

VT 105 Corridor Analysis

Introduction

VT 105 traverses northern Vermont with approximately 93 miles of road across 17 towns. As of November 16, 2022, seven fatal crashes and eight fatalities have occurred along VT 105 in 2022. The Vermont Agency of Transportation Operations & Safety Bureau – Data & Analysis Section reviewed crashes, traffic volumes, traffic speeds, and current infrastructure projects to explore possible causes for the rise in fatal crashes and identify areas with elevated crash rates.

Through this analysis we reviewed all crashes and separately reviewed major crashes. A major crash is identified as a crash where at least one person was fatally or seriously injured. Major crashes make up 7% of all crashes on VT 105 for the period analyzed (2017 – November 2022). Most crashes occurring along VT 105 are property damage or non-reportable crashes, which are lower damage crashes that do not meet the reporting threshold for law enforcement to engage in a full investigation.

Additional analysis was performed on the section of VT 105 targeted for a Road Safety Audit Review in early 2023, see Appendix A.

Key Takeaways

- Speeding, unbelted vehicle occupants, and driver impairment are key behavioral issues noted specifically in fatal crashes but prevalent across all crash types.
- The typical driver involved in a crash is male between the ages of 16 and 29.
- The highest volume of traffic occurs in Sheldon. Two speed counts within Sheldon found that most drivers were traveling above the speed limit.
- Vehicle speeds have increased from 2019 to 2021 on VT 105 near Jay Peak (RWIS station P421).
- In 2022, most fatal crashes have occurred on the section of VT 105 passing through St. Albans, Sheldon, and Enosburg.
- Sheldon has the highest total number of major crashes and the highest rate of major crashes per mile.
- Jay has the highest rate of major crashes per vehicle miles traveled.

Crash Data Breakdown

Although total crash numbers have decreased since 2017, the number of fatalities along VT 105 have increased (Table 1). A total of 19 fatal crashes have occurred since 2017, fourteen of which occurred in the last two years (2021-2022). The five-year average has increased from 2.4 fatal crashes/year for 2017-2021 to 3.8 fatal crashes/year for 2018-2022, with 2022 not yet complete.

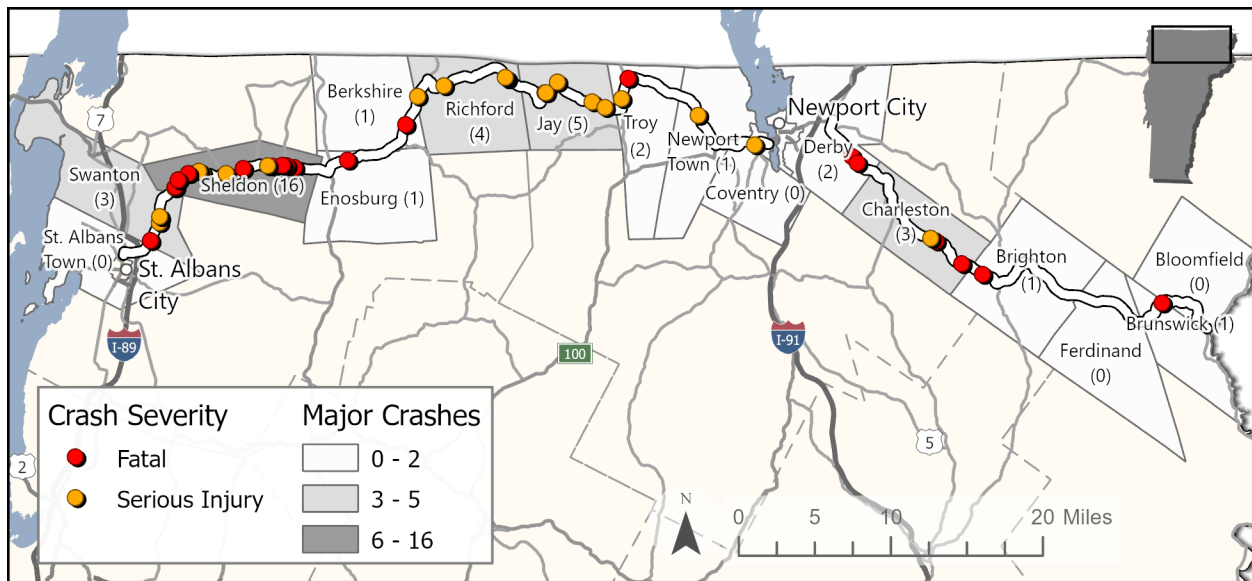
VT 105 Total Crashes by Crash Type 2017 -2022						
Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Non-Reportable Crashes	Total by Year	Major Crashes
2017	0	30	53	23	106	3
2018	1	25	44	4	74	7
2019	1	32	45	53	131	3
2020	3	15	33	42	93	7
2021	7	16	19	49	91	11
2022*	7	22	33	13	75	10
Grand Total	19	140	227	184	570	41

*2022 data incomplete, as reported by law enforcement as of 11/16/22

VT 105 Total Crashes by Crash Type 2017 -2022						
Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Non-Reportable Crashes	Total by Year	Major Crashes
2017	0	30	53	23	106	3
2018	1	25	44	4	74	7
2019	1	32	45	53	131	3
2020	3	15	33	42	93	7
2021	7	16	19	49	91	11
2022*	7	22	33	13	75	10
Grand Total	19	140	227	184	570	41

*2022 data incomplete, as reported by law enforcement as of 11/16/22

Table 1. Total crashes by crash type occurring along VT 105 between 2017 and 2022, November 16.



Map 1. VT-105 fatal and serious injury crashes (major crashes), 2017–2022, November 16.

Speed Related Crashes:

Crashes where a driver was exceeding the speed limit or driving too fast for conditions are considered speed related. There were 92 speed related crashes from 2017 to November 16, 2022, representing 16% of all crashes. Of those speed-related crashes, 54% occurred in the winter months (December, January, February). For all drivers involved, their ages were most likely 16 to 29 years old. This age group was involved in 42% of all speed related crashes.

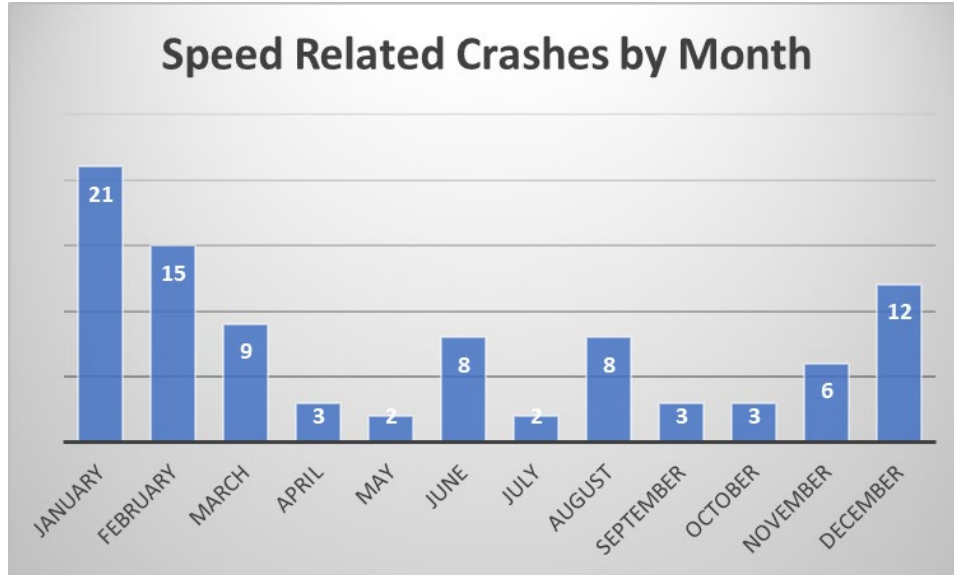


Figure 1. Speed-related crashes by month for 2017 to 2022, November 16. Includes all crash types.

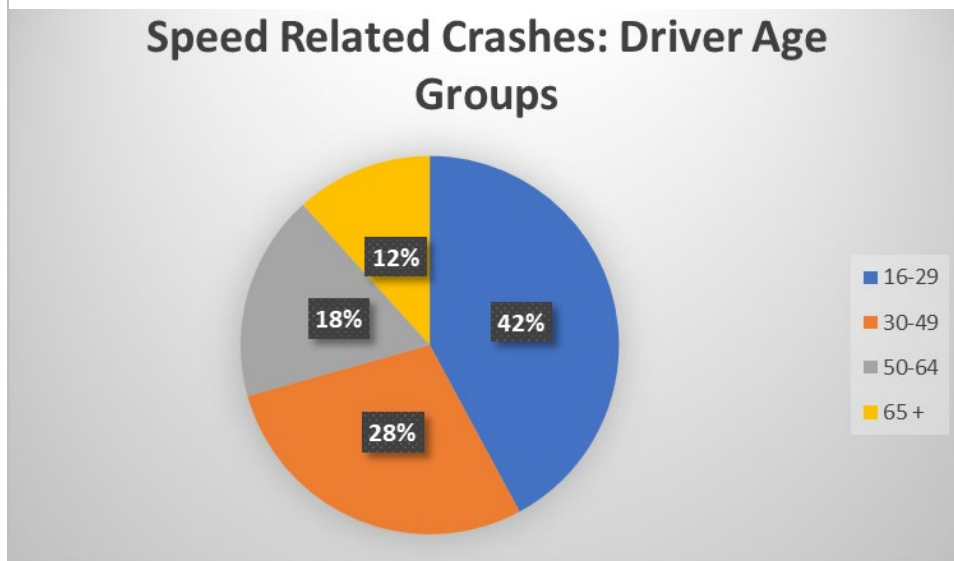


Figure 2. Speed-related crashes by driver age groups for 2017 to 2022, November 16. Includes all crash types.

Vehicle Occupants Unbelted:

There have been 51 crashes where at least one occupant was unbelted (9% of total crashes), with the majority of unbelted occupants being male (67%). Statewide, 4% of all crashes during this time involved an unbelted occupant.

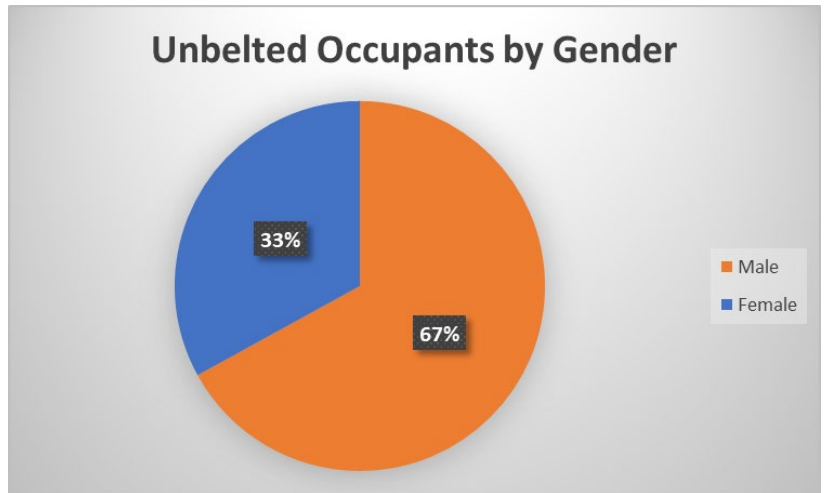


Figure 3. Gender of unbelted occupants involved in crashes for 2017 to 2022, November 16. Includes all crash types.

Cross Centerline Crashes:

Twelve percent (12%) of crashes were cross centerline crashes. Of those, 67% of drivers involved in the cross-centerline crashes were male.

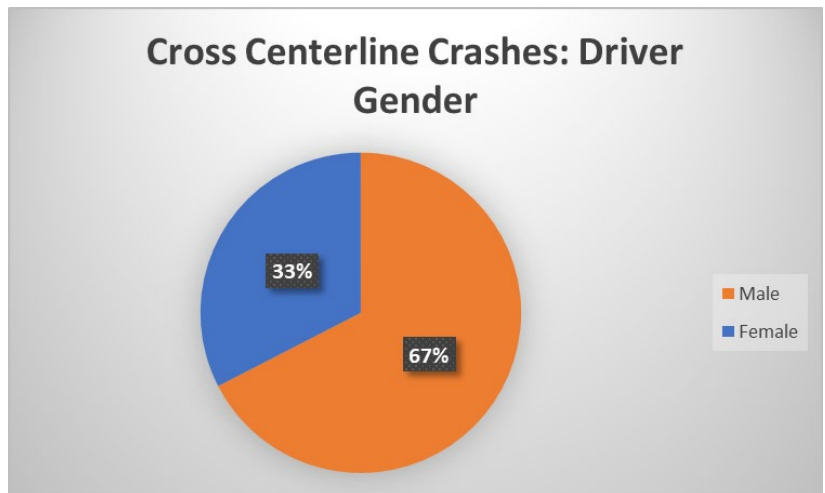


Figure 4. Cross centerline crashes by driver gender for 2017 to 2022, November 16. Includes all crash types.

Impaired Crashes:

During this period, there were 29 crashes where a driver was impaired by alcohol, drugs, or both. Of these drivers, 83% were male and 92% were under 50 years of age.

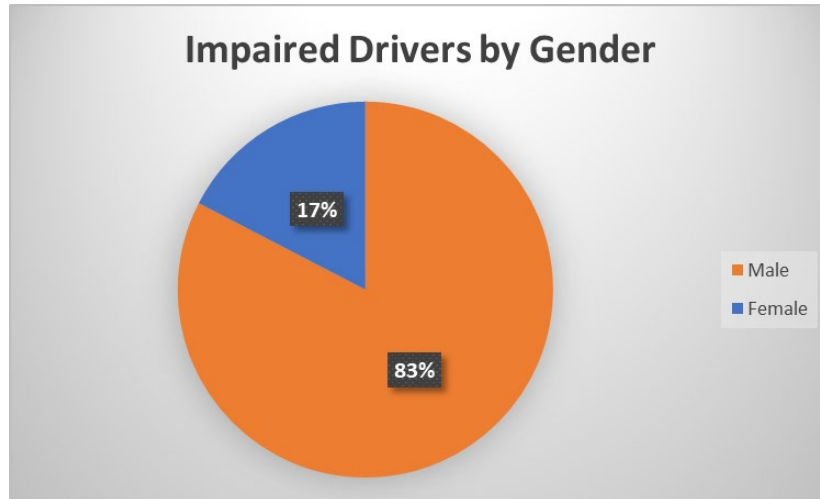


Figure 5. Impaired driver crashes by gender for 2017 to 2022, November 16. Includes all crash types.

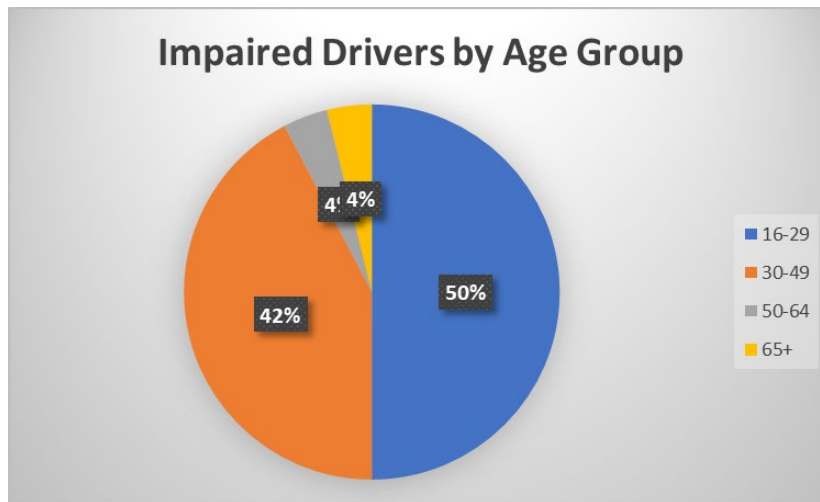


Figure 6. Impaired driver crashes by age group for 2017 to 2022, November 16. Includes all crash types.

Traffic Data

VTrans operates an RWIS site on VT 105 in Jay at the crest of a hill on the west side of Jay. The location of this RWIS site was chosen due to the likelihood of poor driving conditions during winter. Data collected at the RWIS site indicates that average travel speeds have increased since 2019. Most vehicles are traveling between 40 and 50 mph, consistent with the speed limit of 50 mph. The percent of traffic traveling at less than 40 mph has decreased since 2019 while the percent of traffic traveling at speeds greater than 50 mph has increased from 14% of vehicles 2019 to 27% of vehicles in 2021. Figure 7 compares 8-week data sets from 2019 through 2021. Speed data for this site was not available for 2022.

Figure 8 on the next page shows the daily vehicle miles traveled (DVMT) by town as a percent of all vehicle miles of travel on VT 105 and Figure 9 shows the annual average daily traffic (AADT) by town for VT 105. Daily vehicle miles of travel are calculated by multiplying the annual average daily traffic for each road section by the length of the road section.

VT 105 through the town of Sheldon has the highest AADT, indicating the highest volume of traffic occurs along the segment of VT 105 in Sheldon. This segment of VT 105 also has the highest DVMT, carrying 26% of total vehicle miles traveled on VT 105. The segment of VT 105 through Brunswick carries the least traffic, carrying less than 1% of all vehicle miles traveled on VT 105. The town of Sheldon has the longest section of VT-105, with 11 miles of road. The shortest section is within Coventry, with just over 1 mile of VT 105.

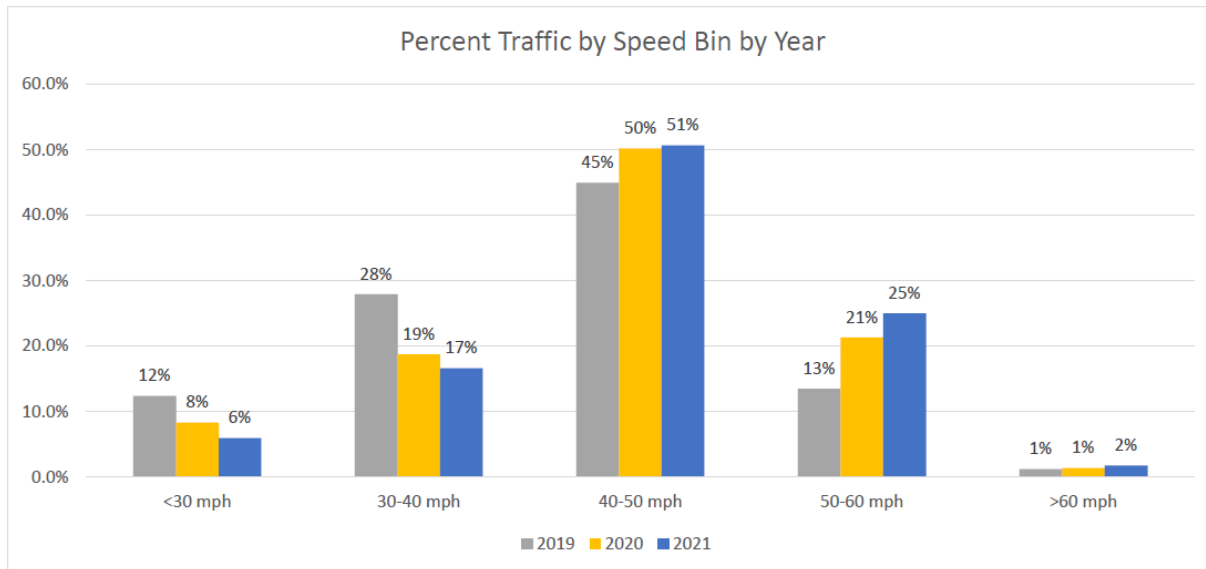


Figure 7. Percent of traffic traveling at each speed bin at RWIS site located in Jay for 2019 to 2021.

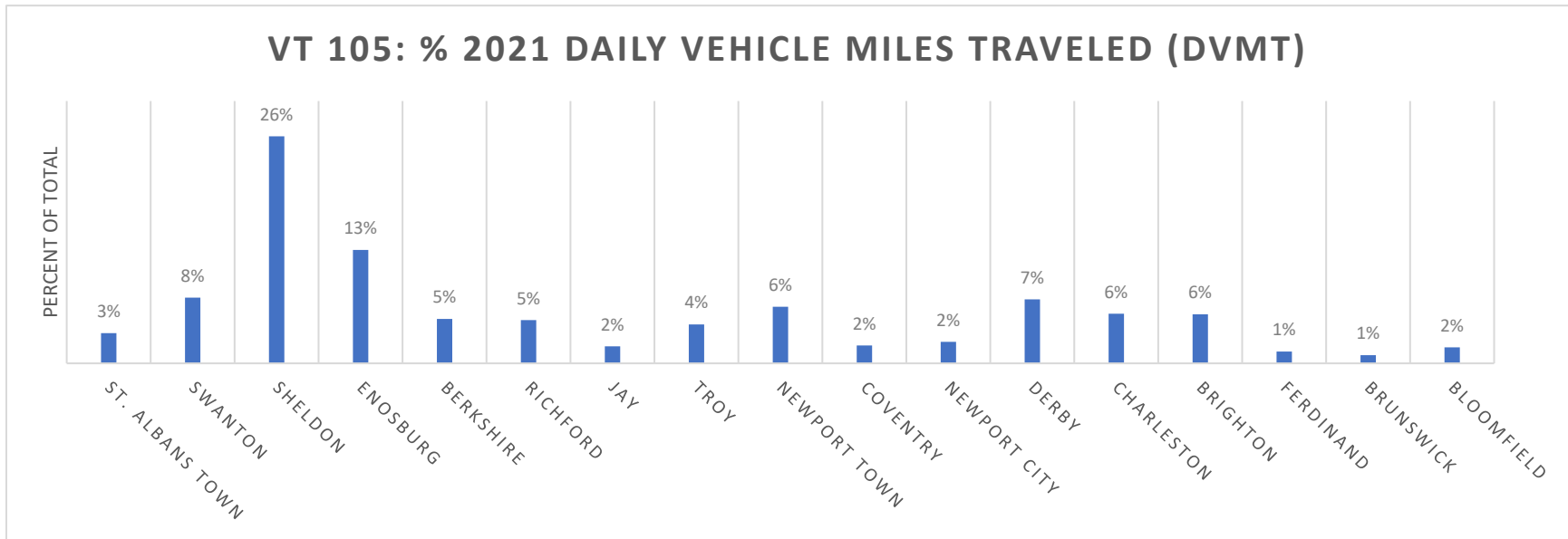


Figure 8. Percent of total daily vehicle miles traveled on VT 106 occurring in each town along route for 2021.

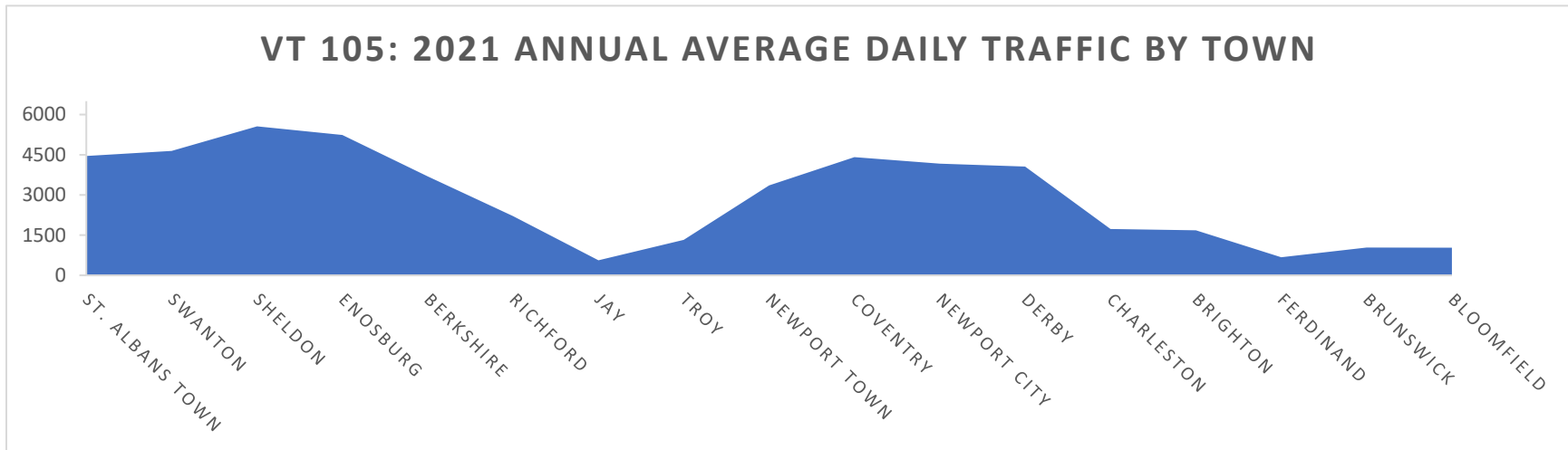


Figure 9. Annual average daily traffic along VT 105 in each town for 2021. Reported as average number of vehicles per day.

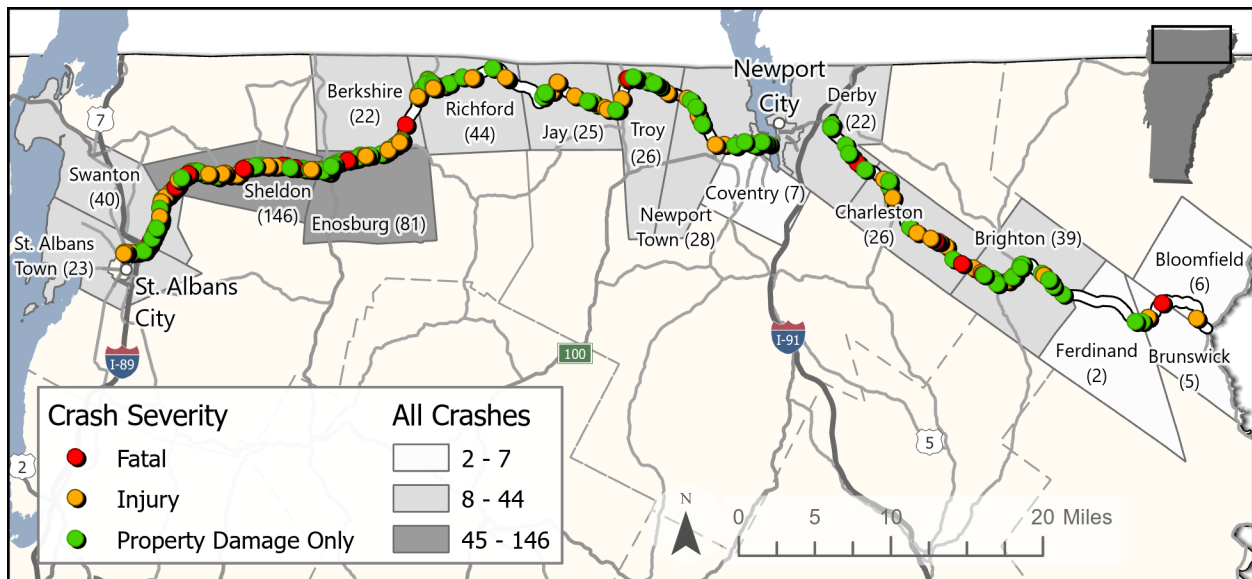
Crash Rates

Crash rates, as well as total number of crashes, vary by town across VT 105. Generally, towns with the highest annual average daily traffic (AADT) also rank higher in total number of crashes. These towns include Sheldon, Enosburgh, and Swanton.

However, other towns, sometimes with fewer crashes overall, rank higher when total crashes are weighted by vehicle miles traveled (VMT) or by roadway miles. Two of these are Jay and Richford.

Sheldon has both the highest number of crashes and the highest number of major crashes (crashes involving fatalities or serious injuries), while also ranking in the top three towns when weighting total crashes by roadway miles and ranking just below average when weighting by VMT.

Map 2 shows all crashes on VT 105 from 2017 through November 16, 2022. Crashes are symbolized by severity and are summarized by town. Sheldon has the greatest number of crashes, followed by Enosburgh and Richford, while Ferdinand, Brunswick, and Bloomfield have the fewest.



Map 2. VT-105 crashes by crash type with town totals, 2017–2022, November 16.

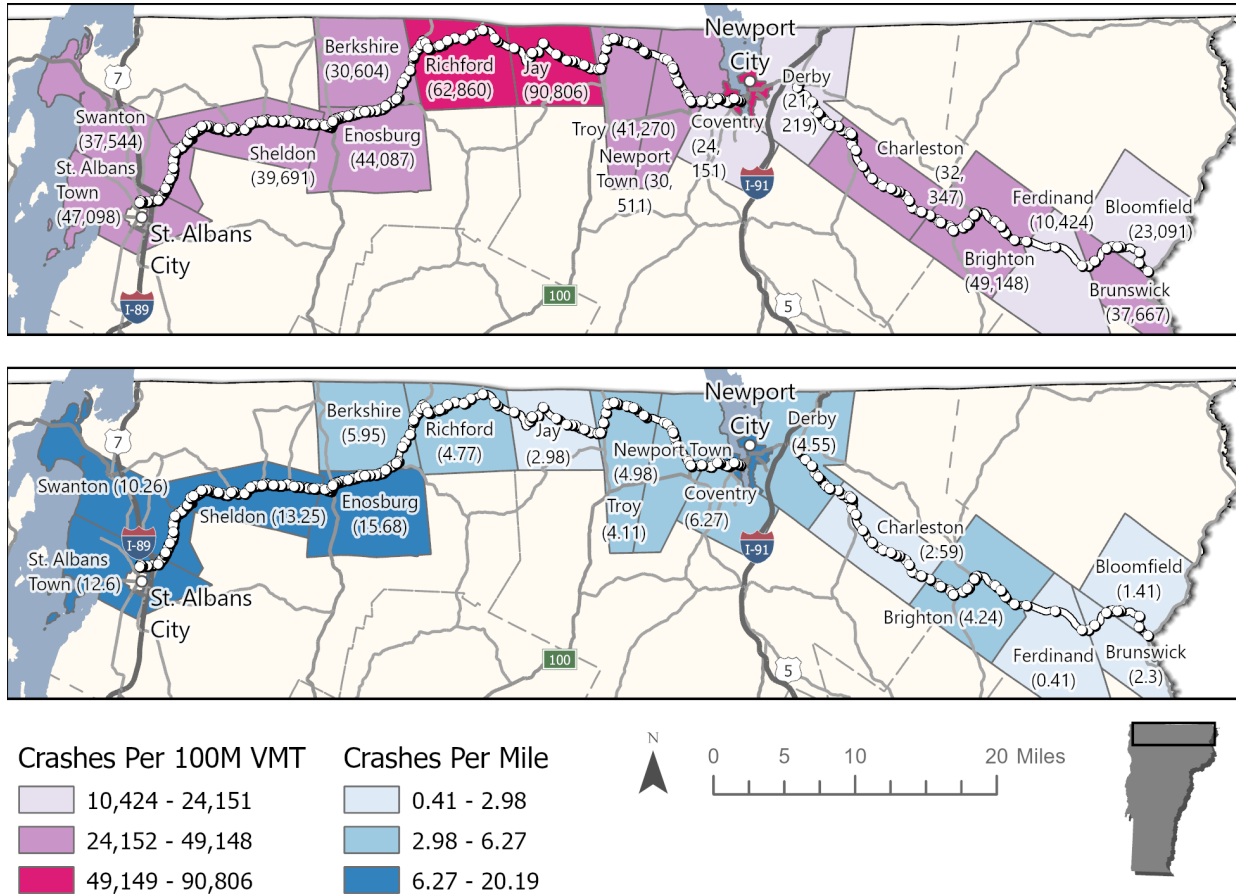
Map 3 shows crashes per 100 million vehicle miles traveled (VMT) by town (purple gradient), and crashes per mile by town (blue gradient). These rates are also shown in Figures 1 and 2 (see Appendix for methodology).

In descending order, the towns with the greatest number of crashes per 100 million VMT are Jay, Newport City, and Richford, while the towns with the fewest are Bloomfield, Derby, and Ferdinand.

Newport City, Enosburgh, and Sheldon have the greatest number of crashes per mile, while Brunswick, Bloomfield, and Ferdinand have the fewest.

Despite ranking highest in total number of crashes, Sheldon does not rank in the top five towns by crashes per 100 million VMT, coming in just below average. However, Sheldon ranks in the top three towns by crashes per roadway mile.

On the other end of the spectrum, Newport City has the greatest number of crashes per mile and ranks second in crashes per 100 million VMT. However, Newport City ranks in the bottom half of towns based on total crashes.



Map 3. VT-105 crashes per mile and crashes per 100 million vehicle miles traveled, 2017–2022, November 16.

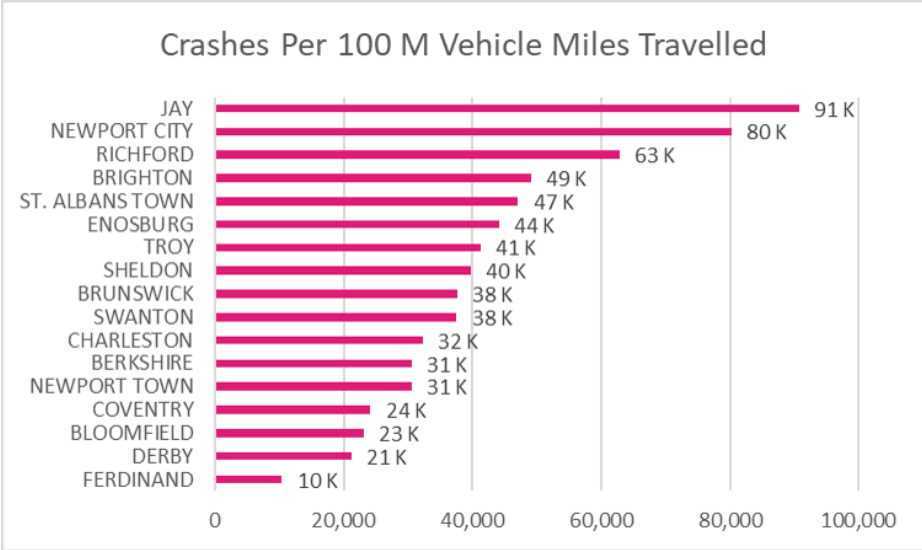


Figure 10. VT-105 crashes per 100 million vehicle miles traveled by town, 2017–2022, November 16. Reported as thousands of crashes (K) per 100 million vehicle miles traveled.

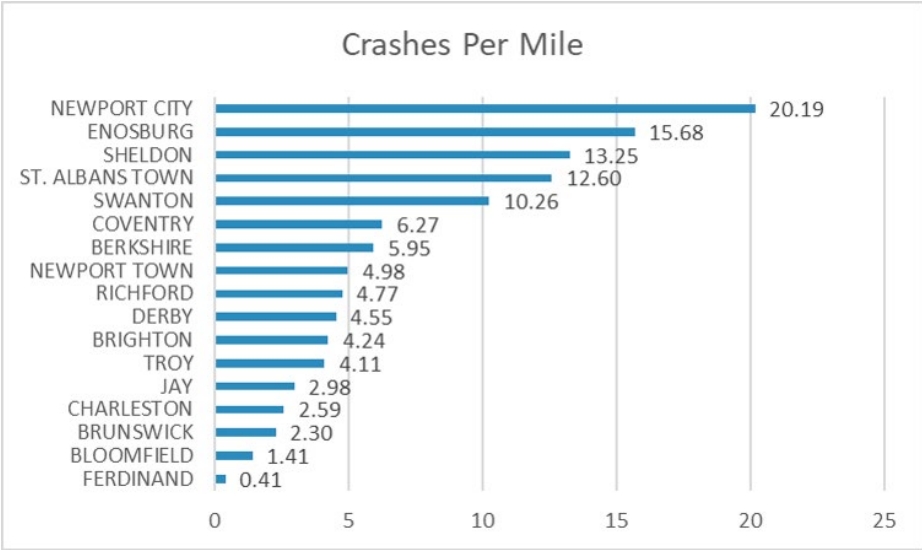
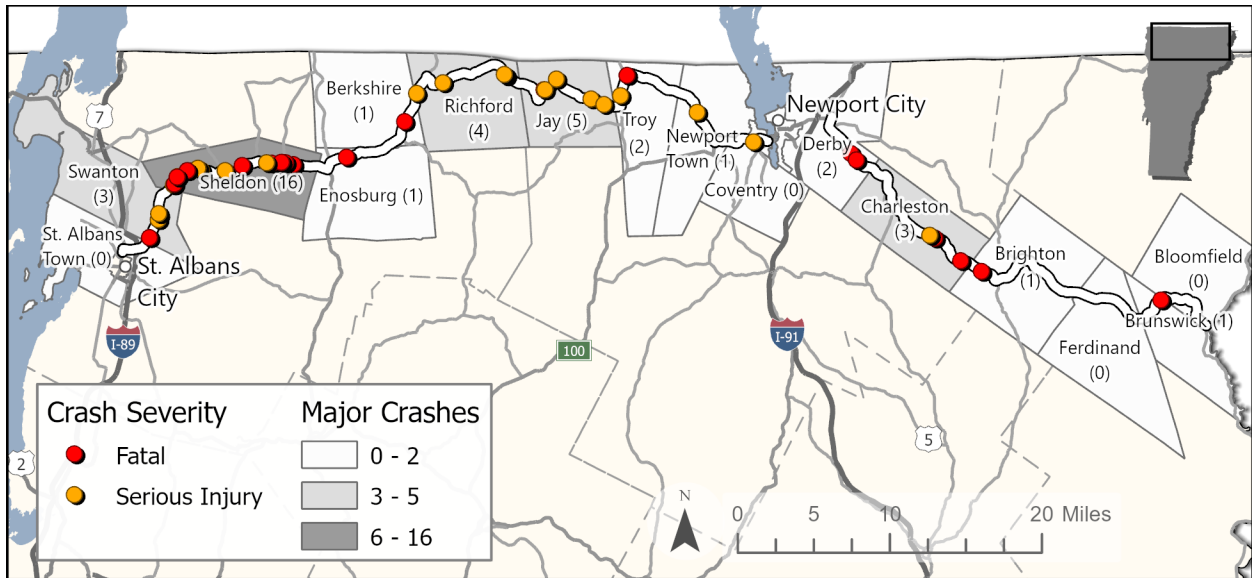


Figure 11. VT-105 crashes per mile by town, 2017–2022, November 16.

Map 4 shows major crashes (crashes involving fatalities or serious injuries) on VT 105 during the period analyzed. Sheldon ranks highest in major crashes with 16 crashes, followed by Jay and Richford.

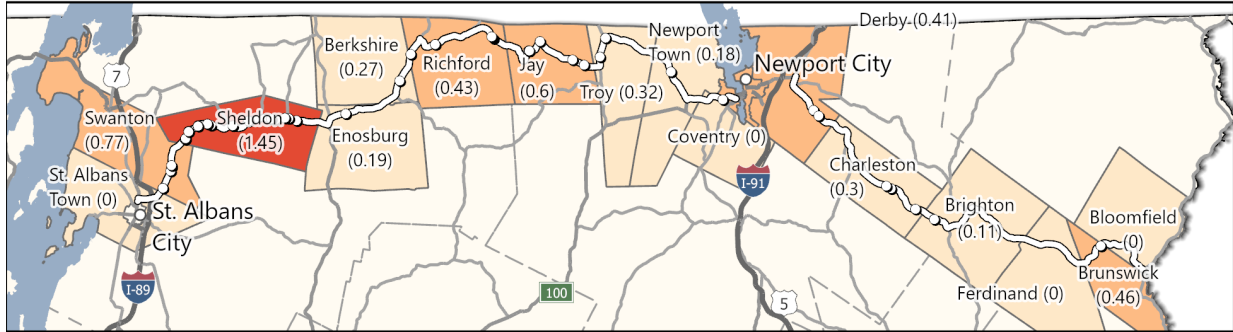
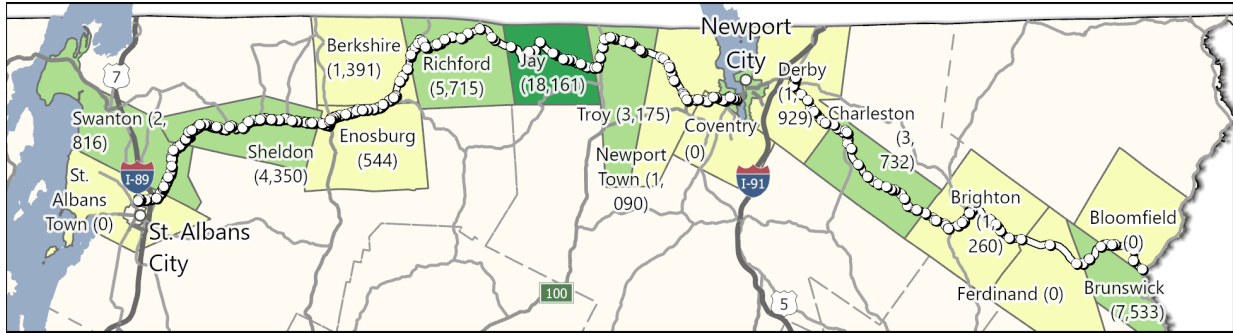


Map 4. VT-105 fatal and serious injury crashes (major crashes) by crash type with town totals, 2017–2022, November 16.

Map 5 shows major crashes per 100 million VMT by town (green gradient), and major crashes per mile by town (orange gradient). Figure 12 and Figure 13 show these same rates.

The top three towns based on major crashes per 100 million VMT are Jay, Brunswick, and Richford. Sheldon, Swanton, and Newport City rank highest in major crashes per mile.

Sheldon stands out as having the highest number of both total crashes and major crashes, as well as ranking first in major crashes per mile, and fourth in major crashes per 100 million VMT.



Map 5. VT-105 major crashes (fatal and serious injury crashes) per mile (top) and per 100 million vehicle miles traveled (bottom) by town, 2017–2022, November 16.

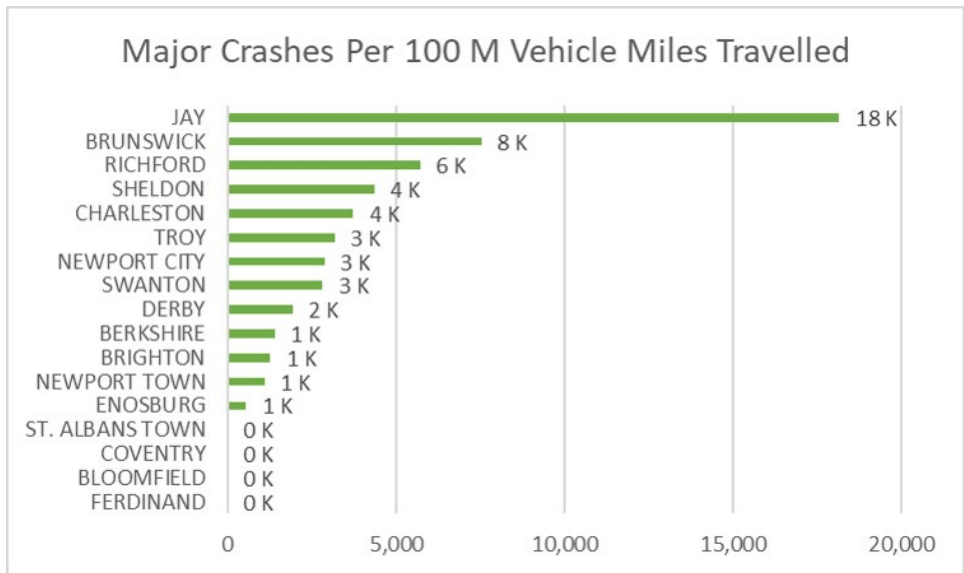


Figure 12. VT-105 major crashes (fatal and serious injury crashes) per 100 million vehicle miles traveled by town, 2017–2022, November 16. Reported as thousands of crashes (K) per 100 million vehicle miles traveled.

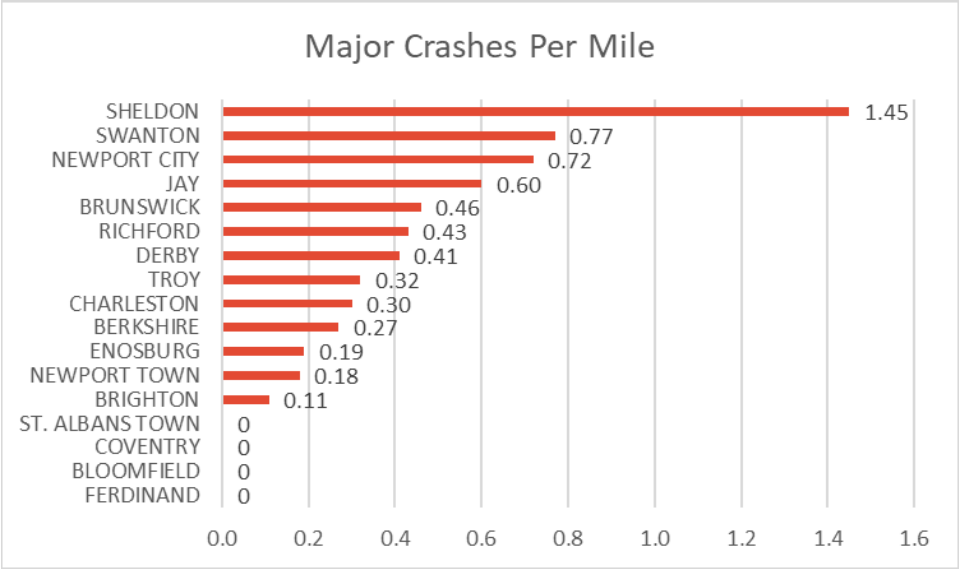


Figure 13. VT-105 major crashes (fatal and serious injury crashes) per mile by town, 2017–2022, November 16.

Conclusion

From 2017 to 2022, a total of 570 crashes occurred along VT 105, 7% of those were major crashes. Occupants involved in crashes along VT 105 (9% of total crashes) are more likely to be unbelted than the state average (4%). The 7 fatal crashes in 2022 so far have showed behavioral patterns: speeding and impaired drivers cause the most fatal crashes. These drivers are most likely to be male and between the ages of 16 and 29 years old. Speeding was noted at a site in Jay, where there was an increase in the percent of vehicles traveling above the 50-mph speed limit in 2021 over 2019. Sheldon stands out as having both the highest number of crashes and the highest number of major crashes (crashes involving fatalities or serious injuries), while also ranking in the top three towns when weighting total crashes by roadway miles and ranking just below average when weighting by VMT.

Appendix A. Road Safety Audit Focus Area

Introduction

A Road Safety Audit Review (RSAR) will be performed in January 2023 for a section of VT 105 – from St. Albans town mile point 1.33 to Enosburg town mile point 0.46, which consists of 15.88 total miles. Additional analysis was performed on crash and traffic data specific to this section of road.

Of the seven fatal crashes that have occurred on VT 105 in 2022, five of those crashes occurred within the RSAR section, specifically within the town of Sheldon.

VT 105 Total Crashes by Crash Type 2017 -2022 Segment						
Year	Fatal Crashes	Injury Crashes	Property Damage Only Crashes	Non-Reportable Crashes	Total by Year	Major Crashes
2017	0	12	21	10	43	2
2018	0	4	17	0	21	0
2019	0	15	20	22	57	2
2020	0	6	11	13	30	3
2021	4	10	6	15	35	5
2022*	5	12	9	0	26	6
Grand Total	9	59	84	60	212	18

**2022 data incomplete, as reported by law enforcement as of 11/16/22*

Table 2. Total crashes by crash type occurring along VT 105 between 2017 and 2022, November 16 for the segment beginning in St. Albans at mile point 1.33 and ending at Enosburg mile point 0.46.

Crash Data Breakdown

Vehicle Occupants Unbelted:

The RSAR segments showed the same trend in unbelted vehicle occupants as the entirety of VT 105. At least one occupant was unbelted in 9% of total crashes on the RSAR segment, with 32% of those unbelted occupants being female and 68% being male.

Impaired Driver Crashes

Of the 68 fatal and injury crashes in the RSAR, 9 involved impaired drivers (13%). Of these, 72% were male.

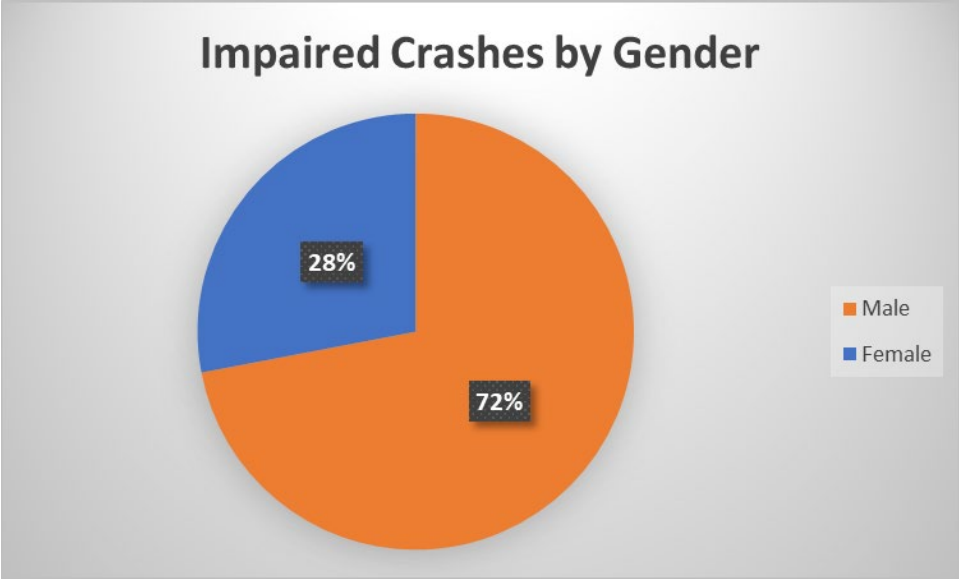


Figure 14. VT-105 RSAR Segment Impaired Crashes by Gender, 2017–2022, November 16.

Distracted Driver Crashes:

Of the 15 crashes where distracted driving was a factor, 59% of the drivers were under 25 years old.

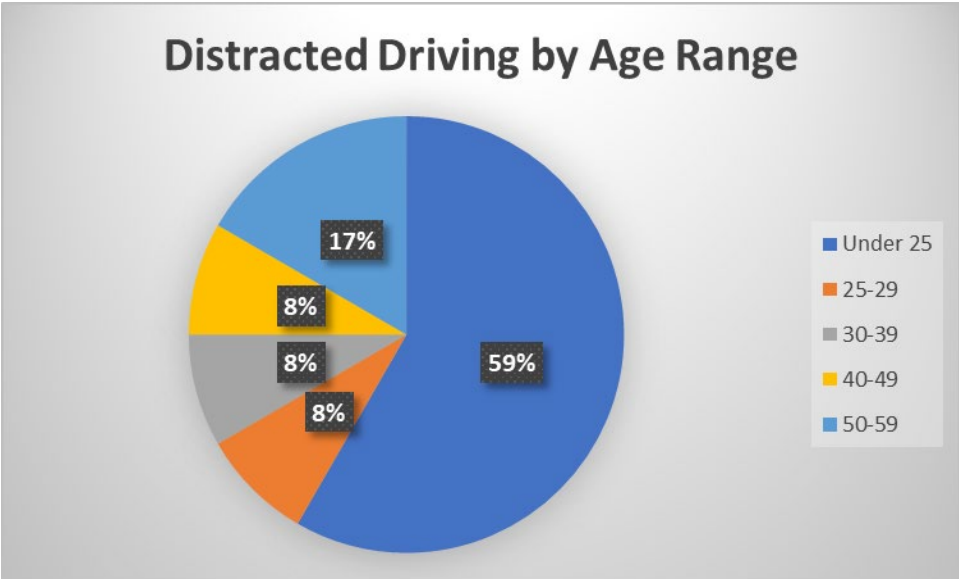
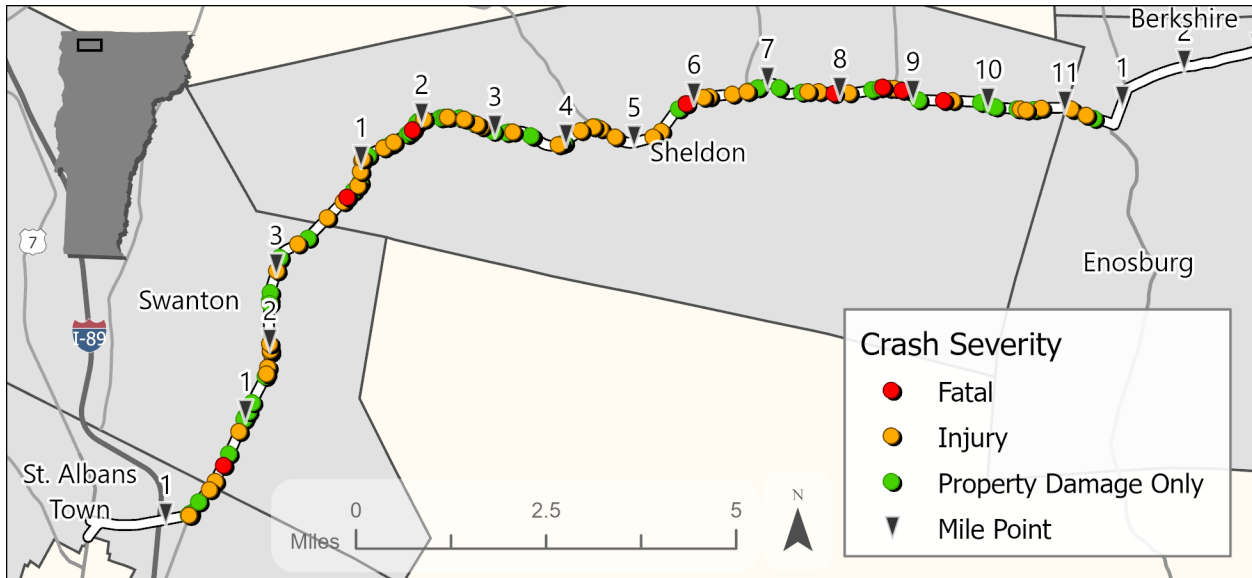


Figure 15. VT-105 RSAR Segment Distracted Driver Crashes by Age Range, 2017–2022, November 16.

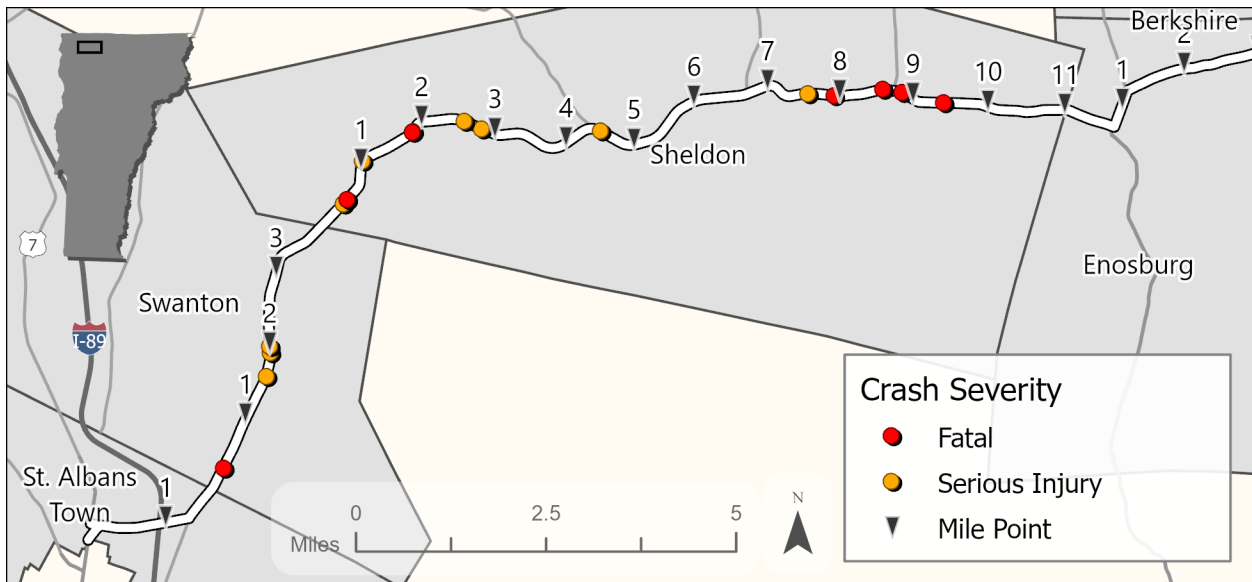
Crash Rates

Map 6 shows all crashes, symbolized by crash severity, within this segment of VT 105. Mile points are labelled along the route.



Map 6. VT-105 crashes by crash type between St. Albans Town (1.33) and Enosburgh (0.46), 2017–2022, November 16.

Map 7 shows major crashes occurring within the same segment of VT 105. The majority of fatal and serious injury crashes occurred in Sheldon.

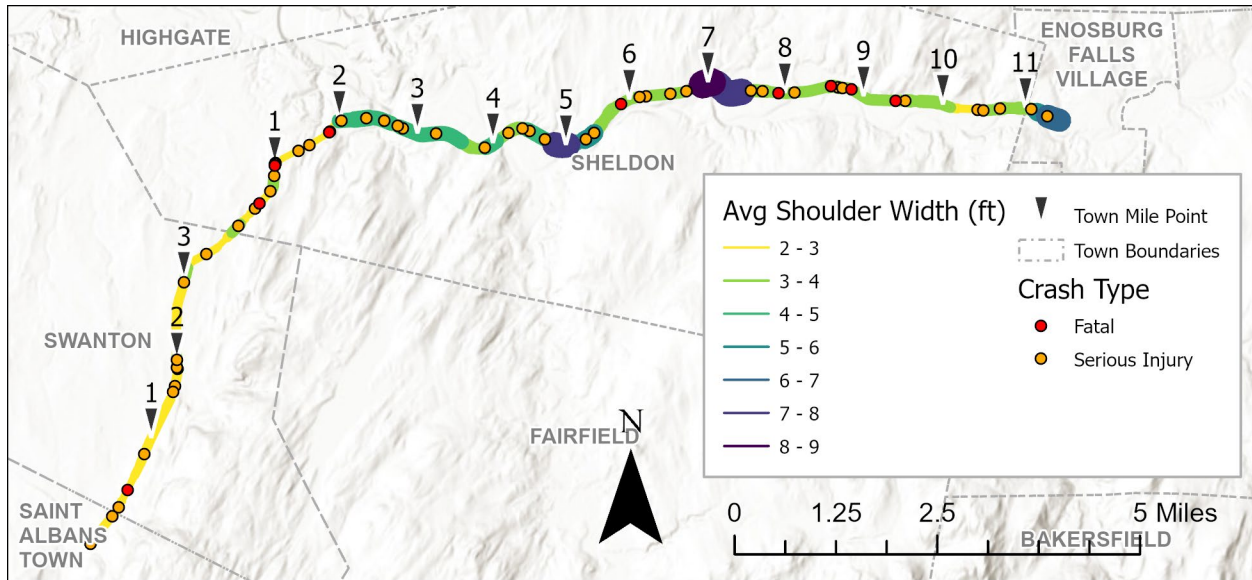


Map 7. VT-105 major crashes (fatal and serious injury crashes) by crash type between St. Albans Town (1.33) and Enosburgh (0.46), 2017–2022, November 16.

Road Structure Review

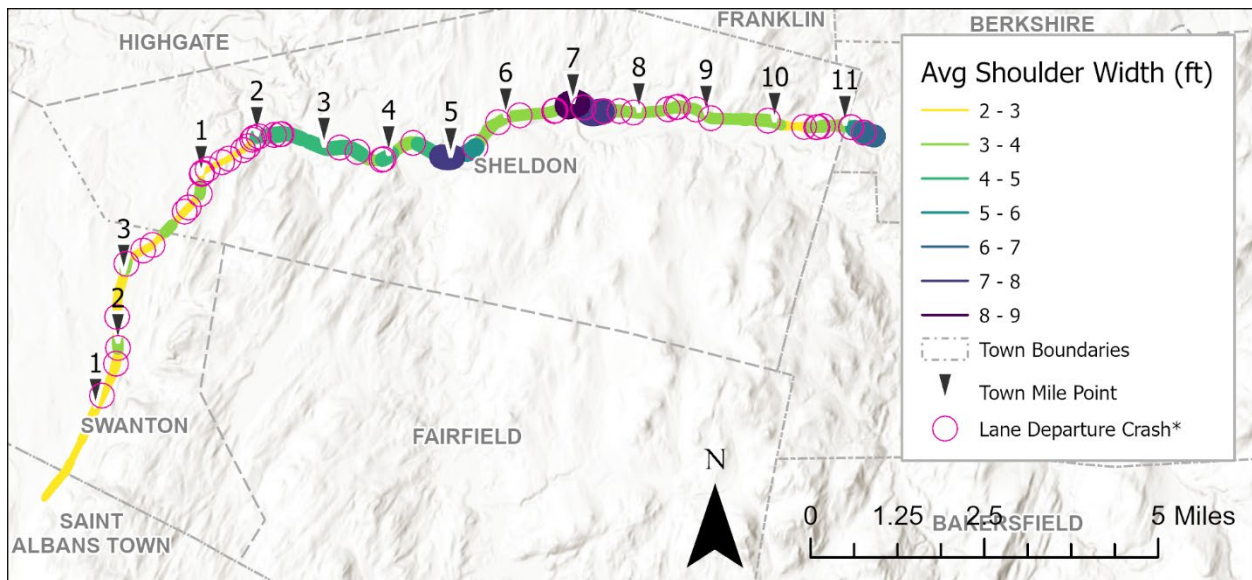
Shoulder widths vary across the Road Safety Audit Review (RSAR) segment of VT 105. The map below shows major crashes (crashes resulting in fatalities or serious injuries) and average shoulder width, symbolized using a yellow to purple color ramp (narrow to wide) and scaled according to shoulder width.

Map 8 shows that average shoulder width is narrowest (approximately 2 – 3 ft wide) at the start of the study area in St. Albans Town through Swanton and becomes wider (> 4 ft wide) from town mile point 2.00 in Sheldon and throughout the remainder of the study area.



Map 8. Fatal and serious injury crashes and average shoulder width (ft).

Map 9 shows lane departure crashes (defined as same direction and opposite direction sideswipe crashes, head-on crashes, and crashes involving vehicles departing the roadway) in purple overlaid on average road width within the RSAR area.



Map 9. Lane departure crashes (*same and opposite direction sideswipe crashes, head-on crashes, and departed roadway crashes) and average shoulder width (ft) in RSAR area.

Within the RSAR study area there is a weak negative correlation between average shoulder width (average of left and right shoulder widths in feet) and the total number of lane departure crashes. Lane

departure crashes, as defined in this report, are commonly used in Federal Highway Administration (FHWA) research in this area because they are assumed to be more affected by shoulder width than other crash types (see Appendix C for list of publications). By focusing on lane departure crashes, the goal is to eliminate instances where variables other than shoulder width are among the main causal factors in the crash.

Sources: <https://onlinepubs.trb.org/Onlinepubs/state-of-the-art/6/6-001.pdf> and <https://www.fhwa.dot.gov/publications/research/safety/15030/006.cfm>

The majority of lane departure crashes (15) occur where the average shoulder width is 3.5 feet, followed by 2 feet (12 crashes), and 4 feet (8 crashes). Average shoulder width and total number of lane departure crashes are weakly negatively correlated using an exponential model (R^2 value = 0.3989).

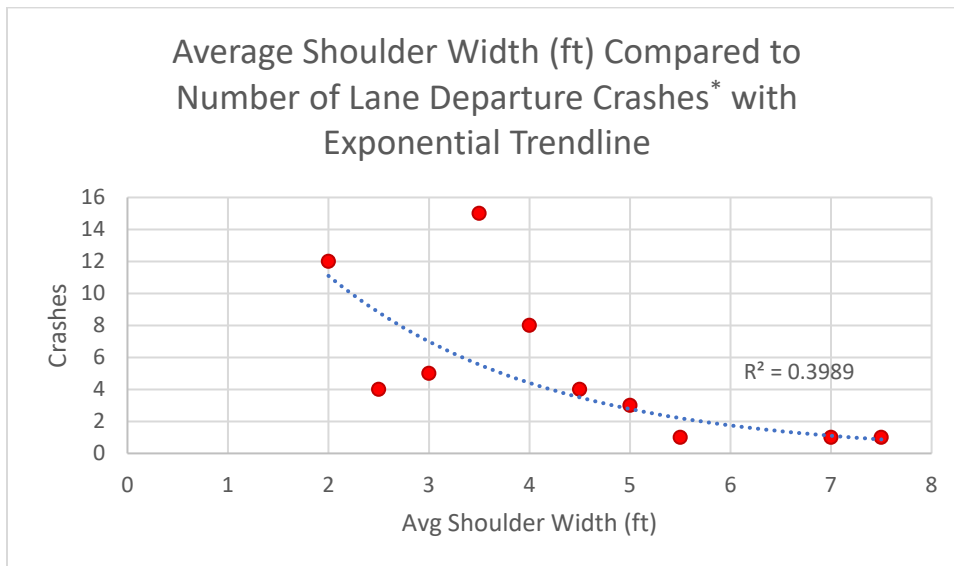
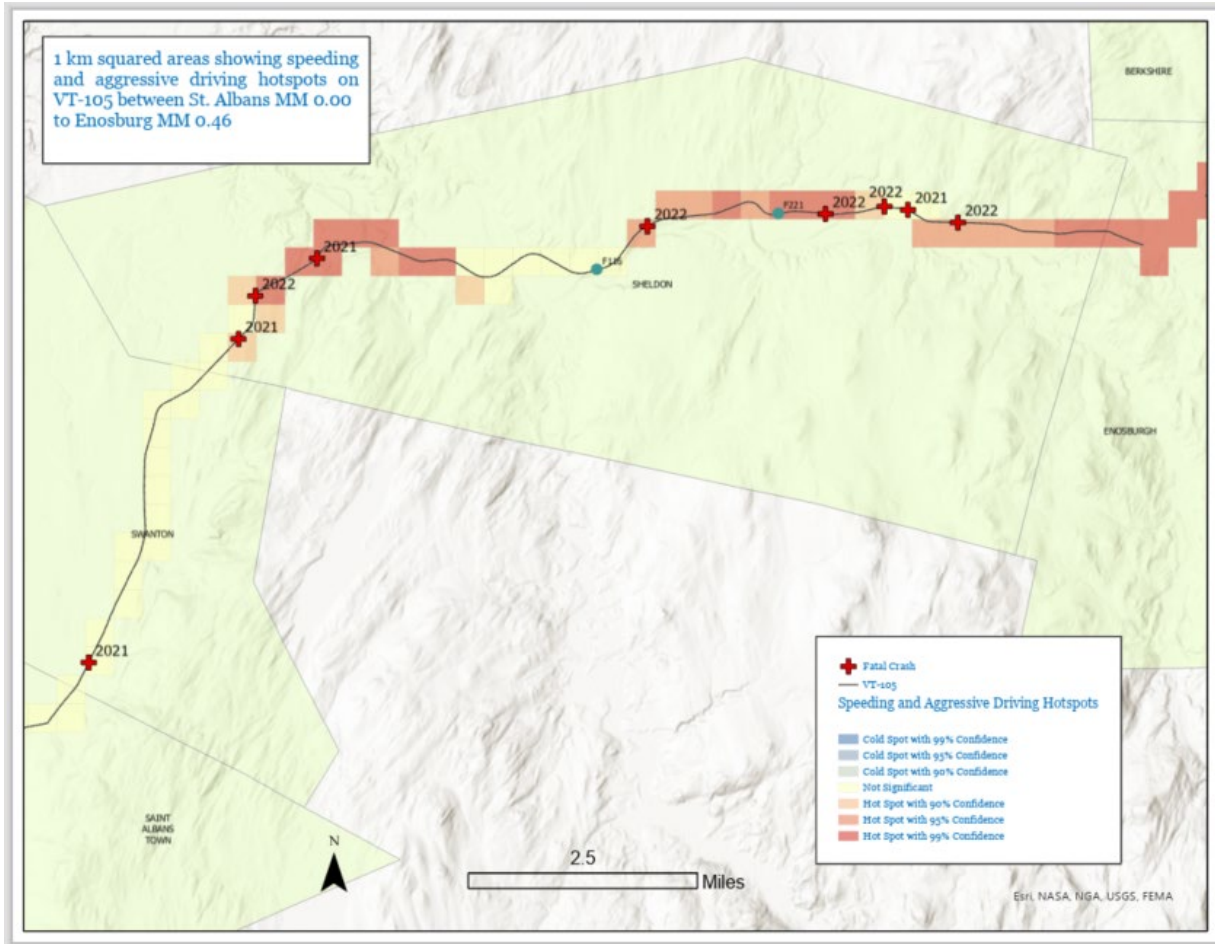


Figure 16. Lane departure crashes (*same and opposite direction sideswipe crashes, head-on crashes, and departed roadway crashes), compared to average shoulder width with exponential trendline and R^2 value.

Speeding and Aggressive Driving

Map 9 shows speeding and aggressive driving hot spots within the RSAR section. Hot spots were determined from all crash types where speeding and/or aggressive driving was considered a contributing circumstance. Also mapped are the fatal crashes that occurred in 2021 and 2022.

Speed counts performed in 2021 at two locations in Sheldon along VT 105 (stations F116 and F221, Map 9) indicate that most vehicles are traveling at least five miles per hour over the speed limit (50 mph). Two percent of vehicles traveled at speeds at least 15 mph greater than the 50-mph speed limit. Cumulative frequency plots show that a majority of vehicles are traveling above the speed limit at the two count locations (Figure 16).



Map 1010. Speeding and aggressive driving hotspots, determined from all crash types, with locations of 2021 and 2022 fatal crashes. In blue are locations of two 2021 speed counts.

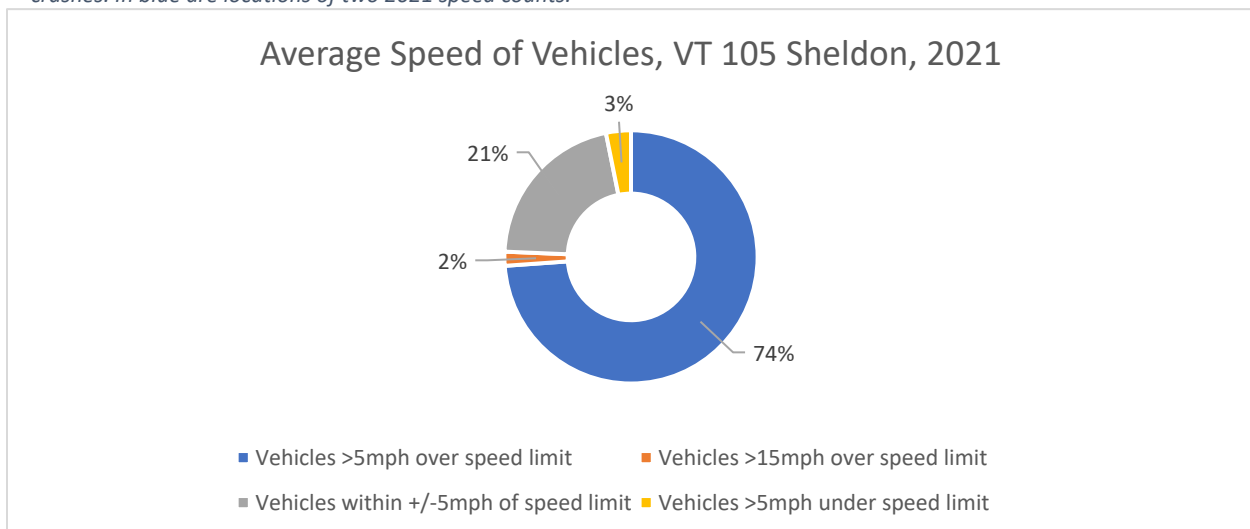


Figure 17. Average speed of vehicles on VT 105, taken at two locations in Sheldon in 2021. Speed limit at both locations is 50 mph.

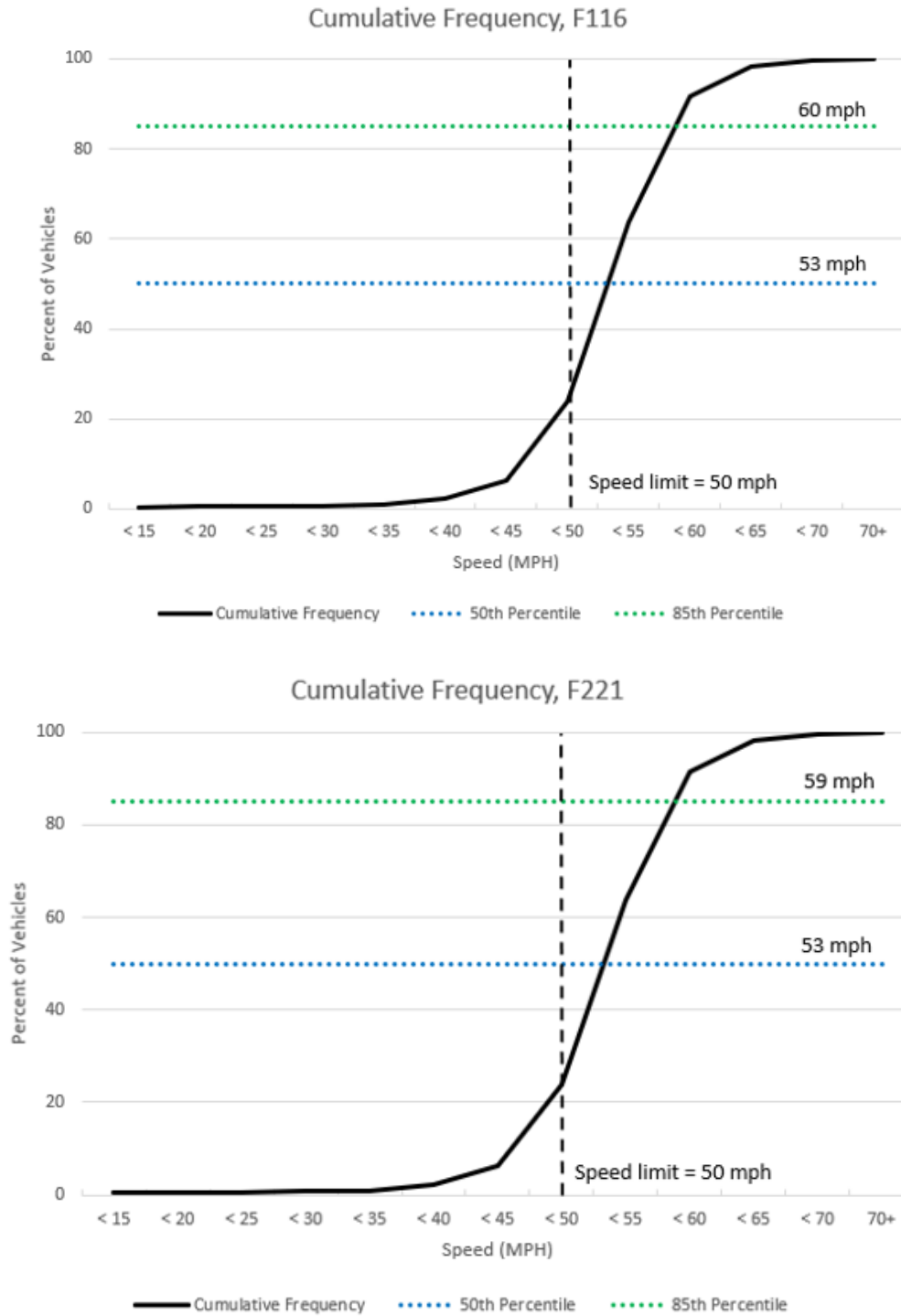


Figure 18. Cumulative frequency plots for station F116 (top) and F221 (bottom). Speed counts were performed in June 2021 for seven days (F116) and 72 hours (F221).

Driver Origin and Time of Day

The majority of drivers involved in injury and fatal crashes along this section had primary addresses listed as Enosburg Falls, followed by Richford (Table 3). These crashes were most likely to occur during the day, with the hours of 8am, 12pm, and 4pm seeing the most crashes.

ENOSBURG FALLS	VT	11
RICHFORD	VT	7
ENOSBURG	VT	5
SWANTON	VT	5
SHELDON	VT	5
FAIRFIELD	VT	3
FRANKLIN	VT	3
ST ALBANS	VT	3
FAIRFAX	VT	2
SAINT ALBANS	VT	2
MILTON	VT	2
HIGHGATE	VT	2
ISLE LA MOTTE	VT	2
SHELDON SPRINGS	VT	2
ST. ALBANS TOWN	VT	1
NEWPORT CTR	VT	1
ENOSBURGH	VT	1
WESTFIELD	VT	1
NEWPORT	VT	1
HIGHGATE SPRINGS	VT	1
HARDWICK	VT	1
DOUGHLASSVILLE	PA	1
SOMERS	CT	1
E BERKSHIRE	VT	1
SOUTH PORTLAND	ME	1
S. RICHMOND	NY	1
SIERRA VISTA	AZ	1
WALDEN	VT	1

Table 3. Driver address of at-fault driver as reported in crash report, 2017 to 2022, November 16.

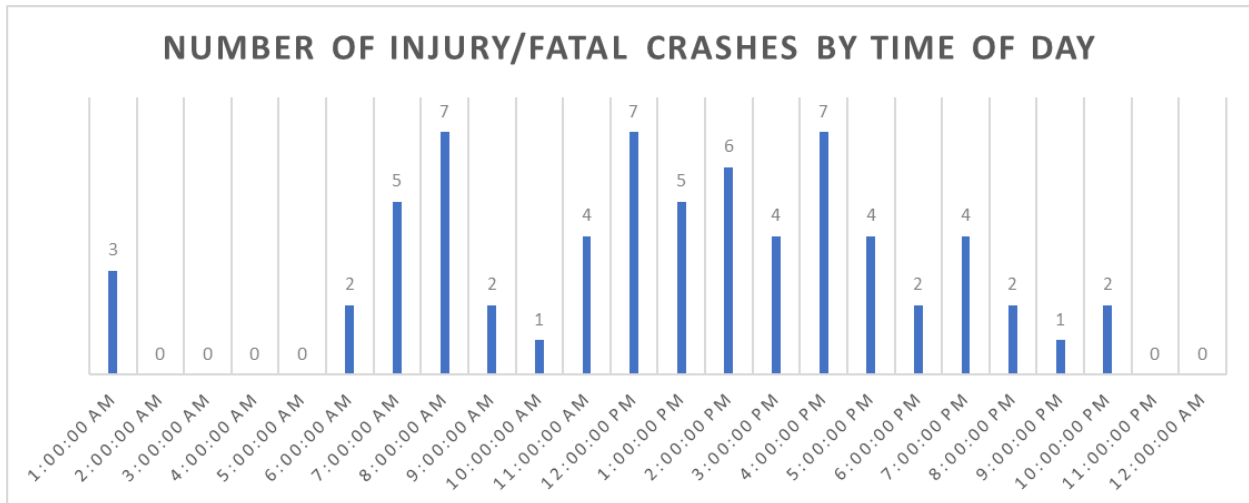


Figure 19. Injury and fatal crashes by time of day, 2017 to 2022, November 16.

Conclusion

The Data & Analysis team also analyzed a 15.88-mile section of VT-105 starting at milepoint 1.33 in St. Albans Town, continuing through Swanton and Sheldon and then ending in Enosburg at milepoint 0.46. This specific corridor has seen a higher frequency of fatal crashes (5 of the 7 in 2022) in recent years and nearly half (44%) of all major crashes on VT 105 occurred on this shorter focus segment. Approximately 25% of all crashes occurred in this corridor, but 47% of all fatal crashes over the analysis period occurred in this corridor. The Data & Analysis team further looked at types of crashes and where they occurred along this segment. Approximately 90% of the fatal and injury crashes were multiple vehicle crashes and 25% were on curves. The team also found that 25% of drivers involved in crashes were from Enosburg and that the highest incidence of crashes were during commute times and the lunchtime hours. About 13% of the fatal and injury crashes involved an impaired driver and a majority of the drivers were male.

Appendix B. Crash Rate Methodology

$$R = \frac{C \times 100,000,000}{V \times 365 \times N \times L}$$

C = Crashes
V = AADT
N = Years
L = Segment Length

Crash data used are from January 1, 2017 through November 16, 2022, and the 2021 AADT is used.

Variable N, years, is set to 5.88 due to partial crash data for 2022. This is calculated based on the total number of complete years of crashes data, plus the percent of 2022 for which crash data is available based on the number of days of available crash data ($320 / 365 = 0.88$).

Crashes per 100 million VMT are rounded to the nearest whole number, while crashes per roadway mile are rounded to the nearest hundredth.

Appendix C. Relevant FHWA Shoulder-Width Publications

“Safety Evaluation of Lane and Shoulder Width Combinations on Rural, Two-Lane, Undivided Roads - FHWA-HRT-09-032.” Federal Highway Administration, <https://www.fhwa.dot.gov/publications/research/safety/09032/>. Accessed 6 Jan. 2023.

“Prediction of the Expected Safety Performance of Rural Two-Lane Highways FHWA-RD-99-207.” Federal Highway Administration, <https://www.fhwa.dot.gov/publications/research/safety/99207/99207.pdf>. Accessed 6 Jan. 2023. “Mitigation Strategies For Design Exceptions - Safety | Federal Highway Administration.” Safety | FHWA, https://safety.fhwa.dot.gov/geometric/pubs/mitigationstrategies/chapter3/3_shoulderwidth.cfm. Accessed 6 Jan. 2023.