MOVING FORWARD TOGETHER

Transportation Plan for the City of Burlington
Appendix 1: Technical Appendix

Prepared for:
The City of Burlington

Prepared by:
Smart Mobility, Inc.
Oman Analytics
ORW Landscape Architects and Planners
Third Sector Associates
TranSystems

January, 2010

TABLE OF CONTENTS

1) Burlington's Transportation Vision....1
Burlington's Citizens, Businesses and Institutions are Calling for Action to Support the Vision 2
Three Primary Themes:....5
Strong and Healthy City....5
Transportation Choices....5
Great Streets....5
2) Transportation in Burlington Today....6
Transportation Serves Residents, Businesses, Institutions, and the Region....6
Demographic Conditions and Trends....6
Downtown/Waterfront Market Study....7
Other Development Areas....8
Neighborhoods....9
Schools....9
Transportation Elements Today....11
Travel Networks/Data....11
Pedestrians....11
Bikes....14
Transit....15
Cars....19
Parking....22
Transportation Demand Management....24
Trucks....27
Burlington International Airport....28
Rail....28
Current Transportation Initiatives....29
Waterfront Improvements....29
Marketplace District Improvements....29
Downtown Transit Center....30
South End Neighborhood Transit Center....30
Champlain Parkway (Southern Connector)....30
Route 2 Study....31
Route 15 Study....32
Current Fiscal Overview....32
Public Involvement....32
Other processes....32
Legacy Project....33
Burlington Livable Community Project....33

Walking Work Group....33
Burlington Bike Council....33
Local Motion....33
Burlington Business Association....34
3) Transportation in Burlington in the Future....35
Street Types and Street Network....36
Street Design Guidelines....39
The Complete Street....39
The Transit Street....41
The Bicycle Street....42
The Slow Street....43
Neighborhood Streets....43
Future Transportation Elements....43
Pedestrians....43
Bicyclists....45
Transit....46
Cars and Trucks....49
Trucks & Freight....56
Passenger Rail....56
Schools....56
Intelligent Transportation Systems....56
Wayfinding....57
4) Implementation....63
Moving Forward....63
Transportation Services....64
Progress Indicators....64
A Five-Year Plan....71
Implementation of the Street Design Guidelines....71
Design Criteria: Traffic Level of Service....72
Potential Improvement Projects....72
Future Transportation Funding....86
Maintenance Expense....86
Capital Expense....86
Transit Finance....87

1) Burlington's Transportation Vision

In recent years, the City of Burlington has continually recommitted itself to a transportation vision which stresses transportation choices and livability. The *Legacy Action Plan* (2000) states:

> *GOAL: In 2030, every Burlington resident has access to a diverse, seamless, multi-modal transportation system to travel easily to jobs, businesses, and recreational and cultural activities. Increased public transit and alternative transportation provides local and regional travel that is safe, accessible, efficient, and environmentally sound. Transportation within, to, and from the city relies less on individual vehicles and integrates the automobile with rail, bus, shuttle, boat, air, pedestrian, and bike transport.*

The transportation vision in the *Municipal Development Plan* (2001 and readopted in 2006) is:

> *…transportation functions as part of an interconnected system which offers a range of choices that are safe, affordable, efficient, and convenient for residents, employees, and visitors alike. As a result, rail, air, ferries, transit, cycling, and walking are successfully competing with the automobile for the dominant mode of choice. Local and regional multimodal corridors and centers are maximizing our use of existing infrastructure, while eliminating congestion, preserving air quality, and conserving energy. Commuters, families, and employers are benefiting from a diverse array of transportation demand management strategies such as car- and van-pools, flexible work schedules, and telecommuting. Land use and transportation decisions are considered together, significantly reducing the need for individual automobiles and large parking facilities. Greater use of rail for freight has been embraced as an effective means of removing trucks from neighborhood streets. City streets are attractive public spaces, and function as part of a system of interconnecting streets. Circulation within the downtown, waterfront, neighborhood activity centers, and institutional campuses is predominantly oriented to the pedestrian. A series of trails and paths provide access between neighborhoods and areas of protected open space.*

The *Climate Action Plan* adopted in 2000 also supports reduced reliance on autos in helping to achieve the City's carbon reduction goals.

Burlington's Citizens, Businesses and Institutions are Calling for Action to Support the Vision

In developing the *Transportation Plan*, we have conducted an extensive public outreach effort including:

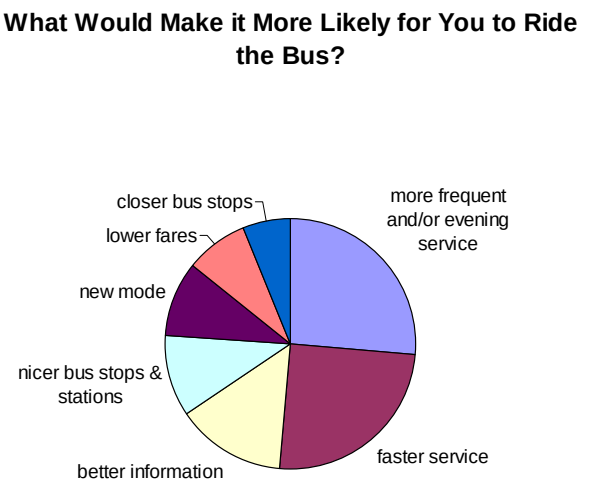
- interviews with representatives of the downtown business community.
- neighborhood meetings,
- small group discussions and surveys at the Legacy Town Meeting,
- reviewing information from other public processes, and
- 10 monthly Steering Committee meetings including representatives of stakeholders groups.

The downtown business community understands that downtown Burlington's competitive strengths are very different from those of the suburbs. The business community sees the pedestrian environment as the foundation of the downtown experience, but also is concerned about parking availability and easy access into and out of the city.

At neighborhood meetings, citizens expressed a strong interest in pedestrian, bicycle and bus transportation choices, and identified many specific issues where improvements are desired. Citizens also expressed concerns about auto and truck volume and speed.

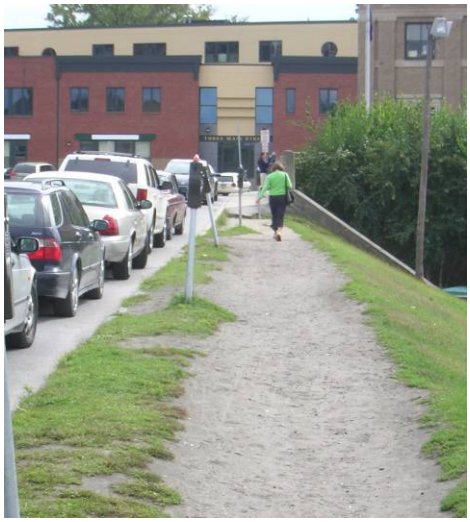
At the Legacy Town Meeting, attendees passed through three stations: 1) pedestrian and bikes, 2) land use, and 3) transit. There was strong interest at the meeting in enhanced bus service. As shown in the figure below, there was especially strong support evening service, increased frequency and faster travel times.

Citizens Give Feedback on Improving Transit at the Legacy Town Meeting



The land use group stressed the need for transit, walk and bike access to services.

The pedestrian/bike group raised concerns about maintenance, including snow and ice removal, bumpy sidewalks and potholes. Pedestrian concerns also have come up strongly at the City's *Pedestrian Summit* and related activities, with strong concerns about "large cracks or uneven pavement", "missing paths or no continuity", and "have items (including vehicles) in the way."



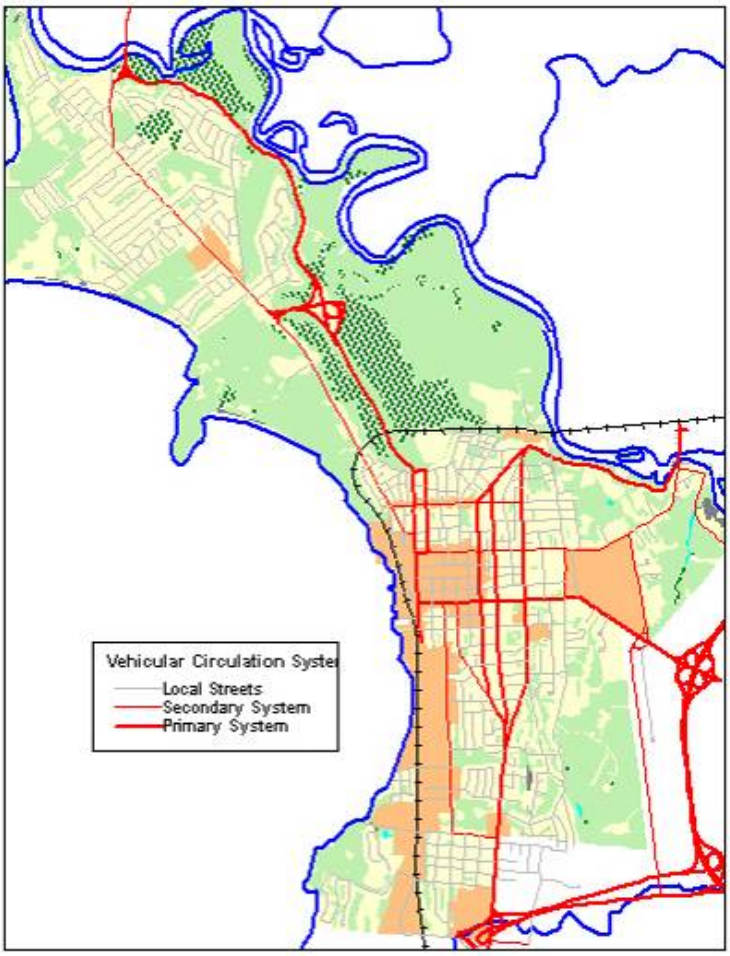
The AARP's *Growing Older in a Livable City* process surveyed 800 local residents age 45 and up about concerns and obstacles to walking and using transit.

The highest ranked walking concerns were: 1) conflicts with bikes and skateboards[1], 2) having adequate places to sit and rest, 3) islands available where needed, 4) drivers stopping at crosswalks, 5) adequate crossing time, 6) sidewalk lighting, 7) sidewalk maintenance, and 8) snow, ice, trash on sidewalks.

[1] Bikes on the sidewalk are partly a symptom of an inadequate on-street bike network.

The top transit concerns were: 1) having adequate shelter, 2) no weekend or evening service, 3) place to sit while waiting, 4) inconvenient schedules, 5) time it takes to use the bus, 6) inconvenient routes, 7) having it go where you need to go, and 8) safe walk access to bus stop.

These public forums have consistently asked for improvements to walking, biking and transit infrastructure. In contrast, there has been relatively little comment received related to automobile transportation. Some concerns have been raised regarding congestion, but at least as many concerns have been expressed about auto speeds and safety. The business community has pointed out that the interests of driving commuters and visitors are important. However, everyone recognizes that there are only a few gateways into and out of the City, and that there is little potential for increasing roadway capacity through these metering points. Only the completion of the Champlain Parkway (Southern Connector) would provide significant additional capacity, and even this is limited by the constraints of Pine Street. No significant increases are feasible through any of the other gateways, although it is important to look for ways to improve the efficiency of traffic operations within the existing rights of way.



After a series of monthly meetings reviewing data on different travel modes and information gathered from the public, the Steering Committee considered different scenarios for the future. The committee agreed that it supported a *Multimodal Scenario* that emphasizes walking, biking, and transit, including:

- Priority high frequency direct bus routes with longer service hours;
- Improved pedestrian crossings and network;
- Complete on-road bicycle network; and
- Lowered traffic speeds to promote walking and bicycle safety and level of service, especially downtown.

Three Primary Themes:

The *Transportation Plan* is focused on expanding on this multimodal vision. Three primary themes are carried throughout the *Plan*:

Strong and Healthy City

Transportation is a foundation of a vital Burlington. It serves residents, businesses and institutions, workers, shoppers and other patrons, visitors, and the entire region. It is fundamental to the economic health of the City and the region. However, transportation is not only utilitarian. Transportation infrastructure is a large part of the urban form and is a strong contributor to how the City is experienced in daily life. Transportation infrastructure can aid in human health by encouraging active living and social opportunities, and it also can detract from human heath through air pollution and stress.

Transportation Choices

Burlington's citizens want transportation choices with higher service levels for non-auto modes. This includes higher frequency transit routes with service continuing into the evenings and on weekends. It includes a complete bike network. It includes more complete and better maintained walkways. These non-auto modes serve critical populations including the young, the old, and the disadvantaged. However, increasing the non-auto mode share for those who have the option to drive is critical for continuing for managing auto travel in Burlington and lessening the negative impacts of cars.

Great Streets

A major component of this Transportation Plan is the new *Street Design Guidelines* (Appendix 2). Street design is where the vision meets the ground. The Guidelines support transportation choices, including provisions for pedestrians, bicyclists and transit riders. They also are concerned with aesthetics and the quality of urban life. The *Guidelines* will be consulted when work is planned on City streets to explore opportunities to reconfigure the streets to be more in accordance with the *Guidelines*.

2) Transportation in Burlington Today

Transportation Serves Residents, Businesses, Institutions, and the Region

The purpose of the transportation system is to enable the residents, business people, shoppers and clients, tourists, students, and other visitors to the city to go about their business comfortably and efficiently. Unlike other consumption, transportation is not done for its own sake but instead to achieve some other purpose. The ideal city transport system enables these other purposes to be achieved as efficiently, safely and enjoyably as possible. When developing the Transportation Plan, it is important to keep three groups in mind:

1) Burlington's residents who use the transportation system but also are impacted by it
2) Burlington's businesses and institutions that are critical to the economic health and vitality of the City
3) The larger region where Burlington is both the economic center and the transportation hub.

Demographic Conditions and Trends

The City of Burlington remains Vermont's most populated community with a 2000 (US Census) population of 38,889. Since 1960, Burlington's population has experienced a series of "ups and downs" with only small real increases over time. While Burlington's population has remained essentially flat, growth has continued in suburban communities.

Three significant features of the population bear directly on the city's transportation needs:

- The City has a population of college students.
- Burlington's population otherwise is aging.
- Burlington is home to a higher proportion of lower income residents than the county as a whole.

All of these populations are especially dependent the availability on non-auto transportation. Auto ownership in Burlington is lower than for the county as a whole. Lower auto availability generally correlates with higher transit and walk/bike usage rates.

Table 1: Vehicles per Household (2000 Census)

Vehicles/Household	Burlington	Chittenden County	Vermont
0	15%	7%	7%
1	42%	33%	34%
2	33%	45%	43%
3+	10%	15%	16%
Average vehicles per household	1.44	1.74	1.75

Source: VT CRS, US Census 2000

The lower auto ownership levels are consistent with higher non-auto commute shares observed in 2000 Census journey-to-work (JTW) data.

Table 2: Mode of Travel to Work

Mode	Burlington	Chittenden County	Vermont
Drove Alone	62%	76%	75%
Carpool	12%	11%	12%
Public Transportation	4%	1%	1%
Walk/Bike	18%	7%	6%
Other	1%	0%	1%
Worked at Home	3%	4%	6%
Average Travel Time (min)	16.82	19.75	21.64

Source: VT CRS, US Census 2000

Based on Census data, Burlington residents commute by public transit at four times the rate of other Chittenden County residents, and commute by walking or biking at three times the rate.

Burlington's employment includes nearly 35% in the health and education fields, with UVM and FAHC being the largest employers. Retail jobs are also significant, comprising 16% of employment, which contributes to overall activity and attracts residents, businesses, and visitors to the City. Manufacturing employment is currently 7.5%, and has declined significantly due in part to job losses at General Dynamics[2]

Downtown/Waterfront Market Study

As part of the Transportation Plan development, an analysis of market conditions in the downtown/waterfront area was prepared. This Market Study is included in its entirety in Appendix 3. It is summarized here.

The Market Study examined three sources of information: 1) the downtown commercial real estate market, 2) the structure of the downtown economic base, and 3) the attitudes and information available through the downtown business community.

The downtown real estate market shows that Burlington, especially downtown, is strong economically. Rents are high without being cripplingly so, and vacancies are low. The Marketplace in particular is very successful with very low vacancy. Burlington still supports 1/5 of all retail space and over 1/3 of all office space in Chittenden County with no loss in the ability to command good rents.

Burlington, like much of the nation, has seen an out-migration of manufacturing, warehousing, etc. Offices and service uses based on high value land and close proximity have fared well. Comparisons of the Burlington economy with the rest of Chittenden County include:

1) Retail employment, except for auto-oriented retail, occurs in Burlington at rates roughly equivalent to the county as a whole, despite concerns about the growth of suburban retail. However, downtown retail has shifted away from general retailers toward more specialized stores.

[2] Municipal Development Plan 2006, p.VI-3-4

2) Hospitality, consisting of both lodging and eating and drinking establishments, is well represented in Burlington. However, with only three major establishments, lodging represents a significant market opportunity.

3) Entertainment is significantly under-represented in Burlington despite the importance of tourism and the hospitality industry. This represents a significant "hole in the market".

The third component of the Market Study focused on discussions with downtown businesspeople and others. Two broad conclusions are widely shared. First, the city, especially downtown, is a very strong market. Second, Burlington has many special qualities that help to distinguish it from suburbs, and among these is a much heavier reliance on non-vehicular (largely pedestrian) transportation.

Several concerns were mentioned. The three most frequently mentioned were:

1) Parking – both its importance to serving both the consumer (shoppers, clients, etc) and employees, and many perceived deficiencies and opportunities for improvement.

2) Congestion – coming into, exiting, and transecting the city by private automobile; this has a direct impact on clients and customers as well as on employees.

3) Wayfinding/information, including transit, walking routes, and, especially, parking.

Other Development Areas

In addition to the downtown/waterfront core, there are other development areas of the city that are of some importance. Three of these include:

- The identified "enterprise zone" lying immediately to the south of the downtown and stretching along the lake shore and Pine Street for over ½ mile. This area contains numerous businesses, offices, and some residual industry, and has been identified as Burlington's "incubator" area for new and growing businesses. Over the past few years, significant redevelopment has taken place in this area, including Champlain Chocolates, the Specialty Filaments site, and the Maltex Building. It contains the Barge Canal Superfund site and the existing Vermont Railway yards, as well as the prospective route for the Champlain Parkway (Southern Connector). The GE plant and site of the future South End Neighborhood Transit Center are at the southern boundary of this area. It has been identified as the likely "next direction" for development in the city.

- The southerly industrial area between Home and Flynn Avenues is the most promising site for any future industrial development in the city. Not only is it ripe for redevelopment, but it supports direct rail access and direct connection to the regional highway system via the Champlain Parkway interchange and I-189.

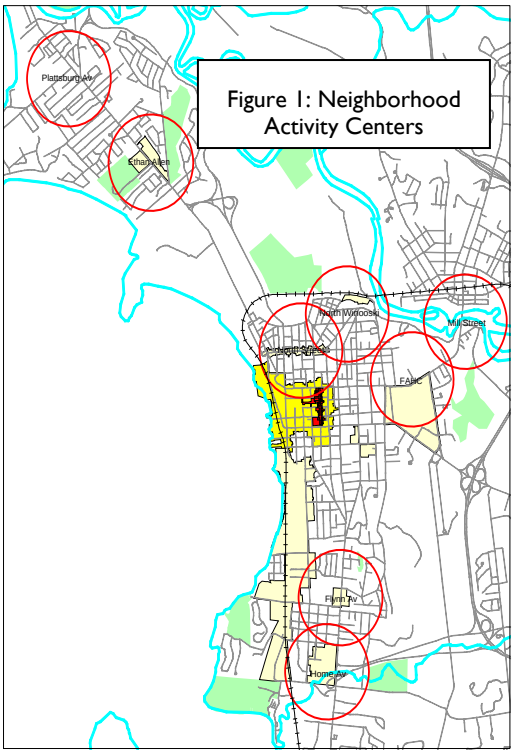
- The City has identified the Intervale area for future development, especially for light- and "green" industry. As at least portions of the Enterprise Zone near the downtown core are drawn progressively into more commercial uses, this area represents a good area for industrial expansion."

In general, these areas are well served by the existing and proposed transportation system, and it is largely on that basis that they represent such desirable development opportunities.

Neighborhoods

The 2006 Municipal Development Plan states:

> *... neighborhoods are the heart and soul of the community, and possess a strong identity. Neighborhoods are linked to each other via a network of greenspaces, public transit, pedestrian, and bicycle routes. Historic patterns of development and architecture are respected, while future growth reflects changes in family, work and travel patterns by offering a range of housing choices. Everyday services such as markets, pharmacies, and childcare are concentrated in higher density mixed-use activity centers that serve the immediate needs of the surrounding neighborhood. Local streets are reclaimed as public spaces, oriented to pedestrians, with minimal through traffic. (Burlington Municipal Development Plan, 2006, p. I-1)*



The neighborhood development concept is focused on what might be thought of as the neighborhood "core" – the neighborhood activity center (NAC), which also is described in the MDP:

> *...higher-density, compact mixed-use settlements. These areas will typically include childcare centers, local banks, grocery stores, offices, branch libraries, pharmacies, small businesses, churches, and housing. NAC's are close to where people live and oriented to serving the neighborhood, thus lessening the need to drive for local errands and convenience shopping. They may also be attractive locations for community technology centers that provide support and resources to small businesses, and serve as remote offices for larger businesses offering employment for nearby residents. (Burlington Municipal Development Plan, 2006, p. I-20)*

NACs have been designated in most areas of the city outside the downtown, illustrated in Figure 1. These centers are intended to be small scale, concentrations of commercial businesses, retail, and services serving the surrounding neighborhood. As such, they should have safe pedestrian connections to the neighborhoods they serve. Many of these centers are located on high volume streets, which naturally tend to attract these types of concentrations, and lack safe and comfortable pedestrian crossings.

Schools

The Burlington *Municipal Development Plan* (2006) makes clear the City's vision for its schools and their place in the overall transport system:

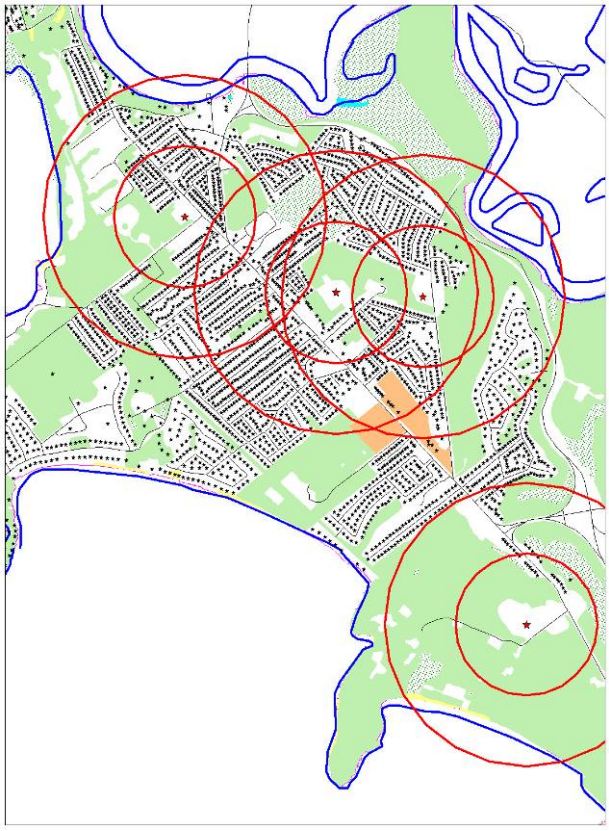
> *Whether it is public or private, elementary or post-secondary, schools are places where there are very high concentrations of pedestrians. Areas around elementary and middle schools have become increasingly congested with traffic from parents transporting children to and from school. This creates a cycle of dependence on motor vehicles to transport children as parents' concern for their children's safety grows along with more traffic and congestion. Areas of particular concern are the three schools in the New North End – Flynn, Smith, and Hunt.*

> *As a community, we have a responsibility to provide safe access to our schools. This includes providing sidewalks, mid-block crossings, bike paths, and trails that offer students an alternative to walking on the street. On a limited basis, Burlington Schools use CCTA buses to transport kids to school – primarily for middle school students. All are intended to minimize vehicular trips. The City will continue to provide these facilities and amenities to the greatest extent possible. (Municipal Development Plan pp X-2-3)*

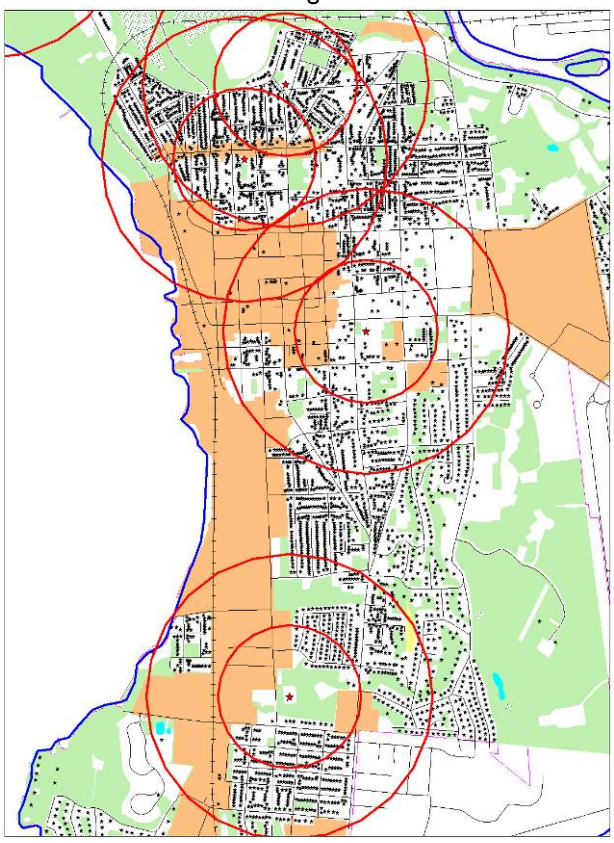
Because of the importance placed on the neighborhood orientation of schools, these have been mapped against a grand list mapping of residential properties showing 1/4 and ½ mile radii from each school in Figure 2

Figure 2 – Walking Distance Radius at Burlington School Sites

New North End Schools



Other Burlington Schools



At the New North End schools and most of the other neighborhood schools, the vast majority of residences lie within an easily walkable ½ mile radius of these schools, so there is great opportunity to increase the portion of students who walk to school. The Burlington High School's presence near the Burlington Bike Path may provide opportunities to increase the bicycling mode share for travel to school. Three schools in Burlington are also participating in the Safe Routes to School program, which provides assistance for increasing active travel to school through education, encouragement, and construction funding assistance.

Transportation Elements Today

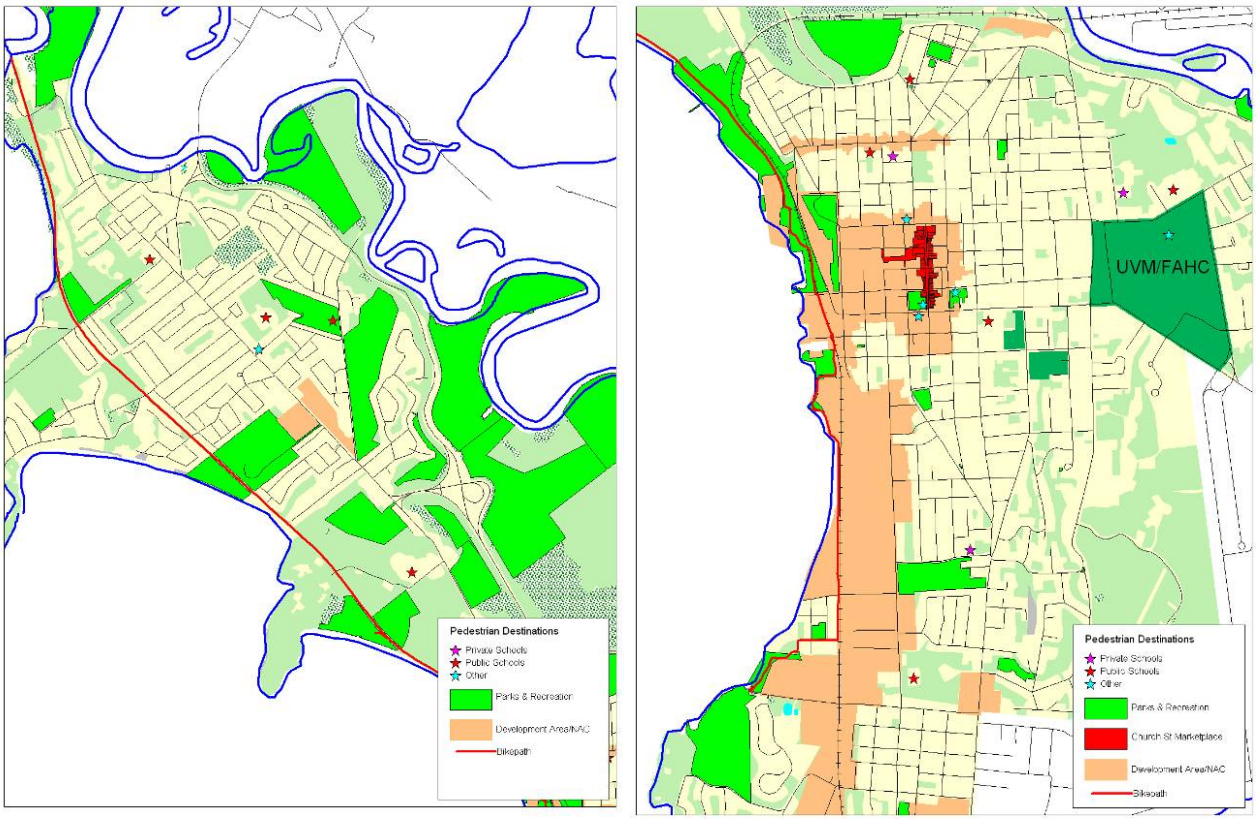
Travel Networks/Data

Overall, Burlington is fortunate to enjoy an attractive network of pedestrian-scaled streets that contribute to the City's distinctive identity and quality of life.

Pedestrians

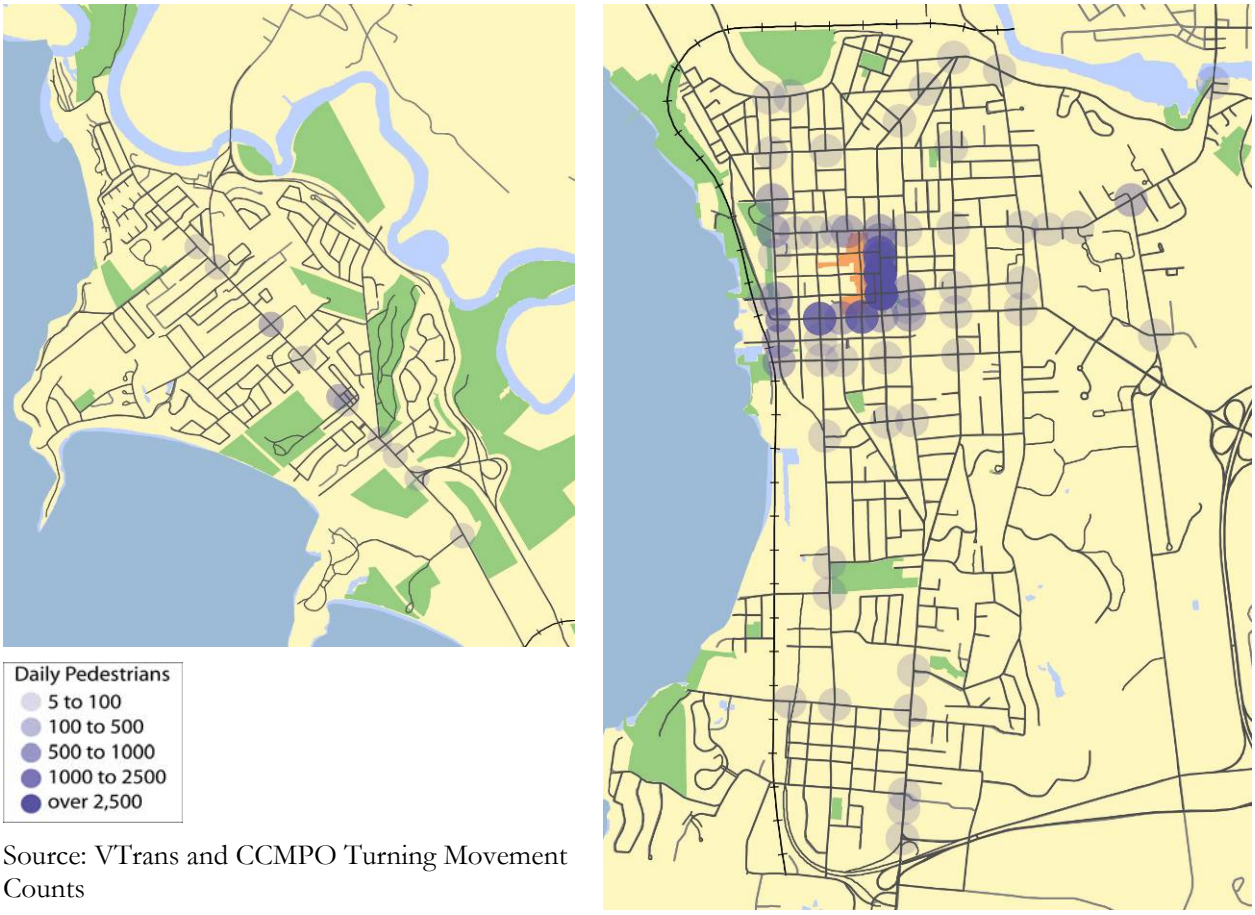
Walking is transportation in its most basic form, and is absolutely vital for a multimodal urban transportation system. Many short trips in the city are made entirely by walking, and walking also links trips between other modes, such as transit, or between parking areas and downtown locations. The downtown business community has also stressed how important walking is to get exposure to potential customers, and to generate the vibrancy and feeling of security from a pleasantly busy, walkable street. Figure 3 shows some of the major generators of pedestrian activity in Burlington.

Figure 3: Locations of Pedestrian Traffic Generators



Data on pedestrians is scarce. While there are some turning movement counts available now that include pedestrian counts, these do not provide complete coverage. However, Figure 4 indicates that the downtown area in and around Church Street has the most intense pedestrian activity.

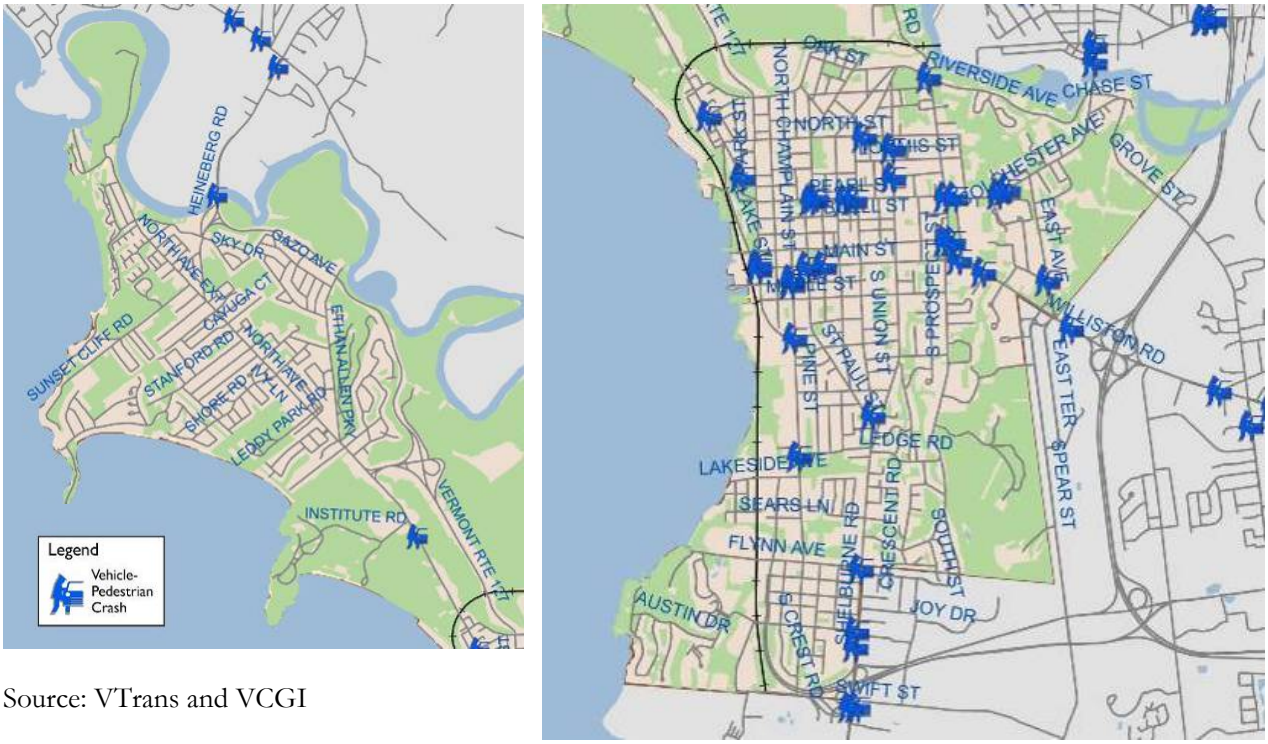
Figure 4: Pedestrian Volumes at Intersections



Source: VTrans and CCMPO Turning Movement Counts

In addition to the volume of pedestrians, some data is available on automobile crashes that involve pedestrians. This data is limited to the federal aid road and street system, so it includes the major roads in Burlington, but not many of the less traveled streets. It is noteworthy that this map does not show pedestrian-vehicle accidents in the same concentration as pedestrian activity. Generally, pedestrians are safest in locations where there are a lot of pedestrians, because automobile drivers expect to see them and take appropriate precautions. Pedestrian-vehicle crashes are spread around the city more uniformly, indicating that the pedestrian crash rate would be substantially higher in the outlying areas.

Figure 5: Pedestrian Vehicle Crash Locations 1998 through 2001



Source: VTrans and VCGI

This data shows that, while pedestrian volumes are highly concentrated in the immediate downtown/Church Street area, the pedestrian-vehicle crashes are distributed much more evenly around the city. While the relatively small numbers of crashes do not allow for rigorous statistical analysis, it can be concluded that the rate of pedestrian-vehicle crashes is low in the areas that have the most pedestrians, and higher in the outlying areas, where in some cases drivers are less attuned to pedestrian traffic.

A Sidewalk and Crosswalk inventory does not exist, so the primary source of information on the conditions and operations of the pedestrian network was at the neighborhood outreach meetings. At these meetings, participants were asked to identify what factors, or what locations, made Burlington a pleasant and safe place to walk, and what factors contributed to uncomfortable or unsafe walking conditions. In general, the public recognized that Burlington is a very walkable community. However, the following were the most frequently noted concerns, complaints, or needs for improvement.

- Icy and snowy sidewalks
- Rough, cracked and bumpy sidewalks
- Pedestrian signals that do not provide enough crossing time
- Lack of consistency in how pedestrian signals operate throughout city
- Turning traffic at intersections that doesn't yield to pedestrians
- Need for more mid-block crossings
- Need for traffic to consistently yield to pedestrians
- Speeding traffic
- Drivers using cell phones and not paying attention to pedestrians

In general, the major corridors were noted as being among the most hostile to pedestrians, as well as some of the higher volume intersections with lower pedestrian volumes and poor pedestrian signals.

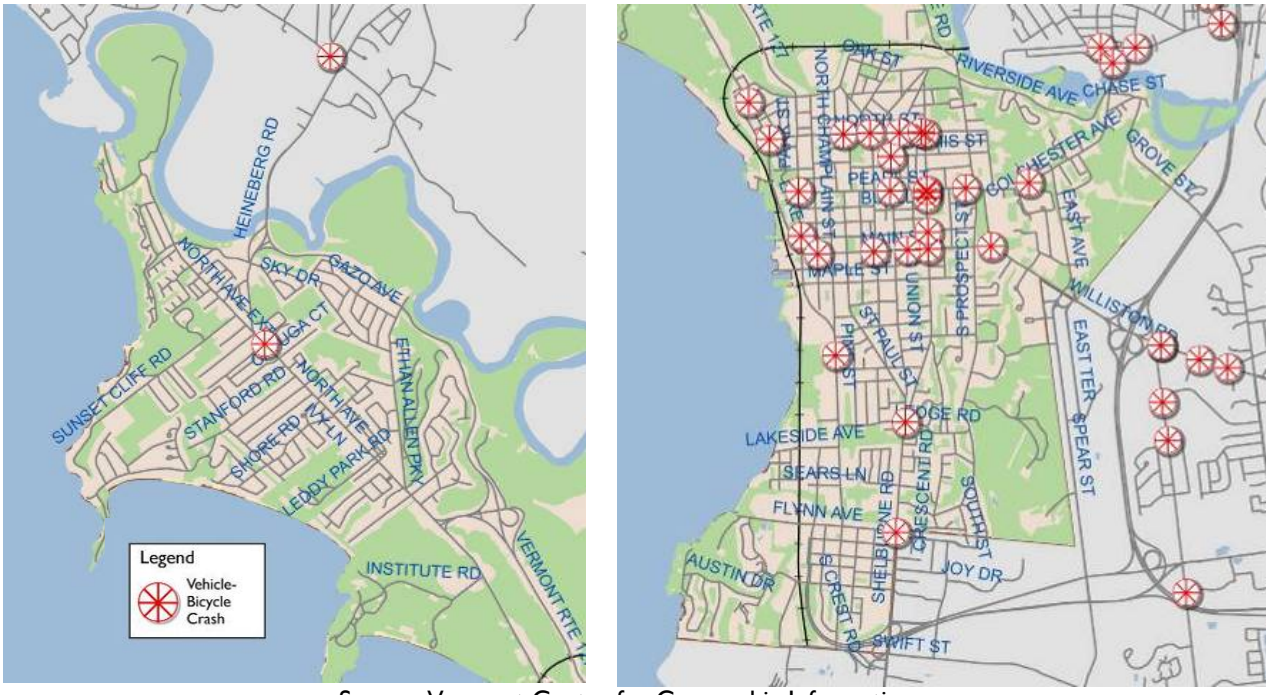
The lower traffic local streets, waterfront, bike path, and Church Street were noted as being excellent places to walk. Specific intersections were noted at neighborhood meetings, and are included in the action plan.

Bikes

Burlington has a network of bicycle facilities, including the renowned Burlington Bike Path, bike lanes on several streets, and designated bicycle routes on other streets. There is also a very active bicycle community, with the Burlington Bicycle Council being a citizens' advocacy organization working to promote the safe use of bicycles for transportation and recreation in Burlington, Vermont. The Council was created by the City of Burlington's Mayor's Office to serve as an advisory body to the Department of Public Works, representing the bicycling public in planning and developing bicycling facilities such as bike paths and bike lanes in Burlington.

Planning for bicycle transportation is even more hampered by lack of mode-specific data. Turning movement counts conducted by CCMPO and VTrans include pedestrians, but not cyclists. Counts have been conducted for the Burlington Bike Path, but there are no comparable data from other facilities. Data for vehicle-bicycle crashes is available, shown in the following map, but with the relatively small numbers, it is difficult to draw too many statistically solid inferences.

Figure 6: Locations of Vehicle-Bicycle Crashes, 1998 through 2001



Source: Vermont Center for Geographic Information

Because we lack data on the numbers of bicyclists on these routes, we cannot make any conclusions about relative rates of bicycle-vehicle crashes. However, the data does provide an indication that many of the downtown streets, including Main, Pearl and Union, may have bicycle safety concerns.

Planning for bicycle facilities is also challenging due to the widely different ability levels and needs of different types of riders. The bike path forms an outstanding facility for young riders or recreational rides, but bicycle commuters heading downtown would want something appropriate for high speed riding and more direct routing.

The neighborhood outreach meetings produced the following most frequently mentioned concerns related to the city's bicycle environment.

- Riding on streets with numerous parked cars, such as College Street, is dangerous due to conflicts with door opening and cars pulling out.
- High speed traffic
- Insufficient places to lock bikes, require using trees which damages them.
- South Winooski between Main and College Streets
- Shelburne, Pine, and Main streets

The Burlington Bike Council has long been working with the City staff to develop a network of bicycle routes, which form a complete network in the city. In addition, the Burlington North-South Bicycle Plan includes data and analysis on the important north south corridors and establishes recommended routes and designs. These are discussed in more detail later in this plan.

Transit

The Chittenden County Transportation Authority operates a regional public transportation system that serves the urbanized portion of Chittenden County, as well as reaching into more rural areas and surrounding counties. The core of its system, though, is located at the heart of downtown Burlington, at its Cherry Street Transit Center. Indeed, all but two of CCTA's routes serve downtown Burlington and seven of its routes (3 local routes, 3 shuttles, and Sunday service) serve the City of Burlington exclusively.

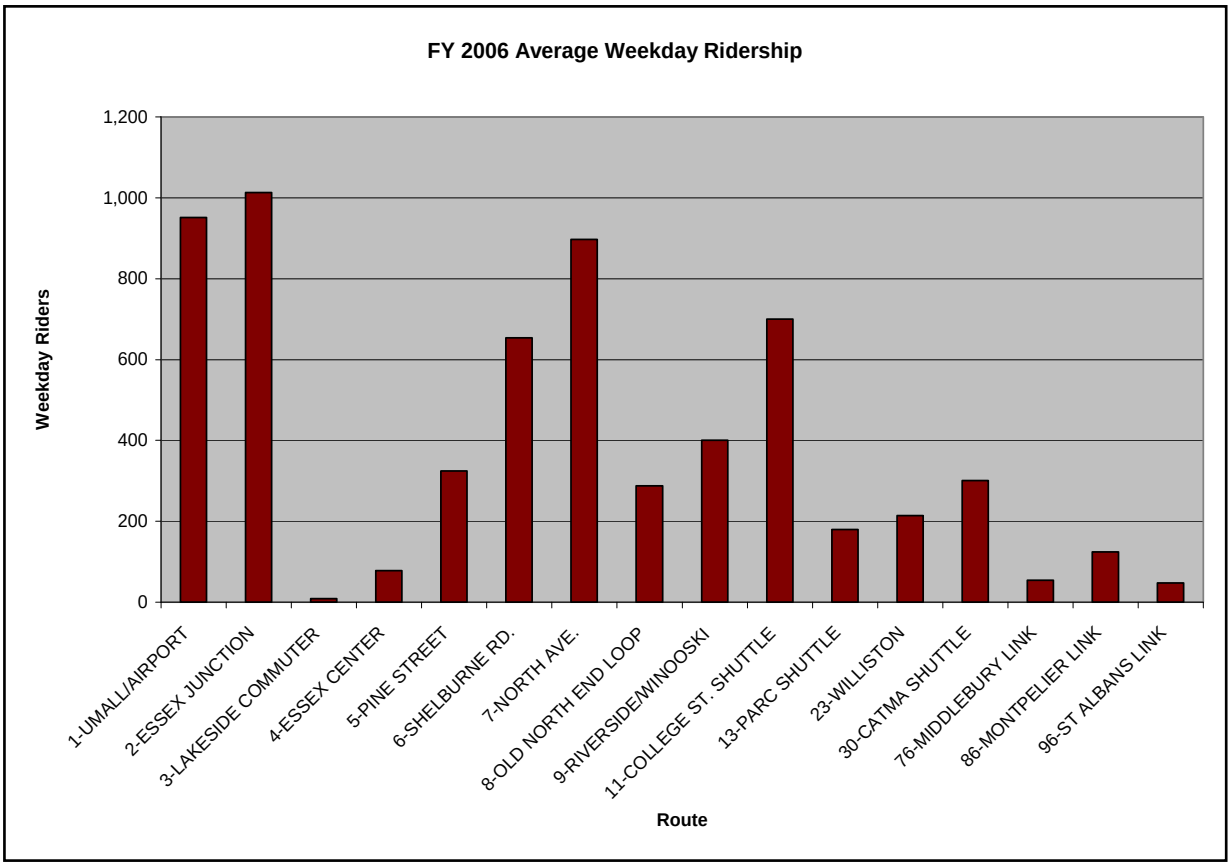
Ridership patterns reflect this focus on Burlington. Table 3 shows a number of relevant statistics based on fiscal year 2006 data.

Table 3: CCTA Ridership Statistics (FY 2006)

Average weekday system boardings ("boardings" are one-way rides)	7,200
Boardings within Burlington	5,200 (73% of system total)
Boardings within downtown Burlington	2,300 (32% of system total)
Boardings at Cherry St Transit Center	1,750 (24% of system total)
Systemwide average weekday transfers	800
Average weekday transfers at Cherry St	625 (78% of system total)
Percentage of boardings at Cherry St that are transfers	36%
Bus stops in system	750
Bus stops in Burlington	330 (43%)

Route-by-route passenger ridership is shown in Figure 7 below. These represent the average number of boardings per weekday over the entire year.

Figure 7: CCTA Route Ridership



Burlington is important both as an origin location and as a destination for transit trips. Many Burlington residents use CCTA services as their primary means of travel. The availability of bus service allows them to have mobility without having to own an automobile. The concentration of employment in Burlington also makes it the primary destination for work trips in the state, while shopping opportunities, medical facilities, institutions, and recreational activities also bring in riders on the bus system.

Figure 8 shows the regional routes system, including several LINK commuter services from Montpelier, Middlebury, and Saint Albans. Figure 9 shows the CCTA local route system, which connects the surrounding municipalities to Burlington. The portion of the CCTA system in the central and southern portion of the City of Burlington itself is shown in Figure 10. The final map in this series (Figure 11) shows the number of boardings on an average weekday at bus stops in the City of Burlington.

Figure 8: CCTA Regional Route System

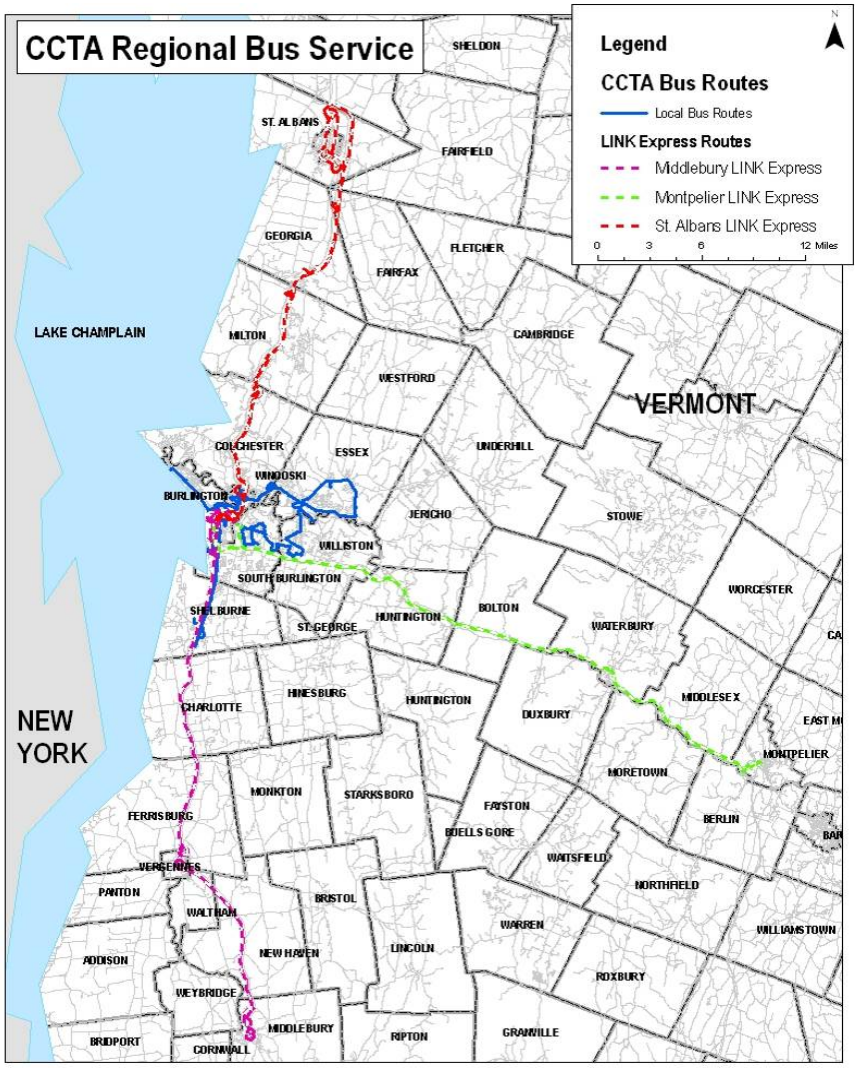


Figure 9: CCTA Local Route System

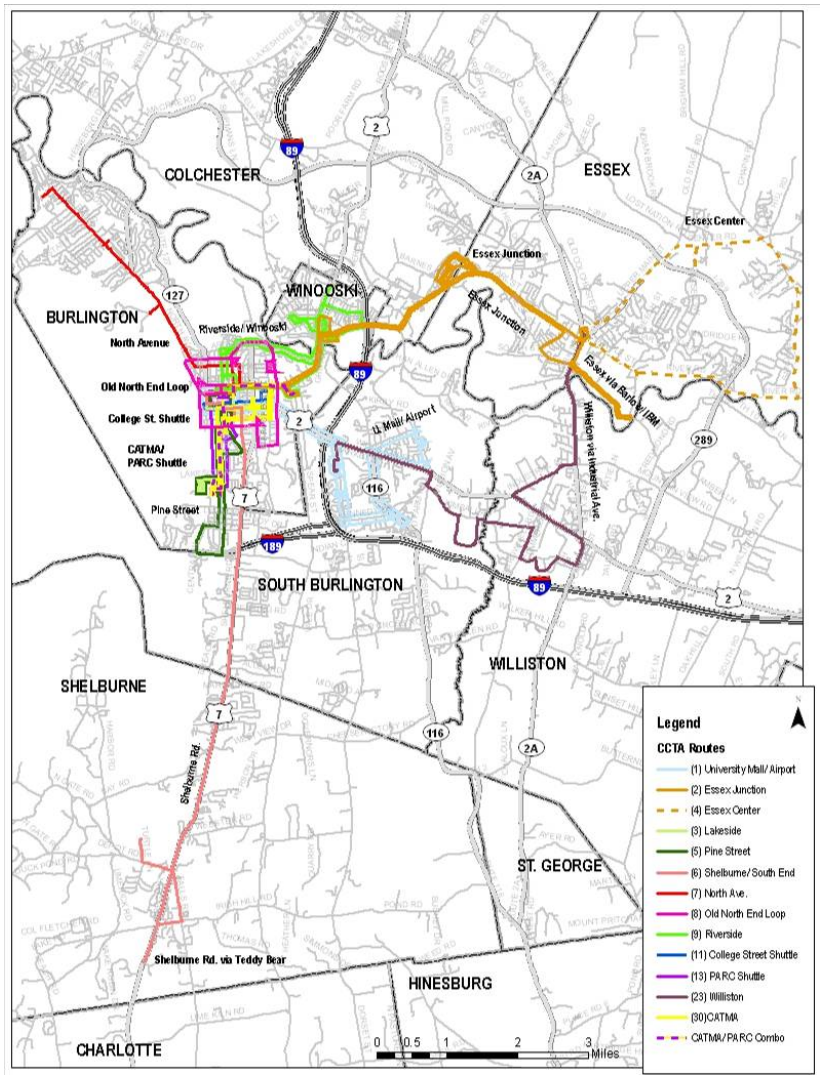


Figure 10: CCTA Local Routes in Central Burlington

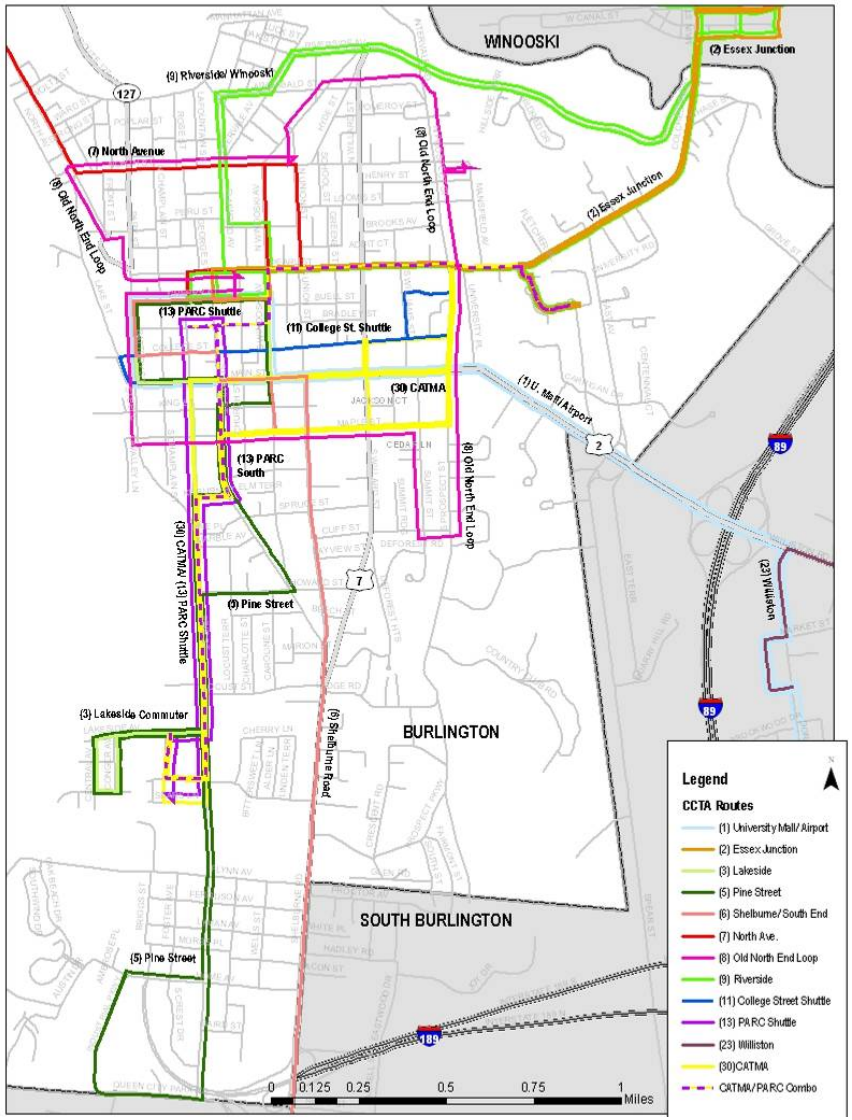
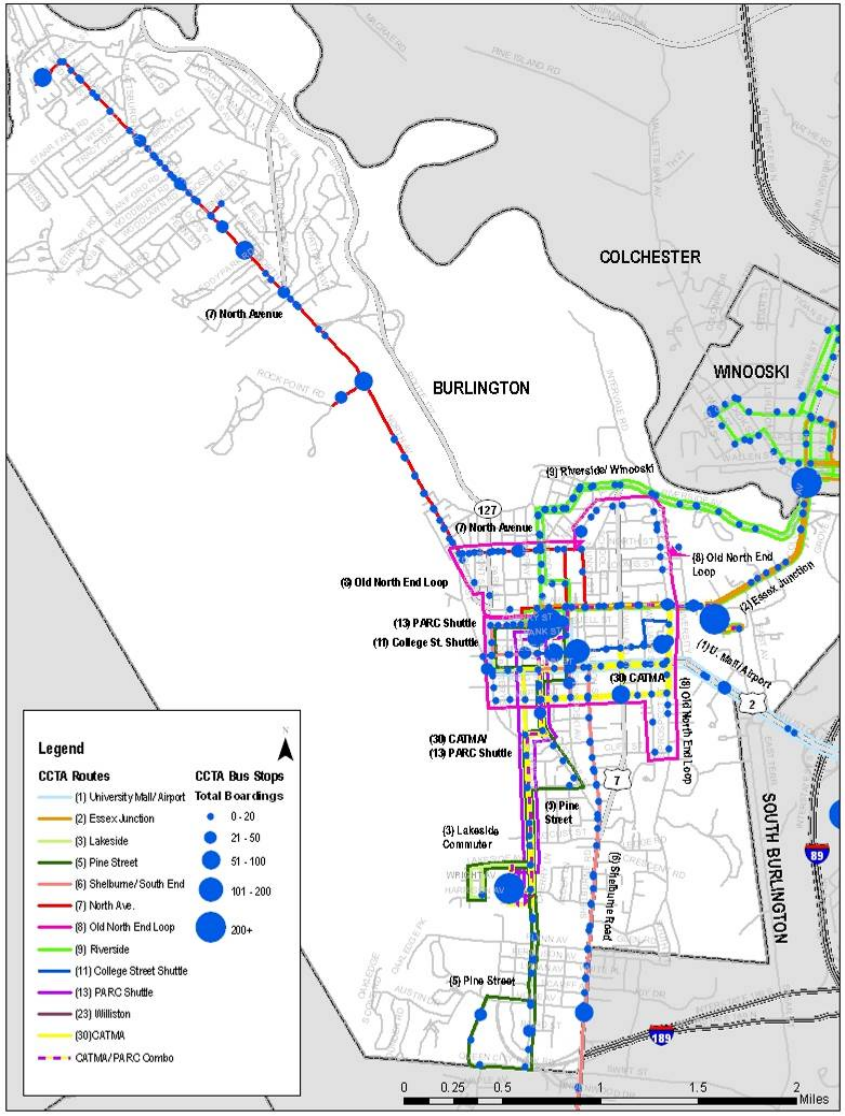


Figure 11: Weekday Boardings at Burlington Bus Stops (Fall 2006 Data)



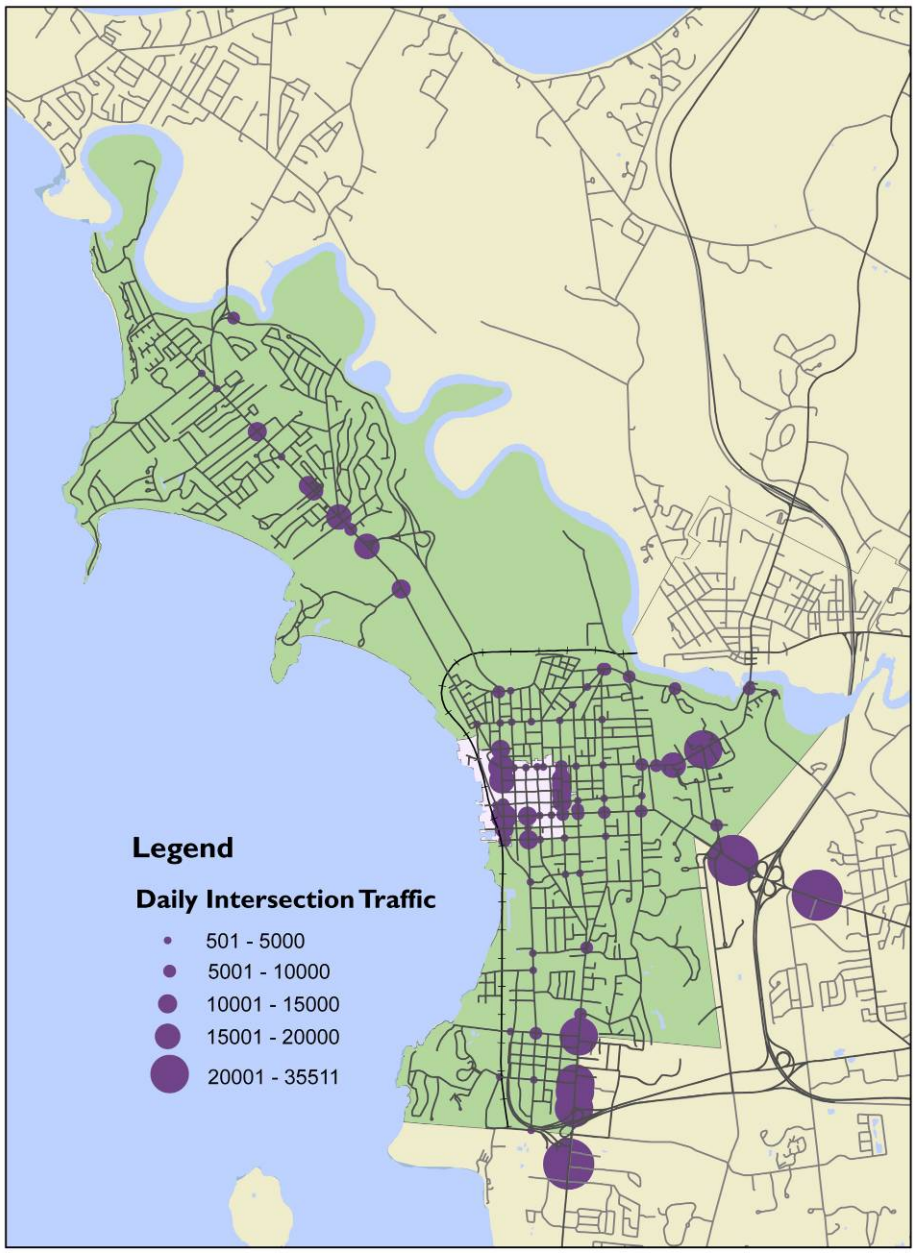
Cars

At the time of this writing, automobiles comprise the primary mode of transportation in Burlington, despite the presence and high usage rates of other modes, compared to the rest of the county and state. Burlington's street network is somewhat isolated from the highway and street networks in adjacent towns due to the presence of major barriers, including the Interstate 89, Interstate 189, the Winooski River and Lake Champlain. There are relatively few points to enter or exit Burlington, including the Heineberg Bridge, Route 7/Colchester Avenue, Route 2/Williston Road, Spear Street, and Shelburne Road. Figure 12 shows the street network, with the relative traffic volumes also indicated where data is available.

The capacity of a street network is primarily limited by the capacity of intersections, and these are the major points of congestion in the city street system. Figure 13 below shows the relative traffic volumes at intersections in Burlington.

Figure 12: Traffic Volumes on Streets

Figure 13: Intersection Volumes

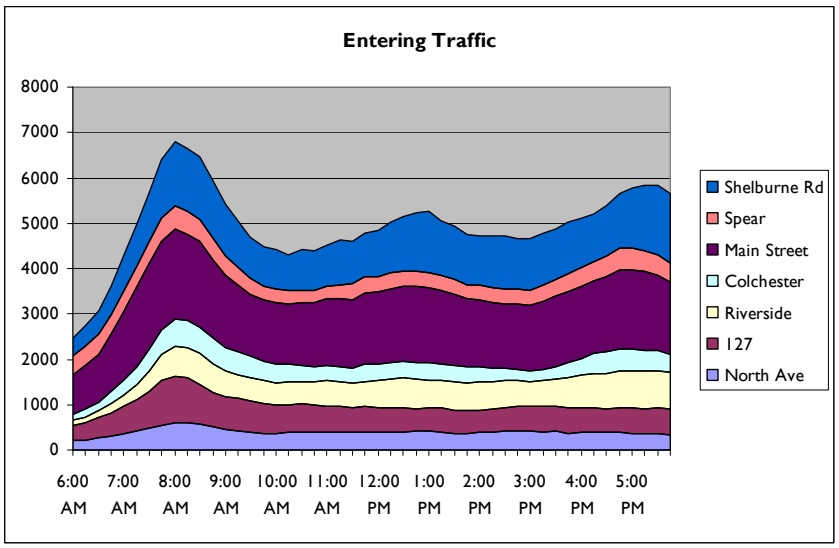


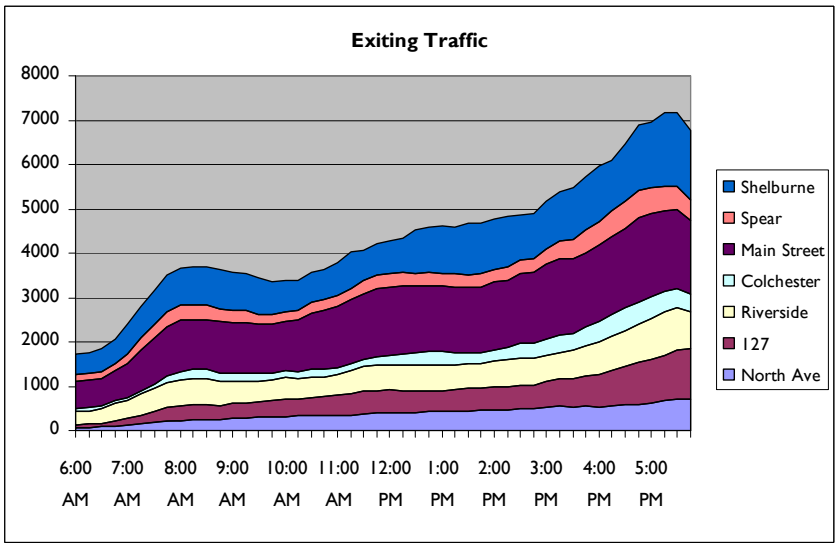
Source: VTrans, CCMPO, and City of Burlington

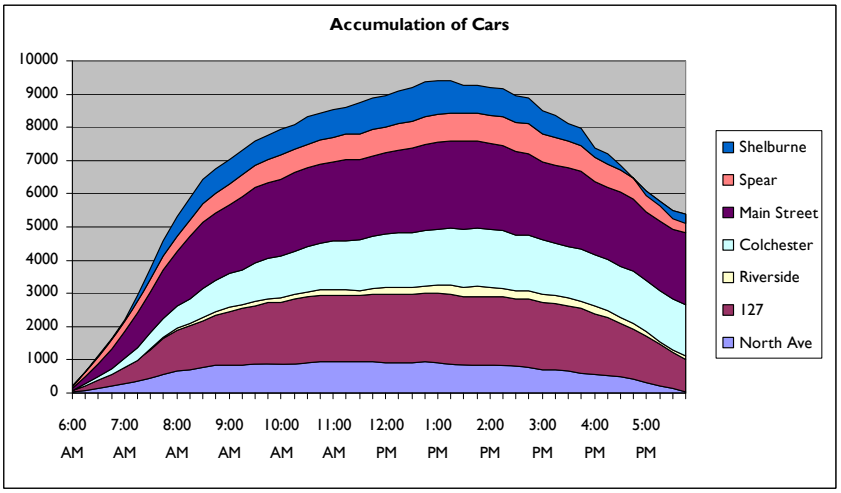
Both Figures 12 and 13 above show that Main Street and Shelburne Road have the highest traffic volumes, but these volumes diminish as these routes approach the center of the city, due to the dispersal of traffic onto the city's network of streets. This valuable function of a street network should not be overlooked in planning the future transportation street system, and the redundancy of streets serves traffic very well.

Figure 14 below show the hourly volumes entering and exiting these locations, and also show the resulting accumulation of cars in Burlington. Traffic count data for vehicles entering Burlington at the Heinburg Bridge were not available, so the following figures show traffic entering Burlington's core area, and do not include the new North End.

Figure 14: Entering and Exiting Traffic at Burlington's Gateways, and Accumulation of Cars







The major gateways are the locations that were cited most frequently in public outreach meetings as being congested. The intersections that are within Burlington's denser, connected street network generally do not experience as severe congestion, as traffic is able to route through the network more efficiently and avoid congested intersections. However, many signalized intersections are not as well coordinated and optimized as possible, and there is room for improvements in operations.

From a regional perspective, the 2025 CCMPO Metropolitan Transportation Plan presents a table with the 23 most congested road segments in the region, and none are in the city of Burlington. The most congested locations are primarily in suburban locations, where this is both high auto dependence and a very limited, sparse street network to carry traffic. In these areas, all traffic must funnel through few points, and these constrictions result in traffic congestion and delays. Burlington's street network provides numerous ways to travel to and through the city, allowing motorists to avoid the most severe congestion.

The "gateways" into Burlington serve a valuable function of metering of traffic into the city. If the capacity of any of these gateway locations was increased significantly, it would likely shift congestion to a new "downstream" bottleneck. An example of this phenomenon is the recent construction of the Winooski circulator, which increased the capacity of the intersection of Routes 15 and 7. However, traffic now queues at the downstream intersection of Colchester and Riverside, which does not have the capacity to handle the morning peak hour traffic leaving Winooski. The net result of the improvements in Winooski may have a limited effect in really reducing travel time for auto commuters into Burlington. When considering projects that would increase vehicle capacity, it is important to look far "downstream" and make sure there is capacity to receive the increased traffic volume.

Parking

The importance of parking in our cities and towns, particularly in downtown and core areas, has long been recognized by the shoppers, clients, visitors, residents, and merchants in these areas. Few aspects of urban life engender so much comment and complaint.

The typical approach to parking has been one of "more is better". More recently, however, the transportation planning profession has become increasingly aware of the importance of parking in our community centers– in its role of providing a crucial service to community merchants, their staff, and their clients/customers, that strongly affects auto demand and transit demand, and as a primary feature of a City's urban form. Parking is seen as a means to an end and not an end it itself.

Parking issues are most critical in the downtown and waterfront areas, collectively known as the WMD (Waterfront/Marketplace/Downtown) area. Parking is also an issue in the higher density areas of the city such as the Old North End and King Street neighborhoods and the hill section near the institutions. Other areas of the city–the neighborhoods and residential areas – largely have adequate parking, both on-street and privately provided. Two areas not falling strictly under the purview of WMD parking are parking in the Hill section and parking for special events. These are addressed briefly below.

The City has undertaken a series of parking studies in the WMD. The most recent studies were completed by Wilbur Smith Associates (WSA) in March, 2003, "Downtown Burlington Parking Study", and by Resource Systems Group (RSG) in April, 2001: "Final Report: Burlington Waterfront Parking and Circulation Study". These studies, with some additional City data, have been the source of data for this analysis.

Both the WSA and RSG studies subdivided their areas into subareas based loosely on walking distance and the organization of uses within them. The RSG study was divided into two areas, both on the waterfront (i.e. west of Battery St), Zone 1 south of College St as far south as Maple, and Zone 2 the remainder of the designated waterfront to the north of College.

The WSA study included more subdivisions as shown in Figure 15. In general, Zone 2 represents the immediate Marketplace area, Zones 1 and 3 represent the northerly and southerly ends of the area adjacent to the waterfront, respectively, and Zone 4 represents the south east quadrant, generally south of Main Street.

Downtown parking is categorized by its ownership and accessibility as public/public (publicly owned and generally available to the public), private/public (privately owned and generally available to the public), or private/private (privately owned and restricted to private use).

Parking inventory is summarized in Table 4.

Figure 15: Parking Study Zones

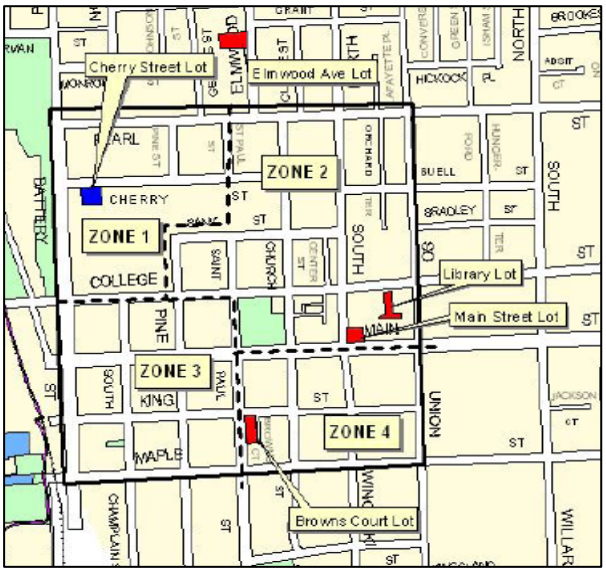


Table 4: Downtown Parking Inventory

Zone	1	2	3	4	Total
On-Street	152	425	338	238	1,153
Public/Public	939	524	0	44	1,507
Private/Public	627	460	0	216	1,303
Private/Private	272	1,013	981	339	2,605
Total	1,990	2,422	1,319	837	6,568
Source: WSA Downtown Parking Study, 2003					

Parking pricing varies by type and location. On-street spaces are generally metered. Most meters have a 2-hour limit and parking rates are $0.75 per hour. Some meters have a 10-hour limit and charge $0.20 or $0.25 per hour. Other meters range from a 15-minute limit at $1.00 per hour to a 3 hour-limit at $0.50 per hour.

Most public surface lots are metered and emphasize long term (10 hour limit at meter rate) parking. Some spaces are leased. Most (about 85%) of surface lot spaces are private and providing parking only for specified businesses or uses.

Most public garage spaces are free for the 1st two hours (paid for through an assessment of all

commercial property within the Downtown Improvement District), $1.50 per hour afterwards up to a maximum daily rate of $5.50. The Burlington Town Center garage is also free for the 1st 2 hours, but about twice the general public rate afterwards. In general, the garages also provide monthly leased spaces. Based on the WSA inventory and standard dimensions for on-street spaces, parking occupies a little over 15% of downtown land area.

Both WSA and RSG estimated peak accumulation in the parking facilities under consideration by counting actual accumulation over a period of time. In the WSA, the highest overall utilization rate observed was 74 percent, occurring mid-day between 11 a.m. and 1 p.m. on a Friday (June 12, 2002). At this time, the most popular on-street parking space areas were full, while the overall on-street parking utilization was 81 percent. Similarly, surface lot and garage utilization rates ranged from a low of 46 percent for the Elwood Avenue lot to 98 percent for the Browns Court Lot.

The WSA study projected that existing peak parking demand for non-residential land use exceeds the existing parking supply. Although the existing parking supply deficiency is currently limited to Zone 2, the deficit is large enough to create an overall parking supply deficiency in the study area during the peak period of approximately 400 spaces. If the existing buildings were fully occupied, the current deficit could increase to 820 spaces.

The discrepancy between the peak utilization rate of 74% and a projected parking supply deficit of 400 or more spaces is a function of the difficulty in accurately estimating parking demand. However, when considered along with the geographic distribution of the parking supply and public perceptions of supply shortages, it is reasonable to conclude that both greater efficiency in the utilization of the existing supply and adding new spaces in strategic locations will need to be pursued.

Transportation Demand Management

The City of Burlington intends to accommodate any increases in population and employment without proportional increases in traffic. This requires a set of activities that are collectively called Transportation Demand Management or TDM. Many of the City's transportation programs are related to TDM - including sidewalk or crosswalk improvements, transit system enhancements or promotion, park and ride or satellite parking development, bike racks, lanes or markings.

The Campus Area Transportation Management Association (CATMA) operates a more formal and comprehensive TDM program for employees and students of the Hill institutions. CATMA has an extensive set of benefits for employees that shift from peak-hour single-occupant-vehicle (SOV) commuting. The carrots include:

- carpool/vanpool incentives
- staggered work and class scheduling
- a joint, confidential carpool matching program (RidesWork)
- mass transit subsidies and an Unlimited Access Program
- incentives to park at off-site locations
- pedestrian walkways and bikeway system

- flex time policies
- a guaranteed ride home program
- bike/walk incentives program
- telecommuting
- extensive shuttle bus system connecting CATMA institutions with off-site parking lots, and also providing transportation within the CATMA area

While the above list shows the extent to which CATMA supports SOV alternatives, it also has been important to CATMA's success that it controls the availability and pricing of onsite parking. CATMA's performance is illustrated in Tables 5 and 6 taken from the CATMA Joint Institutional Parking Plan (JIPP) for fall 2006.

Table 5. CATMA Annual Student Transportation Survey

How do you generally commute to Main campus?

	Residential student			Commuter living within 1/2 mile of core campus			Commuter living outside 1/2 mile of core campus		
Year	2003	2004	2005	2003	2004	2005	2003	2004	2005
Drive Alone	5.2%	1.6%	1.6%	21.4%	12.5%	6.7%	79.4%	68.5%	63.4%
Bike/Walk	64.8%	75.1%	79.0%	64.8%	76.3%	84.6%	7.9%	11.9%	15.0%
CCTA Bus	3.0%	12.1%	11.1%	3.9%	5.4%	4.1%	3.7%	7.9%	11.4%
Car/Vanpool	2.0%	0.8%	0.8%	4.9%	3.5%	2.6%	6.6%	9.5%	8.4%
Shuttle	20.9%	8.7%	6.6%	N/A	N/A	N/A	N/A	N/A	N/A
Other	4.1%	1.8%	0.9%	5.1%	2.4%	2.0%	2.3%	2.2%	1.8%

Source: CATMA Joint Institutional Parking Plan, March 2006

Table 6. CATMA Employee Fall Transportation Survey

	Drove Alone			Carpool	Bus	Train	Bike/Walk	Tele-commute	Other**
Year	Total	PARC Shuttle*	no Shuttle						
2000	73.8%	17.3%	56.5%	11.5%	2.2%	-	5.2%	-	2.8%
2001	69.1%	20.5%	48.6%	11.5%	3.0%	0.9%	10.1%	-	3.8%
2002	68.0%	20.6%	47.4%	12.2%	3.9%	0.8%	9.5%	-	4.4%
2003	64.8%	15.7%	49.1%	11.2%	4.5%	-	13.5%	-	5.9%
2004	61.7%	5.3%	56.4%	12.5%	6.7%	-	14.9%	-	4.1%
2005	59.1%	13.4%	45.7%	12.5%	10.4%	-	12.8%	0.1%	5.0%

* 2004 Survey data DOES NOT Include FAHC. Changes in shuttle use reflects this.

** A large number of those who chose "other", are informal carpools.

Source: CATMA Joint Institutional Parking Plan, March 2006

Only 59 percent of employees drive to work alone, a major reduction from 2000 when 74 percent of employees drove alone to work. A significant portion of the 59 percent SOV share park remotely and use shuttles which reducing congestion in Burlington. Similar reductions in SOV have been realized in the student population. Although largely hidden from view, CATMA's success is a huge benefit to road users in the City, and to residents concerned with the negative impacts of traffic.

CATMA's success is also highly beneficial to the institutions who are facing costs for parking garages of up to $40,000 per space, have other more desirable uses for limited real estate, and would meet greater opposition to construction projects if traffic impacts were not mitigated.

These advantages of employer TDM are relevant to private employers as well, especially for those in the downtown/waterfront district where land is scarce and new parking is very expensive. The Chittenden Bank already offers an employee parking program in conjunction with CATMA and CCTA. There have been discussions about forming a downtown Transportation Management Association (TMA).

Trucks

Burlington has trucks traveling to, from and through the city, serving the residents and the economy. The city is a net importer of freight, so that there are more trucks bringing goods to the city than being shipped out of the city. In addition, some trucks pass through the city on its streets, primarily on US 2 and US 7. While most trucks passing through the area would stay on interstates I-89 and I-189, certain types of through-trucks exceed the weight limits for the interstate highway, but are permitted on the state routes. The trucks with higher weight limits are limited to those carrying raw materials of wood, milk, or quarry products. This situation of two weight limits on the different types of facilities is a long standing Vermont regulation, and is specifically in place to benefit local industries that rely on hauling of heavy raw materials. In the past, there has been little support in the legislature to change the state regulations to match the federal weight limits. The federal weight limits are national limits for the entire interstate system, and until recently there has been strong resistance on the part of the Federal Highway Administration to raising these limits.

The following table presents data available from the Vermont Agency of Transportation regarding truck traffic on some of Burlington's major routes. In the table below, "heavies" refers to tractor trailers, and "mediums" refers to smaller trucks that have at least four tires on the rear axle (i.e. not including light pick-up trucks).

Table 7: Truck Traffic on Burlington Streets (sorted by total number of trucks)

Route	Location	Trucks	Mediums	Heavies
So. Willard (US7)	US7 0.2 mi S of Colchester	639	472	167
Pine St	N of Pine Square entrance	585	446	139
Pearl St	E of S Williams	517	337	181
ALTUS7	So Winooski Ave south of Main	415	344	70
East Ave	N of FAHC	403	312	91
North Ave	0.2.5 mi S of Institute	401	330	71
(ALTUS7)	N Winooski Ave north of Pearl	254	161	93
So. Willard (US7)	Between SpruceSt/TowerTerrace	240	202	38
(ALTUS7)	S Winooski Ave south of Pearl	217	165	52
VT127	1 mi N of beaches exit	209	179	30
VT127	0.1 mi E of North Ave	207	178	29
Home Ave	between Batchelder and RR Track	203	173	29
N Champlain	N Champlain just N of Peru	80	61	19
Briggs	between Ferguson/Lyman	25	23	2

By comparison, some of the villages in Vermont that are bisected by major truck routes, such as Middlebury and Woodstock, have up to 1,000 total trucks per day, and well over 400 tractor trailers (heavies) per day. By these standards, the routes in Burlington have relatively lower levels of tractor trailer traffic. Nonetheless, truck traffic through the city causes concern to residents, due to their large size, air pollution, vibrations and noisy presence.

Truck loading and unloading has been addressed in the Church Street marketplace area by limiting to morning hours, and trucks have access to the pedestrian area during these times. This system has generally worked well, and avoids conflicts where delivery trucks block traffic during busy periods.

Most of the industrial freight in the city originates from the Pine Street industrial area, which generally has streets and site plans that are scaled to accommodate needed deliveries and shipments.

Burlington International Airport

The Burlington International Airport (BIA) in South Burlington is managed by the City of Burlington. The airport plays a critical role in the region's business and tourist economy, as well as access to colleges and universities in the area. The airport is the 6th largest in New England, and is considered a "small hub" airport.[3] Improved public transit service to the airport has been expressed as a goal in numerous forums, including in the ongoing Route 2 Corridor Study.

Rail

At present, Burlington has no passenger rail service. Amtrak's Ethan Allen Express terminates at Rutland, and the "Vermonter" service operates one round trip daily between St. Albans and New York City via Essex Junction. Green Mountain Railroad operates excursion trains between Burlington and Shelburne during the Spring and Summer with extra trains serving lakefront events.

Burlington is served by two freight railroad lines: New England Central, which comes into Burlington from Essex Junction parallel to Route 15, and Vermont Railway, which comes into Burlington from the South, and generally parallels Route 7. Both are exclusively freight lines. Annually, NECR handles 36,410 carloadings annually (entire line), and carries 1.1 million gross tons MGT on the Burlington segment. NECR delivers woodchips to the BED MacNeill plant. Between Rutland and Burlington, VTR handles 8,908 carloadings and 1.16 MGT annually. [4]

[3] VTrans Study of Airport Economic Impact (2002):

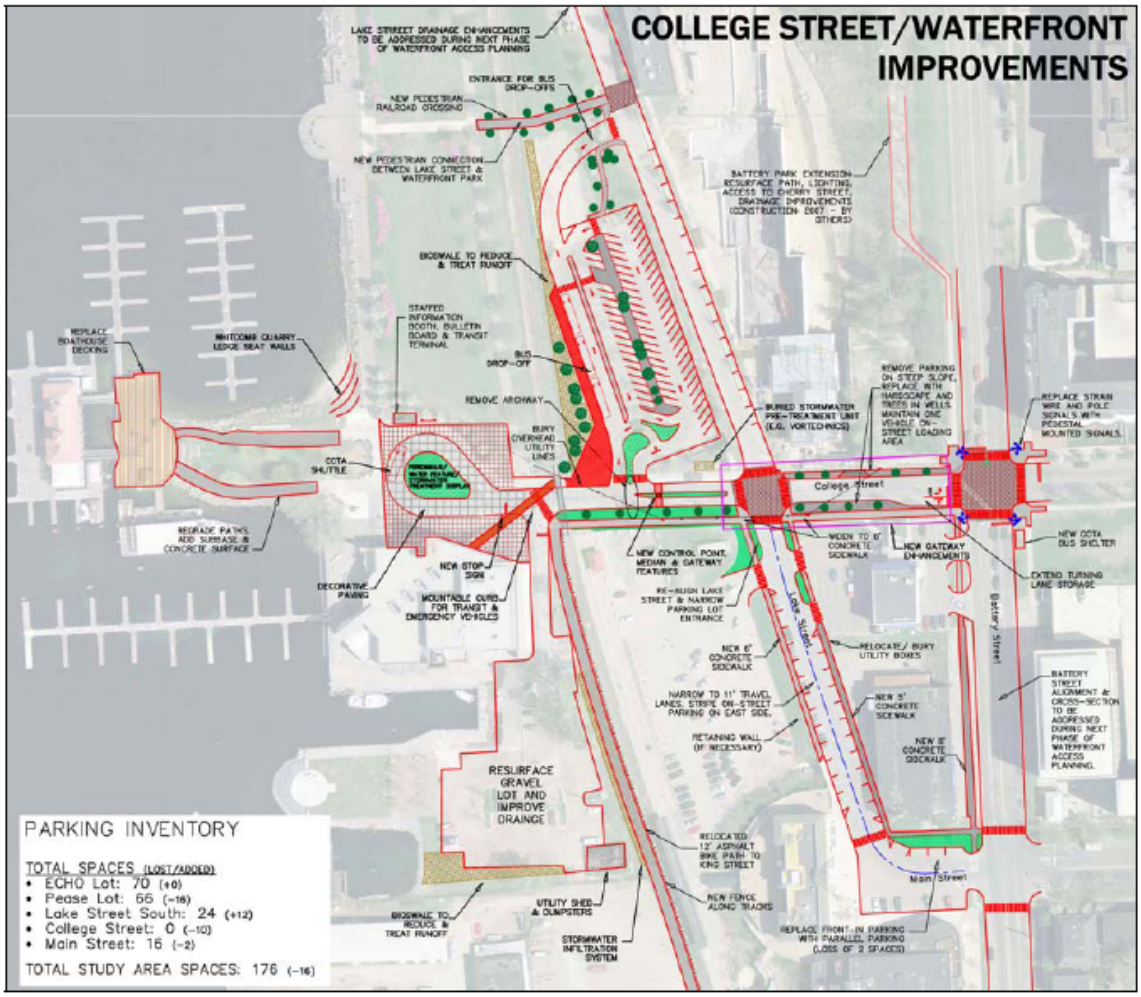
[4] Vermont "State Rail & Policy Plan", December, 2006, Table 4-3, p. 24:

Current Transportation Initiatives

Waterfront Improvements

In 2005, $3.5 million was authorized through the SAFETEA-LU legislation for Burlington waterfront transportation improvements. Total authorizations in the bill exceeded total available funds, so no one is getting the amount authorized. At this point in time, $1,331,000 in Federal funds is committed to date, which requires a City match of $332,750. About two thirds of the money is targeted toward improvements to lower College Street from Lake Street to the Circle. Other planned uses include a Battery Park extension, bicycle and pedestrian improvements on the lakefront, wayfinding, and improved pedestrian crossings at College and Battery. A Preferred Alternative was endorsed by the City Council on March 26, 2007 after an extensive public process.

Figure 16: Preferred Alternative for College Street/Waterfront Improvements



Source: From Waterfront/Collect Street Access Project – Conceptual Planning, Figure 8, p. 18, April 3, 2007.

Marketplace District Improvements

The 2005 SAFETEA-LU legislation also included funds for refurbishing Marketplace infrastructure, and also extending some of the Church Street Marketplace look and feel beyond its current

boundaries. About $3 million has been appropriated for this work to date. This money also must be matched by the City on an 80 percent Federal/20 percent City basis.

Two public meetings in October 2006 attracted 100 citizens and stakeholders who shared many ideas. An engineering and design team is developing recommendations and plans.

Downtown Transit Center

A study is currently underway to choose a location and design a new facility to replace the Cherry Street Transit Center. [Two sites are currently undergoing detailed examination: the State DET building on Pearl Street and St. Paul Street between Pearl Street and Cherry Street.] The main concerns from a public transportation perspective are having adequate capacity for bus berthing and layover, and ease of access and egress to and from the transit center. The current facility at Cherry Street does not have adequate space for CCTA's current operation, much less for a future expanded operation. Passenger amenities at the current facility are poor or non-existent. Bus routing into the current facility is circuitous for most routes, and the limited egress options (via Cherry Street onto S. Winooski) create traffic problems when the buses all depart at 15 and 45 minutes past the hour.

The new Downtown Transit Center would have up to 17 bus berths available to accommodate future expansion, heated passenger waiting space, comfortable seating, restrooms, electronic real-time passenger information signs, and possible concession space. Bus flow in and out of the Center would be designed to eliminate backtracking, reduce travel time, and avoid congestion.

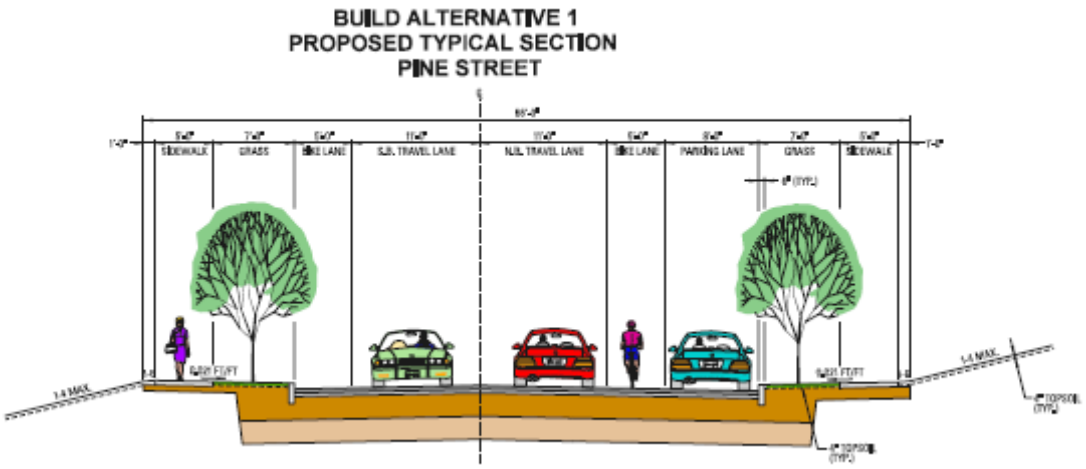
South End Neighborhood Transit Center

CCTA currently operates two shuttle services from the PARC Shuttle Lot (aka General Dynamics lot), located between Sears Lane and Lakeside Avenue, just west of Pine Street. This surface lot with minimal passenger facilities (a simple bus shelter) will be replaced by a parking garage. The total parking capacity at the site will rise from the current 350 to parking for up to 575 spaces with a transit facility and an opportunity to develop neighborhood amenities. No surface parking will remain and it is assumed that the owner, Gilbane Properties, will develop the property. CATMA would like to control 300 spaces. There are currently about 150 downtown users. A feasibility study projected opening year weekday usage at: CATMA 200-300 spaces, downtown 200 spaces, growth 50 spaces. The current concept leaves an opportunity to add at least one more level either for future downtown or CATA parking and/or parking for adjacent development.

Champlain Parkway (Southern Connector)

The Champlain Parkway (Southern Connector) project is intended to connect the western end of I-189 with Burlington. A Final Environmental Impact Statement (FEIS) for an earlier plan for this project was completed in 1979, but only the southernmost section of 0.6 miles was completed, and it has not been opened to traffic. After the FEIS was completed, the Pine Street Barge Canal was designated a Superfund site and it was ultimately determined that the earlier plan was infeasible.

A Draft Supplemental Environmental Impact Statement was completed in 2006 for alternatives which stay clear of the Barge Canal. These alternatives include about 0.7 miles of new roadway and using about 1.0 miles of existing streets (Lakeside Avenue and Pine Street). One alternative would connect with an extended Battery Street through the Burlington rail yard. Pine Street would be reconstructed as a two-lane street with provision for bike traffic (either bike lanes or wider shared lanes). (Note: The FHWA issued a Record of Decision (ROD) endorsing Pine Street as the preferred alternative in December 2009.)



From Southern Connector/Champlain Parkway SDFEIS, Figure 2-8, p. 2-19

This *Transportation Plan* assumes that the Champlain Parkway will be completed and that it will reduce traffic conditions on Shelburne Road (particularly the southern end), Home Avenue and Flynn Avenue, and Pine Street south of Lakeside Avenue. The DFEIS modeling shows a moderate increase in traffic volumes on Pine Street to the north of Lakeside Avenue, but relatively modest overall effects on commuting into and out of central Burlington because Pine Street will continue to operate and moderate speeds and have limited capacity. The planned Champlain Parkway will add limited additional roadway capacity. DEIS analyses indicate that the Pine Street section will continue to act as a metering point. For the peak hours/peak directions, overall roadway capacity into and out of the City is estimated to increase by only about 1-2 percent in the first option and 2-4 percent in the Battery Street Connector option. Therefore, this project does not change the overall goal of accommodating growth in population and employment without growth in traffic.

Route 2 Study

The US 2 Study recommends a wide range of transportation improvements for the primary gateway into Burlington from the east. There are short-term location-specific improvements supporting pedestrians and bicyclists, traffic operations, and safety; access management improvements; and public transportation improvements including a new direct route on US 2 from Cherry Street to Williston. There are also a series of longer-term improvements covering all modes of transportation.

Specific improvements in the city of Burlington include the following:

- Pedestrian bulbouts at the intersection of Main Street and South Willard
- Moving the stop bar at the intersection of Main Street and South Prospect to improve sight distances
- Don't Block the Box campaign for the jug handle at East Avenue and Spear Street
- CCTA improvements including the new US 2 route (direct service from Burlington to Tafts Corners and Williston Village) and other restructuring
- UVM Land Bridge over Main Street at University Heights to connecting the north and south sides of the UVM campus with a multi-modal grade-separated crossing
- Bike lanes and potential bus lanes on Main Street between South Winooski and South Prospect

- Shared-use path parallel to US 2 from Burlington to Williston (alignment to be determined)

Route 15 Study

A corridor study on VT 15 is in progress as of this writing. Specific recommendations have not yet been developed. The boundaries of the study area do not include the city of Burlington, but congestion on Colchester Avenue leading into Winooski has been recognized as a transportation problem.

Current Fiscal Overview

The City's first priority after safety is maintenance of streets, sidewalks, pavement markings, traffic control equipment and parking facilities. All of these systems require ongoing expenditures for operations and maintenance as well as a capital investment to repair/replace them as they age. The city uses a variety of funding sources to meet these needs. The maintenance of streets and sidewalks including minor repairs, pothole patching, sweeping, snow removal and catch basin cleaning in funded primarily from the general tax fund of the city. Major repairs and capital improvements to streets, sidewalks and associated infrastructure such as catch basins and storm drains are funded with a special street tax. The parking system, both on street and in lots and garages as well as the traffic control system and pavements markings and some snowfighting efforts are funded by revenues derived from parking.

To maintain pavements to industry standards would require increasing current expenditures. Many comments have been received asking for better maintenance for pedestrian and bicycle facilities as well. An increase in the street and sidewalk capital dedicated tax or funds from the parking pilot programs (described below) could provide additional money for maintenance.

Public Involvement

The Public Participation Process for the *Burlington Transportation Plan* was designed to provide clear, concise communication to the public through a series of feedback opportunities. These included:

1) project steering committee;
2) series of informational meetings;
3) interviews with and participation in meetings of the downtown business community,
4) participation in the Legacy Town Meeting;
5) meetings with specific constituencies; and
6) final City-wide public meeting.

These activities are documented in Appendix 4.

Other processes

Burlington has a vibrant system of public involvement and engagement, and numerous civic organizations and initiatives, some formal and others ad hoc, that have concerns regarding various aspects of transportation. The Steering Committee includes representation from some of these organizations, and others have been contacted for their information and input. The following lists some of these groups or activities.

Legacy Project

The Legacy Project is a broad participatory planning effort with the goal of maintaining Burlington's livable nature into the future. This process has involved developing a Common Vision:

- maintaining Burlington as a regional population, government, cultural, and economic center with livable wage jobs, full employment, social supports, and housing that matches job growth and family income
- improving the quality of life in neighborhoods
- increasing participation in community decision-making
- providing youth with high-quality education and social supports, and lifelong learning opportunities for all
- preserving environmental health

Burlington Livable Community Project

The Vermont AARP and the Snelling Center have conducted surveys, research studies and outreach activities to evaluate Burlington as a Livable Community for an aging population. The activities ranged from focus groups on a several topics with seniors, including accessibility and mobility, as well as group walks to evaluate the sidewalks, crossings and pedestrian conditions. Together, this work has produced a highly valuable list of issues for this transportation plan.

Walking Work Group

Following a well attended Pedestrian Summit in the Fall of 2006, an ad hoc group has formed to address pedestrian needs with greater focus. This organization has been meeting monthly, and collecting data and assessing needs for pedestrian improvements.

Burlington Bike Council

The Burlington Bicycle Council is a citizens' advocacy organization working to promote the safe use of bicycles for transportation and recreation in Burlington, Vermont. The Council was created by the City of Burlington's Mayor's Office to serve as an advisory body to the Department of Public Works, representing the bicycling public in planning and developing bicycling facilities such as bike paths and bike lanes in Burlington.

Local Motion

Local Motion is a Greater Burlington non-profit organization whose mission is to "promote bicycling, walking, running, inline skating and the facilities that make sure travel safe, easy and fun." The organization seeks to improve personal health and the local economy by developing regional trails, promoting walkable communities, and fostering active lifestyles. Community leaders founded the organization in 1999 to develop the Winooski River Bike Ferry and Cycle the City. With two early successes, the organization broadened its sights on making the Greater Burlington area a better place to walk, bike, run and skate and reconnecting the segments of the former Island Line railbed into a spectacular regional trail. Local Motion is also coordinating the Safe Routes to School efforts in the Burlington area.

Burlington Business Association

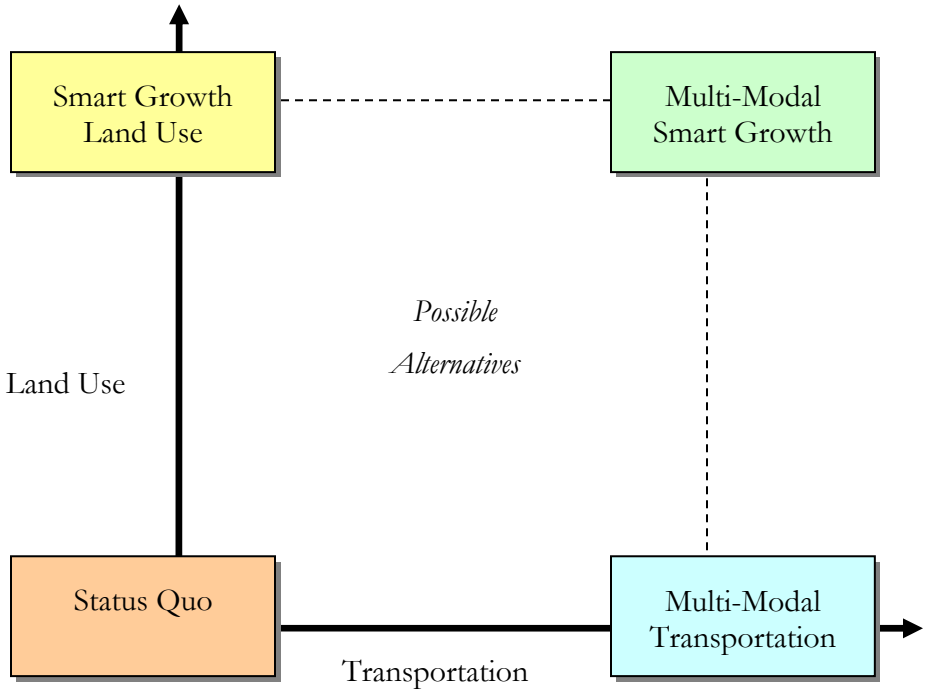
The Burlington Business Association (BBA) is a non-profit and non-political organization founded in 1978. Its 200 members include both businesses and non-profit organizations representing all sectors of the economy and sections of the City. BBA's focus is on the economic well-being of all of Burlington. Transportation is a major concern of the BBA. Recent transportation activities have included:

- working with the Department of Public Works on improved maintenance in the parking garages
- reviewing and making recommendations for the Federally-funded Waterfront/Marketplace/ Downtown - Transportation Improvement Projects,
- studying the possible formation of a Downtown Transportation Management Association (TMA),
- supporting the Champlain Parkway (Southern Connector) project, and
- supporting development of additional downtown parking.

3) Transportation in Burlington in the Future

The Steering Committee considered reviewed existing data and received public comment, and also considered alternative future scenarios. A memorandum summarizing the scenarios and the analysis of the scenarios is attached as Appendix 5. As shown in Figure 18, the scenarios considered included both transportation and land use elements.

Figure 18: Preliminary Alternatives Bound the Preferred Scenario



The Status Quo scenario represents the base case with little change from the current decision. It was assumed that any shift in the transportation system would be toward emphasizing multi-modal transportation based on the policy documents cited earlier, including the *Legacy Action Plan* (2000), the *Municipal Development Plan* (2001 and readopted in 2006), and the *Climate Action Plan* (2000). Similarly, it was assumed that any shift in land use would be toward more population and employment within the City, based on these same documents.

The Steering Committee did not agree about future land use, and also recognizes that this is a larger issue to be addressed in the next *Municipal Development Plan*. Based on community input and consideration of the scenarios, the Steering Committee agreed that it supports a Multimodal Scenario that emphasizes walking, biking, and transit, including:

- Priority high frequency direct bus routes with longer service hours;
- Improved pedestrian crossings and network;
- Complete on-road bicycle network; and
- Lowered traffic speeds to promote walking and bicycle safety and level of service, especially downtown.

Modeling of the Multimodal Scenario indicates that it will increase walking, biking and transit mode shares for the City's residents and visitors. This will translate into lower future vehicle miles traveled (VMT) and less energy use and lower greenhouse gas emissions. These effects will be stronger (particularly regarding transit) if the rest of the region sets the same priorities. Furthermore, the regional effects would be reinforced if a greater share of the region's population growth were in the City of Burlington, because Burlington residents drive much less, on average, than residents of the rest of the County. They use alternative modes, particularly walking, to a greater extent. When they drive, the distances generally are shorter.

As discussed in the introductory section, the Transportation Plan is focused on expanding on this multimodal vision, with four primary themes:

- Strong and Healthy City – Transportation is a foundation of a vital Burlington. It serves residents, businesses and institutions, workers, shoppers and other patrons, visitors, and the entire region. It is fundamental to the economic health of the City and the region. However, transportation is not only utilitarian. Transportation infrastructure is a large part of the urban form and is a strong contributor to how the City is experienced in daily life. Transportation infrastructure can aid in human health by encouraging active living and social opportunities, and it also can detract from human heath through air pollution and stress.
- Transportation Choices – Burlington's citizens want transportation choices with higher service levels for non-auto modes. This includes higher frequency transit routes with service continuing into the evenings and on weekends. It includes a complete bike network. It includes more complete and better maintained walkways. These non-auto modes serve critical populations including the young, the old, and the disadvantaged. However, increasing the non-auto mode share for those who have the option to drive is critical for continuing for managing auto travel in Burlington and lessening the negative impacts of cars.
- Great Streets – A major component of this Transportation Plan is the new *Street Design Guidelines* (Appendix 2). Street design is where the vision meets the ground. The Guidelines support transportation choices, including provisions for pedestrians, bicyclists and transit riders. They also are concerned with aesthetics and the quality of urban life. The *Guidelines* will be consulted when work is planned on City streets to explore opportunities to reconfigure the streets to be more in accordance with the *Guidelines*.
- Moving Forward – Burlington has put forward a consistent transportation vision in recent years. This *Transportation Plan* is focused on moving the reality toward the vision.

Street Types and Street Network

Transportation requires networks. A great street segment is useless for travel unless it is connected to other segments that allow complete trips. Each travel mode (car, transit, walk, and bike) has a different network, with these networks overlapping in some areas. Today, the car network is the most complete, providing full access to the city, and the bike network is the least complete. Some bike lane sections have been marked, but cyclists also must often either mix with traffic in narrow travel lanes or leave the street and use sidewalks. Biking on sidewalks by those aged 16 or over is prohibited by Burlington ordinance, but is common because it is perceived as the lesser evil. Bikes on sidewalks has been cited as a significant pedestrian problem in a survey conducted by the AARP (discussed in an earlier section). Some are discouraged from biking due to lack of facilities, and some may be discouraged from walking because of bikes on sidewalks. An objective of this *Transportation Plan* is to develop a complete bike network.

The pedestrian network includes not only sidewalks but also crosswalks. As discussed above, community feedback indicates that crossings are generally of more concern than the sidewalks, although there are maintenance issues with particular sidewalks. Another objective of this *Transportation Plan* is to improve pedestrian crossings by shortening crossing distances, lowering traffic speeds, and in some cases, providing median pedestrian refuge areas.

The transit network includes not only the transit routes, but also transit stops and the entire pedestrian network. In most cases, a transit trip includes a walk trip at the beginning and a walk trip at the end. Therefore, pedestrian network improvements also improve the transit network. In addition, the *Transportation Plan* identifies a priority transit network which will be the focus of special attention to the quality of transit stops, and where transit priority treatments will be considered including queue jump lanes and signal priority.

Some cities with more parallel streets have elected to prioritize different streets for different purposes; for example one street for moving traffic, another for buses, and a third for bikes. This approach generally is infeasible in Burlington because important gateway streets have no parallel streets. These streets must carry cars, trucks, buses, bikes and pedestrians. They must be "Complete Streets."[5]

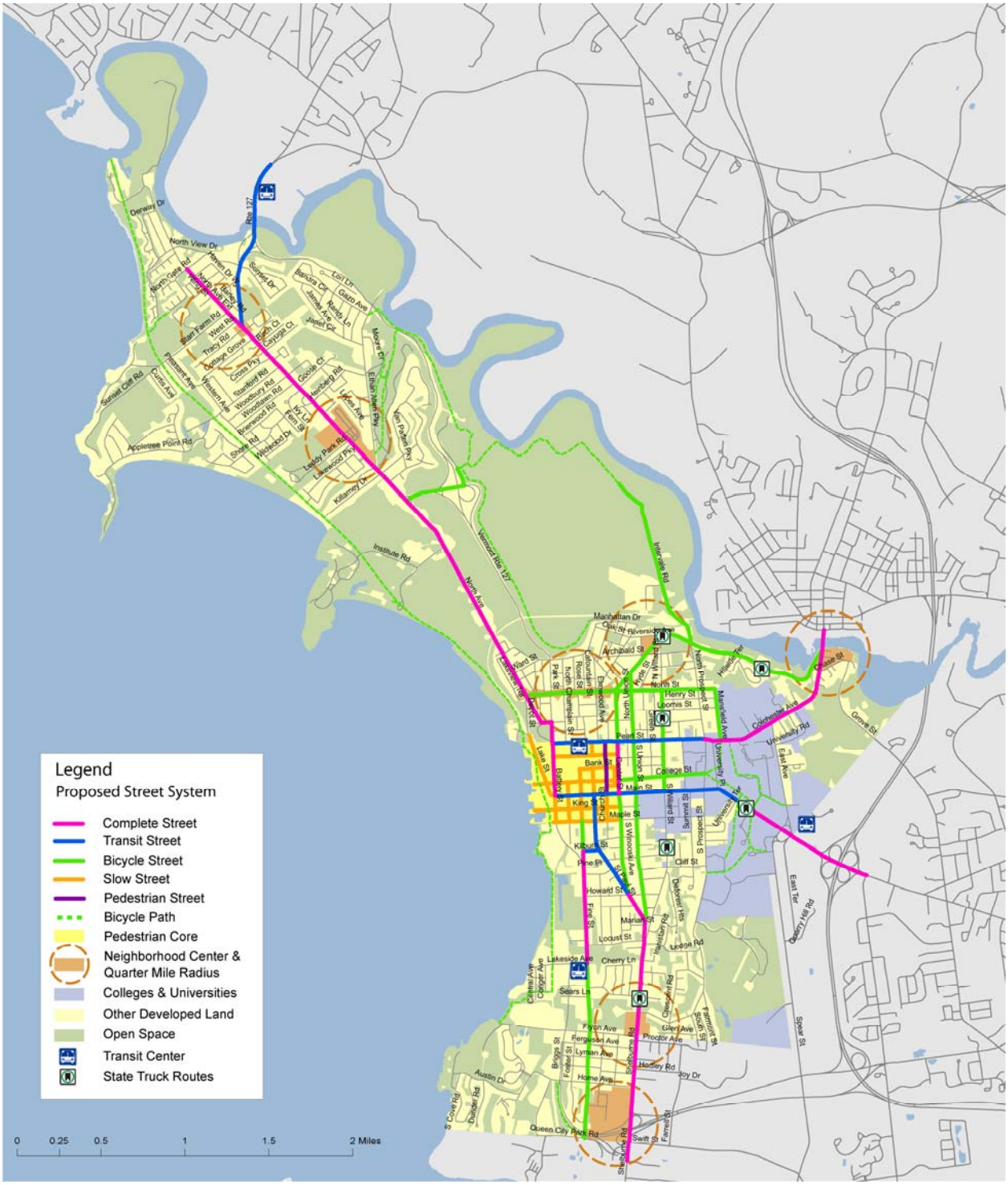
Figure 19 shows the planned street types and street system for Burlington. The street types include:

- Complete Streets (magenta) – important gateway streets that must carry all modes including portions of North Avenue, Colchester Avenue, Main Street, Shelburne Road and Pine Street
- Transit Streets (blue) - a network of streets that along with the Complete Streets, makes up the priority transit system and where bicycles have parallel routes available
- Bicycle Streets (green) – a network of streets that along with the Complete Streets and bicycle paths completes the bicycle network
- Slow Streets (orange) – all streets in the downtown/waterfront area labeled in Figure 19 as "Pedestrian Core" with pedestrian priority and designated 20 m.p.h. with motorized vehicles and bicycles together in mixed traffic
- Pedestrian Street (purple) – Church Street Marketplace
- Neighborhood Streets (black) – all other streets

[5] There is a national movement that is planning and reconstructing streets as Complete Streets. For more information, see www.completestreets.org .

Figure 19 Street Types and Street Network

:



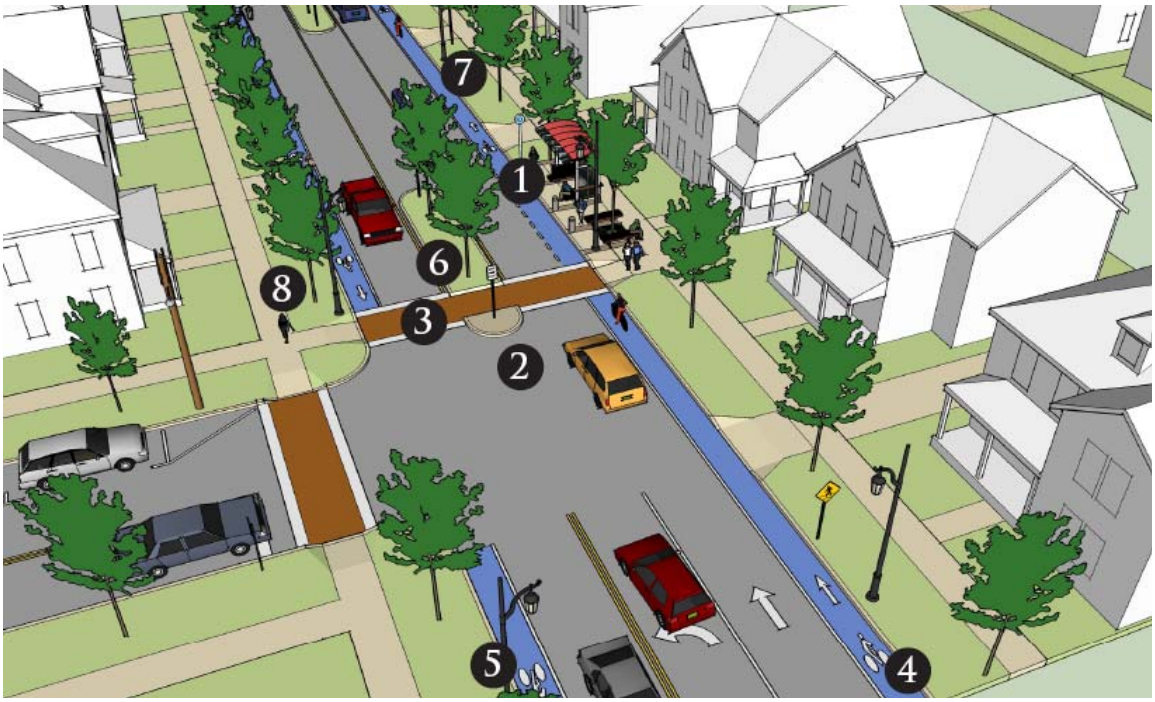
Street Design Guidelines

A major component on this Transportation Plan is the new *Street Design Guidelines* (Appendix 2) which describes these different street types in detail. The *Street Design Guidelines* show alternative uses of existing pavement to better serve the primary themes in the *Transportation Plan*. Important design features include safer pedestrian crossings, a complete bike network, and improved bus accommodation - expanding **Transportation Choices**. The street designs are planned to combine transportation objections with aesthetics; they are **Great Streets**. By encouraging active living, safer travel, and beautiful urban design, the Street Design Guidelines support a **Strong and Healthy City**. The *Street Design Guidelines* are to be consulted when significant paving or reconstruction work is planned on City streets. This is a critical component of the **Moving Forward** component of the *Transportation Plan*.

The following sections summarize *the Street Design Guidelines*

The Complete Street

Figure 20: The Complete Street



The Complete Street overview graphic (Figure 20) includes:

1) enhanced transit stop,
2) traffic calming by removing a lane of through traffic,
3) short pedestrian crossings,
4) bike lanes,
5) updated utilities and lighting,
6) landscaped median island and turn lane,
7) stormwater planters, and
8) tree belts.

Prior to conversion to a complete street, a scoping process will be required which will include input from stakeholders and neighbors. Some of the features shown in Figure 20 could be modified during the scoping process. For example, the landscaped median island might raise concerns about maintenance and could be replaced with a striped median. This would not provide the same levels of traffic calming, pedestrian crossing quality, or aesthetic quality, but would still be a Complete Street. There are some aspects of the Complete Street that can not be compromised. For example, the provision of the bicycle lanes is essential. Furthermore, it would not be possible to remove the bicycle lanes from one section of the street without compromising the entire bicycle network.

While the benefits of the Complete Street design are attractive, there will be concerns about whether a single through travel lane in each direction is sufficient to carry traffic. This issue will need to be addressed on a case-by-case basis in the scoping process, but preliminary analysis suggests that conversion is possible for the four-lane sections of all of the streets identified in Figure 19.[6] In almost all cases, urban street capacity is limited at intersections rather than along street segments. Therefore, it is often possible to reduce width without reducing throughput. Furthermore, in a four-lane cross section, the left lanes operate inefficiently due to conflicts between left-turning vehicles and through vehicles. Moving the left turning vehicles out of through traffic removes these conflicts and also generally reduces accident rates.

Many successful conversions have been done in the U.S. Figure 21 shows before and after photos for a 2002 re-striping project on Fourth Plain Boulevard in Vancouver, Washington. This is an example of a low-cost, reversible conversion that might be done prior to a more expensive reconstruction project.

Figure 21: Fourth Plain Boulevard, Vancouver Washington – Before and After Re-Striping

[6] Shelburne Road is the most challenging candidate because it has the highest current traffic volume. Conversion is likely to be most feasible in conjunction with completion of the Southern Connector project which will reduce Shelburne Road traffic volumes somewhat.

Outcomes for Vancouver, Washington's Fourth Plain Boulevard conversion include:

- Crashes down 52%
- Traffic speeds down 18%
- No traffic diversion
- Pedestrian and bike benefits
- Redevelopment and renovations
- Survey results for "street 'feels' safer" – 67% yes, 21% maybe, 12% no[7]

These results are typical of other conversions.

Some preliminary analysis has been done for the 4-lane section of Colchester Avenue (attached as Appendix 6). The main finding is that traffic on this section is metered at the East Avenue intersection, and that this intersection would have the same capacity before and after conversion. The reduction in capacity at other locations would not be great enough to change the overall picture; the metering point would remain the East Avenue intersection. Synchro and SimTraffic software were used to analyze the performance of Colchester Avenue under both the existing and Complete Street configurations. The results are summarized in Table 8. Average speeds are decreased somewhat (as intended for traffic calming and safety) because passing is prevented and the prudent driver sets the travel speed. However, there are actually fewer stops because conflicts are removed between left lane turning and through movement volumes. This translates into lower air pollution emissions.

Table 8: Analysis of Colchester Avenue Conversion to Complete Street

Measure	*Existing Four Lane*	*Three Lane Conversion*	*Change*
Travel time (hr)	*91.4*	*103.2*	*13%*
Average speed (mph)	*18.1*	*15.8*	*-12%*
Total stops	*4,692*	*4,252*	*-9%*
Stops/vehicle	*1.50*	*1.36*	*-9%*
Fuel used/hr (gal)	*140.8*	*139.8*	*-1%*
HC emissions (g)	*390*	*365*	*-6%*
CO emissions (g)	*14,910*	*12,051*	*-19%*
NOx emissions (g)	*1,228*	*1,085*	*-12%*

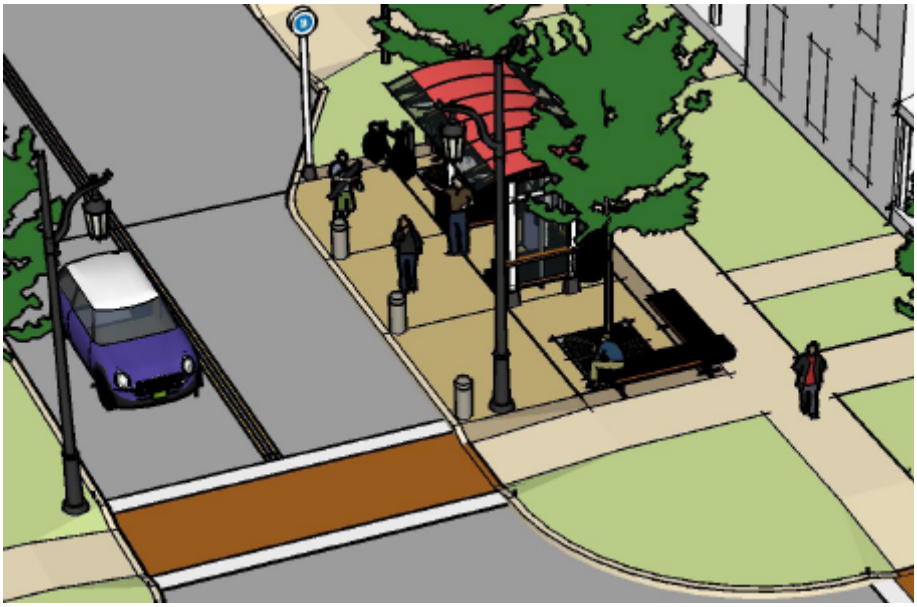
The Transit Street

The first priority of the Transit Street is to facilitate efficient transit movement. Transit Streets respond to curb-to-curb constraints in city streets as well as the need to facilitate transit to and through the City's core. The underlying goal is to give transit buses a 'leg up' on other modes on

[7] Rosales, Jennifer A., "Applying the Road Diet for Livable Communities". Presentation to ITE International Annual Meeting, August 9, 2005.

designated streets, recognizing that efficient travel time is essential for attracting riders who have a choice of driving.

Figure 22: The Transit Street



In the street plan, Transit Streets transition from Complete Streets in places where bicycles are diverted to a parallel Bicycle Street or path. There are no bicycle lanes on the Transit Street. Two Transit Streets, Main and Pearl, expedite transit service through the downtown.

The Bicycle Street

The Bicycle Street gives bicycles priority treatment through street improvements intended to enhance bicycle convenience and safety. The Bicycle Streets, together with the Complete Streets, Slow Streets and off-road paths, provide a bike network that will traverse the city. It is the intention of the plan to implement design changes, specifically through the marking of the pavement and an improved system of wayfinding signage oriented exclusively to bicyclists, to heighten the awareness of bicycling in general, an on these streets in particular, in effect 'branding' them as a Bicycle Street.

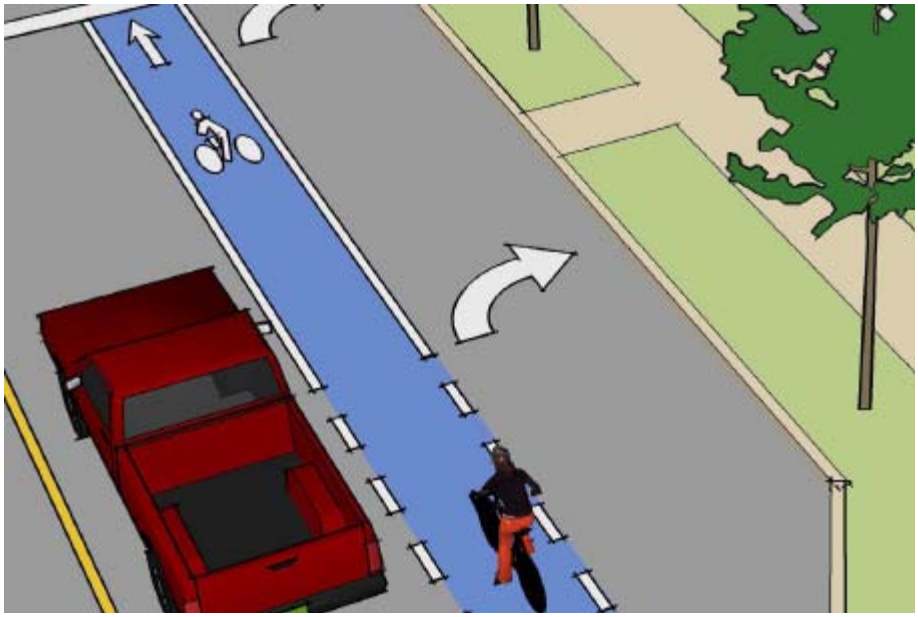


Figure 23: The Bicycle Street

The Slow Street

The Slow Streets are located within the pedestrian-oriented downtown core bounded by South Winooski Street, Maple Street, the waterfront and Pearl Street. Within this area, all modes of transportation are in high demand and vehicular traffic must proceed at slow speeds for safety. Cars, buses and bicycles all share the right of way. Pedestrian convenience is of the utmost importance and crossings are frequent. Cars easily pull in and out of curbside spaces. The rich mix of activity is facilitated by the slow speed of traffic on these streets.

Figure 24: The Slow Street

Neighborhood Streets

The streets not otherwise designated in the street plan are called Neighborhood Streets. This category ranges widely from low-volume residential streets to streets with significant traffic volumes. Although there are not specific guidelines for these streets in the *Street Design Guidelines*, many of the general principles are applicable. Therefore, it would be useful to review the *Guidelines* prior to major work on these streets. In particular, the concepts for providing a quality pedestrian experience and accomplishing traffic calming through design are widely applicable to a wide range of situations.

The topic of appropriate speed limits was mentioned frequently in public meetings, as well as during the pedestrian summit. In order to create the safe pedestrian environment that is desirable for neighborhood streets, the City Council should adopt a blanket speed limit of 25 mph for all streets not otherwise posted.

Future Transportation Elements

The City needs to balance its needs for a good regional accessibility and a vibrant pedestrian environment.

Pedestrians

The *Transportation Plan* seeks to promote walking as an attractive, safe and healthful mode of transportation, an essential part of a **Strong and Healthy City** as well as representing a critical **Transportation Choice**. Chief among the reasons for promoting walking:

- Improved Mobility – Walking is the most basic form of human transportation. In Burlington, 15% of households do not have a vehicle and rely on walking, bicycling and public transportation to get around. While many of us also drive, ride a bicycle or the bus, we are all pedestrians for some portion of the day. Walking encompasses the broadest range of citizens, in particular children and the elderly, groups that may have limited access to other modes.
- Environmental Sustainability – Walking promotes environmental sustainability by replacing vehicle trips and the attendant air and water pollution and consumption of energy inherent in those modes. Tailpipe emissions represent the second greatest source global warming gases in the United States. Walking can be combined with bicycling and transit trips to achieve greater distance travel in a more environmentally sustainable model.
- Health, Fitness and Quality of Life – Studies have shown that regular physical activity improves health and quality of life. Adults can educe the risk of chronic disease (i.e., heart disease, type II diabetes, obesity) with just 30 minutes of moderate exercise, such as brisk walking, five or more days per week. Many Americans report that they want to walk more but find barriers to walking, dangerous pedestrian conditions and far-flung destinations difficult to overcome.

The *Transportation Plan* promotes a vision of the future that is based on a walkable city. Achieving this vision involves investment and stewardship of the pedestrian infrastructure of Burlington to extend and enhance the City's existing network of sidewalks, paths and public space. Placing a priority on walking as a form of transportation will mean assessing the existing network for limitations, expanding the network to underserved areas and strengthening it in priority areas such as routes to school, transit stops and neighborhood activity centers.

First and foremost, the network should strive to keep pedestrians safe. Safety primarily involves managing the relationship between cars and pedestrians. High speed traffic creates safety concerns for pedestrians, with conflicts at crossings being the greatest challenge. Pedestrian fatalities increase with the speed of the vehicle involved in the collision. A pedestrian has an 85% chance of a fatality when hit by a car traveling at 40mph; this chance is reduced to 45% when the car is traveling at 30 mph and 5% when traveling at 20 mph. To a large measure, the speed of traffic begins with roadway design. Lane width, intersections, curves and sight distances, the presence on on-street parking, the design and character of buildings adjoining the street are all factors that give drivers 'cues' regarding driving speed regardless of posted speed limits. Education and enforcement play an important role in controlling excess speed as well.

The pedestrian network must also be convenient and attractive to use. Streetscape design considerations that provide an amenable environment that is comfortable for pedestrian use will further reinforce the vision of a walkable City. While there are many attractive walking routes,

further enhancement of the pedestrian network is needed. The *Street Design Guidelines* incorporate standards to promote pedestrian use.

The City's sidewalk network is largely complete, with a few gap that should be addressed, after an complete inventory is prepared. Sidewalks exist on both sides of many streets, and on one side for others. It is not essential that all streets have sidewalks on both sides. Factors such as traffic volume, land uses, and convenience of crosswalks should be considered in decisions as to whether a sidewalk is needed on both sides.

Bicyclists

The *Transportation Plan* supports bicycle transportation as a **Transportation Choice** for all of the reasons that pedestrians are encouraged, namely bicycling is a non-polluting and energy efficient mode of travel that promotes a healthy lifestyle as well. Burlington has some excellent off-road paths, but lacks the on-street facilities needed to make bicycling a practical alternative to cars for day-to-day transportation. Identifying a clear bicycle network that provides connections between residential neighborhoods and important employment, shopping, recreation, school and transit destinations within the City is a primary goal of this *Transportation Plan*.

This plan builds on the *Burlington North/South Bicycle and Pedestrian Route Study*, adopted in 2002, which defined north south bike and pedestrian routes to better connect the old north end and south end neighborhoods to the downtown. The North/South Plan includes a detailed block-by-block description of bicycle and pedestrian route improvements to the city street network to promote bicycle circulation. Many of those route improvements have been implemented by Burlington Public Works to date, and are incorporated into this plan as well.

The proposed bicycle network takes into consideration that Burlington and its street system is largely built-out. The challenge in specifying a bicycle network is working within the limitations of the existing street system regarding space for bicycle lanes, parking and vehicle lanes. As discussed above, this Transportation Plan calls for a set of Complete Streets and Bicycle Streets which together will accommodate bicycles through lanes, shared routes, pavement stencils, and signage, to heighten the awareness of bicycling in the community and make them feel welcome in the street environment. On the streets, additional bike lanes are proposed, as well as shared routes where street space precludes a separate bike lane on important links in the bike network. Increasing the visibility of bicyclists through prominent lane marking and stencils on the street is recommended in all areas.

In addition to improvements in the street network, facilities to accommodate bikes on transit buses, and accommodating secure parking at major destinations will further promote bike usage.

There also is an important role for education and promotion of bicycling for a better bicycling environment. Education for bicyclists, particularly school-children about riding and safety basics, integrated with safe routes to school programs, and motorists on safe driving habits. Ideally, as new facilities come online, information explaining changes in the street environment should be made available through the city's website, bicycle community, press releases, and the schools, to minimize confusion to drivers and riders alike.

This *Plan* focuses on the City of Burlington. However, the full bike network is regional in nature, and should operate seamlessly at the City's boundaries. There are a large number of trips crossing the City boundaries that are of attractive biking length if adequate facilities are provided. The planned City bike network includes all of the gateways into and out of the City, so the *Plan* supports the regional network. The City should encourage connecting bike lanes in adjacent municipalities.

Transit

Transit is a critical **Transportation Choice**, especially for the young, the old, those without cars, and those who otherwise are dependent on transit. It also is becoming increasingly important that transit be attractive to for choice riders, some of whom must shift to transit if the City is to limit the growth in traffic and meet its goals. Choice riders have identified the current level of service as a deterrent to more transit use, citing lack of evening/weekend service, service frequency, and travel times.

Trunk Routes

For many years, stretching back to the Tri Center Transit Study in the mid 1990s and beyond, it has been a stated long-term goal to institute a high-capacity, high-performance public transportation system in the Burlington metropolitan region. In recent years, attention has shifted from light rail solutions to Bus Rapid Transit (BRT) as a less expensive, more flexible, and faster-to-implement option.

As the map in Figure 19 shows, there are five proposed "complete streets" coming into downtown Burlington, each of which would carry a high capacity transit service.[8] The near-to-medium term vision is to operate frequent "trunk routes" on these complete streets, complemented by shuttle services and neighborhood feeder services. These trunk routes would be converted to BRT lines over time as demand manifests itself and as funding permits. Trunk routes would operate in the following corridors:

- North Avenue (connecting to the New North End),

[8] CCTA trunk lines would not be restricted to using the complete streets, but could operate on other streets if there is ridership demand there. South Union Street, currently served by the Shelburne Road route, is one current example.

- Pearl Street/Colchester Avenue (connecting to Winooski and Essex)
- Main Street (connecting to South Burlington and Williston)
- Shelburne Road (connecting to South Burlington and Shelburne), and
- Pine Street (connecting to Burlington's South End).

The service on the trunk routes would expand from its current level of service to run from 6:00 a.m. to 11:00 p.m., with a 15-minute frequency during peak periods (6:00 to 9:00 a.m. and 3:00 to 6:00 p.m.), a 20-minute frequency in the midday, and a 30-minute frequency in the evening. Saturday service would operate from 6:00 a.m. to 11:00 p.m. at a 30-minute frequency, and Sunday service would operate from 7:00 a.m. to 7:00 p.m. at a 30-minute frequency. New bus shelters would be installed along the trunk route, with an average spacing of 0.5 miles. These would be placed at the stops with the highest passenger boardings and at locations with new development that is supportive of public transportation.

In order to introduce this enhanced service framework, CCTA would need additional vehicles as well as supporting infrastructure such as passenger shelters. There may be queue bypass lanes at certain congested intersections, and signal priority is also a possibility. It is assumed that the new Downtown Transit Center would already be built.

This investment would be the first major step toward the future BRT network. Future steps would be further increases in the service level (to a 10-minute frequency in peak periods), more investments in passenger facilities (enhanced shelters with real-time passenger information and other amenities), higher-capacity buses and more exclusive right-of-way (perhaps including transit-only streets in the downtown area).

It is important to note that there has been little investment in the expansion of CCTA over the past 30 years. The type of service described here would be a departure from past practice, but this plan recognizes it as a critical part of a future transportation system that offers attractive alternatives to driving. Later in the report, order-of-magnitude cost estimates for implementing such a framework within the city are presented.

Other Routes

CCTA also operates other local routes within the City of Burlington. This Transportation Plan assumes that these local routes will continue; however all CCTA routes and schedules are subject to change in response to ridership, potential ridership, and system resources.

The College Street Shuttle has been a successful route that serves the most important trip generators in the City, including the Waterfront, the Church Street Marketplace, UVM, and Fletcher Allen Hospital. Originally designed as a "free and fun" connection between the Waterfront and the downtown area, its function has expanded over time to serve as a primary transportation mode for accessing the hill institutions as well as servicing Waterfront Park. The service was part of the downtown parking strategy: park once in one of the many facilities within a block of the shuttle and have access to the waterfront. To the extent that the Shuttle has become more of a "regular" route, questions arise whether it should continue to be funded exclusively by the City, whether it should continue to operate fare-free (especially if it extended beyond its current terminus at Fletcher Allen into South Burlington, as is suggested in the US 2 Corridor Study), and whether its function of connecting the Waterfront to downtown should be taken over by a different service. The future shift of the Downtown Transit Center to a potential site on Pearl Street also has an impact on this

question, as it would separate the core of the rest of the system from College Street by an additional block.

The final type of service operated within the City of Burlington is shuttles between park-and-ride lots and major destinations. Two shuttles connect the "Gilbane" lot in the South End to downtown and the hill institutions. This lot is planned to be expanded and upgraded into the South End Neighborhood Transit Center. The other intercept lot planned for the near term will be located at Exit 14 in a parking deck at the Sheraton Hotel. In order for this future lot to be successful, it will need to have frequent shuttle service to downtown, the hill institutions, and likely the airport.

Park-and-ride expansion has been identified by the CCMPO and VTrans as a critical means of improving access to public transportation services. Whether at the fringes of Burlington or in surrounding suburbs and along Interstate 89, remote lots with transit connections to Burlington offer commuters a convenient means of reaching the downtown without having to drive all the way in, or pay downtown parking prices.

It is important to note that transit planning is a regional activity and that the analysis of this vision within the *Transportation Plan* does not constitute a service plan for the Chittenden County Transportation Authority. Later in the report, order-of-magnitude cost estimates for implementing such a framework within the city are presented.

Transit Vehicles

As noted earlier in the plan, transportation is not solely utilitarian: transportation infrastructure is part of the urban form and a strong contributor to how the City is experienced in daily life. As such the size of transit vehicles, the fuels they burn and the streets they travel on are concerns of this plan.

Choices about route alignments, vehicle size, and fuel used are made by CCTA's Board of Commissioners. Burlington has two representatives on the CCTA board. The City needs to clearly identify those policies that will lead to the transit system it would like to see operating on its streets to the CCTA Board through its commissioners.

CCTA has been working with its member communities, including Burlington, to "right-size" its fleet. Past purchases of some small medium duty buses have led to customer complaints particularly from seniors and individuals with disabilities who have difficulty with the steps and narrow aisles in these small buses. In addition, the space allocated for wheel chair users in the vehicles is too tight and in some instances uncomfortable for the passenger. CCTA has determined that the best policy to minimize customer dissatisfaction is to purchase low-floor heavy-duty buses. A 29-foot low-floor heavy-duty bus has been identified and will be procured to replace the existing small buses in the fleet. This new low floor heavy duty bus is one foot smaller than the current College Street Shuttle bus.

With respect to fuels, CCTA has committed to operating a clean fleet as soon as possible. Older buses will be replaced with ones equipped with 2007 Clean Diesel engines, using ultra-low-sulfur diesel that is mixed with 20% Biodiesel. The new buses will also have particulate filters to trap emissions, thereby reducing particulate emissions by over 90%. CCTA is interested in hybrid-electric buses as well, but at this time cannot afford to pay the 40% price premium for this technology; that money is better spent replacing the rest of the old fleet more quickly.

Cars and Trucks

Cars represent an important **Transportation Choice,** and trucks are critical to the City's economic life, part of a **Strong and Healthy City**. This *Transportation Plan* does not anticipate any significant increases in vehicular capacity into and out of the City of Burlington, except for some additional capacity which will result from the completion of the Champlain Parkway (Southern Connector). There are no opportunities to provide additional capacity within the geometries of existing streets, and there is no likelihood that the community would support widening any of the key gateway streets. There are some opportunities for improving traffic flow through updating traffic signals and controllers, and improving signal coordination. However, any such increases in hourly traffic throughput are likely to be modest.

Therefore, this *Transportation Plan* maintains a reasonable level of service for traffic through managing traffic demand, rather than be increasing vehicular capacity. Demand management includes:

- expanding transportation choices by encouraging walking, biking and transit,
- parking management,
- employer-based Transportation Management Associations (TMAs), and
- car sharing.

Expanding Transportation Choices was discussed above. The other demand management strategies are discussed in the following sections.

Parking Management – Parking is linked to traffic volumes. Figure 14 (in an earlier section of this Plan) shows how directional traffic volumes at the City's gateways results in a net accumulation of 9,000 vehicles in the middle of a weekday.[9] Most of these 9,000 vehicles end up either in the downtown/waterfront or in the Hill area where parking is managed by CATMA. The 2003 *Downtown Parking Study* counted 6,568 parking spaces in the downtown area with peak occupancy of 4,900 vehicles (74 percent). As noted regarding the transportation system as a whole, parking is a means to an end and not an end in itself. That end is a Healthy Vibrant City.

There is a correlation between increases in the number of parking spaces and increases in traffic. The City's goal is to reduce the rate of growth in traffic and mitigate its impacts through sophisticated Intelligent Transportation Systems (ITS), Transportation Demand Management (TDM), improved public transportation and other strategies recommended in this *Plan*.

Additional parking should be planned to meet defined goals that balance growth in development that is important for the economic vitality and financial sustainability of the City, with successful application of alternative transportation strategies for the people who live in or need access into the City to work, shop, do business and play.

Parking currently is priced by the City and private operators in the downtown/waterfront areas, and limited and priced by the Campus Area Transportation Management Association (CATMA) on the Hill. In other areas of the City, parking is generally free, although this could change over time. For example, continued redevelopment of the enterprise zone to the south of downtown could create

---

[9] This is only part of the accumulation. There also are autos from elsewhere in Burlington that accumulate in the core employment areas daily, but it is harder to estimate the number.

economic pressures for pricing parking there. In general, parking pricing is related to the cost of providing parking, and that cost increases as the value of land for other uses increases. This parking management section focuses on the downtown/waterfront area, but may be applicable to other areas if significant amounts of redevelopment occur and parking demand increases. The price of parking in Burlington has not increased appreciably in the past 15 years, except for the cost of parking violations.

Parking is a critical resource for any community, especially in the downtown/core area. It is the means by which a driver is converted to a shopper, client, visitor, or just plain citizen. Provision of appropriate parking in terms of location, quantity, and accessibility is essential to the survival and prosperity of any community's downtown core, including Burlington. Utilizing the inventory to its maximum capacity is critical.

However, parking also incurs substantial costs. The most obvious cost is the direct cost to provide a parking space. Parking costs vary widely depending on circumstance. Litman (*Parking Management Best Practices*, 2006) suggests $1,800 per space for simple surface lot, and about $8,000 per space for structured parking of ground plus two levels under conditions similar to Burlington (2000 $). Shoup (*The High Cost of Free Parking*, 2005) cites about $12,000 - $15,000 for above ground garages and about $25,000 - $30,000 for underground garages (also 2000 $). The price per space in Burlington can reach $40,000 in cases of small garages that do not reach economies of scale and are in "dual footprint" buildings along with other uses. Parking requires significant annual maintenance including plowing, paving and striping, and fee collection and policing. The rents required to fully cover all these costs depend on the cost of capital (lower for public sector, higher for private sector) but for a ballpark number, a rate of 1 percent per month can be used, i.e. $200/month to cover a $20,000 space and $400 a month to cover a $40,000 space. These translate into about $10 and $20 a day for daily commuters, which is considerably more than most commuters are paying today. The direct cost to construct and maintain parking is not the only cost. There is an "opportunity cost" of building parking instead of other uses.[10]

There also are less tangible costs. The Burlington core area relies heavily on its "character" and attractive environment to support its economic base. Parking, even when attractively done, represents at best a "hole" in the street level activity that is an integral part of that attractiveness. Under more common circumstances, parking represents an unsightly blight on the fabric of the community. Good design can mitigate this (often at high cost), as will be discussed below, but it is crucial to maintain Burlington's ambiance as a fundamental economic underpinning of the CBD. To the extent parking diminishes this quality; the true cost of parking can be very high.

There are more than enough parking spaces in the overall downtown/waterfront area today on the average day to accommodate the demand, but utilization rates vary widely. Some areas are more attractive than others – due to location, price, or a combination of location and price. These areas, including the most popular on-street parking spaces, are fully utilized for much of the day. The Wayfinding section addresses how better information might help drivers find parking and limit unnecessary "cruising" which adds to traffic volume and air pollution.

---

[10] Each parking space occupies 325 - 350 square feet of ground space (roughly half the space and half the circulation area needed to access the space). Assuming a floor area ratio (FAR) of 3.0 in the downtown, each parking space in a surface lot displaces about 1,000 sq feet of gross leasable area.

Businesses and the economy depend upon the above average days and the extraordinary spikes in activity and revenue (such as during the holiday season for retail). Effective parking management strategies for these periods balance providing needed parking with the high cost of adding parking capacity that is rarely needed through achieving maximum parking utilization.

The City of Burlington's current approach to parking management is typical of American urban areas. This approach has three basic elements:

- On-street parking is regulated using time limits based on meters, some signs, and modest fees. The fees and time limits are intended more to accomplish/enforce turnover in the spaces than either revenue generation or demand management.
- There is a presumption that new development should provide off-street parking. This is codified through minimum parking requirements with some provision for waivers in the downtown/waterfront district. The new Zoning Ordinance also includes maximum allowed parking which are higher than the minimum requirements.[11]
- Both the City and private operators operate parking lots and garages.

There is general agreement that the previous Zoning Ordinance required too much parking for new development. The new Comprehensive Development Ordinance requires significantly less. However the premise that all new development should provide its own off-street parking requires further study. Many development sites simply cannot reasonably accommodate on-site parking, and there may be greater efficiencies (in cost, utilization and traffic flow) afforded by facilitating public-private partnerships where-by private development could make a payment-in-lieu or an impact fee to create public parking is strategic locations.

Some parking in the downtown is likely to be lost due to redevelopment. The City has a policy of no net loss, so these spaces will need to be replaced. In developing an overall strategy for parking in the Burlington core area, three broad paradigms were considered: 1) the current system, 2) strongly constraining parking availability to lower demand, and 3) a market-based price approach. The third option, market-based pricing, would provide an intermediate level of parking supply and parking price between the current system and the supply limiting options. Additional parking could be provided if and when the potential revenues from parking fees justified the investment. Each of the three paradigms received support in the Steering Committee, and consensus was not reached.

This *Transportation Plan* calls for addressing the parking deficiencies identified above by taking strategic steps towards addressing both parking supply and parking management including incremental steps toward the market-based price approach. As discussed in the Implementation section, it will be critical to track the effects of these first steps in order to allow an informed judgment as to whether to continue down this path.

The components of the parking management plan includes further consideration of creating additional parking supply – both in and around the Downtown area and on the periphery of the City. Remote parking facilities at major access points would be served by existing public transit and dedicated shuttle services to provide for the needs of commuters and for use during special events.

---

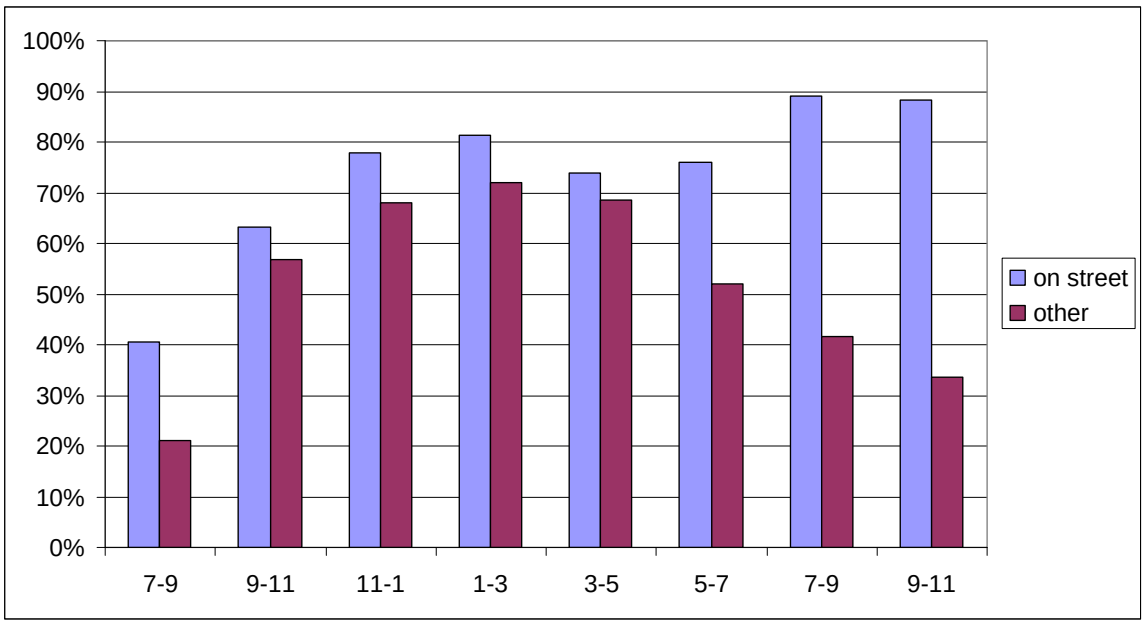
[11] It is unclear whether the maximum parking limits will have a significant impact because few developers want to build more than the minimum parking required; choosing instead to maximum higher value uses on their scarce land.

Additional parking spaces in the Marketplace area also may be needed. Opportunities for increasing parking in the Marketplace area include expanding the Marketplace garage into the Handy air rights, and adding on-street parking spaces with conversion to one-way streets. Both of these ideas require additional study. The Marketplace garage study would include cost estimation, how the project would be paid for, and an estimate of the project lead time. These numbers would be compared with previously identified parking projects associated with the TD Bank site and the "super block" on the northeast corner of Main and South Winooski.

The construction of the Downtown Transit Center will open up space for additional on-street parking. It may also be possible to convert Cherry Street or other downtown streets to one-way, which could provide additional parking spaces through conversion to diagonal parking. Scoping for these changes could be accomplished within the off Church Street improvements project.

For on-street parking, Donald Shoup in *The High Cost of Free Parking* (2005) recommends pricing so that utilization during daily peak periods reaches 85 percent. The remaining 15% of parking spaces assures that high-value customers who are willing to pay will be able to find a parking space quickly and easily. Others, particularly daily workers, will be encouraged to find lower-priced, less visible spaces. This *Transportation Plan* recommends that the City implement this pricing strategy for the metered spaces in the downtown/waterfront area as a pilot program, and extend pricing into the evening hours. The March 2003 *Downtown Parking Study* found very high utilization rates for on-street parking spaces in the evening hours as shown in Figure 25 The overall rate of 90 percent is for the entire downtown area. The utilization rates for the more popular areas were 100 percent and even higher. It is no coincidence that these high utilization rates are achieved when parking is free. While there may be some concern that some customers will be put off by paying for parking in the evening, it is more likely that they will be more satisfied to quickly and easily find convenient parking. This can be achieved by charging for parking and encouraging those who are more price sensitive, include downtown workers, to find off-street spaces that are readily available in the evening. Before implementing this pilot program, prior accumulation studies should be reviewed to determine where parking opportunities are and they should be actively marketed.

Figure 25: On-Street and Off-Street Downtown Weekly Downtown Parking Utilization Rates



There is concern that higher parking fees will drive away customers. In other cities where on-street parking rates have been increased with this 85 percent occupancy goal, better parking availability has outweighed the additional cost. Many of these cities have programs such as the one in Burlington that provides 2 hours of garage parking for free. This gives the customers a choice – free garage parking or priced and highly convenient on-street parking. As long as the 85 percent occupancy goal is maintained, there is strong demand for parking, and customers are coming. If the spaces are not utilized, then the price should be dropped.

An additional benefit of basing parking on price rather than time limits is that time limits could be eliminated for all or most spaces. The purpose of time limits is to achieve turnover in the parking demand and therefore availability, but the pricing makes this unnecessary except possibly for a few spaces devoted to very short drop off and pick up trips. The time limits are both a source of confusion today, and a source of considerable aggravation to downtown parkers. Removing them would enhance downtown attractiveness. This is worthy of further study.

While changing the on-street parking prices and policies could be accomplishing by reconfiguring the existing parking meters, the Church Street Marketplace earmark provides an opportunity to retrofit the area with more sophisticated parking stations. In addition to making it easier to update pricing and policies, the parking stations would support use of paper currency credit cards, "smart cards" which would remove another major inconvenience of traditional parking meters, the need to have the correct change. Replacing meters with a fewer number of parking stations would simplify winter snow removal. The increased parking revenue could also provide the matching funds needed for the earmark.

Depending on demand, different parking rates could be charged for different zones. Preliminary analysis suggests an initial rate of $1 per hour would be appropriate.

A second pilot program is recommended for the waterfront parking lots where parking fees would be charged weekdays and not just during events. The waterfront earmark would be used to support unattended electronic parking payments, and revenues could be used to match the earmark and to maintain the waterfront improvements. The parking charges would begin at modest levels, but could be increased over time if demand warranted such increases. Managing parking in this manner can help the City determine the appropriate time to add parking that meets the overall goal of providing a healthy and vibrant city while additional revenues may be used to help finance its development.

A third pilot program is recommended where a residential permit program is supplemented with selling a number of non-residential permits for daily parking in the neighborhood. The goal of such a program is to optimize the utilization of the parking spaces over the 24-hour period. Before such a program could be launched, neighborhood input would need to be solicited, including input on how the new revenue would be used.

Transportation Demand Management – Transportation Demand Management (TDM) aims at reducing car travel and congestion. Some of the most powerful TDM strategies have already been addressed, including parking management and improving the service levels for alternative modes. Other TDM strategies include:

- rideshare/ridematch,
- vanpools,
- guaranteed ride home,
- flextime,
- telecommute, and
- TDM marketing and promotion.

Many of these strategies are best managed at the employer end. Work trips are not the only trips made but they have a very large effect on peak hour, peak direction traffic. In addition, these trips repeat on a regular basis, so changing even a single daily commute makes a big difference over time.

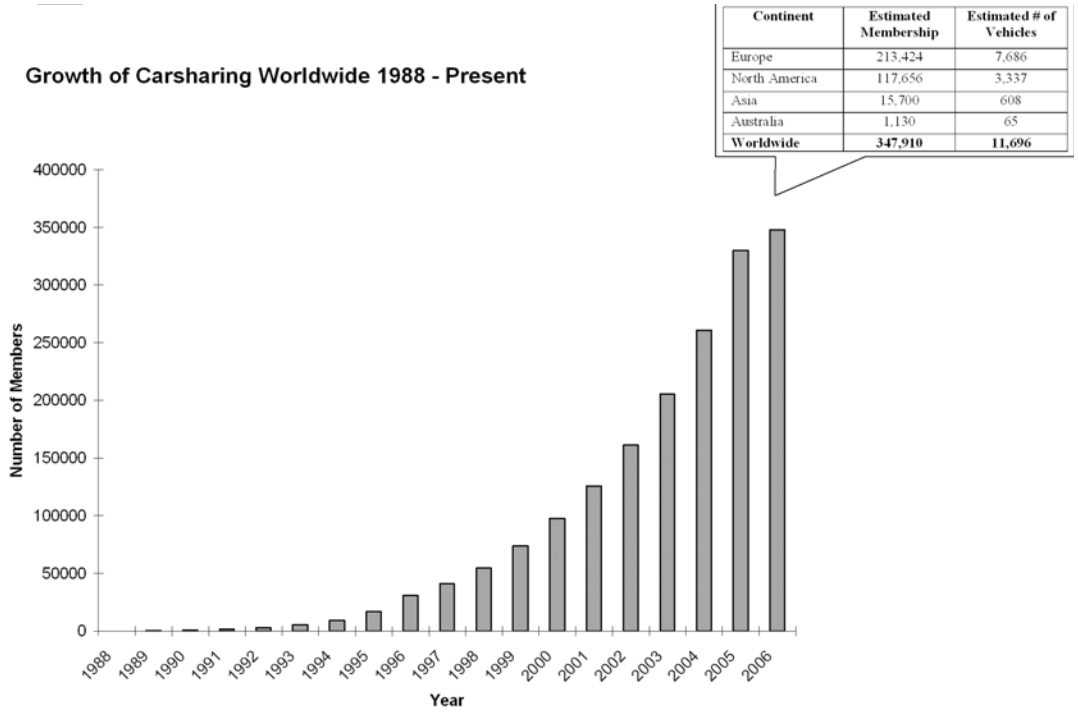
It is most practical for employers to band together and address these issues through Transportation Management Associations (TMAs). The Campus Area Transportation Management Association (CATMA) is a highly successful TMA, whose work has been discussed earlier in this *Plan*. A similar organization and focus is needed for the downtown/waterfront area. This idea has been under discussion for some time, and there appears to be growing receptivity to it. CATMA has expressed willingness to provide assistance in getting the organization going, and CATMA institutions will be important participants because they have significant numbers of workers in the downtown. The Chittenden County Metropolitan Planning Organization (CCMPO) has set aside funds in its work program to assist in forming a downtown TMA. The City should do anything it can to help such an organization get launched, including participating as an important downtown employer.

Car Sharing – Car Sharing members join a Car Sharing service and then can reserve any vehicle on the system, typically using the internet. The vehicles are parked at multiple locations intended to be convenient to walking and transit, and are accessed by the member reserving the vehicle using an electronic card. The vehicles can include small environmentally friendly hybrid vehicles but also larger vehicles including vans and trucks needed only occasionally.

Car Sharing began in Europe and has grown to about 600 cities worldwide including is growing rapidly in cities throughout the U.S. A 2006 global Car Sharing survey counts 118,000

members in North American sharing 3,300 vehicles (about 35 vehicles per member).12 For some members, Car Sharing makes owning a car unnecessary. For others, it replaces one household car. In either case, the members save money and the need for parking spaces is reduced. In addition, having fewer cars readily available strongly encourages use of other modes. When a car is readily available, it is easy to make a short drive without even thinking about the cost of car ownership and maintenance. In the Car Share model, it is easier and cheaper to rely primarily on other modes, purchasing use of a car only when really necessary.

Figure 26: Growth of Car Sharing Worldwide (from Susan and Cohen, 2006)



Continent	Estimated Membership	Estimated # of Vehicles
Europe	213,424	7,686
North America	117,656	3,337
Asia	15,700	608
Australia	1,130	65
Worldwide	**347,910**	**11,696**

Attracting a Car Sharing operation to the City of Burlington is an important priority of this *Transportation Plan*. The City of Burlington and the University of Vermont have had initial discussions with Car Sharing vendors. Factors that make Burlington more attractive to these vendors include making parking spaces for Car Sharing vehicles available at free or reduced prices (which could include both City-owned spaces and also private spaces encouraged through the development review process), being supportive of market-based parking rates, helping to support the Car Sharing market by purchasing car share services as a partial replacement to fleet use, and encouraging other employers to commit to purchasing car share services. The CCMPO is supporting the City and University's efforts and provided funding to study the optimal car sharing service for the region. As a testament to the potential, a new not-for-profit care sharing service open in Burlington in early 2009. CarShare Vermont added almost 450 members in their first year, including 12 local businesses and more than 100 students from UVM and Champlain College. Their nine car fleet is used an average of five hours per day.

---

[12] Shaheen, Susan A. and Adam P. Cohen. "Worldwide Carsharing Growth: An International Comparison. University of California, Berkeley, 2006, http://www.carsharing.net/library/UCD-ITS-RR-06-22.pdf.

Trucks & Freight

A large portion of the truck traffic on Burlington's streets is for the distribution of consumer goods. The volume of trucks has increased in the past ten years due to an emphasis on just-in-time delivery, and many of the trucks are only partial loads. It is likely that the future trends will be influenced on fuel and labor prices, and generally reflect economic conditions on a larger scale.

The VTrans Western Corridor study, which is currently being conducted jointly be regions along the western part of Vermont, will identify opportunities for increased use of rail. It is also possible that through rail freight traffic on the Vermont Railway corridor could increase from a new deep water port proposed in Nova Scotia.

Another issue of concern is the use of local streets for hauling logs and wood chips. This is due to the weight limit issue discussed earlier, and changes to legislation at federal or state level appear unlikely. Therefore, managing truck traffic on local streets through weight and/or safety enforcement in areas where truck traffic imposes burden on streets and neighborhoods may help to alleviate the safety concerns.

Passenger Rail

As noted in the current conditions section of the plan, the State of Vermont has made substantial investments in the western rail corridor that benefit both freight and passenger movements. The City needs to support the state in continued western corridor investment and participate at whatever level feasible to insure that the City's interests continue to be met. Both the state and CCMPO are embarking upon planning activities for the western rail corridor. The City needs to be an actor in these activities. While at present there are no passenger services to Burlington in the western corridor, the City should continue to advocate and support the state in its efforts to revive this mode.

Schools

Burlington is participating in the Safe Routes to School program, which provides education, encouragement, and funding assistance with the goal of increasing the number of students who walk or bike to school.

Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) is the name given to a large family of transportation improvements that rely on data and information to achieve their results either through efficiency enhancements or by directly informing the traveling public. The Chittenden County Metropolitan Planning Organization (CCMPO) has identified several priority ITS projects with direct applicability to Burlington :

- U.S. Route 7 – Shelburne Road Smart Corridor Northern Extension – For section from I-189 to downtown, the project would include improved monitoring and control of the corridor to reduce congestion, providing traveler information about conditions in the corridor to the public; coordinating traffic signal operation in the corridor, and providing signal preemption for emergency vehicles in the corridor.

- Chittenden County Urban Traffic Management System –This project would provide monitoring and signal coordination for key congestion "hotspots" in the region including, but not limited to: downtown Burlington, its radial access corridors (U.S. 2, U.S. 7, VT 15), and other regional arterials.
- Southern Connector Advanced Travel Management System (ATMS) – This project would provide installation of ITS components as part of the construction to help manage operations, detect incidents and inform travelers once the road is constructed.
- Transit Automatic Vehicle Location (AVL) – Automatic Vehicle Location (AVL) uses a vehicle mounted device which communicates the locations of the vehicle to a control center in real-time. The control center can then use this data to display the location of vehicles on a map for dispatcher use. The information can also be used to calculate schedule adherence; calculate headways; provide information to riders on route status and predicted arrival times; as well as real-time assignment and routing functions in a paratransit system or deviated fixed route system.
- Integrated Fare Management – This project would develop an integrated fare medium, such as a smart card, that will build on the existing magnetic card deployment to support bus, rail, parking, ferry applications, and possibly other retail/service locations in the region. The information stored and collected through this type of smart card could also provide valuable service and fare planning information to the region's transit providers. The fare medium would likely include a prepaid balance that would be decremented as the device is used to pay for services and/or purchases.
- Transit Traveler Information System – The transit traveler information system would provide travelers with access to real-time updates and transit planning capabilities when planning their trips or while en-route. A variety of dissemination media will be available including web, telephone, kiosks and specialized displays at bus stop locations. The system would disseminate both static data for planning purposes and real-time data for providing updates to travelers.).

At this point in time, it is hard to know when these projects might go forward. Of all of these systems, only the integrated fare management system has made significant progress. (There have been transit priority installations with new projects such as Riverside Avenue and North Street and they will be included in the earmark projects where eligible.)

In addition to those projects listed in the CCMPO ITS report, this Plan recommends that transit signal priority and/or queue jump lanes be considered along with the corridor ITS activities listed above.

Wayfinding

Burlington is not so large a city as to present a problem of excessive complexity, however, it remains worthwhile to make navigation around the city as easy as possible. The city attracts many tourists and visitors unfamiliar with the area. And being able to identify and navigate efficiently to available parking and other destinations is a benefit even to the veteran Burlingtonian. Wayfinding and the ability to access destinations efficiently and comfortably has been widely identified by citizens and businesspeople alike as one of the most pressing needs of the city transportation system.

The City has undertaken a comprehensive wayfinding plan: "Getting Around Burlington: A Plan for City Signing, Wayfinding and Information", Landworks, May 2003 that addresses many of the key issues of wayfinding in the city.

This plan identified a number of key elements for a city-wide wayfinding system:

- the delineation and development of gateways and entry areas to the City
- auto directional and parking signs, including parking entry signs with electronic information capabilities.
- the integration of transit related signing from bus stops to electronic messaging in the proposed intermodal center
- bicycle and pedestrian signs, including street markings and textured pavement as well as other forms of information such as electronic and paper maps.
- interpretation elements such as signs and brochures and celebration or aesthetic elements such as banners and public art. ("Getting Around...", p.5)

Although the intermodal center envisioned at the time of this plan has been supplanted by a newer version at a different location, the concept remains valid.

The system components of this plan have been developed in a "family" or hierarchy that includes:

- district parking and auto-directional signs, parking garage and neighborhood identification and information elements, all in the hairpin form;
- bicycle signing and marking for recreational and functional purposes;
- transit, transportation facility and public building signage;
- Street sign identification and pedestrian signing;
- Recreational and educational signage and communication elements. ("Getting Around...", p.8)

Generally, both in the original wayfinding plan and this transportation plan, these families have been somewhat condensed to: auto oriented and parking, transit, and pedestrian/bicycle and general information.

The wayfinding plan recognizes the importance of the limited number of gateways to the city, including:

- Waterfront: (ferries, potential future rail)
- Shelburne Rd
- Main Street/I-89 Exit 14
- Winooski Bridge
- Hineburg Bridge

Also, the Champlain Parkway (Southern Connector), when completed, will comprise a sixth gateway.

Additional gateways to specific districts and locales are also recognized. The existing waterfront gateway is noted, and an additional gateway to the Old North End historic district in the vicinity of Riverside/Manhattan/N Winooski is proposed.

The overall structure of the plan is based on a map of "decision points" and preferred routes mapped hierarchically ("Getting Around..." p.19) as "primary", "secondary", and "minor".

Identified "primary" decision points include Main St/I-89 Exit 14, Shelburne Rd/I-189, and the Waterfront. Identified "secondary" decision points include Winooski I-89 exit 15, North Av/Battery/Park/Sherman, Shelburne St/Willard/St Paul/Union "rotary", and I-89 exit 13.

There are a large number of identified "minor" decision points relating to in-town routes and locales and extending out as far as access to the airport.

Figure 27: Regional Context for Burlington Wayfinding Plan

The plan developed a very helpful wayfinding hierarchy for each of the three families (auto/park, transit, and ped/bike) applicable throughout the city ("Getting Around..." pp. 45 - 47). This has been detailed in a mapped downtown wayfinding plan ("Getting Around..." p. 65). Based on the philosophy of the overall wayfinding plan, a number of districts and destinations may be identified:

- Identified in Wayfinding plan: UVM/campus area, downtown, waterfront/boathouse, Old North End.
- Other important destinations: hospital (including emergency), ferries/train station, satellite parking sites/park & ride, downtown intermodal transit terminal, bikepath, Centenniel field, parks, recreation & open space
- Other "districts"/locales: individual neighborhood activity centers (NACs), enterprise zone.
- Burlington International Airport BIA: although well outside the city proper, BIA represents an important destination (and origin!) and needs to be integrated into the larger city wayfinding system.
- Special events such as waterfront festivals, South End Art Hop, downtown festivals, etc. need their own signage and navigation systems.

In general, the City should continue to implement the recommendations of the wayfinding plan supplemented by additional specific recommendations of this plan contained in other sections.

- Auto oriented/parking: existing wayfinding recommendations as supplemented by recommendations contained in the street design guidelines and parking plan
- Transit: existing wayfinding recommendations as supplemented by street design guidelines and transit plan
- Pedestrian & bicycle/general information: existing wayfinding recommendations as supplemented by street design guidelines and pedestrian/bike plan

Additionally, both the existing wayfinding plan and component plans of this plan call for improved maps, including:

- fixed, on-site: for hairpin signage and transit system as identified in street design guidelines and transit plan
- take-with/brochure(s): at the moment, the City does not offer a comprehensive map that locates many features (districts, individual destinations including merchants, hotels, etc, parking, roads and highways, walking and biking routes, etc) on a single map. Such a map available at key locations and gateways would be a valuable resource for visitors to the city.
- on-line maps: interactive/printable/up-to-the-minute detailing all aspects of city transportation system and destinations
- Parking Management, Wayfinding and Information

The goal of this aspect of the plan is to make better use of the parking resource. It has two components:

- Better base information at the city level relative to finding and accessing parking resources

- An active advance parking management system (APMS) that will link major garages and direct parkers to available resources on a real-time basis.

The first portion of this is quite straightforward. At present the City's parking brochure is relatively uninformative and badly needs to be updated. The existing map reveals little about the actual locations of the parking facilities and almost no information is provided. This should be redesigned to include:

- A good quality, readable map that could also be used in other wayfinding applications
- Fees at each parking facility, and
- Specific information relative to total number of publicly available spaces and their likely availability at key times and conditions, such as:
- general weekday availability
- peak weekday availability (define)
- evening
- during major Flynn performances
- during special events
- weekend
- an estimate of typical "full by" times for typically full facilities

Also, the City doesn't post any of this information to its website. A specific parking City website should be developed that contains at least the above information. As the APMS comes on-line, the website should be linked to that as well.

Active, electronic advance parking management systems (APMS) are becoming increasingly prevalent. Under such a system, active real-time information is provided at gateway locations indicating the availability of parking at specific facilities, usually garages, and directing users to them.

In Burlington, initially the facilities monitored should likely include the following garages:

- Marketplace (339/339*)
- Town Center (260/467)
- Lakeview (173/271)
- Corporate Plaza (100/304)
- Courthouse Plaza (88/88)
- South End satellite (?/?)

(#/# = publicly available spaces, weekday/weekend)

Initially the highest priority gateway to the city would be on Main St with subsequent, at least passive directional signs tracking the paths to the respective garages. On the development of the South End satellite it would make sense to also include a gateway on Shelburne Rd and the Champlain Parkway (Southern Connector) when completed.

Other approaches such as euro style "e-park(ing)" which can access information directly from a mobile phone or even reserve space in a garage seem more extreme than required at this point, would require more basic underpinnings anyway, and could be implemented later if desired.

4) Implementation

The 2001 *Municipal Development Plan* included 34 transportation action items. Many of these action items have been completed or are nearly completed, including:

- comprehensive downtown parking study and plan,
- comprehensive traffic circulation and parking study for waterfront,
- North Street project,
- Riverside Avenue project,
- Pearl Street resurfacing,
- Northern Connector Bike Path,
- Extended College Street Shuttle to Winooski,
- South End Park 'n Ride, and
- Winooski River bike bridge.

Other projects have not yet been completed because plans have changed (Downtown Transit Center), the planning process continues (Champlain Parkway/Southern Connector), or because funding has not yet been obtained (several). The waterfront earmark funds are targeted toward two of these action items – Battery Street and better pedestrian linkages to the waterfront.

This new Transportation Plan completes some of the action items, including:

- revised street classification system,
- linking future street improvements and maintenance to the revised street classification system,
- Level of Service standards for pedestrians and bicyclists (addressed through specifying improved pedestrian and bicycle facilities),
- consider alternatives to on-site parking requirements for new development, and
- Re-evaluate City's Residential Parking Program (recommending pilot program for non-residents to buy day permits).

The remaining action items generally fall within three categories:

1) seeking funding for specific projects;
2) ongoing planning and operations – for example Transportation Demand Management (TDM), bicycle and pedestrian safety education and hazards reporting programs, and working toward the regional ITS plan; and
3) advocating for actions beyond the City's direct control – commuter rail service, expanded Amtrak service.

Moving Forward

There has been significant progress toward the transportation goals in the 2001 *Municipal Development Plan*. This *Transportation Plan* builds on this success and aims toward Moving Forward. Because

conditions change with new opportunities arising, and priorities shifting, it is challenging to set a course for five years and expect that it will be kept. Moving Forward on the *Transportation Plan* requires monitoring what is going on, charting a course, and steering toward that course.

Transportation Services

Current practice defers responsibility for implementation of transportation projects to the Department of Public Works (DPW) who oversees an ad-hoc working group known as the Transportation Technical Advisory Committee (TAC) comprised of staff from the Department of Public Works, the Planning and Zoning Department, the Community and Economic Development Office (CEDO), the Parks and Recreation Department, and City Arts.

The adoption of the *Street Design Guidelines* calls out for a "different" way of doing things. City staff must be committed to employing this new philosophy to implement elements of the plan. This will ensure a transparent process and an empowered decision making body..

Changes need to occur in the way the City delivers these programs and services. The changes include:

- treat the streets as serving all users and adjacent neighborhoods as prescribed in the *Street Design Guidelines*,
- develop annual work plans dedicated to meeting the goals of this plan,
- establish mechanisms for the review of these plans,
- develop a project prioritization methodology, and
- develop methods to communicate these activities to the public.

The Department of Public Works will identify staff whose responsibility will be the preparation of work plans and the development of monitoring systems and communications methods designed to meet the goals set by the plan. Staff will continue to work with the city-wide technical advisory committee.

The Public Works Commission will continue its traditional oversight of the maintenance and development of infrastructure, parking, and traffic systems while the City Council Transportation, Energy and Utilities Committee (TEUC) will monitor the transportation indicators described below.

The Mayor and City Council may appoint advisory committees to oversee any phase of specific projects as they see fit.

Progress Indicators

> *If we could first know where we are, and whither we are tending, we could better judge what to do, and how to do it… (Abraham Lincoln, speech to the Illinois Republican state convention, June 16, 1858)*
>
> *Not only do we measure what we value, we also come to value what we measure. The Dow-Jones Index arose from the information needs of stockholders, but now the general public sees it as an indicator of national economic health. No one cared about a blood cholesterol level over 200 until doctors started including it in our annual checkups…*
>
> *Indicators are leverage points. Their presence or absence, accuracy or inaccuracy, use or non-use, can change the behavior of a system, for better or worse. In fact, changing indicators can be one of the*

most powerful and at the same time one of the easiest ways of making system changes … (Donella H. Meadows, Indicators and Information Systems for Sustainable Development, 1998)

The Progress Indicators in this *Transportation Plan* are intended to include not only a set of projects, but also a set of outcomes. The indicators have been chosen because they are important to the goals of the *Plan*, and also because they can be tracked at little or no additional cost.

1) Complete Streets Percent Completed

The Transportation Plan calls for a set of *Complete Streets* serving all modes, The *Complete Streets* are supplemented by *Transit Streets* and *Bicycle Streets* where either priority transit services or bicycle lanes are not needed or simply not practical. This indicator tracks the percentage completion of all these streets, measured on a centerline basis.

Baseline: The *Complete Streets* are a new concept for the City; no segments have been completed. Similarly, none of the *Transit Streets* have been completed. Of the *Bicycle Streets*,.approximately 30% is consistent with the *Plan*.

Long-term goal: 100%.

These projects must be scoped. In some cases, the full *Complete Streets* model may be unattainable. If the goals of the Complete Street can be achieved in some other (for example, providing a parallel bicycle route) then this section of the network would be counted as complete. Otherwise, it may be necessary to lower the goal from 100%.

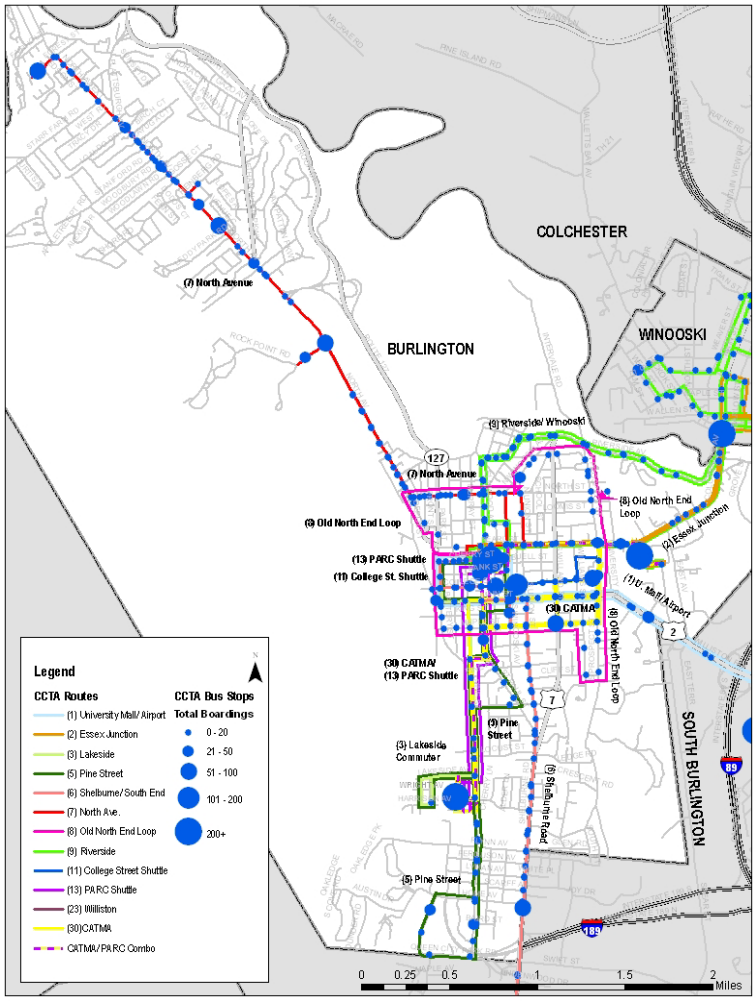
2) Priority Transit System

The Plan calls for priority transit service operating frequently from 6 a.m. until 11 p.m. on:

- North Avenue,
- Colchester Ave/Winooski/Essex,
- UMall/Airport,
- Shelburne Road, and
- Pine Street.

This indicator tracks the number of bus runs per day on these routes as a percentage of the number of bus runs needed to satisfy the *Plan*.

Baseline: Service on most routes today is much less frequent than desired, with 30-minute headways common during peak periods, and little service in the evenings. The Route 15/Colchester Avenue service is planned for an upgrade to 15 minutes headway this fall. The total



overall indicator is currently approximately 50 percent. As part of this indicator, it will also be checked whether this level of service has a reliable funding source.

Long-term goal: 100 percent.

3) Transit Ridership

Increased transit will help limit traffic on the City's streets. Improved transit service will encourage ridership. Along with tracking transit service, it is important to track transit ridership.

Baseline: Today, there are about 7,200 boardings per day on the CCTA system, with about 73 percent of these occurring within the City of Burlington. This indicator will track overall system ridership, which is already collected by CCTA.

Goal: Gradual increases (5 percent annually) with the status quo, and larger increases with service increases.

4) Traffic Volumes Into and Out of the City

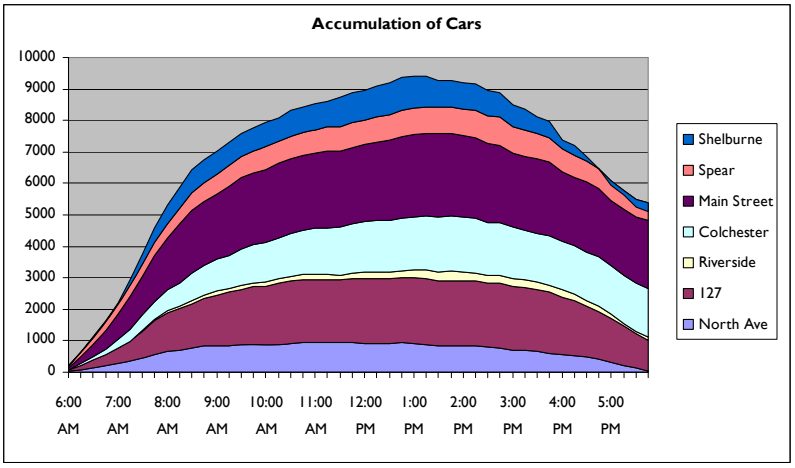
Except for completion of the Champlain Parkway (Southern Connector), no significant increases in roadway capacity into or out of the City are expected. It is a goal that traffic volumes not increase either. During the morning peak hour, traffic entering the City is probably close to capacity already, and during the afternoon peak hour, traffic exiting the City is close to capacity. There is some peak spreading today, with some travelers shifting the time of their trips earlier or later to avoid the worst congestion. If traffic volumes increase, there will be more peak shifting, extending the period of congestion. This indicator tracks the peak three hours inbound in the morning (6 a.m. – 9 a.m.) and the peak three hours outbound in the afternoon (3 p.m. – 6 p.m.) This is based on 12-hour traffic counts at gateways done by VTrans and CCMPO.

Baseline: 16,500 vehicles inbound during the morning peak three hours and 20,800 vehicles outbound during the afternoon peak three hours.

Goal: Avoid growth in traffic volume

5) Accumulation of Cars

We want more people downtown but not more cars, so alternatives are encouraged. Shifts to alternatives ease congestion and open up parking for those who continue to drive. The 12-hour counts also show the net accumulation of cars during the day, with the greatest accumulation during the middle of the day. This accumulation shows the minimum parking usage, even with shared parking.



Baseline: On a weekday, 9,400 more cars enter the City's gateways than exit by the peak accumulation around 1 p.m.

Goal: Avoid growth in cars accumulating in Burlington during the day.

6) Downtown/Waterfront Parking Spaces

This *Plan* highlights the relationship between parking and traffic. The more people we are able to move in and out of downtown in other than single occupancy vehicles, the fewer new parking spaces will be needed.

Baseline: The *Downtown Burlington Parking Study* (2003) counted 6,568 parking spaces in the downtown area bordered by Battery, Pearl, Union and Maple. This number needs to be checked against additions and subtractions since 2003 and summed with the number of spaces on the waterfront.

Goal: Give careful consideration to both increases and decreases in supply. There has been a standing goal to replace lost parking with new spaces. The Downtown Parking Study recommended increasing parking supply further, but the City will be able to make better decisions regarding parking after it has learned to manage existing supplies to their fullest capacity.

7) Downtown On-Street Parking Utilization

This plan calls for a pilot program to price on-street parking in the downtown area so that availability is maintained. A simple survey of parking utilization would be conducted once or twice a year.

Baseline: All parking spaces are used in prime areas during peak periods today, and it is difficult to find a space.

Goal: 85 percent during peak periods.

8) Parking Revenues

Parking revenues are a large portion of the City's transportation budget. Gradual increases in parking pricing would achieve multiple objectives: 1) assuring parking availability, 2) providing incentives for using transportation alternatives, and 3) providing funds for capital improvements and maintenance.

Baseline: $2.5 million per year.

Goal: Price on-street to maintain 85 percent on-street parking utilization, so that spaces are generally available. If the on-street pilot program is successful, this philosophy may be extended to maintain availability at City-owned garages and surface lots, gradually raising parking fees according to the market. The balance between on-street and garage parking rates and utilization needs to be tracked. Today, public garage rates are significantly below the prices charged for some private spaces, which may be resulting in uneven utilization. With increases in meter and garage rates, the parking fine structure should be reviewed and possibly updated, and it may be necessary to increase enforcement.

It will be particularly important to monitor experience during the initial pilot program period. This should require monitoring performance after 1 month, after 3 months, and after one-year, at minimum. The primary goals are parking availability and economic vitality, and thus the review should consider the opinions of the business community and of the general public.

The expectation is revenue will increase significantly when on-street parking charges are extended into the evening hours, and otherwise will increase gradually over time. Possible uses for increased revenues include matching Federal grants, improving maintenance and enforcement, building more parking, and supporting transit.

9) Maintenance Expenses as Percent of Desired Maintenance Expenses

> *The Task Force is concerned that the funding for streets and sidewalks is inadequate to maintain or improve the overall quality of City streets, curbs and sidewalks. The deferred costs of deteriorating right-or-way infrastructure increase significantly over time. It is most cost-effective and efficient to maintain the overall condition of City Streets and sidewalks. The Task Force strongly recommends that the City attempt to increase funding for streets and sidewalks improvements to at least maintain the current quality index of the right-of-way infrastructure. (Mayor's Special Budget Task Force to Assist in the Development of the City's Fiscal Year 2008 Budget, June 20, 2007)*

Many public comments have been received asking for more attention to maintenance on streets, bike lanes, sidewalks, and lighting, and in snow removal. As discussed above, increased parking revenues may provide additional maintenance funds, but there also are other proposed uses for any increased revenue.

Baseline: This needs to be estimated by the Department of Public Works.

Long-term goal: 100%.

10) Number of Burlington Employees Covered by TMAs

Transportation Management Associations are powerful ways to manage travel demand in cities. Today, the Campus Area Transportation Management Association (CATMA) serves the Hill institutions – American Red Cross, Champlain College, Fletcher Allen Health Care, and the University of Vermont. Collectively, these institutions have 9,000 employees and 13,500 students. This Plan recommends that the City work to establish a downtown TMA.

Baseline: 9,000 in CATMA

Goal: Substantial increase.

11) TMA Employee Mode Shares

The potential for TMAs to manage traffic demand are illustrated by CATMA's success.

Baseline: The drive alone mode share for CATMA's employees has dropped from 73.8 percent (2000) to 59.1 percent (2005). During this same period, the bus mode share (not including those who used car and bus shuttle) increased from 2.2 percent to 10.4 percent. The bike/walk share increased from 5.2 percent to 12.8 percent.

Goal: Mode shares similar to CATMA for employees in new TMAs after phase-in period.

12) Mode Shares at Public Schools

One of the central themes in this Transportation Plan is **Strong and Healthy City**. Childhood obesity is considered an epidemic in the United States, and lack of physical activity has been identified as a contributing cause. "Active living" through daily walking and biking is an excellent

remedy to lack of physical activity. In many cases, walking to a bus stop will provide more exercise than walking to the car. Auto dependence at a young age is likely to transfer into auto dependence when the children are old enough to make their own choices. Furthermore, auto trips to school are a major cause of localized congestion and air emissions. For all these reasons, non-auto transport to school should be encouraged, as well as the Safe Routes to School programs.

Baseline: This indicator will require participation of School Department. Ideally, the data collection would be integrated with health education.

Goal: Reduce auto trips to school, and increase "active" mode of walking and bicycling.

13) Traffic Crashes

Another important public policy issue for a **Strong and Healthy City** is traffic crashes. It will be particularly important to track crashes if more people are walking and biking, as we heard from the public that safety concerns are important deterrents to using these modes. The construction of *Complete Streets* should improve safety for all modes. This indicator will track the total number of reported crashes, injury crashes – segmented for crashes involving pedestrians and cyclists.

Baseline: There is a need to work with the Burlington Police Department on this indicator.

Goal: Reduce crashes, particularly those involving injuries or fatalities.

14) Energy Use/Greenhouse Gas Emissions

The transportation sector in Burlington and the rest of Chittenden County uses large amounts of energy and is responsible for a large share of greenhouse gas emissions. Nearly one third of all U.S. greenhouse gas emissions are from the transportation sector, and this is the largest and fastest-growing sector in New England.[13]

While the other indicators have all been selected, in part, because they are relatively simple to monitor, the energy use/greenhouse gas cannot be easily measured directly but is so important that it must be included anyway. Information from the other indicators must be combined with national, state and regional data in order to make an informed estimate.

For conventional vehicles, energy use and carbon dioxide emissions are proportional to fuel consumption or equal to vehicle miles traveled (VMT) divided by the average fuel efficiency (miles per gallon). Indicators (4) Traffic Volumes Into and Out of the City, (10) Employee Mode Shares, and (11) Mode Shares at Public Schools can help with VMT estimation. Fuel efficiency estimates would rely on national or state estimates. Bus, truck and train emissions could be estimated as well. Adjustments could be made for alternative fuels including biodiesel and electric.

Baseline: Needs to be determined.

Short-term goals: Develop estimation method, baseline estimate of energy use and emissions, and set goals. The goals will likely be evolving over the next few years in conjunction with emerging global, national, and state policies.

Longer-term goal: Meet the targets established.

---

[13] Lundren, Kim. "Local Governments & the Cities for Climate Protection Campaign", presented at City of Burlington Transportation Meeting, December 13, 2006.

A Five-Year Plan

Good planning requires a road map but also the flexibility to change the road map as conditions change. The time horizon should be long enough to be able to develop projects with longer lead times due to complex planning and/or funding requirements, but be short enough that the plan is practical. Five years generally is an appropriate time horizon, but the "Five-Year Plan" could also include projects with longer lead times if they are being actively worked on.

The Five-Year Plan includes both projects and more general planning activities. The project-related work includes:

- major projects that use matching funds and often have substantial lead times,
- work toward funding future major projects, and
- small projects that can be programmed in conjunction with the City's ongoing maintenance and resurfacing work.

At present, the City is committed to completing several major projects, including:

- Champlain Parkway (Southern Connector) (primarily a VTrans project largely funded by the Federal Highway Administration),
- Downtown Transit Center (Federal Transit Administration),
- South End Neighborhood Transit Center (Federal Transit Administration,
- Church Street Marketplace improvements (SAFETEA-LU),
- Battery Street and waterfront improvements (SAFETEA-LU), and
- Battery Park extension (Vermont Enhancement Grant).

Working to obtain major Federal and state funding for major projects is an important ongoing activity. Determining which projects to seek funding for is based both on City priorities and the priorities and requirements of the funding agencies.

While the major projects deservedly receive the lion's share of the attention, the goals of this *Transportation Plan* also can be advanced through small pedestrian and bicycle improvements that can be programmed in conjunction with ongoing maintenance and resurfacing work.

Implementation of the Street Design Guidelines

This plan outlines a vision for Burlington's future transportation system, as well as specific design details in the *Street Design Guidelines*. The public outreach process included a series of neighborhood meetings at which specific concerns were solicited from residents. In this section, many of these concerns are discussed in more detail, along with recommendations of how the principles of this plan and the *Street Design Guidelines* could be applied in future maintenance or construction activities. This is by no means a comprehensive list of actions, but it can serve as a starting point from which to develop a specific five year capital improvements and maintenance plan.

The following sections may also stimulate discussion and ideas of additional needs and projects that may lead to projects in the future.

Design Criteria: Traffic Level of Service

The design of improvements to the street network should strive to reach a more balanced, multi-modal operation. One of the key vehicular design criteria is "level of service" (LOS), which is a measure of traffic operations that ranges from "A" (uncongested) to "F" (extremely congested). Typically, traffic engineers design facilities to serve the "design volume" of traffic, which is an estimate of the 30th highest hour of traffic for the "design year". The design year can be anywhere from 5 to 30 years into the future. Traffic designs generally have a goal of providing LOS D, but in more congested urban areas, it is more common to design for LOS E or F, as long as there is some improvement over existing conditions.

While traffic engineering analyses as described above are commonly used and highly standardized, there are no comparable measures for bicyclists and pedestrians that are as well established. In order to meet the vision of the Plan for Burlington to diversify the use of different modes of transportation, it is recommended that a less auto-centric criteria for traffic analysis, which would to establish the design hour as the 100th highest hour of the year, and the design year is 2007, as the goal is not to see increases in peak hour vehicular traffic.

Potential Improvement Projects

The following sections are presented not presented in any particular order, but are grouped into general types of problem areas or projects. Improvement areas covered include:

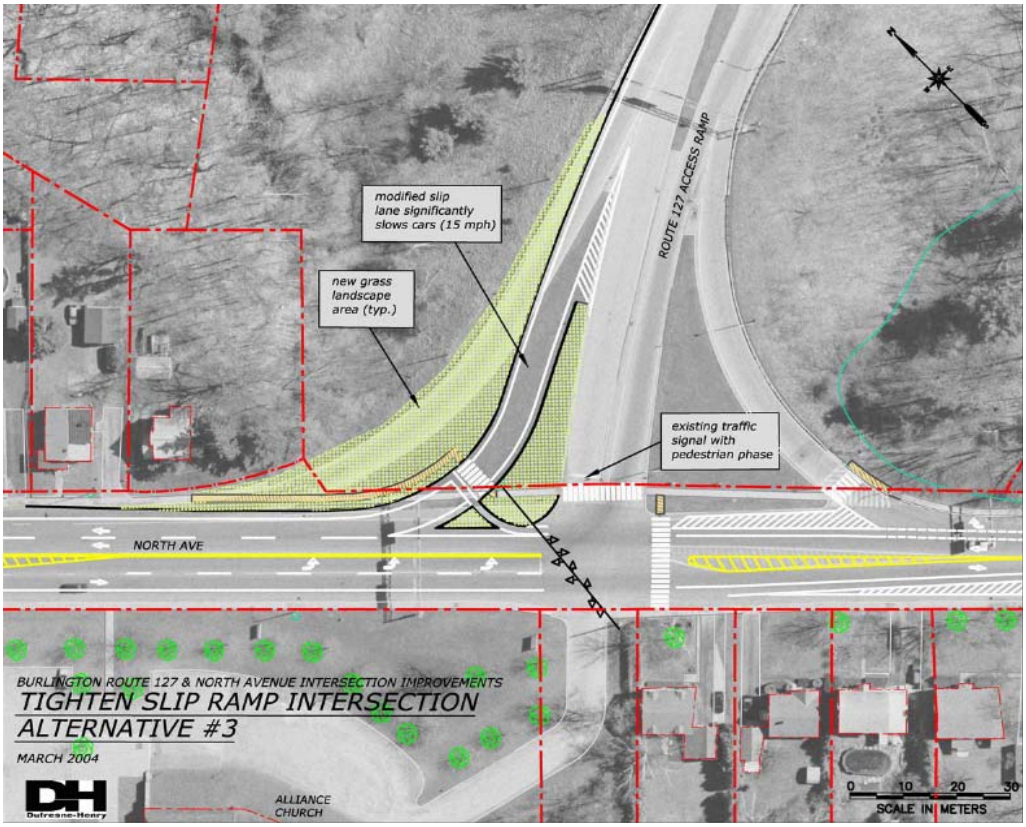
- Critical gateway/metering points and intersections
- Improvements specific to neighborhood activity centers and areas
- Pedestrian crossings/crosswalks and signals
- Conversions to complete streets
- Downtown/slow streets area
- Traffic circulation changes

Critical Gateway Intersections

Concerns have been expressed about the following intersections due to their importance as gateways into the city, and also as points that constrain traffic capacity. The design and operation of these intersections will influence the number of vehicles entering or exiting the City, as well as the speed and character of driving. These transition points should be designed to provide sufficient peak hour capacity, but to also "tame" the driver behavior as they enter an environment that will be more multi-modal.

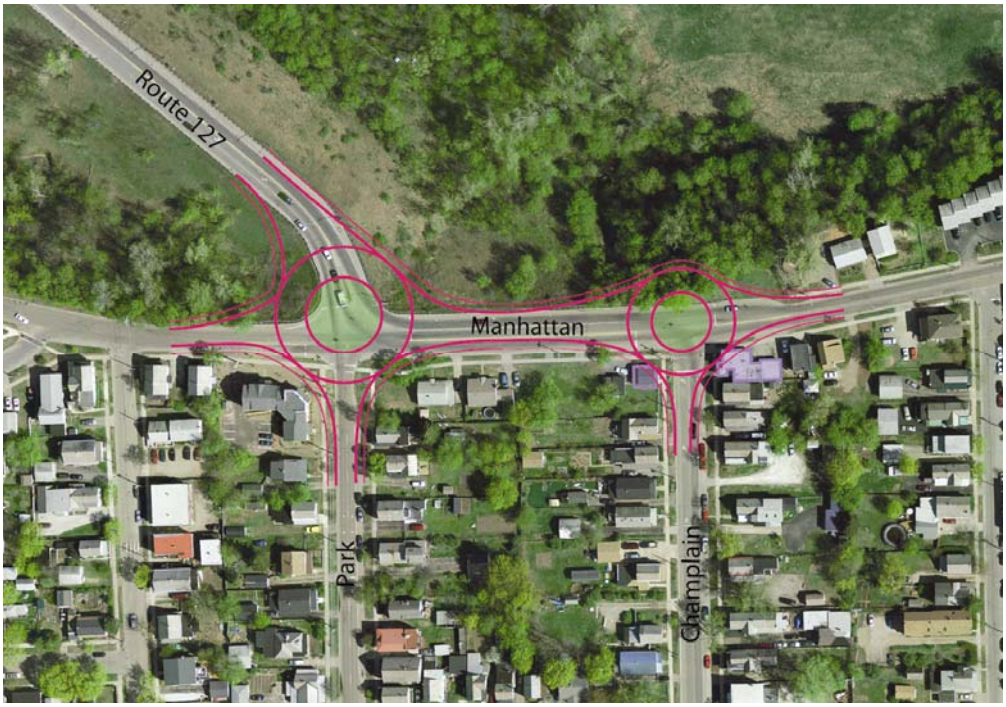
<u>Route 127 Connector/North Avenue</u>

The transition from highway exit conditions to city street has resulted in high speeds on North Avenue, unsafe conditions and poor pedestrian accessibility. A recent scoping study identified the following plan as the preferred alternative, illustrated below. However, it may be appropriate to revisit this alternative with the guidance of this plan, and the Street Design Standards. A modern roundabout was considered for this intersection, but rejected due to cost and the risk of low public acceptance. However, as roundabouts become more common, some of these factors might change. Roundabouts are particularly well suited for transitions between higher speed and lower speed environments, and it may be appropriate to reconsider a roundabout for this intersection.



Park Street/ Manhattan Street

This location represents an important transition from highway conditions to city driving in the densely build Old North End. The following figure illustrates the potential application of two modern roundabouts in creating a more defined transition between the low and high speed environment, while maintaining traffic flow and supporting pedestrian accessibility. Recent traffic counts suggest that a roundabout would provide excellent level of service. As with any roundabout in an area with pedestrians, the scale and pedestrian crossings must be designed with attention to detail.

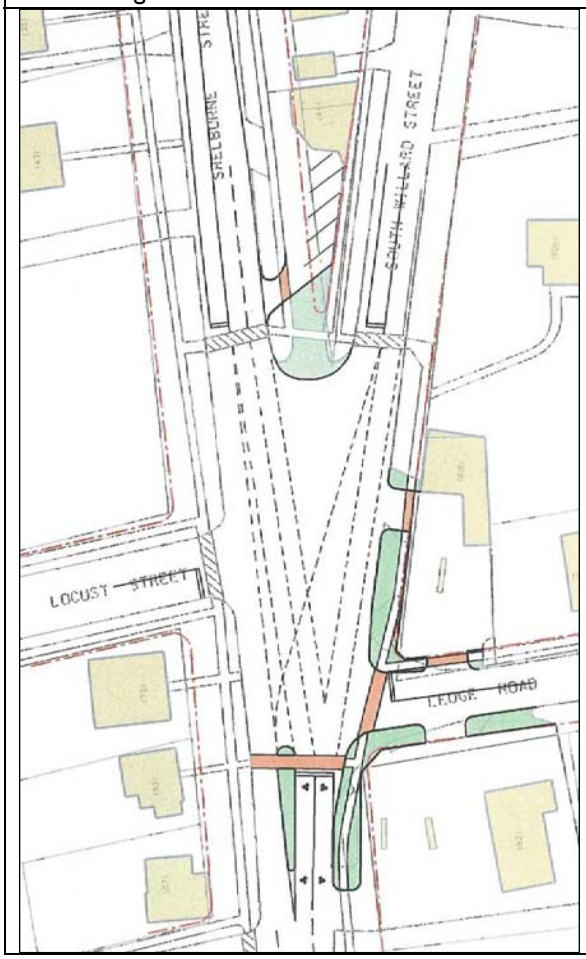
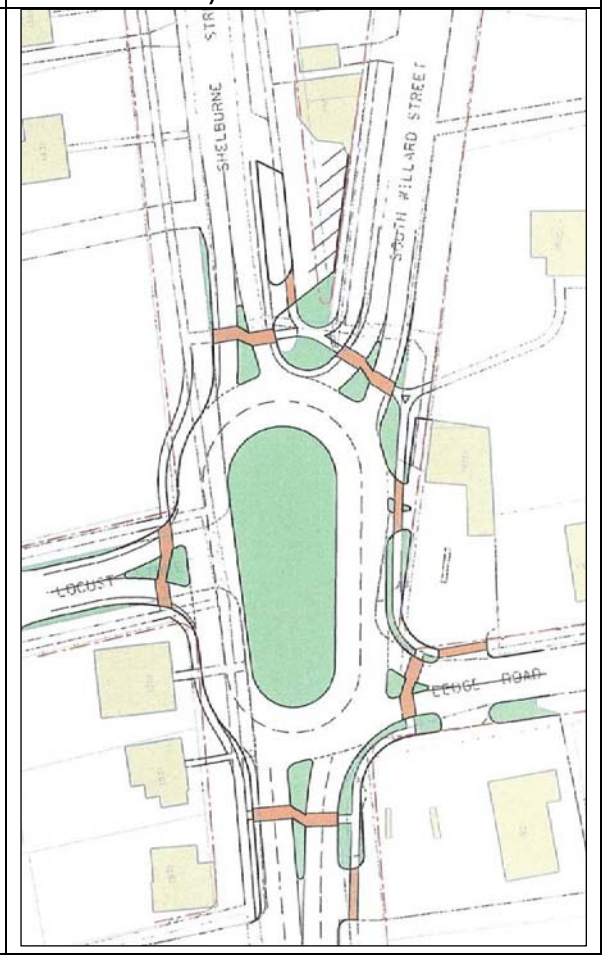


Colchester/Riverside

This intersection on the Burlington side of the Winooski bridge also represents an important gateway to the city. Since the completion of the Winooski "circulator", traffic flow across the bridge has been significantly increased, especially coming into the city. The current configuration of the Colchester/Riverside intersection has now become a constriction in the traffic network. However, because the roadway splits on the Burlington side into two: Colchester and Riverside, the problem here is more likely one of distribution than capacity of the city roadways. It is recommended that this intersection be considered for improvements as part of a more comprehensive evaluation of Colchester Avenue, which is described in a later section. One possibility to consider is construction of modern roundabout. While this would be a challenging location for a roundabout, its operation would likely be more compatible with the traffic flow characteristics of the Winooski Circulator. In addition, the traffic calming effects of a roundabout are suitable for this small neighborhood center area.

Shelburne Rotary

Shelburne Road/Street represents the principal gateway to the city from the south. Because of the dendritic pattern along this route, distribution and collection is generally fairly efficient. There is a significant issue, however, at the non-standard "rotary" at South Willard St. This intersection is confusing, unsafe, offers poor pedestrian support, and represents a poor gateway to the city from the south. It was studied extensively in 2001. The following figures illustrate two preferred alternatives to improvements at this location. These need to be finalized and implemented. This intersection's status as a "high crash location", as ranked by VTrans, may provide funding to address this location.

Signalized Intersection Alternative	Five Way Roundabout Alternative
	

Other Neighborhood Center Areas

In addition to the general neighborhood center improvement guidelines discussed earlier in this plan, specific conditions have been identified meriting attention.

North Avenue/Plattsburg Street

This small neighborhood center at the far north of North Ave has been identified as needing a number of improvements. Most importantly, pedestrian access in inadequate, especially along Plattsburg Avenue, and crossing conditions require improvement. In addition, access management to parking will improve safety and pedestrian access.

Shelburne at Home Ave and Flynn Ave

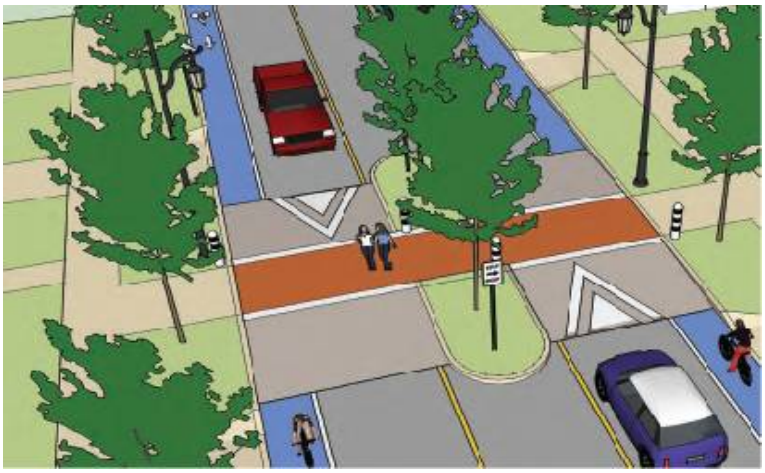
Both of these neighborhood centers are accessed in part from residential/commercial areas across Shelburne St. In addition to the complete streets treatment(s) discussed below, special attention needs to be paid to the pedestrian crossings accessing these locations.

Pedestrian Crossings Needed

Several streets were noted for having inadequate pedestrian support, especially too few crosswalks. While most signalized intersections provide some type of facility for pedestrians to cross, the street network includes some long segments of major streets without any intersections, yet with land uses that create a demand for pedestrian crossings. Two locations in particular were noted as being deficient in pedestrian crossings, in which additional mid-block (i.e. not at a signalized intersection) crossings should be considered. Some attempts have been made in the traffic engineering community to establish "warrants" for mid block crossings, but these are problematic to apply, primarily due to the lack of pedestrian data. Data on need for mid-block crossings is very difficult to collect, because without any marked crosswalks, the prevailing pedestrian patterns may be very dispersed.

It is recommended that considerations of land uses (i.e. the presence of any potential generators of pedestrian traffic) and existing spacing of marked crosswalks be used to determine the need for additional mid block crossings. Pine Street and Colchester Ave are examples where the lack of mid-block crossings has been noted by numerous members of the public.

The following graphics from the street design guidelines illustrate methods by which mid-block crossings may be integrated safely, effectively, and attractively into even a busy street such as these locations.



Improvements to Pedestrian Signals Needed

Members of the public expressed concerns about the existing signalized pedestrian crossings. While several new signals have been established at key intersections on Main Street, many of the pedestrian signals are not considered to be clear and consistent by the user. Over time, pedestrian signals should be upgraded to a standard which will help pedestrians know what to expect. This should include countdown signals, and signs alerting turning cars to the pedestrian signal.

Conversions to Complete Streets

Several of the corridors that have been identified in the draft street design guidelines as "complete streets" are currently configured as a four lane, 40 foot wide arterial, including sections of Shelburne

Road, North Avenue, Battery Street, South Winooski, and Colchester Avenue. For these sections of these corridors, one affordable treatment to create a complete street would be conversion from the four lane cross section to a three lane cross section with bike lanes. In each case, a full scoping study would be conducted, including more detailed traffic analysis to weigh the various alternatives. In this memo. Here is a preliminary analysis for Colchester Avenue as a candidate for this conversion.

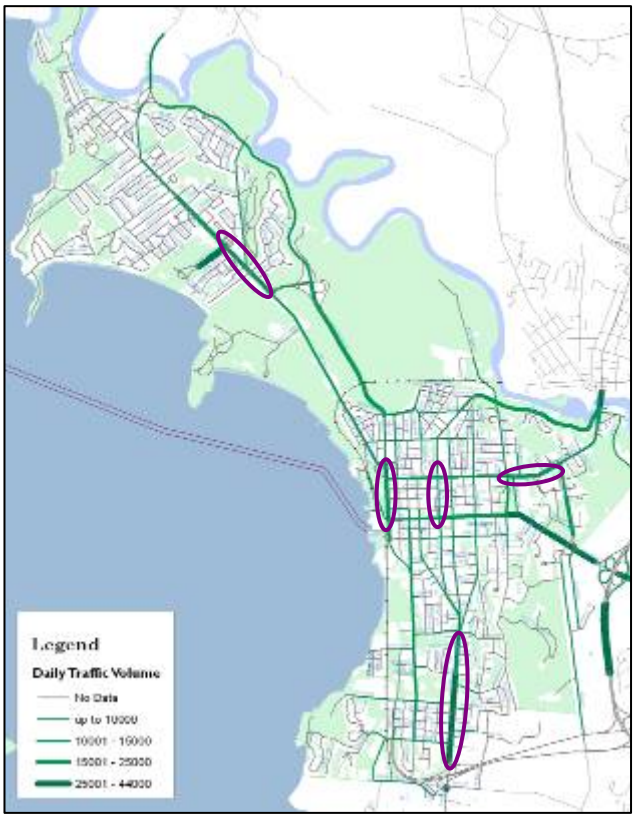
The figures on the following page show a typical existing condition on a four lane, 40 foot wide urban street. This basic condition is found on sections of North Avenue, Battery Street, Colchester Avenue, Shelburne Road, and South Winooski Street. Following that is a proposed conversion to a multimodal street, within the existing curb-to-curb width. The proposed cross section includes bike lanes, two travel lanes, and a central median or left turn lane, depending on the needs and accesses.

Typical Existing Condition: 4 lane urban arterial within a 40 foot curb-to-curb width.

Proposed Conversion to a Complete Street:

This treatment is increasingly common for four lane arterials nationally, and is sometimes referred to as a "road diet". Four lane cross sections are an obsolete design, and are fraught with flaws in how they operate:

- Mid-block left turns block the left lane, effectively reducing the capacity.
- Through traffic sometimes makes excessive lane changing maneuvers to avoid following slower moving vehicles, which results in high crash rates and inefficient use of the travel lanes.
- Bicycle lanes are not provided, and bicycle conditions are dangerous due to high vehicle speeds.
- Pedestrians are more at risk crossing these wider streets because they cannot easily see traffic in the outside lane, and vehicles cannot see pedestrians.

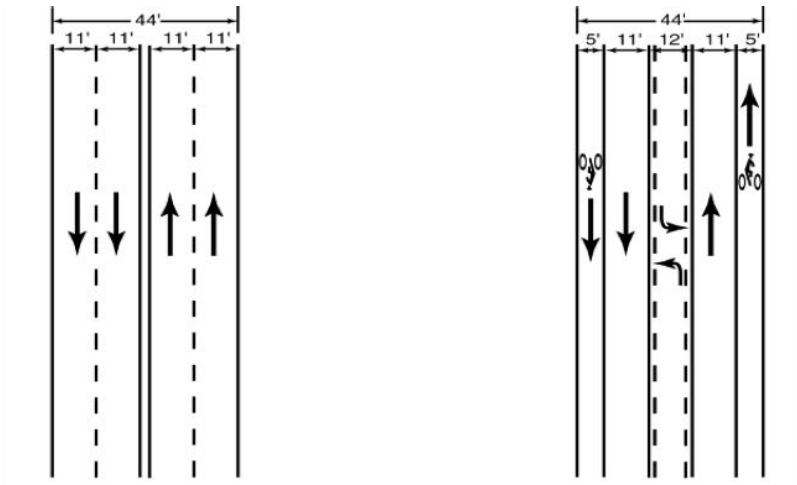


Design solutions to address these problems include adding a left turn lane and bike lanes to the street cross section. To maintain two travel

lanes in each direction, plus a left turn lane and bike lanes, the street right-of-way would need to be substantially expanded. The resulting conditions would be even worse for pedestrians, who would continue to be exposed to relatively high speed traffic, and have to negotiate even wider street widths. On the other hand, a conversion to a three lane cross section with bike lanes can be easily accomplished within the existing common 40 feet width, and will greatly improve conditions for bicycles and pedestrians. The following sections of Burlington arterials are potential candidates for conversion to a three lane. A detailed traffic analysis should be conducted for candidate locations for a four to three conversion as part of the scoping process.

Arterial	From	To	Daily Traffic Volume
Colchester Ave.	East Ave.	North Prospect St.	20,000
Battery St	Pearl St.	Main St.	15,230
South Winooski St.	Pearl St.	Main St.	12,900
Shelburne Rd.	So. Willard/Locust/Ledge	I-189	22,700
North Avenue	Ethan Allen Shopping Center	127 Connector	19,120

The following graphics show schematic examples of a four to three lane conversion



The benefits of the road diet conversions include increasing safety by reducing conflict points at intersections. Actual experience with these conversions has shown substantial reductions in vehicle crashes. The road diet also results in much better visibility of on-coming traffic. This improves vehicular safety, as well as pedestrian safety. The following photographs illustrate examples of four to three lane conversions. These conversions allow additional landscaping opportunities, far safer crossings for pedestrians, and traffic flow at more moderate speed, as passing is eliminated, yet turning blockage is eliminated with the left turn lanes.

Olympia, Washington – former 4 lane arterial

Lake Washington Boulveard, Kirkland, Washington: ADT 21,000

As a case study, a traffic operations analysis was conducted for Colchester Avenue to determine what effects a road diet would have. Using recent traffic counts from CCMPO, morning and afternoon peak hour traffic volumes are available to conduct this analysis. It is important to realize that the four lane section of Colchester Avenue serves traffic that is essentially "metered" at various points outside this area, in particular at the intersection of Colchester and Riverside Avenues. Therefore, peak hour traffic volumes along this corridor are unlikely to grow significantly unless there are capacity increases at these metering points. The primary bottleneck in the corridor is the Colchester/East Avenue intersection, which is at 97% of its capacity. The remaining intersections all have some available capacity. The "road diet" configuration would not change the intersection capacity of the two end points, East Ave/Colchester and Prospect/Pearl/Colchester.

The traffic operations for the existing configuration were compared to the three lane configuration using Synchro and SimTraffic software. This is a very preliminary analysis, conducted for comparison purposes, as these models have not been fully calibrated to match existing conditions. The following table shows the results for the morning peak hour. It is important to understand that this analysis has been **for the same throughput of traffic** as before the conversion, i.e. the total capacity of the system has not been reduced to effect this change.

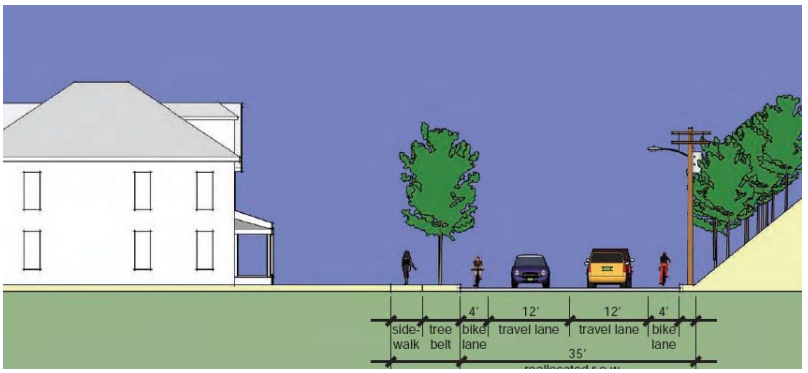
Measure	Existing Four Lane	Three Lane Conversion	Change
Average Speed (mph)	18.1	15.8	-12%
Total Stops	4,692	4,252	-9%
Fuel Used (gal)	140.8	139.8	-1%
HC Emissions (g)	390	365	-6%
CO Emissions (g)	14910	12051	-19%
NOx Emissions (g)	1228	1085	-12%

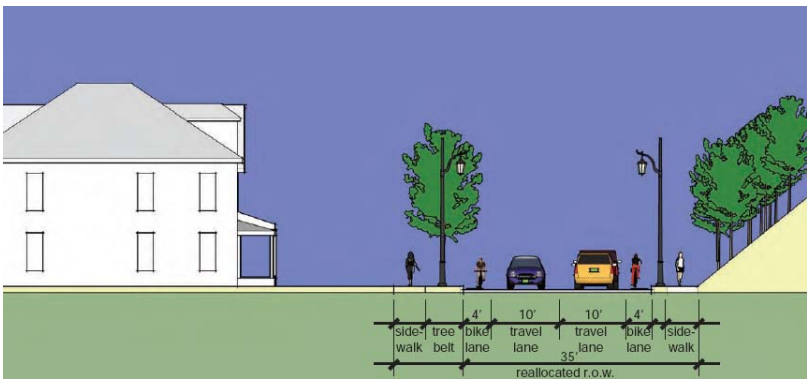
The results show a small increase in travel time through the corridor, and corresponding small decrease in average travel speed. The number of vehicle stops actually decreases with the four to three lane conversion, due to the left turn lanes that are provided. Fuel consumption and air pollutant emissions decrease with the three lane conversion, due to the lower number of stops and slower speeds. These changes in speed and stops represent gains in safety and convenience for bicyclists and pedestrians along this corridor that would be provided by a three lane cross section, as well as other goals of the City regarding energy consumption and greenhouse gas emissions.

The road diet treatment for Colchester Avenue, between East Avenue and Prospect, would tremendously improve conditions for bicyclists in this corridor, allowing it to serve its role as a complete street. The portion of Colchester adjacent to the Winooski Bridge, near the Riverside Intersection, will also be a barrier to more widespread bicycle use due to its very steep grade. One idea that has been discussed is the possibility of a bicycle lift on this section, which would be an innovation for this country. There are a number of these lifts operating in Norway and a few other European countries, and this idea could be explored in a scoping study to determine if this would be a feasible way for this corridor to fulfill its potential as a complete street.

Additional operational improvements, especially to transit, are possible through the use of queue jump lanes, as shown in the figure below at intersection(s) on this corridor. A queue jump lane can improve transit service by bringing it to the front of a traffic queue at a congested intersection, which helps to offset the additional time needed by the user to ride transit rather than drive. These types of improvements to attract "choice" riders will further create a truly multimodal, complete street.

A portion of Colchester Avenue between East Avenue and Riverside lacks a sidewalk on the south side of the street, which should also be addressed in a Complete Streets plan. Due to a steeply sloped bank, and the presence of a cemetery, establishing a sidewalk will be a challenge. However, by reallocation of the existing right of way, it would be possible to provide a sidewalk without the cost and impact of construction along the roadside. The following figures show how this reallocation of right-of-way could be accomplished.





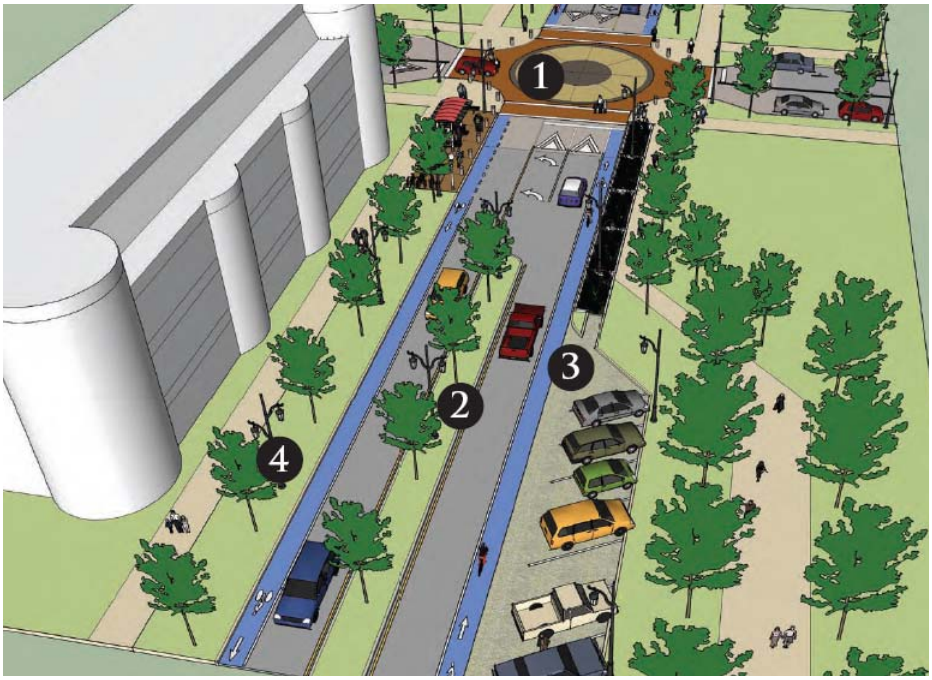
North Avenue

There were numerous concerns expressed about the lack of bicycle safety along the relatively short four-lane section of North Avenue. Based on a comparison of traffic volumes, it should be feasible

to consider a four-to-three lane conversion for this portion of North Avenue, to provide bicycle lanes.

Battery Street

The ongoing Waterfront project has a goal of improving the pedestrian connectivity between downtown and the waterfront. By creating a complete street with a four to three conversion, traffic speeds will be reduced and pedestrian crossing safety greatly enhanced. In addition, many design options could be considered to further achieve these goals, including (1) raised intersection with College Street and other intersections to form "pedestrian bridges" to the waterfront, (2) a tree-lined median where turning lanes are not required, and (3) on-street parking to make the waterfront more accessible.



South Winooski Avenue

The North South Bicycle Plan shows alternatives for South Winooski that will result in a complete street, with bicycle lanes. While traffic volumes on this street are relatively moderate, there are numerous conflict points, intersections, driveways, and other challenges in creating a multimodal, complete street.

Shelburne Road

Additional candidates for complete streets treatment based on existing geometry and current traffic volumes include North Avenue, Battery Street, South Winooski Ave, and Shelburne Rd. In general, Main Street entering the city has not been considered a particularly good candidate for a road diet since it is median divided and does not suffer from obsolete undivided four lane design. It is anticipated that the current difficult intersection at Main and East Ave will be addressed in the MPO's Route 2 corridor study.

Downtown Area: Slow Streets and Pedestrian Crossings

The downtown area faces some special traffic challenges due to the discontinuity of the street grid from the Burlington Town Center mall. Traffic is therefore concentrated on the four main streets surrounding the downtown core: Main, Winooski, Pearl and Battery. These are also streets with very high volumes of pedestrians, and are highly visible pedestrian gateways to downtown and the waterfront. The blending of pedestrians and vehicular traffic is particularly sensitive in this "box" of streets.

Vehicular Traffic Volumes	Pedestrian Volumes at Intersections
	

In general, the street design guidelines show specific techniques to establish "slow streets", which feature tighter curb radii, textured and/or raised pavement, corner bulb-outs, etc. Some of these are shown in the following illustration. These design features should be implemented as improvements or major maintenance are undertaken. The results will be an environment that encourages slower traffic speeds, greater pedestrian activity, and provides for all modes of transportation through the downtown area. Specific locations where special attention should be paid to the blending of pedestrians and vehicles include:

- Main Street at South Winooski, Church and St Paul
- Pearl Street at Winooski and Church, and
- South Winooski at College and Bank

These crossings represent the key accesses to the downtown core from the downtown fringe and surrounding residential areas, including the colleges and institutions. Pedestrian traffic is heavy at these intersections and is forced into direct conflict with the "boxed" vehicular circulation around the core.

- Battery at Main, College, and Pearl: these crossings are the critical links between the downtown and the waterfront areas and must be maintained at the highest level of accessibility and attractiveness.

Some detailed concerns for pedestrian crossings in the downtown area include:

- Intersection of Winooski and Pearl: The signal going west stays green while the face going east turns red. Pedestrians looking at the eastward face step out into traffic
- Intersection of Colchester Ave and Prospect St: Cars traveling in the right lane going west don't always see pedestrians crossing when a car is in the left lane.

In addition to these changes, the City is currently undertaking an improvement study intended to extend a good bit of the "look and feel" of the Church Street Marketplace itself, onto the cross streets, as well as relocate the Cherry Street bus terminal. There are several options available here including converting the side streets to 1-way pairs. This could have several beneficial effects, including enhancing pedestrian safety and convenience on the Marketplace itself, and adding space for parking and/or sidewalk/landscaped pedestrian space on the side streets without harming downtown vehicular circulation patterns.

Future Transportation Funding

Maintenance Expense

The City's top financial priority has been maintenance. The public is asking for more maintenance and one of the Progress Indicators will track the extent to which there is a maintenance budget shortfall. Maintenance expenses are mostly paid for today with parking revenues, and increased parking revenues (tracked with a Progress Indicator) are a likely source for additional maintenance funding.

A very preliminary estimate of additional revenue potential due to a price based system has been made in which would include:

1) $1.50 per hour equilibrium parking price
2) extend fee for parking into evening hours
3) extend metered areas into other high demand areas of the city, especially in the hill section

This estimate indicated additional revenue potential of about $600,000 annually in the Marketplace area and about an additional $1,400,000 annually city-wide, compared to a baseline of $2.5 million per year. There also are competing uses for increased revenues including matching Federal grants, building more parking, and supporting transit.

Capital Expense

The City's second financial priority is capital improvements, primarily for repaving and reconstruction. The City's current capital transportation budget is $1.8 million per year and leverages an additional $2 million in state and federal funds – some from earmarks and some in annual roadway funding programs. It is expected that this pattern will continue, but that there may be cutbacks in state and federal funding unless gasoline taxes are increased, or other state and funding sources are devoted to transportation.

The City's capital transportation budget comes from its property tax revenues, and it is critical that transportation serve to support a growing City tax base as part of a **Strong and Healthy City**. The emphases on **Transportation Choices** and **Great Streets** are intended to make Burlington a desirable place to live, work and visit – which supports higher tax receipts.

There are long-term expectations of public investment in additional parking to serve the Marketplace area and in the satellite sites. Funding sources need to be identified. Modified Tax Increment Financing (TIF) legislation is needed in order for that method to be used. Waivers of parking in the downtown could be tied to funding of shuttle parking. There needs to be a direct relationship between parking needs of a new development and how the developer will contribute to provide for that need if it is not provided on site.

There is no "magic bullet" for transportation funding. The City needs to continue to be vigilant concerning opportunities that might arise and opportunistic in making use of these opportunities.

Transit Finance

The vision for the future of public transportation service in Burlington includes a high level of service on primary trunk routes serving downtown from the north, northeast, east, and south, complemented by shuttle services and neighborhood feeder services. The additional capital and operating expense is shown below in Table 9.

Table 9: Required Investment for Priority Corridors

Route	Add'l Annual Driver Pay Hours	Add'l Annual Net Operating Cost	Add'l Fleet	Add'l Vehicle Cost	Add'l Shelters in Burlingto	Add'l Shelter Cost	Percent in Burlington	Net Operating Cost in Burlington***
North Ave*	6900	$ 410,000	1	$ 367,000	6	$ 120,000	100%	$ 410,000
VT 15/Colchester Ave	14000	$ 834,000	3	$ 1,101,000	2	$ 40,000	25%	$ 208,500
US 2/Main St**	27600	$ 1,642,000	7	$ 2,569,000	4	$ 80,000	25%	$ 410,500
Shelburne Rd	11700	$ 696,000	2	$ 734,000	4	$ 80,000	28%	$ 195,000
Pine Street	5900	$ 351,000	1	$ 367,000	4	$ 80,000	100%	$ 351,000
TOTAL				$ 5,138,000		$ 400,000		$ 1,575,000

*Assumes minor restructuring

**Service level slightly greater than that assumed in US 2 Study

***Exclusive of any potential grant income

The additional capital cost is $5.5 million, mostly for additional buses. The additional operating costs are $2.9 million per year of which $1.6 million would be for service within the city limits of Burlington. These numbers are small compared to the cost of rail transit or other non-bus alternatives, but the numbers are large relative to available resources. The City of Burlington now spends about $300,000 a year for the College Street shuttle, and it is possible that this money could be reprogrammed. However, this is not nearly enough to pay for the proposed system. Given the limitation on local resources, the City, in consultation with CCTA and the CCMPO, will need to decide which corridors will provide the most value for the investment.

Many studies have identified a need for more public transportation service in Burlington and the surrounding communities. These needs include an expansion of the service coverage to new corridors and areas, as well as an enhancement of service frequency and a lengthening of service hours on weekday evenings and weekends. The primary obstacle to meeting these identified needs is a lack of funding. Public transportation services are paid for using farebox revenue, federal and state subsidies, and local property taxes. The reliance on property taxes for the local share is a severe limiting factor on CCTA's ability to increase service.

In Act 141 of 2001, the Legislature recognized that local property taxes are not a viable long-term source to support transit operations. Also given the over-reliance on the property tax as a revenue source for public services, there is no doubt that further reliance on such tax is the primary barrier to non-member communities joining CCTA. While only five of the County's 18 communities are members, several studies have concluded that non-member towns could benefit from fixed route transit services including Colchester, Williston, and Milton. More rural towns could benefit from both commuter services and demand responsive services. Expansion of the CCTA membership, and therefore the service area, is difficult because those communities would have to commit property tax revenue to CCTA.

A transit funding study completed in 1998 identified several options for local funding as an alternative to local property taxes. Some of these are described below as well as a new concept to help fund public transportation.

A. Increase the Gas Tax – Statewide, each penny per gallon increase in the gas tax produces approximately $3 million in additional revenue. At the Chittenden County level, each penny could produce around $600,000 per year in revenue. The state or region might also consider changing the gas tax from a per gallon fee to a percentage of the sale, i.e. to a sales tax on gasoline. This suggestion in the VAOT's Long Range Transportation Plan would help keep revenue rates on a pace with inflation and would currently require an 11 percent to 13 percent tax rate.

Issues for further consideration: 1) Public acceptability and equity issues may hinder the legislative will to increase this tax especially with the recent increase to fund education enacted under Act 60. 2) Establishing a regional tax vs. a statewide increase may be legislatively and administratively difficult. 3) Whether to dedicate some or all of any gas tax to public transportation vs. other transportation (or non-transportation) programs.

B. Regional Sales Tax – The state sales and use tax produces more revenue than all other tax generators except for the income tax - nearly $183 million in FY 96. The Vermont Department of Taxes comparison of computer processed documents revealed that Chittenden County accounted for one third of the state's share of this tax - an estimated $61 million. A regional sales tax of one percent could generate an additional $12.2 million in revenue. Were this dedicated to transportation in the region, extensive local road and bridge investment, as well as considerable public transportation improvements, could be made. The complete removal of the local subsidy for transit would also be possible. The Town of Williston currently uses some of the proceeds of its local option sales tax to fund its share of CCTA's Williston route.

Issues for further consideration: 1) Public acceptability, equity issues and establishing a sub-state tax base may hinder the legislative will to enact a county-based sales tax or increase the state's rate. 2) How would the revenues be divided between public transit and other transportation needs or between transportation and other non-transportation investment demands? How competitive will other interests be for funds generated by this tax increase? 3) Act 60 allowed the option of municipal sales taxes as a way of offsetting the possible negative effects on local school budgets. Should Chittenden County municipalities take advantage of this opportunity, regional coordination may become complicated.

C. Auto/Truck Rental Fees – Auto and truck rental fees are used by 29 states; 10 states allow local governments to employ it as well. In many areas of the country, rates of 14 percent to 18 percent are not uncommon. Vermont currently has a five percent rate on auto rentals that generated nearly $1.3 million in FY 97. An increase to 10 percent, and assuming vehicle rental activity remains stable, would double the revenue and could provide that million dollar plus sum for public transit or other uses. Much of the attractiveness of this source is that visitors, rather than residents, pay a considerable share of it.

Issues for further consideration: 1) A regional rental tax would not likely raise sufficient revenue for Chittenden County transit needs though it is unknown what the county's share of revenue generation is (likely high with the Burlington International Airport's presence). 2) How competitive will other interests be for funds generated by any increase? 3) The political acceptability on the local and state levels has not been established.

D. Regional Tax for Public Transportation – Under this concept, CCTA as a regional organization would be given taxation power subject to approval of the voters in the region to raise a tax from a list of taxes already approved by the Legislature (such as a sales tax, gas tax, or others). Rather than competing with other governmental authorities for the use of this revenue, it would be dedicated to expand public transportation and possibly other transportation projects as well.

Issues for further consideration: 1) This regional tax would relieve the member communities from using property tax revenue to pay CCTA assessments, thus potentially lowering property tax rates in those communities. 2) The political acceptability on the local and state levels has not been established.

E. Parking Fees – A portion of increased parking revenues (discussed above) could be devoted to transit.

Issues for further consideration: 1) Unlike other ideas suggested here, this policy is one that Burlington could implement without regional or state involvement. 2) Increased transit service for commuters and within the downtown could be directly linked to the parking rate increase, so that people could see the benefit from the increased fees.

F. Bulk Purchase of Employee Passes – The City of Burlington could work with CCTA to create a new employee monthly pass, to be purchased in bulk by employers and provided either free to employees or at a very low cost.

Issues for further consideration: 1) The pass would be subsidized with parking revenues generated from increasing monthly parking fees at City-owned garages. 2) An increase in transit usage due to this program would make more room for transient parkers coming into town to spend money and benefit downtown businesses.

F. Public Transportation Capital and Operating Impact Fees – Capital impact fees should be considered as routine in the City permitting process. (As an example, Essex Town just assessed Lowes $40,000 as part of the permitting process). Operating impact fees should be permitted to help cover ongoing operational costs.

Issues for further consideration: 1) Some may argue that such fees would discourage development in Burlington, but it is unlikely that such a fee would be a decisive factor in a locational decision.

It is worth noting that a second major financial hurdle to CCTA service changes was overcome in 2006. The CCTA Board and member municipalities put in place a new local assessment formula, replacing the previous formula that tied local assessments directly to the number of revenue miles operated in each community. That formula made it nearly impossible to make even the smallest changes to the existing local routes, as any cut or increase in service would have an impact on all of the members' assessments. The new formula treats the FY2007 assessment as essentially a fixed payment for the current level of service, while allowing for minor changes in service without any change in the assessment. It also allows CCTA to develop financing packages for new services without being tied down to a specific mileage formula. This will allow CCTA to make greater use of new federal funding as it becomes available.