COMMUTER RAIL FEASIBILITY FOR BURLINGTON, VERMONT—A SMALL METRO CASE STUDY

Tony Redington

Introduction This Burlington-Montpelier-Charlotte Commuter Rail Passenger Service (BMC Commuter Rail Service) study examines a small metro commuter rail service feasibility for Vermont. The concept dates from a 1989 report followed by a number of further analyses and actual service 2000-2003 on a portion of the route. Market potential for commuter rail becomes measurable with more confidence after a decade of commuter bus data and successful demand management experience.

The "Link" commuter buses started 2003 and in 2014 total 60 each workday to and from Burlington along four corridors. The rail route analyzed here includes the 68 km east-west segment between Burlington and the Vermont State House in downtown Montpelier and the 19 km segment south from Burlington to Charlotte, the 2000-2003 Champlain Flyer commuter route. The overall 87 km route evaluated, Map 1, extends from Charlotte via Burlington to State House with 12 stations, eight in town and city centers.

U.S. and Canada Commuter Rail The twenty-five United States and three Canadian commuter rail passenger systems reveal an under-developed facet of North American surface transportation. A historic transportation travel change away from the auto in the U.S. includes: (1) the current seven year downturn of vehicle miles of travel (FHWA 2013); time in car travel dropping among all population groups (FHWA 2011, Figure 5), and perhaps most significant, the proportion of under-age-30 eligible with driver licenses dropped about 10% since 1995 (Sivak and Schoettle 2011). These factors call for re-examining commuter rail feasibility even in small metropolitan areas. Commuter rail constitutes an important part of overall public

transportation. The U.S. Federal Transit Administration (FTA) reports yearly data on 15 public transportation types with commuter rail accounting for 17.4 billion passenger kilometers or 21% of all kilometers (FTA 2011). Three of fifteen service types account for 91% of public transportation passenger kilometers totaling 84.7 billion in 2010: (1) bus 33.2 billion, 39%; (2) heavy rail (subways, etc.) 26.4 billion, 31%; and (3) commuter rail 17.4 billion, 21%. Other service types include cable car, demand services, and monorail.

Table 1: United States Commuter Rail Systems Data

	All 25 Systems		10 Lowest Ridership	
	Range	Median	Range	Median
Weekday riders	1,000-334,100	12,200	1,000-5,400	2,700
Ridership/km	31.3-477.3	139.9	31.3-129.3	54.4
Lines	1-13	1	1-1	1
Stations	5-240	17	5-15	7
Route km	24-1530	143	24-270	65.2

Sources: FTA (2006) p 2; APTA (2013, Table 36, p 40); and Wikipedia (2014).

U.S. public transportation 2013 ridership marked a 50-year high (APTA p 11). U.S. public transportation passenger kilometers 2007-2013 grew 5.1% while motor vehicle travel kilometers dropped 1.9% 2007-2013, remaining below the 2007 record (FHWA 2014). The 2013 84.7 billion public transport kilometers of travel compares to the 2007 record 4.88 trillion vehicle kilometers of travel (FHWA 2014).

The characteristics of U.S. and Canadian commuter rail services in Tables 1 and 2 show a wide range of ridership, stations, and route kilometers. The majority of systems starts—15 of 25 in the U.S. and

Table 2: Canada Commuter Rail Systems

	Toronto	Montreal	Vancouver
Daily Ridership (2013)	185,000	73,900	11,000
Route kilometers	390	214	69

Note: Ontario Province started Toronto 1965; *Société de transport de la communauté urbaine de Montréal* first public Montreal operator 1982; and Vancouver's West Coast Express began in 1995.

one of three in Canada—date from 1990 forward. For U.S. systems (Chicago and the Long Island Railroad services date from about 1900) ten began before 1990, seven 1990-1999, five 2000-2009, and three 2010-2013. All ten lowest ridership systems date from 1990. Ten U.S. systems have more than one line, and nine of those also rank in the top ten in ridership. For the lowest ten ridership systems: (1) all operate a single route; (2) serve 5 to 15 stations; and (3) operate route lengths 24 to 278 kilometers. These ten lowest ridership systems set a yardstick in assessing feasibility new commuter rail services like this case.

Vermont Rail Involvement Vermont's direct rail investment began in 1961 following the Rutland Railroad bankruptcy when the State bought the bulk of the rail properties then leased them to private operators. Vermont, second smallest U.S. in population, continues a six-decade commitment to maintain and invest in the rail mode.

Vermont passenger rail service ended in the mid-1950s except the international Montreal-Washington service, itself undergoing a hiatus from 1966 until restored by Amtrak in 1972. That service continues in a truncated form, now a State supported "Vermonter" Amtrak train St. Albans, VT-Washington. The State supports a second Amtrak service, the Ethan Allen, Rutland, VT -New York City begun in 1997.

In this historic context an unsolicited 1989 report, "VermonTrain," by former rail passenger administrator and advocate Eugene Skoropowski (Skoropowski 1989) outlined a commuter service along three corridors out of Burlington employing self-propelled rail diesel cars operable in two-or-more units (diesel multiple-unit or DMUs) configuration. That report along with two other major studies preceded service, the Champlain Flyer, undertaken through the leadership of Governor Howard Dean along a 19 km corridor between Burlington and Charlotte 2000-2002.

A**uto Decline and Public Transport Growth** Skoropowski's study arrived at the end of Vermont's last burst of vehicle kilometers of travel growth—57% 1980-1990. Growth collapsed to 16% 1990-2000 in the six New England States (FHWA Series). Total New England kilometers vehicle travel then slid to a 3% increase 2000-2010, and a decline is possible this decade.

Vermont car commuters—solo and car-share--dropped 2.5% from 87.1% to 84.6 2000-2010 (U.S Census). Public transit commuting increased 72% and bicycle 107%. As documented elsewhere, median wages and household income in the U.S. remain only slightly higher than 1980. Households view housing and transportation, upwards of half the typical household expenditure, as a single expenditure and work to minimize the combined impact of these two budgetary items (Redington 1999).

BMC Commuter Rail Service builds on the estimated 240 commuters being served by the Chittenden County Transportation Authority (CCTA) Montpelier Link on 18 bus runs each workday (CCTA 2013). The 240 commuters served on the Link Burlington-Montpelier corridor account for the majority of commuters on four corridors followed by St. Albans corridor second, 80, Middlebury third, 70, and the new Jeffersonville service.

BMC Rail Service parameters The following outlines parameters employed for estimating BMC Commuter Rail Services passengers:

1. Estimated workdays each year: 250
2. Estimated "commuters" and "commuters served": Divide passenger trips per workday day by two to obtain "commuters." Multiply "commuters" by 1.1 to obtain "commuters served"--a commuter during a 250 workdays year takes about 25 days without using commuter rail or about 10% of all workdays in leave (vacation, sick, family, etc.), work at another site, travel, etc.
3. Journey-to-work Each U.S. Census reports sample journey-to-work data by (1) destination of a jurisdiction residents to other jurisdictions worksites by jurisdiction and (2) origin for a jurisdiction's worksites by originating jurisdiction.
4. Non-commuter passenger trips: Except for a study of extending the Champlain Flyer service from Burlington to Essex Jct., non-commuter trips are not included (RL Banks 1999, Table 7). The commuter and non-commuter 742 daily boardings from this study (371 individual passenger roundtrips) are allocated as presented along stations from Charlotte to Essex Junction with one minor change.

Base Commuters Estimate Methodology In reaching total workday commuters, 1,110, Table 3, three data and performance sources were utilized: (1) 2010 U.S. Census journey-to-work data; (2) actual

commuter trip data for travel from Montpelier to Burlington from CCTA records; and (3) the RL Banks 1999 study of passenger trips estimated from an extended Champlain Flyer service to Essex Jct. The total estimate of 1,110 base numbers of "commuters" each workday means about 1,200 individual "commuters served."

The actual Montpelier to Burlington Link data in combination with journey-to-work numbers establishes an empirical base to calibrate the commuter rail market potential as all boarding Link buses from Montpelier commute to a Burlington worksite. And journey-to-work Census data on total Montpelier workers commuting to Burlington are combined with three adjacent towns commuter numbers to Burlington to define the "Montpelier market." The Link daily commuters from the "Montpelier market" to Burlington then results in a 23% "market share" for 2012-2013 for the Link. For purposes of analysis here 25% of commuters in a given station town paired with another station town comprises the core of the passenger estimates.

Exceptions are: (1) excluding any Colchester data because the station location far from most of the Town population; (2) using a 20% factor for South Burlington pairs, again because of the station at the City's edge; (3) pairing all towns west of Waterbury to all four of the "Montpelier market" towns; and (4) in the case of "Montpelier market"-Waterbury considering only Montpelier to Waterbury commuters. Also for the 59 Bolton outbound commuters a 30% share factor used reflects the Town lacking ready interstate access and therefore a likely higher rail commuter share. Again, for all inter-station trips between Charlotte and Essex Jct. the RL Banks study 371 roundtrips a day was utilized (RL Banks 1999, Table 7; Redington 2013 pp 19-24).

The Champlain Flyer service with a $1 one-way fare averaged 42 commuter roundtrips daily (all dollars in this report are US). On-board passenger counts totaled 62 roundtrips daily (Vermont Joint Fiscal Office 2003). Note the 1999 RL Banks report estimated Montpelier commuters boarding to Burlington on an extended Champlain Flyer service to Montpelier of four versus the first full week numbers 2014 of 100 daily Link boardings (CCTA 2014).

Table 3: Estimated commuters, Passenger Trips, Passenger Kilometers

Annual Passenger Trips	Subgroup of Commuters
	Short Trips—29 km Average
185,500	Charlotte-Burlington-Essex Jct. Estimate of 742 boardings, 371 roundtrips each workday (RL Banks 1999, Table 7)
18,000	Montpelier to Waterbury U.S. Census 25% journey-to-work Montpelier to Waterbury only, 36 roundtrips
29,500	Commuting from Bolton to Burlington/Essex/ Winooski/Shelburne/Charlotte and Waterbury/ Montpelier 30% of journey-to-work commuter town pairs, roundtrips 59
	Sub-total Short Trips: 466 Commuters 233,000 Annual Trips 6.750 Million Passenger Kilometers
	Long Trips-64 kilometers average
267,500	Commuting between Burlington/Winooski/Essex Junction/IBM Technology Park/Richmond and Waterbury/Montpelier 25% journey-to-work town pairs (for example, "Montpelier market"-Burlington "Montpelier market"-Winooski, etc., roundtrips 535 ("Montpelier market" composed of Montpelier, Barre, Berlin, and Barre Town)
54,500	Charlotte/Shelburne and Waterbury/Montpelier 25% journey-to-work commuter town pairs, 25 roundtrips; 20% between South Burlington and Montpelier/Waterbury 84 roundtrips
	Sub-total Long Trips: 644 commuters, 322,000 Annual Trips 20.728 million passenger kilometers

Total passenger trips annually: 550,000
Total individual roundtrips daily: 1,110
Total annual million passenger kilometers: 27.48

Translating passenger trips to passenger kilometers, trips are divided into two categories--"long trips" and "short trips"--"long" trip 64 km and a "short" trip 29 km. These estimates take into consideration the destination of the two highest station boardings, Burlington and

Montpelier, and examining shorter distance commutes, particularly Bolton located about mid-route. Bolton trips in any direction, trips between Charlotte and Richmond in the west, and Waterbury-Montpelier trips–all receive "short" designation.

The 1,110 base daily commuter roundtrips translate to 555,000 individual passenger trips annually. As of mid-year of 2013-2014 Montpelier-Burlington Link service (January 2014) numbers grew 20%. If this trend continues through June 2014, the rate of about 540 daily trips serving almost 300 commuters reaches a level equal to a quarter of the 1,100 base daily commuters.

Role of demand management Since 2000 Burlington's Campus Area Transportation Management Association (CATMA) demand management programming reduced workers solo journey-to-work trips by about 14 percent, about 1,000 of the sponsoring three institutions' workers (CATMA 2013). CATMA and demand management programming constitute a major element in the success

Table 4: BMC Commuter Rail Service: Trains, Annual Train Kilometers, Passenger Kilometers, and Passengers Per Train Kilometer

Service Level: 14 trains a day composed of three peak roundtrips a.m., three peak roundtrips p.m., and one roundtrip mid-day.
Total one-way Charlotte-Burlington-Montpelier Kilometers: 87
Operating Workdays Yearly: 250
Trains per year: 3,500 Trains per year less mid-day runs: 3,000
Current Link buses per year (three corridors, 2013): 12,500
Train hours of operation per year: 5,250 (based on 1.5 hour per run between Charlotte and Montpelier)
Daily (Revenue) Train Kilometers: 1,217 Annual Train Kilometers: 304,200
Annual Train Kilometers Less Mid-day Run: 260,700

of commuter rail reaching the estimates outlined here. Formed by the University of Vermont, Champlain College and Fletcher Allen Health Care—CATMA serves their 10,000 employees in Burlington (32% of the City's employment) and 16,000 full-time students. The yearly benefit to the commuter switching from solo driving to Link service

Table 4: BMC Commuter Rail Service: Trains, Annual Train Kilometers, Passenger Kilometers, and Passengers Per Train Kilometer (concluded)

Passenger kilometers: 233,000 "short" passenger trips yearly at 29 kilometers and 322,000 "long trips" yearly at 64 kilometers--total passenger kilometers: 27.5 million annual passenger kilometers.

Passengers per train kilometer: 90 passengers per train kilometer or about 23.8 passenger kilometers per liter of diesel fuel (DMU assumed to attain 0.26 kilometers per liter)

Passengers per train: 159 passengers per train (mix of "short" and "long" passenger trips) (current average passengers per Link bus trip Montpelier-Burlington corridor: about 22 on the 18 buses operated each workday (2013)

Table 5: BMC Commuter Rail Service Base Year Roundtrip Boarding Passengers Estimate by Town and Station

Town/Station	Estimated Workday Boardings
Charlotte	38
Shelburne	50
South Burlington	96
Burlington Union Station	268
Winooski	76
St. Michael's/Fanny Allen	7
Essex Junction/Technology Park Stations	120
Richmond	22
Bolton	59
Waterbury	106
Montpelier	268
Total Individual Roundtrip Boardings	**1,110**

Note: Actual station boardings certainly to vary significantly because of use of a mix of estimate methods.

can exceed $8,000. For example, comparing the U.S. federal personal car use reimbursement rate per kilometer of $0.35 (January 2014) versus the $0.062/km transit fare ($4.00 one way) for the 64 km one-way commute between Montpelier and Burlington over 225 workdays—the total yearly commuting cost differential is over $8,000 yearly. Considering the median income household in Vermont

of $51,300 in 2013 (U.S. Census), $8,000 represents a 16% increase in income for the commuter. The BMC Commuter Rail Service projects slightly higher fares than Link, $0.078/km or $5.00 for the 64 km Montpelier-Burlington commute one-way.

Schedule and travel times The workday schedule both directions includes three a.m. and p.m. peak trains and one mid-day, 14 trains total. Travel time for Burlington Union Station to State House ranges 60-70 minutes, and Charlotte to Burlington 20 minutes. Figure 1 contains six trains a.m. peak schedule and two mid-day runs. Even though commuter rail makes seven intermediate stops versus two by the Link between Burlington and Montpelier—and five town centers to none for Link--overall time travel times remain about equal between the two anchor cities. Commuter rail furthers the State premier planning goal "to plan development so as to maintain the historic settlement patterns of compact village and urban centers surrounded by rural countryside…" (Vermont Statutes Annotated).

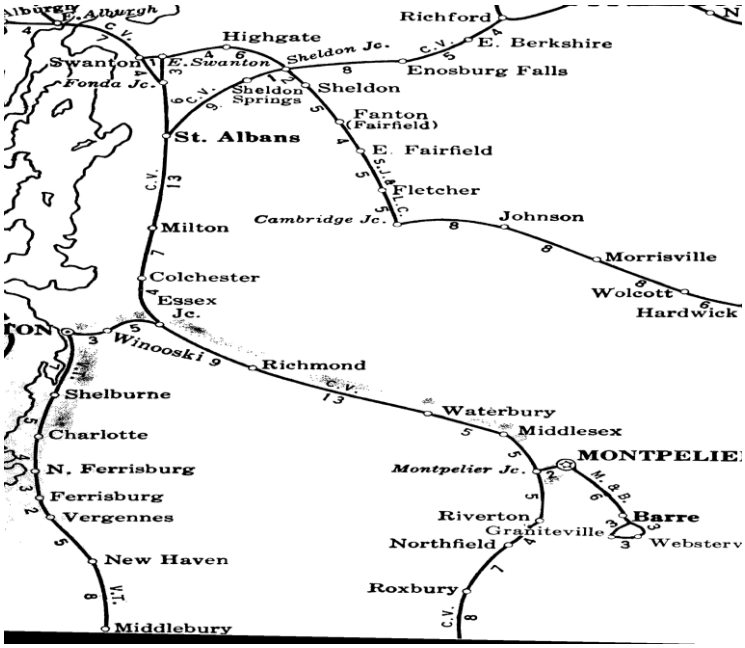
Table 6: Populations of Vermont, Chittenden County, Washington County, and Burlington Metro

Area	Population	Percent of State
Burlington Metropolitan Area	211,261	33.7
Chittenden County (2012)	158,504	25.3
Washington County (2010)	59,534	9.5
Chittenden and Washington Counties combined	218,038	34.8
Vermont (2012)	626,011	100.0

Source: U.S. Bureau of the Census (Burlington Metropolitan Statistical Area comprised of the three northwestern counties--Chittenden, Franklin and Grand Isle).

DMUs—speeds, capacity, fuel efficiency The typical DMU—a power car and passenger car—fits Vermont passenger levels well and obtains high fuel efficiency. DMU maximum operating speeds range about 120 to 135 km/h. Capacity varies considerably depending on seating configuration and space reserved for bicycles and baggage. A two-car DMU carries 125-175 passengers, and an estimated average 95 passengers/km for BMC Commuter Rail Service. A test in Florida of the DMU power unit of a Colorado Railcar DMU power unit

hauling two coaches attained fuel efficiency of 0.4 liters/km, about a third of the fuel consumption of locomotive hauled passenger cars.



Map 1 Rail corridors into Burlington

Capital requirements Overall capital requirements for track investments, stations, DMUs, etc., outlined in Table 8 total $58.7 million. Only two small segments of track require substantial upgrade, the 3.2 km between Montpelier Jct. and the State House and 11 km between Burlington Union Station and Essex Jct. The 51 km Essex Jct.-Montpelier Jct. rail line investments completed in 2012 raised the rating to Class 4 enabling 130 km/h operation with signaling. Capital costs also include a share of Centralized Train Control (CTC) installation and crash preventing Positive Train Control (PTC) with the latter costs indeterminate currently. With new American standards for DMU equipment set in 2012 and little recent DMU manufacture to previous North American standards, the

Figure 1: BMC Commuter Rail Service--Peak a.m. and Mid-day Schedule

	Outbound				**Inbound**			
	a.m. peak			**mid-day**	**a.m. peak**			**mid-day**
Charlotte	5:47	6:27	7:12	11:37	7:08	8:07	8:52	1:41 pm
Shelburne	5:56	6:36	7:21	11:46	6:59	7:59	8:44	1:32
S. Burlington	6:07	6:47	7:30	11:55	6:49	7:49	8:34	1:22
	Leave				**Arrive**			
Burlington	**6:10**	**6:50**	**7:33**	**11:58**	**6:46**	**7:46**	**8:31**	**1:19**
Winooski	6:16	6:56	7:39	12:04	6:40	7:40	8:25	1:13
St. Michael's/ Fanny Allen	6:20	7:00	7:43	12:06	6:36	7:36	8:21	1:09
Essex Jct.	6:27	7:07	7:50	12:13	6:28	7:28	8:15	1:03 pm
IBM Tech. Park	6:31	7:11	7:54	12:17	6:23	7:23	8:10	12:58
Richmond	6:37	7:17	8:00	12:23	6:16	7:17	8:02	12:50
Bolton	6:45	7:25	8:08	12:31	6:08	7:08	7:53	12:41
Waterbury	6:56	7:36	8:19	12:42	5:57	6:57	7:42	12:32
	Arrive				**Leave**			
Montpelier State House	**7:15**	**7:55**	**8:38**	**1:02**	**5:40**	**6:40**	**7:21**	**2:15 pm**

Note: The balance of the workday schedule includes three peak p.m. trains in each direction.

acquisition cost by Denton County, TX acquisition of 11 DMU units in 2009 was used for estimating their cost.

Revenues and Operating The fare-box percentage estimate of 37% of the total cost of service (capital and annual costs) for BMC Commuter Rail Service Phase compares to about 33% for all national and Vermont public transit services. Fare-box recovery of train operating costs estimate is 60%. Estimated operating costs of $9.40/train km approximate national averages and those of Westside Express Service DMU service along a 24 km route near Portland, OR with its 1,700 passengers per day.

Source of capital financing and operating support The capital and operating costs for BMC Commuter Rail Service may cost less State dollars support than the $7 million State dollars budgeted for

Table 7: BMC Commuter Rail Service Capital Cost Estimates Summary: Track and Bridge, Stations, Rail-Highway Crossing Warning, Centralized Train Control and Rail Passenger Equipment (DMU)

Category	Cost Estimate $ (million)	
New Stations (7)	1.4	
Centralized traffic control (2/3 share)	3.3	
Track and bridge upgrades	8.0	
Rail-highway crossing upgrades	3.6	
Rail equipment maintenance facility	0.5	
Subtotal: Track and other physical improvements:		**16.8**
Rail equipment—five two-car DMU sets	36.6	
Contingency (10%)	5.3	
Total Capital Funding		**$58.7**

Notes: 1. Estimates (except as noted) based on past studies with inflation factors applied, and Vermont rail administrators with knowledge of rail infrastructure costs.
2. DMU sets cost based on 2009 Denton County, TX purchase.
3. A shared cost not included here, Positive Train Control for crash prevention, is a certain future requirement.

FY 2014 for the two Amtrak trains. Table 10 outlines a State and federal sharing of capital and operating support consistent with U.S. programs with base year State annual share of all costs $879,000. (Note motor vehicle travel receives large subsidies, for example, about 42% of all U.S. highway capital and maintenance expenditures paid for by mostly general funds and bonding [FHWA Series].)

Table 8: BMC Commuter Rail Service Annual Revenue and Costs Except Capital

	Revenue ($)	
Total Annual Passenger Revenue	**2,565,000**	
Revenue per train kilometer	5.24	
Annual Costs Except Capital		
Operating costs:		
Train Operating Costs:		
Stations	400,000	
Train Operations		
($8.08 per train kilometer)	2,460,000	
Subtotal:		**2,860,000**
Shuttles	250,000	
Administrative (including insurance)	1,150,000	
Total Annual Operating Costs		**4,260,000**
Annual Operating Cost Deficit		**$1,695,000**
Operating costs per train kilometer		**$9.40**
Annual cost support per passenger trip		**$3.05**
Annual cost support per passenger kilometer		**$0.062**
Passenger farebox percentage of total annual costs		**60%**

Notes: 1. Commuter rail average operation cost per revenue vehicle kilometer $9.32 (FTA 2011).
2. Revenue per passenger kilometer $0.093.

Conclusion This study finds BMC Commuter Rail service feasible in view of the projected 1,100 commuters daily, comparable to other low ridership U.S. systems. The service capital and operating cost estimates also track near national averages. The recent movement of Vermont workers away from car commuting, rapid growth of commuters on Link services since 2003, and Burlington demand management programing successes shifting car commuters to bus transit and other modes—all augur well for a successful commuter rail service for the Burlington Metropolitan Area.

Table 9: BMC Commuter Rail Service Support per Passenger Trip and per Passenger Kilometer

	Per Passenger Support ($)	
Support Category	Dollars per	
	Passenger Trip	Passenger Kilometer
Annual Costs		
Less Revenue	3.05	0.062
Capital (amortization)	4.65	0.093
Total support:	**7.70**	**0.155**

Note: Operating support per base 555,000 annual trips Table 3, and operating and capital outlined in Table 7 and 8.

Table 10: BMC Commuter Rail Service Estimated Total Annual Funding—State and Federal for Operations and Capital

	Annual Funding ($)		
	Federal Funds (80%)	State Funds (20%)	Total
Operating Support	1,356,000	339,000	1,695,000
Capital	2,160,000	540,000	2,700,000
Total	**3,516,000**	**879,000**	**4,395,000**

Note: Capital financing, $58.7.4 million, Table 7, amortized over 25 years at 3.0% interest. Federal funding is possible through a number of avenues with no more than a 20% State match.

References

Most Vermont rail studies available at the Chittenden Country Regional Planning Commission online library: http://www.ccrpcvt.org/studies/

American Public Transportation Association (APTA) (2013) 2013 public transportation fact book. *64th Edition* (APTA: Washington).

BRW et al (1996) Burlington area tri-center transit study final report. (Vermont Agency of Transportation (VAOT): Montpelier, VT).

Campus Area Transportation Management Association (CATMA) (2013) Data from CATMA periodic surveys of employee and student commuting patterns. (CATMA: Burlington, VT).

Chittenden County Transportation Authority (CCTA) (2014) Planning section provision of ridership data. Burlington, VT.

LS Transit Systems et al (1993) Vermont rail feasibility study. Final Report. (VAOT: Montpelier, VT).

Redington T (2013) An action outline for Vermont commuter rail passenger services along three corridors out of Burlington, Vermont. 64 p Unpublished paper by Tony Redington, Burlington, VT.

Redington T (1999) Impacts of the modern roundabout on North American traffic circulation, modal choice, sustainable development and land use. *Proceedings of the 34th Annual Conference Canadian Transportation Research Forum, pp 441-455* (CTRF: Woodstock, ON).

RL Banks and Associates (1991) Commuter rail feasibility study: final report. (VAOT: Montpelier, VT).

RL Banks et al (1999) Burlington-Essex passenger rail feasibility report and corridor analysis. (Vermont Agency of Transportation: Montpelier, VT).

Sivak M and Schoettle B (2011) Recent changes in age composition of drivers in 15 countries. P 2 UMTRI-2011-43 (University of Michigan Transportation Research Institute: Ann Arbor).

Skoropowski, E (1989) VermonTrain: A plan for cost-effective regional rail service in northern Vermont using diesel multiple unit [DMU] railcars. Unsolicited study submitted to the VAOT. (VAOT: Montpelier, VT).

U.S. Bureau of the Census (2014) American Community Survey (ACS). An interactive public data base providing annual/multi-year samples of demographic factors, including means of travel to work, reportable by town, county, state, and national. https://www.census.gov/acs/www/

U.S. Department of Transportation (USDOT) (2009) National household travel survey. (USDOT: Washington).

U.S. Federal Highway Administration (FHWA) (Series) Highway statistics. Series (FHWA: Washington). Web:

U.S. Federal Highway Administration (FHWA) (2013) Traffic volume trends November 2013. p 2 Series (FHWA: Washington). Web:

U.S. Federal Highway Administration (FHWA) (2001) Our Nation's Highways 2000 Table: average annual miles per driver by age group. PL-01-1042 (FHWA: Washington). https://www.fhwa.dot.gov/ohim/onh00/bar8.htm

U.S. Federal Highway Administration (FHWA) (2011) Summary of Travel Trends: 2009 National Household Transportation Survey. FHWA—PL-11-022 (FHWA: Washington). Web: http://nhts.ornl.gov/2009/pub/stt.pdf

U.S. Federal Transit Administration (FTA) (2006) Commuter rail safety study. p 3 (FTA: Washington).

U.S. Federal Transit Administration (FTA) (2011) National Transit Database (FTA:Washington). Web: http://www.ntdprogram.gov/ntdprogram/data.htm

Vermont Agency of Transportation (VAOT) (1992) Light rail transit in Burlington, Vermont: an analysis of viable routes and construction costs. Assisted by Pacific Transit Management Corporation (VAOT: Montpelier, VT).

Vermont Joint Fiscal Office (2003) Audit of Champlain Flyer commuter rail service. (Vermont Legislature: Montpelier, VT). Web: http://www.leg.state.vt.us/jfo/reports/Flyer%20Report%2002-2003.pdf

Vermont Statutes Annotated Volume 24 Section 4302 Vermont Planning and Development Goals (State of Vermont: Montpelier, VT).

Wikepedia (2014) U.S. commuter rail systems, Canada commuter rail systems.

Worthen, B (2003) Vermont passenger rail study: final draft. (Vermont Transportation Authority: Montpelier, VT).