The Potential for Enhanced Transit Services in the City of Burlington: Briefing Report

Final Report

May 2011

Summary and Contents

1) The City of Burlington once had an extensive streetcar system. (p. 2-4)

2) Past transit studies in The City of Burlington and Chittenden County are somewhat inconsistent – both in technologies studied and in proposed routes. None have focused on streetcars. (p. 5-7)

3) There is a resurgence of streetcars in the U.S. as "Development-Oriented Transit." The most successful projects have catalyzed mixed use land development at higher densities than would otherwise have been achieved. (p. 8-11)

4) The highest potential for Development-Oriented Transit in combination with extensive redevelopment is in Burlington's south end with connections to the waterfront, the downtown, UVM and FAHC. (p. 12-15)

5) Streetcars are less expensive and less intrusive than Light Rail Transit (LRT), but more expensive and less flexible than expanding bus service and/or Bus Rapid Transit (BRT). A 6-mile streetcar loop in Burlington would likely cost $60 - $100 million. A BRT system with similar amenities would cost less, perhaps half as much. Expansion of conventional bus service could be improved significantly with little capital cost beyond the cost of additional buses. (p. 16-20)

6) The highest ridership and regional environmental benefits would be achieved through development with a significant housing component in the south end. (p. 21-23)

Prepared for the City of Burlington Department of Public Works by Smart Mobility, Inc., Oman Analytics, and the ORW Architects and Planners.

History of Streetcars in Burlington

The City of Burlington once had an extensive streetcar network. This figure shows the network in 1922.

Figure 1-1: Burlington's Streetcar Network of 1922

At its apex, the streetcar network was considerably more extensive than is indicated Figure 1. Photographs in the on-line Lois McAllister collection of UVM's special collections show streetcar lines on both Elmwood Av and South Prospect Street. Streetcar lines extended at least as far as Essex Junction.

Streetcar on North Winooski Avenue

As elsewhere in the U.S., the streetcar network of the early decades of the 20th century had a profound effect on the City and its growth:

> *By 1912, both the dispersion of industry and the concentration of commerce, in which the streetcar had to have been an increment, would become even more apparent. The large multi-story department store--"it was streetcars that brought the hordes of shoppers" they needed--had made its appearance in Burlington in the swank Richardson Block at the head of Church Street. The Masons; having survived anti-masonry, showed their pride in the massive Masonic Temple. On Bank Street between Center Street and North Winooski Avenue the Majestic Theatre had opened, along with the new Strong Theatre on Main Street a block south. A substantial Y.M.C.A. and a Carnegie public library testified to Burlington's aspirations for fitness and knowledge. The Colonial-revival Hotel Vermont had joined the Van Ness Hotel as a center of community life. Numerous camps and cottages had been built at Queen City Park, off the south end tram line.*
>
> *The appearance of a large rendering plant at the end of the Ethan Allen Park line--far from city neighborhoods--shows both the extent of transit and the growing influence of public opinion in the shaping of cities.*
>
> *And finally, out on North Avenue, taking shape rapidly on the plots laid out on the bluff above Lake Champlain in 1903 by James B. Henderson, was a classic icon of the times. Served by streetcar, members of Burlington's educated middle class could now justify living a little farther out, and here they built bungalows, foursquares, and Queen Anne-style homes to suit their particular dreams. "New furnished house for rent on the car line," Mrs. J. A. Campbell advertised emphatically in her Free Press want ad for 143 North Avenue.*[1]

Transportation systems and facilities shape the pattern of urban growth and development. In recent decades, the major force has been the highway system fostering suburbanization and "sprawl." However, in the early 20th century, streetcars were instrumental in the first wave of "suburbanization" from the dense downtowns of the previous century. Sam Bass Warner's 1962 study, Streetcar Suburbs:

[1] Holden, Alfred, "Rails on the Roads: Trolleys and the Growth of Burlington", Chittenden County Historical Society Bulletin, v.27, no.1, Winter 1993 p.8

the Process of Growth in Boston (1870 - 1900), documents the suburbanization of Boston. Alfred Holden describes the creation of James B. Henderson's new "suburb" of Burlington on North Avenue:

> *Significantly for these new clients, North Ave. was also on a streetcar line. What Henderson was creating, while he made his money, remains today as the most visible Burlington example of a phenomenon that was then sweeping the country--the streetcar suburb. Indeed, America by 1911, when the Perias built their house, had been reshaped by mass transit. It was perhaps as dramatically changed from a generation earlier as today's automotive culture is from the trolley age. "Walking distance no longer set the limits of city growth," Lewis Mumford writes of early mass transit in The City in History, alluding why people like the Perias could find it attractive to live out the avenue. "The whole pace of the city extension was hastened..."*[2]

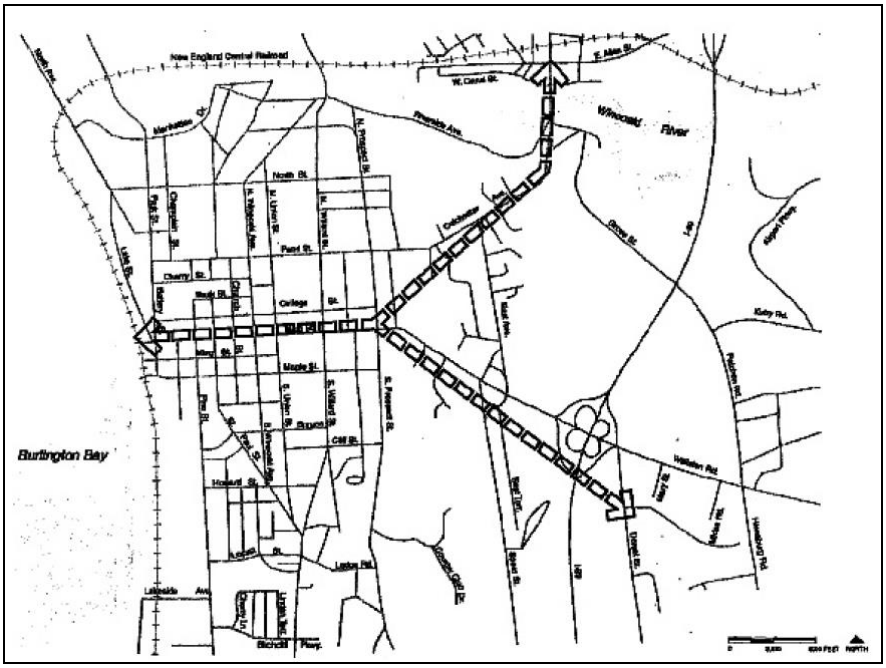
As in most of the rest of the United States, the streetcar system was replaced with buses. On the afternoon of August 4, 1929 several thousand people gathered at Burlington City Hall Park for the ceremonial burning of the last streetcar in Burlington.

[2] Holden 1993.

Summary of Other Burlington and Chittenden County Transit Planning Studies

During the 1990s, two studies took up the issue of rail oriented transit in the City of Burlington. *Light Rail Transit in Burlington, Vermont: an Analysis of Viable Routes and Construction Costs* (November 1992) was a small study which examined a number of alternative connection strategies, all of which began at the Burlington downtown/waterfront. This study recommended the implementation of a Light Rail Transit (LRT) system on the downtown to airport route, and led to the larger *Tri-Center Transit Study*.

The *Tri-Center Transit Study* was completed in 1996. It focused on high capacity transit link(s) between the three major existing, and emerging, urban centers in the area: Burlington downtown/waterfront, Winooski downtown, and South Burlington UMall/City Center.



"Three Downtowns" Concept, Tri-Center Transit Study, Figure 1-2

This was a voluminous study, but the results were inconclusive. A fixed guideway alternative was studied extensively, but it was limited to LRT technology with very high costs and large spatial requirements for a separate right-of-way. In the end, specific route or mode recommendations were not finalized. Instead, there was a general recommendation for a College Street Transitway, followed by a larger, undefined system in the final phase:

Phase 3

A. *Institute College Street Corridor Transitway.*
Time Frame to Complete: Years 2006-2010
B. *Construct South Burlington Busway, as described in TSM Busway alterative.*
Time Frame to Complete: 2006-2010 (Concurrent with Phase 3A)

Phase 4

Implement a corridor-wide, dedicated right-of-way, high capacity system. The transit mode is currently undefined.

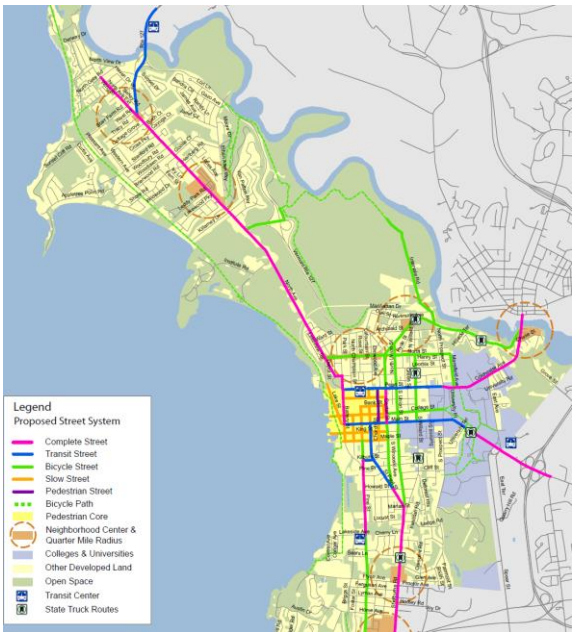
Time Frame to complete: Anticipated by Year 2011 (Begins after Phases 3 A and B)
Priority segments for implementation are:
1. *UVM/Medical Center to Waterfront Spine Segment*
2. *Winooski Segment*
3. *South Burlington Segment*
4. *Southern/Lakeside Extension*

Final Report, Executive Summary for the Burlington Area Tri-center Transit Study, June 1996, p.1-3

The Draft *Transportation Plan for the City of Burlington* (2007) includes a different transit vision for Burlington

> … there are five proposed "complete streets" coming into downtown Burlington, each of which would carry a high capacity transit service. 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 Bus Rapid Transit (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),
> - 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).[3]

College Street is not one of the trunk transit streets identified. College Street is relatively narrow and is not ideal for the current College Street Shuttle. Average operating speeds are about half of those on Main Street and Pearl Street/Colchester Avenue, and there are also a fair number of sideswipe accidents.



[3] *Moving Forward Together: Transportation Plan for the City of Burlington*, Draft August 31, 2007, p. 3-4.

Two other recent studies have addressed transit issues on two of these trunk routes in a regional context – the US Route 2 corridor study (CCMPO: *US 2 Corridor Transportation Management Plan: Burlington, South Burlington and Williston, VT*, 2007), and the Route 15, corridor study (CCMPO: *VT 15 Corridor Draft Final Plan*, 2008). Both of these studies recommend BRT

The Route 2 study makes a set of transit recommendations that generally echo the Tri Center Transit Study except in a BRT context:

- *Introduce new corridor service on US 2 between downtown Burlington and Williston*
- *Extend the College Street Shuttle to University Mall and Market Street, South Burlington, connecting residential and commercial areas north and south of Williston Road to the US 2 corridor service in a manner more-or-less consistent with the Tri-Center Transit recommendations.*
- *Establish transit signal priority (TSP) throughout the corridor to speed up bus operations. Traffic signals would be controlled in a manner that increases green time along an arterial as a bus approaches a signalized intersection.*
- *Implement queue jump lanes at appropriate locations to speed bus service through congested intersections. Queue jump lanes allow buses to bypass long lines of vehicles that are waiting at traffic signals.*
- *Implement a dedicated right-of-way from Staples to UMall with a new crossing of I-89. This crossing, which was identified in a previous plan, would also serve bicycle and pedestrian travel.*

The Route 15 Study similarly calls for upgraded transit service in that corridor.

> *The upgrade of the VT 15 corridor trunk service is a long term recommendation of this study. BRT elements will include:*
>
> - *Increase service levels to 10-minute frequency during peak periods, 20-minute frequency during the midday and Saturday, and 30-minute frequency during evenings and Sundays…*
> - *Implementation of transit signal priority (TSP) throughout corridor to speed up bus operations…*
> - *Construction of queue jumpers at appropriate locations to speed bus service through congested intersections . . .*

The Burlington Transportation Plan Process emphasized minimizing growth in traffic entering and exiting the City, in part by encouraging transit usage instead. Therefore, it is critical that any enhanced transit services within the City of Burlington operate as seamlessly as possible with the regional transit system.

Development Oriented Transit – Resurgence of Streetcars (Case Studies)

Streetcars have had a tremendous influence on the urban landscape and economic geography. These two aspects of streetcars, economic development and placemaking, are closely intertwined as rail transit has always organized and provided a focus for new development, bringing people and activity into its path. Recent experience from around the country with new streetcar systems illustrates that streetcars have been successful in bringing about economic development. Economic development is often a primary reason for establishing streetcar service, with transportation being a secondary goal. [4] Streetcar corridors are able to achieve higher densities and attract development interest because the image and commitment represented by rail transit adds value to new development.

Below is a summary of the economic development experience of four cities that have initiated streetcar service in the last 10 years as part of a larger revitalization effort.

Portland, Oregon (Population: **537,081)**. The Portland Streetcar is often held up as the preeminent example of the economic development potential of streetcars. The Portland Streetcar, which initiated service on 2.4 miles of track in 2001, traverses the downtown and connects to districts north and south of downtown. The streetcar runs from a hospital at one end to a university at the other end. There have been four extensions of the streetcar service, with the total length now 8.0 miles. Further extensions are planned.

The original focus of the streetcar project was on redevelopment of the Pearl District. Since 2001, over 10,000 housing units and 5.4 million square feet of office, institutional, retail and hotel development have been constructed within two blocks of the streetcar alignment. Portland's experience has been extensively studied. In 2005, Eric Hovee found that "…since the streetcar alignment was chosen in 1997, new development achieved an average of 90% of the FAR potential[5] within one block of the streetcar line. This percentage steadily drops to 43% at three of more blocks from the alignment." This same report also notes that: "…Since the streetcar alignment was identified, 55% of all new development within the CBD has occurred within one block of the streetcar." [6]

Ridership on the Portland Streetcar has exceeded projections, with weekday ridership initially projected at 3,500 weekday rides, to actual rides averaging 11,900 riders per day in 2007/08.

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[4] Ohland Gloria and Shelley Poticha, *Street Smart, Streetcars and Cities in the Twenty-First Century*, Reconnecting America, 2009.

[5] The Floor Area Ratio (FAR) is the ratio of the area of the building(s) constructed to the area of the underlying land. Thus a FAR of 2.0 could mean that a 2-story building was constructed that covers the entire land area, or that a 4-story building was constructed on half of the land.

[6] Portland Office of Transportation and Portland Streetcar, Inc, "Portland Streetcar, Development Oriented Transit," April 2008.

Tampa, Florida (Population: 332,888): The 2.4 mile Tampa Electric Company (TECO) Streetcar System initiated service in 2002. The streetcar line runs from Ybor City, a former manufacturing district, to the convention center and connects to the waterfront. The streetcar is credited with spurring $2.9 billion in new retail and residential development along the streetcar's existing or planned route. [7]

The streetcar does not currently go into the downtown, but a one-third mile extension into the downtown office core is planned. Without connections to the downtown, the streetcar largely serves tourists with more than half of the riders made up of out-of-town visitors.[8] Many believe that continued economic development and building local ridership will be boosted by the planned extension into the downtown. Although apparently successful as a catalyst for new development, ridership on the system can be characterized as moderate, with about 1,200 riders per day.

Little Rock, Arkansas (Population 184,422). The River Rail streetcar system initiated service in 2004, linking the downtowns of Little Rock and North Little Rock which are situated on opposite sides of the Arkansas River. In 2007, a one-half mile extension of the system to the Clinton Presidential Library was initiated. It is estimated that one-quarter of the River Rail riders are headed to the Clinton Library. The route connects many public destinations—an arena, convention center, city halls, museums as well as two downtowns.

About $200 million of development has been planned or built along the $19.6 million line.[9] Little Rock just completed a study of a possible extension to the airport. The study found that the potential economic development associated with this extension would not be enough to offset the cost of the extension.

[7] Cincinnati.com "In Tampa, impact but few riders,' August 6, 2009, http://news.cincinnati.com/article/20090806/NEWS01/0908090303

[8] Wall Street Journal Archives, "A Streetcar Names Aspire: Lines Aim to Revive Cities," Herrick, Thadeus, June 26, 2007

[9] Ohland, Gloria and Shelley Poticha, ibid.

Kenosha, Wisconsin (Population 96,240). The two-mile streetcar line has been operating since 2000, with service to downtown, Harbor Park (a brownfield development site on Lake Michigan), the government complex, museums, and the Metra Commuter Rail Station (service on the North Line to Chicago). Total investment for the system was $6.2 million.

One of the reasons why Kenosha's capital costs were so low was that they were able to refurbish historic streetcars that were obtained inexpensively. However, vintage streetcars in condition suitable for refurbishing are not readily available.[10] With increased demand for the few such vehicles available, there may not be any lifecycle cost advantages now over purchasing new replica or modern streetcars unless a private collector who supported a project were to come forward.

The existing line in Kenosha has attracted $150 million in development and the city views development activity as the primary reason to expand the system. The 69-acre Harbor Park development includes a waterfront park, museum, and housing. The housing has been developed at a moderate density, 15-units per acre. While relatively low for a transit location, these housing densities are higher than prevailing development densities in Kenosha.

The Kenosha streetcar is more of a tourist attraction than a transportation service. It never runs before 10 a.m. and operates only 20 hours a week in the winter.[11] The Kenosha Transit Commission is considering eliminating service altogether for the months January – March.[12] It has significant ridership during events, but averages only about 100 riders per weekday on an annual basis.[13] It is a single 2-mile loop (i.e. 1 mile in each direction). It is likely that it would become a more important transportation system if it is extended, as is under consideration.

[10] http://www.heritagetrolley.org/planRollingStock.htm, 11/22/09.
[11] Ohland and Poticha 2009, p. P84
[12] http://www.kenosha.org/council/tcminutes.pdf.
[13] http://www.kenosha.org/departments/transportation/

Lessons Learned from Streetcar Projects in Other Cities

1) **Streetcars Can be a Successful Component of an Economic Development Strategy** – Economic development is often one of the primary reasons that communities promote streetcar development. To what extent can this development be directly attributed to the streetcar? While there has not been a comprehensive study of economic development across new streetcar systems, the experience of new streetcar systems clearly points to the ability of the streetcar to encourage new development if there is potential along the corridor. Most would agree that the development would have occurred somewhere in the region, but the streetcar allows the development to be focused, often at higher density levels than would otherwise have occurred.

2) **Development Potential is Greatest in Areas with Substantial Capacity** – Underutilized areas that have capacity for new development or redevelopment and can be connected to destination attractions such as vibrant urban centers are prime candidates for Development-Oriented Transit. In Portland, the streetcar connects emerging downtown districts to the central city which has an established market of jobs, higher density housing, shopping, tourist and cultural attractions and is served by the regional metro system.

3) **Creating Dense, High Quality Pedestrian Environments goes Hand in Hand with Promoting Economic Development and Ridership** – Greater densities are required for an environment that is walkable and provides a critical mass of people and activities. Increased density will pay off in ridership benefits, decreased automobile use and a lively environment. A mixture of land uses including housing employment, shops and public spaces should be provided to allow pedestrians the convenience of linking trips as they travel to and from the transit stop. Cultivating an attractive pedestrian environment is critical in streetcar districts, including the organization and orientation of buildings the treatment of building facades, sidewalks, and public spaces, and providing streetscape amenities.

4) **Achieving High Ridership Requires a Local Residential Market in Addition to Tourist and Downtown Circulator Markets** – The Portland Streetcar is carrying over 100 times as many daily riders as the Kenosha Streetcar. Portland is larger and the system is longer, but the most important difference is that the Portland Streetcar connects redeveloped mixed use areas that include large numbers of housing units, to jobs centers.

5) **There are a wide range of possible options for organization and funding** – The majority of modern streetcars in the U.S. are operated by regional transit agencies. The Kenosha streetcar is operated by the City but there the City also operates the local buses. The Portland streetcar is notable in that it is a City-initiated project managed by a non-profit separate from the regional transit provider. This has allowed greater flexibility in planning, construction, and operations. In Burlington, there may be some operating cost savings with municipal ownership because the Burlington Electric Department is a municipally-owned utility.

Development Potential in the City of Burlington

The City's most recent (2006) Municipal Development Plan (MDP), identifies its development goals in terms of its neighborhoods, as "neighborhood activity centers", and clear development centers, often closely associated with its identified neighborhood activity centers. This is described in the "Land Use" section of the MDP:

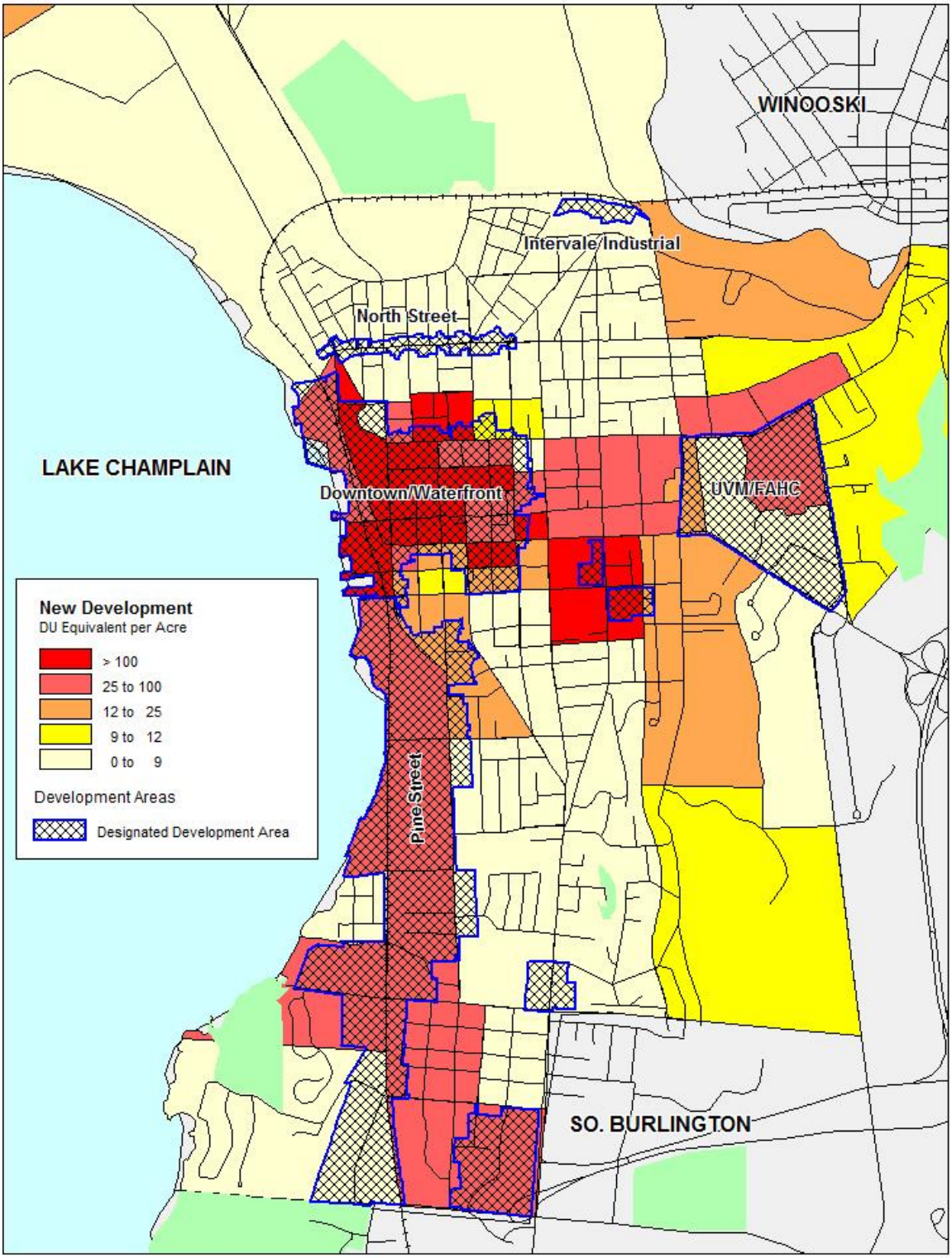
> *Future development and investment in the City of Burlington are guided by a diverse set of policies and strategies intended to encourage and facilitate development in specific parts of the city. The following section outlines the principal land use and development pattern to be implemented over the next 10-20 years, and serves as a policy umbrella to the other sections of the Plan that follow. It defines where and how future development is to occur. All of the other sections offer more detailed information and guidance in specific areas such as transportation or urban design that will help to facilitate this pattern.*
>
> *This section of the Plan is strategic in its approach, and does not offer information or insight for all portions of the city. Instead, it focuses on areas of the city that are targeted for future development or redevelopment. These areas are the* ***Downtown Improvement District****, the* ***Downtown Waterfront****,* ***Institutions****,* ***Neighborhood Activity Centers****, the* ***Enterprise District*** *and* ***Brownfields****. Additionally, this Plan identifies individual neighborhoods that are in a state of change and require strategic planning and investment in order to meet community goals. These neighborhoods are* ***Riverside Avenue****,* ***Mill-Grove Street****, the* ***Old North End Enterprise Community****, and the* ***South End neighborhood****. Where this Plan is silent regarding a specific part of the city – primarily low-density residential areas, it is intended that those areas remain largely unchanged, and that the current development and use patterns remain as they are in order to preserve and maintain a high quality of life.*
>
> City of Burlington, Municipal Development Plan, 22May, 2006, p.i-4

The most intensive urban development is envisioned for the downtown/waterfront development areas with additional development potential located at other identified areas around the city.

We analyzed the redevelopment potential in the City based on the Regional Buildout analysis (RBA) done by the Chittenden County Regional Planning Commission (CCRPC) in 2003. (Please see the Appendix for complete details on this analysis.) It is based on current zoning, which has been designed to implement the City's planning goals. However, it is important to remember that zoning can change, and very possibly should change, if a major transit investment is planned.

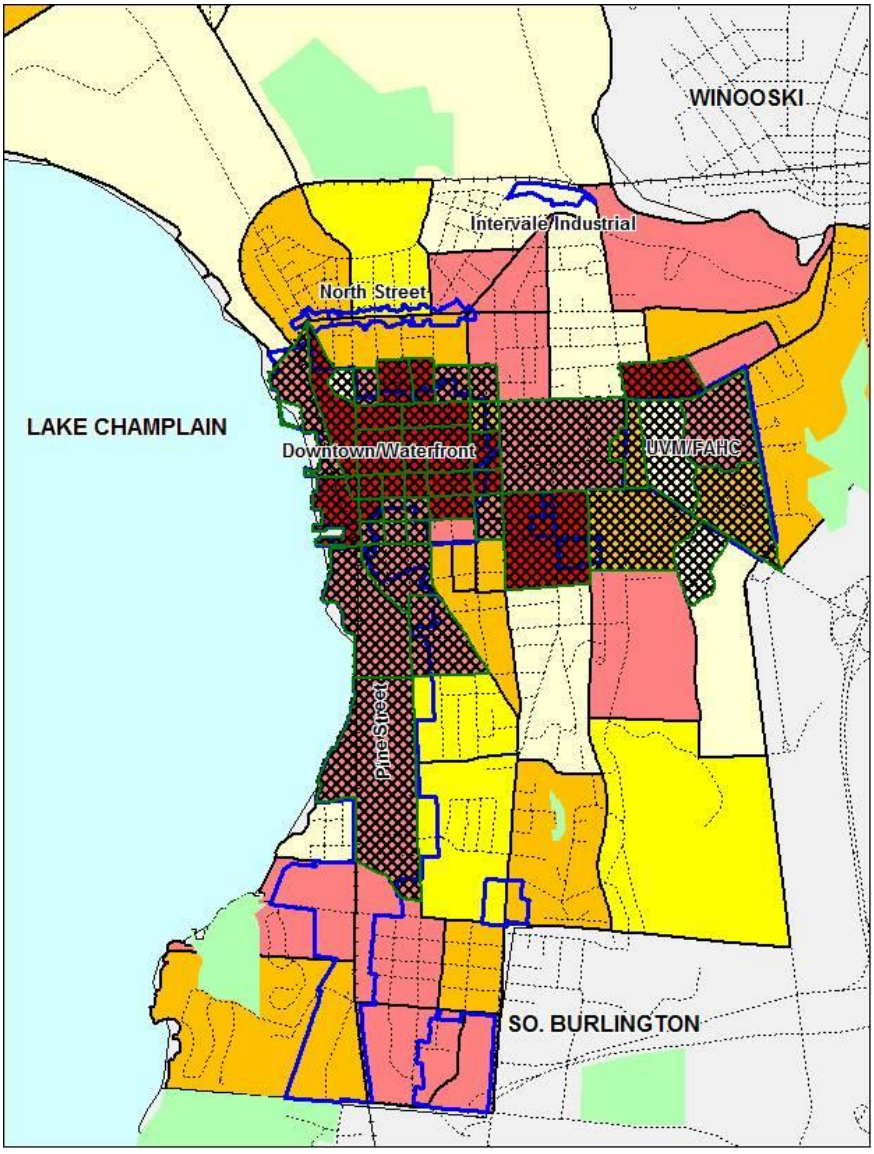
The map on the following page shows development potential within the City. This potential is shown in terms of Dwelling Unit (DU) Equivalents which adds together both residential and non-residential land use potential.

Development Potential in the City of Burlington



Note: DU Equivalent accounts for both residential and non-residential development potential.

Most of the City's development potential (about 65%) is located an inverted "L" shaped area including the Pine Street, Waterfront/Downtown and UVM/FAHC Districts. And a large share of that (about 57% of the non-residential floor area) is in the Pine Street District alone. The Pine Street enterprise area includes the City's proposed South End Transit Center, which is intended, in part, to be a satellite intercept lot providing parking and access to core area locations without the need to bring autos directly downtown. It also encompasses the rail yards south of the existing downtown which is a high priority development location for the City. Recently, this area and neighboring properties have been brought into an expanded tax increment financing (TIF) district. Other prime identified development locations are the Moran Plant on the waterfront, the BankNorth site just south of Main St at St Paul, and the "superblock" (S Winooski, College, S Union & Main), with additional potential in the Perkins Pier area on the waterfront. These findings are consistent with City priorities pointing to the downtown and waterfront as prime development locations. The Pine St area in particular, holds a great deal of potential as is, and could be intensified and expanded for residential uses. Currently this area is zoned primarily for non-residential uses.



Prime Area for Development Oriented Transit in Burlington (cross hatch)

Development potential conceivably could be increased further in the area between the downtown and UVM. However, this question was raised during the Tri-Center Transit Center and was quite controversial. Development at the institutions is likely to be driven by other factors than whether or not there is a streetcar. Therefore, it is most conservative to assume that most new development over an intermediate time horizon that could be attributed to a streetcar would be in the Pine Street Corridor.

Portland Streetcar one-way, 8-mile loop (orange line)

The potential development pattern suggests a possible streetcar system connecting these development areas in the inverted "L" pattern. The route would begin at the South End Transit Center, continue in the Pine Street corridor to the waterfront area and then turn to the east to connect with the downtown, UVM and FAHC, and possibly to an Exit 14 park-and-ride lot depending on its route.[14]

The general "L" shaped route would be functionally very similar to the Portland Streetcar which connects a redevelopment area with the downtown, Portland State University, a medical center, and a waterfront (see figure). The inverted L in Burlington would be about 6 miles in length (3 miles in each direction), or somewhat less than the current length of the Portland Streetcar (8 miles).

[14] The route to or through UVM and FAHC would have to be considered carefully in order to make travel from an Exit 14 park-and-ride lot attractive to all destinations, and also to allow for possible future extension across I-89.

Streetcars vs. Light Rail Transit (LRT) and Bus Rapid Transit (BRT)

Cities throughout the world that have high transit ridership as a share of total travel have a three-layered system of transit service:

1) Local service with frequent stops (inherently slow),
2) Urban express service with less frequent stops and higher running speeds – ideally rail or bus running in fixed guideways, and
3) Regional high speed service like commuter rail and commuter buses on freeways.

Competing effectively with cars across a wide range of geographic markets requires the presence and integration of all three modes. The slow local service provides access and supports short trips. For longer trips, travelers can step up to the higher speed, longer distance services. When only slow, local service is provided, as is currently the case for most Chittenden County customers, transit will win over few choice riders (those that have the option of driving) except in niche markets.

The primary focus of the streetcar projects has been on economic development and place making. Increasing transit ridership has been a secondary goal. These new streetcars, even when they are operating in a fixed guideway, are generally being operated as a slow mode with frequent stops.

> Streetcars aren't like light or heavy rail, designed to carry lots of people over long distances at high speeds. The cars are smaller, the average streetcar system is just 2-3 miles in length, and the average speed is only 3-5 miles per hour. They're not like buses – streetcars are easier to get in and out of, don't lurch in and out of traffic because most run on fixed guideways, and they're less threatening to pedestrians, they're quieter and they don't smell of exhaust.[15]

Almost all streetcars operate with overhead electric. Savannah has recently rebuilt a single streetcar as a biodiesel/electric hybrid.[16] This option could be considered both for reducing capital costs and reducing eliminating the visual impacts of overhead electric.

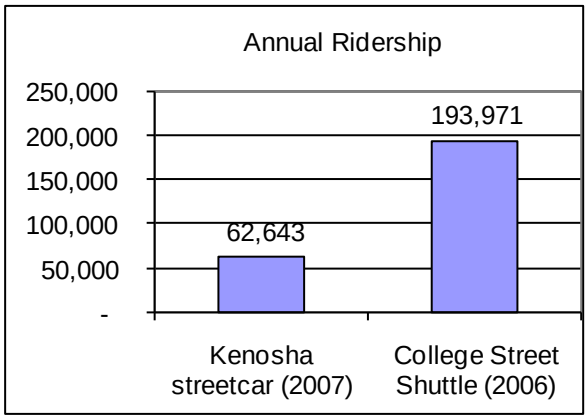
Light Rail Transit (LRT) is like streetcars in that it operates on rails with overhead electric. However, LRT has multiple car trains running in dedicated travel lanes or separate guideways. Some LRT systems are slow local services. Some are regional services. Some try to cover both slow and regional service with a single line, but this compromises travel speed for the longer trips.

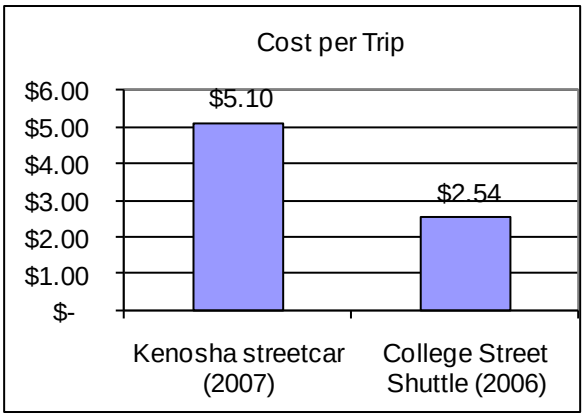
The Tri-Center Transit Study documented high costs and large community impacts for light rail. The draft *Burlington Transportation Plan* could not identify any streets where dedicating lanes to transit only could be justified given anticipated ridership levels. The primary advantage of light rail over Streetcar, high potential seat capacity per train set, is irrelevant to expected ridership levels in Burlington. In fact, the high capacity could be a disadvantage because it could result in lower frequency service in order to save on operating costs, which has happened with some of the less successful new U.S. light rail systems. A dedicated travel lane or separate guideway would be very useful for a regional transit service with stops spaced far apart so that higher speeds could be achieved, but this would be much less important for a transit service with frequent stops operating entirely within the City of Burlington. The

[15] Ohland and Poticha 2009, p. 2.
[16] Ohland and Poticha 2009, Preface.

cost of a regional LRT system would be prohibitive. For these reasons, we recommend that LRT be eliminated from consideration.

Expansion of conventional bus services also could play a role in improving public transportation within the City of Burlington. On both a ridership basis and on a cost per trip basis, the College Street Shuttle's performance exceeds that of the Kenosha Streetcar.

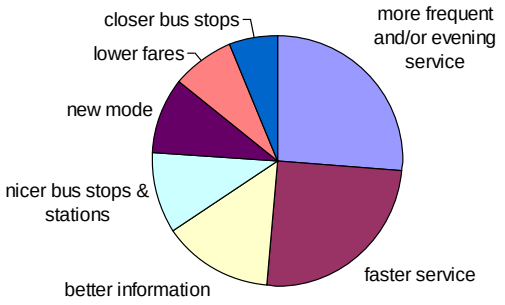




At the December 2007 Legacy Town Meeting, attendees passed through three stations: 1) pedestrian and bikes, 2) land use, and 3) transit. There was strong interest at the meeting in enhanced bus service. As shown in the figure below, there was especially strong support for evening service, increased frequency and faster travel times.

Citizens Give Feedback on Improving Transit at the Legacy Town Meeting

What Would Make it More Likely for You to Ride the Bus?



More frequent service and evening service could be provided with conventional buses. The table below summarizes current CCTA service for the primary Burlington routes.

CCTA Service Headways (Time Between Buses)

	M-F peak	M-F off-peak	M-F evening	Saturday	Sunday
U Mall/Airport	30	30	60	30	60
Essex Jct	15	30	60	30	NA
Pine Street	30	30	NA	30	NA
Shelburne Rd	30	30	60	30	NA
North Ave	30	30	60	30	NA
City Loop	15/30	30	30	30	NA
Riverside/Win.	30	60	NA	60	NA
College Street	15	15	30 (summer only)	15/30 (summer only)	15/30 (summer only)

In general, headways of 15 minutes or less are required for a service to attract "choice riders" (those who have access to a car, particularly for trips that aren't made at the same time every day.

Better information could include communicating transit routes visually instead of through signs and printed schedules. Installing rails is one powerful way to communicate transit routes visually, but there are other ways. Buses need not all look the same. Boulder, Colorado has been very successful in rebranding their primary bus routes as the HOP, SKIP, JUMP, BOUND, DASH, STAMPEDE and BOLT routes, each with a special skin. This helps to update the image of the bus and also helps new riders distinguish one route from another.

Boulder has also been innovative in addressing concerns about perceived out-of-pocket costs. The City's Go Boulder program has successfully marketed bus passes through multiple channels including a Neighborhood Eco Pass that covers 7,000 households (the passes can be puchased in blocks at a much reduced rate per household covering all households in a development or neighborhood – whether they use the bus or not. For these households, transit is "free".

Increasing transit speed significantly in Burlington will be difficult to achieve because of the lack of availability of separate guideway space, but there are steps that can be taken to improve perceived travel time performance. Increased frequency generally improves perceived travel time because waiting time is experienced as particularly onerous by many transit users. Real time information signs about the wait time can reduce the perceived wait time, and therefore reduce perceived travel time. The College Street Shuttle is very popular (partly because it is free) but it operates more slowly than parallel bus routes on Main Street and Pearl Street due to its College Street's narrow width. Replacing this route with faster and more frequent services on Main Street and Pearl Street/Colchester Avenue would speed transit service in the City's core.

Bus Rapid Transit (BRT) has come to mean any type of enhanced bus service, and BRT comes in many flavors. There are two general types of BRT that should be considered in Burlington: 1) local BRT, and 2) regional BRT running at higher speeds and with fewer stops. The first type is a possible substitute for the streetcar mode. It could provide many of same transportation benefits, but probably would not capture the imagination enough to provide the same level of economic development and placemaking benefits.

The second type of BRT is called for in the draft *Burlington Transportation Plan*, and the Route 2 and Route 15 studies. All of these reports call for the implementation of a bus service that would fill the 2nd level tier in a 3-tiered transit system: a faster service with fewer stops. While fixed guideways would be desirable, this service would operate primarily on local streets, with signal priority and queue jump lanes where feasible and useful. Over the long-term some fixed guideway elements could be introduced. For example, it is possible with BRT to use short tunnels to bypass congested intersections. Such a system would be an update on the standard combination of local and express buses that have been used in larger cities for many years. In general, the express buses or arterial BRT would be targeted particularly at users coming into the City from outside. Within the City, the largest amount of ridership would remain on the local services with more frequent stops. For shorter trips within the City, travel speed is less important than it is for longer, regional trips.

If BRT is designed to provide most of the amenities of rail transit, it can be expensive. The new HealthLine BRT in Cleveland (shown in Figure to right) cost $200 million for a 4.2 mile 2-direction BRT system and arterial street reconstruction. Nevertheless, BRT generally will be significantly cheaper than rail because the costs of track, overhead wires, and a rail maintenance facility are avoided.

Capital costs for the three new streetcar lines built in the U.S. in this decade (per track mile including vehicles) are:$11.5 million (Portland), $21.0 million (Tampa), and $9.1 million (Seattle).[17] Thus, a 6-mile inverted L streetcar route in Burlington might cost $60-100 million. A high quality BRT system might cost half as much as it would avoid the costs of rails, overhead electric, and a rail maintenance facility. A higher quality, well designed BRT system could have land development impacts comparable to those of a streetcar system.

Costs for streetcars are higher than for buses, but they have a longer lifetime. A website for a firm involved in both streetcar restoration and replica streetcars states:

> Costs for a replica car currently begin around $900,000 for an air conditioned double-truck vehicle (using rebuilt vintage running gear and modern control equipment). A typical diesel transit bus costs about half as much, but has a shorter service life (17 years vs. 25 for trolley / streetcar / LRV).[18]

[17] Ohland and Poticha 2009, p. 84.
[18] http://www.railwaypreservation.com/vintagetrolley/vintagetrolley.htm

The City of Portland constructed the original streetcar system without direct Federal funding, although it is now seeking Federal transit money for planned expansions. The following excerpt from a City report shows how the City raised the $103 million to construct the current 8-mile loop.[19]

Funding sources for these phases of the project (in millions) include:

- $ 28.60 Bonds backed by revenues from a $.20/hour short-term parking rate increase in City-owned parking garages
- $ 21.50 Tax increment financing from the City's urban renewal agency (PDC)
- $ 19.40 Property owner contribution through an LID on non-owner occupied residences
- $ 10.00 Regional transportation funds
- $ 8.75 City funds
- $ 2.10 Connect Oregon
- $ 5.00 Reallocated transit funds from TriMet
- $ 3.10 Transportation land sale
- $ 4.70 Other sources
- **$103.15 million total construction costs**

A wide range of funding sources were combined, with the largest shares coming from tax increment financing (TIF), local improvement district (LID) charges and parking rate increases.

Of course, capital costs are not the only costs. Almost all public transit in the U.S. requires substantial operating cost subsidies. Operating subsidies on a per-rider basis for either streetcar or BRT would be expected to be in the same general range as those for current CCTA operations. Rail advocates often describe significantly lower operating costs for rail, but this is generally true only when there are large loadings on multi-car trains.

The Fiscal Year 2008 operating budget for Portland Streetcar was $4.9 million. Little of that comes from fares (partly because much of the system operating in a downtown free fare zone). About 2/3 of the budget came from the regional transit operator, Tri-Met, and the other 1/3 came from the City.[20]

In general, operating costs for buses and streetcars on a service hour basis will be similar, because in both cases, the largest expense is for labor However, in cases where the same agency operates both types of vehicles, there are significant differences in both directions (see table below).

Operating Costs per Vehicle Revenue Hour 2007 (FTA National Transit Database)

	Bus	Streetcar	Difference
Kenosha Transit	$84.88	$113.75	+34%
Central Arkansas Transit Authority (Little Rock)	$65.97	$59.72	-9%
Hillsborough Area Regional Transit Authority (Tampa)	$84.85	$133.58	+58%
Island Transit (Galveston)	$54.10	$108.39	+100%
Memphis Area Transit Authority	$99.22	$71.08	-28%
Chittenden County Transportation Authority (CCTA)	$77.91	NA	NA

The cost per trip will largely be determined by ridership. As the costs per hour are relatively fixed, the most important variable is the number of riders per hour. If a streetcar can attract higher ridership than a bus, particularly during off-peak periods, then the cost per rider would be lower.

[19] City of Portland Office of Transportation and Portland Streetcar, Inc. "Portland Streetcar – Development Oriented Transit", April 2008.
[20] Portlandstreetcar.org.

Implications of a Streetcar System in Burlington

It would be difficult to justify a $60-100 million investment in transit in the City of Burlington on a cost per rider basis. It also would be hard to justify such an investment by multiplying the number of miles ridden times a fuel savings per mile. It would be particularly hard to justify an investment that attracted visitors to drive and park in order to take "Train Rides," as was true for a large share of Champlain Flyer riders. Any justification for a large investment would be based on economic development and environmental benefits.

Let us consider a possible future with the 6 mile inverted L route discussed above. We will assume the streetcar is operated 7 days a week from 6 a.m. until 11 p.m. with 15 minute-headways (much more service than any current CCTA route). Four streetcars would be in service, and a fifth would be purchased as a spare. If the streetcar operating cost was $100/hour, the operating budget would be about $2.5 million per year.

The current CCTA system averages 22 boardings per vehicle hour. If this average were matched on the streetcar, the system would carry 550,000 passengers per year. However, given that the streetcar would serve mostly shorter trips, a truly successful streetcar project of this scale would likely reach a ridership of 1 million or more per year. For comparison purposes, the College Street Shuttle ridership is 200,000 per year and Portland Streetcar ridership is 3.8 million per year.

How could 1 million annual ridership be achieved? It would be a combination of different factors including:

1) The streetcar would likely replace the current College Street Shuttle and Pine Street services including the Lakeside Commuter service, and could attract riders from other bus services depending on the alignment.
2) The service would have extended hours and be more frequent, attracting additional riders.
3) The service would be better understood and more attractive than the current bus services.
4) It would be combined with expanded park-and-ride facilities at the south end, and likely also at the east end.
5) It would encourage land development that would produce considerable additional ridership.

Maximum economic development and environmental benefits would be achieved through medium- to high-density mixed used development that emphasizes housing. Today, the City of Burlington has a significant jobs-housing imbalance that requires a net inflow of 11,000 workers each day into the City of Burlington.[21] Almost all of those commuting into the City do so by car (98%), and it will be difficult to push the share down significantly because of the challenges in serving suburban areas with transit. If transit investments led primarily to non-residential development in Burlington, this would worsen the jobs/housing imbalance, and would likely have a net negative impact on regional energy consumption and greenhouse gas emissions. It would be best to plan for development that is at minimum jobs/housing neutral in total, and that ideally would include more housing than jobs to help correct the current imbalance.

[21] 2000 Census data; "net" means there are 11,000 more in-commutes than out-commutes by Burlington residents.

Substantial housing growth is also essential to achieving high ridership. During the Tri-Center Transit Study, the Minneapolis-based prime contractors were puzzled why the ridership forecasts included such small numbers of home-based work trips. The answer was simple: "Almost no one lives on the system." Achieving high ridership requires a combination of residences, workplaces and attractions.

Furthermore, it is likely that substantial development would be needed to help pay for the streetcar. In Portland, 40 percent of the capital funding came from TIF and LID assessments.[22] In addition, walkable mixed use with good transit service would support living with fewer cars, which would lower parking requirements and parking costs. This would help enable the developers to help to pay for a streetcar.

How much development would be needed? The original vision in the Burlington Legacy Project was for The City to maintain the same fraction of the region's housing stock as the region grows. The latest household forecasts adopted by the Chittenden County Regional Planning Commission (CCRPC) call for 42,000 additional households or perhaps about 44,000 additional units (accounting for vacancies). This represents an average of 880 units per year. In 2007, Burlington housed 27 percent of the households in Chittenden County, so Burlington's "share" of future growth would average 240 units per year.

Consider a scenario where 200 units per year were constructed per year in the designated growth areas (particularly in the south end. Furthermore, let us assume that this is mixed use development that includes another 75,000 square feet (roughly one new job per new residence). Over a 20-year period, this would result in 5.5 million square feet of development (assuming an average of 1000 sq. ft. per housing unit). The analysis in the appendix estimates that there is 6 million sq. ft. of potential development in the south end with existing zoning, and 12 million in the entire combined growth area (not including all possible institutional development.) Therefore, 5.5 million square feet of development appears feasible. 5.5 million sq. ft. would be approximately 1/3 of the development that has been attributed to the Portland Streetcar, so is getting into the range of what might be needed for economic viability. It will be important to think big about land development if a streetcar project is to get off the ground.

This amount of development (4,000 new housing units plus 1.5 million square feet of new non-residential development) would generate approximately 60,000 one-way person trips per day. If a 5 percent streetcar mode share could be achieved, the new development would generate 1 million streetcar trips per year in addition to any other streetcar travel. With moderate to high-density, mixed use development, the walk and bike mode share could be as high as 20 percent or even higher, and many of the auto trips would be short ones. Therefore, the regional impacts of the auto trips would be much lower than if the growth were in the suburbs.

Pricing would have a significant effect on ridership. Many streetcars are very inexpensive or free. The Kenosha streetcar costs 25 cents. The Portland Streetcar has a nominal fare of $2 but a large fraction of trips are made within the regional transit agency's downtown free zone. If fares were to be charged, payments should be done before boarding as is done with most of the U.S. light rail systems. A number of bus systems, including Seattle's, have switched to downtown free zones because the time cost of collecting fares was increasing operating costs more than the value of the fare revenue collected; and this simple calculation does not include the time lost by riders waiting while fares are collected.

[22] Tax Increment Financing (TIF) in Vermont must now be shared with the state education fund to satisfy Act 60 requirements.

Environmental Benefits from Expanded Transit in Burlington

There would be some environmental benefits from switching transit from diesel to electric, particularly if the Burlington Electric Department continues to emphasize renewable energy sources. However, the larger potential environmental benefits would be from reducing future regional transportation energy use. The largest environmental benefits would follow from higher density mixed use land use developments that were stimulated by the streetcar network, where the residents have smaller carbon footprints than if the housing were built in more rural, auto-oriented locations. This would result in higher future transit ridership than in a no-streetcar scenario – partly due to a more attractive transit service, but primarily due to a larger market for transit.

Rail transit investments, including streetcar, are strongly linked to development. There is some evidence that BRT systems also can lead to development. It is reasonable to think that the impacts of BRT on development will be strongest where there is a similar permanent commitment to the BRT system including attractive vehicles, off-vehicle payment systems, and high quality stops and shelters. There is evidence that high-quality BRT can lead to significant land development.

Achieving the greatest possible environmental benefits requires planning the Development-Oriented Transit and the Transit-Oriented Development (TOD) together. If conventional bus services were expanded through increasing frequency and extending hours, there would be some environmental benefits, but these benefits would be modest if the transit expansion had no effect on future land development.

Appendix: City of Burlington Development Potential

This appendix presents the methodology used to estimate development potential in the City of Burlington and includes detailed results. Development potential has been estimated based on the 2003 regional buildout analysis (RBA) done by the Chittenden County Regional Planning Commission (CCRPC). It assessed the total capacity allowed by zoning in Chittenden County to support development. It is not a projection or estimate, nor is it based on any date of completion.

The buildout analysis estimates total development supported by existing zoning as either residential or non-residential. Residential development is measured in dwelling units (du), roughly equivalent to either houses or apartments. Non-residential development is measured in square feet (sf) of gross floor area (gfa), which may be put to uses such as a retail store, office space, factory space, etc.

Since the city is already well developed, much future development is likely to occur on parcels already supporting some use, either through redevelopment or through intensification of the existing use without actual redevelopment. The RBA has been explicitly designed to support this method of development in urban areas.

Residential redevelopment is based on a 3x threshold, i.e is assumed only to occur if there is total residential potential for three times as many units on the property as already exist. This is generally intended to reflect a subdivision threshold rather than issues of physical redevelopment\expansion on the same parcel.

Non-residential redevelopment is not based on any threshold, i.e. additional intensification is assumed to be supported at any level above the existing. However, a sensitivity run was made that applied a 2x threshold to additional development. This reduced non-residential development potential a little less than 4% region wide (0.9635).

The "buildout under zoning" can overestimate development potential because actual development usually occurs at lower densities than maximum permitted. On the other hand, zoning itself may change over time in response to changing conditions. Most changes to zoning act to permit higher densities and more development, and few are "downzonings" resulting in less development potential. Therefore, buildout is an indication of possible development but not necessarily what will occur.

One other factor that affects development is the role of the permitting process. The RBA itself is based to a significant extent on the technical aspects of permitting process. However, it can't really consider political aspects of the permitting process that can also play a significant role.

Because this evaluation was completed in 2003, there are a few differences from current conditions, especially in the downtown area. Here, downtown type zoning has been extended somewhat from its 2003 boundaries to encompass a bit more of the St Paul St area to the south, and the “superblock” (S. Winooski, College, S Union, Main) development area. Also, some significant new buildings have already been added to the inventory, including the Westin Hotel, Lake and College, and new development in the hill area including the UVM student center, University Heights, FAHC, and Champlain College.

Because transit is intended to serve both residential and non-residential activities, a synthetic measure of development intensity was developed that is based on the total daily trip generation of projected

development, both residential and non-residential, for each use. These were mapped by transportation analysis zone (TAZ) which have been previously defined for the city (and for the remainder of the county as well) and are used in all transportation analyses. Since conventional transit "thresholds" are often expressed in terms of housing units (or dwelling units: du) per acre, the total development intensities were expressed as du equivalent per acre if based on the total person trip generation per household. Thresholds used were 9 and 12 units per acre[23], with higher densities simply expressing convenient divisions to demonstrate even higher densities. Despite the substantial development already in place in the city, a map of additional, or net, development potential has a similar pattern to the map of total development potential.

The regional buildout analysis itself was evaluated on a parcel-by parcel basis. This enabled the evaluation of development potential in terms of the specific development areas identified by the City. This is shown in the table below.

Development Potential by Designated Development Area							
		Residential (du)			Non-residential (sq ft)		
ID	Development Area	Existing	Total	Net	Existing	Total	Net
1	Downtown/Waterfront	683	1,438	755	2,952,797	7,249,020	4,296,223
2	North Street	237	280	43	141,822	170,025	28,203
3	Ethan Allen	141	291	150	36,254	465,797	429,543
4	Intervale Industrial	0	0	0	27,800	245,023	217,223
5	Pine Street	39	48	9	2,067,507	7,993,278	5,925,771
6	Flynn Ave	0	94	94	59,267	188,526	129,259
7	Home Ave	150	445	295	155,228	741,429	586,201
8	UVM/FAHC	510	624	114	0	580,311	580,311
9	Champlain College	18	58	40	0	218,696	218,696
	Subtotal	1,778	3,278	1,500	5,440,675	17,852,105	12,411,430
0	Remainder of City	18,773	25,657	6,545	2,586,096	7,090,402	4,504,306
	TOTAL	20,551	28,935	8,045	8,026,771	24,942,507	16,915,736

Based on this analysis, it is clear that the City intends its highest development intensities to be in the downtown/waterfront area, with additional foci at the "hill institutions" including UVM/FAHC and

[23] While there is considerable variation in the possible ranges of "thresholds" for transit service, the minimal densities used here are 9 du per acre for light rail transit (LRT) service, and 12 du per acre for subway type rail transit. This is based on data provided via the Victoria Transportation Policy Institute (VTPI) at http://www.vtpi.org/tdm/tdm45.htm (Table 1)

Champlain College, and throughout the Pine Street "enterprise" area. It is likely that the lower apparent intensities seen at UVM/FAHC are an artifact of the zoning which is based on the University master plan there rather than conventional zoning parameters.

Buildout at the "hill" institutions offers a unique case. Two unusual conditions apply that affect the perceived development potential here:

1. The existing development at these institutions is mostly tax exempt and does not show up as existing square footages, which are maintained in City data bases largely for tax purposes. For this reason, some areas, particularly around Champlain College, manifest as having zero existing development.
2. Development at these institutions is not regulated in accordance with conventional zoning. Instead; it is based on the adopted institutional master plans, and not so readily evaluated in a broad, region wide analysis. Thus, while future development under buildout at UVM/FAHC appears quite modest, this is, nonetheless, an important urban development node.