Road Safety Audit Jaffrey, NH

Intersection of US 202 (Peterborough Street) with Nutting Road and Old Sharon Road

August 2022

Prepared for:
NHDOT, Concord, New Hampshire

HOYLE TANNER

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1 INTRODUCTION

1.1 Objective of Study

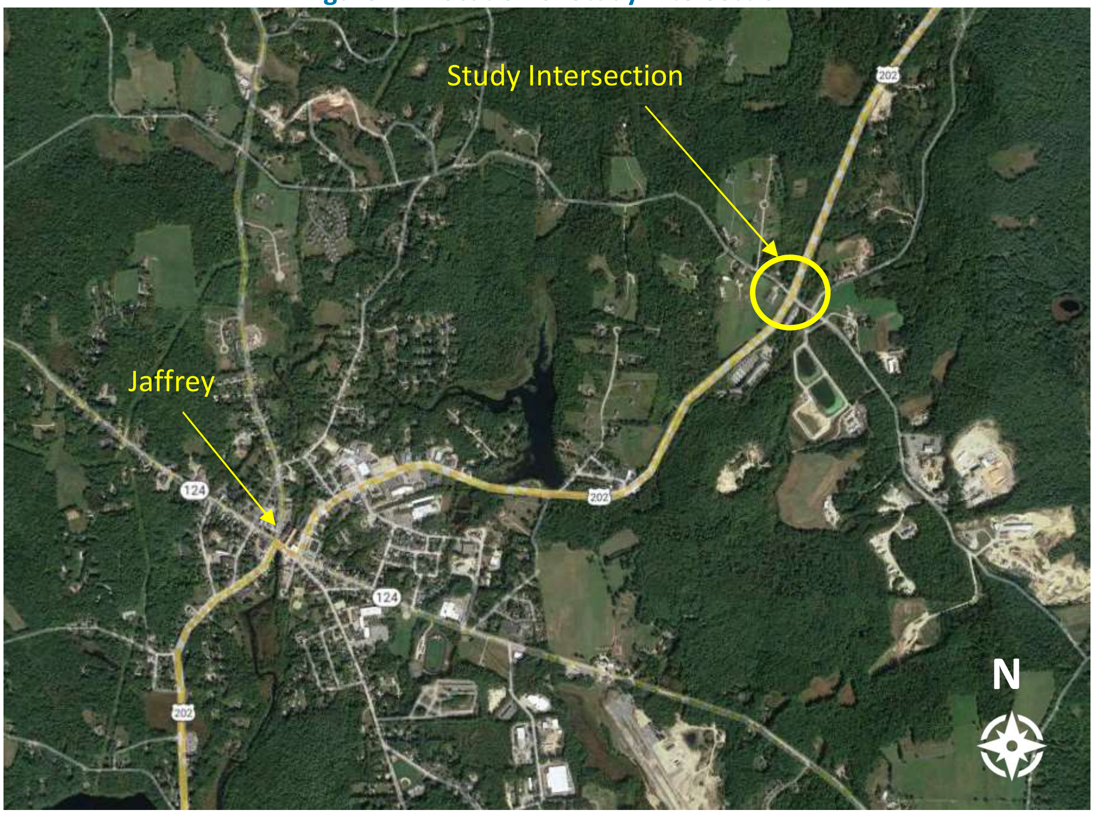
The objective of this study was to perform a Road Safety Audit (RSA) for the New Hampshire Department of Transportation (NHDOT) at the intersection of US 202 (Peterborough Street), Old Sharon Road, and Nutting Road in the Town of Jaffrey New Hampshire. An RSA is a formal safety review of a road or intersection performed by a multi-disciplinary team who identify safety issues and provide potential measures to improve safety for all road users. The study area for this RSA is shown in Figure 1.

Figure 1 - Study Intersection

1.2 RSA Location and Background

The study intersection is located about two miles north of the center of Jaffrey (see Figure 2). The mainline road is US 202 (Peterborough Street), which runs north-south connecting Peterborough to Jaffrey. US 202 is classified as a two-lane minor arterial with NHDOT responsible for roadway maintenance. In Peterborough, US 202 crosses NH 101 and is called Grove Street. US 202 continues south, changing in name to Peterborough Street as it enters Jaffrey, and extends to and through downtown Jaffrey. Nutting Road generally runs east to west and heads northwest from US 202 and then west for about a mile through a mostly rural residential area meeting up with other rural roads and turning southwest before intersecting with NH 137 (North Street). Old Sharon Road runs east from US 202 about a mile and a half before it meets up with Witt Hill Road and Spring Hill Road. The eastern section is a gravel roadway not suitable for large vehicles. Old Sharon Road is a mixture of rural and industrial adjacent land uses; including the Jaffrey transfer station, Monadnock Disposal Services, the Jaffrey wastewater treatment plant, and New England Wood Pellet located along this short section of road. There are no other access points to US 202 within a half a mile of the study intersection. Nutting Road and Old Sharon Road are maintained by the Town of Jaffrey.

Figure 2 – Location of Study Intersection



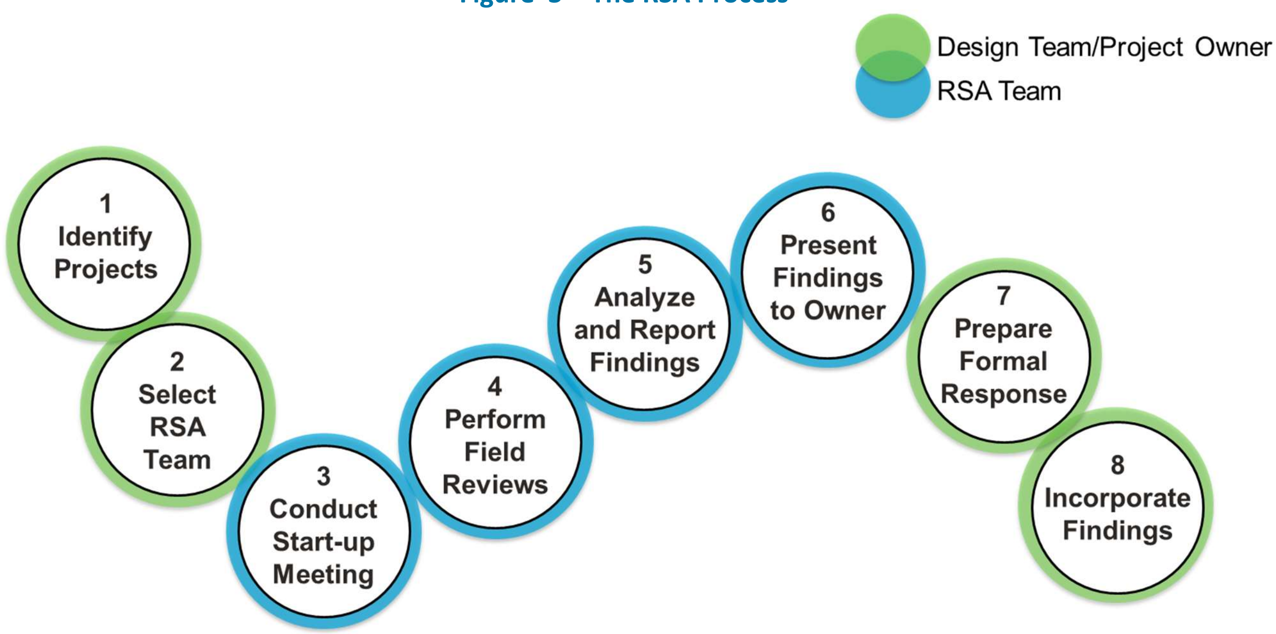
The study intersection is a four-legged, two-way stop-controlled intersection. US 202 is the mainline and is uncontrolled. Both approaches to the intersection on US 202 have dedicated left turn lanes. The Nutting Road and Old Sharon Road approaches are stop controlled.

Due to recent significant vehicle crashes and increased traffic to the industrial area on Old Sharon Road, the Jaffrey Economic Development Commission requested assistance to address the safety issues. The 2016 Town of Jaffrey Master Plan also identified US 202/Old Sharon Road as a problem intersection with a poor level of service and issues with speeding and slow-moving turning trucks. The Town of Jaffrey in conjunction with the Southwest Region Planning Commission submitted an application to the NHDOT to conduct an RSA. Seventeen reported crashes occurred at the study intersection over a 10-year period. Two of the crashes resulted in serious injuries. As part of this RSA, the Southwest Region Planning Commission provided a crash diagram of the study area as well as copies of the police crash reports. The purpose of this RSA was to identify safety issues that may be contributing to the reported crashes or lead to future crashes and identify potential near, mid, and long-term measures to mitigate these issues.

1.3 The RSA Process

The RSA followed the eight-step process outlined in the Federal Highway Administration's *Roadway Safety Audit Guidelines* (FHWA 2006), as shown in Figure 3.

Figure 3 – The RSA Process



After the study site and audit team were identified, members of the audit team reviewed traffic, geometry, and crash data. Hoyle Tanner engineers performed a site visit on September 8, 2021 to make preliminary observations, measure sightlines, note location of signage and road markings, and take photos of the study area. On September 10, 2021, the audit team reviewed the preliminary data and performed a field review. The audit team identified potential safety issues and suggested several near-term, intermediate-term and long term improvements.

The RSA team was comprised of a diverse group of stakeholders representing multiple disciplines, and affiliations, as shown in Table 1.

Table 1 - Participating RSA Team Members

Name	Affiliation
JoAnne Carr	Town of Jaffrey
David Chamberlain	Jaffrey Fire Department
Jon Frederick	Town of Jaffrey
Todd Muilenberg	Jaffrey Police Department
Todd Croteau	Jaffrey Department of Public Works
Eric Peahl	Abutter
Henry Underwood	Southwest Region Planning Commission
Mike Dugas	NHDOT - Safety
Kevin Belanger	NHDOT – District 4
Michelle Marshall	FHWA
Stephen Haas	Hoyle Tanner
Jacob Sparkowich	Hoyle Tanner
Jeffrey Collins	Hoyle Tanner
Alyssa Smith	Hoyle Tanner

2 EXISTING CONDITIONS

2.1 Geometric Conditions

Peterborough Street Looking North Towards Intersection

The intersection of US 202 (Peterborough Street), Old Sharon Road and Nutting Road is a four-leg, two-way stop-controlled intersection. US 202 is two lane undivided roadway section with free-flow conditions and a posted speed limit of 50 mph. Just north of the study area the speed limit changes to 55 mph. There are dedicated left turn lanes on both approaches to the intersection for vehicles turning into Old Sharon Road and Nutting Road. The travel lanes and the left turn lanes are each 12 feet wide. The shoulder width varies from one to eight feet. US 202 is on a slight horizontal curve at the study intersection. US 202 through the intersection is a -1.9% grade heading northbound. Intersection warning signs are on both approaches to the intersection. There is guardrail along the eastern side of the road on both sides of the intersection, and illumination at the intersection.

Nutting Road is a two-lane undivided road with a posted speed limit of 35 mph in the study area. It is stop controlled at US 202. There are no stop line markings or other pavement markings. A stop ahead warning sign is located on the approach to the study intersection. Nutting Road has an approximate 6-8% downward grade on the approach to US 202. Old Sharon Road is a two-lane undivided road which is stop controlled at US 202. The speed limit is not posted and is assumed to be 35 mph (consistent with Nutting Road) per RSA 265:60 for the speed limit in a rural residence district and Class V Town Road. There are no stop line or center line markings, or stop ahead warning signs.

2.2 Traffic and Speed Data

The Southwest Region Planning Commission provided Annual Average Daily Traffic (AADT) volumes with the RSA application. The 2019 AADT is 8,504 vehicles per day (vpd) on US 202, counted at the Jaffrey / Peterborough town line, approximately one mile north of the study area. The AADT volumes for Nutting Road and Old Sharon Road are unknown. Also with its wide shoulders, biking is accommodated and permitted on US 202, and it has become a relatively popular route for cyclists.

In September of 2021, the Jaffrey Police Department collected speed data on US 202 at the intersection. They collected data for each direction over the course of a week. The average northbound speed was 47.8 mph and the 85th percentile speed was approximately 55 mph. The average southbound speed was 53.9 mph and the 85th percentile speed was approximately 63 mph. It is expected that southbound vehicles may be traveling faster than northbound vehicles since the speed limit changes just north of the intersection. However, the 85th percentile speed of 63 mph would still be exceeding the posted speed limit of 55 mph by more than 5 mph (a range often used to set a posted speed limit).

2.3 Crash Analysis

Ten years' worth of crash data was provided by the Jaffrey Police Department and NHDOT. The Southwest Region Planning Commission provided detailed crash reports and two crash diagrams, one for all crashes and one for all injury crashes. See Appendix B for the crash diagrams. There were 17 crashes reported in the study area between 2011 and 2020. Of those 17 crashes, two crashes resulted in serious injuries. One of those crashes involved a single vehicle crash with a single occupant. The second crash involved two vehicles. The driver of one vehicle sustained serious injuries while the passenger and the driver of the other vehicle sustained minor injuries. Five additional crashes resulted in minor injuries. The remaining crashes resulted in property damage only.

Figure 4 - Crashes by Severity

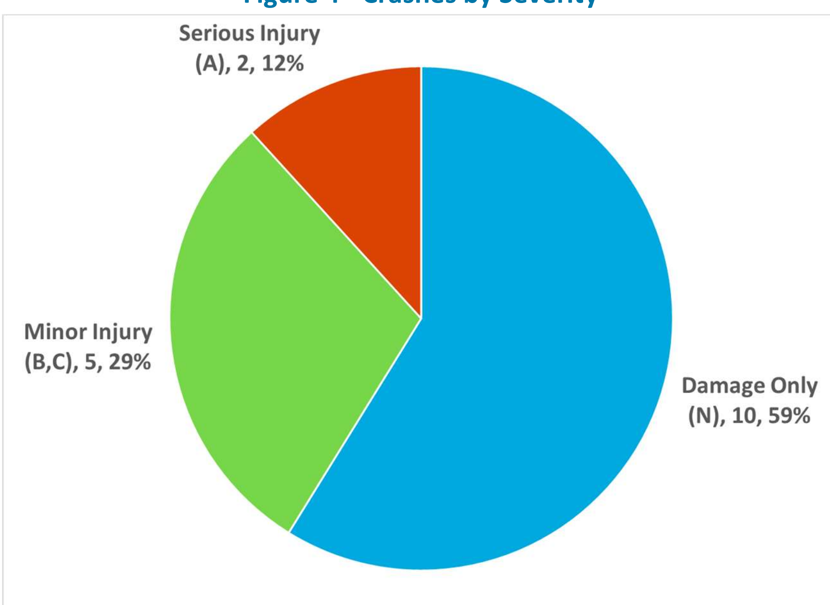
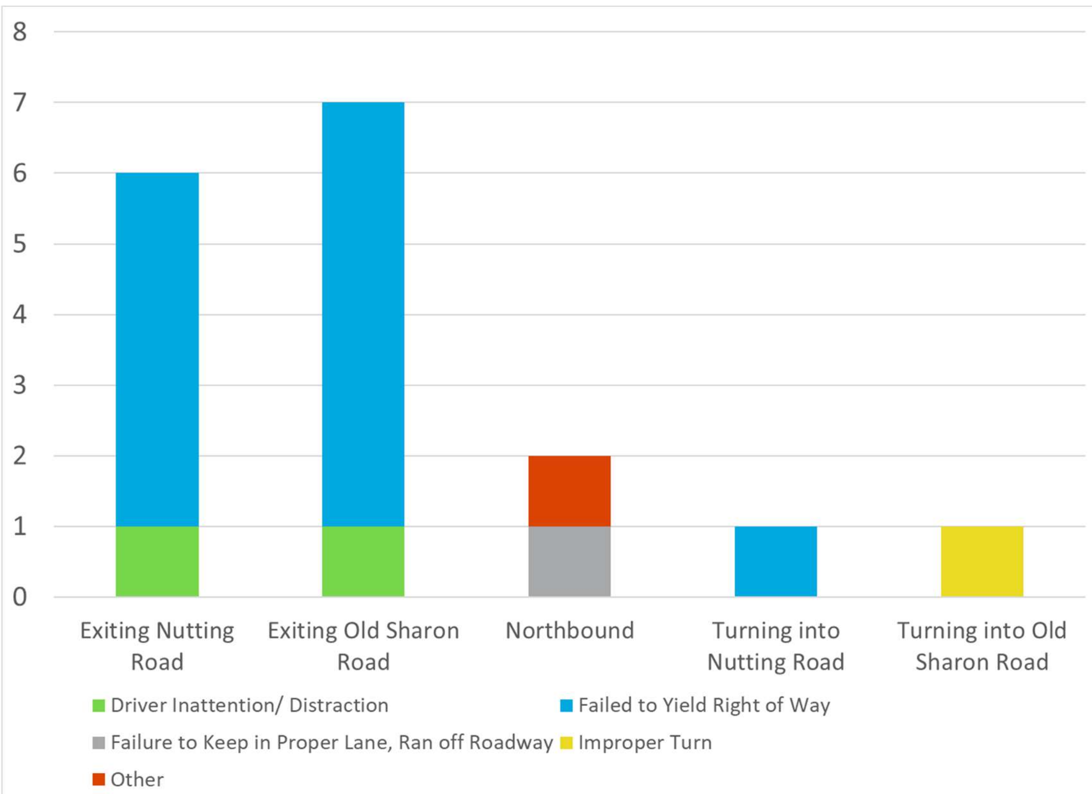


Figure 5 below shows the apparent contributing factor by turning movement. A majority of crashes (13 of the 17, 76%) involved vehicles pulling out of Old Sharon Road or Nutting Road, either to cross or turn onto US 202. Of these crashes, most are attributed to failing to yield to traffic on US 202.

Figure 5 – Turning Movements and Apparent Contributing Factor, courtesy of the Jaffrey Police Department



Of the two crashes involving northbound vehicles, one was an impaired driver losing control and exiting the roadway. The second northbound crash involved a driver that overcorrected to avoid a vehicle that started to cross from Nutting Road but stopped. The crash report indicated that Failure to Yield by the driver crossing from Nutting Road was a contributing factor. Other crashes at this intersection during the study period involved a vehicle turning left into Nutting Road but failing to yield to a southbound vehicle, and a large truck failing to make a wide enough turn into Old Sharon Road and hitting the guardrail.

Figure 6 below shows the number of crashes by day of the week. There were no reported crashes on Sundays. Three crash reports mentioned that vehicles were on their way to the Jaffrey Transfer Station at the time of the crash. It is possible that more of the crashes involved vehicles on their way to or from the Transfer Station, but simply were not recorded in the report. The Jaffrey Transfer Station is open Tuesdays, Wednesdays, Fridays, and Saturdays. It is possible that the reduction in crashes on other days of the week is due to lower traffic volumes when the Transfer Station is not open.

Figure 6 – The Number of Crashes by Day of the Week

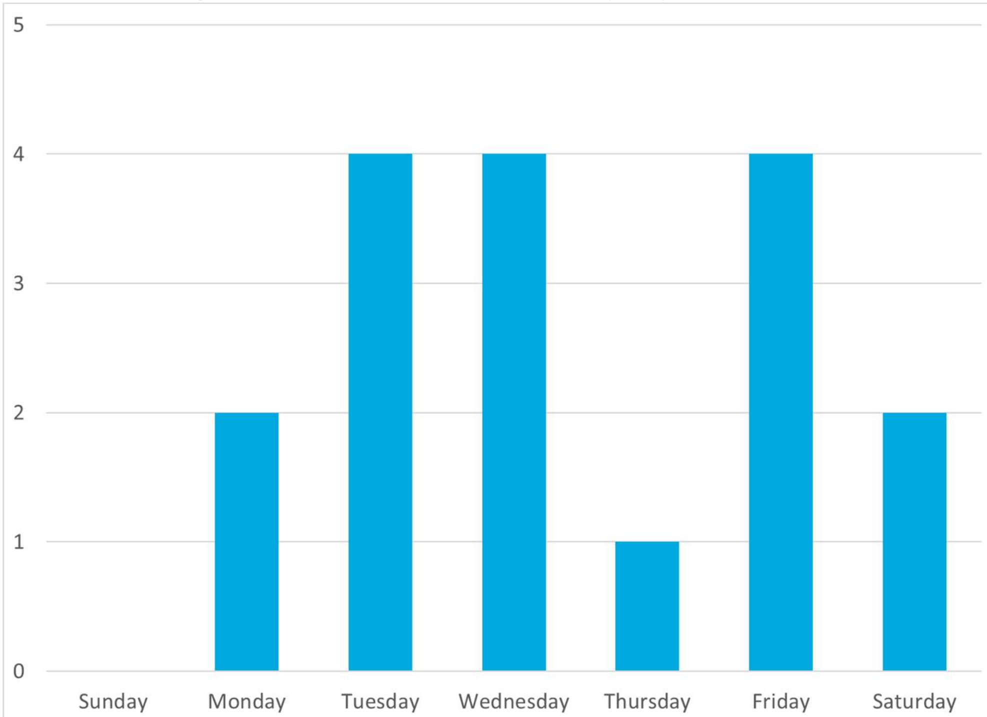
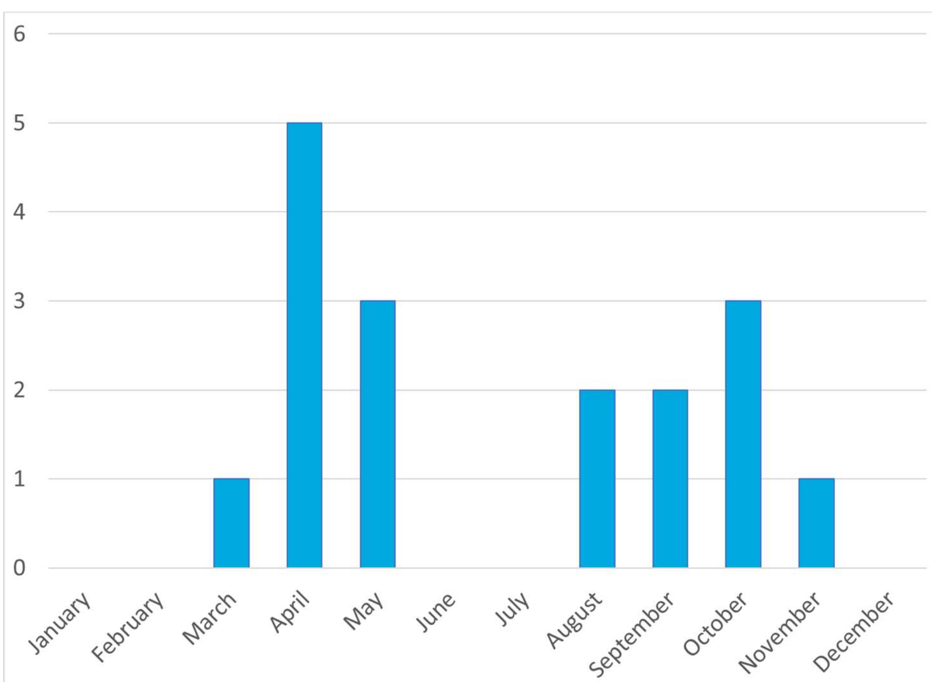


Figure 7 below shows the number of crashes by month of the year. Interestingly, there are no crashes in the winter months or in June and July.

Figure 7 – The Number of Crashes by Month of the Year



All crashes occurred during clear or cloudy weather conditions, with only one crash occurring on wet pavement. This seems to indicate that drainage is not an issue at the intersection. All but two crashes occurred during daylight hours, according to police crash reports. One nighttime crash occurred at the intersection, and one occurred just north of the intersection.

3 ASSESSMENT FINDINGS

3.1 Beneficial Existing Intersection Features

During the September 10th meeting, the audit team noted several existing intersection features that are beneficial to the safety of road users:

Wide Right of Way: The right of way on US 202 is quite wide with no structures and little to no large trees impeding view of vehicles at the study intersection.

Good Horizontal and Vertical Geometry: US 202 is nearly tangent with a large radius horizontal curve through the study intersection and has a gentle 2% decline on the northbound approach. There are no horizontal curves on the Old Sharon Road and Nutting Road approaches. The Old Sharon Road approach is relatively level while the Nutting Road approach has a 6-8% downward grade.

Pavement Condition: The condition of the pavement on US 202, Nutting Road and Old Sharon Road at the study intersection is good. Drainage at the intersection also appears to be good.

Pavement Markings and Signage: There are intersection warning signs with supplemental street name plaques on the US 202 approaches. Nutting Road has a stop ahead warning sign. The signage is in good condition. The pavement markings on US 202 are in good condition and appear to meet current standards.

Adequate Stopping Sight Distance: The minimum required Stopping Sight Distance of 425 feet for 50 mph is met on all approaches to the intersection. The sight distance northbound from Nutting Road is 450 feet, while the sight distance of all other approaches exceeds the intersection sight distance of 555 feet.

3.2 Identified Safety Issues and Concerns

During the September 10th site visit, the audit team used the GORE prompt method to observe the intersection and identify safety concerns. GORE stands for Geometry, Operations, Road Users, and Environment. The audit team identified several issues that may be contributing to crashes occurring at the intersection. These issues are categorized below based on the nature of the issue.

3.2.1 Side Road Approach Visibility Issues

During the September 8th site visit, members of the RSA field team measured the available sight distances using a measuring wheel. Table 2 compares the approximate available sight distance at the intersection with the minimum design Stopping Sight Distance and Intersection Sight Distance. The minimum design distances are based on US 202's 50 mph posted speed limit and level grade at the intersection. Minimum design sight distances are based on the American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets (AASHTO, 2018).

Table 2 – Comparison of Available and Required Sight Distance (50 MPH Design Speed)

Approach	Approximate Available Sight Distance	Minimum Design Stopping Sight Distance[1]	Minimum Design Intersection Sight Distance[2]
Nutting Road (looking left)	450 feet	425 feet	555 feet
Nutting Road (looking right)	>555 feet		
Old Sharon Road (looking left)	>555 feet		
Old Sharon Road (looking right)	>555 feet		

[1] Based on Tables 3-1 and 3-2 Stopping Sight Distance tables in AASHTO's A Policy on the Geometric Design of Highways and Streets 7th Edition, 2018

[2] Based on Table 9-7 Design Intersection Sight Distance – Case B1, Left Turn from Stop in AASHTO's A Policy on the Geometric Design of Highways and Streets 7th Edition, 2018

Stopping Sight Distance (SSD) is the distance travelled by a vehicle from when a driver identifies a hazard in the roadway to the vehicle coming to a complete stop. Intersection Sight Distance (ISD) is the minimum unobstructed line of sight in order for a driver to perceive the presence of a potentially conflicting vehicles approaching the intersection and allow time to stop or adjust speed to avoid collision. Although the Stopping Sight Distances for the study intersection meet the minimum requirements, the southbound visibility to Nutting Road is less than the minimum Intersection Sight Distance of 555 feet. Brush and tall grass in the northwest corner of the intersection reduces available sight distance, and the visibility of vehicles approaching the intersection is constrained.

Looking Left from Nutting Road

While it is important for drivers exiting Nutting Road and Old Sharon Road to see oncoming traffic, it is also important for drivers on US 202 to be able to identify the presence of the side roads and vehicles approaching and waiting at the stop sign in case there is a potential conflict. For the Nutting Road leg especially, very little of the approaching roadway is visible to drivers on US 202, which may be contributing to crashes.

3.2.2 Driver Behavior

Based on the available crash data analyzed, a majority (70%) of crashes are attributed to drivers failing to yield the right of way. All but one of those crashes involved vehicles exiting the side roads. Large trucks waiting to turn left into the side roads can obstruct visibility for drivers exiting the side roads. In some of the crash reports, it was noted that large trucks waiting to turn obstructed the view of drivers exiting Nutting Road or Old Sharon Road, resulting in those drivers making poor gap acceptance decisions. Poor intersection sight distance for Nutting Road eastbound as mentioned above can also be a factor. High volumes of traffic can also be a factor since drivers tend to accept smaller gaps the longer that they are waiting to cross or turn from the side road.

It was also observed that some vehicles are using the left turn lanes on US 202 to bypass right turning vehicles while traveling at full speed. This can lead to conflicts with vehicles legitimately using the turn lanes to turn left and can result in the high-speed bypassing vehicles being hidden from the view of vehicles waiting at the stop signs on the side roads.

Southbound speeds are also high, with the average speed of 53 mph and the 85th percentiles speed of 63 mph both over the 50 mph posted speed limit. The sight distances in Table 2 reflect the sight distance minimums for drivers travelling the posted 50 mph speed limit. Drivers traveling at speeds greater than 50 mph need longer Stopping Sight Distances and Intersection Sight Distances, the latter of which is not met for southbound vehicles approaching Nutting Road. Higher speeds also increase the severity of injuries that result from crashes.

3.2.3 Truck Volume

US 202 has moderately high volume of truck traffic (8%). There is also a high volume of trucks turning onto Old Sharon Road to access the transfer station, New England Wood Pellet, and other businesses. As mentioned above, the presence of turning trucks was a factor in some of the crashes in the study area, including one of the crashes that resulted in serious injuries. Three of the 17 crashes involved commercial trucks. Large trucks were observed to be encroaching on other lanes in order to complete turning movements. This causes conflicts with vehicles using those lanes and is suspected to cause some motorists to make poor gap acceptance decisions to clear the intersection throat for the large vehicle. The pavement turning radii in and out of Old Sharon Road is also tight, with trucks driving off pavement or encroaching into the opposing lane. One crash involved a commercial truck attempting to negotiate a right turn onto Old Sharon Road.

Vehicle Using Left Turn Lane to Bypass Truck Turning Right onto Old Sharon Road

3.2.4 Side Road Geometry

There is a 6-8% downhill grade on the Nutting Road approach and little to no platform for vehicles waiting to exit Nutting Road. This potentially could be an issue if the pavement is wet, snowy or icy and a vehicle slides into the intersection. There are also no pavement markings on the side roads. The lack of stop bars reduces the conspicuity of the intersection. Centerline markings on the side roads would define the lanes and improve lane discipline for entering or exiting vehicles. As mentioned above, there are tight turning radii on Old Sharon Road. In addition to hindering turning truck traffic, a tight turning radius can make it difficult for right turning traffic out of Old Sharon Road to enter a heavily trafficked US 202 at a speed necessary to enter the gap safely.

3.3 Qualified Risk Assessment

In order to better understand which issues identified by the RSA team pose the greatest safety threat, those issues were qualitatively assessed based on the expected frequency and severity of potential crashes utilizing the procedure prepared for the 2006 FHWA RSA: Case Studies Technical Report. The risk assessment process is qualitative and is based on the judgement and experience of the RSA team members. The final risk assessment can be found in Table 6. The process outlined by the FHWA that informs that assessment is described below.

The first step of the assessment process was to look at the expected crash ratings per identified issue. Table 3 shows the crash frequency rating based on exposure, probability and expected crash frequency. Exposure is related to how many road users will likely be at risk from the identified safety issue (i.e., How many road users are affected by the visibility issues at Nutting Road). Probability conveys how likely it is that a collision will result from the identified safety issue. Expected crash frequency was qualitatively estimated on the basis of expected exposure and probability. The existing crash data gives us a general idea of expected crash frequency. The study area had a total of 17 crashes over a ten-year period, with an average of 1.7 crashes per year. The expected crash frequency rating at this intersection is between Rare and Occasional.

Table 3 – Crash Frequency Rating

Estimated		Expected Crash Frequency	Frequency Rating
Exposure	Probability		
High	High	10 or more crashes per year	Frequent
Medium	High		
High	Medium	1 to 9 crashes per year	Occasional
Medium	Medium		
Low	High		
High	Low	less than 1 crash per year, but more than 1 crash every 5 years	Infrequent
Low	Medium		
Medium	Low	less than 1 crash every 5 years	Rare
Low	Low		

1. Crash Frequency Rating table was developed as part of the 2006 FHWA *Road Safety Audits: Case Studies* technical report.

The second part of the assessment looked at the expected crash severity, as shown in Table 4. Given the high speeds on US 202, the moderately high volume of trucks, and the types of collisions (crossing and angle crashes), the expected crash severities at this study intersection range from Low to Extreme. For example, a crash involving a turning truck which did not negotiate the right turn wide enough and struck the guardrail (such as the crash on October 17, 2012) would be a crash involving low speeds and resulting in property damage only and therefore be an example of a Low severity rating crash categorized under Side Road Geometry. A crash involving a vehicle exiting Old Sharon Road and being involved in an angle type collision at potentially high speeds could result in incapacitating injury. Therefore, Side Road Approach Visibility has an Extreme Severity Rating.

Table 4 – Severity Rating Assessment Matrix

Typical Crashes Expected	Expected Crash Severity	Severity Rating
Crashes involving high speeds or heavy vehicles, pedestrians, or bicycles	Probable fatality or incapacitating injury	Extreme
Crashes involving medium to high speed;	Moderate to severe injury	High
Head-on, crossing, or off-road crashes	Minor to moderate injury	Moderate
Crashes involving medium to low speeds;	Property damage only or minor injury	Low

1. Severity Rating table was developed as part of the 2006 FHWA *Road Safety Audits: Case Studies* technical report.

These two factors (crash frequency and crash severity) were then combined in Table 5 to obtain a qualitative risk assessment.

Table 5 – Crash Risk Assessment

Frequency Rating	Low Severity Rating	Moderate Severity Rating	High Severity Rating	Extreme Severity Rating
Frequent	Moderate-Low	Moderate-High	High	Highest
Occasional	Low	Moderate-Low	Moderate-High	High
Infrequent	Lowest	Low	Moderate-Low	Moderate-High
Rare	Lowest	Lowest	Low	Moderate-Low

1. Crash Risk Assessment table was adapted from the 2006 FHWA *Road Safety Audits: Case Studies* technical report.

Table 6 shows the identified issues ranked based on the qualitative risk assessment.

Table 6 - Summary of Potential Safety Issues

Identified Issues	Expected Crash Frequency	Expected Crash Severity	Qualitative Risk Assessment
Side Road Approach Visibility	Occasional	Extreme	High
Driver Behavior	Occasional	High	Moderate-High
Truck Volume	Infrequent	Extreme	Moderate-High
Side Road Geometry	Rare	Low	Lowest

1. Crash frequency and severity ratings for each issue based on the expectations and judgements of the RSA team members, as outlined in the 2006 FHWA *Road Safety Audits: Case Studies* technical report.

This summary is a tool to help the Town of Jaffrey prioritize the concerns identified in the RSA. For example, the side road visibility issues from Nutting Road has a frequency rating of "Occasional" and a severity rating of "Extreme" due to the nature of angle crashes, so the priority of addressing this issue is considered "High" for the Town and the Department. However, this is just one tool in the decision-making process. Cost and feasibility of potential safety mitigation measures are also important considerations as furthered discussed below.

3.4 Potential Safety Mitigation Measures

During the RSA meeting, the audit team suggested potential mitigation measures that would help address some of the safety issues highlighted during the meeting. The near-term measures can be implemented at any time by the Town of Jaffrey using town funds. Other intermediate and long-term improvements may require additional planning, design, and funding. Please note that figures 1 and 2 in Appendix B display multiple safety measures that could be pursued and implemented individually or in various combinations.

3.4.1 Near-Term Safety Improvement Measures

The following is a list of potential near-term safety improvement measures that could be implemented to address safety issues (depicted on Figure 1 in Appendix C). Many of these improvements could be performed in utilizing Town of Jaffrey funds and resources. Some of these improvements might also be able to be included in the next resurfacing of US 202, currently anticipated around 2028.

- Install Stop Ahead warning sign on the Old Sharon Road approach to notify drivers of the approaching stop-controlled intersection.
- Paint stop bars, centerline markings and edge of pavement markings on Nutting Road and Old Sharon Road to make the stop control more conspicuous and improve lane discipline.
- Improve lighting by adding lamps to the existing lighting poles on the approach to the intersection to highlight the intersection to drivers on US 202 and assist drivers navigating the side roads. Since some of the existing lamps are believed to be incandescent, a conversion to LED lamps should be considered to save on electricity costs.

- Mow the grassy areas adjacent to Nutting Road and Old Sharon Road more frequently to maintain adequate sightlines.

The installation of centerline rumble strips to deter centerline crossings was discussed at the RSA meeting. There is no evidence of centerline crossing crashes, and centerline rumble strips would not deter drivers from using the left turn lane to overtake right turning traffic. The need for rumble strips along US 202 will be evaluated as part of the DOT's annual rumble strip program.

3.4.2 Intermediate-Term Safety Improvement Measures

The following is a list of potential intermediate-term safety improvement measures that could be implemented to address safety issues (depicted on Figures 2 & 3 in Appendix C). Most of these measures would likely be implemented by NHDOT.

- Install a right turn lane for northbound traffic turning into Old Sharon Road to provide a deceleration lane for traffic turning there and discourage drivers from using the left turn lane to overtake right turning traffic. This right turn lane can be designed with an offset from the through travel lanes to maintain sight distance for traffic exiting Old Sharon Road. The design of the right turn lane should take measures to reduce conflicts with cyclists on US 202, such as reducing the length of the deceleration lane to require vehicles to reduce speed within lane. Alternatively, a bike through lane could be included in the design. The striping of the lane would be maintained by the Town of Jaffrey.
- Improve the corner radii on Old Sharon Road approach to fully accommodate truck turning movements without encroaching on opposing lanes of traffic.
- Regrade roadside adjacent to Nutting Road to improve Intersection Sight Distance, allowing drivers exiting Nutting Road to make safer turning movements and increase conspicuity of vehicles to US 202 traffic.
- Install an Intersection Conflict Warning System, which is currently being piloted by NHDOT in three locations in the state. This system would use vehicle detectors (similar to traffic signal technology) on the Nutting Road and Old Sharon Road approaches to activate flashing beacons on the US 202 intersection warning signs to alert approaching drivers that a vehicle is attempting to enter the roadway.
- Install a traffic signal, which has been identified to be warranted in the near future (2026/2027) A traffic signal would significantly reduce the number of crashes involving vehicles exiting the side road and failing to yield to vehicles on US 202. A Traffic Signal Warrant Analysis can be found in Appendix F.

Another potential improvement discussed during the RSA meeting is to consider reducing the speed limit along this section of US 202 to assist vehicles attempting to cross or enter the intersection. This measure could be evaluated in the future by the NHDOT. The Town of Jaffrey would need to request a formal speed study. However, in consideration of the highway characteristics and context, it is unlikely a speed limit reduction would be justified or effective at reducing speeds. Lowering the speed limit in isolation is not an effective strategy for reducing speeds without other geometric changes, such as lane and shoulder width reductions or adding raised medians. These types of measures are typically part of a corridor improvement, which is outside the scope of this project.

During the RSA review process, the Town of Jaffrey also expressed interest in removing the existing left turn lanes on US 202. This is deemed not advisable as the installation of left turn lanes is often used to improve safety at intersections and has a conservative estimate of reducing crashes by 27-33% (according to the FHWA Crash Modification Clearing House). Removing the left turn lanes would be expected to have a similar detriment. Although the left turn lanes can impede visibility for traffic exiting the side roads, left turn lanes improve overall safety at an intersection and have a proven safety benefit.

3.4.3 Long Term Safety Improvement Measures

The following is a list of potential long-term safety improvement measures that could be implemented to address safety issues (depicted on Figure 4 in Appendix C). This measure would also likely be implemented by NHDOT.

- Consider constructing a roundabout at the intersection. Roundabouts eliminate angle type crashes, which are the majority of crashes that are being reported to the police. Angle crashes are particularly dangerous to vehicle occupants due to the lack of crumple zones on the sides of vehicles, especially at high speeds. A roundabout would also help drivers who are crossing or turning on to US 202 since they would only need to find a gap in one direction of traffic. Roundabouts also reduce speeds at intersections since drivers must slow down to negotiate the intersection. An appropriately designed roundabout would efficiently accommodate all vehicles.

The possibility of improving other roads in the surrounding area to create better network connectivity, including Old Sharon Road/Witt Hill Road for connection to NH 124 and Hadley Road for northbound traffic, was discussed. However, these offsite improvements were deemed beyond the scope of this RSA and were not evaluated further.

4 CONCLUSIONS

Improving safety at an intersection or segment of road is not easy or straightforward.
The causes of crashes are often complex and involve multiple factors. Solutions to address those crashes can also be complex. Efforts to reduce the number and severity of crashes can be successful with the commitment of stakeholders who wish to improve safety. Road Safety Audits include the input of those stakeholders, and this report can be used as a guide to help in their decision-making process for selecting, prioritizing, and implementing safety improvements.

During the RSA for the intersection of US 202 (Peterborough Street) with Nutting Road and Old Sharon Road, four primary risk factors were identified:

- Side Road Approach Visibility –Although minimum Stopping Sight Distances are met for vehicles stopped on the side road approaches, driver intervisibility is poor for approaching vehicles. Drivers on US 202 need to have good visibility of vehicles stopped or approaching the intersection in order to have time to react to a potential conflict. Intersection Sight Distance minimums are not met at Nutting Road.
- Driver Behavior – Drivers failing to yield when exiting the side roads may be caused by a variety of factors including poor sight distance, the presence of heavy trucks, and the high traffic volumes. High vehicle speeds exacerbate sight distance issues and may contribute to more severe crash outcomes.
- Heavy Truck Volume – Trucks have a difficult time making the turn onto Old Sharon Road. Trucks have also been a factor in several crashes.
- Side Road Geometry – The tight turning radii on Old Sharon Road, lack of pavement markings and the approach gradient on Old Nutting Road may be factors in safety at the intersection.

Potential mitigation measures for these safety issues are discussed in the report. The measures have been categorized as near-term, intermediate, and long-term improvements. The near-term measures are within the Town of Jaffrey's jurisdiction and can be implemented by the Town. The Intermediate and long-term measures involve more engineering design and construction cost. Conceptual drawings for those measures are included in the appendices along with a benefit-cost analysis for the suggested improvements.

The intermediate and long-term improvements will involve further planning, design, and funding. One potential source of funding is the Highway Safety Improvement Program (HSIP). Eligible safety projects must be consistent with New Hampshire's Strategic Highway Safety Plan (SHSP) and have a benefit-cost ratio of at least 1.0. The benefit-cost analysis summaries for the proposed improvement measures can be found in Appendix E. Another potential source of funding is through the Statewide Transportation Improvement Program (STIP), commonly referred to as the Ten-Year Plan. Eligible projects include general improvement projects as well as safety specific improvement projects. A third source of potential funding is the Governors Highway Safety Association (GHSA) Section 402 State and Community Highway Safety Grant Program. The Section 402 program provides grants to states and communities to improve driver behavior and reduce deaths and injuries from motor vehicle-related crashes by enhancing speed enforcement to reduce speeds, and reducing crashes from unsafe driving behavior.

5 APPENDICES

5.1 Appendix A – Speed Data

The following pages show the speed data summaries for US 202 near Old Sharon Road which was collected by the Jaffrey Police Department in September of 2021. The vehicle speed data for southbound traffic was collected September 13-20, 2021, and data for northbound traffic was collected September 20-27, 2021. It is noted that this data was collected "near" Old Sharon Road, and it is unclear if the data was collected in the 50 mph or 55 mph zone.

ALL TRAFFIC SOLUTIONS

Volume by Speed

Peterborough St., NB

Start: 2021-09-20

End: 2021-09-27

Times: 0:00-23:59

Speed Bins: Size 5, Range 1 to 150

Time View: By Hour (Total Volumes)

Time	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 to 70	71 to 75	76 to 80	81 to 85	86 to 90	91 to 95	96 to 100	101 to 150	Avg Speed	Total
0:00	0	0	0	0	0	0	2	3	6	21	26	6	3	0	0	0	0	0	0	0	0	**50.2**	**67**
1:00	0	0	0	0	0	0	1	2	13	18	13	4	0	0	0	0	0	0	0	0	0	**48.2**	**51**
2:00	0	0	0	0	0	2	2	7	7	19	12	6	4	1	0	0	0	0	0	0	0	**48.5**	**60**
3:00	0	0	0	0	0	1	9	9	11	28	27	10	2	0	0	0	0	0	0	0	0	**48.0**	**97**
4:00	0	0	0	0	0	4	27	27	37	99	77	43	8	2	0	0	0	0	0	0	0	**48.3**	**324**
5:00	0	0	0	0	0	4	27	63	96	219	244	83	12	0	0	0	0	0	0	0	0	**48.9**	**748**
6:00	0	0	0	0	0	11	70	120	190	432	535	144	14	4	0	0	0	0	0	0	0	**48.7**	**1520**
7:00	0	0	0	0	0	10	63	92	155	448	558	148	21	2	0	0	0	0	0	0	0	**49.1**	**1497**
8:00	0	0	0	0	0	10	108	161	209	439	424	126	10	1	0	0	0	0	0	0	0	**47.3**	**1488**
9:00	0	0	0	0	0	14	133	174	264	434	340	57	11	1	0	0	0	0	0	0	0	**46.0**	**1428**
10:00	0	0	0	0	0	17	139	166	290	475	359	97	9	1	0	0	0	0	0	0	0	**46.4**	**1553**
11:00	0	0	0	0	0	12	145	219	321	510	371	103	12	0	0	0	0	0	0	0	0	**46.1**	**1693**
12:00	0	0	0	0	0	18	158	235	352	630	430	110	14	1	0	0	0	0	0	0	0	**46.3**	**1948**
13:00	0	0	0	0	0	14	116	204	310	572	403	88	12	1	0	0	0	0	0	0	0	**46.5**	**1720**
14:00	0	0	0	0	0	10	123	206	293	525	457	126	16	1	0	0	0	0	0	0	0	**47.0**	**1757**
15:00	0	0	0	0	0	9	114	145	243	582	561	181	24	1	0	0	0	0	0	0	0	**48.2**	**1860**
16:00	0	0	0	0	0	3	54	93	184	526	590	189	22	2	0	0	0	0	0	0	0	**49.5**	**1663**
17:00	0	0	0	0	0	5	31	86	180	491	568	191	18	2	1	0	0	0	0	0	0	**49.7**	**1573**
18:00	0	0	0	0	0	3	24	62	143	346	403	133	21	1	1	0	0	0	0	0	0	**49.7**	**1137**
19:00	0	0	0	0	0	4	27	59	130	276	186	62	1	0	0	0	0	0	0	0	0	**47.8**	**745**
20:00	0	0	0	0	0	3	13	33	79	191	140	41	7	0	0	0	0	0	0	0	0	**48.3**	**507**
21:00	0	0	0	0	0	1	6	24	66	119	122	31	4	1	0	0	0	0	0	0	0	**48.9**	**374**
22:00	0	0	0	0	0	0	5	13	44	119	80	33	7	1	0	0	0	0	0	0	0	**49.4**	**302**
23:00	0	0	0	0	0	0	2	11	26	54	53	15	2	0	0	0	0	0	0	0	0	**49.2**	**163**
Total	0	0	0	0	0	155	1399	2214	3649	7573	6979	2027	254	23	2	0	0	0	0	0	0	**47.8**	**24275**

Generated by Thomas Bishop on 11-12-2021

Volume by Speed

Peterborough St., NB

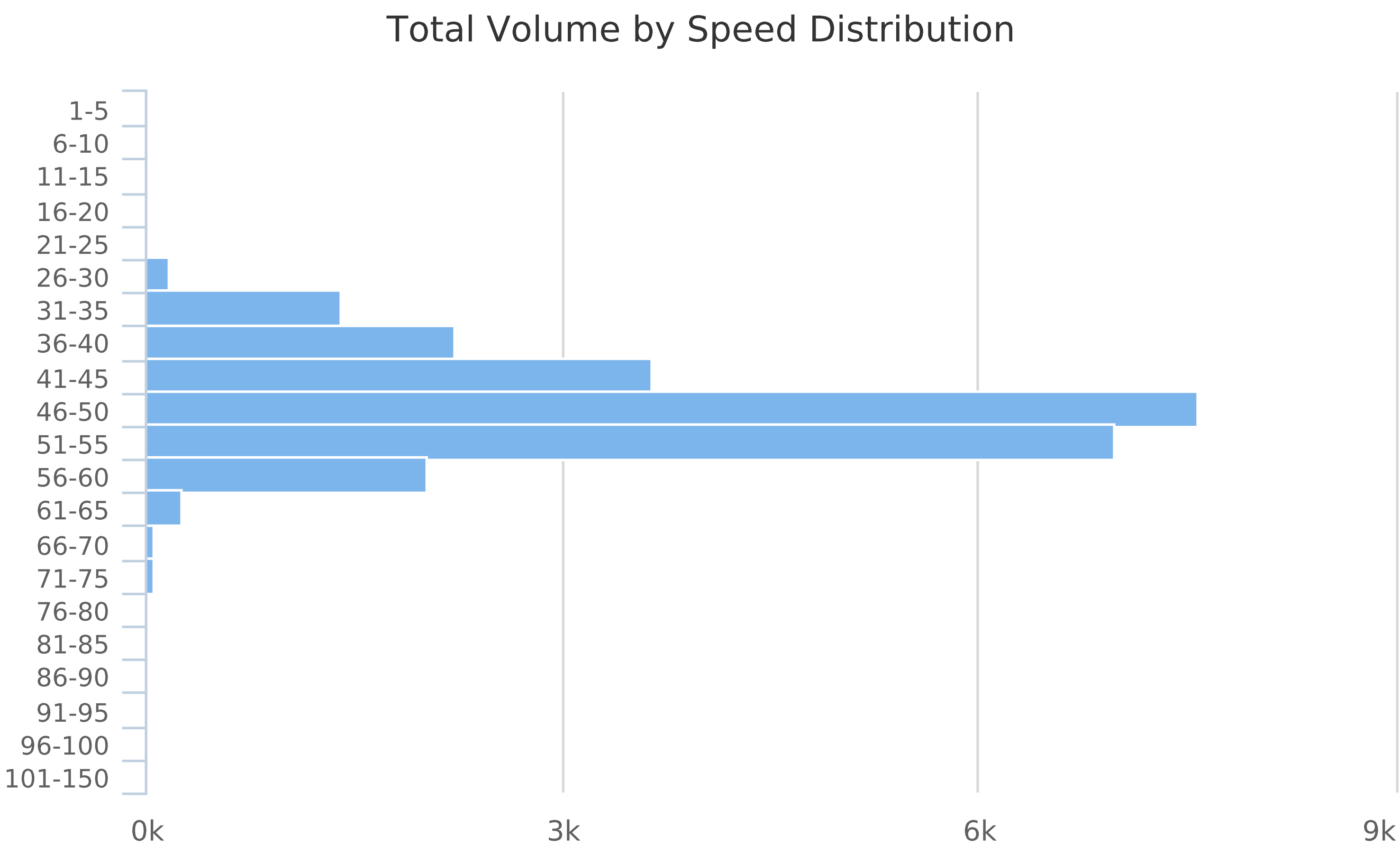
Start: 2021-09-20

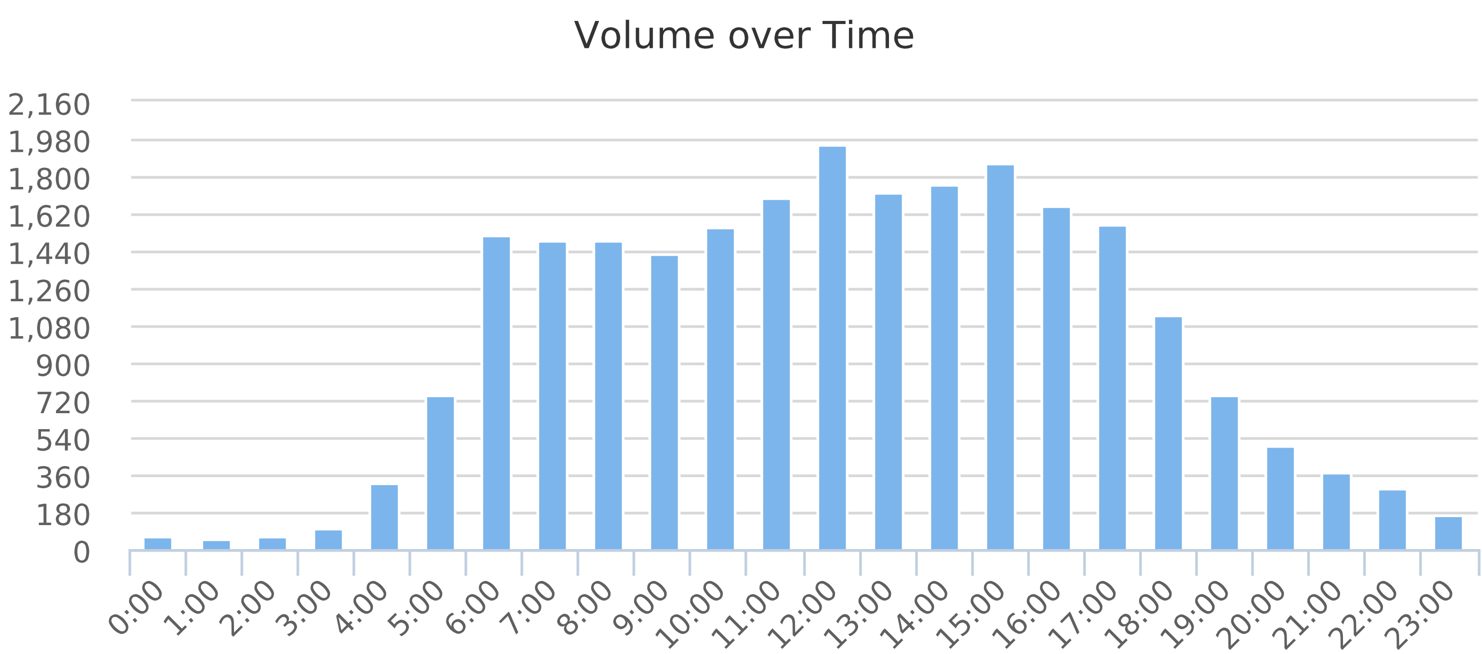
End: 2021-09-27

Times: 0:00-23:59

Speed Bins: Size 5, Range 1 to 150

Time View: By Hour (Total Volumes)





ALL TRAFFIC SOLUTIONS

Volume by Speed

Peterborough Street, SB

Start: 2021-09-13

End: 2021-09-20

Times: 0:00-23:59

Speed Bins: Size 5, Range 1 to 150

Time View: By Hour (Total Volumes)

Time	1 to 5	6 to 10	11 to 15	16 to 20	21 to 25	26 to 30	31 to 35	36 to 40	41 to 45	46 to 50	51 to 55	56 to 60	61 to 65	66 to 70	71 to 75	76 to 80	81 to 85	86 to 90	91 to 95	96 to 100	101 to 150	Avg Speed	Total
0:00	0	0	0	0	0	0	0	1	4	24	38	23	6	3	0	1	0	0	1	0	0	**54.3**	**101**
1:00	0	0	0	0	0	0	0	1	3	9	29	4	4	2	0	0	0	0	0	0	0	**53.0**	**52**
2:00	0	0	0	0	0	1	0	2	4	19	54	44	15	0	0	0	0	0	0	0	0	**54.4**	**139**
3:00	0	0	0	0	0	0	1	0	2	10	29	6	2	0	0	0	0	0	0	0	0	**52.3**	**50**
4:00	0	0	0	0	0	0	0	0	6	12	34	20	8	3	2	1	1	0	0	0	0	**55.5**	**87**
5:00	0	0	0	0	0	0	0	2	17	82	157	100	29	10	0	0	0	0	0	0	0	**53.8**	**397**
6:00	0	0	0	0	0	0	2	6	12	146	333	192	43	7	1	0	0	0	0	0	0	**53.8**	**742**
7:00	0	0	0	0	0	0	4	13	29	153	330	216	70	8	1	0	0	0	0	0	0	**53.7**	**824**
8:00	0	0	0	0	0	0	0	8	48	205	384	273	59	8	3	0	0	0	0	0	0	**53.5**	**988**
9:00	0	0	0	0	0	0	2	12	41	239	410	261	66	10	0	2	0	0	0	0	0	**53.4**	**1043**
10:00	0	0	0	0	0	0	0	11	45	194	460	322	85	14	0	0	1	0	0	0	0	**54.0**	**1132**
11:00	0	0	0	0	0	0	0	3	40	230	528	338	71	10	0	0	0	0	0	0	0	**53.8**	**1220**
12:00	0	0	0	0	0	0	4	6	60	233	521	408	89	22	5	1	0	0	0	0	0	**54.2**	**1349**
13:00	0	0	0	0	0	1	4	11	46	192	534	382	115	22	3	2	1	0	0	0	0	**54.4**	**1313**
14:00	0	0	0	0	0	0	2	7	62	246	552	368	95	19	2	0	2	0	0	0	0	**53.9**	**1355**
15:00	0	0	0	0	0	0	1	10	38	253	645	471	123	11	6	3	0	0	0	0	0	**54.4**	**1561**
16:00	0	0	0	0	0	0	4	11	62	321	742	520	131	24	0	0	0	0	0	0	0	**53.9**	**1815**
17:00	0	0	0	0	0	0	2	10	48	243	597	421	110	20	4	0	0	0	0	0	0	**54.2**	**1455**
18:00	0	0	0	0	0	0	1	2	21	170	399	327	96	14	3	0	2	0	0	0	1	**54.8**	**1036**
19:00	0	0	0	0	0	0	0	3	21	199	290	167	38	3	0	1	0	0	0	0	0	**53.0**	**722**
20:00	0	0	0	0	0	0	0	2	27	126	232	143	25	4	0	0	0	0	0	0	0	**53.0**	**559**
21:00	0	0	0	0	0	0	1	3	27	90	153	99	23	8	0	0	0	0	0	0	0	**53.2**	**404**
22:00	0	0	0	0	0	0	0	2	14	63	119	76	19	5	1	0	0	0	0	0	0	**53.6**	**299**
23:00	0	0	0	0	0	0	0	1	15	43	82	40	10	2	1	0	0	0	0	0	0	**52.9**	**194**
Total	0	0	0	0	0	2	28	127	692	3502	7652	5221	1332	229	32	11	7	0	1	0	1	**53.9**	**18837**

Generated by Thomas Bishop on 11-12-2021

Volume by Speed

Peterborough Street, SB

Start: 2021-09-13

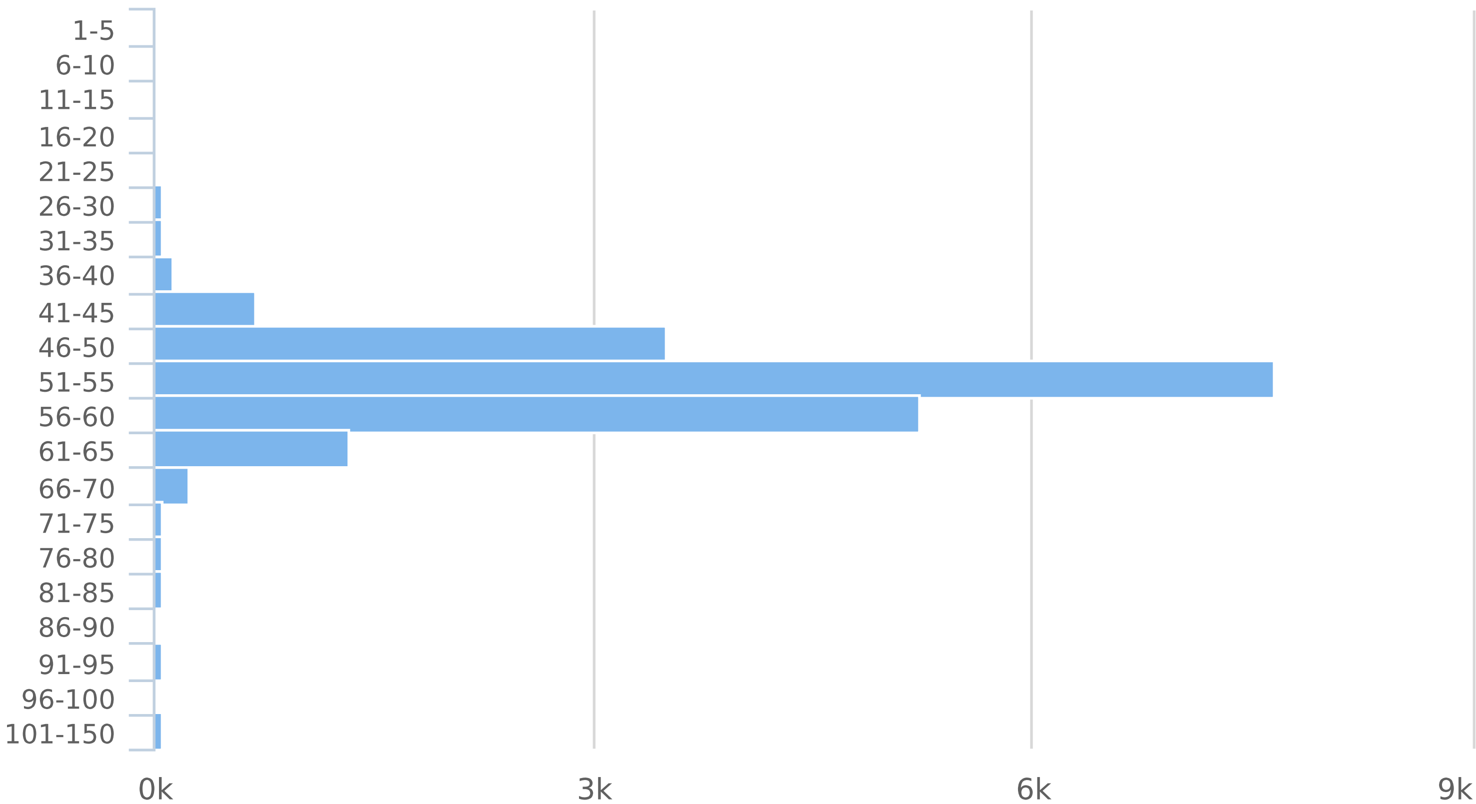
End: 2021-09-20

Times: 0:00-23:59

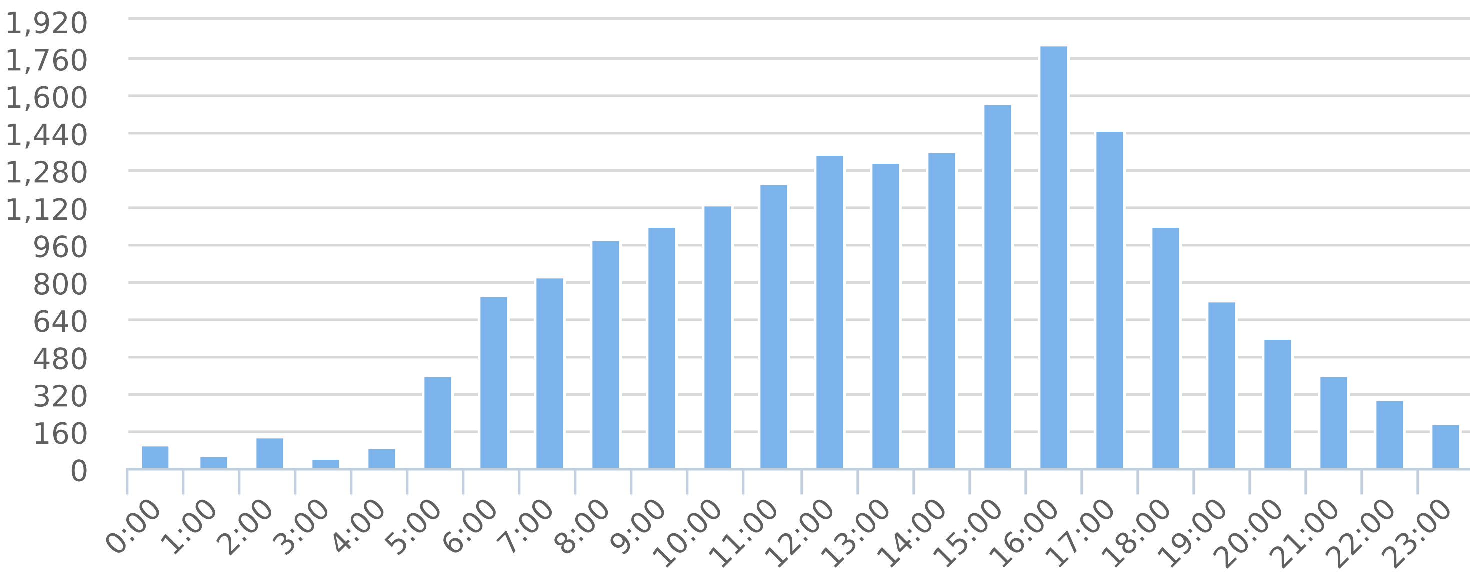
Speed Bins: Size 5, Range 1 to 150

Time View: By Hour (Total Volumes)

Total Volume by Speed Distribution



Volume over Time



Generated by Thomas Bishop on 11-12-2021

ALL TRAFFIC
SOLUTIONS

Volume by Time

Peterborough St., NB

Start: 2021-09-20

End: 2021-09-27

Times: 0:00-23:59

Speed Bins: Size 10, Range 1 to 150

Time View: By Day of Week (Avg Volumes)

Day	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Avg Total
Sun	14	10	10	8	20	18	63	79	124	175	185	221	258	230	192	170	198	136	128	95	59	46	19	17	**2475**
Mon	5	3	7	14	47	132	270	244	239	199	217	234	248	220	236	256	239	169	139	96	65	49	36	20	**1777**
Tue	12	9	10	17	58	153	284	264	238	221	215	245	276	262	277	301	260	239	166	95	78	55	38	21	**3794**
Wed	10	4	15	21	55	128	272	269	221	211	218	241	285	249	264	293	249	211	143	98	62	43	39	23	**3624**
Thu	7	10	6	14	57	139	270	256	221	212	209	213	276	256	238	295	247	240	166	109	80	61	49	28	**3659**
Fri	7	6	9	17	53	136	252	272	237	185	230	248	297	237	283	320	265	230	235	117	82	56	78	38	**3890**
Sat	12	9	3	6	34	42	109	113	208	225	279	291	308	266	267	225	205	179	160	135	81	64	43	16	**3280**
Avg	**10**	**7**	**9**	**14**	**46**	**107**	**217**	**214**	**213**	**204**	**222**	**242**	**278**	**246**	**251**	**266**	**238**	**201**	**162**	**106**	**72**	**53**	**43**	**23**	**3214**

Generated by Thomas Bishop on 11-12-2021

Volume by Time

Peterborough St., NB

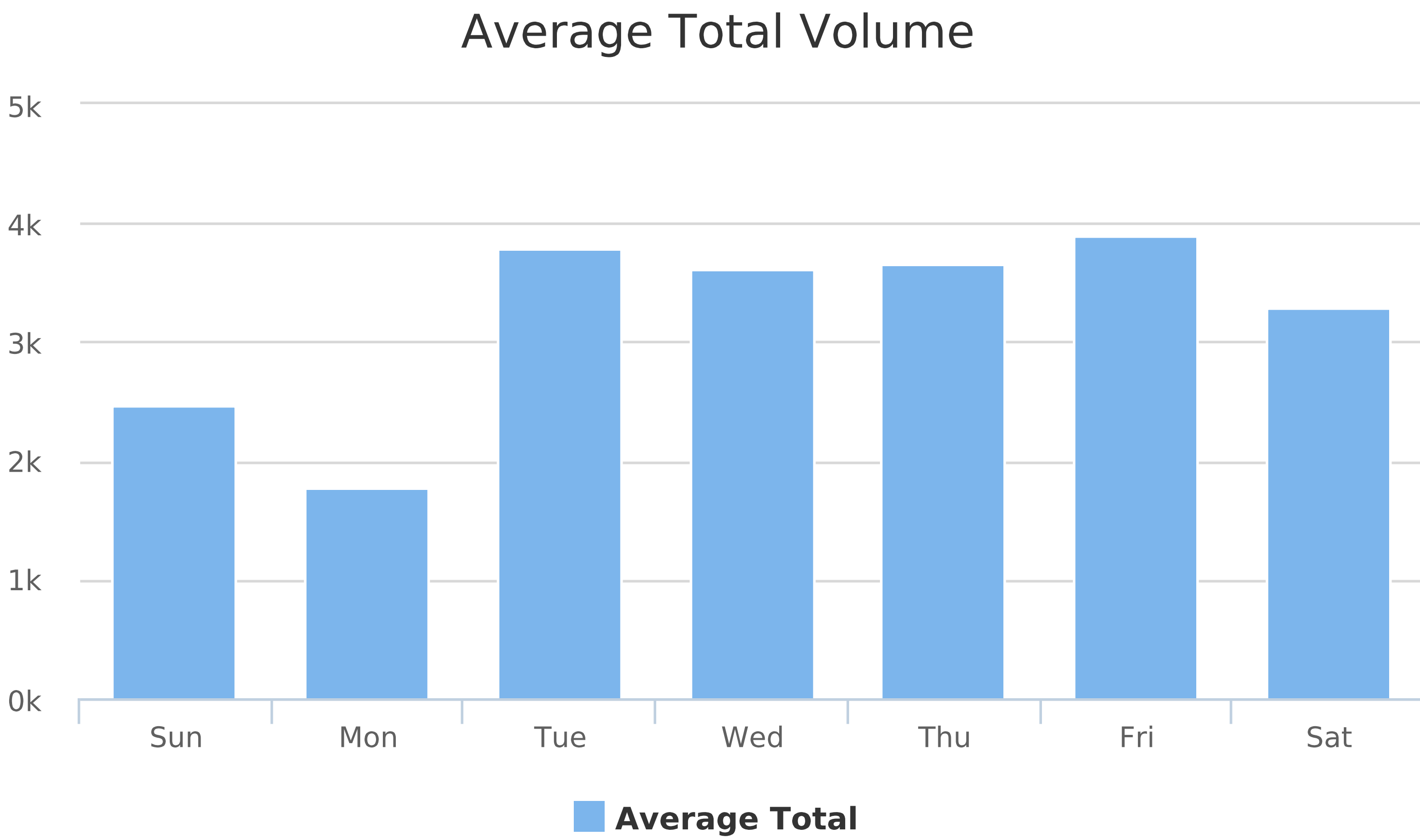
Start: 2021-09-20

End: 2021-09-27

Times: 0:00-23:59

Speed Bins: Size 10, Range 1 to 150

Time View: By Day of Week (Avg Volumes)



Generated by Thomas Bishop on 11-12-2021

ALL TRAFFIC SOLUTIONS

Volume by Time

Peterborough Street, SB

Start: 2021-09-13

End: 2021-09-20

Times: 0:00-23:59

Speed Bins: Size 10, Range 1 to 150

Time View: By Day of Week (Avg Volumes)

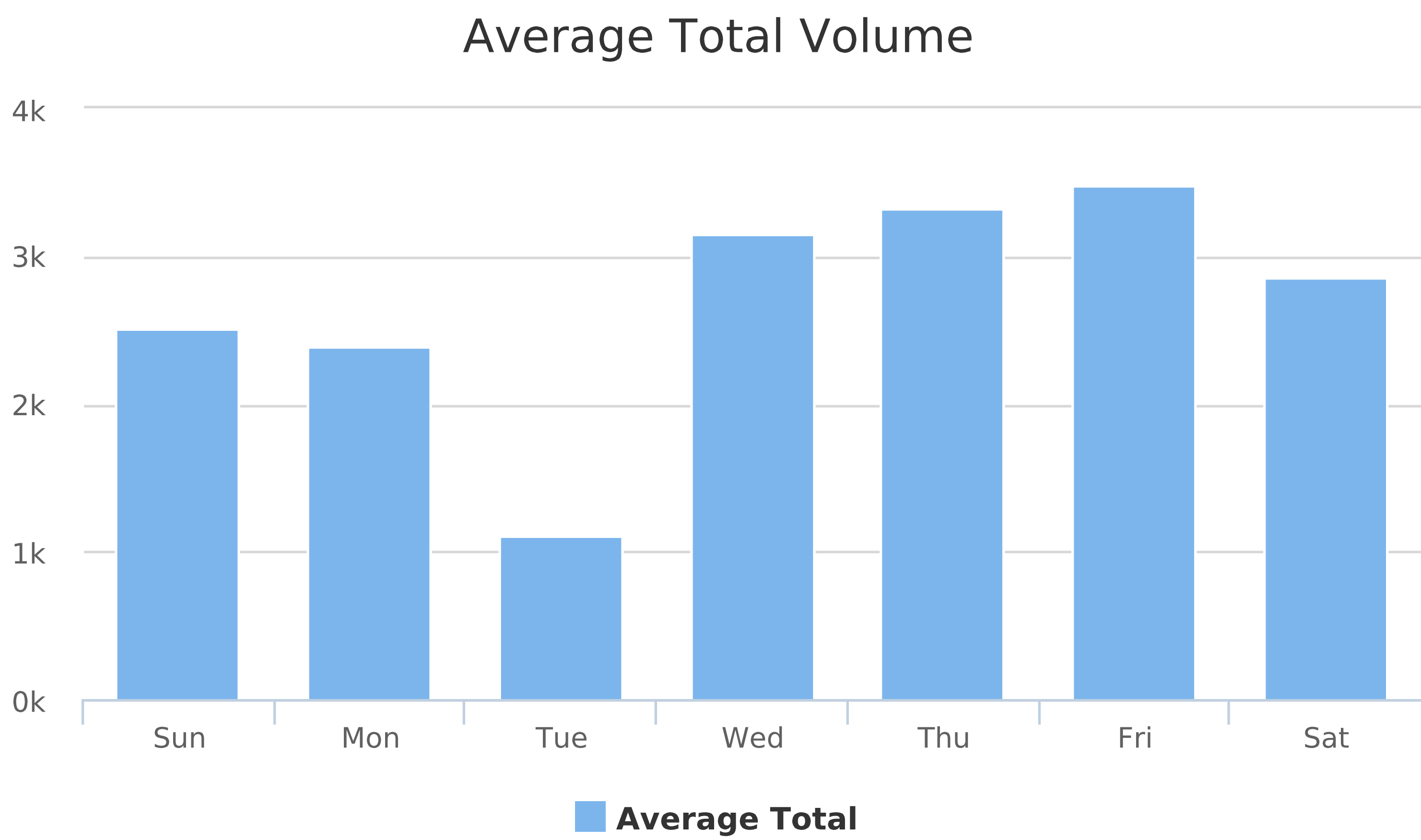
Day	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	Avg Total
Sun	22	10	5	4	8	29	37	79	111	158	201	210	233	192	187	173	195	164	149	111	106	65	41	23	**2513**
Mon	11	7	6	5	13	74	170	169	195	165	167	192	223	218	226	293	257	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**2391**
Tue	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	290	292	175	126	78	68	48	36	**1113**
Wed	17	8	41	12	20	99	165	183	185	197	185	188	233	213	231	288	279	256	148	79	38	34	30	24	**3153**
Thu	14	7	40	12	18	84	158	174	183	170	195	192	207	220	224	300	276	266	185	127	106	78	57	36	**3329**
Fri	13	10	38	11	17	82	152	152	202	176	196	217	229	250	267	289	298	261	198	133	113	74	61	41	**3480**
Sat	24	10	9	6	11	29	60	67	112	177	188	221	224	220	220	218	220	216	181	146	118	85	62	34	**2858**
Avg	**17**	**9**	**23**	**8**	**15**	**66**	**124**	**137**	**165**	**174**	**189**	**203**	**225**	**219**	**226**	**260**	**259**	**243**	**173**	**120**	**93**	**67**	**50**	**32**	**2691**

Volume by Time

Peterborough Street, SB

Start: 2021-09-13
End: 2021-09-20
Times: 0:00-23:59

Speed Bins: Size 10, Range 1 to 150
Time View: By Day of Week (Avg Volumes)



5.2 Appendix B – Crash Diagrams

The Southwest Region Planning Commission provided the following crash diagrams. The diagrams display crashes that occurred between 2011 and 2020.

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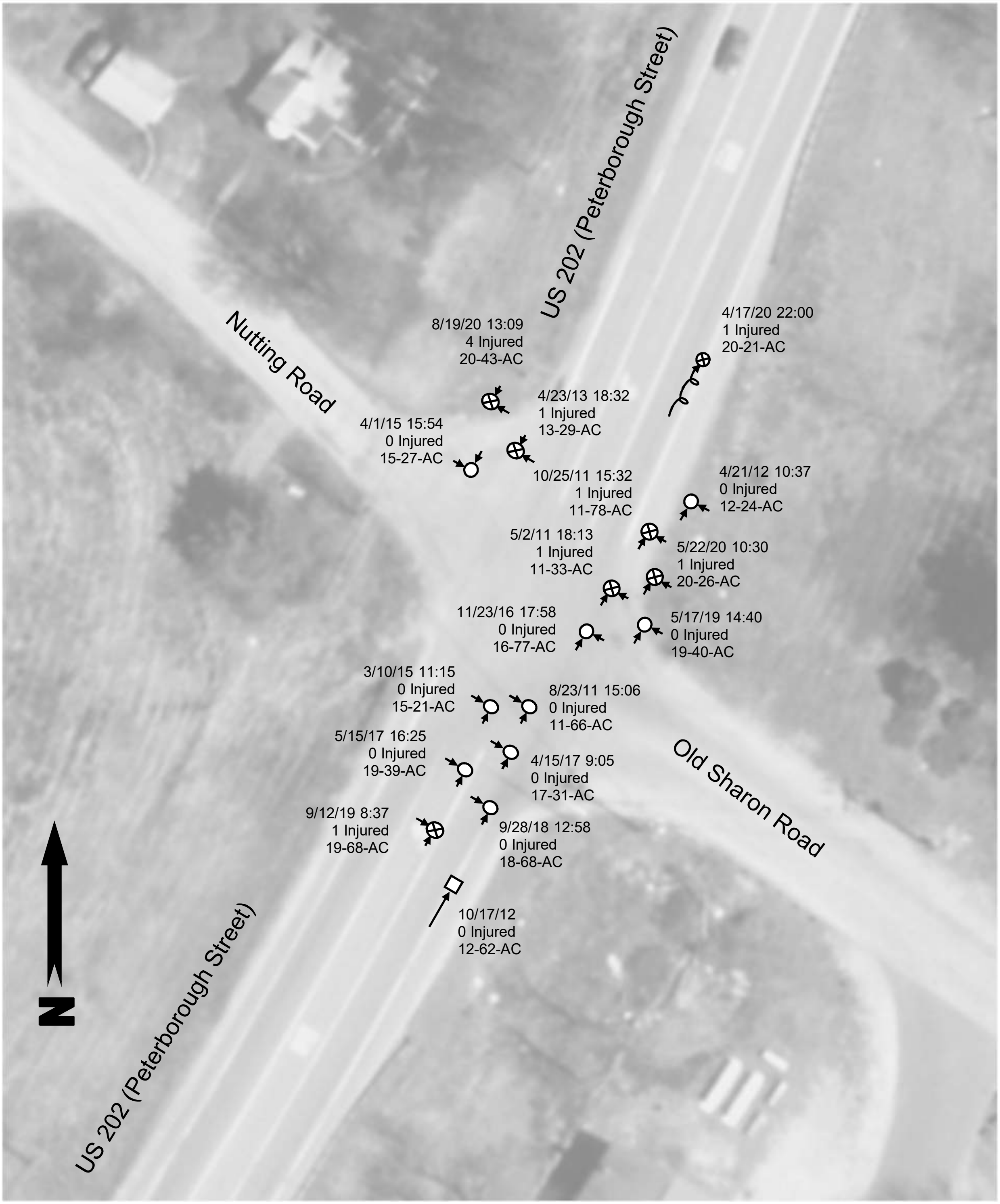
<< TRAFFIC COLLISION DIAGRAM -- INTERSECTIONS >>

INTERSECTION TYPE	
2 Lanes only 2 Lanes only	
2 Lanes only 3 Lanes w / LTC	X
2 Lanes only 3 Lanes w / TWLTL	
3 Lanes w / LTC 3 Lanes w / LTC	
3 Lanes w / TWLTL 3 Lanes w / TWLTL	
3 Lanes w / LTC 4 Lanes only	
3 Lanes w / LTC 4 Lanes w / dual LTC	
4 Lanes only 4 Lanes only	
4 Lanes only 5 Lanes w / LTC	
4 Lanes only 6 Lanes w / dual LTC	
4 Lanes only 7 Lanes w / LTC	
5 Lanes w / LTC 5 Lanes w / LTC	
5 Lanes w / LTC 6 Lns w / dual LTC	
5 Lanes w / LTC 7 Lanes w / LTC	
6 Lanes w / dual LTC 6 Lanes w / dual LTC	
6 Lanes w / dual LTC 7 Lanes w / LTC	
7 Lanes w / LTC 7 Lanes w / LTC	
7 Lanes w / LTC 8 Lanes w / dual LTC	
8 Lanes w / dual LTC 8 Lanes w / dual LTC	
4 Ln div w / LTC&RTC 2 Lanes only	
4 Lns divided/ no LTC 2 Lanes only	
4 Ln div w / LTC 2 Lanes only	
4 Ln div w/ LTC&RTC 3 Lanes w / LTC	
4 Ln div w / LTC 4 Lanes only	
4 Ln div w/ LTC&RTC 4 Lanes only	
N	



DIST	COUNTY	ROUTE	POST MILES DESCRPTN.
4	Cheshire	US 202	North of MP 9.2

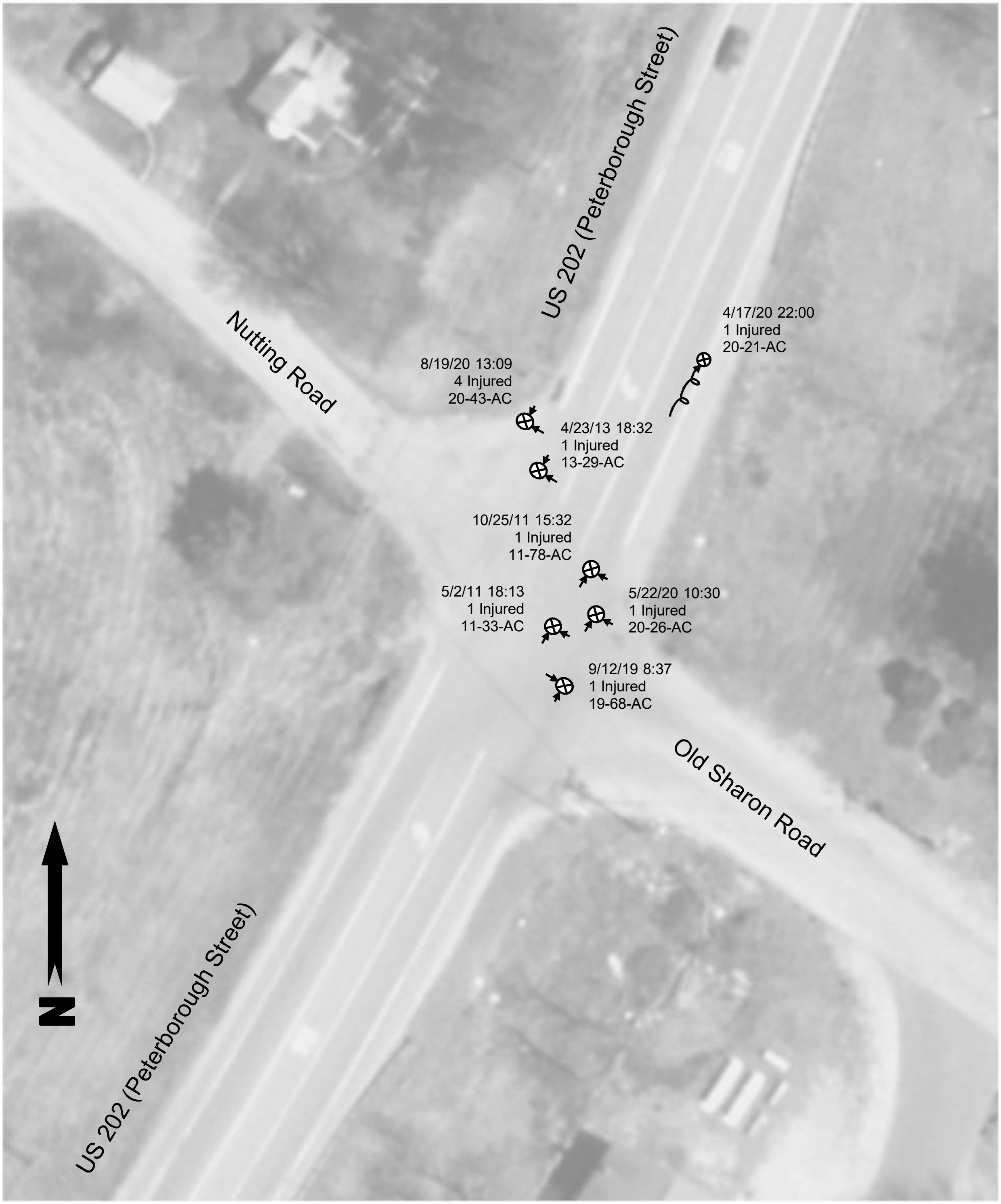
	PDO		INJ		FATAL			PDO		INJ		FATAL	
Head-on							Hit Object						
Rear end							Overturned						
Broadside							Out of Control						
Head-on Sideswipe							Hit Animal			Parked Veh.			
Overtaking Sideswipe							Backing Veh.			Pedestrian			
Overtaking Turn													

WEATHER		LIGHTING	
Clear		Daytime	
Cloudy		Dark	
Raining		Dusk	
Snowing			
Fog			
Wind			

EZplot©

<< TRAFFIC COLLISION DIAGRAM -- INTERSECTIONS >>

INTERSECTION TYPE	
2 Lanes only 2 Lanes only	
2 Lanes only 3 Lanes w / LTC	X
2 Lanes only 3 Lanes w / TWLTL	
3 Lanes w / LTC 3 Lanes w / LTC	
3 Lanes w / TWLTL 3 Lanes w / TWLTL	
3 Lanes w / LTC 4 Lanes only	
3 Lanes w / LTC 4 Lanes w / dual LTC	
4 Lanes only 4 Lanes only	
4 Lanes only 5 Lanes w / LTC	
4 Lanes only 6 Lanes w / dual LTC	
4 Lanes only 7 Lanes w / LTC	
5 Lanes w / LTC 5 Lanes w / LTC	
5 Lanes w / LTC 6 Lns w / dual LTC	
5 Lanes w / LTC 7 Lanes w / LTC	
6 Lanes w / dual LTC 6 Lanes w / dual LTC	
6 Lanes w / dual LTC 7 Lanes w / LTC	
7 Lanes w / LTC 7 Lanes w / LTC	
7 Lanes w / LTC 8 Lanes w / dual LTC	
8 Lanes w / dual LTC 8 Lanes w / dual LTC	
4 Ln div w / LTC&RTC 2 Lanes only	
4 Lns divided/ no LTC 2 Lanes only	
4 Ln div w / LTC 2 Lanes only	
4 Ln div w/ LTC&RTC 3 Lanes w / LTC	
4 Ln div w / LTC 4 Lanes only	
4 Ln div w/ LTC&RTC 4 Lanes only	
N	



DIST	COUNTY	ROUTE	POST MILES DESCRPTN.
4	Cheshire	US 202	North of MP 9.2

	PDO	INJ	FATAL		PDO	INJ	FATAL
Head-on				Hit Object			
Rear end				Overturned			
Broadside				Out of Control			
Head-on Sideswipe				Hit Animal		Parked Veh.	
Overtaking Sideswipe				Backing Veh.		Pedestrian	
Overtaking Turn							

WEATHER		LIGHTING	
Clear		Daytime	
Cloudy		Dark	
Raining		Dusk	
Snowing			
Fog			
Wind			

5.3 Appendix C – Conceptual Drawings

Appendix C includes the conceptual drawings for the near-term safety improvements, the two suggested intermediate improvements (an offset right turn lane and a traffic signal), as well as the long-term potential safety improvement of a roundabout.

Figure 1 – Near-Term Safety Improvements

Figure 2 – Intermediate-Term Safety Improvements: Offset Right Turn Lane

Figure 3 – Intermediate-Term Safety Improvements: Traffic Signal

Figure 4 – Long-Term Safety Improvements

SOURCE: AERIAL IMAGERY IS FROM GRANIT 2010. RIGHT-OF-WAY INFORMATION SHOWN IS FROM 1956 NHDOT RECORD PLANS AND TOWN OF JAFFREY TAX MAPS AND IS INTENDED FOR INFORMATIONAL PURPOSES ONLY.

FILENAME	092596_03genplans
MODEL NAME	ALT A
SCALE	AS SHOWN
DATE	AUGUST 2022
DESIGNED	JFMS
DRAWN	JFMS
CHECKED	SBH

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NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
JAFFREY 43407
RSA US 202\OLD SHARON ROAD\ NUTTING ROAD
NEAR-TERM SAFETY IMPROVEMENTS

PROJECT NO. 21.092596.03

FIGURE
1

8/12/2022
8:25:01 AM
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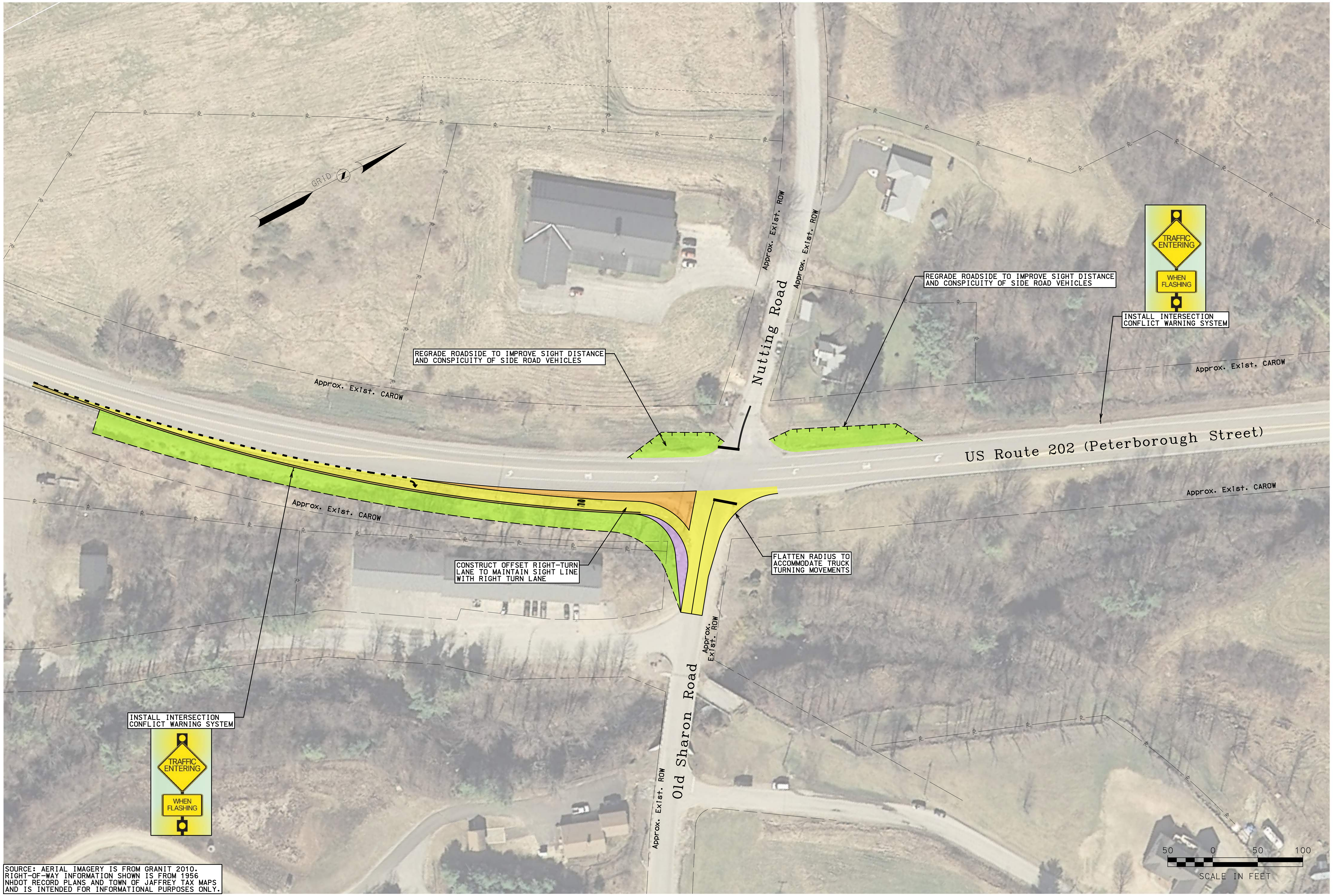

FILENAME	092596_03genplans
DESIGNED	JFMS
MODEL NAME	ALT B
DRAWN	JFMS
SCALE	AS SHOWN
CHECKED	SBH
DATE	AUGUST 2022

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NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
JAFFREY 43407

RSA US 202\OLD SHARON ROAD\ NUTTING ROAD

INTERMEDIATE-TERM SAFETY IMPROVEMENTS:
OFFSET RIGHT TURN LANE

PROJECT NO. 21.092596.03

FIGURE
2

8/12/2022
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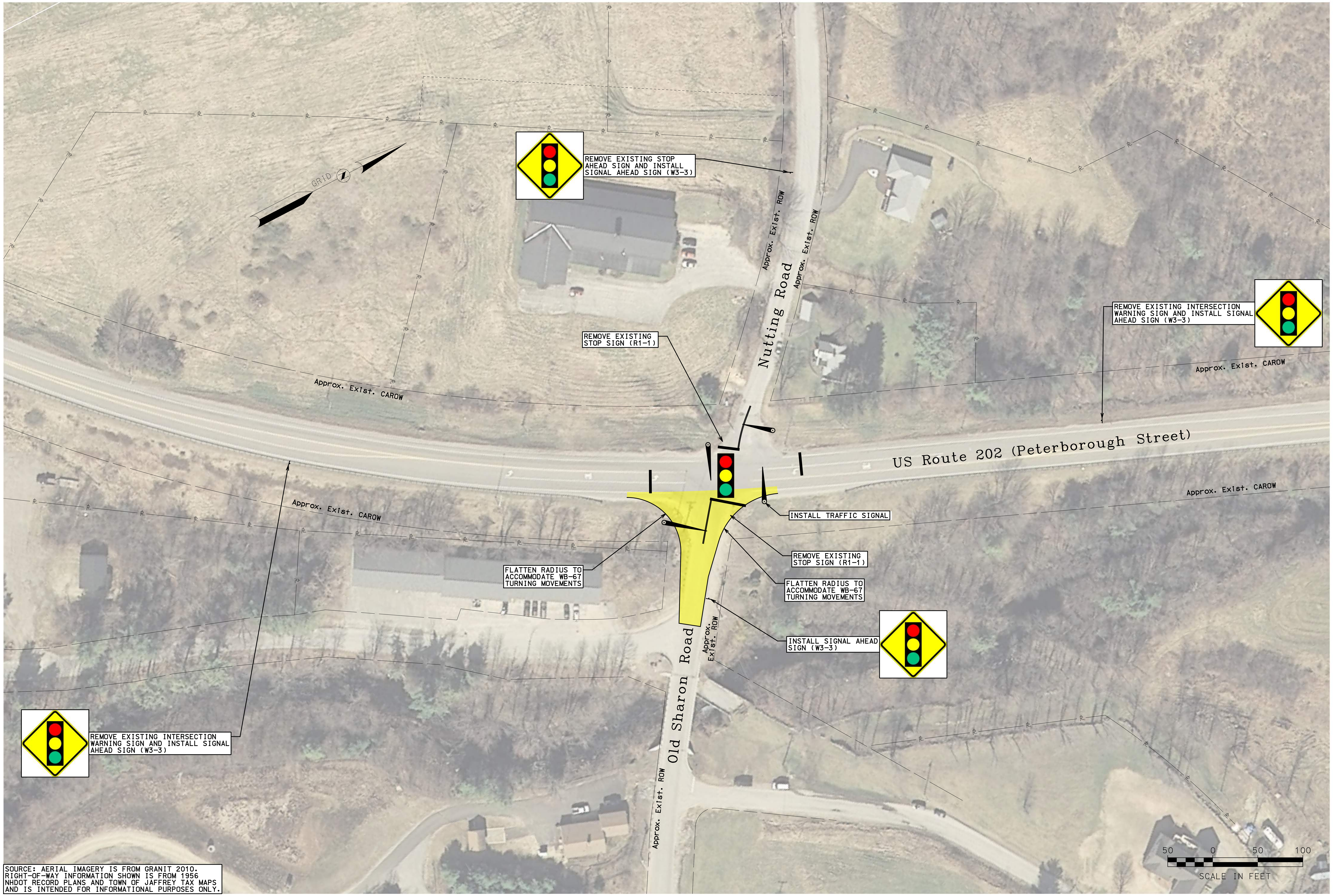

DESIGNED	JFMS
DRAWN	JFMS
CHECKED	SBH
FILENAME	092596_03genplans
MODEL NAME	ALT B OPT2
SCALE	AS SHOWN
DATE	AUGUST 2022

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NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
JAFFREY 43407

RSA US 202\OLD SHARON ROAD\ NUTTING ROAD
INTERMEDIATE-TERM SAFETY IMPROVEMENTS:
TRAFFIC SIGNAL

PROJECT NO. 21.092596.03

FIGURE
3

8/12/2022
8:25:28 AM
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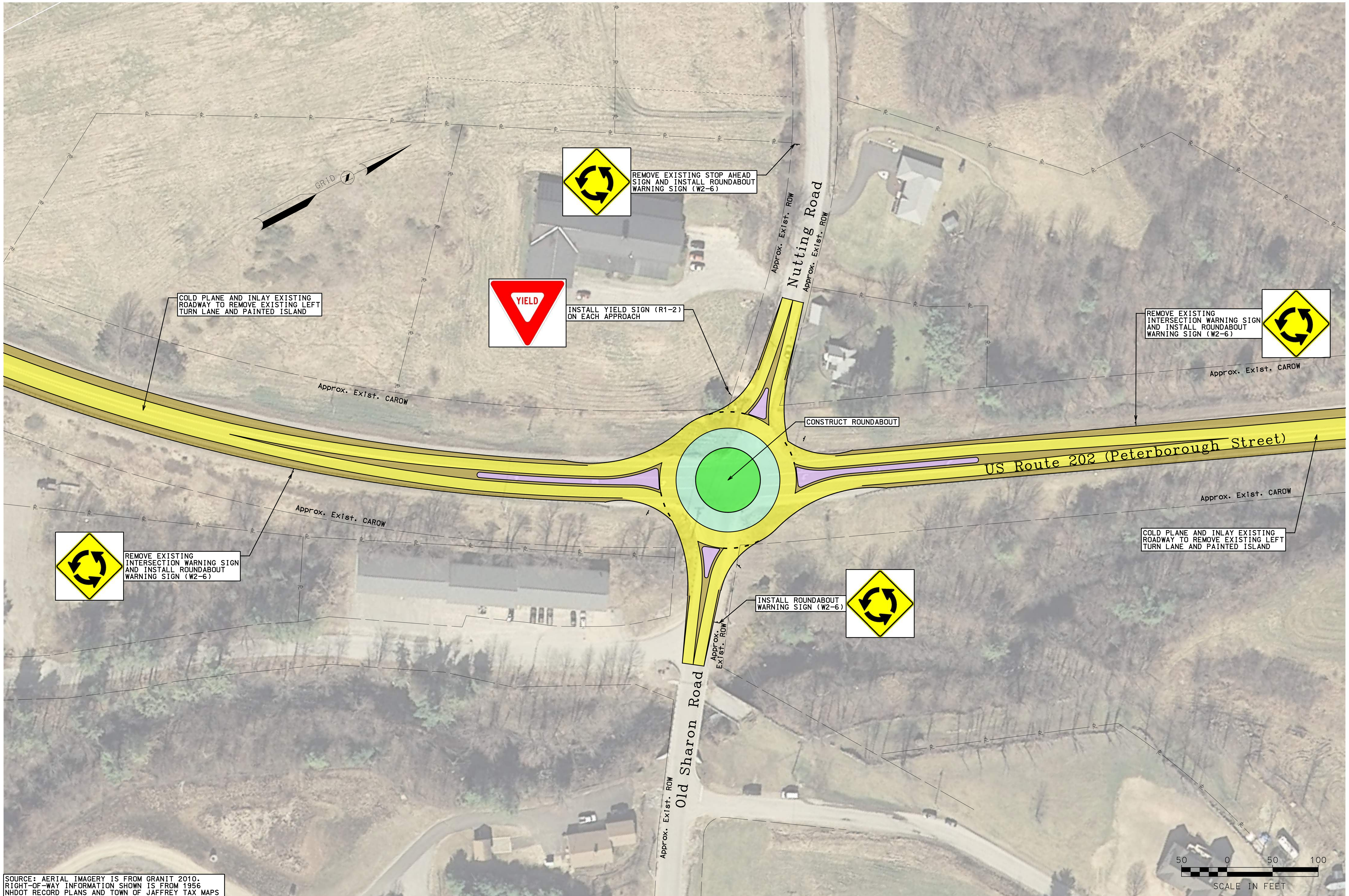

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MODEL NAME ALT C	DRAWN JFMS
SCALE AS SHOWN	CHECKED SBH
DATE AUGUST 2022	

HOYLE TANNER
150 Dow Street • Manchester, NH 03301
(603) 669-5555 • www.hoyletanner.com

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION
JAFFREY 43407

RSA US 202\OLD SHARON ROAD\ NUTTING ROAD

LONG-TERM SAFETY IMPROVEMENTS

PROJECT NO. 21.092596.03

FIGURE
4

FIGURE 4 OF 4

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5.4 Appendix D – Conceptual Cost Estimates

Conceptual cost estimates are included for the two intermediate measures and the long-term measure. The following table summarizes the estimated costs for each measure. The Offset Right Turn Lane improvement includes the Intersection Conflict Warning System.

Improvement	Preliminary Engineering	Right of Way	Construction	Total
Offset Right Turn Lane	$111,000	$15,000	$609,000	$735,000
Traffic Signal	$67,000	-	$371,000	$438,000
Roundabout	$307,000	$30,000	$1,684,000	$2,021,000

HOYLE TANNER

Project:	Jaffrey RSA		
Project No.	092596_03	NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd		
Task:	Conceptual Estimate: Int-Term: Offset Right Turn Lane		
Calculated By:	NAE	Date:	11/5/2021
Checked By:	JFMS	Date:	11/23/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

INTERMEDIATE-TERM SAFETY IMPROVEMENT: OFFSET RIGHT TURN LANE

SECTION A - MAJOR ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTIT	UNIT COST	COST
203.1	COMMON EXCAVATION	CY	1525	$ 20.00	$ 30,500.00
203.6	EMBANKMENT-IN-PLACE (F)	CY	3400	$ 20.00	$ 68,000.00
304.2	GRAVEL (F)	CY	485	$ 30.00	$ 14,550.00
304.3	CRUSHED GRAVEL (F)	CY	485	$ 35.00	$ 16,975.00
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	500	$ 100.00	$ 50,000.00
417	COLD PLANING BITUMINOUS SURFACES	SY	515	$ 4.00	$ 2,060.00
417.412	RUMBLE STRIPS, 12" WIDE	LF	650	$ 3.00	$ 1,950.00
606.18001	31" W-BEAM GUARDRAIL W/8" OFFSET BLOCK (STEEL POST)	LF	675	$ 32.00	$ 21,600.00
608.26	6" CONCRETE SIDEWALK	SY	35	$ 65.00	$ 2,275.00
609.01	STRAIGHT GRANITE CURB	SY	160	$ 30.00	$ 4,800.00
	MISCELLANEOUS ROADWAY		10% OF ABOVE TOTAL		$ 21,271.00
			SUBTOTAL A		**$ 233,981.00**

SECTION B - MISCELLANEOUS ITEMS

SIGNS, MARKINGS, LOAM/HUMUS, ETC.	10%		$ 23,398.10
	SUBTOTAL B		**$ 257,379.10**

SECTION C - DRAINAGE ITEMS

PIPES, UNDERDRAIN, CB's, MH's, ETC.	5%		$ 12,868.96
	SUBTOTAL C		**$ 270,248.06**

SECTION D - TRAFFIC CONTROL

ITEM NO.	DESCRIPTION	UNIT	QUANTIT	UNIT COST	COST
606.417	PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL		750	$ 20.00	$ 15,000.00
618.61	UNIFORMED OFFICERS WITH VEHICLE		27000	$ 1.00	$ 27,000.00
618.7	FLAGGERS		300	$ 45.00	$ 13,500.00
619.1	MAINTENANCE OF TRAFFIC		1	$ 25,000.00	$ 25,000.00
	MISCELLANEOUS TRAFFIC CONTROL		10% OF ABOVE TOTAL		$ 8,050.00
			SUBTOTAL D		**$ 358,798.06**

SECTION E - EROSION AND SEDIMENT CONTROL

EROSION, SEDIMENT, AND POLLUTION CONTROL (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL, ETC.)	30% OF DRAINAGE		$ 3,860.69
	SUBTOTAL E		**$ 362,658.74**

Project:	Jaffrey RSA		
Project No.	092596_03	NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd		
Task:	Conceptual Estimate: Int-Term: Offset Right Turn Lane		
Calculated By:	NAE	Date:	11/5/2021
Checked By:	JFMS	Date:	11/23/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

INTERMEDIATE-TERM SAFETY IMPROVEMENT: OFFSET RIGHT TURN LANE

SECTION F - MOBILIZATION AND CONTINGENCIES

ROADWAY MOBILIZATION	10%	$	36,265.87
ROADWAY CONTINGENCIES	15%	$	54,398.81
	SUBTOTAL F	$	453,323.43

SECTION G - ADDITIONAL ITEMS

Intersection Conflict Warning System		$	100,000.00
CONSTRUCTION ITEMS (CON)		$	553,323.43
CONSTRUCTION ENGINEERING (CE)	10%	$	55,332.34
RIGHT OF WAY ACQUISTION (ROW)		$	15,000.00
PRELIMINARY ENGINEERING (PE)	20%	$	110,664.69
PROJECT TOTAL COSTS (CON, CE, ROW, PE)		$	735,000.00

SEE ADDITIONAL SHEET FOR ASSUMPTIONS MADE WHILE COMPILING THIS ESTIMATE.

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Project:	Jaffrey RSA		
Project No.	092526_03	NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd		
Task:	Conceptual Estimate: Int-Term: Traffic Signal		
Calculated By:	NAE	Date:	11/5/2021
Checked By:	JFMS	Date:	11/23/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

INTERMEDIATE-TERM SAFETY IMPROVEMENT: TRAFFIC SIGNAL

SECTION A - MAJOR ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANT	UNIT COST	COST
203.1	COMMON EXCAVATION	CY	600	$ 20.00	$ 12,000.00
203.6	EMBANKMENT-IN-PLACE (F)	CY	220	$ 20.00	$ 4,400.00
304.2	GRAVEL (F)	CY	250	$ 30.00	$ 7,500.00
304.3	CRUSHED GRAVEL (F)	CY	235	$ 35.00	$ 8,225.00
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	250	$ 100.00	$ 25,000.00
417	COLD PLANING BITUMINOUS SURFACES	SY	150	$ 4.00	$ 600.00
	MISCELLANEOUS ROADWAY		10% OF ABOVE TOTAL		$ 5,772.50
			SUBTOTAL A		**$ 63,497.50**

SECTION B - MISCELLANEOUS ITEMS

SIGNS, MARKINGS, LOAM/HUMUS, ETC.	10%		$ 6,349.75
	SUBTOTAL B		**$ 69,847.25**

SECTION C - DRAINAGE ITEMS

PIPES, UNDERDRAIN, CB's, MH's, ETC.	5%		$ 3,492.36
	SUBTOTAL C		**$ 73,339.61**

SECTION D - TRAFFIC CONTROL

ITEM NO.	DESCRIPTION	UNIT	QUANT	UNIT COST	COST
618.61	UNIFORMED OFFICERS WITH VEHICLE	$	20000	$ 1.00	$ 20,000.00
618.7	FLAGGERS	HOUR	300	$ 45.00	$ 13,500.00
619.1	MAINTENANCE OF TRAFFIC	U	1	$ 20,000.00	$ 20,000.00
	MISCELLANEOUS TRAFFIC CONTROL		10% OF ABOVE TOTAL		$ 5,350.00
			SUBTOTAL D		**$ 132,189.61**

SECTION E - EROSION AND SEDIMENT CONTROL

EROSION, SEDIMENT, AND POLLUTION CONTROL (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL, ETC.)	30% OF DRAINAGE		$ 1,047.71
	SUBTOTAL E		**$ 133,237.32**

HOYLE TANNER

Project:	Jaffrey RSA		
Project No.	092526_03	NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd		
Task:	Conceptual Estimate: Int-Term: Traffic Signal		
Calculated By:	NAE	Date:	11/5/2021
Checked By:	JFMS	Date:	11/23/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

INTERMEDIATE-TERM SAFETY IMPROVEMENT: TRAFFIC SIGNAL

SECTION F - MOBILIZATION AND CONTINGENCIES			
ROADWAY MOBILIZATION	10%	$	13,323.73
ROADWAY CONTINGENCIES	15%	$	19,985.60
	SUBTOTAL F	$	166,546.65
SECTION G - ADDITIONAL ITEMS			
Traffic Signal		$	170,000.00
CONSTRUCTION ITEMS (CON)		$	336,546.65
CONSTRUCTION ENGINEERING (CE)	10%	$	33,654.67
RIGHT OF WAY ACQUISTION (ROW)		$	-
PRELIMINARY ENGINEERING (PE)	20%	$	67,309.33
PROJECT TOTAL COSTS (CON, CE, ROW, PE)		$	438,000.00

SEE ADDITIONAL SHEET FOR ASSUMPTIONS MADE WHILE COMPILING THIS ESTIMATE.

Project:	Jaffrey RSA
Project No.	092596_03
NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd
Task:	Conceptual Estimate: Long-Term: Roundabout
Calculated By:	NAE
Date:	11/5/2021
Checked By:	JFMS
Date:	11/18/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

LONG-TERM SAFETY IMPROVEMENT: ROUNDABOUT

SECTION A - MAJOR ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTI	UNIT COST	COST
203.1	COMMON EXCAVATION	CY	4350	$ 20.00	$ 87,000.00
203.6	EMBANKMENT-IN-PLACE (F)	CY	670	$ 20.00	$ 13,400.00
304.2	GRAVEL (F)	CY	1800	$ 30.00	$ 54,000.00
304.3	CRUSHED GRAVEL (F)	CY	1675	$ 35.00	$ 58,625.00
403.11	HOT BITUMINOUS PAVEMENT, MACHINE METHOD	TON	1700	$ 100.00	$ 170,000.00
417	COLD PLANING BITUMINOUS SURFACES	SY	6200	$ 4.00	$ 24,800.00
608.26	6" CONCRETE SIDEWALK (F)	SY	430	$ 65.00	$ 27,950.00
608.38	8" REINFORCED CONCRETE SIDEWALK (F)	SY	700	$ 85.00	$ 59,500.00
609.01	STRAIGHT GRANITE CURB	LF	1300	$ 30.00	$ 39,000.00
609.01187	STRAIGHT GRANITE CURB, 18" HIGH WITH 3" ROUNDED EDGE	LF	380	$ 65.00	$ 24,700.00
	MISCELLANEOUS ROADWAY		10% OF ABOVE TOTAL		$ 55,897.50
			SUBTOTAL A		**$ 614,872.50**

SECTION B - MISCELLANEOUS ITEMS

SIGNS, MARKINGS, LOAM/HUMUS, ETC.	10%		$ 61,487.25
	SUBTOTAL B		**$ 676,359.75**

SECTION C - DRAINAGE ITEMS

PIPES, UNDERDRAIN, CB's, MH's, ETC.	15%		$ 101,453.96
	SUBTOTAL C		**$ 777,813.71**

SECTION D - TRAFFIC CONTROL

ITEM NO.	DESCRIPTION	UNIT	QUANTI	UNIT COST	COST
606.417	PORTABLE CONCRETE BARRIER FOR TRAFFIC CONTROL	LF	500	$ 20.00	$ 10,000.00
618.61	UNIFORMED OFFICERS WITH VEHICLE	$	65000	$ 1.00	$ 65,000.00
618.7	FLAGGERS	HR	2100	$ 45.00	$ 94,500.00
619.1	MAINTENANCE OF TRAFFIC	LS	1	$ 100,000.00	$ 100,000.00
	MISCELLANEOUS TRAFFIC CONTROL		10% OF ABOVE TOTAL		$ 26,950.00
			SUBTOTAL D		**$ 1,074,263.71**

SECTION E - EROSION AND SEDIMENT CONTROL

EROSION, SEDIMENT, AND POLLUTION CONTROL (HAY BALES, SILT FENCE, SWPPP, TEMP. WATER POLL. CONTROL, ETC.)	30% OF DRAINAGE		$ 30,436.19
	SUBTOTAL E		**$ 1,104,699.90**

HOYLE TANNER

Project:	Jaffrey RSA		
Project No.	092596_03	NHDOT Project #:	43407
Location:	Intersection of US 202 @ Nutting Rd/Old Sharon Rd		
Task:	Conceptual Estimate: Long-Term: Roundabout		
Calculated By:	NAE	Date:	11/5/2021
Checked By:	JFMS	Date:	11/18/2021

CONCEPTUAL ESTIMATE - JAFFREY 43407 - RSA

LONG-TERM SAFETY IMPROVEMENT: ROUNDABOUT

SECTION F - MOBILIZATION AND CONTINGENCIES

ROADWAY MOBILIZATION	10%	$	110,469.99
ROADWAY CONTINGENCIES	15%	$	165,704.99
	SUBTOTAL F	$	1,380,874.88

SECTION G - ADDITIONAL ITEMS

BMP's		$	150,000.00
CONSTRUCTION ITEMS (CON)		$	1,530,874.88
CONSTRUCTION ENGINEERING (CE)	10%	$	153,087.49
RIGHT OF WAY ACQUISTION (ROW)		$	30,000.00
PRELIMINARY ENGINEERING (PE)	20%	$	306,174.98

PROJECT TOTAL COSTS (CON, CE, ROW, PE) $ 2,021,000.00

SEE ADDITIONAL SHEET FOR ASSUMPTIONS MADE WHILE COMPILING THIS ESTIMATE.

5.5 Appendix E – Benefit-Cost Analysis

5.5.1. Near-Term Improvements

Near-term improvements such as removing/mowing vegetation, painting road markings and installing signs can be implemented as part of routine maintenance and generally at a lower cost than intermediate or long-term improvements. Therefore, a detailed benefit-cost analysis was not done for near-term improvements.

5.5.2. Intermediate-Term Improvements

Detailed benefit-cost analysis was done for the two potential intermediate-term. A summary of that benefit-cost analysis is shown in the table below. A more detailed breakdown of the analysis can be found on the following pages.

<table>
<tr><th colspan="2">Improvements</th><th>Net Benefit</th><th>Total Cost</th><th>B/C Ratio</th></tr>
<tr><td rowspan="4">IWCS and Right Turn Lane</td><td>Install Intersection Conflict Warning System</td><td rowspan="4">$1,605,249</td><td rowspan="4">$735,000</td><td rowspan="4">3.18</td></tr>
<tr><td>Install Right Turn Lane</td></tr>
<tr><td>Regrade roadside adjacent to Nutting Road</td></tr>
<tr><td>Flatten radii on Old Sharon Road</td></tr>
<tr><td>Traffic Signal</td><td>Install Traffic Signal</td><td>$1,514,511</td><td>$438,000</td><td>4.46</td></tr>
</table>

5.5.3. Long-Term Improvements

Below is a summary of the benefit-cost analysis for the conversion of the current stop-controlled intersection into a roundabout. A more detailed breakdown of the analysis can be found on the following pages.

Improvements		Net Benefit	Total Cost	B/C Ratio
Roundabout	Install Roundabout	$2,121,650	$2,021,000	2.05

HSIP-Application (Rev 8/26/2018)
New Hampshire Department of Transportation
Highway Safety Improvement Program

New Hampshire DOT Department of Transportation

Project Towns:	Jaffrey	Project #:	43407

Highway Safety Improvement Program - Benefit / Cost Analysis

Date Rec'd (for office use only)

Name:	Stephen Haas	Agency:	Hoyle Tanner	Tel:	603-460-5168	Email:	shaas@hoyletanner.com
Street Address:	150 Dow Street	Cell:		Fax:		RPC Name:	SWRPC
Town, State, Zip	Manchester, NH 03101	Priority Rank: (if submitting 2+ applications this year)				Site submitted in past yrs?	

Site Type	NHDOT District	County	Major Road/Minor Road	Main-tenance	Traffic Control	MP Start/Major Rd SRI	MP End/Minor Rd SRI	Study Period Begins	Study Period Ends
INTERSECTION	D4	Cheshire	US 202/Nutting Road & Old Sharon Road	District	Minor Rd Stop				

Major Rd Funct Class	6-Rural Minor Arterial	Minor Rd Funct Class	9-Rural Local	Area Type	1-Rural	Federal System	0-NON NHS

Briefly Describe Problem and Proposed Work

Crash Data 2011-2020

Severity	Crash Type	Rear End	Sideswipe Same Direction	Left Turn	Right angle	Run off Road	Head On/ Sideswipe - Opposite	Pedestrian	Bicycle	Other	Total Related Crashes	Crash Severity Distribution
Fatal	K = 1									0		
Injury	A = 2				1	1				0	2	11.76%
	B = 3				2	1				0	3	17.65%
	C = 4			1	1					0	2	11.76%
PDO	U+N = 5+6				9	1				0	10	58.82%
	Total			1	13	3					17	100.00%

NOTE: For traffic data , please fill corresponding section for intersection and segment projects. Do not fill both traffic data sections.

Discount Rate (min rate of return): 3.0%

Traffic Data (Inter.)

Year	Enter. AADT	NB AADT	SB AADT	EB AADT	WB AADT	Other leg AADT	# of Approaches	Crash Rate (Intersection)	Critical Rate (Intersection)	Intersection Node	Traffic Annual Growth Rate
											0.01

Traffic Data (Segment)

Year		Sec 1	Sec 2	Sec 3	Sec 4	Sect 5	Total/ Average	Speed Limit (Average)	Crash Rate (Segment)
Segment Length (Mile)									
Average AADT								Lane Width (ft)	Critical Rate (Segment)
Number of Lanes									

Project location listed on the latest Transparency Report? (Y/N)

Improvement Action

Method for combining multiple CMFs

Number	Improvement Description	Service Life	CMF Fatal	CMF Injury	CMF PDO
1	Install Intersection Conflict Warning System (CMF #8438)	20	0.73	0.73	0.73
2	Install Right Turn Lane (CMF #285)	20	0.86	0.86	0.86
3	Regrade roadside adjacent to Nutting Road (CMF estimate)	20	0.90	0.90	0.90
4	Flatten radii on Old Sharon Road (CMF estimate)	20	0.95	0.95	0.95
Total		20	0.54	0.54	0.54

Project Cost Information

PE cost plus $5000 (2)	R/W Utility	Construction	Improvement Initial Cost	Annual Maintenance
$ 111,000	$ 15,000	$ 609,000	$ 735,000	
			$ -	
			$ -	
			$ -	
Total Initial Cost	$ 735,000		$ 735,000	$ -

Project Schedule (After STIP Approval)	Begin PE	Target Advert.	Begin Construction	Estimated Complete Date	Type of Plan

Project Administered by

Economic Evaluation

Benefit	Traffic Growth Factor (TGF)	Present Value of Safety Benefits	Cost	Present Value of Project Costs
	1.11	$ 2,340,249		$ 735,000

Benefit Cost Ratio	3.18
Net Benefit	$ 1,605,249
Annual KA Crash Reduction	0.10

Project Benefit Information

Crash Severity	Societal Crash Cost	Related Crashes	Annual Crash Reduction	Estimated Annual Benefit
K	$ 15,130,940	0	-	$ -
A	$ 815,777	2	0.10	$ 83,976
B	$ 251,167	3	0.15	$ 38,783
C	$ 138,585	2	0.10	$ 14,266
PDO	$ 8,623	10	0.51	$ 4,438
Total		17	0.87	$ 141,463

Duration of crash study=> 9 years

HSIP-Application (Rev 8/26/2018) New Hampshire Department of Transportation Highway Safety Improvement Program	New Hampshire DOT Department of Transportation	Project Towns: Jaffrey	Project #: 43407

Highway Safety Improvement Program - Benefit / Cost Analysis

Date Rec'd (for office use only)

Name:	Stephen Haas	Agency:	Hoyle Tanner	Tel:	603-460-5168	Email:	shaas@hoyletanner.com
Street Address:	150 Dow Street	Cell:		Fax:		RPC Name:	SWRPC
Town, State, Zip	Manchester, NH 03101	Priority Rank: (if submitting 2+ applications this year)				Site submitted in past yrs?	

Site Type	NHDOT District	County	Major Road/Minor Road	Main-tenance	Traffic Control	MP Start/Major Rd SRI	MP End/Minor Rd SRI	Study Period Begins	Study Period Ends
INTERSECTION	D4	Cheshire	US 202/Nutting Road & Old Sharon Road	District	Minor Rd Stop				

Major Rd Funct Class	6-Rural Minor Arterial	Minor Rd Funct Class	9-Rural Local	Area Type	1-Rural	Federal System	0-NON NHS

Briefly Describe Problem and Proposed Work:

Crash Data 2011-2020	Severity \ Crash Type		Rear End	Sideswipe Same Direction	Left Turn	Right angle	Run off Road	Head On/ Sideswipe - Opposite	Pedestrian	Bicycle	Other	Total Related Crashes	Crash Severity Distribution
	Fatal	K = 1									0		
	Injury	A = 2				1 1	1				0	2	11.76%
		B = 3				2	1				0	3	17.65%
		C = 4			1	1					0	2	11.76%
	PDO	U+N = 5+6				9	1				0	10	58.82%
		Total			1	13	3					17	100.00%

NOTE: For traffic data , please fill corresponding section for intersection and segment projects. Do not fill both traffic data sections.

Discount Rate (min rate of return): 3.0%

Traffic Data (Inter.)	Year	Enter. AADT	NB AADT	SB AADT	EB AADT	WB AADT	Other leg AADT	# of Approaches	Crash Rate (Intersection)	Critical Rate (Intersection)	Intersection Node	Traffic Annual Growth Rate
												0.01

Traffic Data (Segment)		Sec 1	Sec 2	Sec 3	Sec 4	Sect 5	Total/ Average	Speed Limit (Average)	Crash Rate (Segment)
	Year								
	Segment Length (Mile)								
	Average AADT							Lane Width (ft)	Critical Rate (Segment)
	Number of Lanes								

Project location listed on the latest Transparency Report? (Y/N)

Method for combining multiple CMFs:

Project Cost Information

Improvement Action	Number	Improvement Description	Service Life	CMF Fatal	CMF Injury	CMF PDO	PE cost plus $5000 (2)	R/W Utility	Construction	Improvement Initial Cost	Annual Maintenance
	1	Install signal (CMF #7984)	20	0.60	0.60	1.00	$ 67,000	$ -	$ 371,000	$ 438,000	
	2									$ -	
	3									$ -	
	4									$ -	
	Total		20	0.60	0.60	1.00	Total Initial Cost	$ 438,000		$ 438,000	$ -

	Project Schedule (After STIP Approval)	Begin PE	Target Advert.	Begin Construction	Estimated Complete Date	Type of Plan
Project Administered by						

Economic Evaluation	Benefit	Traffic Growth Factor (TGF)	Present Value of Safety Benefits	Cost	Present Value of Project Costs
		1.11	$ 1,952,511		$ 438,000
	Benefit Cost Ratio		**4.46**		
	Net Benefit		**$ 1,514,511**		
	Annual KA Crash Reduction		**0.09**		

Project Benefit Information

Crash Severity	Societal Crash Cost	Related Crashes	Annual Crash Reduction	Estimated Annual Benefit
K	$ 15,130,940	0	-	$ -
A	$ 815,777	2	0.09	$ 72,332
B	$ 251,167	3	0.13	$ 33,405
C	$ 138,585	2	0.09	$ 12,288
PDO	$ 8,623	10	-	$ -
Total		17	0.31	$ 118,025

Duration of crash study=> 9 years

HSIP-Application (Rev 8/26/2018) New Hampshire Department of Transportation Highway Safety Improvement Program	New Hampshire DOT Department of Transportation	Project Towns: **Jaffrey**	Project #: **43407**

Highway Safety Improvement Program - Benefit / Cost Analysis

Date Rec'd (for office use only)

Name:	**Stephen Haas**	Agency:	**Hoyle Tanner**	Tel:	**603-460-5168**	Email:	shaas@hoyletanner.com
Street Address:	**150 Dow Street**	Cell:		Fax:		RPC Name:	**SWRPC**
Town, State, Zip	**Manchester, NH 03101**	Priority Rank: (if submitting 2+ applications this year)				Site submitted in past yrs?	

Site Type	NHDOT District	County	Major Road/Minor Road	Main-tenance	Traffic Control	MP Start/Major Rd SRI	MP End/Minor Rd SRI	Study Period Begins	Study Period Ends
INTERSECTION	D4	Cheshire	US 202/Nutting Road & Old Sharon Road	District	Minor Rd Stop				

Major Rd Funct Class	6-Rural Minor Arterial	Minor Rd Funct Class	9-Rural Local	Area Type	1-Rural	Federal System	0-NON NHS

Briefly Describe Problem and Proposed Work

Crash Data 2011-2020

Severity		Rear End	Sideswipe Same Direction	Left Turn	Right angle	Run off Road	Head On/ Sideswipe - Opposite	Pedestrian	Bicycle	Other	Total Related Crashes	Crash Severity Distribution
Fatal	K = 1									0		
Injury	A = 2				1 1	1				0	2	11.76%
	B = 3				2	1				0	3	17.65%
	C = 4			1	1					0	2	11.76%
PDO	U+N = 5+6				9	1				0	10	58.82%
	Total			1	13	3					17	100.00%

NOTE: For traffic data , please fill corresponding section for intersection and segment projects. Do not fill both traffic data sections.

Discount Rate (min rate of return): 3.0%

Traffic Data (Inter.)

Year	Enter. AADT	NB AADT	SB AADT	EB AADT	WB AADT	Other leg AADT	# of Approaches	Crash Rate (Intersection)	Critical Rate (Intersection)	Intersection Node	Traffic Annual Growth Rate
											0.01

Traffic Data (Segment)

		Sec 1	Sec 2	Sec 3	Sec 4	Sect 5	Total/ Average	Speed Limit (Average)	Crash Rate (Segment)
Year									
Segment Length (Mile)									
Average AADT								Lane Width (ft)	Critical Rate (Segment)
Number of Lanes									

Project location listed on the latest Transparency Report? (Y/N)

Improvement Action

Method for combining multiple CMFs

Number	Improvement Description	Service Life	CMF Fatal	CMF Injury	CMF PDO
1	Install Roundabout (CMF #211)	20	0.18	0.18	0.18
2					
3					
4					
Total		20	0.18	0.18	0.18

Project Cost Information

PE cost plus $5000 (2)	R/W Utility	Construction	Improvement Initial Cost	Annual Maintenance
$ 307,000	$ 30,000	$ 1,684,000	$ 2,021,000	
			$ -	
			$ -	
			$ -	
Total Initial Cost	$ 2,021,000		$ 2,021,000	$ -

Project Schedule (After STIP Approval)	Begin PE	Target Advert.	Begin Construction	Estimated Complete Date	Type of Plan

Project Administered by

Economic Evaluation

Benefit	Traffic Growth Factor (TGF)	Present Value of Safety Benefits	Cost	Present Value of Project Costs
	1.11	$ 4,142,650		$ 2,021,000

Benefit Cost Ratio	**2.05**
Net Benefit	**$ 2,121,650**
Annual KA Crash Reduction	**0.18**

Project Benefit Information

Crash Severity	Societal Crash Cost	Related Crashes	Annual Crash Reduction	Estimated Annual Benefit
K	$ 15,130,940	0	-	$ -
A	$ 815,777	2	0.18	$ 148,653
B	$ 251,167	3	0.27	$ 68,652
C	$ 138,585	2	0.18	$ 25,253
PDO	$ 8,623	10	0.91	$ 7,857
Total		17	1.55	$ 250,415

Duration of crash study=> **9 years**

5.6 Appendix F – Traffic Signal Warrant Analysis

The traffic signal warrant analysis prepared by Hoyle, Tanner can be found on the following pages

HOYLE TANNER

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MEMO

To:	**Michael J. Dugas – NHDOT State Highway Safety Engineer**
From:	**Stephen B. Haas – Hoyle, Tanner Project Manager**
Date:	**7/25/2022**
Re:	**Jaffrey (43407) – Signal Warrant Analysis**

The project is located at the intersection of US 202, Old Sharon Road, and Nutting Road in Jaffrey.

A Road Safety Audit was performed at the project location in 2021 during which several safety concerns including excessive travel speeds, significant heavy vehicle volumes, and restrictions or conflicts to sight visibility were observed. The project is intended to provide potential alternatives to improve safety. The alternatives range from near-term improvements for markings, signage, and illumination, to long-term improvements such as conversion to a signalized intersection or roundabout. To confirm the appropriateness of the traffic signal alternative, a signal warrant analysis has been performed based on the guidelines in Chapter 4 of the Manual on Uniform Traffic Control Devices (MUTCD), 2009.

Using field data and turning movement counts provided by the Bureau of Traffic (collected on 12/7/21) and others, the following observations, notes, and assumptions were made.

1. The Jaffrey Police Department recorded speed data at the intersection in September 2021. It was found that the 85th percentile speed was 55 mph and 63 mph for eastbound and westbound traffic respectively.
2. The highest traffic volumes occur during the PM Peak, with the westbound volumes being the higher of the major approaches. For the AM Peak, the eastbound traffic volume is significantly higher than the westbound.
3. The 2020 US Census reported the population of Jaffrey to be 5,320.
4. A 1% annual growth was assumed for traffic volumes.
5. The major approaches, eastbound and westbound, both have left turn pockets however the left turn volumes on those approaches make up such a limited portion of the total approach volume that the approaches should be modeled as single lane.

In order to evaluate the signal warrants as efficiently as possible, a right turn reduction warrant analysis was performed for the AM Peak Hour, PM Peak Hour, 4th Highest Hour, and 8th Highest Hour, each in both 2024 and 2044, using the guidance of NCHRP Report 457 – Evaluating Intersection Improvements: An Engineering Study Guide. The warrant indicated in all cases that the signal warrant analysis should include scenarios using the adjusted minor road volumes.

The signal warrants were evaluated using the following two scenarios and assuming a single lane on all approaches:

Scenario 1 –Assuming 70% volume due to the 85th percentile speeds of 55 mph and 63 mph (over the 40-mph threshold) and as a “built up area of an isolated community having a population of less than 10,000”. This scenario does not take into account any right turn reductions.

Scenario 2 – Assuming 70% volume due to the 85th percentile speeds of 55 mph and 63 mph (over the 40-mph threshold) and as a “built up area of an isolated community having a population of less than 10,000”. This scenario does take into account right turn reductions.

In 2024, the potential opening year, Scenario 1 meets Warrant 2, the Four-Hour Vehicular Volumes Warrant, but does not meet Warrant 1 (Eight-Hour Vehicular Volumes) or Warrant 3 (Peak Hour). Scenario 2, with the right turn reductions, does not meet any of these 3 warrants in 2024. Growing the traffic volumes to 2044, with 1% annual growth, both Scenarios 1 and 2 satisfy all 3 warrants. Iterations were performed to determine when Scenario 2 meets the various warrants. It was found that Scenario 2 is expected to meet Warrant 1 in 2027, Warrant 2 in 2026, and Warrant 3 in 2030. As Scenario 2 is believed to be the appropriate conditions for analysis, its results are summarized in the table below.

	Met in 2024?	Met in 2044?	Approx. Year Met[1]
Warrant 1: 8-Hour Volume	No	Yes	2027
Warrant 2: 4-Hour Volume	No	Yes	2026
Warrant 3: Peak Hour	No	Yes	2030

1.Year Met determined through volume iteration with Synchro Warrant 10 software. Warrant 2 & 3 Year Met also confirmed graphically.

Table 1 - Warrant Analysis Summary using Right-Turn Reduced Volumes

In conclusion, even accounting for right turn reduction of the minor approaches, the intersection of US 202, Old Sharon Road, and Nutting Road is expected to experience traffic volumes that meet the requirements for installation of a traffic signal within the next 5 years for all vehicular volume-based warrants.

HOYLE TANNER

PROJECT NO.	21.092596.03	SHEET 1 OF 4	
PROJECT DESCRIPTION	Road Safety Audit - Jaffrey, NH		
TASK	Signal Warrant Analysis - Right Turn Reduction Check		
CALCULATED BY	JFMS	DATE	7/25/2022
CHECKED BY	SBH	DATE	7/25/22

CLIENT PROJECT NO. 43407

2024 AM Peak Hour

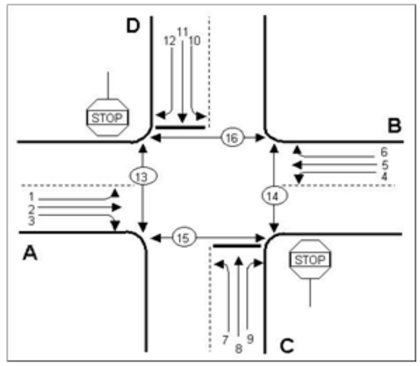
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

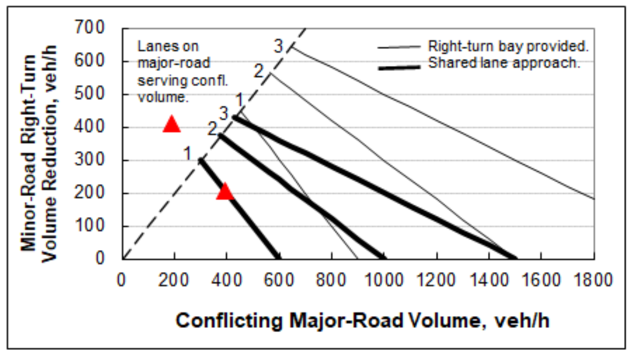
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	375
	3	Right	40
Major B	5	Through	185
	6	Right	5
Minor C	7	Left	40
	8	Through	5
	9	Right	10
Minor D	10	Left	20
	11	Through	5
	12	Right	10

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	395
Conflicting major-road volume (V_{c12}), veh/h:	188
Right-turn volume reduction (V_{r9}), veh/h:	205
Right-turn volume reduction (V_{r12}), veh/h:	413
Adjusted right-turn volume reduction (V_{r9}), veh/h:	10
Adjusted right-turn volume reduction (V_{r12}), veh/h:	10
Adjusted minor-road volume, veh/h:	45
Guidance:	**Conduct warrant check again using adjusted minor road volume.**





2044 AM Peak Hour

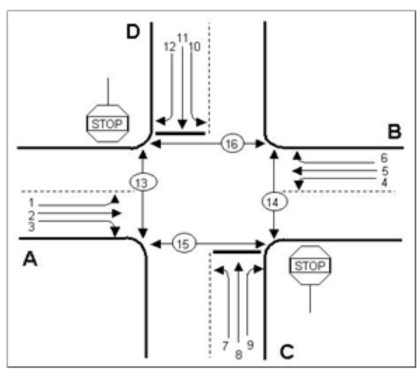
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

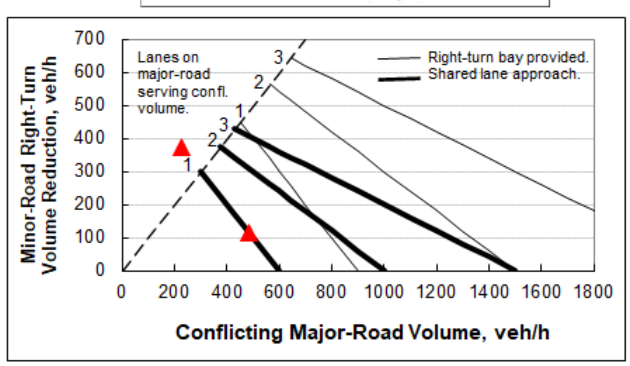
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	460
	3	Right	50
Major B	5	Through	225
	6	Right	5
Minor C	7	Left	50
	8	Through	5
	9	Right	15
Minor D	10	Left	25
	11	Through	5
	12	Right	15

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	485
Conflicting major-road volume (V_{c12}), veh/h:	228
Right-turn volume reduction (V_{r9}), veh/h:	115
Right-turn volume reduction (V_{r12}), veh/h:	373
Adjusted right-turn volume reduction (V_{r9}), veh/h:	15
Adjusted right-turn volume reduction (V_{r12}), veh/h:	15
Adjusted minor-road volume, veh/h:	55
Guidance:	**Conduct warrant check again using adjusted minor road volume.**





PROJECT NO.	21.092596.03	SHEET	2 OF 4
PROJECT DESCRIPTION	Road Safety Audit - Jaffrey, NH		
TASK	Signal Warrant Analysis - Right Turn Reduction Check		
CALCULATED BY	JFMS	DATE	7/25/2022
CHECKED BY	SBH	DATE	7/25/22

CLIENT PROJECT NO. 43407

2024 PM Peak Hour

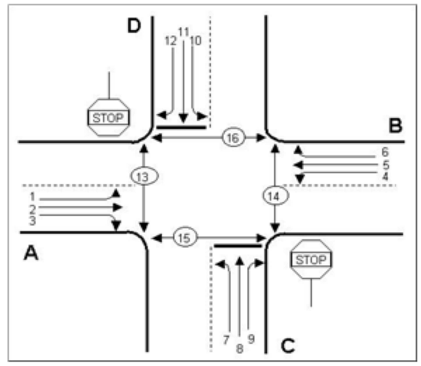
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

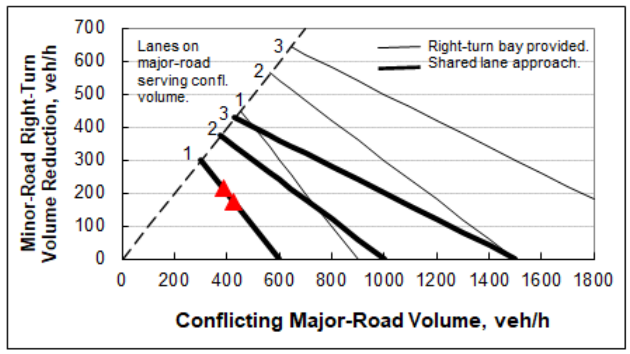
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	360
	3	Right	50
Major B	5	Through	415
	6	Right	20
Minor C	7	Left	80
	8	Through	5
	9	Right	15
Minor D	10	Left	15
	11	Through	10
	12	Right	15

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	385
Conflicting major-road volume (V_{c12}), veh/h:	425
Right-turn volume reduction (V_{r9}), veh/h:	215
Right-turn volume reduction (V_{r12}), veh/h:	175
Adjusted right-turn volume reduction (V_{r9}), veh/h:	15
Adjusted right-turn volume reduction (V_{r12}), veh/h:	15
Adjusted minor-road volume, veh/h:	85
Guidance: **Conduct warrant check again using adjusted minor road volume.**	





2044 PM Peak Hour

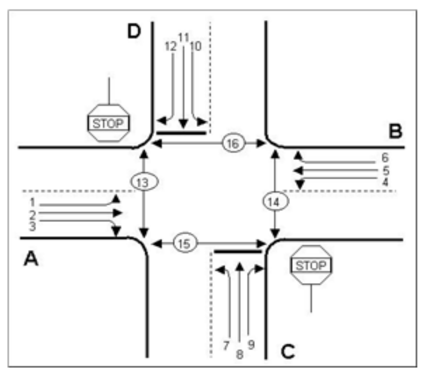
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

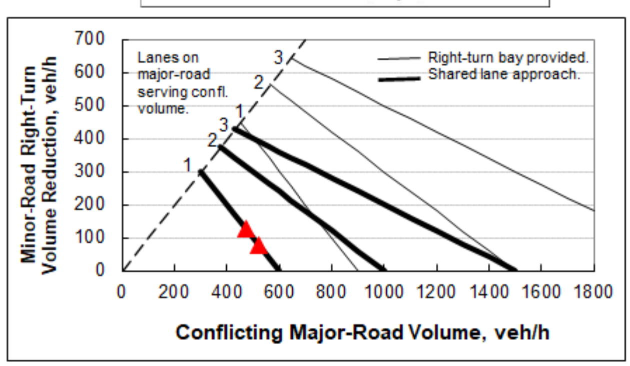
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	440
	3	Right	65
Major B	5	Through	510
	6	Right	25
Minor C	7	Left	100
	8	Through	5
	9	Right	20
Minor D	10	Left	20
	11	Through	15
	12	Right	20

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	473
Conflicting major-road volume (V_{c12}), veh/h:	523
Right-turn volume reduction (V_{r9}), veh/h:	128
Right-turn volume reduction (V_{r12}), veh/h:	78
Adjusted right-turn volume reduction (V_{r9}), veh/h:	20
Adjusted right-turn volume reduction (V_{r12}), veh/h:	20
Adjusted minor-road volume, veh/h:	105
Guidance: **Conduct warrant check again using adjusted minor road volume.**	





HOYLE TANNER

CLIENT PROJECT NO. 43407

PROJECT NO. 21.092596.03 SHEET 3 OF 4

PROJECT DESCRIPTION Road Safety Audit - Jaffrey, NH

TASK Signal Warrant Analysis - Right Turn Reduction Check

CALCULATED BY JFMS DATE 7/25/2022

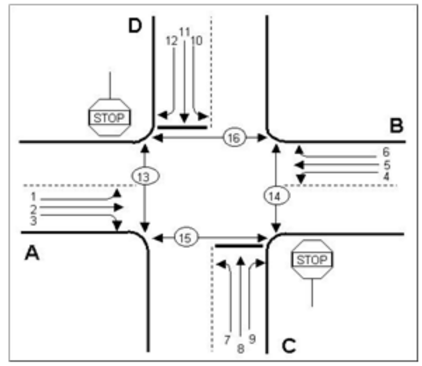
CHECKED BY SBH DATE 7/25/22

2024 4th Highest Hour

Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

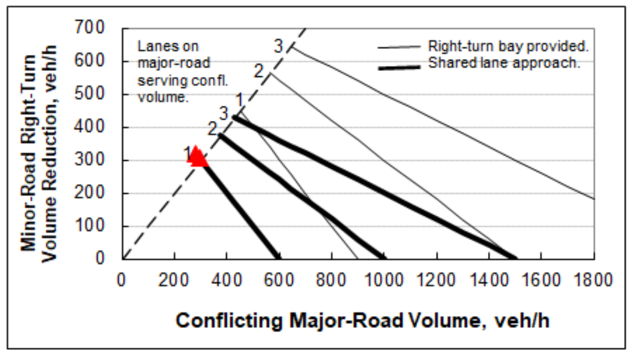
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	260
	3	Right	70
Major B	5	Through	275
	6	Right	15
Minor C	7	Left	75
	8	Through	10
	9	Right	20
Minor D	10	Left	10
	11	Through	20
	12	Right	5



OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	295
Conflicting major-road volume (V_{c12}), veh/h:	283
Right-turn volume reduction (V_{r9}), veh/h:	305
Right-turn volume reduction (V_{r12}), veh/h:	318
Adjusted right-turn volume reduction (V_{r9}), veh/h:	20
Adjusted right-turn volume reduction (V_{r12}), veh/h:	5
Adjusted minor-road volume, veh/h:	85
Guidance: Conduct warrant check again using adjusted minor road volume.	

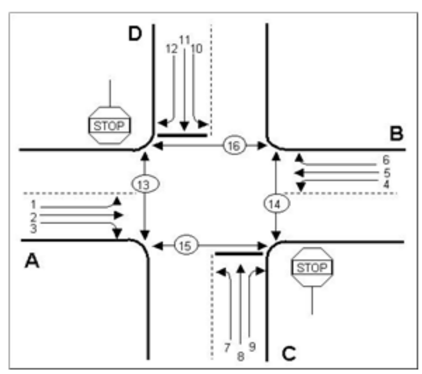


2044 4th Highest Hour

Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

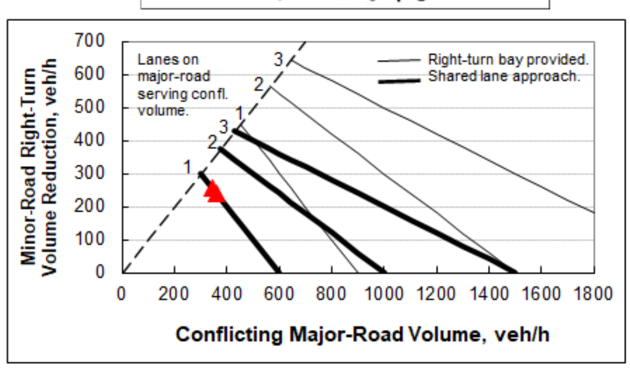
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	Number	Movement	Volume
Major A	2	Through	315
	3	Right	90
Major B	5	Through	335
	6	Right	20
Minor C	7	Left	95
	8	Through	15
	9	Right	25
Minor D	10	Left	15
	11	Through	25
	12	Right	5



OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	360
Conflicting major-road volume (V_{c12}), veh/h:	345
Right-turn volume reduction (V_{r9}), veh/h:	240
Right-turn volume reduction (V_{r12}), veh/h:	255
Adjusted right-turn volume reduction (V_{r9}), veh/h:	25
Adjusted right-turn volume reduction (V_{r12}), veh/h:	5
Adjusted minor-road volume, veh/h:	110
Guidance: Conduct warrant check again using adjusted minor road volume.	



PROJECT NO.	21.092596.03	SHEET 4	OF 4
PROJECT DESCRIPTION	Road Safety Audit - Jaffrey, NH		
TASK	Signal Warrant Analysis - Right Turn Reduction Check		
CALCULATED BY	JFMS	DATE	7/25/2022
CHECKED BY	SBH	DATE	7/25/22

HOYLE TANNER

CLIENT PROJECT NO. 43407

2024 8th Highest Hour

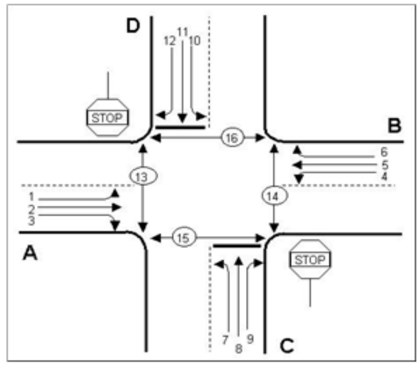
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

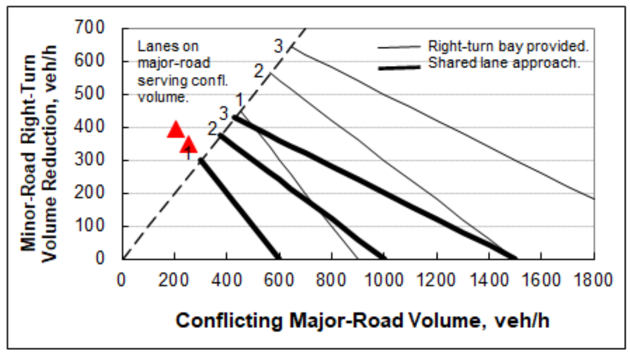
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	**Number**	**Movement**	**Volume**
Major A	2	Through	220
	3	Right	65
Major B	5	Through	205
	6	Right	5
Minor C	7	Left	65
	8	Through	10
	9	Right	20
Minor D	10	Left	10
	11	Through	20
	12	Right	5

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	253
Conflicting major-road volume (V_{c12}), veh/h:	208
Right-turn volume reduction (V_{r9}), veh/h:	348
Right-turn volume reduction (V_{r12}), veh/h:	393
Adjusted right-turn volume reduction (V_{r9}), veh/h:	20
Adjusted right-turn volume reduction (V_{r12}), veh/h:	5
Adjusted minor-road volume, veh/h:	75
Guidance:	**Conduct warrant check again using adjusted minor road volume.**





2044 8th Highest Hour

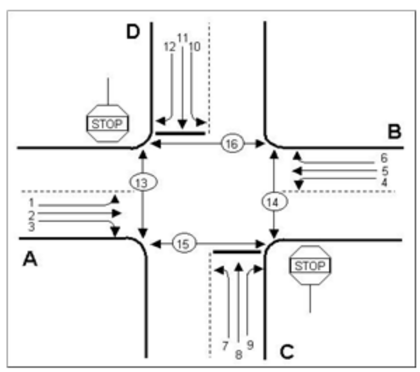
Figure 2 - 11. Minor-road right-turn volume reduction for warrant check.

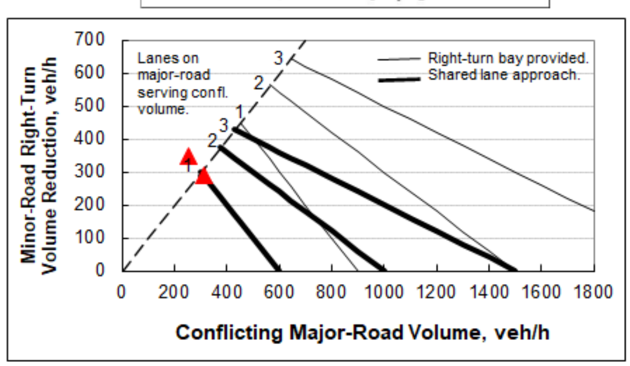
INPUT

Number of lanes on major-road approach:			1
Right-turn geometry on minor-road:			Shared-lane approach
Approach	**Number**	**Movement**	**Volume**
Major A	2	Through	270
	3	Right	80
Major B	5	Through	250
	6	Right	5
Minor C	7	Left	80
	8	Through	15
	9	Right	25
Minor D	10	Left	15
	11	Through	25
	12	Right	5

OUTPUT

Variable	Value
Conflicting major-road volume (V_{c9}), veh/h:	310
Conflicting major-road volume (V_{c12}), veh/h:	253
Right-turn volume reduction (V_{r9}), veh/h:	290
Right-turn volume reduction (V_{r12}), veh/h:	348
Adjusted right-turn volume reduction (V_{r9}), veh/h:	25
Adjusted right-turn volume reduction (V_{r12}), veh/h:	5
Adjusted minor-road volume, veh/h:	95
Guidance:	**Conduct warrant check again using adjusted minor road volume.**





Warrants Summary Report
1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024

Intersection Information

	Major Street	**Minor Street**
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant	**Met?**	**Notes**
Warrant 1, Eight-Hour Vehicular Volume		
	No	
Condition A or B Met?	No	7 Hours met (8 required)
Condition A and B Met?	No	7 Hours met (8 required)
Warrant 2, Four-Hour Vehicular Volume		
	Yes	5 Hours met (4 required)
Warrant 3, Peak Hour		
	No	
Condition A Met?	No	0 Hours met (1 required)
Condition B Met?	No	0 Hours met (1 required)

Warrant 1: Eight-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024

Intersection Information

Major Street Name:	US 202 WB
Major Street Direction:	EB/WB
Minor Street Direction:	NB/SB

WARRANT 1 MET? No

Details:

Condition A Met?	No	7 Hours met (8 required)
Condition B Met?	No	7 Hours met (8 required)

Hour	Major Street Vehicles (Total of Both Approaches)	High Volume Minor Approach Vehicles	70% Standard Met? Cond. A OR Cond. B: Condition A 70% Column	Condition B 70% Column	56% Standard Met? Cond. A AND Cond. B: Condition A 56% Column	Condition B 56% Column
06:00 to 07:00	270	20	No	No	No	No
06:15 to 07:15	310	15	No	No	No	No
06:30 to 07:30	390	15	No	No	No	No
06:45 to 07:45	455	15	No	No	No	No

06:00 to 07:00

	Major Street Vehicles		High Volume Minor Approach Vehicles	
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No
	Volume >= 56% column (280)?	No	Volume >= 56% column (420)?	No
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No

The text displayed here is incorrect but the yes/no result is accurate. The 70% condition should be 105 and the 56% condition 84. (Typical for all of Warrant 1)

06:15 to 07:15

	Major Street Vehicles		High Volume Minor Approach Vehicles	
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No

06:30 to 07:30

	Major Street Vehicles		High Volume Minor Approach Vehicles	
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No

06:45 to 07:45

	Major Street Vehicles		High Volume Minor Approach Vehicles	
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No

Warrant 2: Four-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024

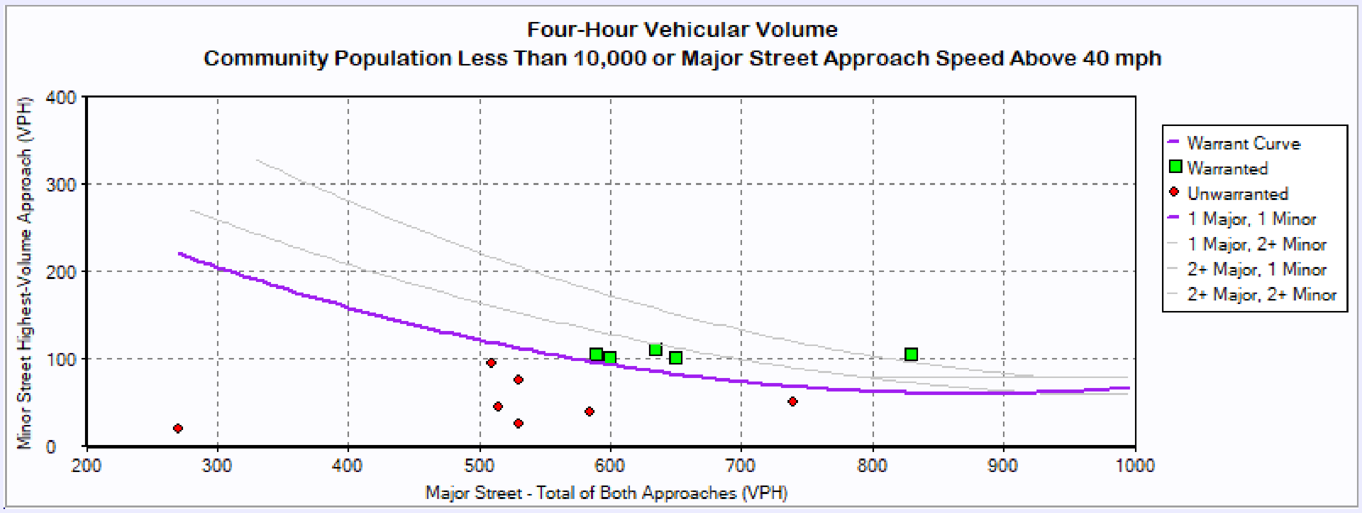
Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant 2 Met? **Yes**

Details:

Notes	5 Hours met (4 required)
Low population	Yes



Warrant 3: Peak Hour

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

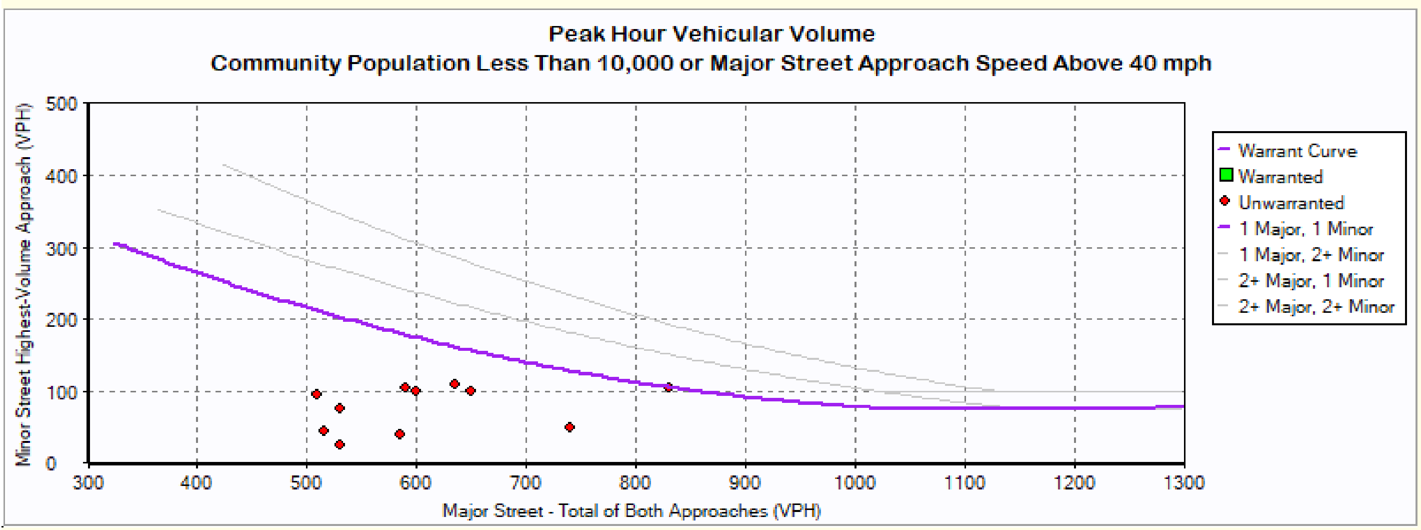
Warrant 3 Met? No

Details

Low Population? Yes

Condition A Met?	No	**Condition B Met?**	No
Notes	0 Hours met (1 required)	**Notes**	0 Hours met (1 required)

Minor Approach Time Delay Condition Met?	Not Met
Minor Approach Volume Condition Met?	Met
Total Entering Intersection Volume Condition Met?	Not Met



Warrants Summary Report

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024, Minor RT Removed

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant	Met?	Notes
Warrant 1, Eight-Hour Vehicular Volume		70% Condition B is met in 2027
	No	
Condition A or B Met?	No	7 Hours met (8 required)
Condition A and B Met?	No	4 Hours met (8 required)
Warrant 2, Four-Hour Vehicular Volume		
	No	3 Hours met (4 required)
		Is met in 2026
Warrant 3, Peak Hour		
	No	
Condition A Met?	No	0 Hours met (1 required)
Condition B Met?	No	0 Hours met (1 required)
		Is met in 2030

Warrant 1: Eight-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024, Minor RT Removed

Intersection Information

Major Street Name:	US 202 WB
Major Street Direction:	EB/WB
Minor Street Direction:	NB/SB

WARRANT 1 MET? **No**

Details:

Condition A Met?	No	7 Hours met (8 required)
Condition B Met?	No	4 Hours met (8 required)

Hour	Major Street Vehicles (Total of Both Approaches)		High Volume Minor Approach Vehicles		70% Standard Met? Cond. A OR Cond. B: Condition A 70% Column	Condition B 70% Column	56% Standard Met? Cond. A AND Cond. B: Condition A 56% Column	Condition B 56% Column
06:00 to 07:00	**270**		**15**		No	No	No	No
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	No	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:15 to 07:15	**310**		**10**		No	No	No	No
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:30 to 07:30	**390**		**15**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:45 to 07:45	**455**		**15**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No				

The text displayed here is incorrect but the yes/no result is accurate. The 70% condition should be 105 and the 56% condition 84. (Typical for all of Warrant 1)

Warrant 2: Four-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2024, Minor RT Removed

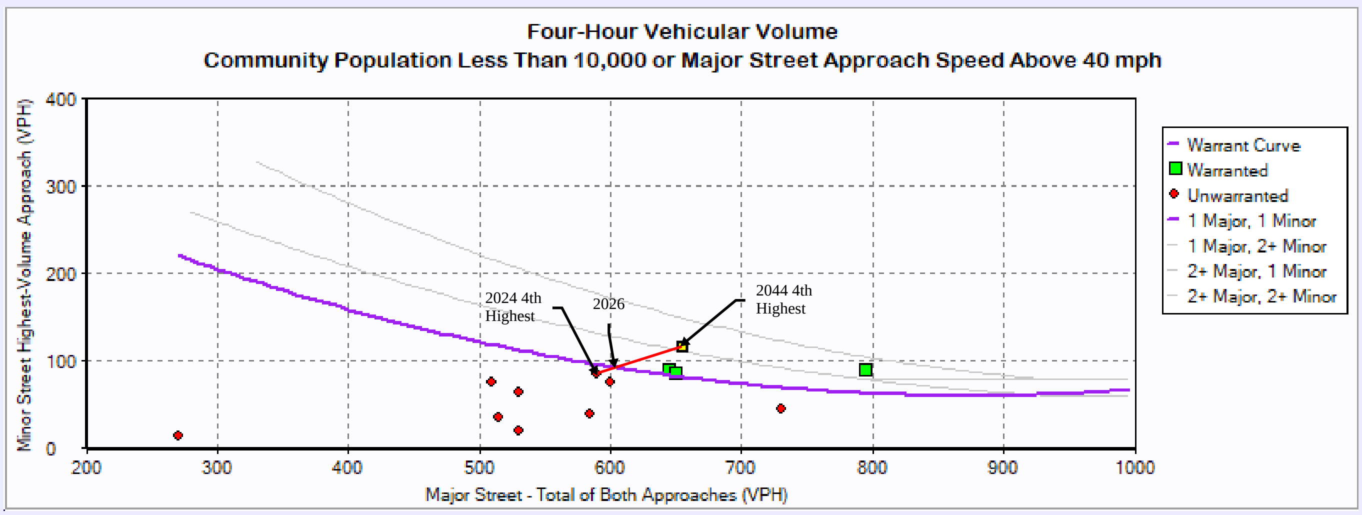
Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant 2 Met? No

Details:

Notes	3 Hours met (4 required)
Low population	Yes



Warrant 3: Peak Hour

1: Jaffrey RSA

Jaffrey (43407)

Warrant Analysis: 2024, Minor RT Removed

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

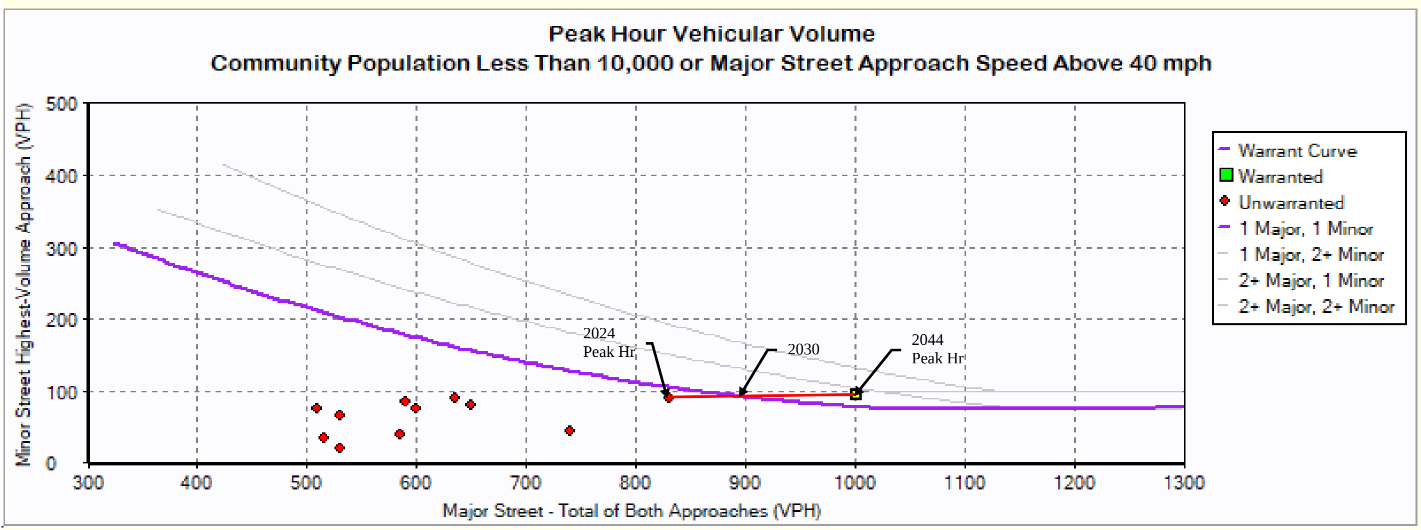
Warrant 3 Met? No

Details

Low Population? Yes

Condition A Met?	No	**Condition B Met?**	No
Notes	0 Hours met (1 required)	**Notes**	0 Hours met (1 required)

Minor Approach Time Delay Condition Met?	Not Met
Minor Approach Volume Condition Met?	Met
Total Entering Intersection Volume Condition Met?	Not Met



Warrants Summary Report

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant	Met?	Notes
Warrant 1, Eight-Hour Vehicular Volume		
	Yes	
Condition A or B Met?	Yes	10 Hours met (8 required)
Condition A and B Met?	No	7 Hours met (8 required)
Warrant 2, Four-Hour Vehicular Volume		
	Yes	8 Hours met (4 required)
Warrant 3, Peak Hour		
	Yes	
Condition A Met?	No	0 Hours met (1 required)
Condition B Met?	Yes	5 Hours met (1 required)

Warrant 1: Eight-hour Vehicular Volume
1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044

Intersection Information

Major Street Name:	US 202 WB
Major Street Direction:	EB/WB
Minor Street Direction:	NB/SB

WARRANT 1 MET? Yes

Details:

Condition A Met?	Yes	10 Hours met (8 required)
Condition B Met?	No	7 Hours met (8 required)

Hour	Major Street Vehicles (Total of Both Approaches)		High Volume Minor Approach Vehicles		70% Standard Met? Cond. A OR Cond. B: Condition A 70% Column	Condition B 70% Column	56% Standard Met? Cond. A AND Cond. B: Condition A 56% Column	Condition B 56% Column
06:00 to 07:00	**325**		**30**		No	No	No	No
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:15 to 07:15	**390**		**35**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:30 to 07:30	**490**		**35**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No				
06:45 to 07:45	**575**		**35**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	Yes	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No				

The text displayed here is incorrect but the yes/no result is accurate. The 70% condition should be 105 and the 56% condition 84. (Typical for all of Warrant 1)

Warrant 2: Four-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044

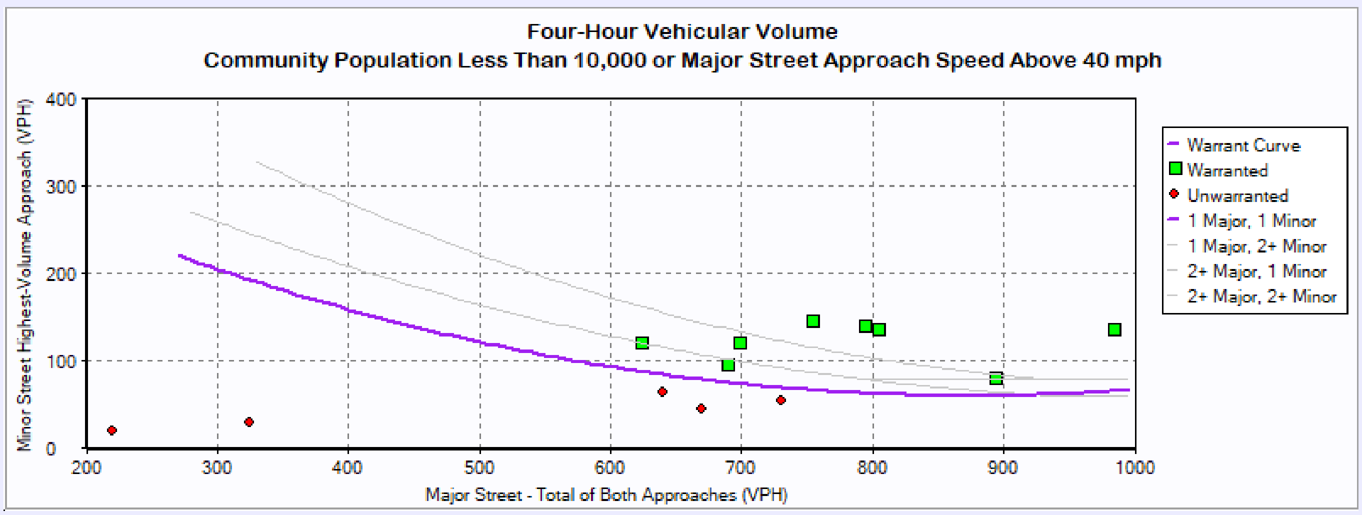
Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant 2 Met? **Yes**

Details:

Notes	8 Hours met (4 required)
Low population	Yes



Warrant 3: Peak Hour

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

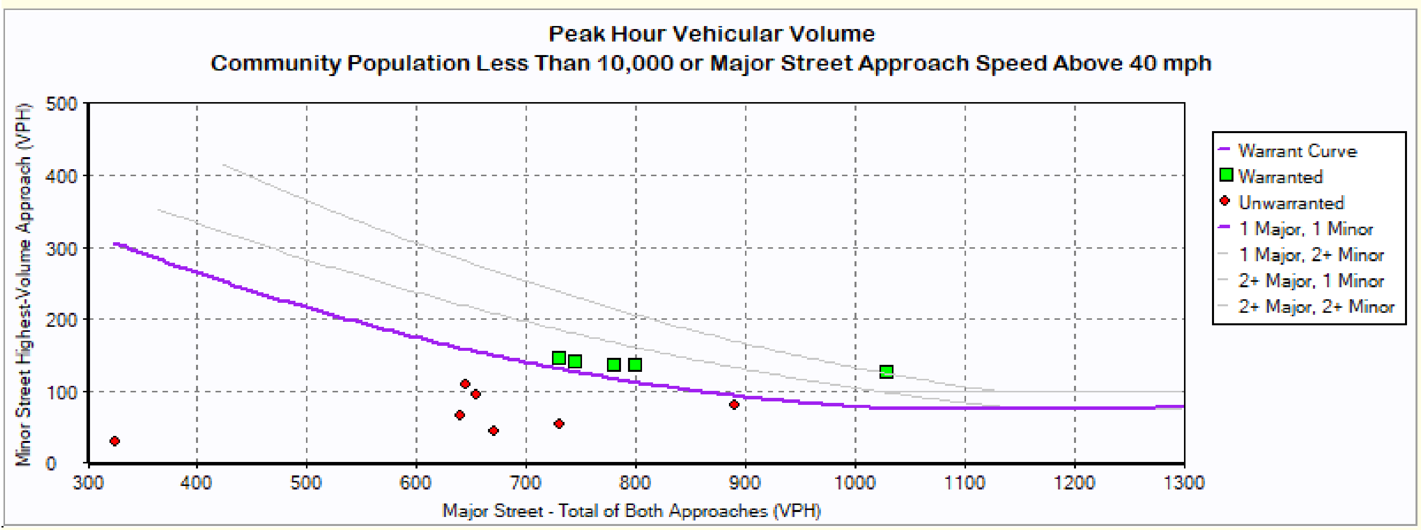
Warrant 3 Met? Yes

Details

Low Population? Yes

Condition A Met?	No	**Condition B Met?**	Yes
Notes	0 Hours met (1 required)	**Notes**	5 Hours met (1 required)

Minor Approach Time Delay Condition Met?	Not Met
Minor Approach Volume Condition Met?	Met
Total Entering Intersection Volume Condition Met?	Not Met



Warrants Summary Report

1: Jaffrey RSA

Jaffrey (43407)

Warrant Analysis: 2044, Minor RT Removed

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant	Met?	Notes
Warrant 1, Eight-Hour Vehicular Volume		
	Yes	
Condition A or B Met?	Yes	8 Hours met (8 required)
Condition A and B Met?	No	7 Hours met (8 required)
Warrant 2, Four-Hour Vehicular Volume		
	Yes	8 Hours met (4 required)
Warrant 3, Peak Hour		
	Yes	
Condition A Met?	No	0 Hours met (1 required)
Condition B Met?	Yes	2 Hours met (1 required)

Warrant 1: Eight-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044, Minor RT Removed

Intersection Information

Major Street Name:	US 202 WB
Major Street Direction:	EB/WB
Minor Street Direction:	NB/SB

WARRANT 1 MET? Yes

Details:

Condition A Met?	Yes	8 Hours met (8 required)
Condition B Met?	No	7 Hours met (8 required)

Hour	Major Street Vehicles (Total of Both Approaches)		High Volume Minor Approach Vehicles		70% Standard Met? Cond. A OR Cond. B: Condition A 70% Column	Condition B 70% Column	56% Standard Met? Cond. A AND Cond. B: Condition A 56% Column	Condition B 56% Column
06:00 to 07:00	**325**		**25**		No	No	No	No
Condition A	Volume >= 70% column (350)?	No	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:15 to 07:15	**390**		**25**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	No	**Volume >= 56% column (42)?**	No				
06:30 to 07:30	**490**		**25**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	No	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No				
06:45 to 07:45	**575**		**20**		No	No	No	No
Condition A	Volume >= 70% column (350)?	Yes	Volume >= 70% column (525)?	No				
	Volume >= 56% column (280)?	Yes	Volume >= 56% column (420)?	No				
Condition B	**Volume >= 70% column (525)?**	Yes	**Volume >= 70% column (53)?**	No				
	Volume >= 56% column (420)?	Yes	**Volume >= 56% column (42)?**	No				

The text displayed here is incorrect but the yes/no result is accurate. The 70% condition should be 105 and the 56% condition 84. (Typical for all of Warrant 1)

Warrant 2: Four-hour Vehicular Volume

1: Jaffrey RSA

Jaffrey (43407)
Warrant Analysis: 2044, Minor RT Removed

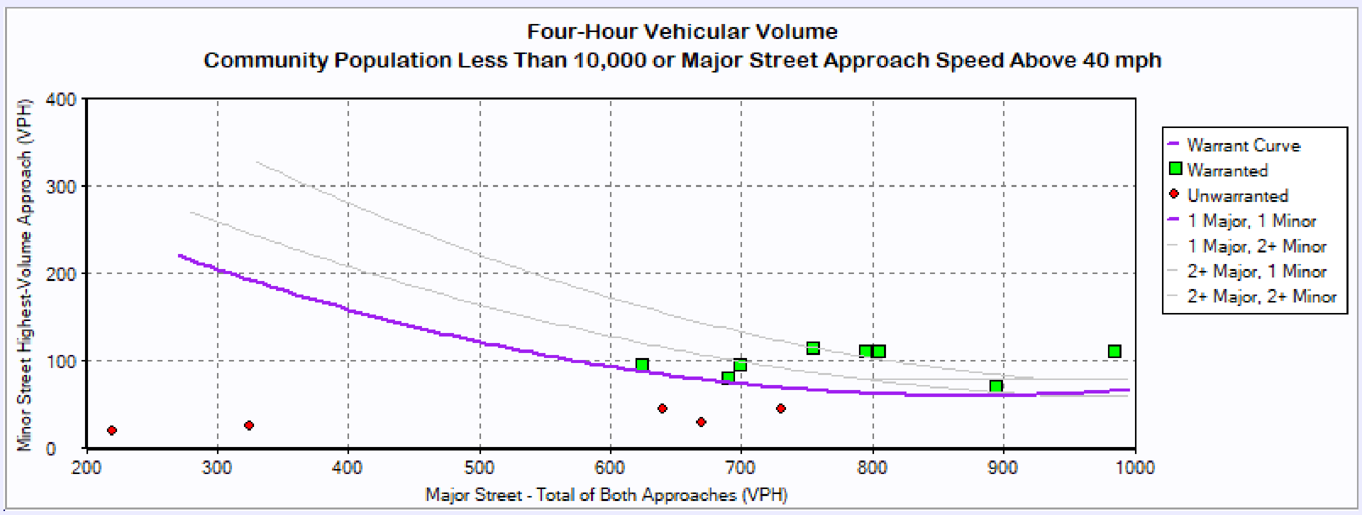
Intersection Information

	Major Street	**Minor Street**
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

Warrant 2 Met? Yes

Details:

Notes	8 Hours met (4 required)
Low population	Yes



Warrant 3: Peak Hour

1: Jaffrey RSA

Jaffrey (43407)

Warrant Analysis: 2044, Minor RT Removed

Intersection Information

	Major Street	Minor Street
Street Name	US 202 WB	Nutting Rd
Direction	EB/WB	NB/SB
Number of Lanes	1	1
Approch Speed	50	35

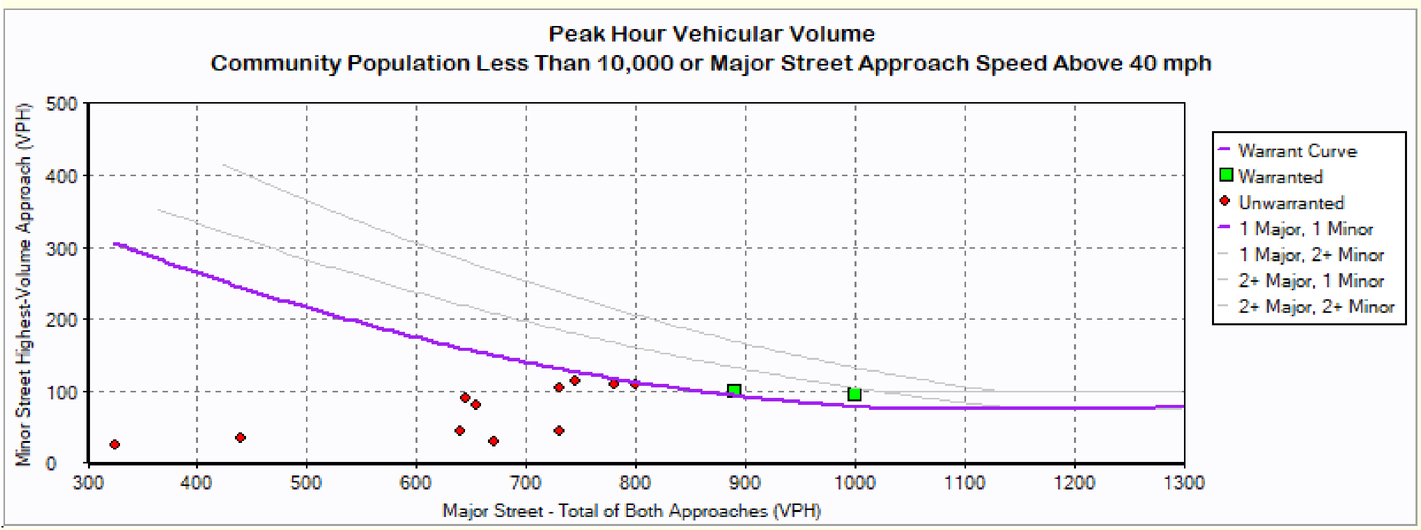
Warrant 3 Met? Yes

Details

Low Population? Yes

Condition A Met?	No	**Condition B Met?**	Yes
Notes	0 Hours met (1 required)	**Notes**	2 Hours met (1 required)

Minor Approach Time Delay Condition Met?	Not Met
Minor Approach Volume Condition Met?	Met
Total Entering Intersection Volume Condition Met?	Not Met



5.7 Appendix G – RSA Presentation – Observations & Potential Improvements

The slides from the RSA presentation containing the Observations (Pros & Cons) and the Potential Improvements identified by the RSA team can be found on the following pages

Town of Jaffrey Road Safety Audit

Intersection of US 202 (Peterborough Street) with Nutting Road and Old Sharon Road

September 10, 2021

Recap Field Review

- Observations:
  - Pros:
    - Wide ROW
    - Horizontal and vertical geometry are good
    - Pavement condition is good
    - Signage is good
    - Sight distance is adequate
  - Cons:
    - No pavement markings on side roads
    - No platforms for vehicles on side roads
    - Poor visibility of vehicles stopped on Nutting Rd from US 202
    - Heavy truck traffic
    - High speed vehicles using left turn lane to bypass right-turning vehicles
    - Large vehicles encroach on other lanes for most turning movements
    - Tight pavement radii in and out of Old Sharon Road

Recap Field Review

- Potential Improvements:
  - Short Term
    - Stop Ahead sign on Old Sharon Road
    - Stop bars on both side roads
    - Increase lighting at the intersection
    - Mow more frequently adjacent to Nutting Road
    - Rumble strips or zones
  - Intermediate Term
    - Right turn lane (possibly offset)
    - Flatter radii in and out of Old Sharon Road
    - Regrade roadside adjacent to Nutting Road
    - Intersection Conflict Warning System
    - Traffic signal
    - Speed adjustment/reduction
  - Long Term
    - Roundabout

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