts as that leg's influence length. In rural areas (as identified by the Functional Classification Map) this table is used directly.

In suburban (built up areas outside of the designated urban area) and urban areas (as identified by the Functional Classification Map) the intersection influence process takes into account overlapping areas of intersection influence from adjacent intersections. In suburban areas we use the SSD table results for each leg, and in the case where legs of two adjacent intersections overlap, the difference is split.

For urban areas, the length of influence for each approach on an intersection is 0.01 mile.

Highway sections are analyzed based on a sliding 0.30 mile section, one 0.10 mile at a time, along the entire length of a route.

Where an HCL intersection occurs within the area of an HCL section, the intersection HCL rules and will be listed in this report and the HCL sections for the legs of the intersection will not be listed.

In the event of overlapping HCL sections, the HCL listed in this report will be those sections with the higher Actual/Critical ratio. When overlapping occurs, it is an indication that the listed HCL section may be part of a longer HCL.

All HCLs in the attached tables that are located within the limits of an anticipated project (as identified in the Capital Program) are flagged with an asterisk (*). Projects include highway or bridge realignment or reconstruction, but do not include paving nor bridge rehabilitation. Further, project flag (*) includes widening, signals, and pavement markings (such as for new turn lanes).

All HCLs that are located within a Class 1 Town Highway section are noted with the number symbol (#).

Although an HCL may rank very high on the listing, in-depth study must be conducted to determine the feasibility of corrective measures before adding the location to the construction program.

For a Section or Intersection to be identified as an HCL, two criteria must be satisfied:

1. The location must have experienced five (5) or more crashes in a five-year period, or the average of one (1) crash per year, and;
2. The Actual/Critical ratio must be 1.000 or higher. Formulas to calculate this information are on the following page.

This report includes HCLs where the Actual Rate to Critical Rate Ratio is 1.0 or greater.

Misc Notes

Roundabouts and Traffic Circles in this report are treated as individual intersections. As an example, the VT-9 and US-5 roundabout in Brattleboro is treated as a four leg intersection for purposes of this report.

There exists along many routes what we refer to as “ghost” sections. These are highway sections where the physical mileage (or Mile Marker) points are non-contiguous. As an example: A VT numbered route runs for several miles until it comes to an intersection with a US route. Then you have to traverse a part of the US route in order to get to the continuation of the VT route. Therefore, the Mile Marker points for the VT route are not physically continuous, but separated by the length of the US route. For a list of the “ghost” sections, please see Appendix A.

Crash Rate Formulas

1. Critical Rate

$$R_C = R_A + K * \text{SQRT} (R_A/M) - 1/ (2*M)$$

Where:

R_C = Critical Crash Rate

R_A = Average Crash Rate for a Specific Category of highway in crashes per million vehicle miles (sections) or million vehicles (intersections). This is the Statewide Average Rate (5 year average) for the Functional Classification of the highway section/intersection under study. (See Appendix C.)

M = Vehicle Exposure in million vehicle miles or million vehicles at the location under consideration.

$$M_{\text{section}} = (\text{AADT} * L * 365 * \text{Number of Years}) / 1,000,000$$

$$M_{\text{intersection}} = (\text{AADT all legs}/2) (365)(\text{Number of years}) / 1,000,000$$

K = A constant. The value of which determines the level of probability. A Value of 2.58 is currently used by this program which gives a 99.5% confidence level.

2. Actual Rate – Sections

$$\text{RMVM} = (C * 1,000,000) / (\text{AADT} * L * 365 * N)$$

Where:

RMVM = Actual Crash Rate in crashes per million vehicle miles.

C = Total Number of crashes for this Section.

AADT = Current AADT for this Section.

N = Number of years being analyzed.

L = Section Length.

3. Actual Rate – Intersection

$$\text{AR} = \# \text{Crashes} / (\text{incoming AADT} * 365 * \text{Number of Years}/1,000,000).$$

Where:

AR = Actual Crash Rate in crashes per million vehicles.

$\# \text{Crashes}$ = Total number of crashes.

Incoming AADT = The sum of the AADT for all legs of the Intersection divided by 2.

Number of Years = Number of Years for crashes under Consideration. (Typically will be 5 except where Roadway Improvements have occurred).

Severity Index

When arranging the order of crash locations, for further investigations, many users may wish to consider severity of crashes and resulting economic loss as well as the basic criteria related to crash numbers and crash rates. The Severity Index, as computed for a location, is a number to aggregate these severity and economic loss considerations and is unique to that particular location. This number can be used for comparison with other similar type locations on a system wide or state wide basis.

The National Safety Council (NSC) estimates for the calculable costs of traffic crashes consist of five economic cost components: (a) wage and productivity losses, which includes wages, fringe benefits, household production, and travel delay; (b) medical expenses including emergency service costs; (c) administrative expenses, which include the administrative cost of private and public insurance plus police and legal costs; (d) motor-vehicle damage including the value of damage to property; and (e) employer costs, which include production costs and training of replacement workers.

This report is for the five year period 2003-2007. The year 2005 is the mid year, therefore the average economic costs as determined by NSC for the year 2005 will be used for the Severity Index calculations.

The average economic costs in 2005 as used in this report are:

Fatality	\$1,150,000
Injury	\$ 52,900
Property Damage Only	\$ 7,500

Severity Index Formula

The formula for calculation of a Severity Index is as follows:

$$S_I = \frac{F_c(F) + I_c(I) + P_c(P)}{A_T}$$

S_I = Severity Index is the average cost per crash at a specific location.

F_c = Cost per fatality.

I_c = Cost per injury.

P_c = Cost per property damage only crash.

F = Number of fatalities at the location under study.

I = Number of injuries at the location under study.

P = Number of property damage only crashes at the location under study.

A_T = Total crashes at the location under study.