RESOURCE SYSTEMS GROUP INCORPORATED

MEMORANDUM

To: Justin Rabidoux
From: Brian Grady and Robert Chamberlin
Subject: Downtown One-Way Circulation Study
Date: December 2000

We have completed model runs and Level of Service analyses relating to two alternative circulation scenarios. These involve the conversion to two-way streets for the South Winooski/South Union one-way pair system, and for the George/Elmwood one-way pair system. For this memorandum, the four scenarios considered are listed in Table 1.

Table 1: Traffic Circulation Scenarios

One Way Pair	Time Period
South Winooski and South Union	AM
South Winooski and South Union	PM
George and Elmwood	AM
George and Elmwood	PM

APPROACH

To estimate changes in traffic flow, we have used the Chittenden County Travel Demand Model. This model contains sufficient network detail in downtown Burlington to adequately capture the dynamics associated with converting one-way pairs to two-way streets. For each of the circulation scenarios, a model was coded that contained the relevant network changes. The model was subsequently run, and resulting roadway volumes for the scenario were compared with the Base Case volumes (Base Case refers to existing roadway conditions).

To facilitate the interpretation of this information, we have produced colored plots for each scenario depicting the major changes in traffic flow from the existing conditions. Table 2 provides a key for interpreting the traffic volume changes between the scenario and the Base Case.

331 Olcott Drive, White River Junction, Vermont 05001
TEL 802.295.4999 ▪ FAX 802.295.1006 ▪ www.rsginc.com

Table 2: Key to Interpreting Maps Showing Estimated Changes in Traffic Volumes

Change in Traffic Volumes (Base Case – Scenario)	Description	Color Code
< -200	Reduction of 200 or more vehicles per hour	Red
-50 to – 199	Reduction of 50 to 199 vehicles per hour	Orange
50 to 199	Increase of 50 to 199 vehicles per hour	Green
> 200	Increase of 200 or more vehicles per hour	Blue

The graphics represent the actual TModel network. Therefore, load links (artificial connections, shown as roads, that load vehicles onto the network) are also included. Street names for the major roadways have been included to help visualize the study area

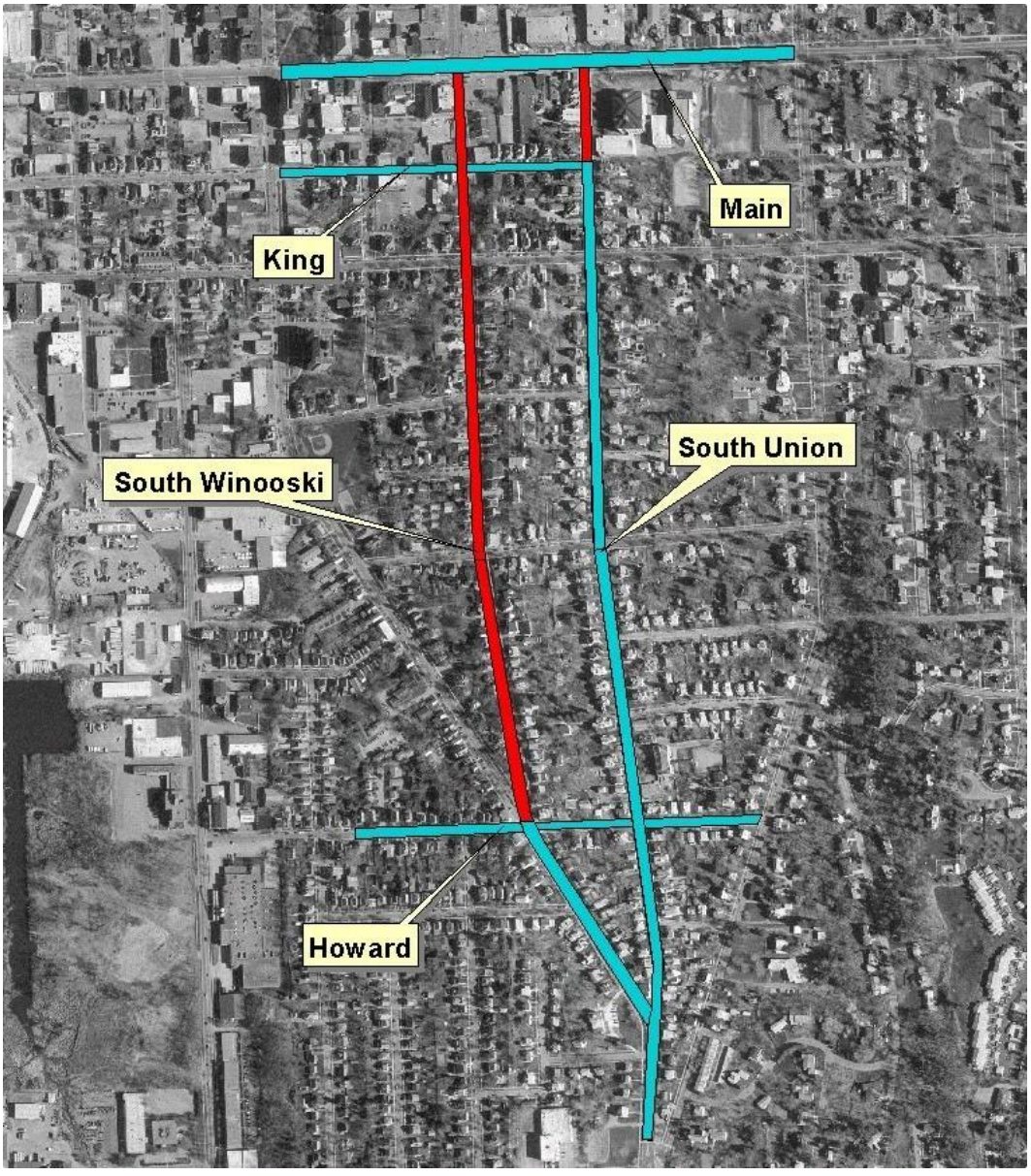
The second component of the analysis involved determining the Levels of Service for 17 intersections within the two major corridors under consideration. For this component, turning movement counts for all but one intersection in the study area were obtained. The turning movement counts were adjusted to reflect year 2000 design hour conditions[1]. Turning movement volumes for each intersection were saved for each scenario run and compared to the design hour turning movement volumes. The resulting traffic volumes (design hour volumes +/- model volume differences) were then used to conduct the Level of Service analysis. The changes due to the conversion of South Winooski/South Union and George/Elmwood were more localized than the changes observed in Round 1. Therefore, only cases where significant changes in LOS are projected are described in the narrative. Since conversion to two-way would necessitate the implementation of new signal timings, we have where appropriate reallocated green time among the various intersection approaches. However, existing cycle lengths were maintained.

[1] The design hour reflects the 30th highest hour of traffic in a year.

SCENARIO 1: CONVERTING SOUTH WINOOSKI AND SOUTH UNION ONE-WAY PAIR TO TWO-WAY

For Scenario 1, South Winooski Avenue from Maple Street to Howard Street was converted from one-way southbound to two-way. In addition, South Union Street from King Street to Main Street was converted from one-way northbound to two-way. Figure 1 is an aerial photo of the study area. The red shaded segments are currently one-way.

Figure 1: South Winooski and South Union Two-Way Conversion Study Area



AM Period

For the AM period, the two-way conversion of South Winooski Avenue and South Union Street results in the expected northbound shift off of South Union Street and onto South Winooski Avenue. In addition, the creation of a South Winooski northbound travel lane at the Howard Street intersection removes 70 northbound vehicles from Saint Paul Street. The Adams Street area neighborhoods have access to both Maple Street and South Winooski Avenue. Therefore, in the two-way scenario, an additional 70 vehicles access South Winooski directly and continue north instead of using Maple Street to exit the neighborhood.

In the southbound direction, there is also a slight shift off of South Winooski and South Union onto Saint Paul Street and Pine Street. The southbound increase on Pine Street continues all the way to Queen City Parkway near the VT 189 interchange. Eastbound vehicles formerly on Main Street now use Pine Street south and continue east on Maple Street. Table 3 summarizes some of the major changes in traffic flow for this scenario.

Table 3: Estimated Traffic Volume Changes, So. Winooski & So. Union Converted to Two Way Streets 2000 AM

Link	Direction	From	To	Increase	Decrease
South Union Street	NB	South Winooski Avenue	King Street		-210
Saint Paul Street	NB	South Winooski Avenue	Pine Street		-70
South Winooski Avenue	NB	Howard Street	King Street	352	
South Union Street	SB	Maple Street	South Winooski Avenue		-55
South Winooski Avenue	SB	Main Street	Howard Street		-55
Pine Street	SB	Maple Street	Queen City Park Road	58	
Saint Paul Street	SB	Pine Street	South Winooski Avenue	65	
Main Street	EB	Pine Street	South Union Street		-176
Pine Street / Maple Street	EB / SB	Main Street	Adams Street	166	

Figure 1, labeled "So. Winooski & So. Union (AM)" shows the volume changes above. The figure shows volume changes west of Pine Street in the area of Battery Street and Main Street. The model has likely overstated this effect, as the model does not accurately assign traffic on equivalent-parallel routes. These volume changes are not related to the two-way conversion, but are a result of "model noise" observed when comparing different model runs. Traffic will filter through this area of the downtown as it does now.

Table 4 shows the results of the LOS analysis for the South Winooski Avenue and South Union Street two-way AM scenario. Table 4 shows the results for the intersections most affected by the two-way conversion, namely South Winooski/Howard, South Winooski/King, South Union/King, and South

Union/Main. The other intersections in the study-area maintained the Base Case level of service with the two-way conversion.

The LOS analysis for the South Union/King intersection is based on raw model output. A turning movement count for this intersection could not be obtained. Therefore, the model output has not been pivoted against a ground count. The LOS improves from an E to a C with the two-way conversion because of the reduced northbound flow on South Union Street. The Base Case LOS at South Winooski/King is maintained. The South Winooski/Howard intersection is a five-leg intersection. The level of service software developed by RSG cannot effectively model a five-leg intersection. The Howard Street westbound approach volume is very small and was therefore not included in the LOS analysis. However, the signal cycle length was reduced from 70 seconds to 65 seconds to account for the westbound vehicles on Howard Street. The northbound approach of the South Winooski/Howard intersection was calculated to operate at LOS E with the current signal timing. However, reallocating green time results in the level of service reported in Table 4. The northbound approach of South Union/Main was calculated to operate at LOS F with the current signal timing. In the Base Case, two northbound travel lanes are available. This approach fails in the two-way scenario because there is only one remaining northbound travel lane. One lane must accept the southbound traffic as this section of South Union is now two-way. However, reallocating green time improves the approach LOS to a C. Although the overall LOS at South Union/Main has been reduced from a B to a C, the calculated delays are acceptable.

Table 4: Estimated 2000 AM Peak Hour LOS at Selected Intersections, Base Case and 2-Way Alternative, South Winooski Avenue and South Union Street

Intersection	Scenario	Base Case	2-way Alternative
South Winooski/Howard	Overall	B - 13.7 sec	B - 15.0 sec
	EB	B - 12.8 sec	C - 17.3 sec
	WB	C - 17.4 sec	C - 18.2 sec
	NB	B - 13.5 sec	C - 16.5 sec
	SB	B - 11.0 sec	B - 8.5 sec
South Winooski/King	Overall	A - 5.0 sec	A - 5.0 sec
	EB	A - 2.0 sec	A - 2.0 sec
	WB	A - 2.0 sec	A - 4.0 sec
	NB	A - 1.0 sec	B - 7.0 sec
	SB	B - 6.0 sec	A - 3.0 sec
South Union/King	Overall	E - 45.0 sec	C - 14.0 sec
	EB	F- 72.0 sec	C - 20.0 sec
	WB	n/a	n/a
	NB	C - 13.0 sec	B - 6.0 sec
	SB	n/a	A - 4.0 sec
South Union/Main	Overall	B - 8.6 sec	C - 18.5 sec
	EB	A - 3.7 sec	B - 9.7 sec
	WB	A - 4.8 sec	C - 18.7 sec
	NB	C - 24.9 sec	C - 24.7 sec
	SB	n/a	n/a

PM Period

In the PM peak hour, there is once again a diversion of the northbound traffic from South Union to South Winooski. In addition, there is a smaller northbound reduction on Saint Paul Street and Pine Street (30-40 vehicles on each road). Some eastbound traffic has also been moved off Main Street to King Street. Table 5 summarizes the major traffic flow changes for this scenario.

Table 5: Estimated Traffic Volume Changes, So. Winooski & So. Union Converted to Two Way Streets 2000 PM

Link	Direction	From	To	Increase	Decrease
South Union Street	NB	South Winooski Avenue	King Street		-270
Saint Paul Street	NB	South Winooski Avenue	Pine Street		-30
Pine Street	NB	Queen City Park Road	Maple Street		-40
South Winooski Avenue	NB	Howard Street	King Street	350	
Main Street	EB	Pine Street	South Winooski Avenue		-80
King Street	EB / SB	Pine Street	South Winooski Avenue	65	

Figure 2, labeled "So. Winooski & So. Union (PM)", highlights the volume changes above. The redistribution of traffic is very similar to the AM scenario. However, in the PM peak the southbound increase on Pine Street and Saint Paul Street is not observed. Once again, there are some confusing route changes west of Pine Street. As was discussed earlier, this result is unrelated to the two-way conversion.

Table 6 shows the LOS analysis for this scenario. The LOS at all 17 study-area intersections was calculated. Table 6 shows the results for the intersections most affected by the two-way conversion, namely South Winooski/Howard, South Winooski/King, South Union/King, and South Union/Main. The other 13 intersections in the study-area maintained the Base Case level of service with the two-way conversion.

The LOS analysis for the South Union/King intersection is again based on raw model output. A turning movement count for this intersection was not obtained. Therefore, the model output has not been pivoted against a ground count. The LOS improves from an E to a C with the two-way conversion because of the reduced northbound flow on South Union Street. The Base Case LOS at South Winooski/King is once again maintained. The northbound approach of the South Winooski/Howard intersection was calculated to operate at LOS F with the current signal timing. However, reallocating green time results in the level of service reported in Table 6. The northbound approach of South Union/Main was also calculated to operate at LOS F with the current signal timing. This approach fails in the two-way scenario because there is only one remaining northbound travel lane. In the Base Case, two northbound travel lanes are available. However, reallocating green time improves the approach LOS to a C. Although the overall LOS at South Union/Main has been reduced from B to C, the calculated delays are still acceptable.

Table 6: Estimated 2000 PM Peak Hour LOS at Selected Intersections, Base Case and 2-Way Alternative, South Winooski Avenue and South Union Street

Intersection	Scenario	Base Case	2-way Alternative
South Winooski/Howard	Overall	C - 18.0 sec	C - 24.4 sec
	EB	D - 13.0 sec	C - 18.7 sec
	WB	D - 27.2 sec	D - 39.2 sec
	NB	C - 15.1 sec	D - 27.7 sec
	SB	B - 14.8 sec	B - 9.2 sec
South Winooski/King	Overall	C - 14.0 sec	C - 12.0 sec
	EB	B - 7.0 sec	C - 13.0 sec
	WB	A - 2.0 sec	A - 4.0 sec
	NB	A - 1.0 sec	B - 6.0 sec
	SB	C - 19.0 sec	C - 12.0 sec
South Union/King	Overall	E - 41.0 sec	C - 20.0 sec
	EB	F- 52.0 sec	E - 31.0 sec
	WB	n/a	n/a
	NB	D - 30.0 sec	B - 9.0 sec
	SB	n/a	A - 3.0 sec
South Union/Main	Overall	B - 10.9 sec	C - 19.2 sec
	EB	B - 5.1 sec	B - 8.3 sec
	WB	B - 5.3 sec	C - 20.8 sec
	NB	D - 32.8 sec	D - 36.2 sec
	SB	n/a	n/a

SCENARIO 2: CONVERTING GEORGE AND ELMWOOD ONE-WAY PAIR TO TWO-WAY

For Scenario 2, George Street from Monroe Street to Pearl Street was converted from one-way southbound to two-way. In addition, Elmwood Avenue from Pearl Street to Grant Street was converted from one-way northbound to two-way. Figure 2 is an aerial photo of the study area. The red shaded segments are currently one-way.

Figure 2: George and Elmwood Two-Way Conversion Study Area

AM Period

For the AM period, the conversion of George Street and Elmwood Avenue to two-way causes a shift of southbound traffic from North Winooski Avenue and George Street to Elmwood Avenue. Similarly, the northbound traffic has been shifted from Elmwood Avenue and North Champlain Street to George Street. These streets provide north-south routing, and the volume burden is now shared. However, the northbound volume on North Champlain Street north of Peru Street is unchanged. This is due to the fact that the northbound increase on George Street filters back to North Champlain Street via east and west streets such as Monroe Street and Peru Street. Figures 3a and 3b show the graphical output of this scenario.

Most importantly, the two-way conversion of George Street results in a high percentage of cut-through trips. Northerly vehicles traveling west on Pearl Street are now presented with two routing options when they reach the George Street intersection. They can proceed west on Pearl Street and take a right turn onto North Champlain Street or they can turn right onto George Street and use either Monroe Street or Peru Street to access North Champlain Street. By examining the link volumes in this area we can determine how many vehicles are "cut-through" trips. 73% of the vehicles that turn right on George Street are destined for the North Champlain Street/North Street intersection. Half of these vehicles use Monroe Street and the other half use Peru Street to access North Champlain. The model may be overstating the attractiveness of this route. Vehicles on Pearl Street encounter two traffic signals that are not encountered using the cut-through. Therefore, the path using George Street was favored in the assignment process. These two routes would share the northbound volume more equally, especially under heavily congested conditions when the signals on Pearl Street would operate more efficiently than the stop signs on George Street.

As described earlier, the traffic changes shown in Figure 3a proximate to King Street, Maple Street and Pine Street are not considered relevant to this analysis. Table 7 summarizes the most significant traffic volume changes resulting from conversion.

Table 7: Estimated Traffic Volume Changes, George St. & Elmwood Ave. Converted to Two Way Streets 2000 AM

Link	Direction	From	To	Increase	Decrease
North Winooski Ave.	SB	North Street	Pearl Street		-180
George Street	SB	Peru Street	Pearl Street		-127
Elmwood Avenue	SB	North Street	Peru Street	219	
Elmwood Avenue	NB	Pearl Street	Peru Street		-142
North Champlain St.	NB	Pearl Street	Monroe Street		-110
George Street	NB	Pearl Street	Monroe Street	311	
George Street	NB	Monroe Street	Peru Street	137	
Monroe Street	WB	George Street	North Champlain St.	128	
Pearl Street	EB	Elmwood Avenue	North Winooski Ave.	256	
North Street	EB	Elmwood Avenue	North Winooski Ave.		-216
Pearl Street	WB	Elmwood Avenue	George Street	218	
Peru Street	WB	Elmwood Avenue	George Street		-268

The LOS at all 17 study-area intersections was calculated. Table 6 shows the results for the intersections most affected by the two-way conversion, namely George/Pearl and Elmwood/Pearl. These are both stop-controlled T-intersections. The other 15 intersections in the study-area maintained the Base Case level of service with the two-way conversion. The Base Case LOS is also maintained at the George/Pearl intersection. The Elmwood /Pearl intersection fails in the two-way conversion scenario. The left turn movement is the source of the southbound approach failure. High conflicting flow on Pearl Street, 984 vehicles in the AM, makes the left-turn a difficult maneuver. The southbound approach is a shared lane, so the right-turn is also shown as failing. Signalization of this intersection may be necessary to improve LOS if George Street and Elmwood Avenue are to be converted to two-way. However, close proximity to other signalized intersections on Pearl Street discourages the signalization of the Elmwood/Pearl intersection. The Church Street intersection is 190 feet away and the Saint Paul Street intersection is only 150 feet away. The LOS for a signalized Elmwood/Pearl intersection was calculated. Although the overall LOS improves, the resulting eastbound left-turn queue length is unacceptable. The eastbound left-turn queue is 100 feet in the AM and 131 feet in the PM. The signalized Saint Paul intersection is only 150 feet downstream, and vehicles in the PM peak period would back up almost all the way to this intersection. Table 8 summarizes the LOS for the two Pearl Street intersections.

Table 8: Estimated 2000 AM Peak Hour LOS at Selected Intersections, Base Case and 2-Way Alternative, George Street and Elmwood Avenue

Intersection	Scenario	Base Case	2-way Alternative
George/Pearl	Overall	A - 2.0 sec	A - 1.0 sec
	SB LT	B - 9.0 sec	B - 10.0 sec
	SB RT	A - 4.0 sec	B - 10.0 sec
	EB LT	A - 3.0 sec	A - 4.0 sec
Elmwood/Pearl	Overall	A - 1.0 sec	F - very delayed
	SB LT	n/a	F - very delayed
	SB RT	n/a	F - very delayed
	EB LT	A - 5.0 sec	B - 5.0 sec

PM Period

As with the AM period, the conversion of George Street and Elmwood Avenue to two-way causes a shift of southbound traffic from North Winooski Avenue and George Street to Elmwood Avenue, while northbound traffic has been shifted from Elmwood Avenue and North Champlain Street to George Street. In addition to the AM patterns, 70 northbound vehicles formerly using North Union Street now use Elmwood Avenue. The cut-through trips observed in the AM time period also occur in the PM. 82% of the vehicles that turn right on George Street end up at the North Champlain Street/North Street intersection. Again half of these vehicles use Monroe Street and the other half use Peru Street to access North Champlain Street. As was discussed in the AM Period section, the model is probably overstating the attractiveness of the George Street cut-through. The number of cut-through trips can be interpreted as a maximum. Table 9 summarizes the major changes in roadway volume estimated for the PM peak hour.

Table 9: Estimated Traffic Volume Changes, George St. & Elmwood Ave. Converted to Two Way Streets 2000 PM

Link	Direction	From	To	Increase	Decrease
North Winooski Ave.	SB	North Street	Pearl Street		-184
George Street	SB	Peru Street	Pearl Street		-52
Elmwood Avenue	SB	North Street	Peru Street	248	
Elmwood Avenue	NB	Pearl Street	Peru Street		-120
North Champlain St.	NB	Pearl Street	Peru Street		-328
George Street	NB	Pearl Street	Monroe Street	526	
George Street	NB	Monroe Street	Peru Street	275	
Monroe Street	WB	George Street	North Champlain St.	215	
Pearl Street	EB	Elmwood Avenue	North Winooski Ave.	60	
North Street	EB	Elmwood Avenue	North Winooski Ave.		-60
Pearl Street	WB	North Winooski Ave.	Elmwood Avenue	180	
North Street	WB	North Winooski Ave.	Elmwood Avenue		-180
Pearl Street	WB	Elmwood Avenue	George Street	320	
Peru Street	WB	Elmwood Avenue	George Street		-317

Figure 4, labeled "George & Elmwood (PM)", highlights the major changes in traffic when compared to the base case. The distribution of traffic changes is very similar to the AM scenario. However, in the PM there are no volume changes west of Pine Street and south of College Street. This helps to confirm the fact that the volume changes observed earlier in this area were not real effects but rather "model noise."

The LOS at all 17 study-area intersections was calculated. Table 10 shows the results for the intersections most affected by the two-way conversion. The other 15 intersections in the study-area maintained the Base Case level of service with the two-way conversion. The Base Case LOS at the George and Elmwood intersection is also maintained in the PM period. The new southbound approach at the Elmwood/Pearl intersection has LOS F because of the new left-turn demand and high conflicting flow (1448 vehicles) on Pearl Street. The LOS could not be improved by reallocating green time because it is a stop-controlled intersection.

Table 10: Estimated 2000 PM Peak Hour LOS at Selected Intersections, Base Case and 2-Way Alternative, George Street and Elmwood Avenue

Intersection	Scenario	Base Case	2-way Alternative
George/Pearl	Overall	A - 1.0 sec	A - 1.0 sec
	SB LT	C - 13.0 sec	C - 16.0 sec
	SB RT	A - 5.0 sec	C - 16.0 sec
	EB LT	A - 3.0 sec	B - 6.0 sec
Elmwood/Pearl	Overall	A - 1.0 sec	F - very delayed
	SB LT	n/a	F - very delayed
	SB RT	n/a	F - very delayed
	EB LT	B - 7.0 sec	B - 10.0 sec

CONCLUSIONS

Converting South Winooski Avenue and South Union Street to two-way does not have any negative operational impacts. Unlike the one-way pairs converted in the Round 1 modeling, very little additional traffic is drawn to the corridor by converting these streets to two-way. Only one block of South Union Street was converted to two-way. However, a northbound travel lane was added to South Winooski Avenue from Howard Street all the way to Main Street. Therefore, the major impacts are primarily observed in the northbound flow. The result is an equal (almost 50/50) sharing of the northbound volume by South Winooski Avenue and South Union Street in both the AM and PM time periods. The northbound AM volume is 642 vehicles, with 304 vehicles using South Winooski. Likewise, the northbound PM volume is 724 vehicles, with 340 vehicles using South Winooski. South Union Street continues to carry about 80% of the southbound volume south of King Street in the AM and PM as it does in the Base Case.

The level of service at affected intersections (South Winooski/Howard, South Winooski/King, South Union/King, and South Union/Main) is also not an issue. The Base Case LOS at South Winooski and King is maintained in the AM and PM time periods. Reallocating green time also maintains Base Case LOS at South Winooski and Howard. The LOS at South Union and King improves from an E to C because of the reduced northbound approach volume. Finally, after reallocating green time, the LOS at South Union and Main is reduced from a B to a C. Despite this reduction in overall LOS, the delays at this intersection are still less than 20 seconds per vehicle.

Both South Union Street and South Winooski Avenue have paved curb-to-curb travel ways measuring 30 feet in width. This pavement area supports one travel lane and one lane of on-street parking on South Union Street. On South Winooski Avenue, the 30-foot road width supports two travel lanes and one lane of on-street parking. Both streets can be easily converted to two-way flow without the loss of any on-street parking.

Currently, CCTA's South End/Shelburne route uses South Union Street for inbound runs and South Winooski Avenue for outbound runs for the segment of the route between Maple Street and Main Street. Conversion to two-way would not require a route change. However, since the South End/Shelburne bus uses South Union Street exclusively south of Maple Street, the leg of the route on South Winooski Avenue south of Main Street may be unnecessary.

Converting George Street and Elmwood Avenue to two-way causes a shift of southbound traffic from North Winooski Avenue and George Street to Elmwood Avenue. Similarly, the northbound traffic has been shifted from Elmwood Avenue and North Champlain Street to George Street. Although this conversion does not attract new vehicles to the corridor, there are some problems with converting this pair. The potential for cut-through is very high, and was observed in both the AM and PM time periods. In the Base Case, cut-through is not possible because George Street is one-way southbound. However, converting George Street to two-way allows northbound vehicles to access North Champlain Street via Monroe and Peru. These cut-through trips avoid two traffic signals on Pearl Street. In the AM time period, 73% of the vehicles turning right onto George Street are destined for the North Champlain/North Street intersection. In the PM, the proportion of cut-through trips increases to 82%. The model is likely overestimating the degree to which this cut-through will occur. However, this will be an attractive route for some vehicles, and should be considered if this scenario is to be implemented.

The level of service analysis also somewhat discourages conversion of George and Elmwood. The Base Case LOS is maintained at the George and Pearl intersection. However, the Elmwood and Pearl intersection fails in both the AM and PM time periods. The southbound left turn is the source of the intersection failure. This intersection is currently stop-controlled. Therefore, the conflicting flow on Pearl Street (984 AM vehicles, 1448 PM vehicles) makes the left-turn a very delayed movement. Signalization of the intersection would be required to improve the LOS to an acceptable level. However, signalization of the Elmwood/Pearl intersection is discouraged because of compact signal spacing on Pearl Street, and the resulting unacceptable queue lengths calculated for the eastbound left-turn movement.

For George Street, pavement widths measure approximately 26 feet curb-to-curb. Within this paved area, east side parallel parking and one travel lane is permitted. South of Monroe Street there are 5 metered on-street parking spaces and 4 spaces closer to Pearl Street that are designated as "Resident Permit Only." During field observation, these spaces were empty. Parking in the 'resident' spaces is only permitted from 6pm-6am. To accommodate two-way travel, these nine on-street parking spaces would have to be eliminated.

Elmwood Avenue is 40 feet curb-to-curb adjacent to the Post Office. There are 6 parallel parking metered spaces on the west side and 17 diagonal spaces on the east side of the street. Just south of Grant Street, the road narrows to 35 feet and there is more on-street parallel parking (5 meters on both sides of the street). The parallel and diagonal on-street parking on both sides of the street can not be accommodated with two-way conversion. With two-way flow on Elmwood, parking on the same side of the street as the Post Office would improve access to motorists and pedestrian safety. There is sufficient

space to create 90-degree parking on the westerly side of Elmwood in front of the Post Office. This parking configuration projects out 18 feet, leaving 22 feet for two travel lanes (11 feet per lane). Minimal lane widths are desirable in high pedestrian areas. Another advantage of 90-degree parking is that vehicles from both directions can access the parking spaces.

Currently, CCTA's Riverside/Winooski route uses Elmwood Avenue for outbound runs and North Winooski for inbound runs for the segment of the route between Grant Street and Pearl Street. Conversion to two-way would not necessarily cause CCTA to change the routing of the Riverside/Winooski bus. However, since the bus uses Elmwood Avenue exclusively north of Grant Street, the leg of the route on North Winooski Avenue south of Grant Street may be unnecessary.

Despite the loss of some on-street parking and the reduced level of service at the Elmwood/Pearl intersection, the two-way conversion will provide more continuity in this area. In addition, the poor level of service after conversion of George and Elmwood may be self-mitigating. That is, some of the left-turning traffic that results in intersection failure will eventually makes its way to traffic signals on Pearl Street in order to make their turn. Therefore, the poor LOS should not be weighted heavily in the overall decision.

From a safety point of view, one-way streets are clearly safer than two-way streets. This safety margin stems from the significant reduction in conflict points at intersections. Studies have documented a greater than 20% reduction in accidents at one-way streets versus two-way streets. This is as important for pedestrian movement as for vehicle movement. For the pedestrian, only one direction of traffic needs to be checked before crossing a street. Countering this safety effect is the tendency for one-way street traffic to travel at slightly higher speeds due to the lack of friction caused by oppositely moving traffic in the two-way scenario.

Conversion of one-way streets to two-way streets is a topic in many cities across the country. In the great majority of cases, from our research, the streets under consideration for conversion are commercial streets in CBD areas. An example is Lubbock, Texas, where Main Street has successfully been converted back to two-way flow. In this case, the downtown business district has deteriorated, and the loss of commercial vitality has been attributed in part to the poor traffic access provided by the one-way street system. The situation is Burlington is slightly different, where the one-way corridors under consideration are primarily residential in nature, and function as urban arterials rather than local streets. The exception to this is North Winooski Avenue, which contains a number of street-side retail establishments.

In addition to the specific analysis provided above, there are more general advantages and disadvantages that are associated with a two-way conversion. These are listed in Table 11.

Table 11: Advantages and Disadvantages of Two-Way Conversion

Advantages	**Disadvantages**
Less confusing to drivers, especially visitors.	Costs—some additional signalization, signage, and striping.
Better access to properties.	Increased congestion.
Improved travel time for many origin/destination pairs	Unlikelihood to convert back to one-way if additional capacity is needed in the future.
	More difficult to achieve signal progression.

Please call if you have any questions.