St. Albans
STP 044-1(2)

VT-104 & SASH / Exit 19
Intersection Scoping Study

July 2024

VERMONT
AGENCY OF TRANSPORTATION

TOWN OF St. Albans VERMONT CHARTERED 1763

VHB

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1. INTRODUCTION & BACKGROUND

The town of St. Albans and surrounding communities in northwest Vermont are some of the fastest growing areas in the region. As the population, employment, and recreational opportunities have developed, so has traffic growth and congestion.

As a primary gateway to the area, the I-89 Exit 19 / St. Albans State Highway (SASH) & VT Route 104 intersection in the town of St. Albans has been identified by the Vermont Agency of Transportation (VTrans) and the Northwest Regional Planning Commission (NRPC) as an area with high traffic congestion and safety issues.

FIGURE 1. Project Area Map

The intersection has been studied for improvement for years, with minor improvements installed to maximize intersection capacity. In 2002, the NRPC prepared a Scoping Study to identify the most appropriate improvement alternative for the intersection. By 2003, traffic conditions had deteriorated such that VTrans installed a temporary traffic signal. In 2009, the southbound VT-104 approach was widened to provide additional storage capacity for the southbound left-turn movement. At the same time, the 2002 study was updated and the previous analysis and results were confirmed. As this most recent study reexamines the intersection, VTrans is preparing to construct a new westbound right-turn lane and signal changes to further maximize the efficiency of the existing signal.

Since 2002, a roundabout intersection has been selected as the preferred alternative to provide long-term safety and traffic capacity improvements at the intersection. However, the preferred alternative has not yet been implemented. Continued traffic growth, high crash rates, and development of the surrounding area necessitate a reassessment of the previous planning efforts to finally implement the long-term traffic solution at this intersection. To assist in developing such a plan, WCG has been engaged to refresh the previous Scoping Study efforts and reevaluate a preferred alternative.

With funding from VTrans, this Scoping Report follows the Project Definition Process Guidebook to update the previous scoping efforts for the development and selection of a preferred alternative with input from stakeholders, local and state officials, residents of the community, and regional partners.

2. EXISTING CONDITIONS

The VT-104 & SASH / Exit 19 intersection is a regionally important transportation node, providing a critical link between the communities in northwest Vermont to I-89. The intersection carries a high volume of passenger, freight, and transit traffic, and is on a primary access route to the Northwestern Medical Center hospital campus. The intersection is a gateway to both the town and city of St. Albans.

The high volume of traffic on the adjacent roadways form a transportation barrier for bicycle and pedestrian travel. The intersection is a natural crossing point for people walking and biking to cross the street. The nearby adjacent land use is a mix between commercial, retail, residential, and recreation, indicating a high demand (potentially unrealized) for walk and bike access through the intersection.

In addition to the existing land use, several large tracts of undeveloped land have potential for significant development, further increasing the vehicle, transit, bicycle and pedestrian travel demands through the intersection.

ROADWAY RESOURCES

Table 1 summarizes the roadway characteristics for each approach to the intersection.

Roadway Characteristic	Northbound VT-104	Southbound VT-104	Eastbound SASH	Westbound Exit 19
Design Speed	40 MPH	40 MPH	50 MPH	50 MPH
Functional Classification	urban major collector	urban major collector	urban principal arterial	urban principal arterial
Traffic Volume: 2023 AADT (vpd)	10,430	3,940	7,190	13,990
Traffic Volume: 2023 DHV (vph)	1,200	490	790	1,500
Clear Zone	16 feet	14 feet	16 feet	16 feet
Right of Way	99 feet (49.5 feet 200 feet south of intersection)	99 feet (49.5 feet 200 feet south of intersection)	200 feet	200 feet
Approach Lane Assignment and Width (feet)	S-L-TR-S 1-12-12-2	S-L-TR-S 1-10-12-2	S-L-TR-S 3-12-12-5	S-L-TR-S 2-13-14-2
Sight Distance	305 feet	305 feet	425 feet	425 feet

AADT = Estimated average annual daily traffic in vehicles per day
DHV = Estimated design hour volume in vehicles per hour
L = left turn lane, TR = shared through / right turn lane, S = paved shoulder

TABLE 1. Summary of roadway characteristics by approach to the study intersection

Design Speed

Posted speed limits in the immediate vicinity of this intersection are 50 mph on SASH and 40 mph on VT-104.

Functional Classification

The I-89 Exit 19 ramps and SASH are both limited-access urban principal arterials; VT-104 is an urban major collector.

Traffic Volumes

Approximately 2,250 vehicles currently (2025) travel through this intersection during the afternoon peak hour on a peak day. It is estimated that by the year 2045, approximately 2,700 vehicles will be traveling through the intersection during the afternoon peak hour with just normal background growth.

Horizontal and Vertical Alignment

Both the SASH and VT-104 are relatively level and straight in the vicinity of the intersection. The two roadways intersect at nearly 90-degrees. East of the intersection, the Exit 19 ramps have significant curvature. The ramps have been designed according to interstate highway standards to accommodate the free flowing, high-speed traffic expected on on- and off-ramps.

Clear Zone

The Vermont State Design Standards recommended clear zone for new construction and reconstruction projects on uncurbed urban principal arterials with volumes such as those on the SASH is 24 feet for fill slopes. Volumes on the VT-104 south of the intersection warrant a 14-foot clear zone on fill slopes. Volumes north of the intersection warrant a 16-foot clear zone.

Where necessary to avoid or minimize disturbance to historic, archaeological, scenic, natural or other resources, the clear zone can be reduced to 10 feet without a design exception. On curbed principal arterials and collector streets, a 1.5-foot horizontal offset to obstructions from the face of the curb should be provided. This dimension should be increased to three feet near turning radii at intersections.

Right of Way

Available right-of-way (ROW) information indicates that the SASH appears to have a 200-foot-wide ROW, and VT-104 has a 99-foot (six rod) wide right-of-way near the intersection. About 200 feet north and south of the intersection, the VT-104 ROW narrows to 49.5 feet in width (three rods).

The ROW of both SASH and VT-104 are owned and maintained by the State of Vermont (VTrans).

Roadway Width and Lane Assignment

All four approaches to the intersection include a dedicated left-turn lane plus a shared through/right-turn lane. SASH west of this intersection has two westbound departure lanes that merge into one lane west of the intersection. Eastbound, there are two departure lanes leading towards the Exit 19 on-ramps. Table 1 documents the existing lane and shoulder widths.

Vermont State Design Standards recommend 11-foot lanes and three-foot shoulders along VT-104, and 12-foot lanes and eight-foot shoulders along SASH. Because the SASH is classified as a limited access highway, bicycle traffic is not currently permitted along it. All bicycle traffic through this intersection must use VT-104, which has narrow (two feet or less) shoulders.

There are no dedicated pedestrian facilities adjacent to or through the intersection.

Utilities

Existing municipal water and sewer mains approach this intersection from the north and south on VT-104, but do not pass through it. Similarly, VT Gas serves the commercial properties surrounding the intersection but does not cross SASH or VT-104 in the vicinity of the project area.

There is an overhead high-voltage electrical transmission line owned by CVPS that crosses north-south approximately 500 feet east of the intersection. Other overhead electrical and communication service wires pass north-south on the west side of the intersection. Most utility poles are approximately 16 feet from the VT-104 edge of travel way, just outside of the clear zone.

Sight Distance

Available stopping sight distances on all four approaches to the intersection exceed AASHTO required distances of 305 feet for a posted speed limit of 40 mph on VT-104, and 425 feet for a posted speed of 50 mph on SASH.

ADJACENT LAND USE CONTEXT

WCG reviewed the existing and potential land uses adjacent to the study area. Figure 2 illustrates the adjacent St. Albans Town zoning districts, growth center overlay, and other significant land uses near the project area.

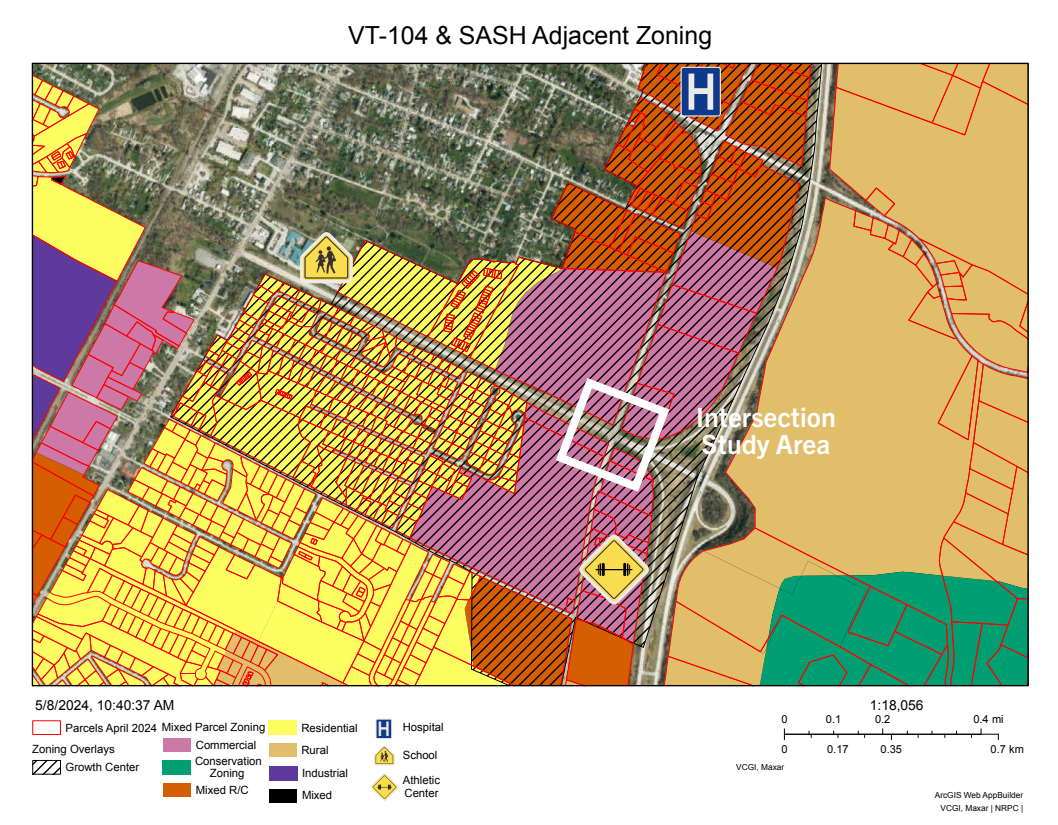

FIGURE 2. St Albans zoning map with significant land uses

Surrounding Land Use

In the immediate vicinity of the intersection, the existing land use consists primarily of commercial land uses on the northeast and southwest corners: gas stations with convenience stores, farm and garden supply retail, a hotel, the Collins Perley Sports & Fitness Center on the southwest corner, and undeveloped agricultural land on the northwest corner. All surrounding land proximate to the intersection is zoned as commercial with a Growth Center overlay in the town of St. Albans.

Further from the intersection, the Northwest Regional Medical Center is approximately ¾ mile north of the intersection, and the urban and suburban development of St. Albans lies generally west of the intersection. Development east of the intersection is limited by topography and access limitations due to I-89.

Projected Background Growth

The VTrans Redbook recommends a traffic growth rate of 8% over 20 years, or about 0.4% per year. This 8% growth estimate would represent a "standard growth" traffic volume scenario.

To estimate a "high growth" scenario, WCG reviewed observed traffic volumes from the historic catalog of turning movement counts at the intersection from 2008 through 2021. The observed annual change in peak hour traffic volume is presented in Table 2 by approach direction and the overall peak hour volume. Observed growth rates by direction and peak hour range from 0.3% per year along southbound VT-104 in the PM peak hour to 3.9% per year along northbound VT-104 in the AM peak hour. It should be noted that, since some of the existing approaches are operating at capacity, the peak hour volume processed during observation periods may not capture the peak hour demand.

With continued regional investment in transportation demand management strategies, improved walk-bike connections, and expected mixed-use development patterns, the background traffic growth rate is expected to moderate into the future. The recommended growth rate for analyses into the future is the average of the state standard growth rate and observed high growth rate.

	NB VT-104	SB VT-104	EB SASH	WB Exit 19	Overall
AM Peak Hour	3.9%	1.2%	2.2%	1.3%	2.0%
PM Peak Hour	3.2%	0.3%	2.2%	0.5%	1.2%
State Standard Growth Rate	0.4%	0.4%	0.4%	0.4%	0.4%
Projected High Growth Rate	3.0%	1.0%	2.0%	1.0%	--
Recommended Growth Rate	1.7%	0.7%	1.2%	0.7%	--

TABLE 2. Average annual change in traffic volume through study intersection, 2008 to 2021, and recommended growth rate

Development Opportunities

A significant amount of undeveloped land is located on the north side of the intersection within the Growth Center overlay district. While no development proposal currently exists, the project assumes this land may be developed into a dense multi-use residential and commercial district in the future.

Adjacent Transportation Infrastructure Projects

The Town of St. Albans has investigated two nearby path projects:

The **SASH Bike & Pedestrian Crossing Study** investigated opportunities to provide a protected bicycle and pedestrian crossing of the SASH along a convenient route between the St. Albans Town Ed. Center (SATEC) and the Collins Perley Sports & Fitness Center. The preferred alternative included a new crosswalk with pedestrian hybrid beacon at Thorpe Avenue approximately 1,500 feet west of the intersection.

The **St. Albans Health Path Scoping Study** is currently evaluating shared-use path alignment opportunities from the Collins Perley Sports & Fitness Center to the Hard'ack Recreation Area and Missisquoi Valley Rail Trail north of the intersection. The path is expected to follow the west side of VT-104, utilizing a protected bicycle and pedestrian crossing to be identified by this current VT-104 & SASH Scoping Study.

ENVIRONMENTAL RESOURCES

WCG reviewed the environmental resources adjacent to the study area. Figure 3 illustrates the Agency of Natural Resources (ANR) Natural Resources Atlas proximate to the study area intersection.

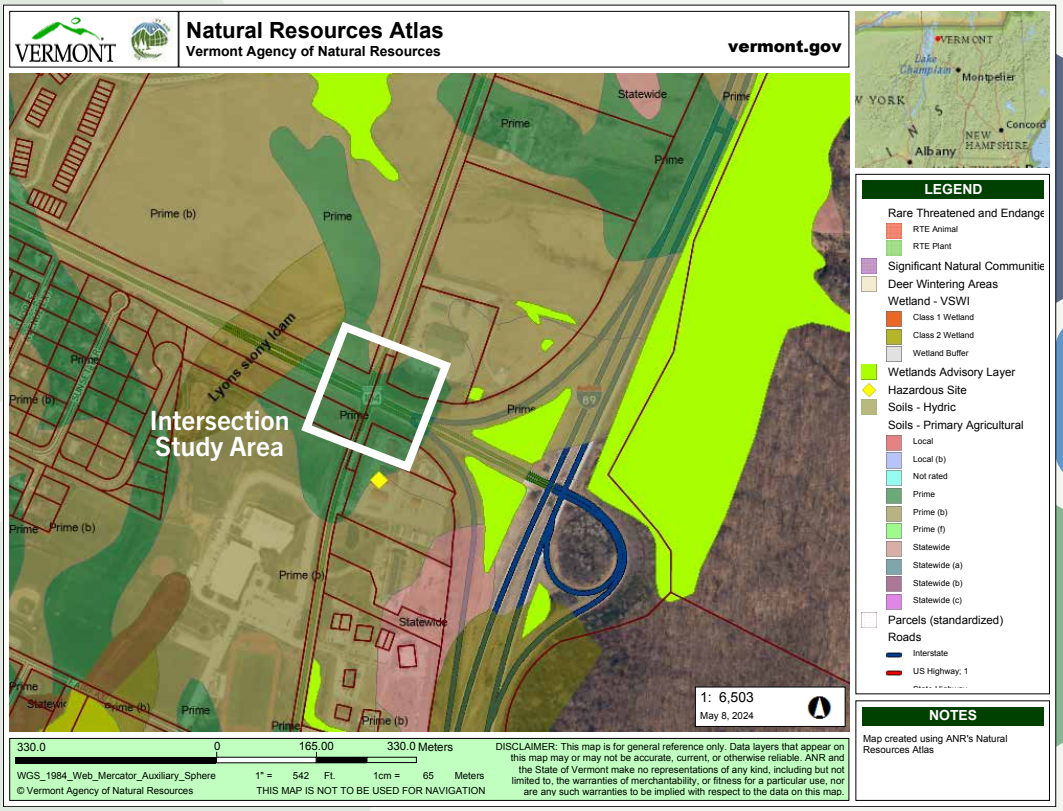

FIGURE 3. ANR Atlas Map

Stormwater Drainage

The intersection is located in the impaired Rugg Brook watershed. The roadway is uncurbed, and stormwater is collected in grass swales along both VT-104 and the SASH. Both VT-104 and SASH are graded to drain away from the intersection in all four directions.

Drainage from the southeast quadrant of this intersection crosses east to west under VT-104 through an 18-inch culvert located approximately 20 feet south of the intersection. Drainage from the northeast corner of the intersection crosses

east to west under VT-104 through a 36-inch culvert in good condition located approximately 300 feet north of the intersection. This drainage continues southwest and crosses to the south side of the SASH through a 48-inch culvert in fair condition located approximately 550 feet west of the intersection.

Wetlands

The Agency of Natural Resources Atlas does not show any existing or proposed significant wetlands mapped in the immediate vicinity of this intersection. It does show, however, potential wetland hydric soils mapped on both sides of culvert crossing the SASH approximately 550 feet west of this intersection, and several Class III wetlands have been identified within the ramp areas of Exit 19.

Both the U.S. Army Corps of Engineers (COE) and the Vermont Agency of Natural Resources (ANR) have jurisdiction over wetlands. Improvements at this intersection would require a COE General Permit if greater than 3,000 square feet of wetlands under their jurisdiction are impacted. Wetlands typically under COE jurisdiction do not include roadside ditches, cultivated croplands or isolated wetlands not adjacent to streams, rivers and lakes. The ANR regulates significant (Class 1 & 2) wetlands and the 50-foot buffer zone which surrounds them. Any impact to a significant wetland requires a Conditional Use Determination from the ANR.

Significant Plant and Animal Species

The ANR Atlas does not show any rare, threatened or endangered species, or any significant natural communities in the immediate area of this intersection. Due to the time lapsed since issuing, the no impact letters issued by the Agency of Natural Resources Department of Fish and Wildlife and its Nongame and Natural Heritage Program for the 2002 Intersection Scoping Study may need to be reissued.

Land and Water Conservation Sites

The Vermont Land and Water Conservation Fund list of funded projects (1965-2015) does not include any projects in St. Albans that are located adjacent to or near this intersection.

Hazardous Materials Sites

The ANR Atlas indicates that the gas station and convenience store in the southeast quadrant of this intersection is a closed Vermont hazardous waste site with voluntary action completed and no further investigation required at this time.

Historic Sites and Structures

There are no identified historic sites or structures located in the proximity of this intersection.

Archaeological Sites

Much of the area immediately surrounding this intersection within the existing highway right-of-ways has been previously disturbed by roadway, drainage, and slope construction. As such, there is little, if any, remaining sensitivity for undisturbed prehistoric or historic cultural resources. Should future intersection improvements extend outside the existing right-of-ways, further archaeological examination may be required.

Agricultural Lands

To the extent that future improvements at this intersection remain within existing highway right-of-ways, there would not be any impacts on agricultural lands.

Surrounding parcels, particularly on the northerly side of this intersection, have been historically used for agricultural purposes and contain soil types having significant agricultural potential.

Drinking Water Sources

All nearby land uses are served by municipal water.

CRASH HISTORY

A high crash location (HCL) is a state-designated intersection or segment of roadway where the number of crashes that have occurred over five years exceeds a critical crash rate specific to the roadway volume and classification. The study area intersection of VT-104 & SASH is designated as an HCL intersection and sections of VT-104 north and south of the intersection have been classified as HCL segments using data from 2012 through 2016.

An initial crash review indicated that 50 crashes were reported at or within ¼ mile of the VT-104 & SASH / I-89 Exit 19 intersection from 2018 through 2022. Further investigation into the 50 records indicated that 20 of these crashes occurred on I-89 or the on- and off-ramps, in adjacent parking lots, or were coded incorrectly; these crashes were determined to be outside the influence of the intersection. Furthermore, 13 of the crash records included no additional details on crash type or direction, and two records were duplicate entries. After sorting through the 50 records, 15 crash records contained enough detail to map on a crash diagram, illustrated in Figure 4.

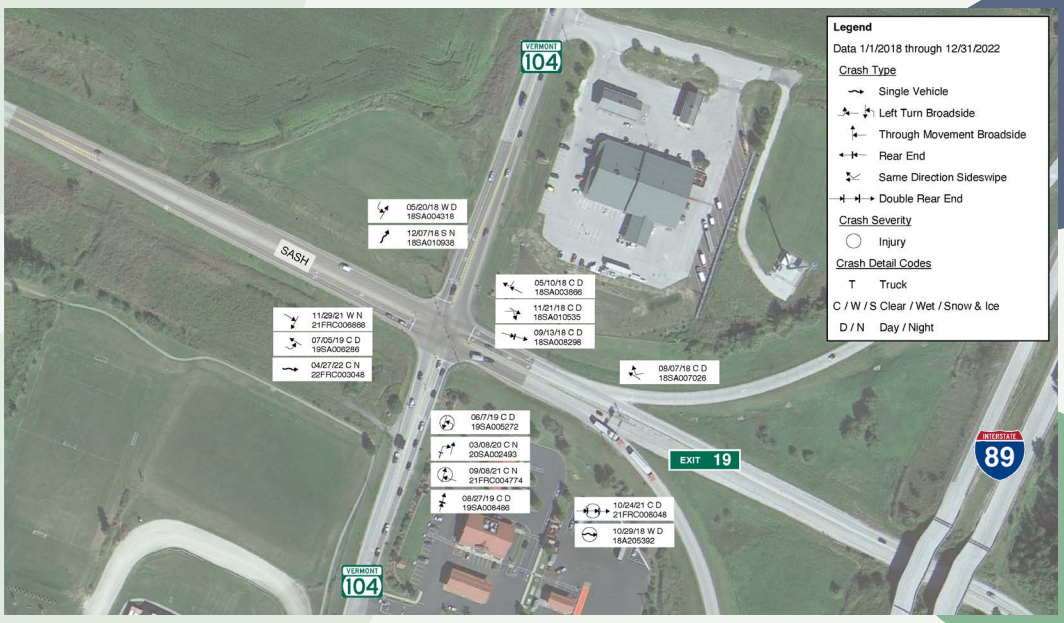

FIGURE 4. Crash diagram of reported crashes between 2018 through 2022

Of the 15 crashes:

- 4 resulted in injury
- 7 (47%, 2 injury) were turn-related broadside crashes
- 3 (20%, 1 injury) were rear end crashes
- 3 (20%, 1 injury) were single vehicle crashes
- 2 (13%) were sideswipe crashes
- 5 (33%, 1 injury) occurred at night
- 4 (27%, 1 injury) occurred with wet, snowy, or icy road conditions

Potential crash mitigation opportunities include:

- Reduced congestion and improved traffic operations may reduce broadside and rear end crashes.
- Many of the turn-related broadside crashes may be addressed with construction of roundabout intersection control.
- Improved lighting may reduce the occurrence of crashes at night.
- Improved advanced lane control signs and adequate weaving distances may reduce the occurrence of sideswipe crashes.

INTERSECTION CAPACITY & CONGESTION ANALYSIS

Intersection capacity analyses were performed at the existing study area intersection. Analyses evaluated average control delay, level of service (LOS), and volume to capacity (v/c) ratios consistent with methodologies documented in the Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis (HCM6).

Level of Service Definition

Level of service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream. LOS is calculated using the procedures outlined in the Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis (HCM6). In addition to traffic volumes, key inputs include the number of lanes at each intersection, traffic control type (signalized or unsignalized), and the traffic signal timing plans, if applicable.

The HCM6 defines six qualitative grades to describe the level of service at an intersection. Level-of-service is based on the average control delay per vehicle; average control delay is a function of a gap acceptance model. Table 3 shows the various LOS grades and descriptions for signalized intersections.

LOS	Characteristics	Signalized Intersection Average Control Delay (sec)
A	Little or no delay	≤ 10.0
B	Short delays	10.1-20.0
C	Average delays	20.1-35.0
D	Long delays	35.1-55.0
E	Very long delays	55.1-80.0
F	Extreme delays	> 80.0

TABLE 3. Level of service criteria for signalized intersections

The VTrans policy on level of service is:

- Overall LOS C should be maintained for state-maintained highways and other streets accessing the state's facilities.
- Reduced LOS may be acceptable on a case-by-case basis when considering, at minimum, current and future traffic volumes, delays, volume to capacity ratios, crash rates, and negative impacts resulting from improvements necessary to achieve LOS C.

- LOS D should be maintained for side roads with volumes exceeding 100 vehicles/hour for a single lane approach (150 vehicles/hour for a two-lane approach) at two-way stop-controlled intersections.

Volume to Capacity Ratio Definition

The volume to capacity ratio (v/c) represents the sufficiency of an approach leg to accommodate the vehicular demand. According to FHWA:

"As the v/c ratio approaches 1.0, traffic flow may become unstable, and delay and queuing conditions may occur. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), traffic flow is unstable and excessive delay and queuing is expected."

VTrans does not have a v/c policy. Typically, v/c is used as an alternative indicator of performance, with preferred values below 0.95.

Existing Conditions Capacity Analysis

Table 4 presents the intersection capacity analysis results for the existing intersection using the 2025 design hour volumes. The results of the capacity analysis confirm the previous analysis results: the existing condition is over capacity with excessive vehicle delay in both the AM and PM peak hours.

Intersections	No Build / Ex. Conditions - 2025 Scenarios					
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
	AM Peak Hour			**PM Peak Hour**		
VT-104 & SASH / I-89 Exit 19						
Overall	F	>100		F	88	
EB, along SASH	F	>100	1.07	D	53	0.88
WB, along I-89 Exit 19 Off Ramps	F	>100	1.20	F	>100	1.17
NB, along VT-104	F	90	1.02	F	94	1.01
SB, along VT-104	E	66	1.03	E	71	1.02

TABLE 4. Peak hour intersection capacity analysis results for the existing intersection in the 2025 scenarios

Picture Source: stalbanstown.com

3. PURPOSE & NEED

The Purpose and Need Statement for this project has not changed since first developed in 2002:

PURPOSE

The purpose of the Exit 19/SASH/VT-104 intersection project is to improve the safety of the intersection for vehicles, bicycles, and pedestrians while providing an adequate capacity for all users.

NEED

The intersection is considered deficient based on its poor levels of service and limited multi-modal capabilities.

Poor Level of Service - This intersection provides access to Interstate 89 at Exit 19. It serves two major travel routes: an east-west corridor linking Exit 19 with South Main Street (US Route 7) in the City of St. Albans. VT-104 is also a regional travel corridor linking Exit 19 and the St. Albans area with VT Routes 36 and 105 north and east of St. Albans, and with VT Routes 128 and 15 to the south and east in Fairfax. This intersection is also located in a regional and town-designated growth center district. Traffic volumes and conflicting turning movements are heavy during both morning and afternoon peak hours resulting in an overall level of service F for the intersection.

Limited Multi-Modal Capabilities - The intersection is not pedestrian- or bicyclist-friendly; the minimal shoulders on VT-104 do not provide sufficient space for bicyclists and pedestrians to safely travel outside of the travel way. Additionally, the SASH is a limited-access highway on which pedestrian and bicycle travel are prohibited. Ongoing residential and commercial development in the area of the intersection is resulting in increased bicycle and pedestrian travel in this immediate area.

Picture Source: Martin Sanchez - Unsplash.com

4. DESIGN OPTIONS

DESIGN CRITERIA

Heavy Vehicles / Design Vehicles

Given the intersection's location serving an interstate highway ramp facility and adjacent truck stop service facilities, the intersection should be designed to accommodate the largest truck-trailer combination: WB-67.

Pedestrian and Bicycle Travel

The Town of St. Albans has identified the SASH as a considerable barrier to bicycle and pedestrian travel in the area. The Collins-Perley Sports Complex on the southwest corner of the intersection has no direct, formal bicycle and pedestrian access to the school campuses to the north and west. The town is planning an off-road shared-use path from the Collins-Perley Complex south of the intersection to Hard'ack Park, north of the intersection along VT-104. There are no pedestrian crossing facilities across VT-104 or SASH at or near the intersection.

Controlled bicycle and pedestrian crossings have been identified as a priority across the northbound, eastbound, and southbound approaches. A controlled bicycle and pedestrian crossing across the westbound approach is desirable, but not critical; the preferred design should not preclude future controlled crossing opportunities.

Picture Source: Kevin Davidson - Unsplash.com

ALTERNATIVES

Consistent with the previous scoping efforts, three alternatives have been evaluated: do nothing / existing condition, expanded signal, or hybrid roundabout.

Do Nothing / Existing Condition

Figure 5 illustrates the Do Nothing / Existing Condition Alternative.

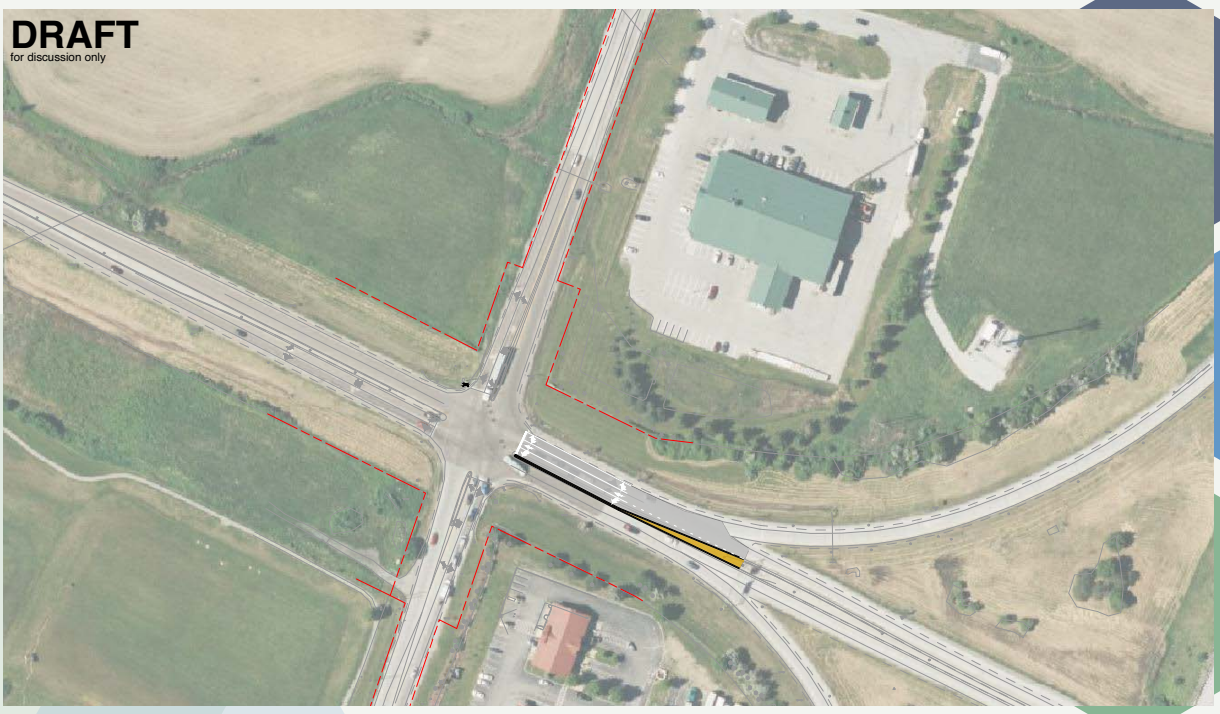

FIGURE 5. Do Nothing / Exisiting Condition

This alternative would retain the existing condition with no changes to intersection capacity. With continued background traffic growth and development of the adjacent parcels, future traffic congestion conditions and delays would continue to increase, and the existing crash patterns would be expected to continue.

Capacity analyses were performed for projected 2045 AM and PM peak hours, the results of which are shown in Table 5.

	No Build / Existing Conditions - 2045 Scenarios					
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
	AM Peak Hour			**PM Peak Hour**		
VT-104 & SASH / I-89 Exit 19						
Overall	F	>100		F	>100	
EB, along SASH	F	>100	1.25	F	>100	1.26
WB, along I-89 Exit 19 Off Ramps	F	>100	1.43	F	>100	1.46
NB, along VT-104	F	>100	1.23	F	>100	1.24
SB, along VT-104	F	>100	1.25	F	>100	1.35

TABLE 5. Peak hour intersection capacity analysis results for the do nothing alternative in the 2045 scenarios*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

Expanded Signal

Figure 6 illustrates the Expanded Signal Alternative.

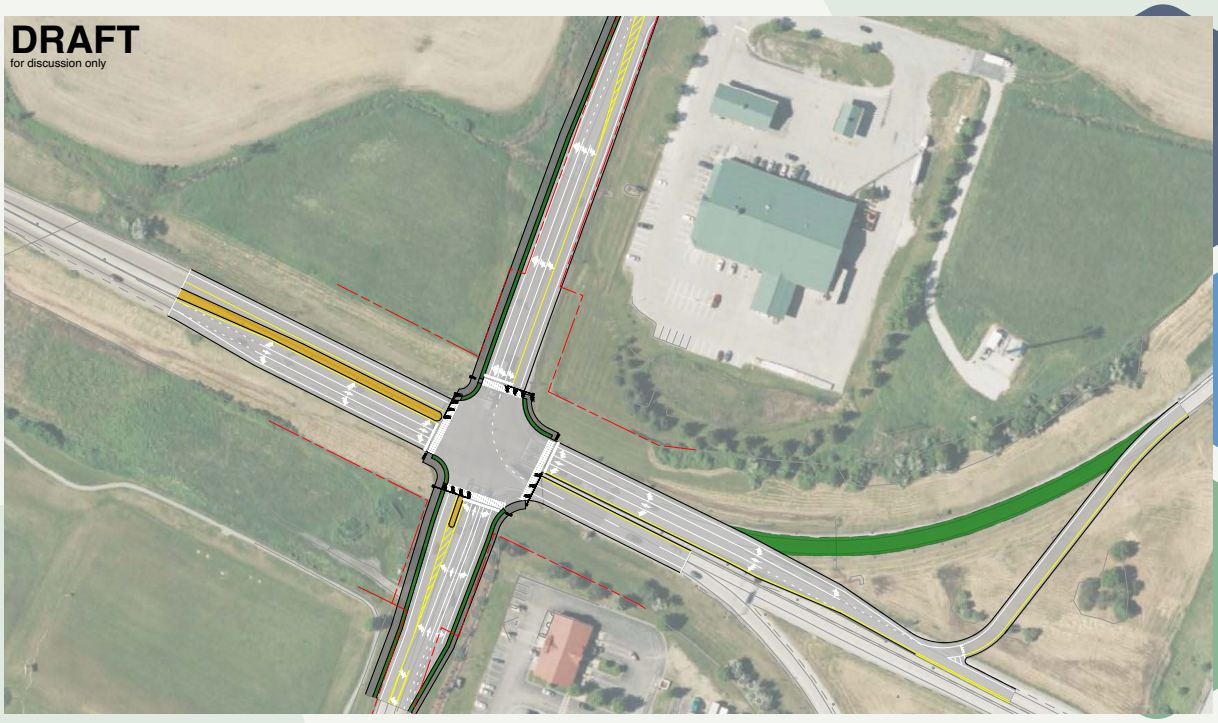

FIGURE 6. Expanded Signal

The Expanded Signal alternative includes an additional southbound left-turn lane, westbound right-turn lane, and a relocated southbound off ramp to provide additional storage capacity to accommodate the projected 2045 peak hour traffic volumes. The design speed of the expanded signal alternative is 40 MPH.

The signal timing plans were intended to include a leading pedestrian interval (LPI) phase. After a person walking pushes the button to cross the street, the pedestrian phase will be given a seven second head start to begin crossing while all traffic is stopped (and right turns on red are prohibited). After seven seconds, vehicle traffic will begin normal operations concurrent with the pedestrian crossing. LPI operations are shown to be the safest pedestrian signal phasing technique.

Table 6 presents the results of the capacity analysis for the expanded signal in the 2045 AM and PM peak hours.

	Expanded Signal - 2045 Scenarios					
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
	AM Peak Hour			**PM Peak Hour**		
VT-104 & SASH / I-89 Exit 19						
Overall	C	34		D	41	
EB, along SASH	D	35	0.80	C	33	0.77
WB, along I-89 Exit 19 Off Ramps	C	30	0.73	D	54	1.06
NB, along VT-104	C	29	0.72	C	31	0.70
SB, along VT-104	D	39	0.90	D	35	0.81

TABLE 6. Peak hour intersection capacity analysis results for the expanded signal alternative in the 2045 scenarios*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

Variation: Dual Southbound Exit 19 On-Ramp

As a variation that could be applied to both alternatives, the southbound Exit 19 on-ramp may be widened to two lanes. Traffic volumes indicate that the southbound on-ramp traffic demand is considerably higher than the northbound on-ramp. Providing two southbound on-ramp lanes would reduce the prepositioning behavior as vehicles queue in a preferred lane.

Roundabout

Figure 7 illustrates the Hybrid Roundabout Alternative.

FIGURE 7. Hybrid Roundabout

The Hybrid Roundabout alternative includes two entering lanes and one exiting lane from each approach direction to best balance traffic capacity demands and minimize pedestrian conflicts. There is one roundabout circulating lane across all approaches except the eastbound approach, with two roundabout circulating lanes. The design speed of the roundabout alternative is 20 MPH.

Table 7 presents the results of the capacity analysis for the expanded signal in the 2045 AM and PM peak hours.

	Hybrid Roundabout - 2045 Scenarios					
	LOS	Delay (s)	v/c	LOS	Delay (s)	v/c
	AM Peak Hour			**PM Peak Hour**		
VT-104 & SASH / I-89 Exit 19						
Overall	C	24		C	18	
EB, along SASH	F	63	0.89	E	36	1.01
WB, along I-89 Exit 19 Off Ramps	A	8	0.70	B	15	0.38
NB, along VT-104	C	22	0.54	B	13	0.68
SB, along VT-104	B	11	0.48	B	11	0.62

TABLE 7. Peak hour intersection capacity analysis results for the hybrid roundabout alternative in the 2045 scenarios*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

Following discussion with the Town of St. Albans Selectboard, the design and right of way acquisition of the hybrid roundabout should allow for future implementation of two lane exits if future congestion becomes unacceptable.

5. ALTERNATIVES EVALUATION

TRAFFIC CAPACITY COMPARISON

There are two primary techniques to evaluate intersection traffic performance: deterministic models, such as the Highway Capacity Manual, and stochastic microsimulation software (such as SimTraffic or VISSIM).

The traffic capacity modeling methodology described by the Highway Capacity Manual (HCM), 6th Edition is the industry standard technique for evaluating intersection traffic performance. The methodology estimates average control delay using a deterministic model, indicating that the resulting delay estimates are calculated using equations that have been developed and calibrated to approximate actual conditions, and the result from the equation is the same value when the calculation is repeated. The HCM model is well suited to isolated intersections using standard intersection configurations.

Microsimulation software packages utilize a stochastic model to estimate average control delay by evaluating individual vehicle operating characteristics. A stochastic model includes elements of randomness, including vehicle arrivals and driver behavior, and as such, the model cannot be repeated. To account for unique situations that may occur in any one model result, a microsimulation model is typically run several times, and the resulting estimate of delay or queue length is averaged. Microsimulation is well suited for complex intersection geometries and congested locations with closely spaced intersections that may interact.

There is not one correct modeling technique—both deterministic and stochastic techniques are models used to approximate actual conditions, and both may be accurate in certain situations.

Picture Source: wikepedia.org

HCM (Deterministic) Model Comparison

Using the HCM model, the Do Nothing / Existing Condition Scenario is expected to continue to fail in the near future (2025) and planning year (2045). The signal is expected to operate at level of service (LOS) C in 2025, declining to LOS D in the planning year. The roundabout is expected to operate at LOS A in 2025, declining to LOS C in the planning year.

Intersections	No Build / Ex. Conditions LOS	Delay	v/c	Signal Expansion LOS	Delay	v/c	Hybrid Roundabout LOS	Delay	v/c
2025 Scenarios - AM Peak Hour									
VT-104 & SASH / I-89 Exit 19									
Overall	F	>100		C	24		A	9	
EB, along SASH	F	>100	1.07	C	25	0.69	C	16	0.63
WB, along I-89 Exit 19 Off Ramps	F	>100	1.20	C	23	0.68	A	6	0.29
NB, along VT-104	F	90	1.02	C	22	0.53	A	10	0.34
SB, along VT-104	E	66	1.03	C	25	0.77	A	8	0.43
2025 Scenarios - PM Peak Hour									
VT-104 & SASH / I-89 Exit 19									
Overall	F	88		C	25		A	9	
EB, along SASH	D	53	0.88	C	27	0.68	B	13	0.55
WB, along I-89 Exit 19 Off Ramps	F	>100	1.17	C	24	0.85	A	8	0.43
NB, along VT-104	F	94	1.01	C	23	0.53	A	8	0.28
SB, along VT-104	E	71	1.02	C	26	0.70	A	7	0.32
2045 Scenarios - AM Peak Hour									
VT-104 & SASH / I-89 Exit 19									
Overall	F	>100		C	34		C	24	
EB, along SASH	F	>100	1.25	D	35	0.80	F	63	0.89
WB, along I-89 Exit 19 Off Ramps	F	>100	1.43	C	30	0.73	A	8	0.70
NB, along VT-104	F	>100	1.23	C	29	0.72	C	22	0.54
SB, along VT-104	F	>100	1.25	D	39	0.90	B	11	0.48
2045 Scenarios - PM Peak Hour									
VT-104 & SASH / I-89 Exit 19									
Overall	F	>100		D	41		C	18	
EB, along SASH	F	>100	1.26	C	33	0.77	E	36	1.01
WB, along I-89 Exit 19 Off Ramps	F	>100	1.46	D	54	1.06	B	15	0.38
NB, along VT-104	F	>100	1.24	C	31	0.70	B	13	0.68
SB, along VT-104	F	>100	1.35	D	35	0.81	B	11	0.62

Delay is the average delay per vehicle in seconds; v/c is the volume to capacity ratio.

TABLE 8. Summary of peak hour intersection capacity analysis results for all alternatives using the HCM methodology in the 2025 and 2045 scenarios*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

The HCM model for a roundabout evaluates the approach volume by lane group compared to the circulating volume and number of lanes within the roundabout. As the roundabout geometry becomes more complex, the capacity of the roundabout decreases. To check the capacity, the approach volume by lane group was compared to the circulating volume capacity curves illustrated in HCM Exhibit 22-6. The result indicates that the volume on several approaches nears the capacity curves, warranting additional microsimulation modeling.

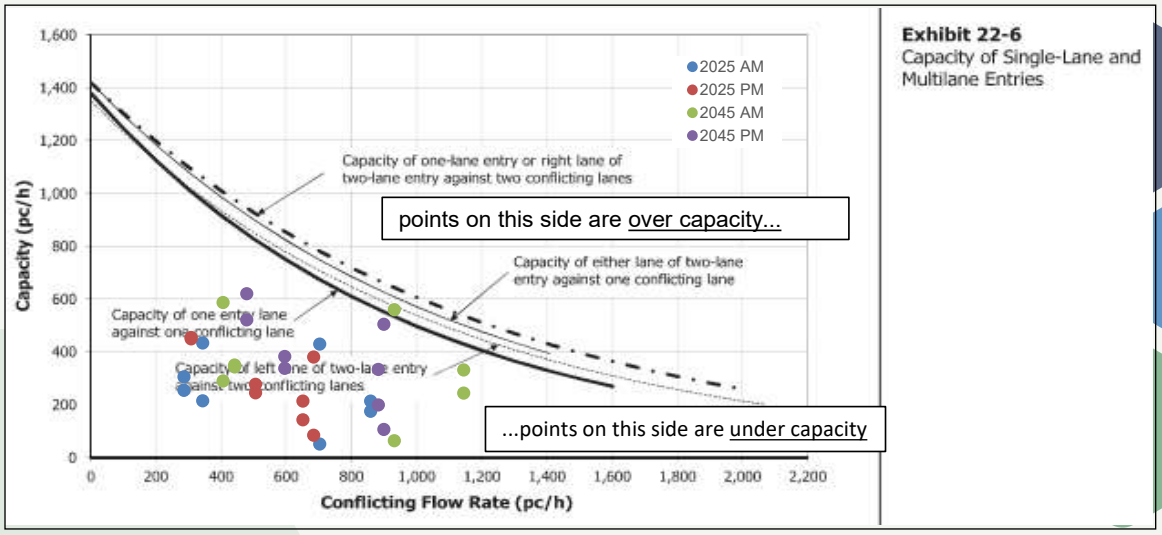

FIGURE 8. Projected roundabout entering and conflicting volumes plotted against HCM roundabout capacity curves

Microsimulation (Stochastic) Model Comparison

The same traffic volumes were used to develop a microsimulation model of the AM and PM peak hours, the 2025 build year, and 2045 planning year time horizons. Talbe 9 illustrates the estimated delay and queue length for each approach using SimTraffic microsimulation software. VISSIM, a more robust microsimulation modeling software, confirmed the general operational results.

Microsimulation Analysis Software	SimTraffic No Build / Ex. Conditions			SimTraffic Signal Expansion			SimTraffic Hybrid Roundabout		
Intersections	LOS	Delay	95th Q	LOS	Delay	95th Q	LOS	Delay	95th Q
	2045 Scenarios with ODVs - AM Peak Hour								
VT-104 & SASH / I-89 Exit 19									
Overall	F	>100		C	29		F	>100	
EB, along SASH	F	>100	78	C	32	10	F	82	39
WB, along I-89 Exit 19 Off Ramps	F	>100	56	C	24	11	A	6	4
NB, along VT-104	F	>100	74	C	26	12	F	>100	77
SB, along VT-104	F	>100	68	C	32	14	F	>100	73
	2045 Scenarios with ODVs - PM Peak Hour								
VT-104 & SASH / I-89 Exit 19									
Overall	F	>100		C	31		F	>100	
EB, along SASH	F	>100	76	C	29	9	F	>100	75
WB, along I-89 Exit 19 Off Ramps	F	>100	48	D	38	21	E	60	52
NB, along VT-104	F	>100	73	C	23	11	F	>100	55
SB, along VT-104	D	43	23	C	30	12	E	57	35

Delay is the average delay per vehicle in seconds.
95th Q is the longest queue by number of vehicles expected to occur in the peak hour for each approach direction.

Table 9. Summary of peak hour intersection capacity analysis results for all alternatives using SimTraffic microsimulation methodology in the 2045 scenarios*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

The microsimulation results confirm that the existing condition is expected to fail in the future. The signal will operate acceptably, but the roundabout may not operate as efficiently as modeled by the deterministic methodology.

For a more complete assessment of the operational performance throughout the day, the microsimulation evaluation was expanded to evaluate build scenario operations from 6 AM through 6 PM, presented in Figure 9.

2045 Planning Year - Above Average Traffic Growth with Dense Adjacent Land Use Development

Signal														Hybrid Roundabout											
Overall		SASH EB			Exit 19 WB			VT-104 NB			VT-104 SB			Hour	Overall		SASH EB			Exit 19 WB			VT-104 NB			VT-104 SB		
LOS	Delay	LOS	Delay	Q	LOS	Delay	Q	LOS	Delay	Q	LOS	Delay	Q	Starting	LOS	Delay	LOS	Delay	Q	LOS	Delay	Q	LOS	Delay	Q	LOS	Delay	Q
C	21	C	25	8	B	16	6	C	21	7	C	21	11	6 AM	B	11	A	9	6	A	4	3	B	17	8	B	13	11
C	32	D	41	10	C	30	11	C	31	12	C	30	14	7 AM	**F**	**>100**	**F**	**82**	**40**	A	6	5	**F**	**>100**	**78**	**F**	**>100**	**74**
C	26	C	32	10	C	23	10	C	26	13	C	25	12	8 AM	**F**	**83**	B	19	11	A	5	4	**F**	**>100**	**78**	D	47	26
C	20	C	26	7	B	17	8	B	20	9	C	21	10	9 AM	B	11	A	8	5	A	4	3	B	20	11	A	9	7
C	21	C	25	7	B	17	8	C	21	10	C	22	10	10 AM	A	8	A	6	4	A	5	4	B	15	9	A	6	6
C	21	C	27	8	B	17	8	C	21	10	C	21	11	11 AM	A	9	A	6	4	A	5	5	B	20	12	A	6	5
C	21	C	27	7	B	18	10	C	21	10	C	21	8	12 PM	A	8	A	6	4	A	8	8	B	11	7	A	6	4
B	19	C	23	7	B	15	7	B	20	9	B	20	7	1 PM	A	6	A	6	4	A	6	6	A	9	7	A	5	4
C	21	C	25	7	B	17	7	C	22	9	C	24	9	2 PM	A	9	B	16	8	A	7	6	A	10	6	A	7	6
C	30	C	35	11	C	28	14	C	28	11	C	32	11	3 PM	D	53	**F**	**92**	**41**	B	19	16	**F**	**>100**	**45**	C	28	19
C	33	D	39	9	C	32	22	C	29	11	C	32	12	4 PM	**F**	**>100**	**F**	**>100**	**76**	**E**	**60**	**52**	**F**	**>100**	**56**	**E**	**57**	**35**
C	27	C	34	10	C	24	10	C	26	11	C	27	11	5 PM	C	22	C	23	15	B	19	21	C	33	17	B	17	11
B	17	C	20	5	B	14	7	B	20	8	B	18	7	6 PM	A	6	A	7	5	A	5	4	A	7	5	A	6	4

LOS = Level of Service
Delay = Average control delay in seconds
Queue = 95th percentile queue in number of vehicles

FIGURE 9. Time-of-Day Microsimulation Evaluation using 2045 planning year traffic volumes with above average traffic growth rates and relatively dense adjacent land use development*

*Refer to Page 11 for definition of level of service (LOS), delay, and volume to capacity ratio (v/c)

The time-of-day microsimulation evaluation presented in Figure 9 indicates that the expanded signal is expected to operate with a consistent average control delay of 20-35 seconds throughout the day, while the roundabout is expected to operate with 6-11 seconds of average control delay outside of the peak hours. In the planning year time horizon with above average traffic growth projections and relatively dense land use development adjacent to the intersection, microsimulation modeling indicates that the overall intersection performance will decline into LOS F conditions in the peak hours.

Picture Source: Venit Views unsplash.com

EVALUATION MATRIX

Table 10 presents a comparison of the estimated benefits and impacts of the do nothing and two build alternatives.

	Existing Condition	Expanded Signal	Hybrid Roundabout	Option: 2-Lane SB On-Ramp
Purpose & Need				
Improves Safety for Pedestrians	poor	good	good	**n/a**
Improves Safety for Bicyclists	poor	good	good	n/a
Improves Safety for Motorists	poor	good	**best**	improved
Improves LOS	**worst**	good	good	improved
Meets Purpose & Need	No	Yes	Yes	n/a
Safety				
Expected Change in Crashes per 5 Years	0	-1	-6	0
Value of Crash Reduction over 20 Years	$0	$87,000	$1,222,000	$0
Order of Magnitude Estimated Costs	$0	$3,290,000	$3,730,000	$960,000
Benefit : Cost Ratio	0.00	0.03	0.33	0.00
Max. Uninterrupted Crosswalk Length (feet)	n/a	88	39	n/a
Total Crosswalk Length (feet)	n/a	300	250	n/a
Capacity Improvements				
Near Term	**worst**	good	**best**	improved
Long Term (Low Growth)	**worst**	good	**best**	improved
Long Term (High Growth)	**worst**	**best**	good	improved
Impacts				
Utility	-	Moderate	Minor	No Impact
Right of Way	-	Significant	Moderate	No Impact
Constructability Effort	-	Moderate	Significant	Minor
Community Character				
Aesthetics Improvements	-	Minor	Improved	Minor
Environmental Impacts				
Wetlands	-	Class III	Class III	Class III
Stormwater Pilot Project Sites	-	SB Off Ramp	SB Off Ramp	None
Significant Plant and Animal Species	-	None	None	None
Land & Water Conservation Fund Sites	-	None	None	None
Hazardous Materials Sites	-	None	None	None
Historic Sites and Structures	-	None	None	None
Archaeological Sites	-	None	None	None
Agricultural Lands	-	Minor	Minor	Minor
Drinking Water Sources	-	None	None	None

TABLE 10. Evaluation matrix comparing the impacts and improvements of each alternative

ALTERNATIVE SCORING

A draft score from 0 to 3 was assigned to each evaluation category for the alternatives based on a subjective initial assessment. A score of 0 indicates poor improvement in the category or high impacts to the evaluated resources; a score of 3 indicates a high degree of improvement in the category or no impacts to the evaluated resources. A higher score is one indication of a higher preference. Each category is equally weighted with a possible total score of 18.

Evaluation Category and Discussion	Do Nothing / No Build	Expanded Signal	Hybrid Roundabout
Purpose and Need The two build alternatives meet the purpose and need by improving safety for people traveling through the intersection by all modes and by improving the level of service. The no-build / existing condition does not achieve either objective.	0	3	3
Safety The no-build / existing condition is not expected to result in any reduction in crashes. The signalized alternative is expected to result in a slight reduction in the number of crashes, and the roundabout alternative is expected to reduce the number and severity of crashes. The roundabout alternative has the shortest total crosswalk length and the shortest maximum uninterrupted crossing distance, resulting in the least pedestrian exposure to vehicle conflict.	0	1	3
Capacity Improvement The no-build / existing condition is not expected to result in an increase in capacity or congestion improvement. The signalized alternative is expected to result in consistent acceptable level of service throughout the day, while the roundabout is expected to result in the least delay for most of the day with moderate to significant delays during the peak hour under high traffic growth projections.	0	2	2
Construction Impacts With no proposed construction, the no-build / existing condition is not expected to create any construction impacts. The signal requires expansion of the roadway at the intersection and lengthening of the turn lanes, resulting in right of way and utility impacts. The roundabout will likely require right of way at the intersection, but no widening outside of the intersection or extension of turn lanes; the roundabout is expected to create temporary impacts during construction.	3	1	2
Community Character The no-build / existing condition is expected to result in extensive delays and frustration from people traveling through the intersection with no improvement to bicycle and pedestrian mobility. Mobility and delays will be improved in both build scenarios, and the roundabout offers aesthetic opportunity (art/landscaping) in the central island.	0	2	3
Environmental Impacts With no proposed construction, the no-build / existing condition is not expected to create any environmental impacts, nor will there be any proposed improvement to stormwater collection and treatment that would be expected as a result of the build alternatives.	2	1	1
Total	**5**	**10**	**14**

TABLE 11. Draft alternative scoring matrix

6. STAKEHOLDER OUTREACH

STORY MAP

As the project has developed, an online Story Map (https://arcg.is/1r1C05) has been prepared and updated documenting the project background and development process. This online resource is open to the public and is an up-to-date reflection of the project status, analysis, and evaluation.

STAKEHOLDER MEETINGS

A stakeholder committee was convened at the beginning of this project. The stakeholders included representatives from the Agency of Transportation as the owner of the facility, staff from the town of St Albans and city of St Albans, and staff from the Northwest Regional Planning Commission. The full stakeholder committee convened for a kickoff meeting, an initial results meeting, and a revised analysis meeting.

In addition to the full group meetings, the individual groups making up the stakeholder committee were consulted in one-on-one meetings to ensure their priorities were captured and addressed as the alternatives were developed and analyzed.

PUBLIC MEETING

The St. Albans Town Educational Center (SATEC) hosted an Alternatives Presentation Meeting on May 15, 2024. In addition to project stakeholders, the meeting was attended by approximately 20 residents. The meeting was recorded by Northwest Access TV, and may be viewed at https://www.youtube.com/watch?v=6s78D_EVFow.

Notes and the presentation from the meeting is included in the Appendices.

PREFERRED ALTERNATIVE

The Stakeholder Committee has selected the Hybrid Roundabout as the preferred alternative for the following reasons:

- Safest alternative with fewer expected severe and injury crashes,
- Least pedestrian exposure / shortest crosswalk length,
- Best benefit to cost ratio,
- Best whole-day performance,
- Operates well into future under moderate growth / lower density adjacent development, and
- Least pedestrian delay.

The design and right of way acquisition of the hybrid roundabout should allow for future implementation of two lane exits if future congestion becomes unacceptable.

The selection of the roundabout as the preferred alternative is consistent with the 2002 and 2009 intersection scoping efforts at this intersection.

TOWN OF ST. ALBANS SELECTBOARD MEETING

The project development process and preferred alternative was presented at the July 15, 2024 Town of St. Albans Selectboard meeting. The Selectboard discussed the potential future capacity constraints of a single lane exit hybrid roundabout and requested that the intersection is designed to allow future upgrades to accommodate additional capacity, if needed. The Selectboard voted unanimously to pass a motion to affirm and support the preferred alternative.

APPENDICES

A. Conceptual Alternative Designs
B. Traffic Analysis Memorandum
C. Notes from Public Meeting
D. Notes from Selectboard Meeting