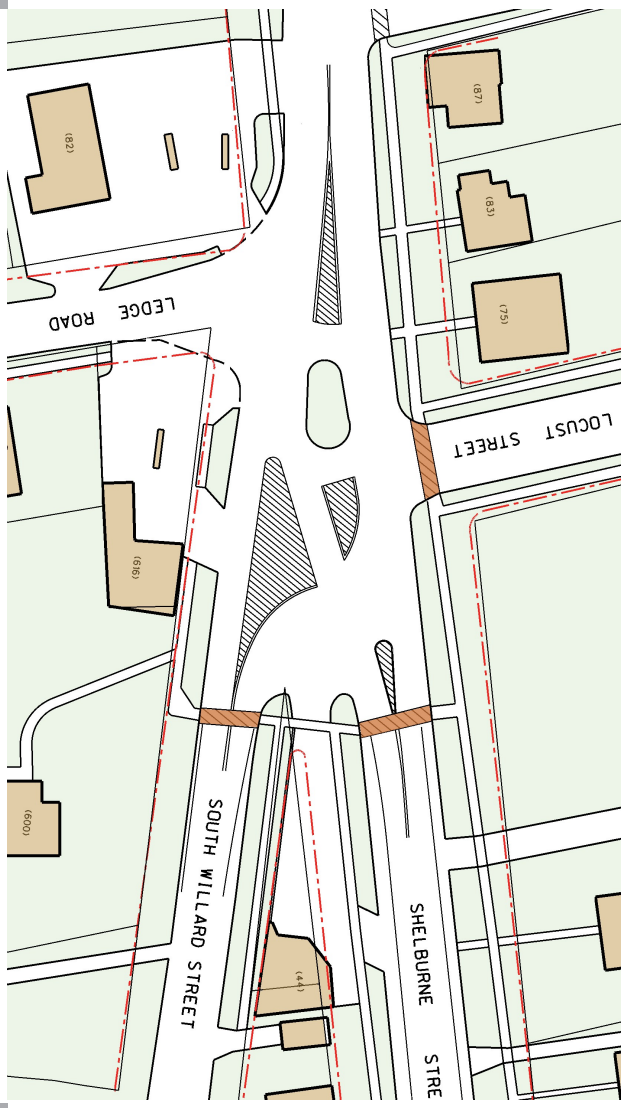
Shelburne Road Rotary Redesign Project

Final Report



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Introduction

In 2000, the City of Burlington began to explore various design alternatives for the intersection of Shelburne Road (Route 7 and South Willard Street) commonly known as the Shelburne Road "Rotary". This area has been of concern to city officials in regards to current and future traffic flow and safety. The community also desired to enhance the location as a prominent gateway to the downtown.

The city requested proposals from traffic engineering and urban design firms, and the Office of Robert A. White, ASLA, Landscape Architects and Planners, assisted by Oman Analytics, Transportation Planners and Forcier Aldrich & Associates, Civil Engineers were selected. The key reasons for the redesign effort were to enhance functionality, safety, address traffic volumes and Levels of Service, pedestrian and bicyclist safety, and to consider the intersection's role as the southern gateway to the City of Burlington. From the beginning, the focus has been on improving the intersection to alleviate these problems including: added signalizing, road redesign. pedestrian/bicycle pathways and/or lanes, landscaping, lighting, and other features to improve the intersection's functionality and aesthetics. Public Participation was in the form of two public workshops that were held for the project: the first in January, 2001, and the second in March, 2001. Seven total design alternatives organized into four groups of conceptual design alternatives for the rotary were developed and presented to the public. Based upon public feedback and review by Burlington Department of Public Works staff, the preferred schemes in this report were selected as finalists to advance to funding and implementation.

The following report summarizes the planning process and presents the seven schemes considered for improvements at the Rotary, The preferred plans (Alternatives D & F) along with their anticipated costs and other considerations are described more fully at the end of the report.

View of the Rotary from Shelburne Street to the north.

View of the Rotary from Route 7 South

View of the intersection from the corner of Shelburne Street and South Willard Street.

Purpose & Need Statement

The purpose of this project is to improve the junction of Shelburne Road (Route 7) and South Willard Road at the southern entrance to the City of Burlington, Vermont, for autos and pedestrians alike. Due to growth in the region, the intersection no longer serves its original purpose effectively, and a new design that integrates safe and efficient vehicle and pedestrian use must be considered. Such a plan should focus on better traffic flow, reduction of traffic speeds, safety for pedestrians and bicycles, and the creation of a "gateway" to the City that is aesthetically pleasing.

The need for this project is evidenced by the traffic back-ups that occur during peak commuting hours due to increased local traffic and commuters from adjacent towns; increase in traffic speeds; and the difficulty in crossing the roadway by pedestrians. During peak hours, it is often difficult for cars entering the roadway from both local side streets (Locust Street, Ledge Road) and the more significant city streets such as South Willard and South Union. Safety for pedestrians and bicycle use--an increasing use in the area--is a key concern and needs to be addressed. Moreover, as one of four major roadways into the City, there is a desire to improve the aesthetics of this key intersection as the southern gateway, which would also slow traffic by providing a cue for drivers as to how they should drive within the city context.

The Shelburne Road Rotary Redesign Project will:
- improve roadway capacity and reduce traffic congestion in the Rotary area and side streets;
- improve safety for motorists by slowing traffic;
- improve safety and access for pedestrians and bicyclists who pass through the intersection;
- heighten Level of Service by decreasing delays at the intersection;
- create an aesthetically pleasing entrance to the City of Burlington.

The need for this redesign effort is substantiated by:
- traffic jams that occur frequently especially at South Willard Street causing delays;
- frequent interruptions in traffic flow;
- traffic that travels at inappropriately high speeds;
- poor access for pedestrians and bicyclists along the roadways and intersection;
- poor visual quality of the landscape and improvements at the intersection;
- difficulty experienced by motorists at egress of side streets near intersection.

Defining Shelburne Road transportation problems

Existing conditions and background information

Despite Burlington's importance in the regional and state-wide economy, it is presently served by only four major accesses, of which Route 7 is one. Route 7 itself is classified a "principal arterial" outside the immediate Burlington urbanized area where it functions as a State highway. Particularly on the southern segments, it provides the primary transportation access to the entire western side of Vermont (which, unlike other portions of the state has never been served by an interstate corridor).

As the principal gateway to Burlington from the south, the Shelburne Road "rotary" has been an integral and idiosyncratic element in the landscape of that gateway for many years. To locals it is a landmark from which directions to the entire southern end of the city may be linked, while non-locals (especially from Massachusetts, where the term rotary has an explicit and portentous meaning) search hopelessly for the anticipated traffic circle. The importance of this single intersection on that gateway clearly establishes its importance in the local and regional transportation network.

As a state highway, the Rt 7 corridor and the intersection in question here must comply with state roadway design policies. However, in a downtown location, there is considerable flexibility in engineering standards – as opposed to a rural highway or interstate due to new Transportation design standards that the state has developed. The "design speed" or posted speed does not have to be 50 mph, the width of the lanes may be somewhat reduced from those used on a typical rural highway, and other design decisions that might better "balance" vehicular traffic with pedestrian and bike uses from the neighborhood, promote "traffic calming" and other improvements are all on the table.

In this study, we have identified the problems this location faces from a traffic and safety perspective to help envision a future improved "City Gateway" that is dignified in it's urban design, safer and more attractive for vehicles, pedestrians, and bicyclists. Two public meetings, on December 4, 2000 and January 10, 2001, provided opportunities for residents of the city to participate in the articulation of the problems and to assist in defining possible solutions.

Map showing funcational classification of routes in Rotary area

Functionality

Unlike streets and highways, intersections are not formally classified according to the functional role they play in the overall street network. In general, intersections simply provide for the connection between two (occasionally more) streets and the distribution of traffic among them -- a distribution function.

Occasionally, however, intersections also play another role. This occurs wherever a major arterial street enters a city or major urbanized area. It is referred to as "metering" and it is the familiar transition of the (often) faster, smooth flow of the highway to the slower flow with frequent turns of the city center. Although this may occur on a segment of roadway itself, it almost always occurs at an intersection and/or interchange.

Shelburne Road/Street undergoes two such metering points as it enters Burlington: one, on the segment of roadway in the vicinity of the I-89 interchange which accesses several major distribution points and the roadway transitions from six to four lanes, and then at the "rotary" where it completes the transition from one arterial four-lane road to two two-lane city streets. Although referred to as a "rotary", this intersection has no real design classification. First, by

supporting five separate approaches, it is outside most common design parameters. Its geometry is something of a cross between channelized approaches and a median islanded through-route with breaks for turning and cross traffic. It has no actual characteristics of a genuine "rotary" intersection or traffic circle except for an attempt to induce a one directional flow around a small planted island. Most of the directional flow is guided by roadway striping.

The resulting lack of definition can lead to sometimes chaotic traffic flow in completely ad hoc directions. As long as volumes remain manageable, speeds slow and drivers vigilant, it is possible to "get away with this." However, as these conditions change, this state of affairs is subject to breakdown.

View of project location from the north on South Willard

Safety/accident history data in Rotary area

Safety

The greatest concern at a location such as this with potentially chaotic traffic flow is safety. The principal measure used by the VAOT to define unsafe locations on the roadway system is the high accident location (HAL) analysis. This intersection and its immediate approaches are not recognized by VAOT as high accident locations. In addition to the identification of specific high accident locations, the VAOT maintains a geo-referenced database of detailed individual accident data. This data base currently contains information for 1994, 1996, and 1997. The table below outlines information on six accidents associated with this location:

ID	Date	Time	Type	Cause	Veh	Inj	Fat
1	4/8/94	02:00 PM	Right angle: broadside	Inattention	2	1	0
2	8/25/94	09:00 PM	Right angle: broadside	Hit & run	2	1	0
3	4/10/97	04:00 PM	Rear end	Inattention	3	0	0
4	01:00 PM	01:00 PM	Angle: trun opp	Failed to yield row	2	0	0
5	10/15/97	01:00 PM	Rear end	Following too close	2	1	0
6	12/19/97	2:00 AM	Hit pole	DWI	1	2	0

There were no fatalities ("Fat") and five injuries ("Inj") associated with the recorded accidents.
There are no recorded accidents (in the VAOT database) involving pedestrians or bicycles at this location.

While it is difficult to speak of a "pattern" arising from only 6 instances, it is clear that all of these accidents are consistent with the confused circulation (broadside and angle types) and need to slow, often unexpectedly, to accommodate it (rear end types, especially the "chain reaction" style of number 3).

While this intersection is not formally classified as a high accident location, and most people do appear to know how to negotiate it reasonably safely, its idiosyncratic layout must be considered a safety detriment. During any brief period, movements completely in opposition to the intended "rotary" movement may be observed, and it is only through the vigilance of the operators that numerous accidents have been avoided. It is a place of near - misses and unexpected movements, neither of which bode well for long-term safety.

Aerial view of the Rotary

Average Annual DailyTraffic data for the intersection

Volume and Level of Service

Turning movements for this intersection have been synthesized from two recent counts: a VAOT count conducted on 7/8 and 7/12 1996, and a more recent MPO peak hour count conducted on 7/28/2000. It has been necessary to synthesize the data since the more recent MPO count did not adequately distinguish all the separate movements, but obviously represents more current information. To accomplish the synthesis, the VAOT proportions for the individual movements were applied to the undifferentiated MPO approach volumes.

Design hourly volumes (DHV: the 30th highest hour of the year) have been estimated for this intersection by applying the VAOT DHV adjustment factors for urban roadways. This has yielded the following DHV turning movements:

	AltUS7 fr St Paul St"(1)				US7 fr US2"(2)				Ledge Rd) fr Prospect"(3)				US7 fr So. Burlington"(4)					Locust St fr Pine"(5)		
	5	2	3	4	1	3	4	5	2	4	5	1	3	5	1	2	4	1	2	3
	R	LL	L	T	R	T	LL	L	RR	L	T	R	RR	L	T	R	R	L	LL	T
AM Peak	17	0	15	694	2	0	165	12	0	22	10	10	24	21	510	154	40	5	5	19
PM Peak	18	1	33	653	5	2	159	5	4	35	8	11	44	34	590	422	56	5	6	18
DH V	15	1	28	571	4	2	139	4	3	31	7	9	39	30	515	369	49	4	5	16

The level of service (LoS) at this intersection was analyzed using current highway capacity software. Since the current version of this software does not recognize 5-way stop controlled intersections, it has been analyzed as a conventional 4-legged two way stop controlled intersection. In this instance, we have judged that this results in an adequate representation of actual conditions since there is little interaction between the Ledge and Willard Street approaches, and the very low volumes on Ledge will produce negligible interference with other movements. The level of service of each approach is as follows: Level of ServiceQ95: The 95% queue length, or the length that will not be exceeded 95% of the time. In general, the intersection as configured will function satisfactorily except for the Willard Street approach. Here, long delays and a substantial queue (up to 21 vehicles) may develop at peak periods.

Approach	**Delay (sec)**	**LoS**	**Q95**
St Paul	0.3	B	na
Willard	426.7	F	21
Shelburne	0.1	A	na
Locust	16.8	C	1.3

Number of Lanes

Signal Warrants

Based on existing volumes, this location satisfies the following signal warrants:
Warrant 1: minimum vehicular volume
Warrant 2: interruption of continuous traffic
If it is the city's desire to place a signal at the intersection there is adequate justification to do so.

Pedestrians and bicycles

Despite the presence of a school directly adjacent to this intersection on Locust Street and nearby City recreational facilities, there is currently relatively light pedestrian traffic at this location. The VAOT found a total of 304 pedestrians over the course of an entire 12 hour count, while the MPO counted only 15 pedestrians in the morning peak hour and 21 in the afternoon peak.

Because most of the counting activity has taken place in the summer months, an additional observational reconnaissance was undertaken for an hour during the school year on 6/8/2000.
During this period, 46 pedestrians (including bicyclists) made crossings of the intersection.
This included only one group of identifiable school children, consisting of 4 children and 2 adults.

Some of the problems in regard to pedestrian safety and the rotary identified were:

- high traffic volumes make crossing difficult
- long, exposed crossing points, even at crosswalks
- high speeds and confusing traffic patterns
- the existing sidewalk crossing just north of the intersection was a major concern because of the speed of traffic exiting the rotary towards St. Paul Street
- most of the legs of the intersection do not offer any possibility of a defined, safe pedestrian crossing
- lack of bicycle accommodations either on- or off-road
- the prominence of the rotary location suggests the intersection is a strategic (possible) hub for pedestrian/bicycle access between the downtown and south end neighborhoods and the region on Route 7 southward

Effect of the Southern Connector

Future traffic volumes at this location will be significantly affected by the completion of the Southern Connector, which will increase the number of southern gateways to Burlington from one to two. Unfortunately, the connector impact study that was conducted in 1994 was intended to estimate the impact of increased traffic on South End neighborhood streets rather than the diversion from existing streets, so no specific estimates are available. It is all but certain to reduce traffic at this location, however, this may not be an entirely good thing, since as volumes drop, speed may increase resulting in potential safety issues.

Conclusion:

The Shelburne Road "Rotary" is a high volume intersection with a non-standard, idiosyncratic layout. It represents one of two major metering points for traffic on the only southern entrance to the city. Most people are familiar with this intersection, it even enjoys a bit of local notoriety. Because of its unique layout and high volumes, people drive slowly, carefully and have avoided major disasters.

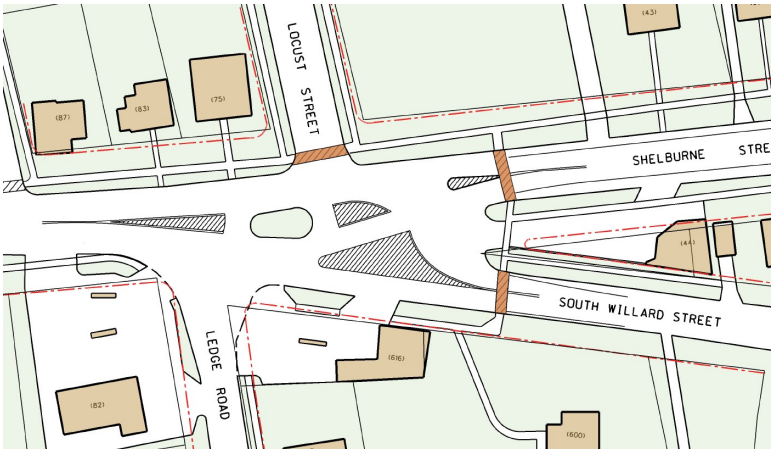
At the moment it functions reasonably satisfactorily relative to safety but access from side-streets suffers at peak hours. Basically, because of its unique layout and potential capacity problems, it would have to be considered to be in a state of unstable equilibrium. This could be upset by any disturbance possible, including even a reduction in peak hour traffic volumes resulting in faster traffic which could lead to a safety and/or capacity breakdown of this equilibrium

Summary of designs considered

Nine conceptual design alternatives for the intersection were developed. Each is briefly summarized below including its performance in terms of Levels of Service, relative costs, and general pros and cons, including the plan's ability to accomplish the overall goals of the redesign project. A no-build alternative (Alternative "A") was included, but deemed unsatisfactory.

Alternative A: No-Build

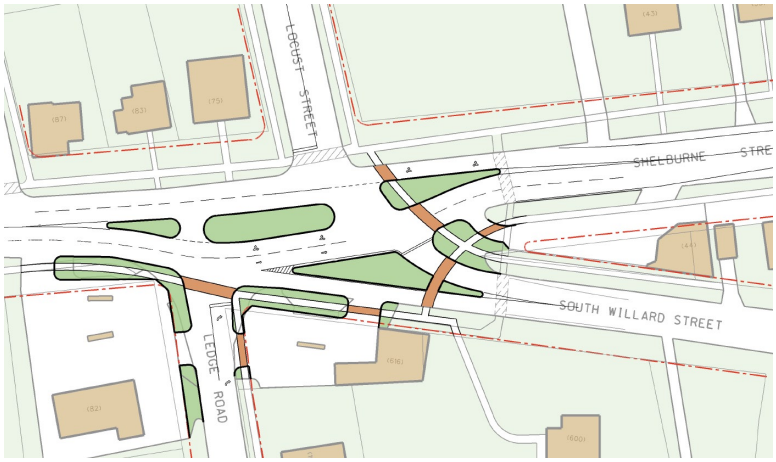
Maintaining the status quo is an option to be considered in every design project. Allowing the current traffic patterns to continue would not address bicyclist or pedestrian concerns, improve circulation or safety, or create a downtown gateway.



Pros: Economical, easy to accomplish, minimum disruption including minimum effect on private property and local businesses.
Cons: Continued barrier effect to pedestrians, potential collapse of intersection, unstable equilibrium leading to safety or capacity failure, likely delays and long queues on South Willard, no improvement in neighborhood focus, distribution or gateway function.
Relative cost: None.

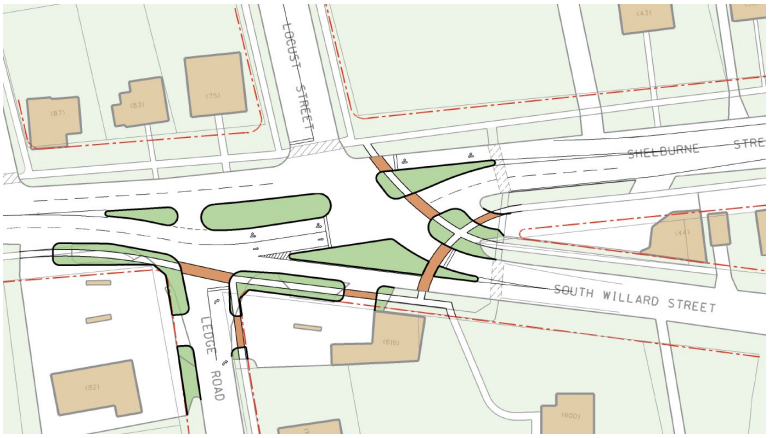
Alternative B: Modified Existing

This alternative is primarily focused on improving pedestrian safety at street crossings, while also clarifying vehicular movements. This plan assumes the city places higher budget priority on pedestrian issues over vehicular concerns, and defers the installation of signalization until a later time. It is also possible that this could be an interim scheme while funding and permitting are secured for a future signalized or other design option. As shown on this plan, all construction would be within the existing curbs and right of way, Minimizing impacts to private property and creating a plan that is low in cost with the exception of surface treatments of curbing and grass. This plan changes areas of unnecessary pavement into landscaped islands and better defines vehicular movements. Raised grass islands will improve pedestrian connections by providing "refuges" at both Shelburne Street and South Willard Street. Pedestrian push button lights could also be incorporated into the islands. The islands will also better define vehicular circulation and create potential for additional landscaped gateway treatments. In this option, Locust Street may turn right onto Shelburne Road to go southbound, but, as it exists today, must go around the traffic island to go up South Willard Street or northbound on Shelburne Street.



Summary of traffic Levels of Service (LoS) for this alternative:
Because there are few alterations to the existing traffic patterns, this plan may be only a slight improvement over Alternative A, the No-Build.
Pros: Relatively economical and easy to implement, improvement in pedestrian access, improves access management around Ledge Rd. (also true for all subsequent alternatives).
Cons: Likely need for some control to overcome barrier effect of Shelburne St. and accommodate traffic flow, continued need for land use control, no resolution of unstable equilibrium of intersection nor likely delays and queues on S. Willard.
Relative cost: Low due to only surface construction, no ROW costs.

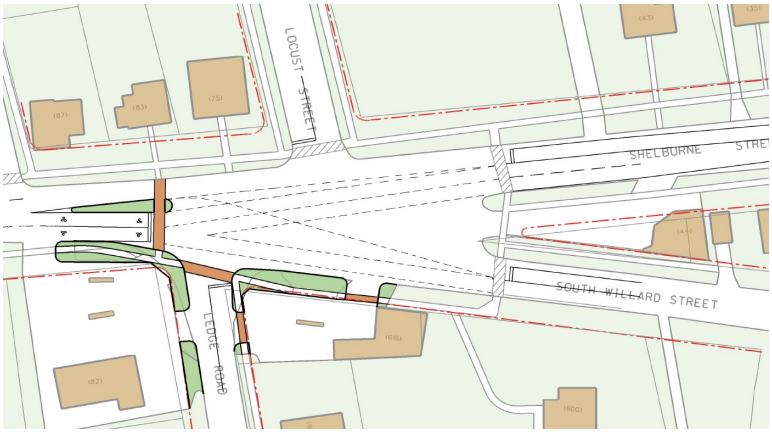
Alternative C: Modified Existing with Signal



This alternative is similar to Alternative B, but with the addition traffic signals to create a controlled 4-way intersection (Ledge Road is treated separately and controlled by a stop sign). All construction would be within the existing curbs and right of way, simplifying land acquisition and minimizing impacts to private property. Raised grass islands will improve pedestrian connections by providing "refuges" at both Shelburne Street and South Willard Street. The islands and traffic signal will better define vehicular circulation and create potential for additional landscaped gateway treatments. A pedestrian phase could also be incorporated into the traffic signal.

Summary of traffic Levels of Service (LoS) for this alternative: D
Similar to Alternative E
Pros: Relatively economical and easy to implement, improvement in pedestrian access, improves access management around Ledge Rd. (also true for all subsequent alternatives).
Cons: Likely need for some pedestrian control to overcome the barrier effect of Shelburne Street and accommodate traffic

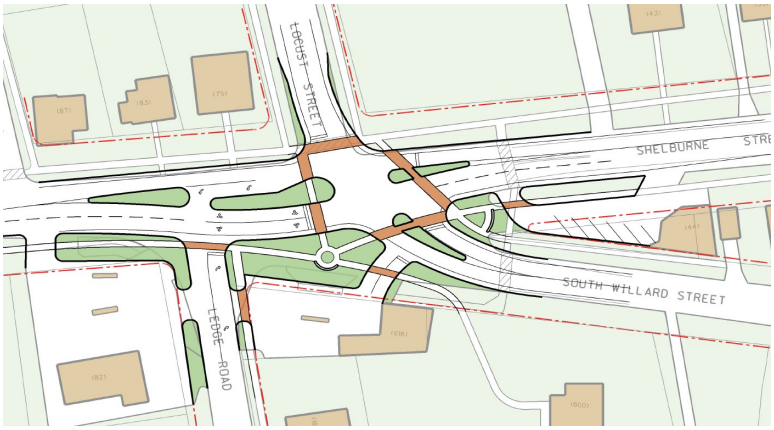
Alternative D: 5-Way Signalized Intersection



This alternative signalizes the existing intersection, such that each side street comes to a complete stop, while other lanes and pedestrians traverse the intersection. Similar to the intersection with South Winooski and Howard Streets, a 5-phased traffic signal would be used. Common to other multi-leg signals, this layout will cause longer delays. However, a pedestrian phase in the signal would improve pedestrian safety. Vehicular circulation would be clarified in this option by minimizing the number of lanes traveling at one time. All construction would be within the current existing curbs and right of way. Given that the current intersection would essentially remain the same, the potential for development of an attractive landscaped gateway is minimal. The creation of a gateway for the corridor under this plan might better be relocated to a different location altogether, perhaps further to the north.

Pros: Possible pedestrian cycle, interruption of continuous traffic on mainline.
Cons: Capacity, high lost time, resulting in long delays and inefficient operation, difficult geometry (approx. 200' across intersection) requiring long clearance intervals and potential conflicts, need for far side northbound lane drop.
Relative cost: Moderate.

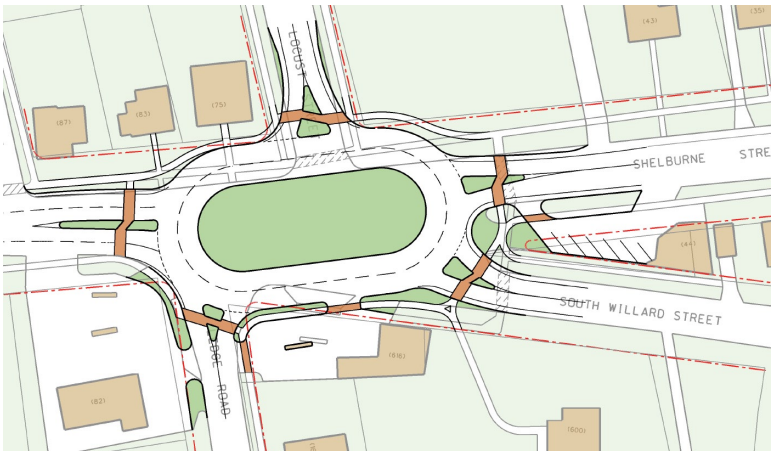
Alternative E: 4-Way Traffic Light



This alternative creates a more traditional four-way signalized intersection. Traffic will come to a complete stop at the South Willard - Shelburne Road and Shelburne Street -Locust Street legs of the intersection. Ledge Road is held away from the signals to allow entering and exiting as a right turn into the signal controlled further to the north. Crosswalks can be located at all corners of the intersection, with a phased pedestrian crossing, thus improving pedestrian safety. Both the intersection and the optional planted boulevard islands approaching the intersection would clarify vehicular circulation and reduce erratic traffic movements. New public spaces for trees, other landscape elements, and gateway landscaping would be achieved with minimal right of way changes. The current right of way is adequate for this design.

Pros: Conventional 4-way operation, provides improved pedestrian access and improved neighborhood focus and open space.
Cons: Relatively poor level of service, cost of signalization, aesthetic issues of signalization, significant lost time potential, difficult geometric configuration, requires far side northbound lane drop.
Relative cost: Moderate

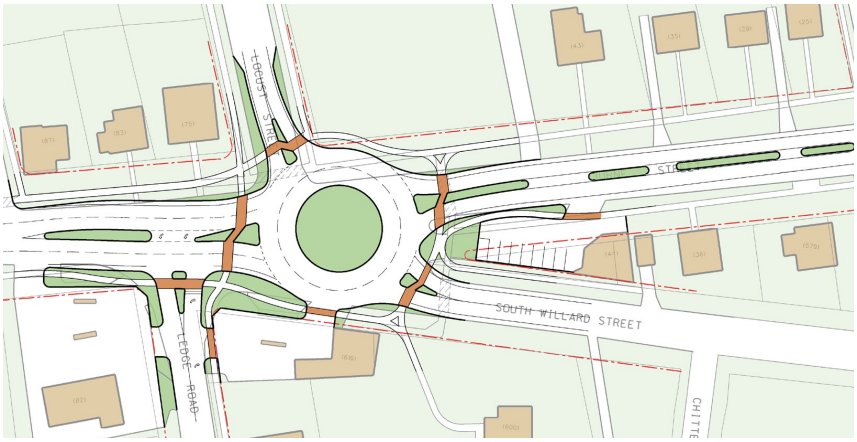
Alternative F: 5-Leg Roundabout



This alternative incorporates all five streets into one, elongated roundabout to improve traffic and pedestrian flow, although trucks may have problems traversing this roundabout. Traffic speeds may be higher than in a modern, circular roundabout. Two traffic lanes would allow for improved and clarified vehicular circulation. Planted boulevard islands approaching the roundabout are optional and would help to "calm traffic" and enhance the sense of traveling through a gateway. The current public right of way would need to be expanded at multiple properties. The center island of the roundabout allows ample room for creation of a landscaped gateway.

Pros: As for Alternative G (Modern Roundabout), except that this plan resolves access issues around Ledge Street: safety, capacity, bike/ped. friendly, metering plus distribution functions, provide for minor street access without unduly restricting mainline access.
Cons: As for Alternative G (Modern Roundabout), the modified oval shaped circulation pattern instead of a classic round roundabout. This plan encroaches significantly on one local business property, which have been dealt with in design refinements in the final preferred alternatives.
Relative cost: High

Alternative G. Modern Roundabout



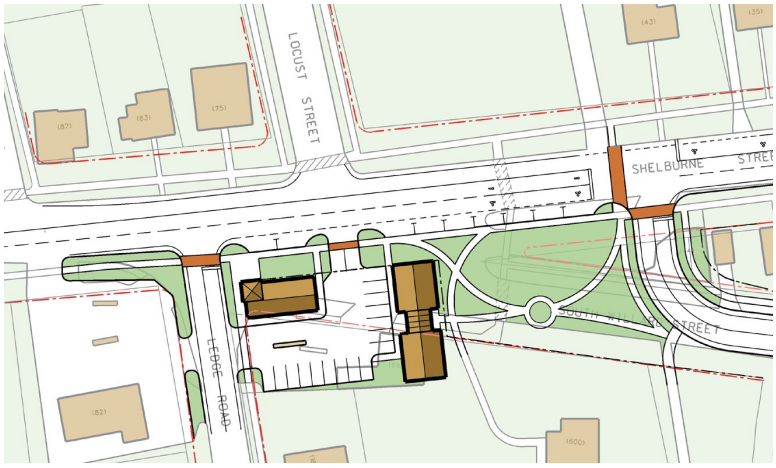
The reconfiguration of the rotary into a modern roundabout would create traffic speeds that are safe and appropriate for this area of mixed business and residential uses. From a traffic perspective, the performance of the intersection could improve the left turn delays experienced on most side streets, while still allowing free movement along the Route 7 corridor. A roundabout with two lanes would allow for improved traffic circulation. A left turn onto Ledge Road would be protected from accelerating traffic with a turning space. Planted boulevard islands approaching the intersection from the north are optional and would improve pedestrian safety, help to calm traffic, and extend the gateway treatment. Pedestrian crossings are accomplished one direction at a time, with angled crossing of refuge islands. The angled crossing assists the pedestrian in facing oncoming traffic. The current right of way would need to be expanded at the school property. The center island of the roundabout allows ample room for creation of a landscaped gateway.

Pros: Safety, capacity, superior level of service, bike/ped friendly, metering plus distribution functions, provide for minor street access without unduly restricting mainline access, provides for neighborhood focus and gateway functions, aesthetically pleasing.

Cons: Lack of public familiarity with roundabout circulation patterns, possible ROW issues (although in this configuration, appears to encroach minimally on any private property and not at all on any local business), awkward handling of southbound left turn into Ledge, probable delays at Ledge to southbound.

Relative cost: Moderate.

Alternative H. Separate Intersections



This alternative reconfigures the rotary by relocating South Willard Street further north on Shelburne Street and making a T-intersection. Similar to the rest of the Route 7 corridor, the two lower volume side streets, Ledge Road and Locust Street, are handled as “stop” controlled intersections. The new South Willard Road is a new 3-phase signal.

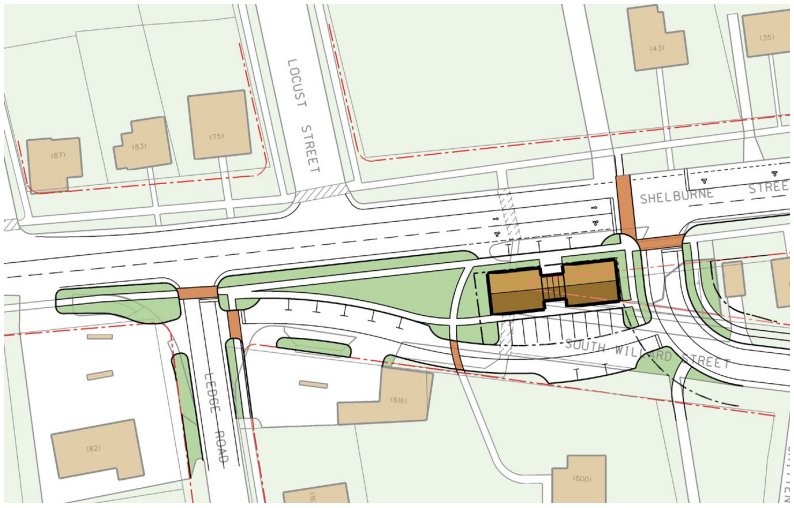
This plan requires the relocation of the current Century 21 property, but accommodates a larger new building, parking, and a side street connector with on-street parking. This alternative provides pedestrian crossings on the side streets and at the new South Willard-Shelburne Street intersection. Vehicular circulation would be clarified, although the traffic light warranted at South Willard Street may cause some level of delays, but not the extent of the 5-phase signals previously described. A left turn onto South Willard would be accommodated with a 15’wide lane. This plan will require both right-of-way and property acquisition and/or exchange and redevelopment compensation. Since this plan essentially creates more of a linear landscaped streetscape corridor, the introduction of a gateway could be difficult; however, the change and dramatic improvement of the streetscape in itself, combined with economic development potential may be a worthy accomplishment!

Pros: Provides for adequate levels of service at the key S. Willard Street intersection, will require signalization, provides for better layout around relocated real estate office, provides for improved pedestrian access. Enhances the continuum of Shelburne Road streetscape.

Cons: Continues and even possibly even increases barrier effect of through - route, provides no improvements to side streets (Locust and Ledge), possible grade issues for new S. Willard Street alignment, requires relocation of real estate office.

Relative cost: Highest cost, due to land acquisition, street relocation, and redevelopment.

Alternative I. Separate Intersections with a Park



This alternative is similar to Alternative H, but the connecting side street between Ledge Road and South Willard Street is eliminated and the new development of the Century 21 parcel is combined with redevelopment of the Mobil station, allowing a new park to be created in front of the church. This approach will visually link the green space at Sacred Heart School with the Chapel on the hill to the east and crate a new neighborhood park, narrow the scale of Shelburne Road/Street, and promote new economic development for the neighborhood. Vehicular circulation is simplified and clear, although traffic speeds may exceed the posted limits since there is minimal traffic calming deflection in the street realignments. A left turn onto South Willard would be accommodated with a 16'wide lane. Pedestrian crossings are the same as Alternative H. Parking is placed behind the gas station and real estate office, enhancing the street frontage. Since major redevelopment of the gas station and Century 21 properties are required, right of way issues may or may not be acceptable in this plan. Introduction of the gateway could be difficult given the linear nature of this option.

Summary of traffic Levels of Service (LoS) for this alternative:
Same as Alternative H.
Pros: As for Alternative H. except provides for improved public open space.
Cons: As for Alternative H.
Relative cost: Similar to H, this is the highest cost of the options.

Preferred design alternatives

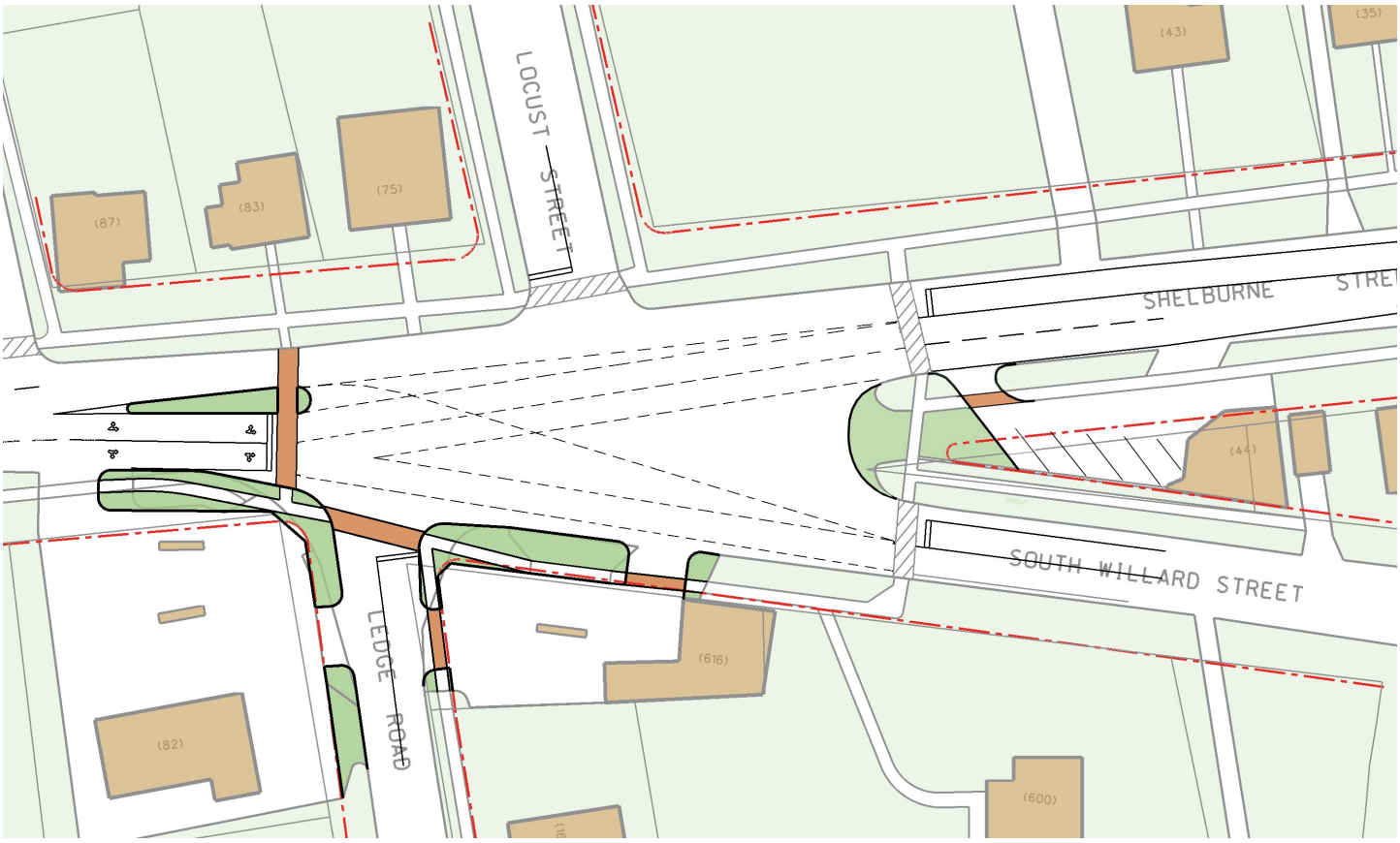
Alternative D: Five-way Signalized Intersection

This alternative signalizes the existing intersection such that each side street comes to a complete stop, while other lanes and pedestrians traverse the intersection. Similar to the intersection with South Winooski and Howard Streets, a 5-phased traffic signal would be used. Common to other multi-leg signals, this layout will cause long delays. However, a pedestrian phase in the signal would improve pedestrian safety. Vehicular circulation would be clarified in this option by minimizing the number of lanes traveling at one time. All construction would be within the current existing curbs and right of way. Given that the current intersection would essentially remain the same, the potential for development of an attractive landscaped gateway is minimal. The creation of a gateway for the corridor under this plan might better be relocated to a different location altogether, perhaps further to the north.

Summary of Traffic Levels for Alternative D:

Approach	Ave. Delay“(sec/veh)	v/c	Level of“Service
Shelburne St. NB	14.6	0.95	B
Shelburne St. SB	383.7	1.26	F
Willard St.	582.5	0.53	F
Locust/Ledge St.	166.4	1.19	F
Overall Intersection	261.6		F

Pros: Possible pedestrian cycle, interruption of continuous traffic on main line.
Cons: Limited capacity with high lost time resulting in long delays and inefficient operation, difficult geometry (approx. 200’ across intersection) requiring long clearance intervals and potential conflicts, need for far side northbound lane drop.



Existing photograph of the rotary from Willard Street.

Sketch of the intersection after Alternative D improvements: Handsome black signal posts, banners to celebrate the entrance to the downtown, street tree plantings, clearly defined pedestrian crossings, and development of a mini-park at the northern terminus of the intersection will all contribute to forming a gateway to the city.

Alternative F: 5-Leg Roundabout

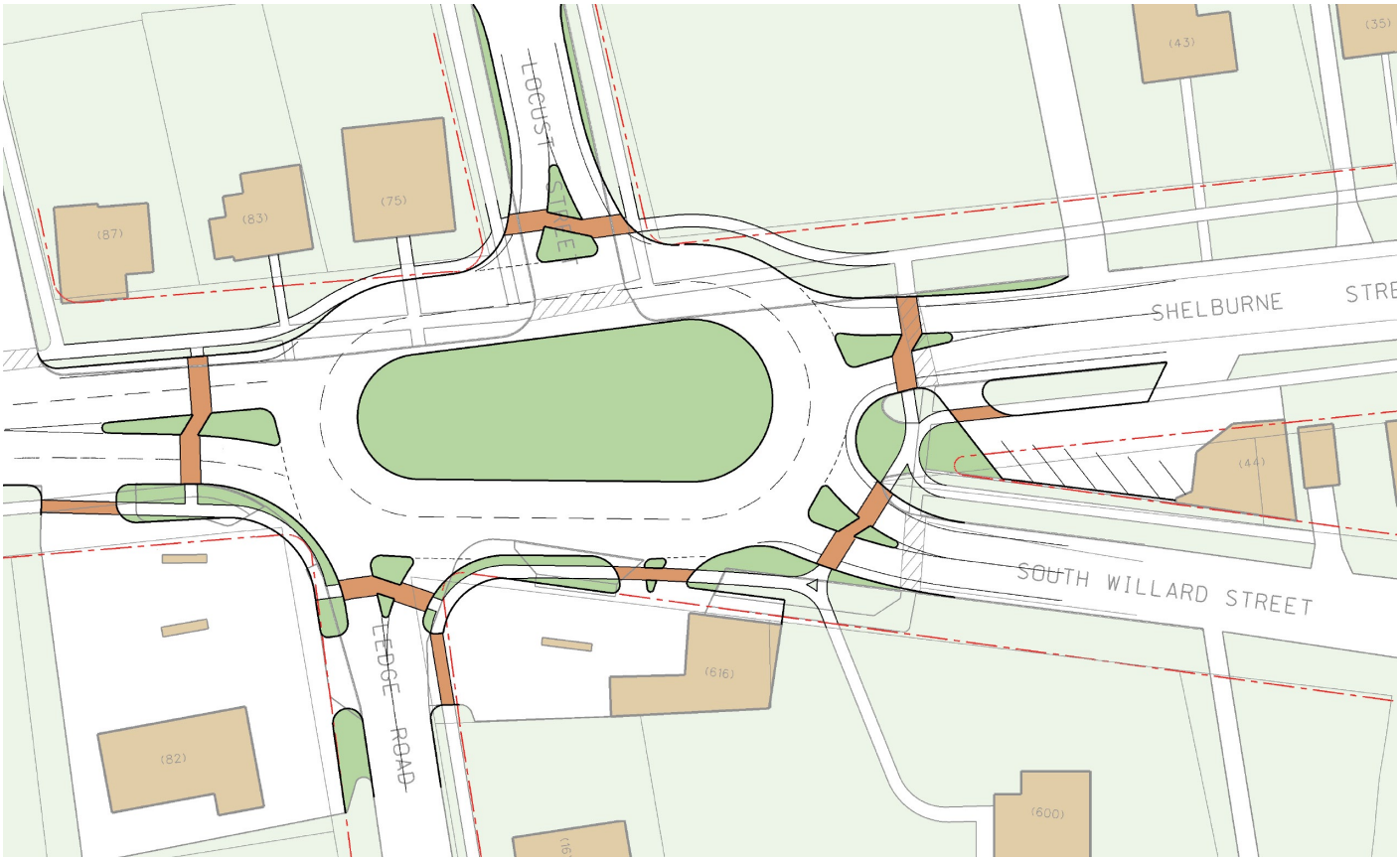
This design incorporates all five streets into an elongated roundabout to improve traffic and pedestrian flow for all through movements and side streets. While trucks have problems traversing the current rotary, this roundabout has been designed to support appropriate truck traffic for both through movements and full U-turns in most directions. While the traffic speeds may be higher than in a modern, circular roundabout. due to the longer straight sections of the oval, the roundabout will serve as an effective traffic alming measure to slow highway speed vehicles as they enter the downtown. Two traffic lanes in the roundabout proper will allow for improved vehicular circulation and increased capacity at peak hours. Planted islands approaching the roundabout are optional and will help to "calm traffic" and enhance the sense of a gateway. The current public right of way would need to be expanded at multiple properties. The center island of the roundabout allows ample room for creation of a landscaped gateway.

Summary of Traffic Levels for Alternative F:

Approach	**Ave. Delay"(sec/veh)**	**Level of"Service**	**95% Queue**
Shelburne St. SB	0.9	A	1
Locust St.	2.5	A	0
Shelburne St. NB	0.3	A	0
Ledge Rd.	2	A	0
Willard St.	1.8	A	0
Overall Intersection	0.8	A	

Pros: As for Alternative G, Modern Roundabout, except resolves access issues around Ledge Street: safety, capacity, bike/ped. friendly, metering plus distribution functions, provide for minor street access without unduly restricting mainline access.

Cons: Lack of public familiarity, ROW issues, the longer straight leg of the oval may allow slightly higher design speeds.



Note: This plan has been revised from the earlier conceptual alternative to have less impact on the gas station

Existing photograph of the rotary from Willard Street.

Sketch of the intersection after Alternative F improvements: Wheras a signalized intersection focuses on the enhancement of the roadside areas and the roadway itself remains as a large open paved area, the roundabout alternative redefines the street and intersection such that a landscape with integrity and identity is formed. The enhancement is of the whole roadway. Street trees, improved pedestrian crosswalks are all a part of the roundabout design, and similar to the previous design, a mini-park at the northern end is developed. Both plans intergate the traditional "Hairpin" sign for the Burlington Wayfinding system.

Opinions of Probable Cost for preferred plans:

Alternative D: Five-way Signalized Intersection

Signalized alternative

Description	Quantity	Unit	Unit Price	Total
Demo pavement	960	sy	$6.50	$6,240.00
Demo sidewalks	250	sy	$7.50	$1,875.00
Demo concrete curbs	440	lf	$4.00	$1,760.00
Disposal of demo materials	214	cy	$10.00	$2,138.89
Rough Grade Site	13,900	sf	$0.25	$3,475.00
12” Gravel Base	644	cy	$14.00	$9,009.26
6” Cr. Gravel	322	cy	$18.00	$5,791.67
6” Pavement	1,500	sy	$12.00	$18,000.00
Pavement Markings	1	ls	$1,500.00	$1,500.00
Traffic Signs	1	ls	$2,500.00	$2,500.00
Crosswalks	900	sf	$10.00	$9,000.00
5” Sidewalks	1,000	sf	$3.50	$3,500.00
Granite Curbs	250	lf	$35.00	$8,750.00
Signals w/ mast arms, 2 faces ea, 2 ph	ea	25,000	5	$125,000.00
Additional ph controller	ea	3,000	3	$9,000.00
Full actuation w/ detectors	l.s.	10,000		$10,000.00
Ped push buttons	ea	1,500	4	$6,000.00
Interconnect, direct burial	lf	2	500	$1,000.00
Subtotal for signals				$151,000.00
Traffic Control Officer	80	hr	$40.00	$3,200.00
landscaping allowance				$75,000.00
Mobilization	1	ls	$3,000.00	$3,000.00
Topsoil	50	cy	15	$750.00
Seeding	4,000	sf	$0.10	$400.00
Subtotal				$306,889.81
General Conditions	8	%		$24,551.19
Subtotal				$331,441.00
Profit & Overhead	6	%		$19,886.46
Total				$351,327.46
Contingency	10	%		$35,132.75
Total Probable Cost of Construction				**$386,460.21**

Alternative F: 5-Leg Roundabout

Scheme E

Description	Quantity	Unit	Unit Price	Total
Demo pavement	3,200	sy	$6.50	$20,800.00
Demo sidewalks	500	sy	$7.50	$3,750.00
Demo concrete curbs	900	lf	$4.00	$3,600.00
Disposal of demo materials	642	cy	$10.00	$6,416.67
Rough Grade Site	45,400	sf	$0.25	$11,350.00
12” Gravel Base	926	cy	$14.00	$12,962.96
6” Cr. Gravel	463	cy	$18.00	$8,333.33
6” Pavement	2,500	sy	$12.00	$30,000.00
Pavement Markings	1	ls	$3,000.00	$3,000.00
Traffic Signs	1	ls	$4,500.00	$4,500.00
Crosswalks	1,760	sf	$10.00	$17,600.00
5” Sidewalks	7,000	sf	$3.50	$24,500.00
Granite Curbs	1,200	lf	$35.00	$42,000.00
Traffic Control Officer	320	hr	$40.00	$12,800.00
Landscaping allowance				$75,000.00
Mobilization	1	ls	$5,000.00	$5,000.00
Topsoil	400	cy	15	$6,000.00
Seeding	13,000	sf	$0.10	$1,300.00
Subtotal				$288,912.96
General Conditions	8	%		$23,113.04
Subtotal				$312,026.00
Profit & Overhead	6	%		$18,721.56
Total				$330,747.56
Contingency	10	%		$33,074.76
Total Probable Cost of Construction				**$363,822.32**