Burlington/Essex
Passenger Rail Feasibility Study
And
Corridor Analysis

Final Study Report

Chittenden County
Metropolitan Planning Organization

Submitted By

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EXECUTIVE SUMMARY

Purpose and Introduction

The Chittenden County Metropolitan Planning Organization (CCMPO) engaged a team of consultants led by R.L. Banks & Associates, Inc., (RLBA) to assist CCMPO in determining the feasibility of passenger rail service in the Burlington-Essex corridor, assuming it operates as an extension of the Charlotte-Burlington passenger rail project. This report describes the analysis accomplished, as well as the consultant's conclusions and recommendations.

Background

The CCMPO initiated this study, in partnership with the Vermont Agency of Transportation, to understand the extent to which passenger rail service in the Burlington-Essex corridor would be feasible and help achieve the region's adopted transportation goals.

To gauge the feasibility of passenger train service, one must understand that there are several factors that directly drive whether that service will be successful. These include (in general descending order of relative importance):

- **On-time, dependable service**
- Affordable fare
- Easy access and connections to stations (by bus, car, bike or foot)
- Affordable parking
- Customer-friendly bus connections, minimizing waiting
- Shuttle bus service coordinated with train arrivals and departures
- Guaranteed taxi or bus ride if passenger must return at time when train not operating
- Adequate lighting and secure environment at stations
- Non-hassle ticketing, free transfer to/from bus
- A fare structure that rewards frequent use, e.g. $1 per ride, $10 monthly pass
- A comfortable, clean seat and smooth ride
- A clean passenger car, with clear windows
- Timely information when a train is late or cancelled
- Where practical, amenities at/near station (child care, newspapers, food, coffee, dry cleaning, etc.)
- On-board amenities (e.g., tray tables, electrical outlets, bike racks, food and drink)

If Chittenden County is to attain the regional transportation goals articulated in its 1997 Long Range Transportation Plan regarding accommodation of travel demand by public transportation, support of growth center-based development and attraction to transit of 6 percent of peak hour trips, the rider's expectations must be met by satisfying as many of the above factors as possible.

Study Approach

Two passenger rail service scenarios were devised to form the basis upon which Charlotte-Burlington-Essex corridor rail ridership was estimated:

1. An "All Day Service Scenario" would require four trainsets to provide service every 30 minutes, from 6 a.m. to 9 p.m., seven days a week (with a reduced level of service on weekends and holidays).

2. A "Moderate Service Scenario" would utilize two trainsets to provide hourly service only during the morning and evening peak traffic periods (three trains would depart Charlotte and Essex in the morning hours, and three trains would repeat that service in the afternoon peak traffic period), weekdays only.

Study Findings

The study classified its results and findings into several categories: Ridership Projections, Infrastructure Needs and Costs, Station Locations, Coordination with Existing Transportation System, Environmental Impacts, Institutional and Funding Issues, and Integration with Local, Regional and State Plans. In addition, the consultant provided a limited analysis and quantification of potential benefits of passenger rail service in the Burlington-Essex corridor.

Ridership Projections

The All Day Service Scenario results in an estimated 1,350 to 1,700 riders per day carried by the passenger rail service. The Moderate Service Scenario is projected to result in a range of 590 to 650 riders per day. The All Day Service Scenario represents an estimated four percent of travel demand in the corridor during the peak hour; the Moderate Service Scenario, about two percent. These percentages would comprise a significant step forward in meeting the goal of the Chittenden County Long Range Transportation Plan that transit capture six percent of the county's peak hour trips. At present, transit use constitutes only 0.6 percent of peak hour trips region-wide.

Additional estimates were made with regard to ridership if service were extended to Montpelier and St. Albans ("Extended Service Scenario").

Assuming hourly trains, on weekdays only, between 6 a.m. and 8 p.m., 1,700 to 2,000 riders (including those associated with the Charlotte-Burlington-Essex core service) would be attracted in this scenario. A one dollar per trip fare is assumed in all scenarios.

Infrastructure Needs and Costs

A significant level of capital investment would be required in the Burlington-Essex corridor to allow passenger train speeds of 60 miles per hour maximum and to provide the reliable service upon which riders would insist. Maximum train speed is now only 10 to 15 miles per hour (significantly slower than between Charlotte and Burlington); to achieve auto-competitive passenger train schedules and to avoid conflicts with wood chip trains to Burlington Electric, improvements estimated at $23 million (Moderate Service Scenario) to $37 million (All Day Service Scenario) are required between Burlington and Essex.

Station Locations

Station sites are recommended at:

Burlington Union Station,
Intervale (Potential Future Station),
Winooski,
Fanny Allen,
Fairgrounds (Potential Future Station),
Essex Junction, and
Essex Park and Ride.

Coordination with Existing Transportation System

In order to maximize ridership, the passenger train service would be fully integrated into and coordinated with the region's transportation system, in particular bus service. The existing line haul bus routes that would compete with the new rail would have to be reconfigured as feeder service that would carry passengers to and from train stations. Convenient automobile access to and affordable parking at stations is strongly recommended.

Environmental Impacts

Environmental resources were identified along the project corridor, along with the potential permitting or documentation necessary for implementation of passenger rail. Sensitive resources identified include several Class Two wetlands, a state-listed endangered species, and an active hazardous waste site. Delineation of the boundaries of these sites would likely be necessary as part of the permitting process, and final design plans would be developed to limit impacts to these and all resources within the project area.

Institutional and Funding Issues

Various institutional arrangements are required to implement a new passenger rail service. The roles of owner, manager, and operator relate to the opportunities and responsibilities associated with the complex passenger rail service business. It is possible, and common, for one entity to fill two or even all three of these roles. It will be essential for an owner/manager/operator agreement to be solidified well in advance of proceeding toward service implementation. In addition, further consideration of a new multi-modal regional transportation organization is warranted. Such an organization would provide the unity of effort highly important in integrating regional transportation to provide the most efficient and convenient system possible for the region's residents.

Closely tied to the institutional arrangement is project funding. Determining where and how funds for capital and operating needs would be generated cannot be divorced from the institutional questions examined in the CCMPO's recent "Transit System Analysis". Capital funding is probably more readily available through various sources, primarily federal, than are long-term operating funds. Federal sources for operating funds have become increasingly scarce over the years, thus underscoring the need to seriously assess and consider the availability and sustainability of local and state operating funding sources in the long-term.

Integration with Local, Regional and State Plans

It is important to judge feasibility of passenger rail service in the context of current and projected transportation conditions as well as local, regional and state transportation plans and objectives. Current local and regional plans show a 60 percent increase in traffic by year 2013 in the regional core. They show traffic conditions deteriorating to "gridlock" by year 2005. Currently there is very low transit usage (0.6 percent) in the region. Plans call for almost no highway expansion.

The options are to do nothing, invest in transit and/or passenger rail, or build more highways.

If nothing is done, "gridlock" will occur at the most congested intersections by 2005, travel times will increase, motorists will pay more to travel to their destinations, air quality and energy usage will suffer, and the region will experience long-term problems concerning the area's attractiveness. Addition of passenger rail would use an existing and underutilized right of way, adding travel capacity; could combine with existing bus transit to provide a more effective public transportation system; would provide land use development opportunities around stations; and would be complementary to existing land use and growth patterns. The highway option is the most expensive, would require displacements/right of way takings, would encourage sprawl, and would change the region's character.

Thus a major question facing Chittenden County is, What do we want our community to look like over the next 50 years?

The prospective passenger rail service is found to support regional and state plans, including the Chittenden County Long Range Transportation Plan and Vermont's Long Range Transportation Plan. In particular, passenger rail service would: (1) boost the region toward achieving its specific goal of attracting 6 percent of peak hour trips to transit, and in accommodating travel demand by public transportation, and (2) support growth center-based development, specifically in Burlington, Winooski and Essex Junction. With the proper level of resource and public policy support, a passenger rail system can reduce highway congestion, improve air quality and provide other benefits including the option to use rail in the future when growth adds still more vehicles to the highway system. Clearly, the community sees no other alternative to the growing transportation problem—considering the growing demand for transportation services--which would not destroy the character of the communities. The rail corridor is considered essential to the continued growth and economic vitality of the metropolitan area.

Quantification of Potential Benefits

The introduction of passenger rail service between Burlington and Essex will generate both costs and benefits, borne and received by a diverse set of persons and entities. Whether the prospective benefits appear sufficient to justify the costs will depend in large measure on the breadth of the view taken, with the balance shifting along a spectrum that extends from the short term and strictly financial to the longer term and encompassing a wider panorama of socioeconomic, environmental and public interests. The feasibility and ultimate success of a system such as that proposed lies as much in its planning as with its execution. Without strong and continuing community commitment to the system and a willingness to provide a "critical investment mass" of service features, the likelihood of drawing visible benefits in excess of costs is extremely low.

Potential benefits analyzed include land use impacts, environmental benefits, avoided cost of automobile operations, savings in congestion costs, and improved safety. For the Burlington-Essex rail service, annual automobile ownership, congestion cost, and safety benefits could range from $2.3 million (All Day Service Scenario) to $1.1 million (Moderate Service Scenario). One-time land use benefits could range from $10.9 million (All Day Service Scenario) to $4.4 million (Moderate Service Scenario). The one-time land use benefits are not additive to the annual benefits, as certain double-counting is implied. Further, because there are additional land use and other environmental benefits that have not been quantified, these projections are considered only partial.

Conclusion

The passenger rail project is feasible technically; that is, it is practical to implement from engineering and operational points of view. Economically, passenger rail service is deemed to be feasible provided that it receives strong and committed long-term financial support from both public (federal, state and local levels) and private sectors.

The local property tax base is not sufficient to fund expansion of bus service, much less the implementation of a new passenger rail system. One or more new, dedicated funding sources are required if Chittenden County public transportation is to attain the goal and objectives set for it in county and state transportation plans.

The benefits of this project would provide substance to the region's and state's long range plans and goals. In particular, passenger rail supports:

- Attracting 6 percent of peak hour trips to transit,
- The growth center-based land use development desired by the community,
- Community preservation,
- Strategic investment focused on major transportation corridors, and
- Sensitivity to Vermont's character.

CHAPTER 1

RIDERSHIP PROJECTIONS

Introduction

This chapter provides a description of the methods used to estimate ridership, and the resulting ridership projections, for a passenger rail service proposed in Chittenden County, Vermont. In addition to Core Service connecting Charlotte-Burlington-Essex in Chittenden County, ridership has been analyzed for Extended Service, which expands the Core Service to include stations in Washington and Franklin Counties.

For both Core Service and Extended Service, this report addresses:

Description of the service
Approach to estimating ridership
Ridership estimates

Passenger ridership estimates have been produced to indicate projected hourly and daily ridership on a weekday, as well as annual estimates for 1999 and 2009.

Core Passenger Rail Service
Service Description

Map 1 shows the alignment of the proposed passenger rail system within Chittenden County. In 1995, a Major Investment Study analyzed the impacts of establishing passenger service between Charlotte and Burlington, operating on track owned by the State of Vermont and leased to the Vermont Railway, Inc. The passenger rail service that is the subject of this feasibility study would extend the Charlotte-Burlington service to Essex, operating on track owned by the New England Central Railroad.

The two components would operate as one core passenger rail service connecting Charlotte with Essex. Thus, this feasibility analysis presumes a coordinated passenger rail system serving travel between all station pairs. This feasibility study considers two service scenarios within this Core Service. These service scenarios are referred to as "All Day" and "Moderate". Table 1 lists the station stops selected for each service scenario.

MAP 1
PROPOSED PASSENGER RAIL SYSTEM

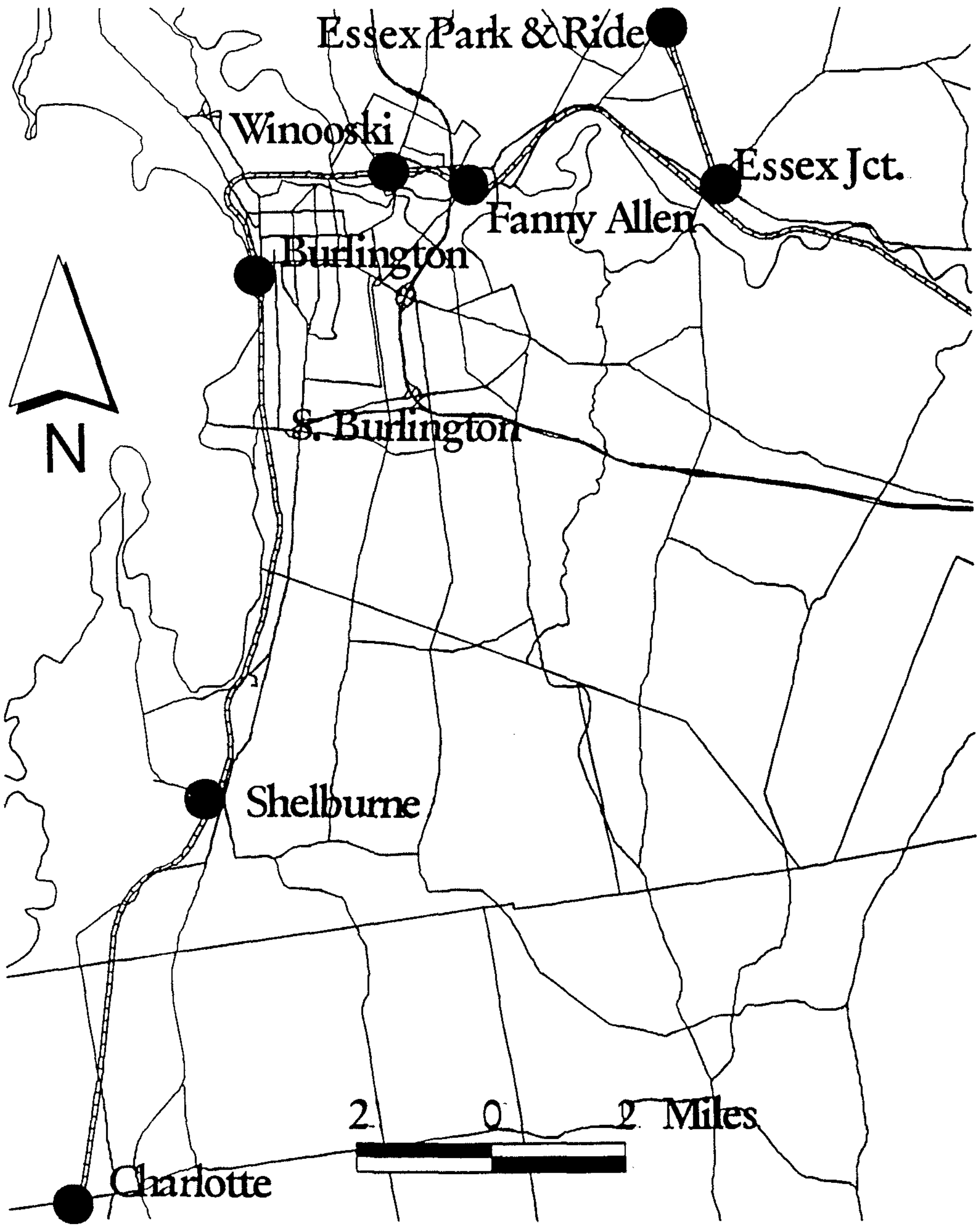


Table 1

Station Stops

Moderate Service	All Day Service
Charlotte	Charlotte
Shelburne	Shelburne
South Burlington	South Burlington
Burlington	Burlington
Winooski	Winooski
Essex Junction	Fanny Allen
Essex Park & Ride	Essex Junction
	Essex Park & Ride

Other station stops were evaluated and are discussed in Chapter 4. For example, Woodside was also selected and analyzed, but rejected as a station stop because of low ridership. Map 1 shows the 8 station stops which were deemed to have sufficient weekday ridership to be served upon implementation of All Day Service.

Table 2 describes other important service parameters of the two service scenarios.

Table 2

Key Service Parameters

Service Parameter	Moderate Service	All Day Service
Fare	$1.00	$1.00
Headway	1 Hour	30 Minutes
Hours of Operation	6 AM – 9 AM, 3 PM – 6 PM	6 AM – 9 PM
End-to-End Rail Travel Time (including dwells)	42 Minutes	44 Minutes
Weekend Service	No	Yes, 9 AM – 4 PM, 1 Hour Headway
Station Stops	7	8

The assumption in both scenarios is that the headway corresponds to travel in both directions. Under the Moderate Service Scenario, one train per hour would depart each end station, Charlotte and Essex Park and Ride. In the All

Day Service Scenario, one train would depart each end station every 30 minutes.

These assumptions were used explicitly in a travel demand model for the purpose of estimating ridership.

Approach to Estimating Ridership

Resource Systems Group (RSG) developed the Chittenden County Travel Demand Model for the Chittenden County Metropolitan Planning Organization (MPO). Successive Travel Demand Models of the region have been developed in 1989, 1993 and most recently in 1998. In 1993, RSG used the model to estimate Charlotte-Burlington rail ridership.

The model used in this study represents 1998 land use and travel conditions. Travel demand is determined in part by a household trip diary survey conducted by RSG during 1998. A total of 428 households completed daily trip diaries that provide a complete record of their weekday trip-making. This information provided the database from which trip generation, by household and trip type, could be estimated statistically. Further, the trip diary database is used to estimate trip lengths for different trip types, i.e., work and non-work trips.

Updated land use information is also important to this feasibility study as it provides the most accurate estimates of housing and job density in areas proximate to proposed rail stations. This is critical in helping to determine overall feasibility in that higher densities enable a greater amount of pedestrian access to rail stations. Generally, a potential rail trip with pedestrian access on both ends (i.e., walk to the rail station from the point of origin, and walk from the rail station to the ultimate destination) provides the most competitive travel niche for the rail mode choice.

In this analysis of ridership, all modes of access to rail are considered, including:

Walk Access
Bus Access
Park and Ride
Kiss and Ride (drop off)

Estimation of ridership assumes adequate parking for park and ride trips at proposed station sites. Demand for parking will vary by station. Stations at Charlotte, Shelburne, South Burlington, Winooski and Fanny Allen each should provide between 15 and 30 parking spaces. At Burlington and Essex Junction, a more detailed parking analysis (in the preliminary engineering phase) should account for shared parking opportunities created from the mixed use areas in which those stations are located.

Also, the ridership analysis assumes that existing Chittenden County Transportation Authority (CCTA) routes can adequately serve the proposed station sites. In most cases, this will not mean any substantial change in either routing or schedule. For example, the College Street shuttle serves Burlington's Union Station. Similarly, both the Riverside and Essex Routes operate within one block of the proposed Winooski station site while the Essex route currently serves the Amtrak station in Essex Junction.

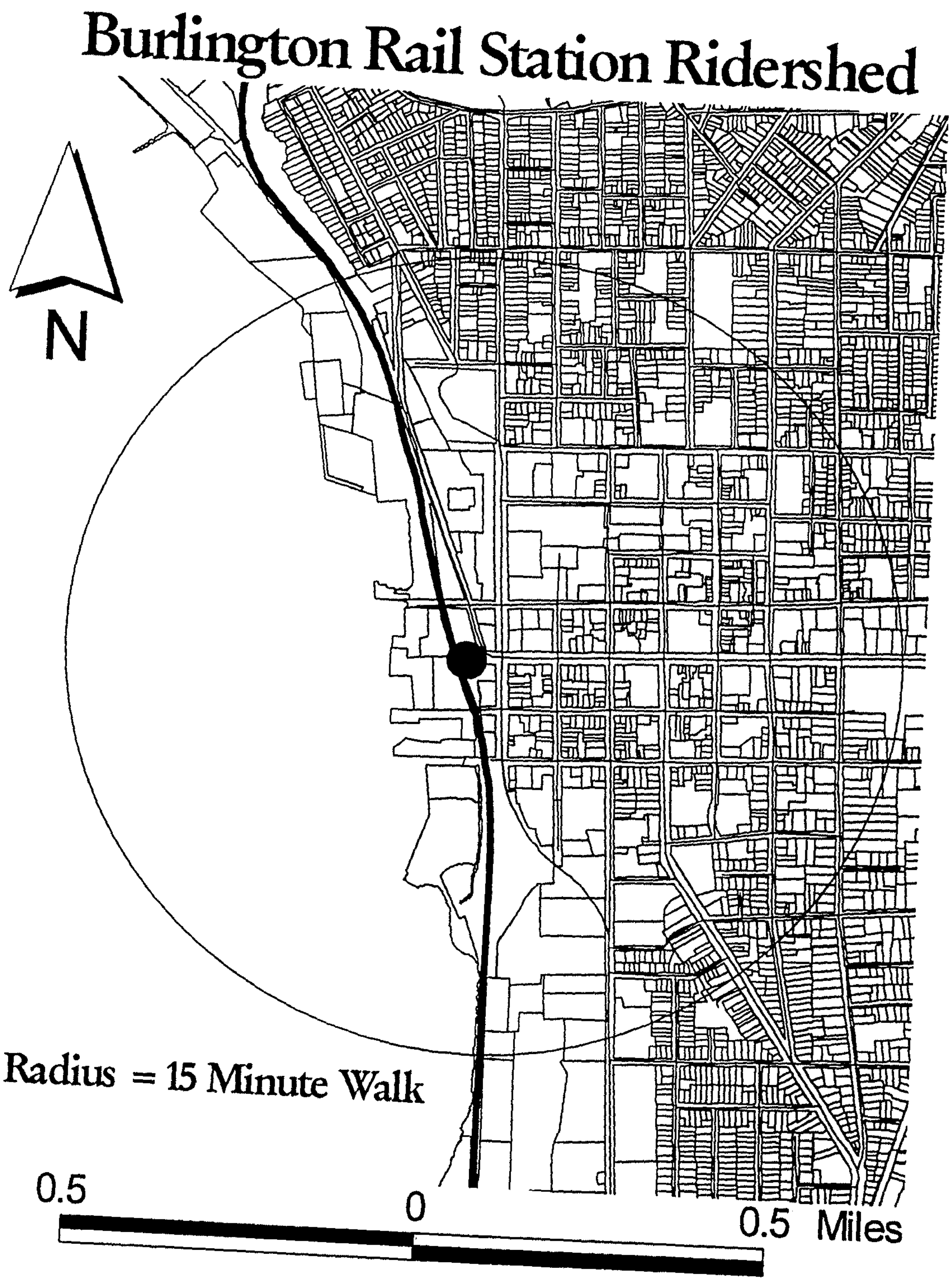
At the Charlotte station, no feeder bus service is assumed. In this case, the majority of projected rail users are park and ride customers. In the case of South Burlington, no definitive station site has been determined. The logical station locations are within a 10-minute walk from Shelburne Road, which is served by the South End/Shelburne CCTA route.

Major employers in the region, most notably IBM, University of Vermont (UVM), and Fletcher Allen Health Care, are assumed to have shuttle bus access to their respective rail stations. In the case of IBM, direct shuttle access to the plant from the Amtrak station is assumed. In the case of UVM and Fletcher Allen Health Care, the College Street shuttle is presumed to serve these sites directly.

Prior to implementation of any passenger rail service, it is of critical importance to coordinate it will other transportation modes. This is especially true of bus and feeder bus/van services, which should provide convenient and easy transfer between bus and rail.

Rail is most competitive when it can serve as the trunk line mode for a trip consisting of walk access on either end. Maps 2 through 4 show the areas within Burlington, Winooski and Essex Junction, respectively, that can be considered within reasonable walking distance of proposed rail stations. In the case of rail, a "reasonable" walking distance is the distance traversed in 15 minutes, walking at a comfortable speed of 2 mph. This equates to ½ mile. Maps 2 through 4 are provided to give an idea of the land use densities within a reasonable radius of each proposed station site in Burlington, Winooski, and Essex Junction. No hard and fast rule for determining walking distance is employed in this analysis. For example, it is customary to assume a maximum ¼ mile walking distance to a rail station. This is a rule of thumb that has been observed in other commuter rail networks. The quantitative approach to estimating ridership in this study is largely based on a shortest path algorithm, where every possible means of making a specific trip is compared with each

MAP 2


Burlington Rail Station Ridershed
N
Radius = 15 Minute Walk
0.5
0
0.5 Miles

MAP 3

Winooski Rail Station Ridershed

MAP 4


Essex Junction Rail Station Ridershed
N
Radius = 15 Minute Walk
0.5
0
0.5 Miles

other, and the least cost means (in terms of cost and time) is selected. What this means is that there will be instances where people, who begin their trip within a 15 minute walk of a rail station, will access a rail station by bus or car. Similarly, there will be instances of people walking to a rail station who begin at a point more than 15 minutes distant. The approach employed tests for all possible means of successfully completing the trip, accounting for the geographic reach of the bus and rail transit network.

Areas within the 15 minute walking radius of the Burlington, Winooski, and Essex Junction stations encompass a number of households and jobs, as shown in Table 3.

Table 3
Households and Jobs Located within a 15-Minute Walk of Proposed Rail Stations in Burlington, Winooski and Essex Junction

Station	Estimated # of Households	Estimated # of Jobs
Burlington	3,100	5,400
Winooski	2,400	2,300
Essex Junction	900	800
Total	6,400	8,500

The travel demand model translates geographically located land use information (i.e., households by type of household, jobs by type of job) into trip making. Trips are initially calculated as person trips and are then split into "modal" trips by a mode split model. The Chittenden County Travel Demand Model includes a mode split model estimated from blended stated preference and revealed preference data collected in Chittenden County in 1993. The mode split model determines what portion of the travel market uses auto (drive alone), carpool, bus, walk/bike, or rail. A person trip table from the 325-zone regional model is run through the mode split model, with the output being mode-specific person trip tables. In this way the model produces ridership estimates on each rail segment and every station pair.

Key independent variables of the mode split model are shown in Table 4 (showing sample data only) and include travel time, cost relative to income and frequency of service. Travel time for all modes includes terminal times of 1 – 5 minutes, depending on the zone. Rail travel times include access and egress times which, in turn, are based upon the mode of access to the rail station. Access to proposed stations includes walk, bus, and auto.

Table 4
Factors Determining Mode Split in the Chittenden Mode Split Model
(sample data)

	Auto	Carpool	Walk/Bicycle	Bus	Rail
Travel Time (min.)	30	34	0	35	30
Travel Cost (cents)	100	50	0	100	100
Headway (min.)				30	30
Walk/Bicycle Time (min.)			N/A		
Income (1,000$)	39	39	39	39	39
Average Size		2.2			

The Chittenden County Travel Demand Model models AM and PM peak travel periods. Travel for times outside of model periods is accomplished through scaling the AM and PM peak hour ridership results by factors obtained from trip diary surveys in Chittenden County. These surveys reveal the amount of travel occurring on an hourly basis throughout a normal workday.

As part of this feasibility study, a separate market research effort was initiated, which involved a phone survey of 400 residents in Burlington, Winooski, and Essex Junction. This market research survey yielded additional preference data pertaining to fare and frequency sensitivity. The results of this survey largely support the analysis of the 1993 stated preference data discussed above.

One area where the market research indicated a departure from the earlier stated preference data was in the area of non-work travel. The 1999 market research effort indicated a significantly greater propensity to use the proposed rail service for non-work travel than was earlier estimated in the 1993 data. Generally, rail is more suited to serve work trips than non-work trips because of the relatively fixed times of arrivals and departures. In addition, people usually work in only one location, whereas there are multiple destinations serving non-work trips--shopping, eating, library, medical, entertainment, etc. For this reason, most passenger rail systems have evolved to serve primarily work-related trips.

The 1998 market research data indicate a willingness to use rail for non-work trips that is approximately twice the magnitude exhibited in the 1993 data. For this reason, a set of ridership range estimates has been developed. The low range reflects the non-work trip propensity estimated in the 1993 data, while the high range reflects the non-work trip propensity estimated in the 1999 data.

The All Day Service Scenario assumes reduced weekend and holiday service operating on 1-hour headways between 9 AM and 4 PM. This service generates additional ridership amounting to approximately 10 percent of the average weekday ridership for the All Day Service Scenario, based on ridership data obtained from other passenger rail services.

Projections of ridership to 2009 have been performed as well, based upon projected travel growth in the region from data produced by the Vermont Agency of Transportation. These data include vehicular traffic based on Continuous Traffic Counter statistical regressions and upon demographic projections in the State's Long Range Transportation Plan.

The ridership estimates reflect a core of patronage and exclude consideration of tourism, induced ridership (riders who would not have traveled absent the rail service) or ridership to/from special events.

Passenger Ridership Estimates for the Core Service

Passenger ridership estimates can be expressed in a number of ways. In this report, ridership estimates are provided in the following format for both Moderate and All Day Service Scenarios:

Hourly boardings (average weekday)
Daily boardings by station (average weekday)
Station-to-station daily boardings (average weekday)
1999 annual and 2009 annual boardings

Ridership Estimates for the Moderate Service Scenario

Figure 1 shows the estimated hourly boardings for the Moderate Service Scenario. As mentioned, this service operates on one-hour headways, a total of 6 hours per day, during two 3-hour periods bracketing the AM and PM commuting periods.

Figure 1

Hourly Boardings, 1999 Average Weekday, Moderate Service Scenario

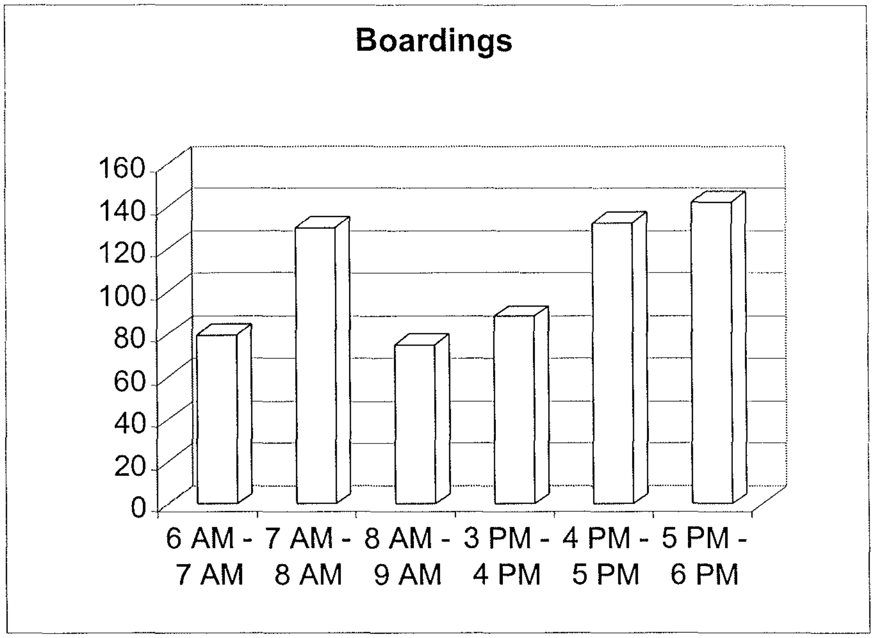


Figure 1 shows a maximum hourly ridership of 120-140 passengers, with the 5-6 PM slot claiming the highest passenger total. Ridership during AM peak hours is more focused, corresponding to tighter arrival time requirements.

Over the course of a normal weekday, each of the 7 stations in the Moderate Service Scenario contributes a number of boardings, as shown in Table 5.

Table 5
Estimated 1999 Average Weekday Daily Station Boardings, Moderate Service Scenario[1]

	Low Range	High Range
Charlotte	60	60
Shelburne	60	70
South Burlington	80	90
Burlington	210	230
Winooski	70	80
Essex Junction	100	110
Essex Park & Ride	10	10
Total	590	650

Tables 6 and 7 show ridership estimates of daily station-to-station travel for the Moderate Service Scenario. The estimates are for 1999 and 2009, respectively and reflect high range non-work rail travel assumptions.

Table 6
Estimated 1999 High Range Station-to-Station Average Weekday Daily Station Boardings, Moderate Service Scenario

	Charlotte	Shelburne	South Burlington	Burlington	Winooski	Essex Junction	Essex Park & Ride	Total Arrivals
Charlotte	0	15	15	24	0	4	1	60
Shelburne	10	0	14	38	3	5	1	71
South Burlington	21	13	0	43	2	9	2	90
Burlington	21	30	51	0	44	78	7	230
Winooski	0	2	3	42	0	34	2	83
Essex Junction	5	5	23	48	23	0	0	105
Essex Park & Ride	0	1	2	4	2	0	0	9
Total Departures	58	66	107	202	75	129	13	649

[1] Some ranges do not appear different due to rounding.

Table 7
Estimated 2009 High Range Station-to-Station Average Weekday Daily Station Boardings, Moderate Service Scenario

	Charlotte	Shelburne	South Burlington	Burlington	Winooski	Essex Junction	Essex Park & Ride	Total Arrivals
Charlotte	0	18	18	28	0	5	1	69
Shelburne	12	0	16	43	3	6	1	81
South Burlington	24	15	0	50	3	10	2	104
Burlington	24	34	58	0	50	89	8	263
Winooski	0	3	3	48	0	39	2	94
Essex Junction	6	6	26	56	27	0	0	121
Essex Park & Ride	0	1	2	5	2	0	0	11
Total Departures	66	75	123	230	85	148	14	742

Table 8 shows the estimated 1999 and 2009 annual station boardings for the Moderate Service Scenario.

Table 8
Estimated 1999 and 2009 Annual Station Boardings, Moderate Service Scenario

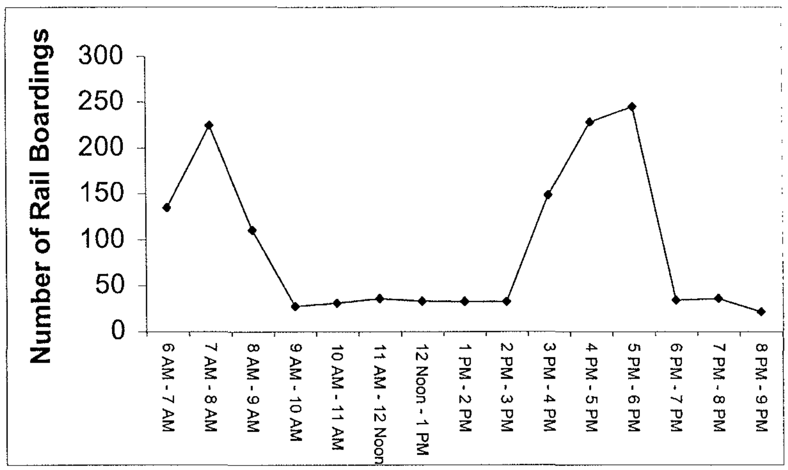
	1999		2009	
	Low	High	Low	High
Charlotte	14,800	15,700	17,800	18,300
Shelburne	16,600	18,500	18,900	19,900
South Burlington	21,900	23,600	25,400	26,500
Burlington	55,100	60,100	58,100	60,900
Winooski	17,800	19,600	19,300	20,500
Essex Junction	27,300	29,100	33,200	34,300
Essex Park & Ride	2,400	2,400	3,400	3,400
Total	155,900	169,000	176,100	183,800

The Moderate Service Scenario is estimated to generate from 155,000 to 169,000 annual passengers were it to be operating in 1999. By the year 2009, based upon estimated travel growth rates in each corridor, the total annual ridership is estimated to range from 176,000 to 184,000 passengers.

Ridership Estimates for the All Day Service Scenario

The All Day Service Scenario, designed to maximize ridership, is high frequency service (30 minute headways) offered from 6 AM to 9 PM on weekdays. In addition, the All Day Service Scenario featurs reduced weekend/holiday service, operating at one hour headways from 9 AM to 4 PM. Figure 2 shows an hourly ridership profile for the All Day Service Scenario, for a typical 1999 weekday.

Figure 2
Estimated 1999 Hourly Weekday Boardings,
All Day Service Scenario



The All Day Service Scenario has more than double the estimated patronage of the Moderate Service Scenario for the hours when both operate (6 AM – 9 AM, 3 PM - 6 PM). Higher frequencies are the main reason for better performance. Midday usage of the train declines owing to two main reasons. First, overall travel outside the peak hours is often 50% or less of travel during peak periods. Second, most travel during off peak periods is non-work-related. As discussed earlier, rail tends to be less competitive with the automobile for this type of travel.

Over the course of a normal weekday, each of the 8 stations in the All Day Service Scenario contributes a number of boardings as shown in Table 9.

Table 9

Estimated 1999 Average Weekday Daily Station Boardings, All Day Service Scenario[2]

	Low Range	High Range
Charlotte	70	80
Shelburne	110	140
South Burlington	180	230
Burlington	430	560
Winooski	210	260
Fanny Allen	90	100
Woodside	negligible	10
Essex Junction	240	300
Essex Park & Ride	20	20
Total	1,350	1,700

Tables 10 and 11 show ridership estimates of daily station-to-station travel for the All Day Service Scenario in 1999 and 2009, respectively. The estimates reflect the high range non-work rail travel assumptions.

Table 10

Estimated 1999 High Range Station-to-Station Average Weekday Daily Station Boardings, All Day Service Scenario[3]

	Charlotte	Shelburne	South Burlington	Burlington	Winooski	Essex Junction	Essex Park & Ride	Total Arrivals
Charlotte	0	12	20	40	2	2	1	76
Shelburne	13	0	19	80	10	16	2	139
South Burlington	25	20	0	81	44	59	4	233
Burlington	49	84	69	0	140	206	13	562
Winooski	3	9	47	130	0	63	4	255
Essex Junction	3	7	46	170	68	0	0	294
Essex Park & Ride	0	1	3	8	4	0	0	17
Total Departures	93	133	204	508	268	346	23	1,576

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2 One range does not appear different due to rounding.

3 The Woodside and Fanny Allen stations are shown neither in this nor the next table. Ridership estimates are negligible to small such that there is a high uncertainty associated with any station pair including either of these stations as an origin or destination. Of the two stations, Fanny Allen holds the greater promise of generating rail ridership.

Table 11
Estimated 2009 High Range Station-to-Station Average Weekday Daily Station Boardings, All Day Service Scenario

	Charlotte	Shelburne	South Burlington	Burlington	Winooski	Essex Junction	Essex Park & Ride	Total Arrivals
Charlotte	0	13	23	45	2	2	1	86
Shelburne	15	0	22	91	12	18	2	159
South Burlington	28	23	0	94	52	69	4	271
Burlington	56	96	81	0	160	238	15	646
Winooski	3	11	55	149	0	73	4	295
Essex Junction	3	8	54	197	78	0	0	340
Essex Park & Ride	0	1	3	10	5	0	0	19
Total Departures	105	152	238	585	309	401	27	1,817

Table 12 shows the estimated 1999 and 2009 annual station boardings for the All Day Service Scenario.

Table 12
Estimated 1999 and 2009 Annual Station Boardings, All Day Service Scenario

	1999		2009	
	Low	High	Low	High
Charlotte	17,700	20,700	23,500	25,300
Shelburne	29,900	37,800	44,700	49,300
South Burlington	47,500	62,500	62,300	71,200
Burlington	117,900	150,600	138,600	157,800
Winooski	55,800	69,500	77,800	85,000
Essex Junction	64,700	80,700	93,900	103,300
Essex Park & Ride	4,100	4,500	6,500	6,700
Total	337,600	426,300	446,700	498,600

The All Day Service Scenario is estimated to generate from 337,000 to 426,000 annual passengers were it to be operating in 1999. By the year 2009, based upon estimated travel growth rates in each corridor, the total annual ridership is estimated to range from 446,000 to 498,000 passengers.

Extended Passenger Rail Service

Service Description

The Extended Passenger Rail Service is assumed to operate with station stops in Montpelier, Waterbury, Richmond, Milton and St. Albans. At Essex Junction, the Extended Service would connect with the Core Service. Map 5 shows station stops assumed in the Extended Service.

The Extended Service Scenario assumes one hour headways operating on the legs outside the Core Service. Fares are assumed to be $1.00. Rail travel times have been estimated from the Amtrak Vermonter schedule, which has an average operating speed of 40 mph. No weekend service is assumed.

Approach to Estimating Ridership for the Extended Service

The approach to estimating ridership for Extended Service mirrors that employed in the Core Service. The analysis requires:

an estimate of commuter and non-commuter travel between areas served by rail stations, and
an ability to compete relevant modes against one another such that each can claim a share of the estimated travel market.

The combination of these two factors leads to an estimate of ridership for the proposed rail service.

The process of forecasting contains inherent uncertainties. To minimize these, a variety of approaches and data sets have been used to develop confidence in the final estimate provided here.

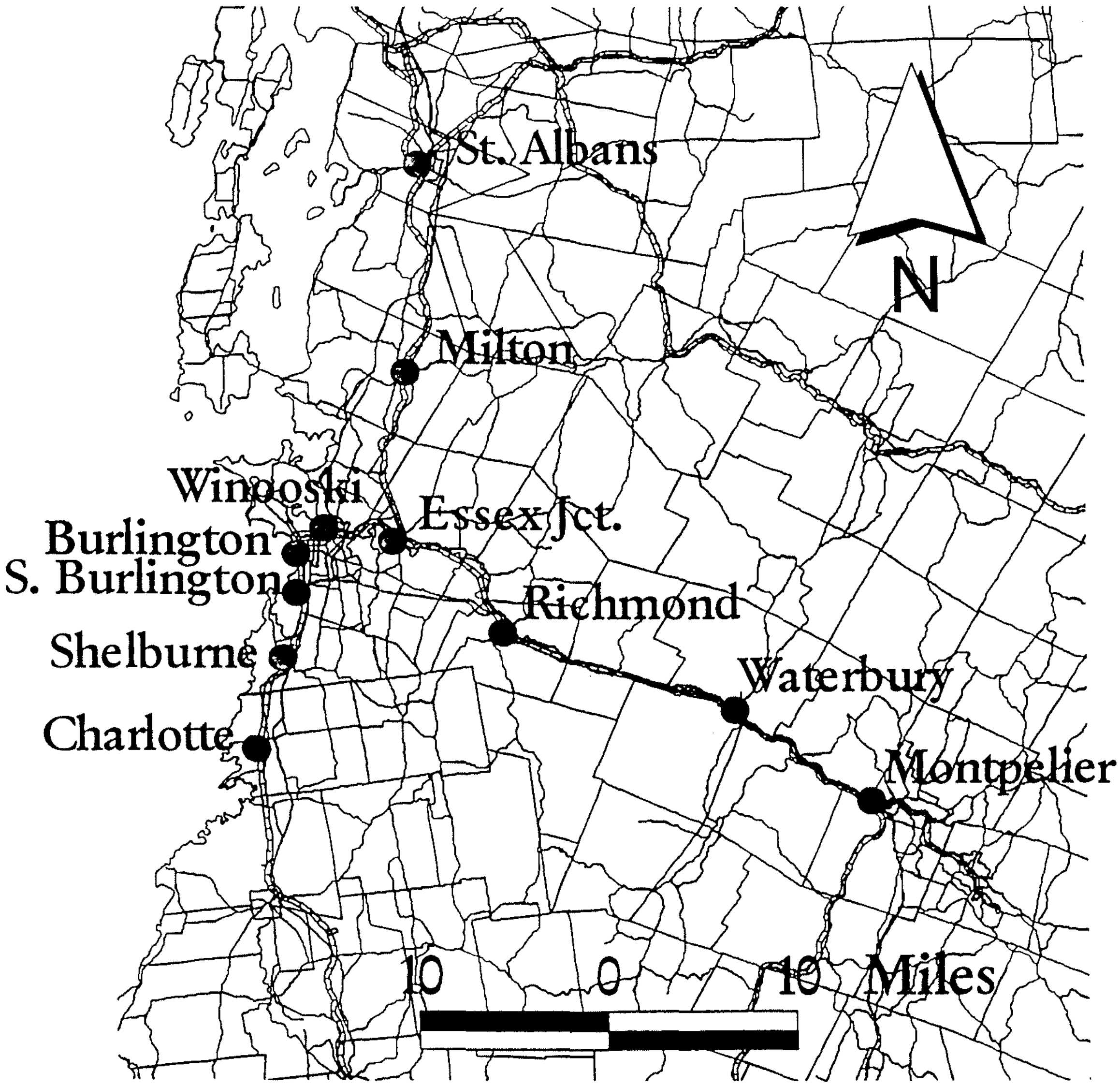
Data Sources

As mentioned above, this analysis begins with an estimate of daily and peak hour travel between areas served by station pairs. Two sources are used in estimating travel demand, namely:

Vermont Statewide Travel Demand Model
Census Transportation Planning Package (for estimating work trips)

The Vermont Statewide Travel Demand Model provides base year (1994) and future year (2015) person flows between Transportation Analysis Zones (TAZs). The TAZs are geographic collections of households and jobs, and are coterminous with town boundaries. Using this data source, a "station shed"

MAP 5
PASSENGER RAIL SYSTEM



trip table is developed. Included within each station shed are all municipalities that border on the municipality which is home to the rail station. Thus, for the Montpelier station shed, this means that total person trips originating in and destined for Montpelier, East Montpelier, Barre, Berlin, and Middlesex will be accumulated within the trip table. The 1994 trip table from the Vermont Statewide Model has been scaled to the base year, 1999, using a 1.0% annual growth rate.[4]

The trip table from the Vermont Statewide Travel Demand Model provides an estimate of person flow for all trip purposes, including work and non-work trips, between station sheds for the years of interest.

The Census Transportation Planning Package (CTPP) provides another trip table, but is focussed on work trips only. The CTPP data is based upon the 1990 Census long form, and includes Journey to Work data. These data are summarized on a municipality-to-municipality basis. The CTPP work trip data have been expanded to the base year using a 1.0% annual growth rate. The end result of using this data set is a person trip table between station sheds, for work trips only. These data are used to validate the work trip table acquired from the Vermont Statewide Model.

Estimation Techniques

Total travel demand derived from sources described above needs to be put into the various modes of travel. This process is called mode split. Mode split determines which share of the travel market is claimed by which modes. Several mode split models that include rail as a mode in competition with auto and intercity bus have been developed. Three of these models are applicable to rail extensions to Franklin and Washington Counties:

Chittenden County Mode Split Model
Georgia Statewide Intercity Model
Amtrak Vermont Model

Each model has strengths and weaknesses. Hence, it is important to treat them with due care and professional judgment in evaluating results.

The Chittenden Model was derived using stated and revealed preference data collected from 419 Chittenden County residents in 1993. Thus, it is a

[4] Initially it was assumed that the 1999 trip table would be estimated through interpolating between the 1994 and 2015 trip tables. However, several inconsistencies in these data sets, most of which involve significant decreases in volumes from 1994 to 2015, led to the conclusion that applying a simple growth factor would be a better approach.

relatively recent data set from a population that can be considered reflective of the larger population considered in this analysis. The Chittenden Model tests for auto, carpool, walk/bike, bus, and rail modes, using inputs displayed in Table 4.

The Chittenden Model features both work and non-work structures. It is more applicable to shorter trips since that was the context in which the stated preference data, upon which it is based, were collected. It will, however, provide one bound for determining the share of the travel demand market claimed by the proposed rail service.

The Georgia Statewide Model was estimated by RSG as part of the Georgia Intercity Rail Plan. This model includes many of the same variables as the Chittenden Model and was based upon stated preference data collected in 1995 in the State of Georgia. In addition to auto, rail, and bus, the Georgia model includes an air mode. This mode was eliminated in this analysis, with the resulting shares split among the remaining modes: rail, auto and bus.

The Georgia model includes business and non-business trip structures. In addition to travel time, travel distance was found to be a significant variable. Thus, travel distances between station sheds were derived as inputs to this model.

The Georgia model is more applicable to distances longer than those traveled within Vermont. Thus, it provides another outer bound when compared with the Chittenden Model.

RSG developed a statistical regression model for estimating ridership on Vermont's two Amtrak services, the Vermonter and Ethan Allen Express. This model effectively combines an estimate of the travel market and mode split into one model. The travel market is estimated based on a Total Demand Model and modified by local market data. Local market data includes household income and population data and also indicators of tourism (e.g., rooms and meals tax receipts). Consideration of competing modes is also included.

A final variable is added to this model, which accounts for whether the rail station is located in a downtown setting from which several relevant destinations can be arrived at by walking. This type of variable would treat St. Albans, where the rail station is directly within the central business district (CBD), differently from Montpelier, where the rail station is a significant distance from the CBD.

The key assumptions of this analysis pertain to the service characteristics of each mode competing for trips. For auto trips, total travel outside of

Chittenden County is estimated using the Vermont Statewide model travel time matrix. For bus trips, travel times 10 percent longer than the competing auto trips are assumed. To this 10 percent factor is added a minimum of 5 minutes each on the origin and destination ends to reflect terminal times.

The rail trip will consist of a primary segment traversed at 40 mph (the average Amtrak speed over the Vermonter line), plus any additional time as taken from the illustrative scenarios prepared for portions of the rail trip within Chittenden County (e.g., for the Charlotte-Burlington-Essex rail corridor). As with bus, a time penalty is added on both ends of the primary segment.

Passenger Ridership Estimates for the Extended Service

Table 13 shows the estimated average daily ridership for the Extended Service, for the different approaches described above.

Table 13
Daily Ridership Estimates, Extended Service

Travel Data Source	Mode Split Model	Total Daily Ridership Estimate
Vermont Statewide Model	Chittenden County (RSG)	1,720
CTPP	Chittenden County (RSG)	1,689
Total Demand Model (synthesized)	Amtrak Intercity (RSG)	2,017

The three approaches show a moderate level of convergence around 1,700-2,000 passengers per day. The CTPP ridership is the lowest because it represents only work trips. Since Core Service accounts for approximately 1,600 of this total, the additional estimated ridership attributable to the new stations on the extended service amounts to between 100 and 400 passengers per day.

Tables 14 through 16 show the projected 1999 daily station-to-station ridership for each of the three estimation methods.

Table 14
Estimated 1999 Average Weekday Station-to-Station Ridership, Extended Service (Vermont Statewide Model)[5]

	Burlington	Charlotte	Essex	Milton	Montpelier	Richmond	Shelburne	S. Burlington	St. Albans	Waterbury	Winooski	
Burlington	0	49	206	17	2	8	84	0	8	3	140	517
Charlotte	40	0	2	0	0	0	12	20	0	0	2	76
Essex Jcn	170	3	0	11	3	8	7	46	7	4	68	327
Milton	17	0	11	0	0	1	1	4	8	0	5	47
Montpelier	3	0	4	0	0	1	0	2	0	9	1	20
Richmond	10	0	10	1	1	0	1	2	0	2	4	31
Shelburne	80	13	16	1	0	1	0	19	0	0	10	140
S. Burlington	81	25	59	5	2	2	20	0	3	2	44	242
St. Albans	8	0	8	8	0	0	0	2	0	0	3	31
Waterbury	4	0	5	0	9	2	0	2	0	0	2	25
Winooski	130	3	63	5	1	3	9	47	3	1	0	265
	542	93	384	47	18	27	134	144	30	23	279	1,720

Table 15
Estimated 1999 Average Weekday Station-to-Station Ridership, Extended Service (CTPP)

	Burlington	Charlotte	Essex	Milton	Montpelier	Richmond	Shelburne	S. Burlington	St. Albans	Waterbury	Winooski	
Burlington	0	49	206	11	2	6	84	0	3	1	140	503
Charlotte	40	0	2	0	0	0	12	20	0	0	2	77
Essex Jcn	170	3	0	15	2	10	7	46	6	2	68	329
Milton	11	0	15	0	0	1	0	5	8	0	5	46
Montpelier	2	0	2	0	0	1	0	1	0	11	1	19
Richmond	8	0	13	1	1	0	1	3	0	1	4	32
Shelburne	80	13	16	0	0	1	0	19	0	0	10	139
S. Burlington	81	25	59	6	1	3	20	0	1	1	44	241
St. Albans	3	0	6	8	0	0	0	1	0	0	2	21
Waterbury	2	0	3	0	11	1	0	1	0	0	1	19
Winooski	130	3	63	5	1	3	9	47	2	1	0	264
	527	93	386	47	18	27	133	142	20	18	277	1,689

[5] For simplification, ridership associated with Fanny Allen and Woodside station stops is included in Winooski and and Essex Junction station stops, respectively. Likewise Essex Park & Ride is included in Essex Junction. This comment applies to Tables 14, 15 and 16.

Table 16
Estimated 1999 Average Weekday Station-to-Station Ridership, Extended Service (Total Demand Model)

	Burlington	Charlotte	Essex	Milton	Montpelier	Richmond	Shelburne	S. Burlington	St. Albans	Waterbury	Winooski	
Burlington	0	49	206	3	1	21	84	69	9	7	140	590
Charlotte	40	0	2	0	0	3	12	20	0	1	2	79
Essex Jcn	170	3	0	3	1	24	7	46	8	10	68	340
Milton	25	0	21	0	0	2	3	2	20	1	21	97
Montpelier	4	0	7	0	0	3	1	1	1	24	3	42
Richmond	21	0	24	0	0	0	4	2	1	8	17	79
Shelburne	80	13	16	0	0	4	0	19	1	2	10	146
S. Burlington	81	25	59	3	1	19	20	0	9	9	44	270
St. Albans	11	0	10	3	0	1	1	1	0	1	8	37
Waterbury	8	0	12	0	3	10	2	1	1	0	6	45
Winooski	130	3	63	3	0	20	9	47	9	6	0	292
	570	93	420	17	7	108	144	209	60	70	320	2,017

Table 17 displays the estimated annual ridership from each of the three estimation methods.

Table 17
Estimated 1999 Annual Ridership, Extended Service

Travel Data Source	Mode Split Model	Total Daily Ridership Estimate
Vermont Statewide Model	Chittenden County (RSG)	438,631
CTPP	Chittenden County (RSG)	422,216
Total Demand Model (synthesized)	Amtrak Intercity (RSG)	514,430

Based upon this analysis, it is reasonable for planning purposes to conclude that the proposed service would generate approximately 450,000 riders per year. Based upon projected growth rates in the corridor estimated by the Vermont Agency of Transportation, total ridership would be anticipated to increase at a rate of 1.25% annually between 1999 and 2009.

Finally, it should be stressed that in their present state of development, ridership estimation techniques fall somewhat short of a precise science: new passenger rail starts in San Diego, Denver, Dallas, Portland (Oregon) and St. Louis have all substantially exceeded initial ridership estimates.

CHAPTER 2

PASSENGER RAIL SERVICE PLAN

General

The rail service plan is developed in coordination with estimation of ridership and evaluation of infrastructure. The process is iterative since changes in service plan may change estimated ridership. For example, ridership is influenced (among other things) by travel time and changes in travel time may be affected by changes in infrastructure or rolling stock. A goal in this process is to maximize ridership at a reasonable cost. The rail service plan includes train schedules, bus and other transportation connections, rolling stock (locomotives and cars or multiple self-propelled units) and other factors related to a complete service plan.

This study has been performed with the understanding that Burlington-Essex passenger rail service is considered an extension of the Charlotte-Burlington passenger rail project, being implemented by VAOT. Thus ridership estimation includes Charlotte-Burlington stations. Similarly, operating costs and cost of rolling stock assume operation of the entire Charlotte-Burlington-Essex corridor. Other capital costs (right of way improvements, stations), however, are based upon improvements deemed necessary in the Burlington-Essex rail corridor.

Train schedules

Commuter train running times are developed based upon the freight railroad's timetable, findings of an extensive field examination, estimated train meeting points, projected infrastructure improvements and the number and location of stations identified for the line.

Two service scenarios form the basis for estimation of ridership (Chapter 1) and development of rail service plans.

Ridership projections serve as a basis to decide whether passenger rail service is feasible, and if so, which service scenario is adopted. Ridership forecasts also affect composition and number of trainsets required, number of station stops and station design.

The two scenarios described herein span a reasonably broad range, from Moderate Service (peak period service only) to All Day Service (frequent service throughout the day). They are derived from numerous considerations including previous studies, map study, on-site reconnaissance and discussions with local planners and the Project Advisory Committee (PAC). The "Regional/Passenger Rail Success Factors" (see Appendix A) and "Station Siting Criteria" (Appendix B) papers developed at the outset of this study, also are considerations.

Since initial scenarios included more stations than would be supportable by ridership, some were deleted due to low projected patronage. The scenarios assume combined operations with planned commuter rail service between Charlotte and Burlington to provide a single service plan including Charlotte, Burlington and Essex, and ridership is estimated accordingly.

Moderate Service Scenario

The Moderate Service Scenario provides weekday service during peak commuting hours to a minimum number of stations. As shown in Table 18, there are six morning trains, three northbound (departing Charlotte at 5:25 AM, 6:25 AM and 7:25 AM) and three southbound (departing Essex Park and Ride at approximately the same times) and six afternoon trains, also three northbound (departing Charlotte 3:10 PM, 4:10 PM and 5:10 PM) and three southbound (at approximately the same times).

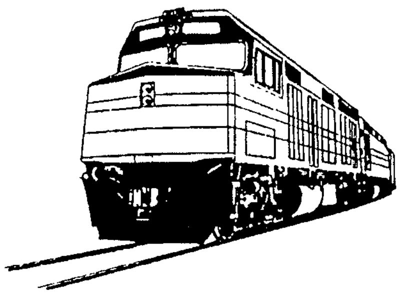
Initial stations tested were Charlotte, Shelburne, South Burlington, Burlington, Winooski, Essex Junction and Essex Park and Ride (Route 289 and Colchester Road). This scenario utilizes two trainsets and requires one meeting point, at Burlington Union Station.

This scenario requires lower capital expenditures compared to the All Day Service Scenario in terms of equipment (two trainsets instead of four) and also infrastructure improvements (one meeting point instead of three and smaller layover facilities). Operating, fuel and maintenance expenses would be lower than the All Day Service Scenario since fewer trains would be operated. It also is likely that a total of only two crews, as opposed to eight crews in the All Day Service Scenario, would be required to operate this schedule, since they could operate four hours in the morning, rest for six hours and then operate the evening shift.

All Day Service Scenario

In the All Day Service Scenario, shown in Table 19, trains operate seven days per week. Weekday service features 30-minute headways between 5:30 AM and 9:00 PM Weekend service includes hourly headways between 9:00 AM and 4:00 PM.

TABLE 18



Illustrative Charlotte - Burlington - Essex
Moderate Service Scenario (Two Sets of Equipment)

Revised 6/17/99

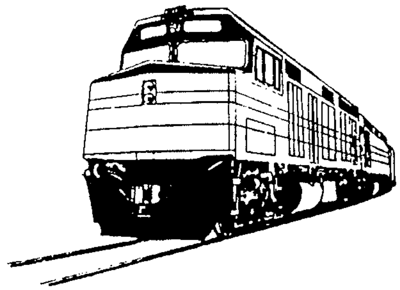
Charlotte - Essex Park and Ride Three hourly trains in morning and afternoon						
Dp. Charlotte	05:25 AM	06:25 AM	07:25 AM	03:10 PM	04:10 PM	05:10 PM
Dp. Shelburne	05:33 AM	06:33 AM	07:33 AM	03:18 PM	04:18 PM	05:18 PM
Dp. South Burlington	05:40 AM	06:40 AM	07:40 AM	03:25 PM	04:25 PM	05:25 PM
Ar. Burlington	05:47 AM	06:47 AM	07:47 AM	03:32 PM	04:32 PM	05:32 PM
Dp. Burlington	05:50 AM	06:50 AM	07:50 AM	03:35 PM	04:35 PM	05:35 PM
Dp. Winooski	05:56 AM	06:56 AM	07:56 AM	03:41 PM	04:41 PM	05:41 PM
Dp. Essex Junction	06:04 AM	07:04 AM	08:04 AM	03:49 PM	04:49 PM	05:49 PM
Ar. Essex Park & Ride	06:07 AM	07:07 AM	08:07 AM	03:52 PM	04:52 PM	05:52 PM

Essex Park and Ride - Charlotte Three hourly trains in morning and afternoon						
Dp. Essex Park & Ride	05:30 AM	06:30 AM	07:30 AM	03:15 PM	04:15 PM	05:15 PM
Dp. Essex Junction	05:32 AM	06:32 AM	07:32 AM	03:17 PM	04:17 PM	05:17 PM
Dp. Winooski	05:41 AM	06:41 AM	07:41 AM	03:26 PM	04:26 PM	05:26 PM
Ar. Burlington	05:47 AM	06:47 AM	07:47 AM	03:32 PM	04:32 PM	05:32 PM
Dp. Burlington	05:50 AM	06:50 AM	07:50 AM	03:35 PM	04:35 PM	05:35 PM
Dp. South Burlington	05:57 AM	06:57 AM	07:57 AM	03:42 PM	04:42 PM	05:42 PM
Dp. Shelburne	06:04 AM	07:04 AM	08:04 AM	03:49 PM	04:49 PM	05:49 PM
Ar. Charlotte	06:12 AM	07:12 AM	08:12 AM	03:57 PM	04:57 PM	05:57 PM

Meeting point and three minute dwell time at Burlington Union Station. Monday – Friday service. One minute dwell time at all other stops.

Source: RLBA estimates.

TABLE 19



Illustrative Charlotte - Burlington - Essex All Day Service Scenario (Four Sets of Equipment)

Revised 6/17/99

Charlotte - Essex Park and Ride 30 minute headways beginning at 5:25 AM until 8:55 PM						
Dp. Charlotte	05:25 AM	05:55 AM	06:25 AM	06:55 AM	07:25 AM	07:55 AM
Dp. Shelburne	05:33 AM	06:03 AM	06:33 AM	07:03 AM	07:33 AM	08:03 AM
Dp. South Burlington	05:40 AM	06:10 AM	06:40 AM	07:10 AM	07:40 AM	08:10 AM
Ar. Burlington	05:47 AM	06:17 AM	06:47 AM	07:17 AM	07:47 AM	08:17 AM
Dp. Burlington	05:50 AM	06:20 AM	06:50 AM	07:20 AM	07:50 AM	08:20 AM
Dp. Winooski	05:56 AM	06:26 AM	06:56 AM	07:26 AM	07:56 AM	08:26 AM
Dp. Fanny Allen	06:00 AM	06:30 AM	07:00 AM	07:30 AM	08:00 AM	08:30 AM
Dp. Essex Junction	06:06 AM	06:36 AM	07:06 AM	07:36 AM	08:06 AM	08:36 AM
Ar. Essex Park & Ride	06:09 AM	06:39 AM	07:09 AM	07:39 AM	08:09 AM	08:39 AM

Essex Park and Ride - Charlotte 30 minute headways beginning at 5:26 AM until 8:56 PM						
Dp. Essex Park & Ride	05:26 AM	05:56 AM	06:26 AM	06:56 AM	07:26 AM	07:56 AM
Dp. Essex Junction	05:28 AM	05:58 AM	06:28 AM	06:58 AM	07:28 AM	07:58 AM
Dp. Fanny Allen	05:35 AM	06:05 AM	06:35 AM	07:05 AM	07:35 AM	08:05 AM
Dp. Winooski	05:39 AM	06:09 AM	06:39 AM	07:09 AM	07:39 AM	08:09 AM
Ar. Burlington	05:45 AM	06:15 AM	06:45 AM	07:15 AM	07:45 AM	08:15 AM
Dp. Burlington	05:48 AM	06:18 AM	06:48 AM	07:18 AM	07:48 AM	08:18 AM
Dp. South Burlington	05:55 AM	06:25 AM	06:55 AM	07:25 AM	07:55 AM	08:25 AM
Dp. Shelburne	06:02 AM	06:32 AM	07:02 AM	07:32 AM	08:02 AM	08:32 AM
Ar. Charlotte	06:10 AM	06:40 AM	07:10 AM	07:40 AM	08:10 AM	08:40 AM

Service pattern continues throughout the day, with final departures from Charlotte at 8:55 PM and Essex Park and Ride at 8:56 PM. Seven day per week service, with reduced service on non-workdays. Three minute dwell time at Burlington Union Station. One minute dwell time at all other stops. Three meet points: Shelburne, Burlington Union Station and near Fairgrounds.

Source: RLBA estimates.

Stations considered during service planning were Charlotte, Shelburne, South Burlington, Burlington, Intervale, Winooski, Fanny Allen Health Center Campus, Woodside, Fairgrounds, Essex Junction, and Essex Park and Ride. It was decided not to include Intervale and Fairgrounds in the estimation of ridership, and Woodside subsequently was dropped as a station because of low ridership.

This scenario requires four sets of equipment and three separate train meet points. These meet points, located near Shelburne, at Burlington Union Station and near the Fairgrounds, will require addition of track so that trains can pass each other. The meet at Burlington Union Station would take place during a three-minute layover. Further discussion is provided in Chapter 3, Corridor Infrastructure and Safety. Following a decision to implement the service, passenger train schedules would have to be discussed with the freight railroads, New England Central Railroad and Vermont Railway, Inc.

Eight crews would be required to operate the four trainsets. The number of crew members required per train, and their specific duties, are described later.

Variations on the two scenarios, which combine strong points of each, were explored. An alternative scenario that may be attractive would provide one-hour headways between approximately 5:30 AM and 9:30 PM. This is the highest-train-frequency scenario that may be performed given the lower capital and operating costs of two trainsets.

Bus and Other Connections

As suggested in the previous chapter, effective integration of rail and bus service is crucial to the success of the proposed service. Buses should serve major origin and destination stations. Buses should be "dedicated" extensions of train service, i.e., inbound buses should arrive at the station shortly before train departure times and outbound buses should meet each incoming train and not depart the station until that train has arrived and passengers have made the connection. At that time, buses should depart promptly and proceed directly to major destinations including employment, educational, entertainment, retail and residential areas. Passengers' transfers between rail and bus should be covered and sheltered to the maximum extent practicable.

Inasmuch as Burlington is a major destination/origin, the meet of northbound and southbound trains at that location with a three-minute layover will allow buses to drop off and pick up rail passengers traveling in either direction. The scenarios are arranged so that Burlington train arrivals, 13-15 minutes before the hour or half-hour, will allow buses to carry passengers to their Burlington destinations in time for work, assuming most jobs start on the hour or half-hour.

Amtrak serves the region with the Vermonter, which is scheduled to depart Essex Junction at 8:30 AM southbound and 8:35 PM northbound. The All Day Service Scenario, with its 30-minute headways, offers the potential of good connections with Amtrak trains. The illustrative schedule above envisions an 8:06 PM arrival at Essex Junction from Burlington and an 8:58 PM departure to Burlington. No convenient connection exists between commuter and Amtrak trains under the Moderate Service Scenario, because service hours do not overlap Amtrak's current schedule.

Rolling Stock

This section describes types of equipment (also called rolling stock, or trainsets) appropriate to passenger rail service in Chittenden County, and provides recommendations. In brief, the choices include locomotive-hauled trains or self-propelled diesel multiple unit (DMU) cars. The passenger equipment may be either compliant with Federal standards for shared use, or non-compliant, as explained below.

It is understood that the State of Vermont has acquired equipment for prospective Charlotte-Burlington passenger rail service. Nevertheless, RLBA believes that the following discussion is appropriate.

Compliant vs. Non-Compliant Equipment

The Federal Railroad Administration (FRA) regulates structural safety standards for passenger equipment to be operated in "shared use", i.e., over tracks shared with conventional freight or passenger equipment. Equipment which meets FRA requirements in this regard is termed "compliant"; equipment which does not, "non-compliant". Passenger equipment manufactured and used in Europe is generally non-compliant; however, some manufacturers express a willingness to produce compliant models for the United States. Non-compliant equipment is generally lighter and therefore costs less, requires less power, consumes less fuel, and may have better braking characteristics, compared with compliant equipment. Light rail vehicles—electric or diesel-powered "streetcar" type equipment used in urban street-running applications and not used on the general rail system of the United States—are non-compliant. There exist two operations in the United States in which non-compliant equipment is operated on the general rail system of the United States, and on the same track as compliant equipment: the light rail systems in Baltimore and San Diego. Both light rail operations are strictly time-separated from the freight rail operations (also referred to as "temporal separation").

At the outset of this study, it was appropriate to consider whether it would be desirable to seek a waiver to operate non-compliant vehicles in a shared use (not time-separated) service. Since that time, two FRA actions have clarified policy with respect to use of non-compliant vehicles. In May 1999, FRA issued a long-awaited update of its passenger car safety standards affirming or increasing structural strength requirements, effectively keeping the door closed to previously non-compliant equipment. Also in May, FRA and the Federal Transit Administration issued notice of a "Proposed Joint Statement Concerning Shared Use of the General Railroad System by Conventional Railroads and Light Rail Transit Systems". While the policy is not yet final, the document demonstrates that the two agencies overwhelmingly prefer temporal separation where track is to be shared by compliant and non-compliant equipment. This is not a new preference, rather it is the first explicit (albeit not final) statement of policy.

The conclusion in an earlier study that non-compliant vehicles should not be used on the existing rail line between Burlington and Essex Junction remains valid. It appears impractical to time-separate the proposed passenger service from the freight services and their heavier, compliant equipment which would also use that right of way at the same time. If the passenger service were expanded to include St. Albans and Montpelier, a potential for which there are cogent arguments, interaction with additional freight traffic as well as Amtrak trains would likely require compliant equipment. Another means of separating compliant from non-compliant equipment, construction of a dedicated track for non-compliant passenger equipment, is deemed cost-prohibitive. Thus compliant equipment should be used in new passenger rail operations between Charlotte and Essex Park and Ride.

Push-Pull Operation

Standard commuter rail practice is that each trainset (single or coupled self-propelled diesel units, or a locomotive hauling unpowered passenger coaches) will operate in the push-pull mode, that is, the trainset may be operated from either end and need not be turned around to proceed in the opposite direction. "Push-pull" is the term given to trainsets which can operate in either direction, and this train configuration speeds up and simplifies operations in that special track is not required to turn the train around. Push-pull commuter trainsets have become the industry standard for this reason, and it is recommended that such equipment be used in Charlotte-Burlington-Essex service.

Comparison of Locomotive-Powered Trains and DMUs

Commuter rail operations have used trainsets composed of locomotives hauling non-powered passenger coaches (examples include Southern California Regional

Rail Authority's Metrolink and Northern Virginia's Virginia Railway Express), electrical multiple units (EMUs) (SEPTA, LIRR and Metro North) and diesel multiple units (DMUs) (Trinity Railway Express in Dallas uses rebuilt Budd DMUs). Modern DMU equipment has not yet been introduced into revenue operation in the United States.

EMUs require electrification of the right of way to distribute electrical power to the trains; this implies major capital costs and is deemed unjustified in the case of Chittenden County. The decision between the remaining technologies is based upon a number of factors. Speaking at the Transportation Research Board Conference on January 13, 1998, Bill Whitbred of LTK, a passenger rail equipment consultant, gave several reasons for the selection of compliant DMUs for the Trinity Railway Express service in Dallas. He cited modest ridership (1,600 per day), short trains, capital cost, operations and maintenance cost and the small size of the equipment order.

DMUs currently marketed in the United States include those shown in the Table 20. The column marked "FRA" indicates whether the equipment is FRA-compliant.

Table 20
Diesel Multiple Unit Equipment

Diesel Multiple Unit Manufacturer	Currently Available	Seating Capacity	Max Speed	FRA	Consist
Adtranz Flexliner IC3	Yes	140-180	110 mph	Yes	3 car unit w/ dual controls.
Bombardier DMU	No	78-113	100 mph	Yes	2 or 3 car unit w/ dual controls.
Budd RDC	Rebuilds	96	85mph	Yes	Dual control single unit, or multiple unit capability.
Nippon Sharyo	No	87	80mph	Yes	Dual control single unit or multiple unit capability.
Siemens Regio Sprinter	Yes	74	60mph	No	Dual control single unit.
Siemens VT 628 DMU	No	250	80mph	Yes	Dual control 3 car unit.

DMU capital cost per seat remains fixed as seating capacity is increased by adding DMUs because each additional unit costs and seats the same as the first. In contrast, cost per seat declines as locomotive-hauled train capacity is increased by adding cars because no additional locomotive power is required (up to 8 to 10 cars). Some DMU models are sold in sets of three cars, which cannot be operated as single units. This configuration commits operators to a six car consist if ridership demands more than a three car set. The expected number of riders per train should be assessed for each equipment alternative. Given the absence of a developed market, capital and operating cost projections concerning modern DMUs should be considered order-of-magnitude.

While specific breakpoints at which one technology becomes more cost-effective than the other are not precise, one may generalize that locomotive-hauled trains are superior for moving large numbers of people during peak periods. DMUs appear to be the better choice for relatively smaller passenger loads, especially when there are frequent headways.

Locomotive-Hauled Trains

Should locomotive-hauled trains be chosen, this type of passenger service generally requires four axle diesel electric locomotives having a minimum rating of 2,000 horsepower. Several new start and growing systems have relied on locomotives which were rebuilt from four axle freight locomotives. RLBA believes that the operating needs of a commuter rail system such as the proposed Chittenden County service are best served by rebuilt units. The cost to acquire a reliable rebuilt locomotive is estimated to be approximately $1.5 million per unit based on costs of other similar programs involving both passenger and freight locomotives. Maryland Rail Commuter (MARC) acquired 19 GP40WH-2 units in 1994 at a cost of approximately $1.4 million per unit. These locomotives were converted from GP40 freight locomotives by MK Rail, and in many respects are equivalent to brand new locomotives. The GP40WH-2 units are rated at 3,000 horsepower per unit, and are equipped with computer-based electrical control systems and a head end power generator. A recent price quote from Boise Locomotive Works for rebuilt 3000 horsepower GP40-2 AC's and F40-PH's is $1.5 million. The order would have to be for a minimum of four units, and Boise would need an 18 month lead time. The 1998 cost of similar rebuild programs is estimated at $1.5 million per unit based on the following:

Cost of the hulk	$ 200,000
Rebuild of major components	$ 800,000
Cab conversion	$ 200,000
Head end power installation	$ 300,000
Total	$1,500,000

This cost assumes rebuild to modern standards including compliance with federal emission standards and upgrade of electronics to current microprocessor technology. Upon completion, the rebuilt unit should have a service life that will equal or exceed 25 years, assuming proper maintenance.

With regard to the alternative of acquiring new motive power, two major manufacturers of new locomotives in North America, General Electric (GE) and Electromotive Division of General Motors (EMD), each offer standard passenger locomotive production models. The GE Genesis series and the EMD F59PFI model entered Amtrak inter-city service in the early 1990's. These locomotives are very sophisticated and have performance capabilities which far exceed the needs of most commuter rail requirements. New unit prices of both models exceed $2.4 million per unit.

With respect to conventional passenger coaches, it is appropriate for the Charlotte-Burlington-Essex Junction service to use single level equipment, negating the need for increasing the vertical dimension in the tunnel north of Burlington to accommodate double deck cars, which are used by many other passenger railroads. The market for passenger coaches is somewhat different than for locomotives because the availability of retired passenger equipment (rebuildable hulks) is limited and inconsistent. This makes it impractical to depend upon finding sufficient used equipment to initiate service, although such options should be explored at the outset of the car procurement process.

It is estimated that the cost to acquire new coaches and cab cars is approximately $1,750,000 per unit. This estimate is based on a review of orders placed by commuter rail operators in recent years; winning bids submitted in the late 1980's and early 1990's for similar coaches were in the range of $1.2 to $1.9 million per unit. It is important to note that new equipment need not be purchased, but may also be acquired by lease, which substantially reduces initial capital outlays.

Based on experience with other commuter rail systems, it is prudent to maintain an inventory of spare parts for both locomotives and passenger coaches. Given the on-going maintenance and equipment service requirements anticipated here, a reasonable estimate related to such an inventory will be approximately 5 percent of the total acquisition cost, or about $75,000 per locomotive and $87,500 per new passenger coach. Alternatively, it may be preferable to negotiate a maintenance contract with the vendor.

An additional 15 percent of the rolling stock purchase price should be allowed for procurement assistance and for provision of training to the local commuter rail agency in the form of project management, development of equipment specifications, engineering and design, checking up on progress and quality control during manufacture/rebuild process, acceptance testing as well as operator training and the need to create operation and training manuals.

Table 21 contains estimated costs for locomotive-hauled equipment.

Table 21
Estimated Locomotive-Hauled Equipment Purchase Cost Summary

Type of Equipment	Est. Cost Each	One Consist[1]
3,000 hp. Locomotive:	$ 1,500,000	$ 1,500,000
Coach and Cab Car:	$ 1,750,000	$ 3,500,000
Equip. Subtotal		$ 5,000,000
Parts Inventory	@ 5%	$ 250,000
Procurement / Training	@ 15%	$ 750,000
Total per Consist:		$ 6,000,000

[1] Each train consist includes 1 locomotive, 1 coach car and 1 cab car.

Source: RLBA.

Recommendation

While projected passenger loads appear well-suited for DMU technology as does the frequent service called for in the All Day Service Scenario, the absence of a source for proven, available compliant DMUs mandates a recommendation that locomotive-hauled trains be used especially if service is to be instituted in the near term. That assumption is carried forward through facility planning and cost estimation. However, it is also recommended that at the outset of the equipment procurement process, an assessment be made as to whether at that time DMUs are available either in the form of new, compliant equipment or Budd RDCs which might be economically rebuilt to provide reliable and comfortable service.

Spares

It is recommended that one additional locomotive and two additional cab control cars (or an extra DMU car set should that technology be chosen) be acquired for back-up and rotation purposes.

Crewing of Trains

Trains crews of two persons--one engineer and one conductor--are recommended. The conductor is the senior crew member and is responsible for compliance with all railroad rules and orders and for the safety and comfort of passengers. He or she monitors train speed, location, radio communications and adherence to orders and restrictions. The conductor assists in boarding and alighting, controls the train doors and signals the engineer to proceed at the completion of each station stop; he or she attends to passenger needs en route and answers questions. The conductor often has a role in fare verification or collection. In order to make a two person crew feasible, the conductor should have no cash-handling or fare-selling duties. The engineer is responsible for the safe operation of the train and compliance with all signal indications, rules, orders and the conductor's instructions.

In the Moderate Service Scenario, two crews would be utilized. They would report to the location at which their trains are stored overnight (either in the same location or separately) and start, inspect and position the trains. Each crew then would operate three one-way trips over the line. Equipment would be stored at the endpoints or returned to a service facility in or near Burlington for the midday period. During this time, crews would go off duty with respect to Federal Hours of Service provisions. Under most rail labor agreements, they are paid at a reduced rate during this period. Crews would go back on duty in the afternoons and operate three one-way trips. Trains then would be parked in the layover facilities and crews would go off duty.

In the All Day Service Scenario, the first two crews would go on duty at approximately 4:45 AM to staff the 5:30 AM departures from Charlotte and Essex Park and Ride. The next two crews would go on duty at about 5:15 AM to protect the 6:00 AM departures. Those four crews would be relieved approximately early afternoon by a second set of four crews to operate the trains through the final trips departing from Charlotte and Essex Park and Ride at approximately 9:00 PM.

Equipment Maintenance

Many starting passenger rail operations are inclined to contract out all major maintenance and overhaul, and this appears to be the appropriate course for Chittenden County. Contract maintenance could be performed by the contract service operator, the car builder or supplier or another entity. Unless the selected contractor can provide an adequate service facility, it likely will be the sponsor's responsibility to do so. The maintenance facility could be located at the overnight storage yard or could be centrally located. The primary functions of the maintenance staff would include basic tasks such as fueling and normal equipment servicing, periodic inspections and running repairs and deep cleaning, maintenance and repairs to car interiors. Major overhauls could be performed by the maintenance contractor or contracted separately to railcar builders, railcar maintenance companies, other commuter rail agencies or Amtrak.

Service Operating Costs

Operating costs, shown in Table 22 below, are estimated to total $3.1 and $6.7 million, respectively, in the Moderate and All Day scenarios. These costs assume operation over the entire Charlotte-Burlington-Essex corridor in accord with both service scenarios.

Table 22
Operating Cost Estimates
Charlotte-Burlington-Essex Junction

Operating Costs	Moderate	All Day
Train Operations	$522,000	$1,752,000
Equipment maintenance	717,000	2,174,000
Railroad charges and fees	369,000	918,000
Station maintenance and operations	268,000	376,000
Insurance	580,000	770,000
General and administrative	636,000	676,000
Total operating costs	$3,092,000	$6,666,000
Source: RLBA estimates.		

Train operations costs are comprised of train crew wages and benefits, fuel and transportation supervision. Train crews are assumed to consist of an engineer and conductor who are compensated based upon shortline wage rates. Fuel costs are based upon fuel consumption characteristics that reflect both size of the trains and amount of service in each scenario. Transportation supervision provides for a single manager in the Moderate Service Scenario and two of them in the All Day Service Scenario.

Equipment maintenance costs are based on the experience of Virginia Railway Express commuter service, adjusted for operating characteristics of the Burlington service. It includes the cost of performing interior and exterior train cleaning.

Railroad charges and fees include the cost of track maintenance and inspection, dispatching, other costs, incentive payments for on-time performance and railroad overhead. Track maintenance assumes improvement of the line to allow passenger train operations up to 60 mph and maintenance to this standard following such rehabilitation. The cost includes an additional weekly physical inspection of the track by the freight operator as well as an annual inspection of the track by a rail defect detector car.

Dispatching costs represent the additional dispatching occasioned by introduction of passenger service. Both the Moderate and All Day Service Scenarios include the cost of an additional dispatcher during the day and the All Day Service Scenario includes a dispatcher on the weekend.

Other costs allow for provision of train supplies, based on the number of commuter trips.

An incentive payment for on-time performance is included in railroad charges and fees. The maximum amount of incentive the railroad can earn is equal to its cost to maintain the track structure. Each scenario estimate assumes that the short line has earned the maximum on-time performance amount.

Railroad overhead is equal to ten percent of railroad charges and fees, excluding overhead, the rate contained in the Access Agreement Between the Vermont Agency of Transportation and Vermont Railway, Inc.

Station maintenance and operations expense provides for a sales and customer service agent at the Burlington station during operating hours for each scenario. Other stations would be unstaffed. Station maintenance is based upon an estimated $30,000 annually per station. Parking lot maintenance costs are estimated to be $100 annually per parking space.

Insurance expense assumes that the commuter rail operation is partially self-insured with excess coverage provided through commercial insurance policies. The self-insurance portion is based upon the experience of the Southern California Regional Rail Authority's (SCRRA) risk management expense, adjusted for Burlington's operating characteristics. Commercial coverage is based on quotations to a freight railroad covering Amtrak's passenger service in New England over the freight carrier's track.

General and administrative expense (G&A) is based upon the assumption that the Charlotte-Burlington-Essex service is to be administered by an independent, stand-alone organization. Although the current practice among new start commuter rail services is to contract out most functions, the following G&A activities are usually retained by the sponsoring entity:

- Contract negotiation and oversight
- Liaison with local government(s) and freight railroad(s)
- Marketing and public relations
- Oversight of contract operator
- Ticket sales and customer relations

Table 23 arrays approximate expenses that would be incurred with commencement of commuter rail service under the Moderate Service Scenario.

Table 23
General & Administrative Expenses

Expense Category	Annual Expense
Salaries and fringe benefits	$245,000
Outside professional services	25,000
Postage and printing tickets and notices	15,000
Professional dues and expense	3,000
Temporary help and answering service	15,000
Office rent and furnishings	40,000
Office supplies and miscellaneous	30,000
Telephone	15,000
Audit	5,000
Board of directors expenses	3,000
Vehicle expense, local travel and staff expense	20,000
Communications and maintenance of ticketing and Other hardware	130,000
Computer services, software licenses and maintenance	40,000
Marketing	50,000
TOTAL	$636,000

Salaries and fringe benefits expense assumes a staff consisting of a general manager, manager of administration/accountant, secretary/administrative assistant and receptionist/clerical assistant. These individuals would be full-time employees, responsible for overseeing contract administration and supervising vendors and temporary help.

Outside professional services contemplates the need to hire outside professionals to handle specialized engineering tasks and equipment and operations issues that would arise from time to time. It is prudent to have the ability to consult with outside experts as operations actually begin and operational issues arise.

Postage and printing tickets and notices is the cost of general postage, printing of ticket stock and operating an advance purchase by mail program.

Fees, professional dues and expenses is the cost of dues and meeting fees related to trade and professional associations.

Temporary help and answering service provides 24 hour phone coverage and help with peak work activities.

Office rent and furnishings covers the rental, furnishing and equipping of office space.

Office supplies and miscellaneous provides for the purchase of consumable supplies.

Telephone expense is for both local and long distance service.

Audit is the estimated cost to obtain an annual audit of financial statements by certified public accountants.

Board of directors expense is the expense incurred by directors to attend meetings and outside seminars and prepare reports for their use.

Vehicle expense, local travel and staff expense is the estimated cost to lease one vehicle for staff use, reimburse staff for use of personal automobiles and cover miscellaneous staff expenses.

Communications cost and TVM (ticket vending machines) and hardware maintenance provides funds to lease dedicated phone lines and maintain computerized ticketing machines, public address system and centralized automated phone system.

Computer services, software licenses and maintenance is the cost to license and maintain computer programs related to accounting systems, ticet vending machines and automated phone system.

Marketing expenses are related to the purchase of media advertising, promotional materials and special events.

In the All Day Service Scenario, G&A increases by $40,000 to provide for increased printing, temporary help and telephone expenses associated with the increased operating hours and passengers.

Much of the expense described above and arrayed in Table 23 could of course by avoided if ways and means could be identified for cost-sharing with Chittenden County Transportation Authority.

Cost of Feeder Bus Service

Bus and other connections were discussed earlier in this chapter, where it is stated that buses should be dedicated extensions of train service. The cost of feeder bus service is not included in Operating Cost Estimates, Table 22. As a component of preliminary engineering, following a decision to implement passenger rail service, it will be necessary to design feeder bus service to meet demand at specific stations. Some stations, for example, Burlington, may require only modest changes to existing bus service in order to provide connections. Others, such as Fanny Allen, will require a dedicated van or small bus to bring boarding passengers to the train and to take deboarding passengers to their destinations.

In order to provide at least a "ball park" estimate of the cost of feeder bus service, assumptions are made that the service will be performed by contract, at $30 per hour per station,[6] at five stations for the All Day Service Scenario, and at four stations in the Moderate Service Scenario. Thus for the All Day Service Scenario the estimated annual cost would be $876,000, and for the Moderate Service Scenario, $242,000.

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[6] Figure provided by Jeanette Berry, CCTA, September 15, 1999.

CHAPTER 3

CORRIDOR INFRASTRUCTURE AND SAFETY ISSUES

General

This task requires an assessment of current track structure, evaluation of existing grade crossings, analysis of safety issues, and coordination with the Route 15 Corridor study.

Assessment of Current Track Structure

General Track Assessment

The Burlington-Essex line is currently suitable for 10 mph freight operations. Increasing track speed to 60 miles per hour (mph), deemed necessary for automobile-competitive passenger rail schedules, will require replacement of rail and ties, surfacing (leveling of the track) and some subgrade replacement. Additionally, other rehabilitation measures should be taken to ensure maintainability and prevent delays, including ditching (to improve current drainage), vegetation removal, and culvert and bridge repairs. Table 24 shows the rehabilitation and improvement cost estimate ($9.7 million) for track and structures (excluding tunnel improvements, and potential bridge structural improvements) for 60 mph (maximum speed) passenger train operation between Burlington and Essex Junction. This table includes cost of rail, turnouts, ties, ballast and surfacing, ditching, brush cutting, minimum bridge repairs and signals.

Rail

Nearly the entire line is 100 pounds per yard rail of either 100RA Head Free design manufactured in the 1940's or 100RA manufactured in the 1950's. All rail is jointed except for one mile at Essex Junction (west from the wye) which is continuous welded rail (CWR). About ½ mile of track east (north) of College Street is lightweight 80 and 90 pounds per yard rail from the 1920's. For 60 mph (maximum speed) passenger rail service, it is recommended that all this rail be replaced by 115 pounds per yard continuous welded rail (CWR). The existing hand-thrown turnout in Essex Junction at the New England Central Railroad main line is replaced with a powered switch.

Table 24
Track and Structures Rehabilitation and Improvement Estimate
Burlington-Essex Junction Excluding the Tunnel
60 mph Operation

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Rail						
Replace Rail with New 115 CWR	0.2	7.9	7.6	Mile	$ 300,000	$ 2,280
New Turnout - 15 mph	Lake St.-VTR		1	Each	60,000	60
New Turnout - 15 mph	Burl. Elec.		2	Each	60,000	120
New Turnout - 15 mph	Essex Team		1	Each	60,000	60
New Turnout - 30 mph	South Wye		1	Each	130,000	130
Ties						
Replace Ties	0.2	7.9	12,000	Each	$ 60	720
Surfacing						
Two passes surface and line	0.1	7.9	7.8	Mile	30,000	234
Two passes surface and line	0.2	0.7	0.5	Mile	30,000	15
Undercut track	0.1	0.2	528	Feet	60	32
Undercut track	Br. 2.41		500	Feet	60	30
Undercut track	Winooski		2640	Feet	60	158
Undercut track	Br. 4.02-4.12		1000	Feet	60	60
Undercut track	West Street		500	Feet	60	30
Undercut track	South Summit		500	Feet	60	30
Undercut track	Essex Junction		500	Feet	60	30
Bridges and Structures						
Replace two replace bridge seats	Br. 2.47		1	Sum	20,000	20
Miscellaneous steel work	0.2	7.9	1	Sum	15,000	15
Replace bridge ties	Br. 4.02		256	Each	230	59
Replace bridge ties	Br. 4.12		220	Each	230	51
Repair culverts	0.2	7.9	1	Sum	100,000	100
Repair and concrete toe of fill	Burl. Elec.		300	Feet	200	60
Ditching						
Work train, ditcher and air-dump cars	0.2	7.9	20	Day	4,000	80
Work train and spreader	0.2	7.9	5	Day	2,500	13
Backhoe	0.2	7.9	14	Day	600	8
Remove loose rock	4.1	4.3	1	Sum	15,000	15
Brush Cutting						
Cut Brush -light	0.2	1.7	1.5	Mile	1,000	2
Cut Brush - medium	1.7	3	1.3	Mile	2,000	3
Cut Brush - heavy	3	7.6	4.6	Mile	4,000	18
Clip or remove trees	3.5	7.6	4.1	Mile	6,000	25
Signals						
Signal interlocking - one turnout	Essex Junction		1	Each	550,000	550
Turnout protection	0.2	7.9	5	Each	75,000	375
Automatic block signals	0.2	7.9	7.7	Mile	200,000	1,540
SUBTOTAL						$ 6,922
Engineering and project management				Percent	17%	1,177
Contingencies				Percent	20%	1,620
TOTAL						$ 9,718

Source: RLBA estimates.

Ties

The last significant tie replacement occurred in the early 1980's, but most ties date from earlier years. Many still good ties date from the early 1960's. On average, all ties installed before the 1960's, and there are many such, must be replaced. Ties in the well-drained tunnel date from 1926. The worst tie location is under the street overpass bridges in Winooski where drainage must be improved for passenger rail service; ties south of St. Michael's College (mileposts 4-5) are also in poor condition. Needed tie replacements presently total 47 percent. It is assumed that performance of the work will be accomplished in year 2001, when approximately 51 percent (allowing for continued deterioration), or 12,000 ties, would require replacement.

Ballast and Surfacing

Much of the line has inadequate subgrade. At a minimum, the entire line should be raised 6 inches on new stone ballast. Where the line cannot be raised because of overhead structures or road crossings, it must be undercut at least 16 inches below bottom of ties, and new ballast installed.

Culverts

Some culverts require repair to prevent failures.

Ditching

For 60 mph train operation, all ditches must be reopened to an adequate cross section and maintained. Some highway crossings need additional culvert pipes.

Brush Cutting

Cutting brush not only eliminates safety issues of brush hitting rail equipment and personnel, but also enables the road bed to dry and drain. In addition, trees adjacent to the roadbed must be cut or topped before snow loads cause them to fall onto the tracks. This cutting is primarily between mileposts 4 and 6 (south of St. Michael's College and Fort Johnson).

Trackside Maintenance Access

With half-hourly passenger rail service, all major maintenance must be completed at night or during special weekend periods. Access roadways should be provided along main track wherever practical to enable daytime spot maintenance and facilitate access for nighttime heavy maintenance.

<u>Bridges</u>

An inventory of bridges and other structures is contained in Table 25. Required repair to steelwork appears to be minor. Bridges 4.02 and 4.12 over the Winooski River (east of I-89) need new ties. Bridge 2.47 over the Winooski River (east of Burlington Electric) requires new bridge shoes and seats on the east (railroad north) end.

Table 25
Railroad Structure Inventory

Milepost	Overhead/ Undergrade	Owner	Waterway/ Highway	Type	Length (feet)	Year Built	1963 Rating	Tie Type	Tie Size (inch)	Tie Condition	Repairs
1.15	Tunnel	NECR	North Avenue	Tunnel	340	1860	n/a	Track	n/a	Installed 1926	Masonry
1.36	OH	NECR	VT 127	I-Beam	n/a	n/a	n/a	n/a	n/a		AOT retaining walls as necessary
2.41	UG	NECR	Winooski River	Through Truss	230	1928	E50	Open Deck	8x12	Fair	Replace 7 south end ties
2.41	UG	NECR	Winooski River	Deck Plate Girder	90	1928	E50	Open Deck	8x12	Fair	Replace north end seats
3.09	OH	City of Winooski	Weaver Street	Concrete Arch		1916	n/a	n/a	n/a		
3.16	OH	AOT	Main Street	I-Beam	25	1952	n/a	n/a	n/a		
3.85	OH	AOT	I-89	I-Beam	44-54-44	1961	H20	n/a	n/a		
3.87	OH	AOT	I-89	I-Beam	44-54-45	1961	H20	n/a	n/a		
4.02	UG	NECR	Winooski River	Through Truss	256	1928	E-50	Open Deck	10x12	Poor	Replace ties
4.12	UG	NECR	Winooski River	Through Truss	110	1921	n/a	Open Deck	10x12	Poor	Replace ties, some rivets
4.12	UG	NECR	Winooski River	Through Truss	110	1921	n/a	Open Deck	10x12	Poor	Replace ties
4.42	OH	AOT	Lime Kiln Road	Concrete/ Steel	22-22	1913	n/a	n/a	n/a		AOT will replace
108.8	UG	NECR	Creek	Concrete Slab	n/a	n/a	n/a	Ballast Deck	n/a	Fair	
110.0	OH	AOT	VT 289	Steel	n/a	n/a	n/a	n/a	n/a		
110.2	OH	AOT	VT-289	Steel	n/a	n/a	n/a	n/a	n/a		
110.22	OH	AOT	Lamore Road	Concrete	n/a	1991	n/a	n/a	n/a		

Source: NECR.

Increasing track speed in order to accommodate passenger rail service increases impact live loading on bridges. This preliminary analysis assumes that no structural changes are required before operation of passenger trains.

Should this passenger rail project proceed to engineering, a structural engineer should evaluate all bridges to determine their adequacy to carry passenger trains at passenger train speeds.

Railway Signaling

A railway signaling system assists in maintenance of safe distance between trains on the same track, warns of mis-aligned or vandalized switches, and identifies the presence of broken rails. With rare exceptions, passenger trains in the U.S. are operated on track with signals. Two of those exceptions are Amtrak operations on Vermont Railway, Inc. (VTR) and New England Central Railroad (NECR). RLBA recommends installation of a signal system for enhanced passenger safety.

Tunnel

The existing tunnel, located approximately one mile north of Burlington Union Station and constructed in 1861, is narrow and low; passenger cars barely fit within the tunnel and are moved through the restricted area at walking speed. To increase operating speed to 25 mph would require additional superelevation as well as additional clearance for normal train car "bounce", which in turn mandates increased width. As the tunnel is elliptical in shape, increased width can be obtained by lowering the floor.

A 1998 study prepared by Gordon, Bua & Read, Inc., found the tunnel "deficient in vertical clearance ... with respect to Plate H[7] with 6-inch buffer requirements" and considered two alternatives: (1) lower the track 5'2" to obtain 20'8" vertical clearance for Plate H equipment, at a cost ranging from \$5.2 to \$6 million, or (2) construct a new tunnel on a new alignment, reducing the degree of track curvature inside the tunnel and providing a clearance of 23' above top of rail recommended by the American Railway Engineering Association at a cost ranging from \$6.1 to \$7.1 million. These cost figures were estimated in year 2003 dollars.

There is at least one more option, minimum lowering of the track to permit 25 mph operations. It is expected that this will cost somewhat less than the \$5.2 to \$6 million range quoted above. A preliminary "ball park" figure, is estimated conservatively at \$5 million; it is possible that the figure could be closer to \$1 million. This cost must be refined in preliminary engineering, the

[7] The plate clearance code, in this case, Plate H, is a designation by the Association of American Railroads indicating the dynamic clearance envelope for a given class of railroad equipment. Plate H was selected because it would accommodate passage of "double stack" container loads on freight railroad flat cars. Plate diagrams are contained in *The Official Railway Equipment Register*.

next phase of this project. The history of the tunnel and the type of soil through which it passes suggest that a structural and geotechnic analysis be made prior to performing any work. Since the tunnel also impedes freight traffic, it may be appropriate for all beneficiaries of tunnel improvements to share in their cost. If future freight needs justify it, an option which goes to Plate F (nearly all railroad freight equipment) or H (all railroad equipment including doublestacks) should be considered, and paid for to an appropriate extent by freight interests.

<u>Addition of Passing Tracks</u>

The extent of additional passing sidings varies according to the operating scenario.

In the All Day Service Scenario, opposing trains will meet every 15 minutes. Between Charlotte and Essex Junction Park & Ride, trains will meet at three locations: Shelbourne, Burlington and Fairgrounds (near West Road). If all trains ran on time, short sidings would suffice, but the real measure of an efficient operating system is its ability to recover from unexpected events and delays. Constructing second track to provide that recovery capability should be not less than one-third of the line and preferably should encompass about one-half the line. Avoiding second track construction at bridges, the tunnel, through rock cuts and wetlands, to avoid high environmental or construction costs, it is recommended that second track be added to about one-half the Essex Junction-Burlington line.

Starting at Burlington, a second track would extend north one mile to the west tunnel entrance. An additional ten-foot strip of right of way would be required from the land that the City acquired from the railroad in 1991. The section of double track by Fairgrounds would begin just east of Fanny Allen Campus (milepost 4.8) and extend to the wye switch south of Maple Street in Essex Junction (milepost 7.5).

In general, adding a second track within the NECR right of way will be possible. Most right of way is 100 feet wide with the track located 5½ feet south (railroad east) of the centerline. When the track was constructed in the late 1840's, this shift was made to allow room for a future second track. It is wider through some cuts and fills and narrower along Vermont 15 and by Green Mountain Power where some right of way has been sold. Adjacent to Burlington Electric, the width increases to 112 feet on this 1860 alignment. West of the tunnel under North Avenue in Burlington, NECR operates on a 30-foot wide easement, as all railroad lands were sold to the City of Burlington in 1991.

Table 26 shows the second track improvements deemed necessary in the All Day Service Scenario and estimated cost ($14.9 million).

It has been assumed, in the All Day Service Scenario, that passenger trains operating on the approximately two-mile segment of NECR's mainline between Essex Junction and Essex Park and Ride (railroad mileposts 108.1 and 109.9, respectively) will not interfere significantly with either NECR's four to six freight trains per day (some of which operate at night), or the two Amtrak trains each day.

In the Moderate Service Scenario, opposing trains would meet every 30 minutes. Between Charlotte and Essex Junction Park & Ride, trains would meet only at one location, Burlington. While several miles of double track through Burlington would result in more dependable passenger rail service, this is not considered a practical alternative because of existing development. Operation is relatively simple with only two train sets. If one train is late, only one other train can be delayed. No additional delays will cascade through the system setting multiple trains off-schedule. Consequently, it is proposed to add a short siding at (alternatively, near) Burlington Station to allow one train to pass the other. Estimated cost of this improvement, shown in Table 27, is $2.5 million.

Improve NECR Mainline Track North of Essex Junction

NECR currently maintains the tracks north from Essex Junction for a 20 mph maximum speed over the first one-half mile and for 59 mph maximum speed over the remaining 1.4 miles to Essex Park & Ride, and has an on-time performance incentive contract with Amtrak that encourages maintenance of these speeds. It is recommended that the first half mile be upgraded to 59 mph. Estimated cost is $0.2 million, as shown in Table 28.

On the remaining 1.4 miles, RLBA assumed that within three years tie and surface maintenance would be required, but that NECR might not be able to fund such work. This extra rehabilitation of replacing ties and surfacing track would cost about $0.2 million.

New Station Track at Essex Junction

No station track was found necessary in any of the three scenarios, but any station development plan at Essex Junction should consider the need for such a track based upon the possibility of increased intercity and/or freight traffic.

Table 26
Second Track Construction Cost Estimate

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Construct Second Track Between Burlington and Tunnel, Mileposts 0 and 1.2						
New spring switch -30 mph	0		1	Each	$ 135,000	$ 135
Signal interlocking - one turnout	0		1	Each	550,000	550
Grade for second track - light	0	1.2	6,336	Feet	67	422
Construct track new 115RE CWR	0	1.2	6,336	Feet	130	824
Remove pavement	0.1	0.2	1,000	Feet	30	30
New crossing with rubber surface	College St.		40	Feet	600	24
Move gate for second track	College St.		1	Each	80,000	80
Relocate fencing	0.2	1.2	5,280	Feet	15	79
New crossing with rubber surface	Footpath		12	Feet	600	7
Move gate for second track	Footpath		1	Each	80,000	80
New crossing with rubber surface	Lake		60	Feet	600	36
Move gate for second track	Lake		1	Each	80,000	80
New spring switch -30 mph	1.2		1	Each	135,000	135
Culverts	4.8	7.7	1	Sum	50,000	50
Permitting	4.8	7.7	1	Sum	200,000	200
Construct Second Track Between Fanny Allen Campus and Essex Junction, Mileposts 4.8 and 7.7						
New spring switch -30 mph	4.8		1	Each	135,000	135
Signal interlocking - one turnout	4.8		1	Each	550,000	550
Grade for second track - moderate	4.8	7.7	15,312	Feet	114	1,744
Construct track new 115RE CWR	4.8	7.7	15,312	Feet	130	1,991
New crossing with rubber surface	5.4		45	Feet	600	27
Move gate for second track	5.4		1	Each	80,000	80
New crossing with rubber surface	West St.		40	Feet	600	24
Move gate for second track	West St.		1	Each	80,000	80
New crossing with rubber surface	S. Summit		45	Feet	600	27
Move gate for second track	S. Summit		1	Each	80,000	80
New crossing with rubber surface	Park St.		70	Feet	600	42
Move gate for second track	Park St.		1	Each	80,000	80
Construct 8 foot retaining wall	5.7	6.3	3,168	Feet	400	1,267
Construct 12 foot retaining wall	7.4	7.5	528	Feet	700	370
Relocate fiber optic line	1.2		1	Sum	500,000	500
Utilities	4.8	7.7	1	Sum	100,000	100
Culverts	4.8	7.7	1	Sum	50,000	50
Land	4.8	7.7	1	Sum	100,000	100
New spring switch -30 mph	7.7		1	Each	135,000	135
Modify existing interlocking	7.7		1	Each	200,000	200
Wetland mitigation	4.8	7.7	2	Acre	50,000	100
Permitting	4.8	7.7	1	Sum	200,000	200
SUBTOTAL						$ 10,614
Engineering and project management				Percent	17%	1,804
Contingencies				Percent	20%	2,484
TOTAL						$ 14,902

Source: RLBA estimates.

Table 27
Burlington Station Siding Construction Cost Estimate

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Construct Siding at Burlington Station, Mileposts 0.0 and 0.3						
New spring switch -30 mph	0		1	Each	$135,000	$ 135
Signal interlocking - one turnout	0		1	Each	550,000	550
Grade for second track – light	0	0.3	1,584	Feet	67	106
Construct track new 115RE CWR	0	0.3	1,584	Feet	130	206
Remove pavement	0.1	0.2	1,000	Feet	30	30
New crossing with rubber surface	College St.		40	Feet	600	24
Move gate for second track	College St.		1	Each	80,000	80
New spring switch –30 mph	1.2		1	Each	135,000	135
Signal interlocking – one turnout	1.2		1	Each	550,000	550
SUBTOTAL						$1,816
Engineering and project management				Percent	17%	309
Contingencies				Percent	20%	425
TOTAL						$2,549

Source: RLBA estimates.

Construction of Track to Accommodate Joint Mid-day Freight and Passenger Operations at the Power Plant

A solution to passenger-freight conflicts is to operate freight trains at night. It is understood that this solution is not practicable in the Burlington area, because wood chip cars received and dumped at Burlington Electric must be unloaded in the daytime in order to comply with Burlington's noise ordinance. An explanation of the wood chip unloading process and its requirements follows.

NECR provides freight service on the line between Burlington and Essex Junction 3 to 6 days each week depending upon demand. It currently includes bringing wood chips to Burlington Electric and delivering cars to and receiving cars from the VTR.

Table 28
Track and Structures Rehabilitation and Improvement Estimate
Essex Junction-Essex Park & Ride

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Ties						
Replace ties	108.3	108.8	400	Each	$ 60	24
Replace switch ties	108.5		40	Each	95	4
Surfacing						
Surface and line with 2 inch raise	108.3	108.8	0.5	Mile	15,000	8
Road Crossing						
New predictor, add gates	Central Street		1	Each	70,000	70
Ditching						
Backhoe	108.3	108.8	2	Day	600	1
Brush Cutting						
Cut brush -light	108.3	108.8	0.5	Mile	1,000	1
SUBTOTAL						$ 107
Engineering and project management				Percent	17%	18
Contingencies				Percent	20%	25
TOTAL						$ 150

Source: RLBA estimates.

On days when wood chips are loaded, twenty special woodchip cars are filled at Swanton, Vermont, beginning about 4 a.m. A train crew from St. Albans arrives with the chip train at Burlington Electric about noon. The unloading trestle accommodates three cars, so the entire 20-car train is unloaded in seven moves. Though the car bottoms have multiple doors, wood chips tend to coagulate, so Burlington Electric connects power to on-car electric shaker/vibrators to clear the car. This unloading consumes about 1½ hours during the summer, but in sub-freezing weather, unloading may consume up to 3 or 4 hours. Then the cars are returned to Swanton for the next loading. Sometimes, when snow is expected, cars are left overnight at Burlington, where snowfall is less. On windy days, chip loading must cease and await a calmer day.

The track configuration is such (length of the siding, and the position of the three-car unloading trestle relative to the ends of the siding) that unloading of the train blocks the branch line through track. Thus another train, e.g., the proposed passenger rail service, cannot pass the Power Plant during unloading operations. Unloading frequency may fall to only twice a week (Tuesdays and Thursdays) when electric demand is low or increase to four days a week (Monday, Tuesday, Thursday and Friday) when electric demand is high. A large increase in chip consumption is not anticipated; any moderate increase could be accommodated by operating on additional days. Specifically, in consideration of City of Burlington policy to maximize use of Burlington Electric, the additional track structure recommended in this study would accommodate five to six wood chip trains per week, which would provide sufficient wood chips to operate Burlington Electric at capacity.[8] Finally, the chip cars, at a height of 15 feet 9 inches above top of rail, do not fit through the Burlington Tunnel and must be left at Burlington Electric while the train delivers and receives cars from VTR.

Burlington Electric expects the train to arrive by noon, so unloading can proceed during the warmest part of the day. Waiting until after passenger services cease after 9 p.m. would violate City of Burlington noise ordinances as well as pose staffing issues. Up to nine persons help unload cars in the winter. Installing an auxiliary rotary dumper would speed unloading and resolve staffing issues, but might increase unloading noise. Purchase and installation of such a dumper and modification or replacement of railcars would cost $2-4 million. If the dumper were carefully matched with new railcars, unloading time could drop to under 40 minutes. Thus, there could be a trade-off in potential solutions cost between a new dumper and track improvements.

After leaving the empty chip cars at Burlington Electric, NECR delivers cars to VTR in Burlington and picks up cars from VTR, returns to Burlington Electric, picks up the empty wood chip cars and returns north.

RLBA has identified and estimated costs of two different solutions: (1) minimal use of main tracks to enable the freight operations to weave between All Day Service Scenario trains without delaying the passenger trains, and (2) moderate use of main tracks enabling NECR's freight train to dodge less extensive, peak period, passenger service.

In the case of the All Day Service Scenario, RLBA would anticipate extending the siding 1,200 feet west (using retaining walls at the toe of the fill to avoid filling wetlands) and 1,550 feet east to the Winooski River bridge. Both

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[8] Phone conversation, Lucien R. "Pete" Brosseau, Supervisor, Plant Operations, Burlington Electric Department, and Ken Withers, July 15, 1999.

switches would be powered to expedite freight movements between passenger train schedules and would be remotely controlled. This would enable the train to remain coupled in one-piece (as long as the number of cars destined to VTR did not equate to a length exceeding 1,000 feet) and complete all unloading without blocking the main track. Estimated cost would be $4.2 million (see Table 29). Although the recommended eastward siding extension would cross Intervale Road, thus allowing placement of wood chip cars on the siding, wood chip unloading operations would not interfere with automobile traffic on Intervale Road any more than they do today because 20 wood chip cars could be stored between the road and Burlington Electric.

Table 29
Extend Burlington Electric Freight Siding Cost Estimate
30-Minute All Day Service Scenario

	Mile Post	Mile Post	Quantity	Unit Unit	Cost Item	Item Subtotals ($000)
Extend Burlington Electric Freight Siding Mileposts 1.5 and 2.4						
New spring switch -30 mph	1.5		1	Each	$ 135,000	$ 135
Signal interlocking - one turnout	0		1	Each	550,000	550
Grade for second track – moderate	1.5	1.7	1,200	Feet	114	137
Construct 12 foot retaining wall	1.5	1.7	1,200	Feet	700	840
Construct track 100RA CWR	1.5	1.7	1,200	Feet	90	108
Grade for second track – light	2.1	2.4	1,550	Feet	67	103
New crossing with rubber surface	Intervale		100	Feet	600	60
Construct track 100RA CWR	2.1	2.4	1,550	Feet	90	140
Relocate main track	2.1	2.4	1,550	Feet	35	54
New spring switch -30 mph	2.4		1	Each	135,000	135
Signal interlocking - one turnout	2.4		1	Each	550,000	550
Culverts	1.5	2.4	1	Sum	50,000	50
Permitting	1.5	2.4	1	Sum	100,000	100
SUBTOTAL						$ 2,962
Engineering and project management				Percent	17%	503
Contingencies				Percent	20%	693
TOTAL						$ 4,158

Source: RLBA estimates.

In the Moderate Service Scenario, it is recommended that the Burlington Electric siding be extended eastward by 1,550 feet and westward by 200 feet, and that another 2,400 foot siding be constructed east of the Winooski River bridge to hold cars for VTR. Since at this site east of the river there previously was a siding, grading costs would be minimal and no extensive retaining walls should be required. This plan would require more main track switching movements than would be required with one long siding as in the first option; such switching and track occupancy could be achieved efficiently only with limited passenger train operation. With more track occupancy time between passenger trains, spring switches would be installed on both sidings instead of expensive power switches. Estimated cost for this scenario is $2.5 million (see Table 30).

Table 30
Extend Burlington Electric Freight Siding Cost Estimate
Moderate Service Scenario

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Extend Burlington Electric Freight Siding Mileposts 1.5 and 2.4						
New spring switch -30 mph	1.7		1	Each	$ 135,000	$ 135
Turnout protection	1.7		1	Each	75,000	75
Grade for second track – moderate	1.7	1.7	200	Feet	114	23
Construct 12 foot retaining wall	1.7	1.7	200	Feet	700	140
Construct track 100RA CWR	1.7	1.7	200	Feet	90	18
Grade for second track – light	2.1	2.4	1,550	Feet	67	103
New crossing with rubber surface	Intervale		100	Feet	600	60
Construct track 100RA CWR	2.1	2.4	1,550	Feet	90	140
Relocate main track	2.1	2.4	1,550	Feet	35	54
New spring switch -30 mph	2.4		1	Each	135,000	135
Turnout protection	2.4		1	Each	75,000	75
Culverts	1.5	2.4	1	Sum	50,000	50
Permitting	1.5	2.4	1	Sum	100,000	100
Construct Freight Siding at Winooski Mileposts 2.5 and 3.0						
New spring switch -30 mph	2.5		1	Each	$ 135,000	$ 135
Turnout protection	2.5		1	Each	75,000	75
Construct track 100RA CWR	2.5	3	2,500	Feet	90	225
New spring switch -30 mph	2.4		1	Each	135,000	135
Turnout protection	2.4		1	Each	75,000	75
SUBTOTAL						$ 1,753
Engineering and project management				Percent	17%	298
Contingencies				Percent	20%	410
TOTAL						$ 2,461

Source: RLBA estimates.

Construction of Layover and Servicing Facilities

In order to store half the trainsets at night, or to store trainsets when not running in the daytime, a layover facility would be constructed at or near Essex Park & Ride with sufficient capacity to hold half the total number of trainsets. This facility would cost about $1.9 million, as shown in Table 31.

The other trainsets would layover at Charlotte. Major maintenance or rehabilitation of equipment would be contracted out, perhaps with NECR at St. Albans, or VTR at Burlington.

Table 31
Essex Park & Ride Station/Layover Track Construction Cost Estimate

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals $000
Construct Station/Layover Track at Essex Park & Ride, Milepost 110.3						
New turnout - 30 mph	0		1	Each	$130,000	$ 130
Signal interlocking - one turnout	0		1	Each	550,000	550
Grade for second track – light	0	0.2	1,056	Feet	67	70
Construct track new 115RE CWR	0	0.2	1,056	Feet	130	137
Utilities	0	0.2	1	Sum	100,000	100
Layover electric power	0.1	0.2	1	Each	200,000	200
Locker and storage building	0.1	0.2	1	Each	50,000	50
Layover roadway, fencing and gates	0.1	0.2	1	Sum	53,000	53
Permitting	0	0.2	1	Sum	50,000	50
SUBTOTAL						$ 1,341
Engineering and project management				Percent	17%	228
Contingencies				Percent	20%	314
TOTAL						$ 1,882

Source: RLBA estimates.

Improvements, Based on Scenario, and Estimated Costs

The estimates in this report are to be considered preliminary. Following this study, and decisions regarding the service to be implemented, engineering design is required prior to construction of improvements. This design, to include structural analysis of bridges and the tunnel, will produce engineered design solutions and their costs.

Preliminary cost estimates are contained in Table 32.

Table 32
Estimated Improvement Costs by Scenario
(in millions of dollars)

Improvement	All Day Service Scenario	Moderate Service Scenario
Upgrade track/bridges	$9.7	$9.7
Tunnel improvements	5.0	5.0
Highway crossing warning devices	1.9	1.9
Adding passing tracks	14.9	2.5
Freight sidings	4.2	2.5
Layover and servicing facilities	1.9	1.9
Upgrade main track to park & ride	0.2	0.2
Total estimated cost	$37.8	$23.7

Source: RLBA estimates.

Exploration of Less Expensive Options

In the above evaluation and cost estimate regarding the upgrade of track and bridges, the largest track component expenditure is for new rail, which leads to the question, "Why not use the existing rail?" The existing rail (with some replacements) could be upgraded to achieve 40 mph passenger train operation. However, this is not recommended, because retention of the existing old and jointed rail would result in maintenance and delay costs likely to be an uneconomic option. Furthermore, the quality of the passenger train service would not achieve the reliability level deemed necessary to attract maximum ridership.

The existing rail on this branch line is "relay rail" removed from main track several decades ago because it became unsuitable for 60 mph main line service. Since then, the existing rail has been adversely affected by poor tie condition.

Even if it were decided to use existing rail, the rail between the tunnel and Burlington would have to be replaced in order to remove older non-controlledcooled (therefore more brittle) rail, to ensure passenger train safety. Rail through downtown Winooski would have to be replaced as it has been rendered unusable for passenger train speeds because of poor tie condition and bad drainage. At a minimum, approximately 100 rails elsewhere on the line would have to be replaced because they are bent, worn or engine-burned. All rail bolts would have to be tightened, during which process perhaps one in 10 would be found frozen or defective and would have to be cut and replaced. To ensure signal continuity, bond wires would have to be placed at each joint.

If the existing rail were rehabilitated and upgraded, not replaced, there also would be a maintenance price to pay after the start of passenger service. Several extra maintenance employees would be required to (1) tamp up low joints weekly or daily, (2) keep bolts tightened and replaced as necessary, (3) unload spot ballast as needed to support tamping, (4) replace additional rails that are later found to be permanently bent, and (5) weld up battered rail ends on rail that is not bent. This process would result in slow orders which would delay passenger service, waste fuel, and absorb additional time on the part of train crew, dispatcher and management. Without close and careful (and therefore costly) monitoring of track deterioration, there would be increased accident exposure. Even with all this attention, the railroad would remain in less-than-desirable condition.

The point is that there would be considerable expense and service sponsor management attention associated with the process to rehabilitate and upgrade existing rail, and then to maintain it, and the money would be better spent replacing all rail and obtaining a more reliable track which will result in higher passenger train reliability and lower overall maintenance costs.

Other questions arise: "If we do replace the rail, is it necessary to upgrade the track to 60 mph standards?" "Wouldn't 40 mph service be adequate?" The recommendation of this report is to invest the small additional amount and obtain the quality and speed implied by 60 mph standards. The cost of replacing rail and upgrading to 60 mph standards is $9.7 million. The cost of replacing rail and upgrading to 40 mph standards is $9.1 million. In the All Day Service Scenario, a 60 mph standard results in an estimated travel time between Burlington and Essex Junction of 15 minutes. With the 40 mph standard, the time is 17 minutes—not a great difference. However, the success of this passenger rail service depends upon attracting riders, and a big incentive to use the train is time savings. Automobile time between Burlington and Essex Junction is approximately 27 minutes at peak hours.

The larger the difference between auto and train time, the greater the number of riders using the train.

Grade Crossings

Inventory

Between Burlington and Essex Junction, 13 highways and one footpath cross the railroad (see Table 33). One crossing in Burlington is on the VTR segment and two crossings in Essex Junction are on the NECR main line.

Table 33
Highway Crossing Inventory

Mile post	Street Name	Owner	Public/ Private	Warning Devices	Crossing Length	Crossing Rail	Crossing Surface	Crossing Condition	Highway Speed (mph)	Track Circuit	Maximum Estimated Train Speed	Comments	
0.0	Maple Street	VTR	Public	Crossbuck	40	131RE	Asphalt	Good	25	None	n/a		
0.1	King Street	VTR	Public	Crossbuck	65	127DY	Asphalt	Fair	25	None	n/a		
	BURLINGTON UNION STATION												
0.2	College Street	VTR	Public	Crossbuck, Stop sign	60	105DY	Rubber		25	None	25	Replace	Joints in crossing
0.4	Foot Path	NECR	Public	12FL	12	90RA	Rubber	Good	n/a	DC	40	Chg. Rail	
0.5	Lake (Power Plant Road)	NECR	Public	Crossbuck	51	90RA	Rubber	Good	25	None	50	Replace	Raise track
2.3	Intervale Road	NECR	Public	Crossbuck, Stop sign	48	100RA	Tim. & Asph.	Fair	25	None	45	Chg. Rail	Raise track
3.0	Mallets Bay Road	NECR	Public	12FLC	63	100RA	Rubber	Fair	25	DC	45	Replace	
3.3	Barlow Street	NECR	Public	12FLG	40	100RE	Asph. & Rail	Fair-poor	25	DC	20	Replace	
3.5	East Allen Street VT 15	NECR	Public	12FLC	120	115RE	Rubber	Fair	25	DC	50	Chg. Rail	Relocate one mast
4.6	St. Michaels College Road	NECR	Private	None	16	100RA HF	Tim. & Asph.	Bad	25	None	60	Replace	
5.4	City of Essex	NECR	Private ?	12FL	40	100RA	Tim. & Asph.	Fair	25	DC	45	Chg. Rail	
6.5	West Street	NECR	Public	12FL	32	100RA HF	Tim. & Asph.	Bad	25	DC	60	Replace	
6.7	Closed 1981	NECR	Closed	Now an unauthorized footpath									
7.4	South Summit	NECR	Public	12FLG+ 1C	40	100RA-CWR	Asphalt	Fair	25	DC	40	Replace	Ties bad
7.7	Park Street	NECR	Public	12FL	63	115RE	Rubber	Good	25	DC	25	Chg. Rail	
108.1	Maple Street	NECR	Public	12FLC	40	115RE	Rubber	Fair	25	Motion Sensor	30	Damage Surf.	
108.2	Main Street	NECR	Public	12FLGC	81	115RE	Rubber	Good	25	Motion Sensor	25		247-706H
	ESSEX JUNCTION STATION												
108.3	Central Street	NECR	Public	12FLC	35	115RE	Rail & Asph.	Fair	25	Motion Sensor			247-707P

Source: NECR; RLBA inspection.

Evaluation and Upgrade

Every crossing will require upgrading. Twelve (on the branch) have DC track circuits. As passenger trains will operate at twice the speed of freight trains, it is assumed that sensors and predictors will replace the old detection circuits to prevent motorist delays. Though most crossings do not now have gates, it is assumed that all crossings will be improved with full-quadrant gates. As heavier and higher rail would be installed throughout the branch to accommodate passenger trains, all crossing surfaces must be replaced. Of the twelve, five would receive new rail, surface and ballast; seven would be completely replaced. Some crossings also require advance warning roadway paint and yellow crossing signs. Estimated cost of improving highway and pedestrian crossings is $1.9 million, as shown in Table 34.

Before initiating new, higher speed services, an Operation Lifesaver program should be conducted in the area. There may be a nominal cost associated with that.

Analysis of Other Safety Issues

This section is to identify and analyze safety issues within the rail corridor.

Railroad Bridge between Winooski and Burlington

Of particular note is the long-standing trespass problem on the bridge over the Winooski River between Winooski and Burlington. This problem is to be assessed in the context of providing a solution that eliminates the conflict of trains and people while satisfying pedestrian movement in the vicinity. The safest and perhaps most expensive solution would be to parallel the railroad right of way with a pedestrian (and bicycle) path, outside of the railroad right of way and separated from it with a fence, and to construct a new and parallel pedestrian/bikeway bridge across the river.

Alternatively, it has been proposed to attach a pedestrian footbridge to the railroad bridge. This alternative uses the railroad right of way and assumes the owning railroad will agree to a foot and bicycle way on its right of way.
This raises a number of issues:

- Safety and liability concerns of the railroad
- Impact of footpath/bicycle way on railroad maintenance
- Pedestrian access to bridge
- Liability concerns of the government jurisdiction sponsoring the footway/bikepath

Table 34
Highway and Pedestrian Crossing Rehabilitation and Improvement Estimate

	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals ($000)
Highway Crossings					
Replace rubber panels	College St. (VTR)	65	Feet	450	$ 29
New flashlights and gates	College St. (VTR)	1	Each	120,000	120
New crossing with rubber surface	Lake St.	51	Feet	600	31
New flashlights and gates	Lake St.	1	Each	120,000	120
New crossing with rubber surface	Intervale Road	50	Feet	600	30
New flashlights and gates	Intervale Road	1	Each	120,000	120
New crossing with rubber surface	Mallets Bay Ave.	65	Feet	600	39
New gates and predictor	Mallets Bay Ave.	1	Each	90,000	90
New crossing with rubber surface	Barlow Street	50	Feet	600	30
New predictor, add gates	Barlow Street	1	Each	70,000	70
New gates and predictor	VT-15, East Allen	1	Each	90,000	90
New crossing with rubber surface	St. Michaels	20	Feet	600	12
New flashlights and gates	St. Michaels	1	Each	120,000	120
New crossing with rubber surface	Woodside Drive	40	Feet	600	24
New gates and predictor	Woodside Drive	1	Each	90,000	90
New crossing with rubber surface	West Street	40	Feet	600	24
New predictor, add gates	West Street	1	Each	70,000	70
New crossing with rubber surface	West Street	1	Feet	600	1
New predictor, add gates	S. Summit St.	1	Each	70,000	70
New crossing with rubber surface	S. Summit St.	40	Feet	600	24
New predictor, add gates	Park Street	1	Each	70,000	70
					Pedestrian Crossings
Replace rubber panels	Lake Path	12	Feet	450	5
New predictor, add gates	Lake Path	1	Each	70,000	70
SUBTOTAL					$ 1,349
Engineering and project management			Percent	17%	229
Contingencies			Percent	20%	316
TOTAL					$ 1,894

Source: RLBA estimates.

Perhaps the most important issue is the requirement to reach agreement with the railroad. It will probably be concerned most about the safety and liability issue, and will not want to assume liability for pedestrians and bikers. If the railroad agrees to a shared use of its right of way arrangement, it no doubt will require that liability, maintenance and other issues be fully addressed. The railroad will expect the sponsoring government jurisdiction to pay all costs associated with any such agreement.

With regard to railroad maintenance activities, it is expected that the railroad will require: (1) adequate clearance distances for track repairs (industry minimum is 12′ from track centerline, 15′ or more is preferred), (2) drainage of track structure (railroad requires good drainage, and probably wishes to continue use of its access road beside track), and (3) adequate fencing, to reduce the likelihood of accidents (industry minimum is no less than 10′ from centerline of track; 8′ high chain link is recommended).

It will be necessary to engage a structural engineer to determine whether the existing bridge has adequate strength to be used to support a structure for footpath/bikeway, and, if so, to design the latter. The existing embankment will require expansion to provide sufficient space for a pedestrian and bicycle path. This will require engineering design, which will probably encompass a retaining wall in order to expand width of the embankment to accommodate a pedestrian/bike path. Noise and wind impact, caused by close passing trains, must be a design consideration.

The sponsoring government jurisdiction should fully investigate its liability in any arrangement providing pedestrian/bicycle access on railroad property. There will be other issues of importance, for example, security and lighting. The sponsoring government jurisdiction may be obliged to provide routine inspection of the pedestrian and bicycle path to assure proper use and good fencing maintenance.

<u>Rock Cut West of Lime Kiln Road</u>

Trespassers also frequent the rock cut west of Lime Kiln Road (railroad milepost 4.2), which has become a rock-climbing attraction. Fencing cannot prevent unauthorized use of the railroad right of way.

The steep faces of this rock cut have become known as a challenging location to climb. NECR reports that train crews and track inspectors have found climbers "tied off" to the rails. The action in this case must be enforcement, as trains and climbers cannot safely share the rock cut.

Route 15 Corridor Study (Bike/Pedestrian Path)

The requirement regarding this portion of Task 4 is to coordinate with the alternative path scoping study currently underway in the Route 15 corridor.

This bicycle/pedestrian path project is important to the Village of Essex Junction and others in Chittenden County.

General Background

The concept of locating multi-use trails along or adjacent to active railroad or transit corridors presents a unique set of challenges for transportation planners and decision-makers. These corridors provide connections between communities and people that are becoming increasingly rare as available land is used for development. Thus, for trail advocates and others they represent, the corridors constitute prime recreational as well as alternative transportation opportunities. At the same time, however, these corridors contain active train traffic, raising real safety and liability concerns for trail users as well as railroad employees and rail passengers.

Since the 1960's, some of the demand for multi-use trails has been met by converting abandoned rail rights-of-way to public use trails, known as rails-to-trails. It is likely, however, that available abandoned rights of way will decrease over time, particularly if the rail industry continues to strengthen and the demand for freight and passenger rail transportation continues to increase. As a result, transportation planners and others will increasingly look to other corridors, such as active rail and transit rights-of-way, to locate multi-use trails.

The transportation community already is taking a closer look at the possibility of rails-with-trails. For example, the Institute of Transportation Engineers is working on a best practices informational report, the Rails-to-Trails Conservancy has published a report, the American Association of State Highway and Transportation Officials (AASHTO) has conducted a survey, and the issue has been discussed at several conferences, including a February 1997 rails with trails conference sponsored by the Federal Railroad Administration. The Federal Highway Administration and the U.S. Department of Transportation's Rails-with-Trails Working Group are sponsoring a study of the issues associated with rails with trails.

Route 15 Corridor Alternative Path Scoping Study

The bicycle and pedestrian path would connect Essex Town Offices with Lime Kiln Bridge, with the preferred route running along the southern side of Route 15. In places, the route would lie within the NECR right of way.

A Lamoureux, Stone and O'Leary Consulting Engineers study shows the paved bike/pedestrian path as close as about three feet from the nearest rail, at or near the present Amtrak station in Essex Junction. It appears that the bike/pedestrian path would share the passenger station platform. Other typical section drawings show distances of between 10 and 23 feet between the path and the nearest rail. This proximity, between pedestrians and bikers and a moving train, has safety and liability implications which should be carefully considered. Three feet from the nearest rail is deemed unsafe, as rail equipment width would impinge on the path. In any event, it is clear that these issues must be settled between the railroad and the interests supporting the path, if the project is to proceed.

A CCMPO letter dated May 11, 1998, asked NECR for that railroad's conditions for such a bike/pedestrian path. It is understood that the study has not progressed because the railroad is not interested in cooperating.

The discussion regarding the railroad bridge between Winooski and Burlington applies also to the proposed bike/pedestrian path. In both cases, the implications of a fast-moving (60 mph maximum) passenger train (as opposed to today's slow-moving freights) should be considered in the context of the distance between bike/pedestrian path and track. Again, these issues must be resolved with the railroad owner.

Phased Infrastructure Improvement Program

Appendix C describes a phased infrastructure improvement program.

It must be emphasized that the recommended infrastructure improvements shown in Table 32 are deemed necessary in order to produce reliable passenger train schedules which are the basis for ridership projections in the Moderate and All Day Service Scenarios described in Chapter 1. Any reduction in the infrastructure improvements recommended, or phased construction of the improvements over a period of time, will have important ridership implications. In short, if the infrastructure improvements are not made, passenger rail service will not be reliable, and passengers will not come.

CHAPTER 4

STATION SITES AND INTERMODAL LINKS

Station Siting Criteria

Siting of stations is guided by criteria described below.

Proximity to Trip Origins and Destinations

Stations should be located where there are population centers, whether residential or business. In other words, stations should be where they are most convenient to prospective passengers. Also, there should be easy intermodal access; each station should be well-connected with pedestrian, automobile, bus and bicycle access, and where possible to intercity rail (Amtrak).

Community Impacts

Station locations should fit community plans and community land use policies. When established as part of multimodal transportation stations and economic development plans, passenger rail stations may reinforce growth-center based redevelopment, a stated objective in regional plans. It is of considerable importance to encouragement of ridership when the passenger station is a community landmark and located at the center of commerce. A passenger station may help the community in projecting its image.

Highway Access

A passenger rail station should be convenient to highway access, have adequate parking, and contain provisions for automobile drop-off and feeder bus service where appropriate.

Cost

The cost of establishing and maintaining a station at a given site must be reasonable.

Railroad Agreement

The site should be one with which the operating railroad agrees. For example, stopped passenger trains should not interfere unduly with freight traffic. It is preferable to site passenger train stations on level and straight track and where the stopped passenger train will not interfere with turnouts and grade crossings.

Typical Station Site Layout

Passenger rail stations in the United States run the gamut from no facilities (a train stop at an unimproved location) to Grand Central Station in New York City. We assume Chittenden County would require at least an identifiable platform adjacent to track and provision for access to that platform by bus, auto, bicycle and foot. For passenger rail service implementation, a 100 feet long x 12 feet wide platform is recommended. Bike racks or lockers should be a consideration wherever their use is likely. A weather shelter should be added. Adequate free parking is an inducement to use commuter rail, and should be provided. Provision for the disabled is required; with regard to those who use wheelchairs, this could be a mobile lift at the station, a mini-ramp on the platform or an on-board lift.

Considering the above, it is recommended that the typical station include:

- Platform with canopy and wind shelter
- Access to platform (pedestrian, bicycle, automobile, bus)
- Parking
- ADA mobile lift
- Bicycle racks
- Lighting

Station Cost Estimate

Station costs may be modest or otherwise, depending upon community preferences. A station including platform, disabled lift, lighting, small shelter and bus and auto drop-off/pick-up would cost about $80,000. Site preparation (clearing, drainage, grading) would be site-dependent and would be estimated as part of preliminary engineering. Parking construction cost is about $3,500 per space. Thus, for 20 parking spaces, the cost would be $70,000, assuming a prepared site. Finally, the costs of any required access routes (pedestrian/bike path, highway access) to the station, real estate and bringing electrical power to the site, all of which are site-dependent, would be determined in preliminary engineering.

In very preliminary terms, a simple station with parking for 20 cars would cost upwards of $150,000, depending on site characteristics.

Station Sites

The following station sites are evaluated in this study. Also shown is the range of estimated ridership (estimated daily boardings) with regard to the All Day Service Scenario. Absence of ridership figure indicates that station was omitted from the estimation of ridership.

Station	Estimated Daily Ridership
Burlington	380-460
Intervale	
Winooski	180-220
Fanny Allen	90-110
Woodside	10-30
Fairgrounds	
Essex Junction	220-260
Essex Park and Ride	20-30

Burlington

The City of Burlington plans a multimodal transportation center across Lake Street from Union Station. Several transportation modes will come together: College Street shuttle, regional bus, intercity bus, passenger rail, ferry, bicycle and pedestrian. Union Station is already a community landmark, and a part of the Burlington commercial center. Thus, Union Station is the obvious site for a Burlington passenger rail station. As expected, Burlington's Union Station exceeds all others in anticipated number of riders.

Intervale

Although not included for purposes of ridership estimation, Intervale is listed as a potential station because of plans for nearby development. When these plans are realized, a station stop at Intervale should be considered. The potential station would be located near the intersection of the railroad and Intervale Road.

Winooski

Like Burlington, Winooski plans an intermodal transportation center located at its downtown business center, at the southeast quadrant of the intersection of Main Street and East Allen Street. Also like Burlington, the passenger rail platform will be across the street (across East Allen Street in the case of Winooski) and adjacent to the railroad tracks, in this case south of the tracks and west of Barlow Street. The City of Winooski plan for location of the rail station conforms with the above station siting criteria.

Fanny Allen

This station is intended to serve the Fanny Allen Campus of Fletcher Allen Health Care on Route 15, Camp Johnson, St. Michael's College and residential areas in the vicinity. Because of distance, feeder bus service would be necessary to bring passengers to the train to board, and take de-boarding passengers to their destinations.

Station location is the intersection of the railroad with the unpaved road which is the southeast extension, across Route 15, of Campus Road. Use of the property adjacent to the railroad right of way for parking, and access to the station, would require permission from the owner, St. Michael's College.

Woodside

A station located at the intersection of Woodside Drive and the railroad is intended to serve the residential area on the north side of Route 15 and perhaps Camp Johnson. Because of distance, feeder bus service would be necessary to bring passengers to the train to board, and take de-boarding passengers to their destinations.

As in the case at all other stations, a platform would necessarily be constructed on railroad right of way. Additional facilities (parking, bus and auto access, etc.) would require an agreement with the landowner. At this location, the property owners adjacent to the station site are the State of Vermont, Winooski Valley Park District and St. Michael's College. The terrain at this location is not flat, and specific siting of facilities for parking and bus stop would require subsurface investigation and appreciable leveling costs.

Because of the very low ridership predicted at this station, its inclusion as a station is not recommended.

Fairgrounds

Although not included for purposes of ridership estimation, Fairgrounds is listed as a potential station because of the opportunity to use the railroad to transport people to and from the Champlain Valley Exposition (Fairgrounds) at seasonal events. The station could be located at any appropriate site alongside the track and opposite the Fairgrounds entrance.

Given the decision not to recommend a station at Woodside, the population density in the vicinity of the Fairgrounds, and the plans for a new Essex Junction Civic Center at that location, it may be appropriate at some point in the future to consider a regular—as opposed to seasonal—station at the Fairgrounds.

Essex Junction

Essex Junction has selected the current passenger railroad station as the site for the future train station and this site conforms with the station siting criteria listed above.

Essex Park and Ride

A 1993 study of parking and ride share sites shows a "high volume area" site on the east side of Route 2A, bounded by a future off ramp for a section of the Circumferential Highway that would come from Colchester. VAOT has identified this site as a future commuter lot, holding some 370 cars. The study suggests that a walkway (across—over or under--an intervening highway on-ramp) could connect the commuter lot to a future commuter rail stop. Distance between the commuter park and ride lot and the railroad right of way is about 100 feet.

A 1999 CCMPO interim report, "Chittenden County Park and Ride Lots Prioritization", shows this park and ride lot, identified as "Essex: VT 2A and VT 289 Exit", among the top three park and ride lot locations.

It is recommended that a passenger rail station be included at this site; however, considering the relatively low ridership estimated for this location in the passenger rail study, the site should be monitored to determine whether actual train usage from this location warrants its continued use.

IBM

The IBM plant located in Chittenden County is Vermont's largest employer. The New England Central Railroad main line passes very close to this plant. Although IBM has chosen to adhere to its current employee access arrangements, automobiles and shuttle bus service, it is strongly recommended that IBM be approached again, perhaps during preliminary engineering. A station at IBM would be appropriate for this major trip generator.

Integration of Transportation Modes Including Bus Links

In general, a transportation system should be multimodal and well-connected, providing convenience and choice to its passengers. CCTA feeder bus service is to be an integral part of the service at each station. Success of the passenger rail service depends upon a fully integrated public transportation system. In particular, the rail component should do what rail does best (move passengers rapidly over long distances on its fixed guideway), and the bus system should do what the bus does best (respond to changing local travel patterns, provide service where rail cannot, and serve as a feeder and distributor for the rail system).

The rail component also should be linked to longer distance transportation modes and connections with Vermont Transit Lines and Amtrak can be made. Two Amtrak trains per day, one northbound and one southbound, serve Essex Junction. Essex Junction plans a new Multimodal Transportation Center at the site of the present Amtrak station and this "could serve as a commuter rail link, foster new bus ridership, and encourage growth in a traditional village core."[9]

Most Vermont Transit Lines intercity bus routes include Burlington and that city plans a Multimodal Transportation Center which will include CCTA and Vermont Transit buses, taxis, the College Street Shuttle and approximately 300 parking spaces.

Winooski plans an Intermodal Transportation Center at Main Street and East Allen "to serve as a transportation hub in Chittenden County."[10]

The integration of passenger rail service with the planned transportation centers at Essex Junction, Burlington and Winooski will encourage the Chittenden County goals to promote growth centers and to stimulate increased use of public transit during peak periods.

Linkages with bicycle and pedestrian trails is also encouraged. Implementation of passenger rail service should be accompanied by coordination with all other transportation modes, including highway, to link the rail service to those modes by convenient access.

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[9] Eve Thorsen, "Alternative transportation group may receive funding", *The Burlington Free Press*, May 28, 1999.
[10] "Winooski Intermodal Transportation Center Feasibility Study", prepared by Dunn Associates, Inc., December 20, 1994.

Ownership/Management Alternatives

There is no "rule" or "accepted practice" regarding ownership of rail passenger stations. Stations are owned by railroads (including Amtrak) and by cities and communities. Typically the station platform is located on railroad property, while parking and access are adjacent to but outside of the railroad right of way.

Community ownership and development of passenger rail stations and the establishment of "community identity" associated with station development, should be strongly encouraged. It appears that plans in Essex Junction, Burlington and Winooski fully support this concept.

CHAPTER 5

RESOURCE AND PERMITTING ISSUES

The Burlington-Essex rail corridor runs through a wide variety of surroundings, ranging from commercial downtown areas to the open fields of the Intervale in Burlington's North End, and residential neighborhoods of Winooski. In this chapter, potential environmental concerns along the rail corridor are identified, along with the permits or documentation which may be required to implement passenger rail service along this corridor.

No "fatal flaw" environmental resource impacts are identified that would seem to deny the implementation of a passenger rail service along the Burlington-Essex corridor. However, several sensitive environmental resources do exist along the corridor. If the project moves forward, a more detailed review and evaluation of these resources will be required, and potential mitigation, or adjustments to the project may be necessary.

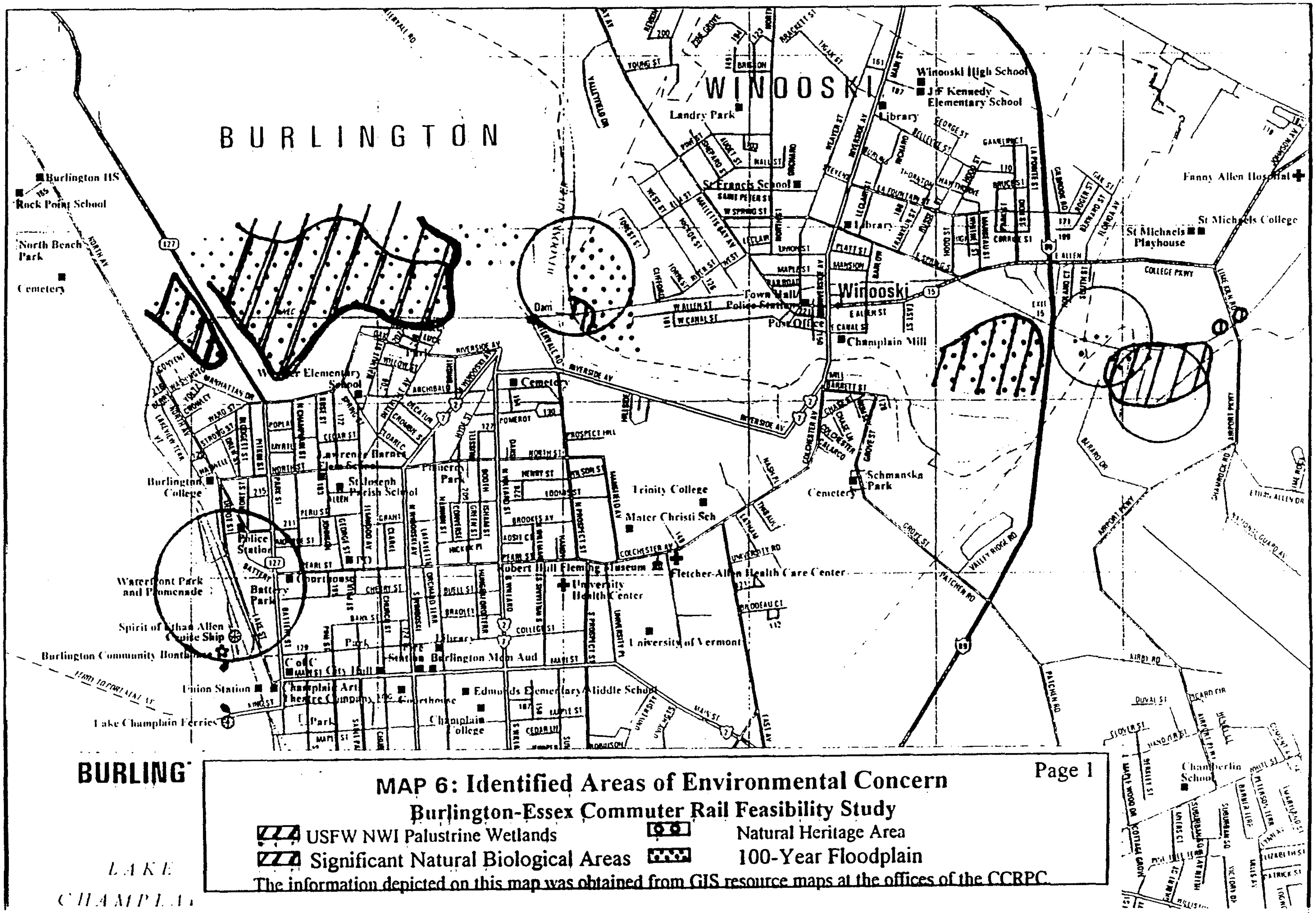
First, under Environmental Resource Inventory, environmental resources identified along the corridor, potential impacts to these resources from the proposed passenger line, and the permitting issues that may be triggered, are discussed. Then, under Permitting and Documentation, the permits and documentation that may be necessary to implement the project are addressed, along with the level of effort necessary, and typical permit acquisition period.

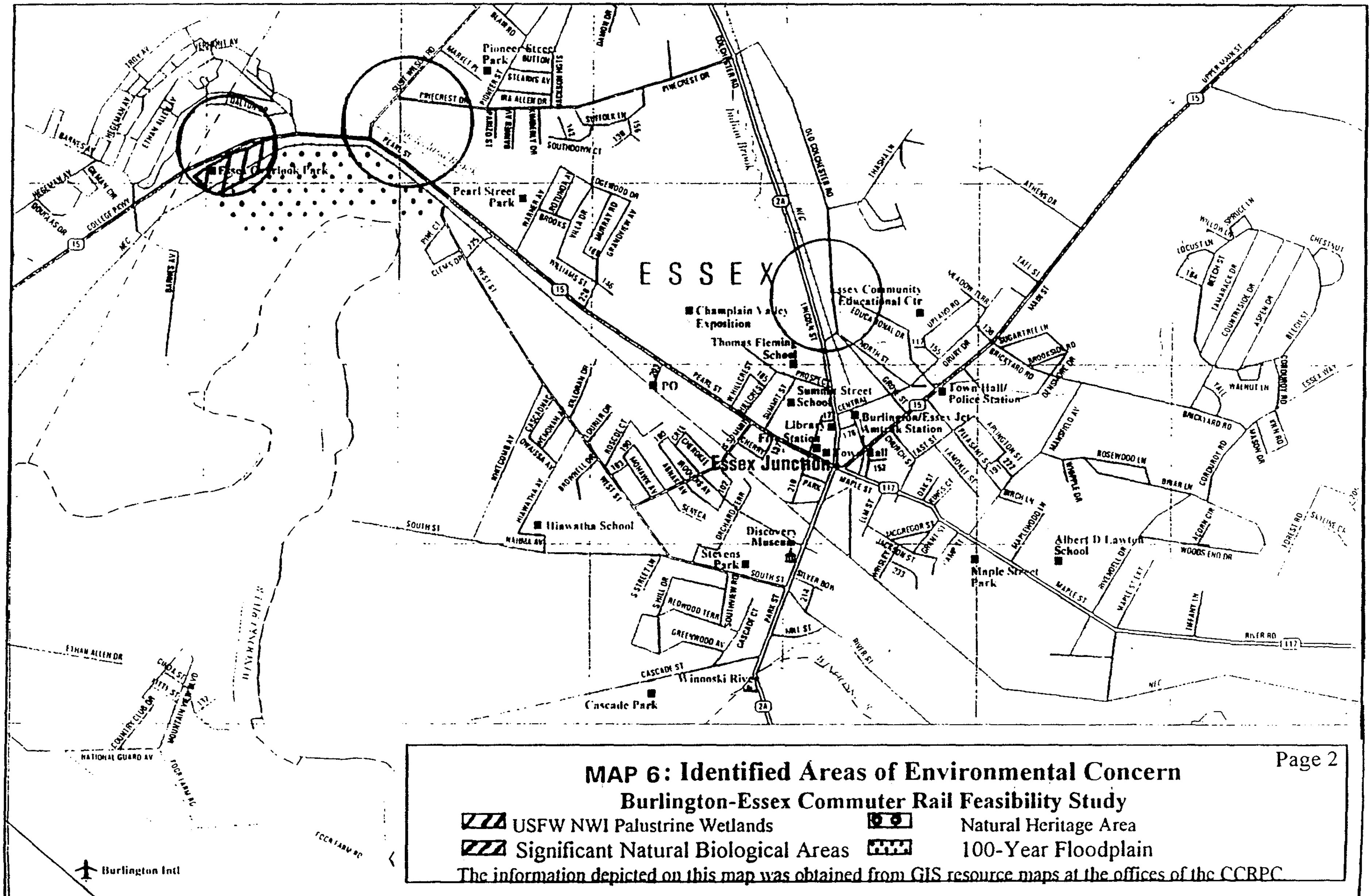
Environmental Resource Inventory

An inventory of environmental resources along the project corridor is set out below, based on information obtained from field inspections and document reviews at the Vermont Agency of Natural Resources (VANR).

Wetlands

There are six mapped wetlands adjacent to the rail corridor, of which the corridor bisects three. "Mapped wetlands" are those identified on the National Wetlands Inventory (NWI) map. These are deemed "significant wetlands", designated Class One or Class Two, and as such are protected under the Vermont Wetland Rules, although there are currently no Class One wetlands in Vermont. The determination of whether any specific wetland is significant is based on an evaluation of the extent that it serves one or more of ten specific functions. Class Two wetlands, including the six mapped wetlands along the project corridor, shown on Map 6, Pages 1 & 2, as well as wetlands contiguous to them, require 50 foot buffer zones.


BURLINGTON
WINOOSKI
Winooski
Burlington HS
Rock Point School
North Beach Park
Cemetery
Landry Park
Winooski High School
J F Kennedy Elementary School
Library
St Francis School
Fanny Allen Hospital
St Michaels College
St Michaels Playhouse
Town Hall
Police Station
Post Office
Champlain Mill
Dam
Cemetery
Trinity College
Mater Christi Sch
Schmanska Park
Fletcher-Allen Health Care Center
Robert Hull Fleming Museum
University Health Center
University of Vermont
Burlington College
Police Station
Waterfront Park and Promenade
Battery Park
Courthouse
Spirit of Ethan Allen Cruise Ship
Burlington Community Boathouse
Union Station
Lake Champlain Ferries
City Hall
Library
Burlington Mem Aud
Edmunds Elementary/Middle School
Champlain College
Champlain School
Lawrence Barnes Elem School
St Joseph Parish School
Pomeroy Park
BURLING
LAKE CHAMPLAI
Page 1
MAP 6: Identified Areas of Environmental Concern
Burlington-Essex Commuter Rail Feasibility Study
USFW NWI Palustrine Wetlands
Significant Natural Biological Areas
Natural Heritage Area
100-Year Floodplain
The information depicted on this map was obtained from GIS resource maps at the offices of the CCRPC.



MAP 6: Identified Areas of Environmental Concern

Burlington-Essex Commuter Rail Feasibility Study

USFW NWI Palustrine Wetlands

Significant Natural Biological Areas

Natural Heritage Area

100-Year Floodplain

The information depicted on this map was obtained from GIS resource maps at the offices of the CCRPC.

The most apparent impact to wetlands from this project involves the Intervale wetlands of Burlington's North End. This includes the area east and west of Route 127 from North Avenue and east through the Intervale. These wetlands house associated natural species, including Harsh Sunflower, *helianthus strumosus*, which is state listed as Threatened, and these wetlands are therefore also considered Significant Natural Habitats as discussed below. A contiguous, unmapped wetland exists from west of this wetland to the east end of the tunnel.

Additional Class Two wetlands are located on the eastern bank of the Winooski River where the rail corridor crosses the river between Burlington and Winooski, and east and west of Limekiln Road in Colchester (Map 6, Page 2). Impacts to these wetlands would be mitigated if track improvements do not require expansion of the base into or adjoining the wetlands, and if station locations remain outside these areas.

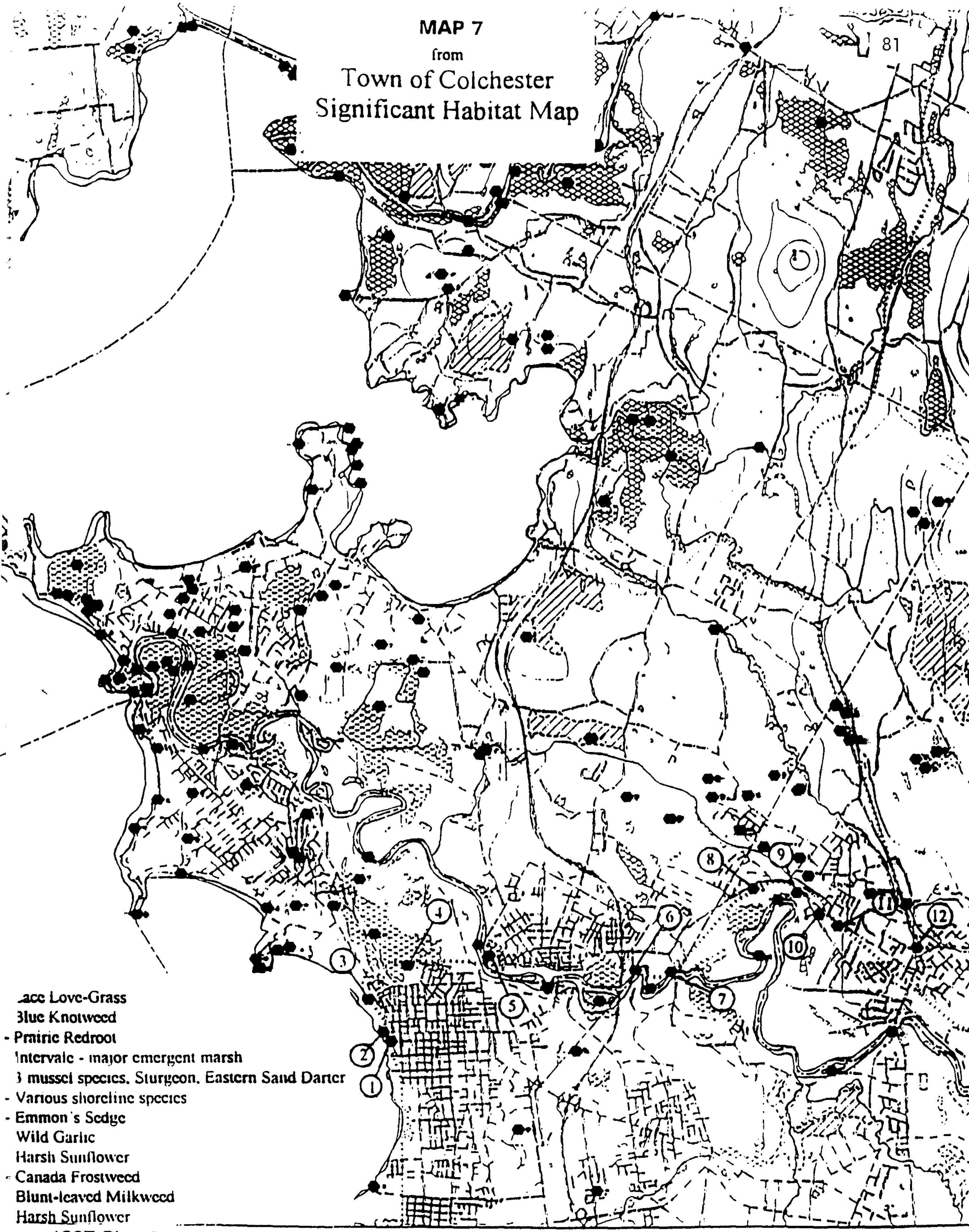
Within, or adjoining, these significant wetlands are areas currently proposed for track siding extensions to accommodate passenger rail and potentially new construction to allow use of the tunnel at the higher passenger train speeds anticipated in this project. The Wetland Rules contain a list of activities allowed within significant wetlands and their adjacent buffer zones, without the requirement for review under the rules, provided there is no draining, dredging, filling, grading or altering the water flow. Routine maintenance and repair is typically an allowable use. All other uses are conditional and require review under the rules. Any extension of the track, or new construction, likely would require review under rules.

An inspection of the corridor revealed the probable presence of numerous Class Three wetlands. Class Three wetlands are those either considered not significant in producing any wetland functions when last evaluated, or those that have not been mapped on the NWI maps. The Vermont Wetlands Rule does not include jurisdiction of Class Three wetlands; however, these are regulated by federal jurisdiction through Section 404 of the Clean Water Act and are subject to review under Vermont Act 250.

<u>Rare, Threatened or Endangered Species or Significant Natural Communities</u>

The existing rail corridor passes adjacent to twelve areas identified as having rare, threatened or endangered species, or Natural Communities (see Map 7). The most significant of these is an existing community of Prairie Redroot, which is state-listed as Endangered. This is the only site in New England where Prairie Redroot, *ceanthus herbaceus*, is native. This site is located in

MAP 7
from
Town of Colchester Significant Habitat Map



1997 Significant Habitat Map • Vermont Department of Fish and Wildlife

Burlingon west of Lakeview Terrace, south of the railroad tunnel, and is identified by the number "3" on Map 7. This area, considered a highly sensitive site, is currently identified as a possible location for a second track. Therefore any improvements or construction would require review by a state wildlife biologist to delineate an acceptable construction alignment.

Wild Garlic, *allium canadense*, identified by the number "8" on Map 7, is located in the general vicinity of Essex Overlook Park after the rail line crosses Barnes Avenue in Essex, heading east. Wild Garlic is a state Threatened plant. Due to the probability that it is located near the rail bed, expansion in this area would be of concern. The remaining identified rare, threatened, or endangered species are also shown on Map 7.

The majority of the Significant Natural Communities identified are related to the Winooski River and associated wetlands. (Map 7 identifies Natural Heritage Areas, which in some cases are also identified as Significant Natural Communities. Information from VANR Natural Heritage staff indicate that these two categories would be treated similarly with regard to review and permitting.) Species with state status as Threatened or Endangered are protected under Vermont's Endangered Species Law (10 V.S.A. Chapter 123). Permit determination is handled by the Nongame and Natural Heritage Program of the Vermont Fish and Wildlife Department.

Federally listed Threatened or Endangered Species are protected by the Federal Endangered Species Act (P.L. 93-205). It appears that no federally listed Threatened or Endangered Species are located within the work area.

Floodplains

The rail corridor passes through several 100-year floodplains as shown on Map 6. This is relevant only if construction is proposed outside of the existing rail bed, in a floodplain. If floodplains will be impacted, coordination of review and mitigation is required through VANR for Section 401 Water Quality Certification and US Army Corps of Engineers (COE) for Section 404 Permit. A specific finding regarding the project's impact on floodplains is required by documentation that must be prepared pursuant to the National Environmental Policy Act (NEPA).

Historical and Architectural Sites

An inventory of historic bridges in the state is unavailable, however, several bridges along the rail corridor may have historic merit. Therefore, if the project proposes physical changes which will impact any bridge along the corridor, that bridge would need to be evaluated by a qualified consultant to determine its eligibility for the National Registry of Historic Places, as would the tunnel, constructed in the 1860's.

Additional historical assessments would only be necessary in a minimal number of cases, such as if renovation of a historical building is proposed for a station site. Such buildings currently identified in the project area include: the Knights of Columbus Hall on the corner of Weaver Street and Railroad Lane in Winooski; 21 buildings in the Fort Ethan Allen complex in Colchester; and buildings located at 3 Main Street, 43 Central Street and Railroad Street in the Village of Essex Junction.

Historical resources need to be reviewed by the Vermont Agency of Transportation (VAOT) and the Vermont State Historic Preservation Office (SHPO) under Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act. They also need to be addressed in NEPA documentation, and Vermont Act 250 permitting (see below).

<u>Archeological Sites</u>

Proposed station sites and areas for track extension also will require evaluation regarding their potential to be in archaeologically sensitive areas. This should be done on an individual site basis, as it would be cost-prohibitive to assess the entire corridor from Burlington to Essex Junction. Since the corridor follows the shore of Lake Champlain and the Winooski River, there is high potential for involving archeologically-sensitive sites in areas where work will extend beyond locations currently disturbed.

Archaeological resources need to be reviewed by VAOT and the Vermont SHPO under Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act. They also need to be addressed in NEPA documentation and Act 250 permitting.

<u>Hazardous Sites</u>

Since the proposed passenger rail service line utilizes an existing rail corridor, it is probable that several as yet unidentified sites may be located along the corridor itself. Hazardous waste sites in Vermont are cataloged by address, making it difficult to assess the entire corridor. Once construction sites have been identified along the corridor, an evaluation of those particular locations can be completed.

One site which is currently known, and which may impact project design is the Burlington Landfill on Intervale Avenue. Information from the VANR Sites Management Section indicates that the hazardous waste site may extend to the edges of the existing rail west of the McNeil Power Generating Station on Intervale Avenue and east of Route 127. The site may encompass the area proposed for a siding extension to accommodate introduction of passenger rail traffic so as to avoid conflict with rail freight operations. Any work requiring excavation would be of concern in this area, and would require coordination with VANR.

Water Quality

Water quality impacts include those to surface water, groundwater, floodplain and wetlands. Waters which could be impacted by this project include the wetlands and floodplains previously mentioned, as well as the Winooski River and associated streams. Protection of water quality is administered through the VANR and COE under Section 401 Federal Clean Water Act, and Section 404 of the Federal Water Pollution Control Act, respectively. Water quality impacts also must be evaluated, and mitigation addressed in NEPA documentation, and under Act 250 criteria. Water quality impacts are also addressed through VANR Stormwater Discharge Permits.

Air Quality

The use of passenger rail has the potential to impact air quality by altering the relative degree of mass transit and private vehicle use. Passenger rail service will reduce motor vehicle usage. However, emissions from passenger trains may impact air quality. A determination of the project's need for an indirect source permit is completed by the VANR Air Pollution Control Division based on a summary of the net effect on air quality. Based on this determination, an air quality impact evaluation may or may not need to be included in NEPA documentation. Air quality impacts are also reviewed under Criterion 1, Undue Water and Air Pollution, of Act 250.

Noise and Vibration

The project as proposed will create additional noise and vibration impacts from the operation of passenger rail trains. Noise impacts include engine noise and horn-blowing. Also, construction of the new stations and track improvements and extensions along the rail corridor will create short-term noise. Existing sources of noise within the corridor include the daily freight train operations as well as automobile and truck traffic from cross streets and adjacent roadways. The rail corridor passes through a variety of land uses including residential, recreational, open lands and industrial/commercial areas. Noise and vibration from passenger rail operations will impact these land uses differently. Noise and vibration impacts need to be reviewed under NEPA. Noise impacts are also reviewed under Criterion 1, Undue Water and Air Pollution and Criterion 8, Aesthetics, of Act 250.

Permitting and Documentation

Implementation of the proposed passenger line will require certain permits and environmental documentation, with the level of effort dependent on the scenario chosen and final project design. The project falls within the ambit of numerous state and federal regulations; only those permits or reviews that appear pertinent are discussed here.

Wetlands Conditional Use Determination

Construction in significant wetlands within the State of Vermont falls under the jurisdiction of the VANR and is regulated by the *Vermont Wetlands Rule* as per Title 10 VSA Chapter 37 Section 905(7). These rules establish allowed uses for which the Secretary of the VANR must issue a Conditional Use Determination (CUD). A CUD will be issued if it is determined that proposed uses will have no undue adverse affect on the protected functions of the wetlands, or that proper mitigation has been planned. The routine repair and maintenance of an existing structure is an allowable use under the rules; however, any other work in a significant wetland or in a buffer zone will require review by the wetlands office of the ANR. The project as proposed may impact Class Two wetlands identified along the project corridor, and therefore would be subject to review in accordance with Vermont Wetland Rules.

The Vermont Wetlands Rules do not include jurisdiction of Class Three wetlands; however, these are federally regulated by through Section 404 of the Clean Water Act and subject to review under Act 250, as discussed below.

No fee is associated with the CUD application. Typical turn-around time is 2-4 months after receipt of a completed application. This process is subject to a 15 day public notice period. A wetlands biologist must identify wetland functions and extents as part of the application. If impacts to the wetland from the project are identified, mitigation plans may be required.

Water Quality Certification

The Federal Clean Water Acts of 1977 and 1987 regulate discharge to waters through Section 401 Water Quality Certificates. Section 401 also requires applicants for Section 404 Permits (discussed below) to obtain certification or waiver from the state water pollution control agency to discharge dredged or fill materials. In Vermont, the certifications are administered under the jurisdiction of VANR, and can be issued with Conditional Use Determinations, Stream

Alteration Permits as well as Lake and Pond Permits. It is likely that a Section 401 certification would be obtained through the CUD for this project.

There is no application form. Appropriate information, which demonstrates that the activity will not be carried out in a manner which violates Vermont Water Quality Standards and assures that the project will comply with any other appropriate requirements of state law, must be submitted to VANR.

Federal Water Pollution Control Act Section 404 Permits

Section 404 is intended to prevent water pollution by regulating discharge of dredged or fill materials, excavation, or mechanized clearing in all waters of the United States, including wetlands. Discharge includes the placement of materials required for structural foundations. Permits are administered through the COE. General, Nationwide and Individual Permits are issued to meet the requirements of this regulation. General Permits are issued for projects with minimum activity involving minimal or insignificant environmental impacts. Nationwide permits are a series of permits granted for certain minor projects. Individual permits are required for projects which do not fall under criteria for general or nationwide permits. Section 404 permits require a Section 106 determination and a Section 401 Water Quality Certificate.

The COE will issue a permit based on an evaluation of impacts identified during a Public Interest Review and compliance with 404(b)(1) guidelines. The Public Interest Review provides for evaluation of the probable impacts of a proposed project on public interests, considers the environmental, social and economic concerns of the public, and includes comments of federal, state and local agencies, as well as the general public. The 404(b)(1) guidelines prohibit discharges where less environmentally damaging practicable alternatives exist, which result in violations of other state or federal regulations, which cause or contribute to significant degradation of waters and wetlands, where appropriate mitigation has not been taken, or where there is insufficient information to determine compliance.

An application must be submitted with a wetlands delineation, including wetland boundaries, dimensions of proposed work, and extent of wetland encroachment. Application fees range up to $100, depending on the type of permit to be processed. Small, non-controversial projects can be processed in 15-90 days, large controversial projects can take considerably longer.

Stormwater Discharge Permit

A Stormwater Discharge permit is required if the project involves the disturbance of greater than five acres of land, or the creation of greater than one acre of impervious area under certain conditions. This project would most likely require a Stormwater Discharge Permit under the latter condition. A General Permit may be obtained for certain standard projects. Runoff control and mitigation needs to be designed with reference to the *Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites*, as revised in 1987. The US Environmental Protection Agency has delegated jurisdiction of this matter to VANR. Permits are administered through the Wastewater Management Division.

Permitting fees are $125 per acre of impervious surface created, with a $100 minimum per application. The review period is limited by statute to five months.

Air Pollution Control Permit: Indirect Sources

Section 5-503 of the Vermont Air Pollution Control Regulations requires certain new or modified indirect sources to obtain an air pollution control permit. The primary objective of the review and permitting of indirect sources is to ensure that emissions from increased motor vehicle activity will not cause or contribute to a violation of ambient air quality standards. Typically, mass transit projects do not require air pollution control permits as they decrease motor vehicle usage. However, a determination from the VANR Air Pollution Control Division (APCD) of the need for an air pollution permit is required in NEPA documentation. The APCD must be provided with a general description of the project, quantification of pollutant emissions and an evaluation of the net effect on air quality.

Threatened and Endangered Species

The Endangered Species Act of 1981 established the protection of endangered and threatened plants and animals. Conformance with the requirements of the Endangered Species Act requires a site inventory by a VANR biologist in areas of proposed work. Close coordination with the VANR Nongame and Natural Heritage Program staff during planning stages will help minimize impact and avoid areas of concern while reducing delays and permits required. An additional impact survey may be required by the VANR.

No application fee is specified. However, if extensive investigation or monitoring is required, a fee may be imposed as part of the permit conditions. The time required for application review is not specified, as reviews may require inspection of a site during a certain season. As proposed, this project will require an assessment by a VANR wildlife biologist, and an assessment of the project's impact on identified endangered species and habitat areas.

Section 106 of the National Historic Preservation Act of 1966

Section 106 of the National Historic Preservation Act of 1966 aims to protect historical and archeological resources. The NEPA document (discussed below) should address several issues including impact upon the historic environment, both structural and archeological. Information from a National Historic Preservation Act review must be incorporated, including the preparation of a Cultural Resources Survey to identify and evaluate potentially affected historic properties. The Cultural Resources Survey should be completed by an approved historical consultant.

Findings of the Cultural Resource Survey are provided to VAOT archeologists and historians, who will coordinate these with the Vermont SHPO. The Advisory Council on Historic Preservation reviews the effects of projects on historic and archeological properties. Historical and archeological reviews on projects involving wetlands or other US waters are coordinated with COE.

If a determination of "No Impact" is made, the SHPO will sign a letter of concurrence to that effect. If impacts and mitigation are identified, a Memorandum of Agreement documenting measures taken to mitigate adverse impacts is prepared.

Department of Transportation Act of 1966 - Section 4(f)

Section 4(f) acts to protect publicly owned parks, recreation areas, wildlife refuges and historic sites. As described in 49 U.S.C. 303§4(f) ensures that use of the above mentioned properties for transportation projects occurs only after it has been demonstrated that there is no prudent alternative to using the land under public jurisdiction and that the project includes all possible measures to minimize impact to such land. Use of land subject to Section 4(f) occurs when such land is acquired for a project, when occupancy of such land is adverse to the statute's preservation purposes, or when impacts, such as noise and pollution, substantially impair the purpose for which that land was preserved. To utilize Section 4(f) land, a Section 4(f) evaluation must be completed. Information regarding likely impacts on 4(f) lands must be included in the NEPA document.

The National Environmental Policy Act

NEPA describes the process necessary to assess and document any potential environmental impact from federally funded projects. This policy ensures that projects subsidized with federal funding:

- Are coordinated between agencies,

- Take alternatives into consideration with the public interest in mind,
- Provide opportunity for public involvement and,
- Incorporate measures to avoid, minimize, or mitigate any environmental impact.

There are three levels of documentation utilized to satisfy NEPA requirements. In order of increasing project impact, these are Categorical Exclusion, Environmental Assessment, and Environmental Impact Statement. It is likely that this project will require an Environmental Assessment (EA), which reviews the proposed project for social, economic and environmental impacts. The EA should identify alternatives considered, a review of environmental impact on resources, including air quality, noise, water quality, historic and archeological resources, parks and recreation areas, wildlife, hazardous waste sites, social factors, land use, aesthetics and other items, as well as any alternatives that would mitigate impacts.

If it is determined that the project will cause no significant impacts, the EA would be submitted to the Federal Transit Administration with a "Finding of No Significant Impact" recommendation. If at any time it is determined that the project will have significant impacts, an Environmental Impact Statement (EIS) would be prepared in place of the EA. The EIS would describe impacts, proposed alternatives and mitigation measures. The preparation of either of these documents is subject to periodic public review. The EA, or EIS, is typically completed by a consultant in coordination with, and on behalf of, VAOT or municipal applicant.

Act 250

Vermont State Act 250 reviews a project's impact on water and air pollution, water supply, soil erosion, traffic, educational services, municipal or governmental services, aesthetics, historical sites, rare or irreplaceable natural areas, impact of growth, earth resources, utilities and compatibility with local and regional plans.

The Act 250 permit process falls under the jurisdiction of a District Environmental Commission, and its appellate body, the Environmental Board, both entities independent of VANR. This project is within the jurisdiction of District 4. An Act 250 permit is required for state, county and municipal government projects, under certain conditions and provides a forum for public involvement while ensuring that proper state and local permits are obtained. An Act 250 permit is required for construction by the state or local government if the project involves more than 10 acres. Also, Act 250 involvement can be triggered if proposed work occurs in an area already under Act 250 jurisdiction.

A jurisdictional decision regarding the necessity for a permit will be required from the District 4 Commission once project plans have been completed.

Since certain state permits are required as part of the Act 250 application, they should be obtained before submitting the application. Similarly, local zoning and planning permits should be obtained to facilitate the Act 250 process. Application fees for an Act 250 Permit are $4.25 per $1,000 of estimated construction costs, perhaps subject to waiver for a public project as here proposed. Average processing time for these applications is 60 to 120 days. It should be noted that since this process is public in nature, this process could involve public meetings and require some modifications to proposed plans.

Summary

Although permit application turn-around times range from 15 days to several months, several of the permits required for the project necessitate evaluation of a resource, for an example wetlands or the Prairie Redroot, which may be possible only in certain seasons. Also, several permits or documents, such as NEPA documentation, or an Act 250 application, require public hearings. Environmental permitting for the project will require the expertise of environmental specialists or scientists, whether from state offices, or consultants. Impacts to resources, such as wetlands may require mitigation plans. Therefore it is recommended that project plans anticipate a period of 1 to 1 1/2 years for environmental review and the process of securing permits. Of necessity, this period overlaps preliminary and final design, as permit conditions may require certain project specifications. Table 35 provides a summary of permitting and documentation requirements which may be applicable.

Table 35
Permitting Chart

Permit/Documentation/ Agency Responsible	Regulates	Cost/Time-frame	Comments
Wetlands - Conditional Use Determination (CUD) VANR	Work in significant wetlands.	No fee. 2-4 month typical turn-around.	Requires 15-day public review. May have seasonal restrictions
Water Quality Certification - Section 401 VANR	Discharge, include. fill, into Federal waters.	No fee. Must submit project plans and other information for impact review.	Issued with CUDs, Stream Alteration permits, and Lake & Pond permits.
Federal Water Pollution Control Act - Section 404 COE	Discharge of dredged or fill materials, excavation, or mechanized clearing in Federal waters.	$0-$100 fee. 15-90 days for small projects. Larger projects may take longer.	Must submit wetlands delineation and extent of wetlands encroachment. Most likely will require wetlands consultant.
Stormwater Discharge Permit VANR	Discharge from impervious surface to surface waters.	$125 per impervious acre created, $100 minimum. 5 month maximum review time.	Regulates discharge from runoff.
Air Pollution Control Permit VANR	Indirect sources of potential air pollution.	N/A	Requires statement by VANR Air Pollution Control Division as to impact.
Threatened and Endangered Species VANR	Impacts to Threatened and Endangered plants and animals.	No fee. If extensive study is required a fee may be imposed. No time-frame specified.	Most likely will require field inventory by ANR personnel. Review may be seasonally dependent.
Historic Preservation Act - Section 106 VAOT/SHPO	Impacts to historic and/or archeological sites.	No fee. No time-frame specified.	Requires coordination with State Historic Preservation Office. Most likely will require consultant inventory.
Section 4(f)/Section 6(f) VAOT/VANR	Impacts/use of publicly owned parks, recreation areas, wildlife refuges, and historic sites.	Permit only required if using 4(f)6(f) land.	Information regarding 4(f)6(f) impacts must be included in NEPA documentation.
National Environmental Policy Act (NEPA) FTA	Documents environmental, social, and economic impacts of the project.	No fee. No time-frame specified. Subject to periods of public review.	This project would most likely require the preparation of an Environmental Assessment.
Act 250 Permit District 4	State Permit required for some projects. Addresses environmental, social, and economic impact of the project.	$4.25 per $1,000 estimated improvement / $50 per lot created. Review period of 60 - 120 days typical. Subject to public review.	A judgment will be required by the District 4 Environmental Commission as to the Jurisdiction of Act 250 regarding this project.
CERCLA VANR	Hazardous Waste Sites	N/A	May require avoidance, mitigation, or remediation of any hazardous waste sites encountered.

CHAPTER 6

INSTITUTIONAL AND FUNDING ARRANGEMENTS

This chapter examines the ownership, management and operational issues which must be resolved, as well as other considerations important in implementing new passenger rail service.

Ownership, Management and Operations

Who should own, manage and operate new passenger rail service? These roles—owner, manager and operator—relate to the opportunities and responsibilities associated with the complex business of providing passenger rail services.

General

In passenger rail situations,

- the **owner** of railroad right of way and infrastructure thereon is typically responsible for maintenance, rehabilitation and real estate management, including the issues of risk and liability,

- the **manager** plans, implements, markets and bears financial responsibility for the passenger rail service, and

- the **operator** staffs and supervises train movement and also may perform other functions such as track and equipment maintenance, depending on local choice and circumstances.

Although three roles are described, there may be from one to three distinct entities involved because it is possible, and common, for one entity to fill two or even all three of the roles of owner, manager and operator.

Owners, by virtue of their property rights and in the case of freight railroads, their Federally recognized rights and responsibilities as common carriers, exert control over what services may use their facilities and under what conditions, thus controlling whether or not a new commuter service may be implemented. In addition, owners exercise a paramount influence over the ability to achieve long-term goals, to add and modify service, to institute physical improvements and to implement new technology. Owners also may exercise, if they so choose, operational control over the railroad property. By the same token, ownership is also vested with ultimate responsibility for maintenance of way and structures and for resolution of such environmental problems as may arise, as well as for liability, indemnification and insurance arrangements. Finally, owners (public agencies and Amtrak excluded) must pay taxes on and manage real property and address the public policy implications of what has been done or failed to be done with the involved property itself and with operations on it.

Managers have particular opportunities with respect to service marketing and setting of fare policies. They also generally possess an ability to specify or change operators. To a lesser extent, managers influence additions to and modifications of the service, the achievement of long term goals and the degree to which service quality is attained. By contrast, they bear responsibility for funding operating deficits, financial risk, liability and indemnification exposure, funding capital improvements, equipment supply and maintenance. Managers influence, but do not control, labor and work force arrangements, passenger security and environmental issues as well as affect public policy ramifications associated with the operation.

Operators, the third element of the institutional triad, are capable of influencing service quality substantially and, if selected by contract, enjoy an opportunity to earn a profit as well. Their responsibilities entail complete supervision over train operations and enforcement of arrangements with the work force, particularly with respect to operational safety and passenger security.

In summary, the role of rail passenger service manager provides a limited amount of fundamental authority but a noteworthy amount of significant responsibility. In contrast, a rail passenger service operator, acting on its own behalf or under contract to a service sponsor, possesses relatively less authority but nonetheless bears a significant amount of responsibility. However, the operator is uniquely positioned to realize a profit if operations are conducted in accordance with a commercial contract. Finally, ownership of the track over which rail passenger service is operated as the term "ownership" is generally understood (absent a lease to others) represents by far the greatest level of financial and human resource commitment to a rail passenger service, promising tremendous authority concurrent with numerous and significant responsibilities.

Table 36 illustrates some owner-manager-operator arrangements used in passenger rail services in the United States today.

Table 36

Passenger Rail Owner-Manager-Owner Operator Arrangements

Passenger Rail Line	Manager	Operator	Right-of-Way Owner
Amtrak Washington-Baltimore Penn Line	MARC	*Amtrak*	*Amtrak*
Port Jervis Line in New York State	Metro-North	New Jersey Transit	*Conrail*
CalTrain: San Jose-San Francisco	Peninsula Corridor Joint Powers Board	*Amtrak*	Peninsula Corridor Joint Powers Board
Northern Indiana Commuter Transportation District (NICTD)	NICTD	NICTD	NICTD
Tri-County Commuter Rail Authority (Tri-Rail)	Tri-Rail	*Herzog Transit Services, Inc.*	FLA-DOT

Note: Table includes public agencies as well as private organizations, the latter noted in *italics*.

Source: RLBA research.

Public Ownership Option

If a public entity seeks to control use of a right of way, and preserve it for public transit or other public use, it may wish to acquire it. Ownership of a right-of-way brings with it control of activity conducted on it, by whom and under what circumstances. This allows a passenger rail sponsor to implement, alter and add services as it deems appropriate. Tenant freight operations must be given reasonable opportunity to satisfy their common carrier obligation, but essentially they would operate at the owner's convenience, subject to pre-existing contractual arrangements. On the other hand, the entity which owns the rail right of way and infrastructure bears the responsibility for maintenance, rehabilitation and real estate management, including exposure to risk and liability.

Certain public jurisdictions, as indicated in the table above, have acquired railroad rights of way. Acquisition of the Burlington-Essex line by the County or State would suggest a commitment to preserve the corridor for long-term public use and would entail a financial obligation with regard to maintenance and rehabilitation. If the County or State is inclined to make such a commitment, then acquisition is recommended provided the transaction can be consummated on reasonable terms. If the County or State is not so inclined, then it may still utilize the Burlington-Essex railroad right of way provided agreement is reached with the owner, such as a lease, easement or grant of trackage rights, each of which has specific legal and financial implications governing landlord-tenant relationships.

There has been some discussion regarding the advisability of public ownership of the Winooski Branch (rail line between Burlington and Essex Junction). The pros and cons of such ownership generally follow those just described. There also are some benefits specific to the Winooski Branch. Public ownership would:

- be in keeping with State policy of preserving rail corridors,
- ease the institutional arrangements of developing trails along portions of the right-of-way,
- indicate to potential freight and passenger customers that the line will probably continue into the indefinite future,
- simplify operations over then entire Charlotte-Essex segment in functions such as dispatching, coordinated maintenance, and contracting service, and
- provide, through the acquisition process, a potential vehicle for obtaining necessary trackage rights to the Essex Park and Ride station and perhaps future rights to Montpelier Junction and St. Albans.

<u>Management of the Burlington-Essex Passenger Rail Service</u>

The manager of the passenger rail service bears the financial responsibility for the service. Should the service be locally managed, by Chittenden County, or managed by the State? This is a public policy issue which ultimately must be decided by elected public officials. Here it is appropriate to suggest some considerations. Passenger rail service supports local and state plans. As stated elsewhere in this report, passenger rail supports Chittenden County goals of attracting 6 percent of peak hour trips to transit, growth center-based development and community preservation, while supporting State goals regarding strategic investment focused on major transportation corridors and sensitivity to Vermont's character. Passenger rail, if implemented, would be a component of the County's transportation system, which, to be successful, must be harmoniously integrated with the bus service and financially supported. During the course of this study, the question has arisen, "What about the impact of passenger rail on CCTA bus service?" RLBA believes that's the wrong question, as it suggests a competition between bus and rail. An important policy articulated by the landmark Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), and carried forward by its successor, the Transportation Equity Act for the 21st Century (TEA-21), is intermodalism, or interconnectedness of transportation modes, allowing users to select modes and change from one mode to another, based upon efficiency, utility, increased productivity, and reduction of energy consumption and air pollution. Bus, rail and other modes of transportation should be interconnected so that each may be used to its best advantage. If passenger rail is implemented, it should be done in close and harmonious coordination with the Chittenden County Transit Authority (CCTA) so that bus and rail are mutually supporting. Because of the vital importance of close coordination between rail and bus, RLBA recommends consideration of a common management system which includes bus and rail within a regional transportation operating authority. By "common management system", we do not mean addition of a management layer, but rather the integration of passenger rail into CCTA, or creation of a new authority to manage all regional transit operations. If this is not possible, then RLBA recommends that some mechanism assure the close and harmonious coordination deemed necessary if Chittenden County Long Range Transportation Plan goals are to be achieved.

Operation of the Charlotte-Burlington-Essex Passenger Rail Service

Operation of the passenger rail service may be accomplished by the local transit authority, the railroad which owns the line (if it agrees), or by contract with another entity. All passenger rail operations which may be considered "new starts" (no existing service) over the past decade have chosen to operate by contract. The National Railroad Passenger Corporation (Amtrak) and Herzog Transit Services, Inc. (Herzog), of St. Joseph, Missouri, operate a number of passenger rail services. For example, Amtrak operates MBTA, VRE, and that portion of the State of Maryland's Rail Commuter Service (MARC) which utilizes Amtrak's Northeast Corridor. Herzog operates Tri-County Commuter Rail Authority between West Palm Beach and Miami, Florida (Tri-Rail) and Trinity Railway Express of Dallas, Texas.

The State and the Vermont Railway, Inc., (VTR) entered into an access agreement in July, 1998, which not only gave the State the right to operate passenger rail service between Charlotte and Burlington but also established that VTR will perform most operator functions, including staffing and dispatching trains, maintenance of way and maintenance of equipment. VTR thus must be considered a leading candidate to operate Burlington-Essex service, if any institutional barriers related to ownership can be resolved. (NECR may wish to operate the service on its lines.)

Performance Criteria

The purpose of this section is to recommend performance criteria by which passenger rail service may be monitored and evaluated.

Discussion

There are many feasibility or performance factors that can be used to compare operations of different active passenger railroads or examine feasibility of a new start. Chittenden County's six percent transit goal and other local objectives are very important to gauging the value of the proposed rail service.

Another approach to assessing passenger rail service is to examine performance of other such services. Table 37 is derived from data extracted from the 1997 Federal Transit Administration (FTA) National Transit Database, the latest information currently available from FTA, and compares operating measurements of eight commuter rail systems throughout the United States to operating estimates for the Chittenden County Moderate and All Day Service Scenarios between Charlotte and Essex Park and Ride. The eight commuter lines used for comparison are Southern California Regional Rail Authority (SCRRA), Peninsula Corridor Joint Powers Board (CalTrain), Tri-County Commuter Rail Authority (TCRA), Northeast Illinois Regional Commuter Railroad Corporation (Metra), Northern Indiana Commuter Transportation District (NICTD), MTA Long Island Railroad (LIRR), MTA Metro-North Railroad (Metro-North) and Virginia Railway Express (VRE). Using the FTA data, values were calculated for comparison in the categories of operating expense per passenger trip, operating expense per vehicle mile, operating expense per passenger mile, passenger mile per vehicle mile, farebox recovery ratio, subsidy per passenger trip, revenue per vehicle mile, revenue per passenger trip and revenue per passenger mile.

Table 37 reveals a range of values in each category. There is no rule of thumb regarding what is considered appropriate for startup or an established system. Each commuter system has its own individual goals. For example, VRE has a farebox recovery ratio requirement of 50 percent, in accordance with the Master Agreement establishing VRE service among its several jurisdictions. MARC also has a goal of 50 percent. As the table indicates, 50 percent is fairly typical of farebox recovery ratios among the eight systems chosen. Local policies and decisions vary. Where a commuter rail transportation alternative is deemed essential, such as in the Los Angeles area, offering the rail service and diverting highway travelers has been deemed worth the cost. Graphical comparisons of operating cost and farebox recovery are shown in Figure 3.

Another basis for evaluating prospective and actual commuter rail systems is comparison with highway alternatives. For example, commuter rail may be an alternative to widening an existing highway, and so comparison of outright costs and capacity cost per person could be in order. A recent study identified costs of highway widening from $4.4 million per mile in urbanized areas to

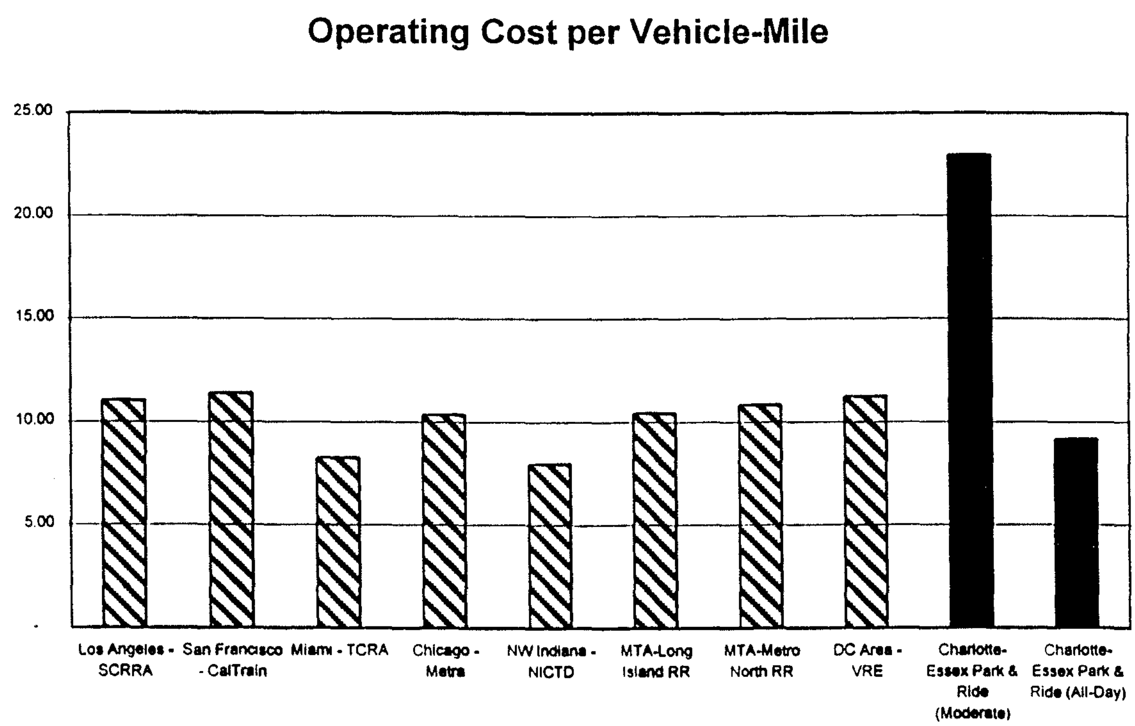
Table 37
Comparison of Factors Used to Evaluate Commuter Railroads

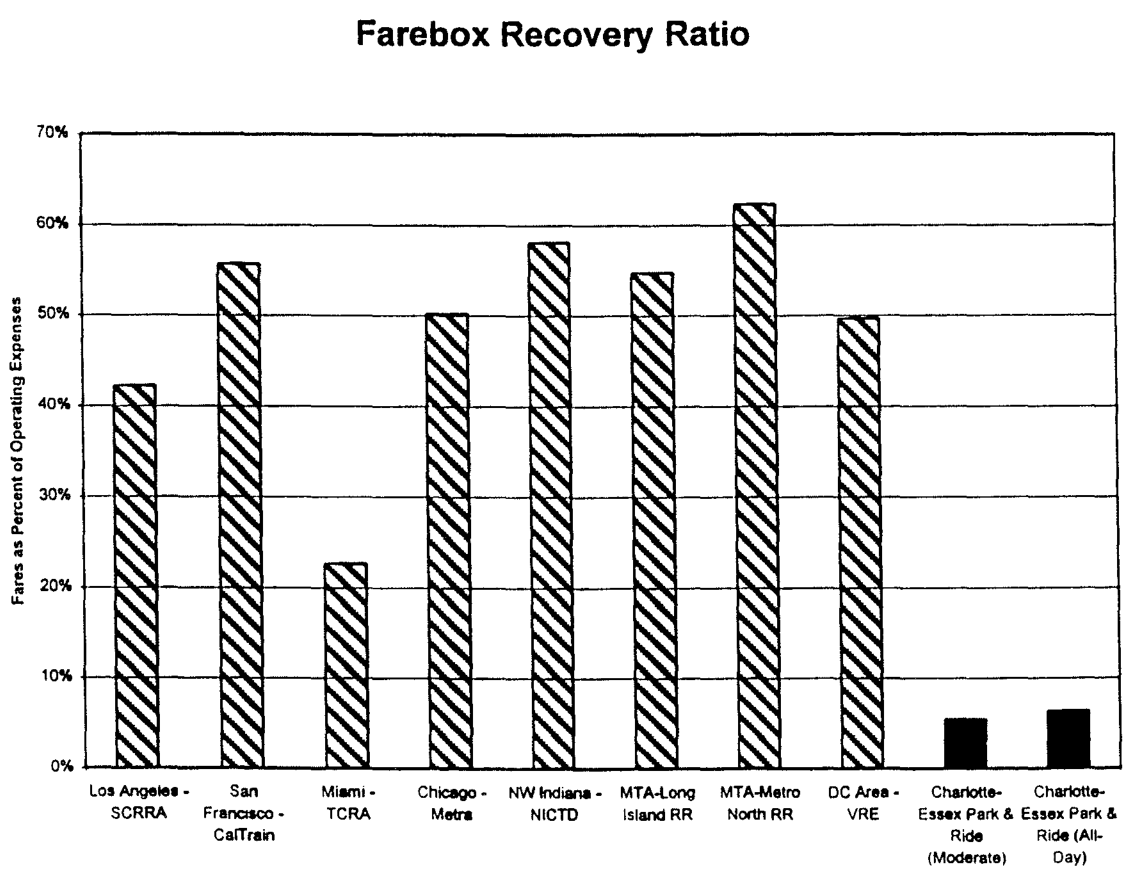
Commuter Line	Annual Operating Expenses ($ 000)	Annual Revenue Vehicle Miles (000)	Annual Unlinked Passenger Trips (000)	Annual Passenger Miles (000)	Total Farebox Revenue ($ 000)
Los Angeles - SCRRA	57,700	5,226	5,535	199,683	24,370
San Francisco - CalTrain	43,141	3,786	7,040	156,875	24,015
Miami - TCRA	20,571	2,492	2,315	69,463	4,666
Chicago - Metra	343,374	33,162	66,217	1,434,360	172,416
NW Indiana - NICTD	21,736	2,731	3,384	92,057	12,626
MTA-Long Island RR	601,926	57,712	96,535	2,115,830	329,413
MTA-Metro North RR	471,739	43,568	64,057	1,700,280	293,875
Northern Virginia - VRE	15,411	1,372	1,758	57,116	7,650
Charlotte-Essex Park & Ride (Moderate)	3,092	135	169	1,572	169
Charlotte-Essex Park & Ride (All-Day)	6,666	726	426	3,965	426

Commuter Line	Operating Expense Per Passenger Trip ($)	Operating Expense Per Vehicle Mile ($)	Operating Expense Per Passenger Mile ($)	Passenger Miles Per Vehicle Mile	Farebox Recovery Ratio	Subsidy Per Passenger Trip ($)	Revenue Per Vehicle Mile ($)	Revenue Per Passenger Trip ($)	Revenue Per Passenger Mile ($)
Los Angeles - SCRRA	10.43	11.04	0.29	38.21	42%	6.02	4.66	4.40	0.12
San Francisco - CalTrain	6.13	11.39	0.28	41.43	56%	2.72	6.34	3.41	0.15
Miami - TCRA	8.88	8.25	0.30	27.87	23%	6.87	1.87	2.02	0.07
Chicago - Metra	5.19	10.35	0.24	43.25	50%	2.58	5.20	2.60	0.12
NW Indiana - NICTD	6.42	7.96	0.24	33.71	58%	2.69	4.62	3.73	0.14
MTA-Long Island RR	6.24	10.43	0.28	36.66	55%	2.82	5.71	3.41	0.16
MTA-Metro North RR	7.36	10.83	0.28	39.03	62%	2.78	6.75	4.59	0.17
Northern Virginia - VRE	8.76	11.23	0.27	41.63	50%	4.41	5.58	4.35	0.13
Charlotte-Essex Park & Ride (Moderate)	18.30	22.96	1.97	11.67	5%	17.30	1.26	1.00	0.11
Charlotte-Essex Park & Ride (All-Day)	15.64	9.18	1.68	5.46	6%	14.64	0.59	1.00	0.11

Source: 1997 FTA National Transit Database, and RLBA calculations.

Figure 3
Graphical Comparisons





$2.0 million per mile in more rural areas, excluding right of way acquisition. Highway construction/expansion costs can be several times higher in restricted urban areas or through difficult terrain.

A lane of highway in the study corridor can carry about 1,540 persons per hour based on typical automobile occupancy (about 1.1 persons per car) according to VAOT. Depending on train make-up and number of trains, a passenger rail corridor can carry up to 6,000 passengers an hour or more, several times that of a single highway lane.

Yet another basis for evaluation of passenger rail systems is consideration of their benefits:

- Reduction of highway congestion
- Reduction of automobile emissions
- Reduced use of non-renewable resources
- Increased safety
- Reduced cost of automobile use
- Reduced accident costs
- Addition of a transportation option

A limited quantification of benefits is contained in Chapter 10.

And finally, introduction of new passenger rail service in Chittenden County should be evaluated based upon its conformance with local, regional and state plans and objectives. This is discussed in Chapter 7.

The prospects of Chittenden County Moderate and All Day Service Scenarios between Charlotte and Essex are not unlike those of other new start commuter rail services. Even though initial performance and cost characteristics do not compare with those of established systems, these characteristics will improve as ridership increases. Ridership increases are typical in start up commuter services including Southern California's Metrolink, Florida's "Tri-Rail", Virginia Railway Express and Chicago Metra's new North Central Service to Antioch, Illinois. A 1999 Tri-Rail publication shows daily ridership having increased from about 2,500 since start up in 1989 to 8,500 daily passengers in 1998.

As ridership increases, increased farebox revenue helps to pay for the more stable operating expenses. Operating expense per passenger trip, operating expense per passenger mile and subsidy per passenger trip will decrease. Passenger miles per vehicle mile, farebox recovery ratio and revenue per vehicle mile will increase.

Performance Criteria Conclusion

RLBA concludes from this evaluation of feasibility thresholds that the performance and operating characteristics of prospective Chittenden County Moderate and All Day Service Scenarios between Charlotte and Essex do not compare well with those of established commuter rail systems and viability will depend greatly on increased ridership and savings realized as an alternative to highway construction. Also, a decision to implement passenger rail service assumes that the benefits are worth the costs, and should be evaluated in terms of conformance with local, regional and state plans and objectives.

Coordination with State and Federal Agencies

Implementation of Burlington-Essex service will require close coordination with at least one, and probably a second, Federal agency. The Federal Railroad Administration (FRA) administers rail safety and operations, including those of passenger rail services which use the general railroad system (as will Burlington-Essex service, regardless of who owns the Winooski Branch). The new service will have to satisfy FRA requirements before initiating service and its ongoing operations will be monitored and regulated by FRA.

The service's primary interface with the Federal Transit Administration (FTA) will be in the areas of receiving and using Federal new-start funds administered by that agency. New-start funding and FTA's role are described below.

State-level coordination will be necessary with Vermont AOT, in its role as state transit administrator and, in addition, as the sponsor of the Charlotte-Burlington service (unless a separate administering agency is established).

Railroad Access Agreement

One of the most important steps following a decision to implement passenger rail service will be to negotiate an access agreement with the New England Central Railroad (NECR).

General

Agreements must define the three primary relationships, between owning railroad, government entity ensuring the passenger service, and the contract operator. Each relationship can be considered one side of a triangle. Sometimes roles are combined and several large metropolitan services provide all three functions in a single entity. A railroad access agreement focuses upon the relationship between the railroad and the government entity.

It would seem that a railroad access agreement would be about largely about sharing costs, but instead other issues are always the difficult ones. For example, imagine that two people were to write a contract about sharing a house, but traversed from room to room using automobiles. Conflicts are bound to arise. Trust in the other party is most important, but even so, the rights and responsibilities of both parties must be detailed.

Between Burlington and Essex Junction, NECR will operate a single freight train to Burlington and return, not necessarily operated every day, while the proposed passenger trains will operate numerous round trips. However, it is likely that the solitary freight train will generate more revenues than all the passenger trains combined. Passenger trains are assumed to have priority over freight trains, yet the passenger operations are merely a tenant or renter occupying and using the property of another business, absent public acquisition of the line. In addition, currently there is no existing track long enough to hold the freight train while unloading at Burlington Electric to enable a passenger train to pass. Finally, the proposed rehabilitation and other improvements to the line by the government may exceed the original purchase value paid by NECR. These various points are all resolvable, but mentioned to demonstrate how a dispute could arise from unrealistic expectations.

Key access agreement issues include:

- Risk management and insurance,
- Times of use and priority of each to occupy the track,
- Who will dispatch the freight and passenger trains,
- Who will maintain the tracks and to what minimum standards,
- Who will own improvements added the property,
- How improvements to realize planned operating speeds will be mutually approved,
- Station improvements,
- How disputes will be resolved, and
- Compensation.

Risk Management and Insurance

While damage to equipment is not inconsequential, the real issue is personal injury; no cargo is as valuable as passengers. In addition to risks to passengers, initiating passenger service provides a valid reason for persons to be on the rail right-of-way at station sites, increasing the likelihood of incidents. However, rare or unlikely, the damages from one serious incident could exceed the value of the entire NECR. Without appropriate liability, NECR would in effect be betting the entire railroad each time it allowed a passenger train to operate. Thus NECR (as owner) will require that high value insurance coverages be secured and that it be protected against most liability as part of the access agreement. The agreement must also specify how responsibility for property and equipment damages will be determined. Related to this, but usually under the operating provisions, is identification of which party will provide the equipment, expertise and rapid response to clear or re-rail damaged equipment. In addition, the agreement should spell out responsibilities, if any, for the security of each party's assets.

Track Occupancy, Dispatching

NECR probably desires to continue dispatching, but there are advantages to unifying Charlotte-Burlington and Burlington-Essex passenger service under a single dispatcher (whether NECR or VTR or other) to ensure coordination and to train and maintain a consistent approach to emergency response. The choice of dispatcher often dictates use of a specific set of prescribed operating rules. The unified dispatching arrangement should of course include the entire passenger rail operation, including that portion between Essex Junction and Essex Park & Ride. As discussed below, passenger and freight train conflicts are anticipated that only can be resolved through new capital improvements. Consequently, an important part of the agreement will specify how many and when passenger trains may operate as well as the required priority and a process for changing or adjusting schedules. It may even provide steps whereby if specified improvements are completed, additional trains may be operated. This part of the agreement also would spell out the grant of rail service rights as well as specifying who would provide the qualified personnel. Operation of special trains must also be addressed.

Maintenance of Tracks

NECR is likely to continue to maintain its own property. The agreement must specify minimum standards and speeds as well as the fiscal responsibility of the passenger service to compensate NECR for that effort.

Ownership of Improvements

The passenger service will expend several million dollars upon NECR property and such improvements are not readily portable. Still, the expending agency may retain some residual ownership in, for example, rail or ties, should the rail line be abandoned, sold or materials replaced at a future date.

Accomplishment of Right of Way Improvements

The railroad and the government agency must agree on a specific list of rehabilitation and improvements as well as the anticipated cost and a procedure for inspecting, verifying and accepting the improvements. While NECR may choose to complete most of the rehabilitation, it may execute some by contract.

Stations

A special set of improvements involves stations. The railroad must authorize the construction upon its property and provide minimum standards and clearances for safety and efficient freight rail operation, and approve final plans. In addition, government contractors must meet railroad specified insurance requirements and may require railroad supervision or flagmen at agency cost.

Dispute Resolution

Litigation is costly and time consuming, so an arbitration process is usually specified. To avoid misunderstanding, the dispatching entity must provide specified management reports and the parties should agree to conduct periodic conferences. Ideally, a joint operating committee should review with the railroad(s) on regular meeting dates the causes of delays and identify methods to improve communications and receive written responses from the railroad regarding group recommendations.

Compensation

Railroad compensation should involve three components. First, a landlord return to NECR; however, a portion of some improvements may in part be treated as landlord compensation. Second, recompense for annual expenditures to dispatch trains, administer the contract and maintain the railroad to the specified standard. The latter usually requires an escalation agreement to provide for inflation. Finally, an incentive payment should be based upon service performance. Typically, the operator and perhaps the owner as well receive variable payments based upon a scale reflecting on-time train performance, equipment reliability, customer satisfaction and number of passengers. For example, on-time performance payments usually start with a minimum amount paid when on-time trains reach a specified level, such as 90 percent adherence to schedule. As train performance improves above the minimum, incentive payments increase.

Implementation Plan Outline

General

The following sequential phases are inherent in passenger rail project implementation:

Feasibility Planning
Decisions Regarding Implementation (Funding, Governance)
Railroad Negotiations
Preliminary Engineering, Environmental Assessment, Permitting
Final Engineering/Design, Construction and Equipment Acquisition and Testing of Equipment and Training of Staff

This report concludes the first, feasibility planning, phase.

Decisions Regarding Implementation

Following feasibility planning, decisions are made regarding implementation and funding.

This second phase begins with a decision whether or not to implement the service. Determination of funding sources should be identified in this phase, along with the structure for owning, managing and operating the service. An indispensable part of the second phase is the process of coalition-building to make funding of the project a reality.

In the second phase decisions are made regarding execution of the following activities:

Operation of the service
Management of the service (marketing, funding, administration)
Construction of right of way improvements and stations
Maintenance of right of way
Acquisition of rolling stock
Maintenance of equipment
Cleaning of equipment
Dispatching
Maintenance and cleaning of stations

Timing of this phase is dependent upon reaching agreement with regard to funding and executing the project.

Railroad Negotiations

Once the decision is made to implement the service, funding is arranged, and a governing structure is established, it is appropriate to enter into negotiations with the owning railroad to develop an agreement regarding the intended use of the railroad's property. Railroad access negotiations have been previously discussed.

It is strongly recommended that consummation of an agreement with the railroad, for passenger service access, be completed prior to commitment of funds for preliminary engineering, construction and equipment acquisition. Otherwise negotiating posture vis-à-vis the railroad is considerable weakened.

Given the interest shown by Vermont's regional railroads in hosting passenger rail service, negotiation could require less than a year.

Preliminary Engineering/Design, Environmental Assessment, Permitting

Preliminary engineering is performed to provide the drawings and specifications required to refine design and more perfectly estimate cost. It may be decided also to include preparation of drawings and specifications suitable for construction and rolling stock acquisition, in other words, bid packages.

In this instance, preliminary engineering specifically should determine (1) whether the Winooski River through truss bridges require strengthening in order to withstand the impact loading of passenger train speeds, (2) the ability to make modifications to the floor of the Burlington tunnel without disturbing the integrity of the structure, and (3) site-specific requirements associated with parking and access to the several stations.

Inasmuch as station design and construction may be a community function, it is appropriate at the outset of this phase to make decisions regarding which entities are responsible for individual stations, given that all stations must meet certain common criteria.

Equipment standards and then specifications should be developed in this phase. As preliminary engineering advances, project parameters should be well enough defined to make general decisions about equipment, canvass new and used equipment markets as applicable, and develop specifications suitable to solicit bids.

About a year is required for preliminary engineering, including time required to advertise for and select a consultant. Environment assessment and permitting may require one to one and a half years and should be accomplished concurrently with engineering/design.

Final Engineering/Design, Construction, Equipment Acquisition, Testing of Equipment and Training of Staff

In the fifth phase, at least 18 months should be allowed for equipment procurement from the time a contract is awarded. With specialized or unique equipment, this process could require two years or more. Simple station construction may consume as little as six months, but time must be added for the permitting process related to construction of parking at stations, if sufficient parking does not exist already. Similarly, permitting could delay right of way and track work if environmental and permitting issues are not resolved within the fourth phase. Weather too must be considered, as much of the work has a limited season. While the fifth phase may consume up to three years, one and a half to two years is possible in the absence of permitting problems.

Total Time to Implement Service

Considering the phases described above, implementation time following completion of feasibility studies should require between 3-1/2 and 5-1/2 years.

Fare Policy

A fare of $1 was assumed in initial ridership estimates, and then the effects of raising the fare to $2, and lowering it to 25 cents, were tested. As expected, there were fewer riders at the $2 fare, and more riders at 25 cents. But the "fewer" and "more" were surprisingly modest. Thus it may be possible to improve revenues by raising fares with only a small degradation in ridership. However, most transit services would rank providing mobility options and serving the public ahead of simply maximizing revenue.

CCTA bus fare is currently $1. It seems reasonable to charge the same fare for the train as for the bus, and a fare of $1 appears to be an appropriate recommendation.

Fare structures are, of course, a matter of public policy. Some jurisdictions require their transit agencies to strive to attain specific farebox recovery ratios, for example, 25 percent. Others attempt to maximize ridership, based upon achieving the maximum benefits associated with public transportation use, such as reduced requirement for additional highway infrastructure, lower air pollution, savings in congestion costs, etc. RLBA recommends the latter policy, and especially so considering county and state objectives, stated in long range transportation plans, related to improving public transit ridership, fostering growth-center development and preserving Vermont's unique character. Maximizing ridership also anticipates, and reacts in a positive manner to, the estimate that traffic congestion in Chittenden County will increase by more than 60 percent between 1993 and 2013, given no transportation improvements.[11]

RLBA recommends all measures which make it easy to decide to use public transit, including low fare (as low as 25 cents if politically acceptable) free transfer between bus and rail and free parking at rail stations.

Project Funding

<u>Federal Funding Opportunities and Procedures</u>

Capital and start up operating funds are available for regional passenger rail service new starts from the federal government in a variety of ways, perhaps chiefly through Federal Transit Administration (FTA) Capital Investment Grants, Federal Highway Administration (FHWA) flexible funds and Urbanized Area Formula Grants. Capital funds probably are more readily available than funds for operating expenses, though numerous regulations and guidelines govern the distribution of both. Federal Transit Administrator Gordon Linton recently remarked that half of the Transportation Equity Act for the 21st Century (TEA-21) new start projects are for rail. With the rise of new start passenger rail proposals throughout the country, 179 currently[12], competition for those funds is likely to increase. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) and subsequently TEA-21 have made available more funding to transit, in part through flexibility provisions which reduce restrictions on how federal transportation money is spent.

FTA strongly recommends that any potential applicant contact its regional office early in the process in order to understand the eligibility requirements for federal funding.

To be eligible for a FTA Capital Investment Grant, which allows 80 percent federal funding with a 20 percent local match, a new start project must be part of the metropolitan or statewide planning process. An alternatives analysis, providing information on the benefits, costs, and impacts of alternative

[11] Draft Corridor Plans for Chittenden County, Vermont, January 1995: prepared by Chittenden County Metropolitan Planning Organization, Rural Planning Organization, and Regional Planning Commission: page Essex Junction Growth Center – 3.
[12] Cho, Aillen. "Rail Squeeze is Focus at APTA" *Engineering News Record*, June 7, 1999, page 15.

strategies, must be performed. The FTA New Start project planning and development process typically follows four major steps:

- System planning
- Preliminary engineering/environmental impact statement
- Final design; and
- Construction and start up.

In the past a Major Investment Study (MIS) would complete the system-planning phase, which would be structured to address FTA new start funding criteria. In addition the MIS would lead to a selection of a locally preferred solution for the community's mobility needs.[13] TEA-21 eliminated the MIS as a separate requirement, integrating it into other planning and environmental regulations.[14]

A project with total FTA funding under $25 million is exempt from FTA new start criteria and requires no alternatives analysis. However, it remains appropriate, even for projects below the $25 million threshold, to provide FTA with information on which it will base a funding recommendation. Consequently, FTA advises that proponents of projects examine the FTA new start funding criteria and provide as much relevant information as possible.[15]

FTA new start funds are not available to conduct alternatives analyses; however, funds may be available through the FTA Planning and Research Program, FTA Urbanized Area Formula Funds and flexible funds (funds that are available for use on highway or transit expenses) through the Surface Transportation Program (STP) and Congestion Mitigation and Air Quality Improvement Program (CMAQ).

Prior to preliminary engineering, the agency sponsoring a new start project should submit a request for FTA approval to the FTA regional office, in this case, Region 1 at Boston, including information regarding the planning process that led to the selection of the project, and its inclusion in the metropolitan transportation plan and transportation improvement program (TIP).[16] The request should address project justification and local financial criteria, except

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[13] Annual Report on New Starts. U.S. Department of Transportation Federal Transit Administration, 1999, page 5.

[14] Federal Register, Volume 64, Number 66, April 7, 1999, page 17063. This Notice of Proposed Rulemaking on "Major Capital Investment Projects", pages 17062-17071, is an important guide to current FTA policy.

[15] Phone interview with Andy Motter, FTA Region I Community Planner, Cambridge, Massachusetts, June 29, 1999.

[16] Federal Transit Administration, Section 5309 (Section 3(j)) FTA New Starts Criteria, December 19, 1996, page 20.

where the sponsor believes the project is exempt from new start criteria, in which case the sponsor would request FTA concurrence in the exemption. Although projects costing less than $25 million are not bound by FTA requirements to the extent of larger projects, it is appropriate for project sponsors to assist FTA by addressing and providing data which will enable FTA to make decisions based upon the new starts criteria.

In approving commencement of preliminary engineering on a project, FTA employs Section 5309 New Starts Criteria shown in Table 38.

Table 38
FTA Section 5309 New Starts Criteria

Criteria	Performance Measure	Measurements
1. Mobility Improvements	Value of travel time savings	New Start compared to No-Build and TSM
	Low Income households served	Number within ½ mile of boarding points
2. Environmental Benefits	Change in pollutant emissions	New Start compared to No-Build and TSM
	Change in regional energy consumption, expressed in BTU's	New Start compared to No-Build and TS
	EPA air quality designation for region	Current EPA designation
3. Operating Efficiencies	Operating cost per passenger mile	New Start compared to No-Build and TS
4. Cost Effectiveness	Incremental cost per incremental passenger in forecast year	New Start compared to No-Build and TS
5. Transit Oriented Land Use	Rating on transit supportive existing land use and future patterns	Combined rating on a set of factors Existing land use Containment of sprawl Transit supportive corridor policies Supportive zoning regs Tools to implement land use policies Performance of land use policies
6. Others Factors	Optional consideration of other factors	Local policies, programs and factors relevant to success of the project
7. Local Financial Commitment	Proposed local share of project costs	Percent of capital funds form non-Federal (non-Section 5309) sources
	Stability and reliability of capital financing	High, medium, low ranking
	Stability and reliability of capital financing	High, medium, low ranking

Source: Technical Guidance on Section 5309 New Starts Criteria, FTA Office of Planning, September 1997, page 3-2.

As projects proceed through the development phase, information concerning costs, benefits, and impacts is refined, and the ratings are updated to reflect new information.

For each of the project justification and local financial commitment criteria, the new start is evaluated against both a No-Build and a Transportation System Management (TSM) alternative. FTA assigns one of five descriptive ratings (high, medium-high, medium, low-medium, and low) for each of the criteria, with other factors considered as appropriate.[17]

TEA-21 has added the requirement to establish summary ratings for each proposed project of "highly recommended", "recommended", and "not recommended", based on evaluation of the criteria for project justification and local financial commitment.[18]

The primary factors in determining the combined justification rating are measures of transit-supportive land use, cost effectiveness and mobility improvements.[19]

Preliminary engineering is typically financed with Section 5307 funds, local revenues and flexible funds under STP and CMAQ. Given the significant demands placed on the Section 5309 new start program, FTA does not support the use of new start funds for preliminary engineering except in the case of unusually large and costly projects.[20]

The last phase of the development project is final design, which includes preparation of final construction plans, detailed specifications, construction cost estimates and bid documents. The final design stage cannot be initiated until environmental requirements have been satisfied, as evidenced by a Record of Decision or a Finding of No Significant Impact (FONSI). Final design typically is financed with Section 5309 new start funds.[21]

Additional federal funds may be available from FHWA flexible fund categories such as the Surface Transportation Program, Donor State Bonus, Interstate Maintenance, Bridge Replacement and Rehabilitation, National Highway System, Substitute Highway, and Congestion Mitigation and Air Quality Improvement (CMAQ) program. While these funds are considered to have

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[17] Annual Report on New Starts: Proposed Allocation of Funds for Fiscal Year 2000, FTA, March 23, 1999, page 8.
[18] Ibid.
[19] Annual Report on New Starts: p.9.
[20] FTA Notice Section 5309 (Section 3(j)) FTA New Starts Criteria: p.21.
[21] Ibid.

intermodal flexibility, there are limitations on the use of at least some portions of the programs, for example, there are funds in some programs available only to rural and only to urbanized areas.[22]

Flexible funds may be used for any non-operating purpose under the Urbanized Area Formula Program. CMAQ funds may be used for operating assistance (as in the case with Charlotte-Burlington passenger rail service), with certain limitations, including the time period for this assistance: 3 years.[23]

State and Local Funding

State and local funding for Chittenden County transportation services are described in "Public Transit Operation Funding in Chittenden County: Current Conditions and Potential Opportunities", revised September 25, 1998, Chittenden County Metropolitan Planning Organization (CCMPO), and "Operational Analysis, System Plan, and Funding Alternatives for the Chittenden County Transportation Authority (CCTA)", May 12, 1999, prepared for CCMPO by KFH Group, Bethesda, Maryland.

The CCMPO document describes the long-standing desire to replace the local property tax as a funding mechanism for public transportation, spurred by the CCMPO Long Range Transportation Plan's call for expanded transit service and examines certain financing options including an increased gas tax, a regional sales tax, auto/truck rental fees, student transportation fees and maximizing CCTA's revenue potential.

The KFH Group document points to funding requirements for an expanded CCTA system (at a $5,249,220 annual operating cost, vs. $4,619,583 in the draft fiscal year 1999 budget), mentions the constrained federal and state formula allocation assistance, evaluates advantages and disadvantages of each option in the CCMPO paper, tables additional options (additional state funding for transit; room, meals, alcohol taxes; sales tax on utilities; local vehicle registration fee; creation of a new regional transportation organization, combining CCTA bus transit, paratransit, the airport, commuter rail, and ferry services), and recommends (1) increased state operating funding, (2) increased student utilization of transit, and (3) revenue enhancements (e.g., advertising, contract work, sponsored services).

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[22] FTA Circular 9030.1C, "Urbanized Area Formula Program: Grant Application Instructions", October 1, 1998, Chapter I, Section 5.

[23] FTA: The Congestion Mitigation and Air Quality Improvement (CMAQ) Program Under the Transportation Equity Act for the 21st Century (TEA-21): Program Guidance, April 1999, page 8.

RLBA recommends further consideration of a new regional transportation organization for reasons beyond reduction in administrative overhead and possible internal cross-subsidies; a new regional transportation organization would provide the unity of effort which RLBA believes is highly important in integrating regional transportation to provide the most efficient and convenient system possible for the consumer.

RLBA recognizes that state and local funds must provide a minimum of 20 percent of capital funding assuming the federal government provides 80 percent, and agrees that the issue of operating funds requires resolution.

Funding Requirements and Projected Sources

Table 39 summarizes the capital cots associated with the proposed project.

Table 39
Summary of Capital Costs

	Scenario	
Component	Moderate	All Day
Corridor infrastructure	$23,700,000	$37,800,000
Stations	800,000	1,200,000
Rolling stock	15,800,000	26,300,000
Total	$40,300,000	$65,300,000

Source: RLBA.

Transit projects will normally receive federal financial assistance to cover a part of the investment required by new start transit projects. Table 40, Capital Fund Split, arrays the amounts required by funding source for capital costs based upon a typical funding arrangement.

Table 40
Capital Fund Split

Funding Source	Percent	Scenario: Moderate	Scenario: Aggressive
Federal	80	$32,240,000	$52,240,000
State	20	8,060,000	13,060,000
Local	0	0	0
Total Funding Requirement		$40,300,000	$65,300,000

Source: RLBA.

Table 41, Summary of Operating Results, arrays the annual net operating deficit accruing under both scenarios.

Table 41
Summary of Operating Results

	Scenario: Moderate	Scenario: All Day
Revenues	$ 176,000	$ 382,000
Operating costs	3,092,000	6,666,000
Net Operating deficit	$(2,916,000)	$(6,284,000)

Source: RLBA.

Under the Moderate Service Scenario, the proposed service will accrue a net operating deficit of $2.916 million and a net operating deficit of $6.284 million will accrue under the All Day Service Scenario. The deficit in either case would have to be funded. Table 42, Operating Cost Funding, arrays a possible operating cost funding arrangement.

Under this funding arrangement, federal, state and local governments would be responsible to fund the percentage of operating expenses shown in Table 42. Local government would be permitted to apply fare box revenues to its local match. If this policy were implemented, the annual subsidy required of local government would total $597,000 and $1,284,500 under the Moderate and All Day Service Scenarios, respectively.

Operating costs could be funded with an annual appropriation from general revenues or by one of the funding mechanisms described above.

Table 42
Operating Cost Funding

Funding		Scenario	
Source	Percent	Moderate	Aggressive
Federal	15	$ 463,800	$ 999,900
State	60	1,855,200	3,999,600
Local	25	773,000	1,666,500
Total Funding Requirement		$3,092,000	$6,666000

Source: RLBA.

CHAPTER 7

REVIEW OF EXISTING PLANS AND INTEGRATION OF PASSENGER RAIL SERVICE

Introduction

The purpose of this chapter is to review recently completed transportation and land use plans prepared by local governments, regional organizations, and state government and to assess compatibility with those plans of the proposed passenger rail service project under consideration. Of particular concern is how the proposed Burlington-Essex passenger rail service will fit into the larger transportation network, particularly, the transportation corridor through which it is intended to operate.

Review of Existing Plans

Numerous transportation and land use plans have been developed over the years, but only a select number were analyzed. Current plans, which were representative of major urban areas, counties, or the state, incorporated previous studies and reflected the most comprehensive community consensus at the time, were chosen for review. The selected documents are:

- *Corridor Plans for Chittenden County,* Prepared by Chittenden County Metropolitan Planning Organization, Chittenden County Rural Planning Organization, and Chittenden County Regional Planning Commission, January 1995.
- *Vermont's Long-Range Transportation Plan,* Prepared by the Planning Division, Vermont Agency of Transportation with the assistance of Wilbur Smith & Associates, August 1, 1995.
- *Burlington Area Tri-Center Transit Study -- Locally Preferred Alternative Strategy*, Prepared by the Steering Committee of the Burlington Tri-Center Transit Study, June 1996.
- *A Twenty-Year Vision for Transportation in Chittenden County*, Chittenden County Regional Planning Organizations, 1997 (CCMPO Long Range Plan).
- *System Plan and Operational Analysis*, Chittenden County Transportation Authority, Preliminary Service Concepts, Prepared for the Chittenden County Metropolitan Planning Organization by the KFH Group, March 22, 1999.

A review of each of these documents is provided below.

Corridor Plans for Chittenden County

The applicable portions of this study address the analysis of the transportation corridors for the:

- Essex Junction Growth Center
- Essex Town Subregional Growth Center,
- Regional Growth Center (includes Burlington and Winooski).

The corridor analysis, completed in 1995, evaluated both land use and transportation alternatives. This work preceded both the Light Rail and passenger rail studies, both of which have been seriously considered in the last few years. The evaluated land use alternatives included:

- Traditional suburban style development, or "sprawl"
- "Growth Center" development

The transportation alternatives examined included:

- Maintenance only
- Highway-based
- Transit-based

Within the Regional Growth Center (Burlington, Winooski and northeast portion of South Burlington), roadway congestion will increase by over 60 percent between 1993 and 2013. The Burlington-Essex corridor will be gridlocked by the year 2005.

The conclusion of the land use alternatives analysis indicated that it was preferable, as well as more cost-effective, to take action to support the Growth Center development concept in the various communities. There is a strong regional desire to preserve existing communities and avoid major roadway widening, property displacement and/or encroachment issues. There is also a solid orientation to pedestrian access and bicycle paths for daily activities. Additionally, there is a community desire to reduce air pollution and energy consumption by reducing automobile use. The recommendations concluded that "the single most effective approach to addressing transportation issues is the implementation of a Growth Center based development pattern." In-filling and higher densities in existing urban areas are recommended for strategic locations. The report indicated that the regional Growth Center's share of county development could increase by 240 percent the Growth Center's land use concept is followed, compared to traditional suburban growth, with increased transit service (see Table 14, page 20, Corridor Plans).

In the transportation alternatives examination, the report concluded that "of the transportation alternatives, a public transit based future holds the most promise." However, the study clearly recognized that there is inherent "anti-transit bias" built into the transportation plan and that this will require basic policy and financial shifts to support the public costs associated with the operation of a major transit network. It also recognized the need for a total transit "system" that would include major trunk line corridors, feeder services, as well as collectors and distributors, to provide total community coverage, in order to be a viable option to automobiles.

Long-term highway improvements planned in the Burlington-Essex corridor are generally regarded as maintenance and minor traffic management improvements. The various communities do not want to destroy their character; therefore, they have not included major widening projects in the Transportation Improvement Program (TIP). The corridor along VT 15 will reach unacceptable levels in future years, even with the proposed Circumferential Highway that will provide an alternative traffic route. The Circumferential Highway certainly will not hurt transit development in the Burlington-Essex corridor, but could promote urban sprawl, which will have indirect community costs. The Circumferential Highway, if properly planned, should not create a new growth corridor, but simply provide a transportation alternative for local travel that transit cannot currently fulfill. Future transit provisions, including necessary right of way, should be added into the detailed plans for the Circumferential Highway. Any expansion of this facility beyond two lanes in either direction should include transit as the sole future expansion alternative. The Circumferential Highway seems to be rated as a low priority in the overall transportation program, according to the study.

Overall, the proposed passenger rail project does not conflict in any way with the corridor plans, although detailed information will need to be developed. If the community determines that it will support the project, further refinements will be necessary to accomplish the full integration of existing transportation and land use plans with the passenger rail project.

<u>Vermont's Long-Range Transportation Plan</u>

This document, prepared in 1995, is a statewide comprehensive policy document that addresses transportation issues and priorities. This plan clearly indicates that maintenance activities for the state highway program have been funded below optimal level for several years. The plan advocates stopping the current cycle of "deferred maintenance costs today and incurring large capital costs in the future." Therefore, the state indicates that a rational and sustainable maintenance program, targeted at minimizing capital spending on the existing surface transportation system, is the number one priority for Vermont's transportation future.

The future state transportation program is seen as making investments that are not only sensitive to Vermont's special environment, but:

- If Vermont effectively manages and maintains current transportation assets, the need for new facilities will be limited to only those that are important to the economic vitality and quality of life.

- Intermodal connections and the development of non-automobile and truck modes of travel may provide a new means to meet the mobility needs of the future.

- Design standards can be tailored for highways, railroads, bridges, and other transport facilities to respond to Vermont's landscape and still provide safe and efficient means of moving people.

An analysis of the State of Vermont's strategic capital investment criteria shows that they have focused on the following major principles:

- Make the greatest financial investment in major corridors
- Coordinate freight and intermodal investments
- Support and enhance Vermont's communities
- Support economic linkages to the rest of New England, New York, Canada, and to the global economy.
- Support the travel and tourism industry.

Survey research results of Vermont citizens and their attitudes toward transportation issues were presented in the report. Mobility and safety were the highest ranked concerns of the public, even over environmental and economic development objectives. The survey also indicated that if convenient access to local bus service were available, more than half (52 percent) of the citizens would use it. About 48 percent said that they wouldn't use local bus service; however, less than 1 percent of current trips are by bus. The discrepancy between potential and actual use suggests the potential for significant transit ridership growth, were convenient service available, and is also a further indication that people want a change and choice in future transportation modes.

While passenger rail service is supportive of Vermont's Long-Range Transportation Plan, the exact commitment to actual funding is not well defined. All of the words are there for transit development support, but the statement of "rail travel for work, tourism and other trips should be promoted to the extent possible" certainly leaves a lot of discretion in financial commitment to alternate modes. The plan does recognize that "the public, acting individually and through elected officials, has opted for a transport system dominated by the private automobile and truck, but there is a desire for and willingness to accept change".

Because of Vermont's environmental sensitivity, considerable attention is given to air quality concerns and the desire to use technology and lifestyle changes to reduce automobile air emissions. The State of Vermont has been actively participating in a consortium of public and private sector organizations to test the feasibility of the "EVermont" electric vehicles. This experiment has provided data on real-life experiences with vehicles in hilly areas and cold weather.

Additionally, Vermont is implementing strategies that support ridesharing, carpooling, public transit and non-highway options for the movement of goods and passengers. Biking trips constitute more than 4 percent of the trips in Chittenden County, for example. This is consistent with the overall mission of managing and maintaining the existing transportation system. These strategies would reduce reliance on automobiles and mitigate some of the automobile's negative effects on the environment.

It is clear from the state transportation revenue financial analysis that not all monies collected for transportation purposes are being used for transportation purposes. Additionally, there is a distinct and significant shortfall in funding just to adequately maintain the existing highway system. The state has given clear policy direction with regard to future allocations and where the monies should be spent. The priorities would be:

- Preventive maintenance of state systems
- Increased funding for town highway grants targeted to system preservation and preventive maintenance
- Increased funding for alternative modes of transportation.

When reviewing the investment projections (Tables 5 and 6, Figures 18 and 19 of Vermont's Long-Range Transportation Plan), rail, public transit, intermodal and bike and pedestrian improvements would receive approximately 12 percent of revenues under the fully allocated scenario requiring new funding sources.

The plan also indicates a desire to preserve rights-of-way for critical highway corridors. No mention is made about preservation of right of way for transit purposes. The concept, advocated by many regional and local governments, is missing from the document. Also, the plan discusses the need to apply life cycle cost analysis in evaluating multimodal transportation improvements.

Considerable more detail about this subject, as well as the actual application of such analysis concepts to the state plan, should be included in the next iteration of this document.

Burlington Area Tri-Center Transit Study

This study, completed in 1996, focuses on major urban areas/activity centers in Chittenden County of Burlington, Winooski and South Burlington. The study concentrates on how core urban areas can be strengthened by the systematic development of additional transit service. This effort was largely a policy document that offered broad support for increased transit development serving the major urban core areas. The major objectives identified in this study included:

- The public transit system should serve to further strengthen the existing transit spine and main travel corridors. Priority improvements are intended to lead into implementation of dedicated transit corridors and service by the year 2000.

- Future transit improvements should not preclude any technologies for no-emission or low-emission, high-capacity transit and should promote the introduction of new technologies to enhance transit ridership.

- Critical elements of all future transit improvements should include "seamless" intermodal connections and full coordination and integration of different modes.

- Future transit service expansion should not use local property taxes to fund implementation.

This effort resulted in policies supportive of the passenger rail project between Burlington and Essex. At the time of this document's development, passenger rail had been examined in the region, but no specific actions had been taken to implement it. The document could be updated to address more specific aspects of proposed passenger rail service, and realignment of bus service to support rail service, connecting major activity centers in Chittenden County. It is very clear that the property tax, currently being used as the major source of funding for transit service, was a major inhibitor to expanding transit service and that new techniques and sources of funding are needed to support the desired long-term transit improvement program in the community.

A Twenty-Year Vision for Transportation in Chittenden County

This comprehensive document, prepared in 1997, addresses both transportation and land use alternatives. The report was officially adopted by the Chittenden County Metropolitan Planning Organization (CCMPO) and represents a solid consensus at the local, regional, and state levels. The document reiterates the basic policies of:

- Increased emphasis on transit expansion, with a specific defined goal of 6 percent transit ridership in the PM peak hour for the entire geographic area. Currently, the transit ridership in the PM peak hour is only 0.6 percent, although a complete appendix is provided in the document that describes how the region can achieve higher levels of transit ridership.

- Continued commitment to creation and intensification of land use in Growth Centers as the single most effective measure of addressing region-wide congestion. This policy was a confirmation of the *Chittenden County Regional Plan of 1991*, which has impacted local planning and zoning activities for some time. The twenty-year plan supports dense community centers that mix residential and commercial development to facilitate mass transportation and offer basic services accessible by means other than private, single-occupancy vehicles. In these developments, transportation services would, be more energy efficient, cost effective and foster a sense of community.

- Development of a comprehensive and multimodal transportation system that offers travelers viable options and links to alternate modes of transportation. This would include not only transit, but also bikeways and pedestrian paths throughout the community that would be linked together into an effective system.

- The importance of maintenance and improvements to incorporate alternate forms of transportation (walking, biking, mass transit, etc.).

- Congestion management programs, designed exclusively to increase highway capacity for single-occupancy vehicles, should be undertaken only when no better alternative can be found.

The Twenty-Year Vision is one of the most comprehensive reports available and provides detailed information about how the community should be developed and design criteria that should be followed. The goal of 6 percent transit ridership in the PM peak hour for the entire regional area is a goal that needs to be refined over time, especially in the over-capacity corridors that serve the Growth Centers. Special attention should be given to these corridors to increase the PM peak hour transit trips to more than 6 percent. If projected PM peak hour passenger rail ridership is about 200 persons, corridor capacity will have increased almost 50 percent over the limited roadway capacity in certain portions of the VT 15 corridor. It is consistent with other major corridors that transit usage in the PM peak hour could be as high as 200 percent of existing roadway capacity.

The passenger rail project is fully compatible with this document.

<u>System Plan and Operational Analysis for CCTA</u>

The Chittenden County Transportation Authority (CCTA) recently completed a system plan and operational analysis for the area with a "fresh look" at barriers, as well as opportunities, for servicing the regional population. A "clean slate" approach was utilized in assessing bus service needs. Two scenarios were formulated: a constrained service and an expanded service based on needs, rather than current jurisdictional boundaries that CCTA services today. The constrained scenario tried to operate under the existing budget of $3.5 million, while the expanded scenario assumed a 47 percent increase in revenues and a budget of $5.25 million. No consideration of passenger rail service was examined.

It was clear from the analysis that the funding mechanism and policies for bus service are major constraints in the provision of cost-effective service to the regional population. Property tax is the only source of funding available at the local level to currently support CCTA operations. Expansion of services to any of the lower density areas of the region may force the CCTA Board to reconsider its allocation of local costs to member jurisdictions. With regard to this concern, the CCTA Board has set a requirement that all new transit services meet a 50 percent farebox recovery before they can be included in the general allocation of transit funding. This will need to be changed if CCTA wishes to encourage system growth, innovation and non-traditional modes of service.

The current service provided by CCTA in the proposed passenger rail corridor between Burlington and Essex Junction is a commuter bus and trunk line fixed route bus service. An increase in the frequency of the current service is proposed. Minimal feeder lines and collector/distributor service connecting to the commuter/trunk line service are planned for either of two operating scenarios. The exceptions are downtown Burlington, where the CCTA services hub is located and the College Street Shuttle operates, and in downtown Winooski, where local circulator service will be provided by CCTA with a loop configuration bus route.

Implementation of a passenger rail project is not deemed inconsistent with the objectives of this analysis. However, the CCTA system will have to be realigned if the passenger rail project is implemented, as CCTA and passenger rail service will in that case need to be carefully coordinated in the manner which best utilizes the advantages of each system. (For example, trains often reduce travel time, since they are separated from the congestion problems affecting highways. Buses are able to convey passengers to and from train stations, and can change their routes to accommodate changes in the local travel market. The two transportation modes will be integrated to optimize the county's overall public transportation system.) The Burlington-Essex corridor records the highest ridership of any bus route in the CCTA service area.

A key focus of this study is funding, with problems and opportunities clearly presented. The recommendations include additional state support of transit development costs due to limited financing opportunities at the local level. The study specifically highlights the critical nature of major decisions that must be addressed, both at the state and local levels, and are necessary to achieve consensus on long-term transit funding. This is further emphasized by the fact that passenger rail costs, both capital and operating, have not been included in the analysis. In future implementation activities, there is a unique opportunity to address simultaneously the financial posture of both passenger rail and bus services.

Conclusions of the Analysis of Existing Plans

Passenger rail is consistent with and supports existing transportation and land use plans. *Ridership estimates indicate that passenger rail service would provide a very strong boost to Chittenden County's goal of 6 percent transit ridership during the peak periods, and provide a significant improvement over the current 0.6 percent.* Additionally, land use policies and growth policies are fully supportive of passenger rail transit development. Most of the documents reviewed are policy plans, with general goals and objectives that relate directly, or indirectly, to the passenger rail project. What is clear is that the state and regional and local communities recognize and support efforts to provide transportation alternatives to the private automobile. The land use and growth concepts that are locally preferred, for many different reasons, are also supportive of the passenger rail project. The communities are concerned about transportation alternatives, and, if financing efforts are successful, poised to set in motion new transportation improvements that are dramatically different than those of the last 50 years. This will take a combination of state and local support to be financially viable. Without state support, passenger rail projects will be very difficult to implement.

There are a number of critical issues concerning the Burlington-Essex passenger rail project that need to be addressed with refined future study. These issues can be categorized as transportation or land use/development concerns and are summarized below:

Transportation Issues

Transportation issues to be addressed in implementation of the Burlington-Essex passenger rail project include a wide range of topics that affect the general public, employers, as well as transportation providers, and include the following.

Reshaping the Transit Financing Structure

As discussed in the previous chapter, transit financing is at a critical juncture in the regional community and statewide. Property tax has been the major source of CCTA funding; clearly its limitations have inhibited regional transit service development. If major transit improvements are to be implemented, there must be a more robust funding source. Both CCTA and the passenger rail programs (both Charlotte-Burlington and Burlington-Essex) require a reshaping of the current funding mechanism in a coordinated and unified manner.

Coordination of the Existing Bus System with Passenger Rail

Prior to implementation, the current passenger rail plan must be thoroughly coordinated with the existing CCTA bus system, integrating the two into a cost-effective and efficient public transportation system. If the All Day Scenario with 30-minute passenger train headways is implemented, CCTA service will have to modify its function in this corridor to become a feeder and local circulation system for the passenger rail project. Close coordination with other services that will link to the passenger rail project also should be closely examined, such as the Charlotte-Burlington passenger rail, the College Street Shuttle and the Campus Area Transportation Management Association (CATMA).

Incentives to Support Transit in the Community

There are any number of inducements which may be instituted to encourage and promote transit ridership. A comprehensive investigation of the available techniques and tools should be examined and heavily employed. Available techniques include disincentives with regard to automobile use such as gas tax increases, parking charges and tolls on major highways (particularly bottleneck segments), aggressively low public transit fares with universal and liberal transfer privileges, incentivized business support, tax credits for employees who use public transit, employer support of monthly passes, etc. Appendix K ("Enhancing Public Transportation Performance: Strategies to Achieve a Dramatic Improvement in the Chittenden County Transportation Authority's Peak Hour Mode Share") of the Twenty-Year Vision (CCMPO Long Range Plan) discusses this subject. It needs to be said bluntly: the relatively large investment required for major transit improvement cannot be justified unless all the resources of government at all levels are marshaled to insure its success. Half way or half-hearted measures are a formula for failure.

Connection to Major Corridor Employer

IBM is the major employer in Chittenden County and in the State of Vermont. The passenger rail project as currently envisioned does not directly serve the Chittenden County IBM plant. Although cooperating in the provision of information regarding employee commuting patterns, IBM has indicated that at the present time it chooses to adhere to current shuttle bus services, as opposed to placing a passenger rail station in the railroad right of way adjacent to its property. Passenger rail service to IBM could significantly increase the potential number of system users, although the company's shift hours may require accommodation. Special attention and service for this major trip generator should be reconsidered in the future because of the tremendous impact which direct rail service to IBM would have on reducing highway congestion and enhancing use of public transit.

If the passenger rail project is extended to St. Albans, Husky, the second largest employer in the study area, also will be served along the route. Adequate service to the major employers' facilities could have a significant ridership impact.

Passenger Rail Service Traffic Impacts

The impact of Burlington-Essex passenger rail on the local highway system has not investigated. Effects of additional trains on downtown Burlington, Winooski and Essex Junction should be carefully reviewed. For example, the various Essex Junction highway-railroad at-grade crossings increase accident risk, considering the number of trains proposed and the state of road congestion which already exists. It would be appropriate to look into this during the preliminary engineering phase.

Parking and Public Transit

There are diverse views on this subject; it is appropriate to mention them here. The provision of free or low-cost parking tends to work against the objective of encouraging transit use. On the other hand, parking encourages use of transit, for example, where provided at suburban passenger rail collector stations. One could argue that even in downtown Burlington, parking should be provided adjacent to the passenger rail station for those who wish to use their automobiles to get to the station. It may also be argued that provision of parking at the planned Burlington Multimodal Center (288 spaces are planned for the development; 148 are anticipated in support of passenger rail operations) does not complement public transit goals. The June 1995 Major Investment Study (MIS) for the Shelburne Road Corridor (US 7) identified a need for 148 parking spaces in downtown Burlington to support passenger rail.

The City of Burlington 1996 Municipal Development Plan discusses the subject, mentioning economic competition with the suburbs, necessity of parking for the economic well being of the city, attraction of visitors and workers, affordability of parking to downtown workers, and--as a technique to lessen demand for additional parking--changing the number of parking spaces required by the zoning ordinance from a minimum to a maximum. The latter is included as an action item in the Transportation Action Plan,[24] but no action has been taken.

Other Transportation Facilities

In reviewing the documents, there was only one proposed transportation improvement that might conflict with the Burlington-Essex passenger rail project. The Circumferential Highway, while a low priority in the TIP today, could be a potential detractor to the project. As a transportation project, the Circumferential Highway could possibly complement the Burlington-Essex corridor by making it easier for citizens of rural areas to get to passenger rail stations; proper planning is needed to insure that this is accomplished. However, if construction of the Circumferential Highway promotes development of a new growth corridor, contrary to all land use concepts that have been adopted by regional and local communities, passenger rail service would be adversely affected. A careful examination of this situation also is warranted.

<u>Land Use/Development Issues</u>

Land use and development issues are also highly relevant. Much of the preliminary work is very positive, yet considerable refinement needs to be accomplished. The issues that remain to be addressed include:

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[24] City of Burlington, Vermont, 1996 Municipal Development Plan, page V-20.

Future Comprehensive Planning to Support Community Transit Development

A close examination and further refinement of the comprehensive plans and zoning in affected communities should be conducted to maximize development support of growth patterns that would complement the passenger rail service if implemented. Increased densities in proximity to transit stations and access corridors will be important factors to consider, and to weight against the alternative of further sprawl.

Redevelopment Plans Around Potential Stations

If it is decided to implement the passenger rail project, the preliminary engineering phase should include development of a Station Area Plan at each of the proposed stations along the corridor, to define what redevelopment could be centered around each station, and to design the appropriate access connections (bus, auto, bicycle, pedestrian) to each station. At optimum, the fully developed stations could perform a mall function, providing a wide range of services to the public. This is an important process that allows each area to have input and coordination in the design of the station. The private sector should be actively involved in this process to fully understand the redevelopment opportunities available.

It should also be mentioned that there are "payback" opportunities to communities where transportation investments are made. These depend upon local market conditions. One of the highly-touted examples of this phenomenon is development surrounding passenger rail stations established upon implementatiion of Metrorail in the Washington, D.C., region. In particular, the amazing amount of development surrounding the Ballston station in Arlington, Virginia, has received much acclaim. King Street Station in Alexandria, Virginia, is another especially good example, where redevelopment continues in the vicinity of the Metrorail station, which itself is adjacent to the Virginia Railway Express commuter rail and Amtrak station.

Acquisition of Corridor Right of Way

The Burlington-Essex corridor is a valuable resource to the community and should be preserved as a transportation corridor for future use. It is recommended that Chittenden County take appropriate steps to ensure safeguarding the right of way for future use. Should the rail corridor owner ever choose to abandon the line, it would be appropriate for a public entity to acquire it in order to prevent termination of its use as a transportation corridor. Alternatively, there may be public policy reasons for acquiring the line even if the owner is not considering abandonment.

Future Work Plans to Accomplish Implementation

Based on the above analysis, additional community efforts are necessary to prepare for passenger rail service should the decision to pursue implementation be made. The following tasks are recommended as the next steps for the Burlington-Essex corridor implementation, based upon specific implementation decisions as to scenario and service plan:

- Refine Goals and Objectives
- Coordinate CCTA bus service with passenger rail service
- Establish Station Area Plans
- Analyze Traffic Impacts
- Develop Community Involvement Program

CHAPTER 8

PROJECT FEASIBILITY

Burlington-Essex passenger rail service, as an extension of Charlotte-Burlington service, is technically feasible. The earlier chapters of this study report demonstrate that given certain right of way improvements, passenger trains can carry riders, in numbers related to the two service scenarios, between stations along the corridor. The New England Central Railroad has indicated its interest in the project, and volume of freight traffic on the rail corridor does not preclude addition of passenger service. With commitment of sufficient resources, the project can be implemented.

Will the number of passengers transported be sufficient to justify the project? Will the project contribute significantly to regional and state transportation planning objectives? Will the benefits of the projects be worth the costs? RLBA believes that the answers to all questions is "yes", *but only if there is sufficient funding and long-term commitment to ensuring project success*.

Chittenden County has for some time considered the relatively low ridership response to CCTA bus service, and has studied ways of increasing the number of riders. The recent KFH Group study examines concepts for improving transit services in Chittenden County, advances a redesign of the system which would increase ridership, and suggests funding mechanisms to support the new design.

There is a parallel here. Improving CCTA ridership and instituting new rail service both require dependable funding and long-term commitment.

This study was prompted by the need to reconcile increasing highway/road use, including concomitant congestion and urban sprawl, and demand for even more road infrastructure investment, with the desire to preserve the values which make Chittenden County and Vermont attractive to its citizens and those who visit.

The idea of instituting passenger rail service in the region is to preserve and strengthen its existing quality of life and land use values, and inhibit sprawl. A goal of the Chittenden County Long Range Transportation Plan is improving use of public transit to 6 percent of peak hour trips from the current 0.6 percent. This is recognized as an imposing challenge, and the Long Range Transportation Plan reviews measures taken in other jurisdictions to stimulate increased public transit use.

With a population of about 140,000, Chittenden County is at the low end of the many communities in this country now considering initiation of passenger rail service. *This suggests that a strong and substantial commitment will be required on the part of the county and the state, both in funding and in the establishment of new public policies, if this initiative is to succeed.*

Ridership estimates show that passenger rail will take about four percent and two percent of corridor peak hour traffic, respectively, in the All Day and Moderate Service Scenarios. In the context of the county's long-term goal that transit (bus and rail) attract 6 percent of current peak hour trips, county-wide, it is fair to state that passenger rail could make a substantial contribution, especially in the All Day Service Scenario.

RLBA believes that public transit in Chittenden County will have to be very convenient and dependable to fulfil this promise. Attainment of the 6 percent goal may require the institution of measures to discourage auto use in combination with attractive, convenient, frequent and well-coordinated rail and bus service.

A convenient and dependable on-time passenger rail system, disincentives with regard to automobile use, aggressively low public transit fares with universal and liberal transfer privileges (and therefore more public funding support as well as incentivized business support) may be the minimum required if Chittenden County is to attain an appreciable increase in use of public transportation.

No rule of thumb tells us whether the proposed service will succeed or fail with regard to meeting the region's and state's long-term transportation objectives. One thing is clear: those objectives relating to increasing transit ridership, growth center based development, reduction of sprawl and preserving Vermont's character will not be achieved if passengers are not attracted to rail and bus.

It needs to be said bluntly and repeated: the relatively large investment required for major transit improvement cannot be justified unless all the resources of government at all levels are marshaled to insure its success. Half way or half-hearted measures are a formula for failure.

CHAPTER 9

PUBLIC REVIEW PROCESS

This study included a formal public review and involvement process in order to provide an opportunity for communities affected by prospective passenger rail service to be involved in the study process.

A Public Participation Plan was included in the Study Team's proposal and additional specific plans were devised in preparation for public meetings. Public participation included three sets of public meetings, in February, April and July. Each set included meetings in Burlington, Essex Junction and Winooski. Each public meeting featured a presentation by the Study Team, followed by questions and answers. Comment sheets were provided, and Study Team addresses and phone numbers were publicized. Additionally, handouts were provided in order to inform the public: "What This Study Will Accomplish" (See Appendix D) and "Passenger Rail Success Factors" (See Appendix A).

Each public meeting was preceded by dissemination of a press release to the media, announcing the meeting. Residents who signed up at the earlier meetings were mailed or e-mailed press releases pertaining to subsequent meetings. Questions raised at the public meetings were answered in papers distributed before and at subsequent public meetings (see Appendix E).

The Study Team presented ridership information to representatives of Franklin and Washington Counties, with regard to estimates associated with the Extended Service Scenario—passenger rail service to St. Albans and Montpelier.

A demonstration train ride on the Burlington-Essex rail line was offered on January 8, 1999, and attracted members of the media, public officials and the Project Advisory Team.

Monthly updates were provided to the Project Advisory Team:

Jeanette Berry	CCTA
Dan Bradley	City of Burlington
Susan Compton	VAOT
Paul Craven	CCMPO
Stanton Hamlet	CCRPC
Peter Keating	CCMPO
Dennis Lutz	Public Works Director, Town of Essex
Mike O'Brien	CCMPO Board, City of Winooski

Mike Olmstead	New England Central Railroad
Bob Penniman	Vice Chair, CCMPO Board; CATMA
Peter Plumeau	Executive Director, CCMPO
Charles Safford	Manager, Village of Essex Junction
Lewis Wetzel	Colchester; CCRPC

In addition, briefings were provided to VAOT.

"Chittenden Transportation Quarterly", newsletter of the Chittenden County Metropolitan Planning Organization, published articles describing the progress of the study and results thereof.

The *Burlington Free Press* ran a story on the study on April 7, 1999, following one of the public meetings.

The Study Team used a media list, developed in coordination with CCMPO, to distribute its press releases. A copy of a press release is at Appendix F.

Members of the Study Team visited the state's largest employer, IBM, and discussed the study and station siting.

CHAPTER 10

QUANTIFICATION OF BENEFITS

Introduction

This chapter constitutes a brief and limited quantification of potential benefits of new passenger rail service between Burlington and Essex. This is not a comprehensive analysis. Only the following readily-quantifiable benefits are included:

Land use impacts,
Environmental benefits,
Avoided cost of automobile operations,
Savings in congestion costs, and
Improved safety.

This partial analysis uses only data immediately available, and shows only the above-specified benefits, and portions of those benefits, that readily lend themselves to quantification. A more comprehensive analysis would probably result in the quantification of additional benefits, or result in increases in the quantification resulting from this partial analysis. RLBA believes that this analysis is conservative.

The introduction of passenger rail service between Burlington and Essex will generate both costs and benefits, borne and received by a diverse set of persons and entities. Whether the prospective benefits appear sufficient to justify the costs will depend in large measure on the breadth of the view taken, with the balance shifting along a spectrum that extends from the short term and strictly financial to the longer term and encompassing a wider panorama of socioeconomic and environmental and public interests. This analysis is constrained by data and resource limitations to the more prosaic and shorter-term. A fuller exploration of demographic trends, implications for regional development patterns and ecological impacts would be desirable and a formal analysis of economic impacts may eventually need to be considered, though both are beyond the ambit of this study. However, there should be no illusion that the feasibility and ultimate success of a system such as that proposed lies as much in its planning as with its execution. Without strong and continuing community commitment to the system and a willingness to provide a "critical investment mass" of service features, the likelihood of drawing visible benefits in excess of costs is extremely low.

The assessment of benefits likely to accrue from the implementation of commuter rail service is, like many similar endeavors, part art, part science.

The difficulties in measurement stem in part from the still-rudimentary ability of economics to monetize, or place dollar values, on individuals' perceptions of utility or disutility associated with various aspects of travel. For example, how does one value time spent in commuting? Is time spent in traffic the same as time spent on or waiting for a train? Other limitations on the precision of benefit quantifications stem from the frailties inherent in economic forecasting; and from the complexities inherent in identifying, let alone measuring, all the socioeconomic externalities. What size ecological "footprint" do Vermonters wish to impose on the environment in the long term is as much a lifestyle and political issue as it is an economic one; and the value of any reduction in that "footprint" will vary widely based on individuals' priorities and beliefs. Thus, to a very real extent, evaluation of instituting passenger rail service is akin to deciding whether to have a child or how much to invest in national defense-what or whether it can be afforded is a threshold question only. In making the final decision certain other things must be considered which just are not fully or confidently susceptible to reduction to dollars - and - cents.

The following analysis of quantifiable benefits is intended to represent only initial year savings, employing 1999 data as a baseline. (Savings are all estimated in constant 1998 dollars.) Future year benefits are not forecast, thereby avoiding more speculative elements of estimation, but also understating the results. That future benefits are more speculative does not make them less real; they would in all likelihood increase and at a rate in excess of the anticipated increase in ridership.

Overview of Benefit Assessment

The most readily identifiable and measurable benefits of passenger rail operations are those associated with the relief of costs associated with automobile transportation. In the simplest and most conservative construction, no new travel demand is induced by the rail system; it merely serves to attract riders from other modes. This static analysis determines a major portion of the benefits by calculating the costs avoided by not having to provide the infrastructure allocable to the shifted trips, or, alternatively, the benefits accruing to those persons not attracted but who no longer have to share the infrastructure with those who are attracted. (The costs corresponding to the production of these benefits are, of course, subsumed in the cost of providing the rail service, and therefore need not be readdressed in this section.)

Additional socioeconomic benefits of rail service, in roughly decreasing order of tangibility, are (1) those associated with reduced imposition of contaminants on the environment, (2) those generative of desirable land-use patterns, specifically sprawl-reducing "agglomeration," (3) economic impact of development investment and other secondary effects, (4) tertiary respending impacts, and (5) insurance" effects of preserving alternative transportation corridors and modes which may or may not become more crucial over time. This last benefit may in future generations become exceedingly tangible, but for now the magnitude of its importance is extremely speculative and not capable of quantification.

Even the most certain to occur and tangible of the benefits, those pertaining to reduction in pollution, are exceedingly difficult to quantify. Despite substantial research in the matter, and several available estimates of the costs associated with discrete levels of emissions, RLBA is not satisfied with the precision of quantification currently feasible to provide. In fact, estimates of the value of one well-known potential benefit, reduction of greenhouse gases, range from zero to beyond measuring; politics would appear to be driving the more extreme estimates on both tails of the curve. The benefits, if realized, would also be bestowed quite broadly over the planet and over time. Nevertheless, there is concern about air pollution in Chittenden County, even though it remains an "attainment" area, and any reduction in air pollution should be considered an important benefit.

Measurement of Direct Benefits

The vast proportion of direct, quantifiable benefits accrue to regional residents in the form of:

(1) Reduction in cost of owning, operating and maintaining automobiles.

(2) Reduction in congestion costs associated with accommodating passenger trips diverted from automobile to rail. These saved congestion costs include value of delay time and excess fuel costs. (Unmeasured, but equally real is the positive environmental effect of decreasing unnecessary engine running time, especially in stop-and-go traffic. This is incremental to other environmental benefits anticipated by diverting passengers from automobile use.

(3) Land use impacts. This accounts for land consumed in corridor development and otherwise required for accommodation of automobiles.

(4) Safety benefits. Rail transportation is significantly less dangerous than is travel by automobile; the net reduction in accidents and fatalities is estimated by applying mode-specific accident frequency data to expected changes in modal usage.

An alternative to the congestion cost analysis is the estimation of the cost of providing incremental infrastructure, i.e., highway capacity, which would result in relief of congestion equivalent to that provided by attraction to rail. This involves the allocation of the cost of fractional lanes, which, while odd in conception is analytically sound as long as continuance of traffic growth will eventually require investment in capacity enhancements. The effect measured by the "fractional lane" methodology is in fact the value of being able to delay investment in additional roadway capacity. This congestion cost analysis produces a lump sum (one-time investment) estimate of costs whereas the value-of-time based analysis generates an annualized figure.

Reduction in Cost of Owning, Operating and Maintaining Automobiles

Benefit estimates are provided for two scenarios: the Moderate Service Scenario (three trains in each direction during peak commuting hours, Monday through Friday (250 days per year) and at the All Day Service Scenario (half-hour service in each direction on work days between 5:30 AM and 9:00 PM, and on all other days hourly service between 9 AM and 4 PM).

Ridership estimates (see Chapter 1) reflect an assumed $1.00 fare irrespective of distance traveled, consistent with current bus practices. Twenty-five percent of train passengers are anticipated to be attracted from bus, the remainder from current automobile users.

The benefit analysis assumes that a discrete reduction in the number of automobiles and automobile-miles will occur equal to that allocable to the provision of the passenger trips attracted to rail. Again, this requires the simplifying assumption of the elimination of several "partial automobiles" - no specific auto owner is assumed to surrender his or her car merely because some trips may now be accomplished by train. Rather, the net effect of intermittent decisions not to purchase second or third vehicles for commuting purposes will be equivalent to that necessary to maintain the current metropolitan fleet of autos running at the same level of intensity, i.e., without changing annual average miles per vehicle.

Average annual vehicle mileage per vehicle of approximately 11,500 has been developed as reflected in Table 43, as well as per-vehicle ownership and variable (per mile) costs. Separate estimates have been provided for automobiles and light trucks, vans and sport utility vehicles reflecting the approximate levels of ownership in Vermont of each vehicle type.

Table 43
Capital and Operating Cost Breakdown, 1998

	Automobile (60%)	SUV, Light Truck (40%)	Total
Gas plus Oil	$ 0.063	$ 0.072	$ 0.067
Maintenance plus tires	$ 0.045	$ 0.048	$ 0.046
Tot. Op. Exp./mi.	$ 0.108	$ 0.120	$ 0.113
Average Miles	11,300	11,800	11,500
Average annual Op. Cost	$ 1,220	$ 1,416	$ 1,297
Annual Ownership costs	$ 5,175	$ 6,193	$ 5,582
Total Costs Yr./Auto	$ 6,395	$ 7,609	$ 6,879
Vermont Registrations (1997)	298,000	205,000	503,000
Avg. Annual Veh. Miles	11,316	11,827	11,492
Source: APTA Table 92, National Transportation Statistics 1998, Statistical Abstract.			

Table 44 develops rail passenger trip miles for the All Day Service Scenario based on average weekday usage of 1,700 trips, reflecting the ridership analysis developed with 1999 survey data. The average trip length is computed as 6.90 miles on rail, the greatest passenger densities being between Burlington and Winooski (1,027 All Day Service Scenario riders) winnowing out to 800 riders between Winooski and Fanny Allen. This stretch of about five miles is within the most heavily trafficked parts of the region, with sections of roadway accommodating about 30,000 vehicles per day (for example, at the Winooski bridge).

Table 44

Forecast Distribution of Daily Rail Passenger Miles - 1999 All Day Service Scenario, 1700 Passengers Per Day

	Arrive Charlotte	Arrive Shelburne	Arrive S. Burlington	Arrive Burlington	Arrive Winooski	Arrive Fanny Allen	Arrive Essex Junction	Arrive Essex Park & Ride	Total daily pass. miles:	Avg. mi./trip
Depart Charlotte	-	64.8	178.0	492.0	30.6	102.0	40.2	22.0	930	11.20
Depart Shelburne	70.2	-	66.5	552.0	99.0	174.0	235.2	33.2	1,230	7.94
Depart S.Burlington	222.5	70.0	-	275.4	281.6	145.8	660.8	52.4	1,709	6.81
Depart Burlington	602.7	579.6	234.6	-	476.0	163.2	1,689.2	131.3	3,877	6.54
Depart Winooski	45.9	89.1	300.8	442.0	-	3.4	302.4	26.8	1,210	4.69
Depart Fanny Allen	-	-	81.0	102.0	34.0	-	-	-	217	4.34
Depart Essex Junction.	60.3	102.9	515.2	1,394.0	326.4	-	-	-	2,399	8.16
Depart Essex Park & Ride	-	16.6	39.3	80.8	26.8	-	-	-	164	10.22
Total daily pass. miles:	1,002	923	1,415	3,338	1,274	588	2,928	266	11,735	
Avg. mi./trip	10.77	6.94	6.61	6.31	4.43	8.06	8.46	11.07	6.90	

Source: RLBA Calculation.

Other assumptions respecting trip characteristics are as follows:

(1) Access and egress trips connecting rail travelers' ultimate originations and destinations with boarding and disembarking stations average one mile on either end of the rail trip. It is assumed that this distance is fully incremental to automobiles as well as to rail travelers. Thus, on a portal to portal basis for travelers on the Burlington-Essex Park & Ride segment the average one-way rail-based trip is 8.9 miles; 6.9 miles on rail and 2.0 miles on access and egress trips. With zero circuity advantage for any mode, auto and bus trips from which rail trips are attracted also are assumed to be 8.9 miles in length

(2) Fifty percent of all rail trips will involve the use of an automobile for either an access or an egress trip. On average, each rail-based trip would include 0.5 miles by automobile and 1.5 miles by other modes - walking, bus, or bicycling.

(3) Average automobile miles reduced per trip attracted to rail will equal: (a) portal to portal distance of 8.9 miles, (b) minus 0.5 miles attributable to automobile access/egress use, or 8.4 miles per rail trip, (c) adjusted by average automobile occupancy of 1.11 passengers to an effective average distance per attracted automobile trip of 7.6 miles.

The reduction of automobiles occasioned by rail service is displayed in Table 45. Under the moderate scenario, 557 passengers per weekday, or 75 percent of total rail ridership, would be attracted from auto. Over 250 days per year, and with 1.11 passengers per car occupancy, this scenario would reduce auto usage by 1.05 million vehicle miles per year, or the amount of miles generated by 92 vehicles.

Table 45
Development of Equivalent Reduction In Automobiles

	Moderate Service Scenario	Weekday/ Peak	Weekday off-peak	Weekend	All Day Service Scenario
Rail Passenger trips/day	743	1,190	510	170	1,233
Trips/day diverted from auto	557	893	383	128	924
Operating days/year	250	250	250	110	360
Rail pass. miles per year at 6.9 rail miles/trip	1,281,675	2,052,750	879,750	129,030	3,061,530
Passenger trips diverted to rail from auto/year	139,313	223,125	95,625	14,025	332,775
Annual reduction by diversion to rail of automobile passenger miles at 8.4 miles/trip	1,170,225	1,874,250	803,250	117,810	2,795,310
Annual reduction in Pass. Vehicle miles at 1.11 per car occupancy	1,054,257	1,688,514	723,649	106,135	2,518,297
Equivalent reduction in pass. Vehicles at 11,500 mi./yr./vehicle annual miles per passenger vehicle	92	147	63	9	219

Source: RLBA calculations.

Similar calculations for the All Day Service Scenario produce a reduced demand of 219 passenger vehicles. Although automobile ownership and operating costs savings reflects a reduction of the full 219 cars, in assessing congestion savings and highway capacity investment savings, only the 147 autoequivalents attributable to peak service are considered. (Capacity requirements pertain only to peak periods, and off-peak congestion savings would be minimal.)

Table 46 calculates the savings attributable to personal costs of passenger vehicle ownership. Savings are calculated separately for automobiles and "light truck" categories; vehicle costs, reflecting the per-vehicle estimates developed in Table 1, above. annual savings of approximately $1.5 million would accrue from the All Day Service Scenario, and $630,000 from the Moderate Scenario. Annual savings would be anticipated to grow at a rate reflecting (1) rail ridership growth, (2) shifts in travel patterns, both geographic and modal, and (3) compounding effects of increases in pertinent cost categories.

Table 46
Automobile Savings Engendered By Transit: All Day Service Scenario

	Automobile (60%)	SUV, Lt. Truck (40%)	Total
Vehicle miles eliminated	1,510,000	1,008,000	2,518,000
Equivalent no cars eliminated.	134	85	219
Annual ownership cost eliminated	$ 691,535	$ 529,006	$1,222,502
Variable costs eliminated	$ 163,080	$ 120,960	$ 284,030
Total savings by reducing autos by 101.8	$ 854,615	$ 649,966	$1,506,532

Automobile Savings Engendered By Transit: Moderate Scenario

	Automobile (60%)	SUV, Lt. Truck (40%)	Total
Veh. miles eliminated	632,400	421,600	1,054,000
No cars eliminated	56	36	92
Annual ownership cost eliminated	$ 289,617	$ 221,269	$ 511,851
Variable costs eliminated	$ 68,299	$ 50,592	$ 118,891
Total savings by reducing autos by 101.8	$ 357,916	$ 271,861	$ 630,742

Source: RLBA Calculations

Having said this, Congress's Office of Technology Assessment issued a report in 1994, entitled "Saving Energy In U.S." in which it provided estimates of the full costs of motor vehicle use in 1990. Averaging high and low estimates for relevant categories of costs, and converting to 1998 dollars, the per-vehicle mile costs as shown in Table 47 were developed:

Table 47
Cost per Vehicle Mile: Hidden Costs and Externalities

Hidden private sector expenditures		
Free nonresidential parking excluding taxes less payments	$	0.069
Other hidden costs	$	0.035
Public expenditure for highway infrastructure and services less taxes	$	0.029
Non monetary externalities		
Congestion time cost on other	$	0.085
Pain and suffering on others	$	0.082
Mortality and morbidity effects pollution	$	0.073
Other external costs	$	0.037
Total	$	0.411

Source: Saving Energy in U.S. Transportation Office of Technology, July 1994.

There is very high confidence that the savings estimated in both the "auto equivalence reduction" and the congestion analysis immediately following would actually be realized, and a reasonable probability that benefits would achieve growth above baseline at a rate far greater than the current projections for 2009 ridership. Driving this confidence is the unfortunate realization that exploding automobile costs must eventually be impossible to deny or ignore. The common misconceptions that automobile costs are actually declining as evidenced by historically low gasoline prices and constantly improving fuel economy have restrained growth of passenger rail systems. Few Americans appear to recognize or internalize the fact that average ownership cost per vehicle mile is now cresting at over 60 cents.

It is true that gasoline cost per vehicle mile has experienced a lengthy decline following the energy crisis of 20 years ago. From 1980 to 1990 gas and oil cost per vehicle mile dropped from 14.1 cents to 12.1 cents in constant 1998 dollars, and continued to decline to 11.3 cents in 1998. Savings engendered by increased fuel efficiency of passenger autos had been dramatic for a short period, but improvement ceased a decade ago and Americans continue to purchase increasing quantities of gasoline.

Fleet fuel efficiency the U.S. has improved only marginally in the past 15 years and by some standards has regressed as the share of less-efficient "light trucks" has rapidly grown. Vehicle acquisition, acquisition cost and per unit mileage have grown unabated, compensating for any improvements in efficiency by vehicle category. Counter to conventional wisdom, Table 48 demonstrates that real new vehicle efficiency - as reflected in actual fleet composition - actually declined by nearly 10 percent between 1985 and 1997.

Table 48
New Vehicle Fuel Efficiency
(miles/gallon)

Year	Domestic			Imported			CAFE Standard	
	Cars	Light Trucks	Cars + Lt. Trucks	Cars	Light Trucks	Cars + Lt. Trucks	Passenger Car	Light Truck
1985	26.3	19.6	24.0	31.5	26.5	30.3	27.5	19.5
1990	26.9	20.3	23.9	29.9	23.0	28.5	27.5	20.0
1994	27.5	20.5	23.7	29.6	22.1	27.7	27.5	20.5
1997	27.9	20.1	23.4	29.8	22.1	27.5	27.5	20.7
Change 85-97	1.6	0.5	-0.6	-1.7	-4.4	-2.8	0	1.2
Pct. Change	6.1%	2.6%	-2.5%	-5.4%	-16.6%	-9.2%	0.0%	6.2%

Source: National Transportation Statistics 1998 Table 4-5, 4-9.

The cost of fuel used in this benefits analysis, based on 1998 data, represents the lowest cost in real terms in history and is unlikely to be sustained. Current fuel prices are already about 20 percent above last year's troughs. That "cheap gas" does not constitute the whole story is obvious from the data displayed in Table 49.

Table 49

Growth of U.S. Automobile Usage: 1980-1996					
				Percent Change:	
	1980	**1990**	**1996**	1980-96	1990-96
Private Automobiles: Total Costs ($Bill)	$ 548	$ 1,031	$ 1,321	141%	28%
Operating Costs ($Bill)	$ 273	$ 422	$ 550	102%	30%
Total cost/mile	$ 0.390	$ 0.520	$ 0.578	48%	11%
Vehicle Miles (Trillion)	1.403	1.983	2.283	63%	15%
Gasoline Consumption (Bill. Gallons)	93.8	105.2	116.0	24%	10%
Vermont Motor Vehicle. Registrations	347,000	462,000	503,000	45%	9%
Vehicle Miles Per Lane - Urban	613	764	820	34%	7%

Source: U.S. Statistical Abstract, 1998
1998 constant dollars

Vermont's passenger vehicle registrations appears adjacent to the corresponding changes in the number of (US) vehicle miles per urban lane mile. The growth rates are almost identical - a phenomenon caused by rapidly growth in the number of vehicles accompanied by negligible growth in road capacity to accommodate them. The implications of continuance of this trend is suggested in the results of the analysis which follows.

Reduction in Congestion Costs

Congestion costs are measured largely in terms of the value of time consumed in travel in excess of that which would be expended under freely flowing conditions. That is, as more cars attempt to share the same roadway, congestion occurs. The cost of congestion increases exponentially, and with the unremitting continuation of several trends, urban residents face substantial mobility constraints over the next few decades. It is clear that whatever tradeoffs must be made, they will not be easy. Table 50 illustrates the phenomenon that transportation activity is highly correlated with national income, and not simply population. The simplest solution for an impending transport capacity crisis is an economic downturn; not an attractive choice. The relationship between GDP and vehicle-miles is shown to underscore the fact that roadway congestion is an exponentially and not linearly driven phenomenon. Population times per capita income equals national income - multiplying the first two columns produces the third- GDP- which is nearly precisely correlated with transportation demand.

Table 50
Comparison of Indexed Passenger Transportation Activity
With Population and Income (1985 = 100)

				Vehicle/Car Miles		
Year	US Population	US Per Cap. Income (Constant)	Constant Dollar GDP	Pass. Cars, Lt. Trucks	Transit industry (Tot.)	Commuter Rail
1975	91	80	73	75	78	95
1980	95	91	87	86	82	98
1985	100	100	100	100	100	100
1990	105	110	115	121	116	116
1996	111	117	130	139	131	132

Source: US Dept Commerce, National Transportation Statistics.

RLBA's analysis relies upon the compounding effects of vehicular congestion. A well-known national study of urban area congestion by the Texas Transportation Institute produces annual reports on the costs of freeway congestion in 50 urban areas - seven in Texas and the remainder selected largely by size. Study results, which take three to four years for widespread release, are prominently published by both the U.S. Department of Commerce (Statistical Abstract) and in the Bureau of Transportation Statistics' National Transportation statistics. The 1998 edition of each of these publications contains results of the 1994 analysis. Relevant study parameters and results are shown in Table 51.

Table 51
Texas Transportation Study Basic Parameters: 1994

Population in combined regions	135,740,000
Freeway lane miles	67,400
Vehicle miles per lane mile of freeway	13,180
Implicit annual congestion cost per lane mile	$ 862,476
Annual weekday vehicle miles (miles)	222,072
Delay per vehicle mile (seconds)	47.13
Average congestion cost per vehicle mile	$ 0.262
Implicit Daily miles per driver/auto	8.39
Delay per daily trip (minutes)	6.59
Cost per hour auto/driver delay	$ 19.99
Per driver/auto daily delay cost	$ 2.20
Annual delay hrs per driver or per auto	27.46
Per driver annual cost of delay constant 1998 dollars	$ 549
Annual delay hours per capita	22.50
Per capita annual cost of delay	$ 428

Source: 1998 US Statistical Abstract No. 1040. Roadway Congestion: 1993 Texas Transportation Institute, College Station, Texas; Roadway Congestion in Major Urban Areas, Annual.

RLBA analyzed the relationship between the average traffic volume (vehicle miles per lane mile of freeways, interstates and major arterials) of each metropolitan area and the experienced congestion costs. Grouping the cities by deciles produced a clear picture of the escalating cost of congestion as capacity limits are reached. This is shown is Table 52.

Table 52
Freeway Usage

Decile Rank	Vehicle Miles Per Lane Mile of Freeway	Congestion Cost Per Vehicle Mile (1998 dollars)
1	17,764	$ 0.336
2	15,868	$ 0.294
3	14,210	$ 0.297
4	13,732	$ 0.223
5	13,208	$ 0.193
6	12,674	$ 0.189
7	12,010	$ 0.167
8	11,660	$ 0.152
9	11,098	$ 0.136
10	9,590	$ 0.132

Source: RLBA analysis.

Regression results produce an R-square of 0.90, an extremely good fit. The regression equation produced intuitively good results both with respect to the average congestion cost at a given level of traffic and the marginal cost of an additional vehicle-mile. Table 53 displays a range of results for a broad range of freeway usage.

Table 53
Regression Results Applied to Discrete Traffic Densities

Vehicle Miles Per Freeway Lane Mile	Delay Cost Per Vehicle Mile	Daily Delay Cost Per Lane mile	Marginal Delay Cost Per Vehicle Mile
20,000	$ 0.413	$ 8,258	$ 0.967
19,000	$ 0.384	$ 7,291	$ 0.908
18,000	$ 0.355	$ 6,383	$ 0.850
17,000	$ 0.325	$ 5,533	$ 0.792
16,000	$ 0.296	$ 4,741	$ 0.733
15,000	$ 0.267	$ 4,007	$ 0.675
14,000	$ 0.238	$ 3,332	$ 0.617
13,000	$ 0.209	$ 2,715	$ 0.559
12,000	$ 0.180	$ 2,157	$ 0.500
11,000	$ 0.151	$ 1,656	$ 0.442
10,000	$ 0.121	$ 1,214	$ 0.384
9,000	$ 0.092	$ 831	$ 0.325
8,000	$ 0.063	$ 505	$ 0.267
7,000	$ 0.034	$ 238	$ 0.238

Source: RLBA analysis.

Table 54 translates the statistical results to Burlington by associating the vehicle miles saved by commuter service to the range of density values attributable to the affected highways. Although Burlington's roadways are not primarily major arterials as studied by the Texas group, associating one-way annual average daily traffic (AADT) levels with freeway lane densities should serve as a good approximation.

Table 54
Annual Congestion Cost Savings Estimate

Moderate Scenario					
Freeway Vehicle Miles per Lane Mile or Arterial AADT	Current Average Delay cost Per Veh. Mile	Marginal Delay cost per Veh. Mile	Percent of Affected Roadway	Veh. miles	Incremental Delay cost per year
7,000	$0.034	$ 0.238	25%	263,500	$ 62,727
10,000	$0.121	$ 0.384	30%	316,200	$ 121,337
12,000	$0.180	$ 0.500	30%	316,200	$ 158,198
15,000	$0.267	$ 0.675	15%	158,100	$ 106,745
			Total:	1,054,000	$ **449,008**
All Day Service Scenario					
Freeway Vehicle Miles per Lane Mile or Arterial AADT	Current Average Delay cost Per Veh. Miles	Marginal Delay cost per Veh. Miles	Percent of Affected Roadway	Veh. Miles	Incremental Delay cost per year
7,000	$0.034	$ 0.238	25%	422,125	$ 100,488
10,000	$0.121	$ 0.384	30%	506,550	$ 194,381
12,000	$0.180	$ 0.500	30%	506,550	$ 253,432
15,000	$0.267	$ 0.675	15%	253,275	$ 171,005
			Total:	1,688,500	$ **719,307**

Source: RLBA analysis.

Table 55 provides supporting data on the distribution of functional highways in Vermont and the relation between lane densities by classification.

Table 55
Vehicle Miles Traveled Per Lane (000)

	1980	1990	1996
Urban, total	613	764	820
Interstate	3,327	4,483	4,901
Other Arterials[a]	1,451	1,751	1,855
Collector[b]	572	634	687
Local	146	184	181

Source:1998 Statistical Abstract Table 1019 Highway Mileage—Functional Systems as of 12/31/96

Reduction in congestion resulting from rail implementation along the Burlington to Essex Junction Corridor would be most evident on the roads that parallel the railroad right of way. The 1997 to 1998 AADT volumes on portions of Routes 7, 15, Susie Wilson Road and 2-A, which run near the proposed railroad averaged 20,030 vehicles total (both directions) are shown in Table 56.

Table 56
AADT of Affected Segments Along Proposed Rail Route

Location	Year	AADT
VT 15 Between Barlow & Spring	1998	18,400
VT 15 Between Spring & I-89 Exit 15	1998	19,600*
VT 15 Between Entrances of Fort Ethan Allen	1996	21,890
VT 15 by Fairgrounds	1996	14,930
VT 15 Between Summit & Five Corners	1995	13,820
VT 2A Between Central and Prospect	1998	8,500
VT 2A Just South of Pinecrest	1998	8,900*
VT 2A Between Pinecrest & Susie Wilson Road	1996	6,590
Susie Wilson Road Between Kellog & VT 2A	1998	13,720
Susie Wilson Road Between Pinecrest & Kellog	1998	20,790
Susie Wilson Road Between VT 15 & Pinecrest	1998	23,330*
Route 7 at Winooski Bridge	1997	28,290*
Route 7 Riverside Drive	1998	19,200
Colechester Drive	1997	12,100

* Sample used to calculate Average AADT

Source: CCMPO.

Much of the route 15 and 7 corridor which parallels the proposed rail service receives a level of service rating in the Corridor Plans for Chittenden County, Vermont report of D or worse in 1993 as defined in the Transportation Research Board's Highway Capacity Manual: Special Report 209, dated 1985. "Level of service" is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists. Six levels of service are defined, with level of service A representing the best operating conditions and level of service F representing the worst. Level of service C is in the range of stable traffic flow. The Corridor Plans for Chittenden County, Vermont report defines level of service of D or worse as congested.

The report deemed Route 7 between Burlington and Winooski to be congested, experiencing levels of service of E in 1993 (most problems at intersections) and predicted to deteriorate to F by 2013 assuming no improvements. Susie Wilson Road and routes 15 and 2A feeding into Essex Junction are congested in places (level of service level E between Florida Avenue and Limekiln Road and at most intersections) and traffic is predicted to increase by 60 percent by 2013 to unacceptable levels of service E and F assuming no improvements to current infrastructure. The report stated that approximately 25 percent of the traffic volume on Vermont Route 15, or 1,000 vehicles per hour, traveled between Essex Junction and Burlington and Essex Junction and Winooski in 1995. Although portions of Susie Wilson Road and Routes 15 and 2A stretch beyond the rail corridor, the proposed rail service would significantly relieve congestion.

Land Use Impacts

Land use impacts of passenger transportation relate to what effect a commuter rail system would have on the real estate resources required to sustain urban passenger demand. This requires consideration of the amount of land consumed not only for corridor development, but the land required to accommodate automobiles at rest as well including parking costs, subsidized or not, and the cost of garaging at home.

The capital costs of automobile infrastructure (additional highway lanes needed, parking and garaging space needed, and cost of land for same), which would be required to support the number of passenger rail riders estimated to use this service, would amount to $ 4,400,000 in the Moderate Service Scenario and $10,900,000 in the All Day Service Scenario based on the following discussion. The implementation of rail service will remove current motorists from the highways. Therefore capacity will be added to highway infrastructure and downtown parking spaces, thus prolonging the need for expansion of either. These figures will increase and become more significant as rail ridership increases over the years, and the Chittenden County forecast of a 60 percent increase in traffic along Route 15 by the year 2013 pushes present infrastructure beyond its capacity.

In highly urbanized areas, such as Chittenden County, the cost of building freeway or adding freeway lanes rises dramatically. The three mile Shelburne road expansion cost $16 million in construction costs ($5.3 million per mile), but includes sidewalks and a median strip among other amenities, and the .7 mile Main Street expansion project in downtown Burlington cost $12 million ($17 million per mile), but includes numerous costs associated with downtown construction[25].

Generally speaking the capacity of one lane of road is between 1400 and 1900 vehicles per hour according to VAOT (1400 representing level of service C and 1900, level of service F). Since 75 percent of rail ridership is estimated to come from automobiles, and based upon occupancy of 1.1 person per automobile, automobiles removed from the corridor during a peak hour would equal 64 cars moderate scenario and 121 cars all day scenario. Under the moderate scenario this number represents 4.6 percent of capacity of 1,400 autos per hour during peak travel time to maintain Level of Service C, or contributes $114,000 of the $2.5 million per route mile to add lanes. Similarly, under the all day scenario this number represents 8.6 percent of capacity of 1,400 autos per hour during peak travel time to maintain Level of Service C, or contributes $216,000 of the $2.5 million per route mile to add lanes.

Assuming that public parking garages estimated by CCMPO to cost $12,500 per space are needed to accommodate workday passengers who leave their autos at home and choose rail, this would amount to $3,600,000 under the moderate scenario, and $9,300,000 dollars under the all day scenario. Results displayed in Table 57.

Table 57
Capital Costs of Automobile Infrastructure to Support Rail Passengers

Description of Capital Cost	Moderate Service Scenario (4.6%)	All Day Service Scenario (8.6%)
Cost of 6.9 Miles of Construction*	$ 788,571	$ 1,490,892
Land Acquisition 5.3%	$ 41,794	$ 79,017
Cost of Parking spaces	$ 3,609,375	$ 9,328,125
Total Cost	$ 4,439,740	$ 10,898,034
*Average length of rail passenger trip. Source: RLBA Estimates		

[25] CCMPO.

Environmental impacts of rail transport are important benefits that need to be considered. Reductions in auto pollutant emissions due to the diversion of highway traffic to rail are calculated based on Federal Highway Administration's (FHWA) guidelines and diverted auto miles estimated above. Table 58 displays quantities of major pollutants saved.

Table 58
Average Annual Environmental Savings Benefits

Moderate Scenario

	Carbon Monoxide (kg)	Hydrocarbons (kg)	Nitrogen Oxide (kg)
Auto (decrease)	10,654	799	1,598

All Day Service Scenario

	Carbon Monoxide (kg)	Hydrocarbons (kg)	Nitrogen Oxide (kg)
Auto (decrease)	25,457	1,909	3,819

Source: FHWA estimates, RLBA calculations.

RLBA has not assigned a dollar value to these environmental benefits because of reasons earlier discussed. The benefits must nonetheless be considered as very positive, and in keeping with the Burlington region's desire to remain an attainment area.

Safety Impacts

Two safety impacts are investigated for the proposed rail service. These are the benefits associated with the reduction of highway traffic and the cost of train and grade crossing accidents.

A close correlation exists between traffic volume and the frequency of accidents. Reduced automobile use will, without doubt, lead to fewer traffic accidents and will lower the costs related to property damage and casualties. The annual economic cost of automobile accidents is estimated at 7 cents per vehicle mile.[26] Based on this figure and estimates of reduced auto miles, safety benefits of the proposed service are estimated to be $37,290 at the Moderate Service Scenario level or $ 89,101 at the All Day Service Scenario

[26] Highway Safety Facts, U.S. Department of Transportation, National Highway Traffic Safety Administration, 1993. Updated to 1999 dollars using the consumer price index for urban consumers.

level. 1993 VAOT statewide average cost per accident is $41,152.[27] National Safety Council costs per accident with injuries is $31,850 and for property damage is 6,300.

The increase in train traffic, however, may cause an increase train-related accidents. The U.S. Department of Transportation[28] estimates 7 grade-crossing accidents per million train miles operated. The proposed service will increase rail traffic by 94,248 (Moderate Service Scenario) and 400,554 (All Day Service Scenario) train miles annually. Therefore, statistically, few or no additional grade-crossing accidents may be expected annually under the Moderate or All Day Service Scenarios. It should be noted that between the years 1993 and 1997 there were no grade crossing accidents reported along the corridor.[29] In fact, in 1997 there was only one recorded grade crossing accident in Vermont.[30]

Summary

Table 59 summarizes the annual and one-time benefits.

Table 59
Summary of Annual Benefits (Partial) ($millions)

	All Day Service Scenario	Moderate Service Scenario
Reduction in Cost of Ownership	1.5	.6
Reduction in Congestion Cost	.7	.5
Safety	.1	.04
Total	$2.3	$1.1

One-Time Benefits (Partial)

	All Day Service Scenario	Moderate Service Scenario
Land Use	10.9	4.4

The one-time land use benefits are not additive to the annual benefits, as certain double-counting is implied. There are additional land use and other environmental benefits which have not been quantified.

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[27] We are told that figure has not been updated.
[28] Highway-Rail Crossing Accident/Incident and Inventory Bulletin, U.S. Department of Transportation, Federal Railroad Administration, No. 16, July 1994.
[29] VAOT Accident Reporting System, Accident Summary.
[30] FRA Total Highway – Rail Incidents by State, 1997.

APPENDIX A

Regional/Passenger Rail Success Factors

What makes regional/passenger rail feasible? What are the generally-accepted success criteria?

From the passenger's point of view

A person will step onto a train if it is an improvement over alternative transportation. Various factors enter into the decision, some of which are listed below. The foremost and generic factors are the three first listed.

- Competitive overall trip time
- Reasonable fare
- Reliability
- Distance/time between origin and origin station
- Access to station by foot or bicycle
- Availability of parking at, or bus to, station
- Distance/time between destination station and final destination
- Availability of bus at destination station and low- or no-cost transfer
- Ability to return to origin at times other than rush hour
- Options regarding frequency of trains (the more, the better) and operating hours (the more, the better)
- Modern, clean, comfortable passenger cars with amenities (laptop outlets, phones, bike racks)
- Amenities at or near stations (day care, bank, dry cleaning, convenience store)

From the community's point of view

A community will consider commuter rail feasible depending on community values. Factors considered important may include the following:

- Augments transportation options (as a quality of life issue)
- Mitigates need to expand highway capacity
- Encourages development of growth centers
- Improves area transportation as an economic development catalyst
- Provides new options for non-auto users; link workers to jobs
- Can be done at an affordable cost (start-up and annual)
- Meets goals, especially land use goals, of local and state plans

APPENDIX B

Station Siting Criteria

Burlington/Essex Passenger Rail Feasibility Study and Corridor Analysis

1. Close to trip origins and destinations

   Useful/convenient to passengers
   Good pedestrian network (existing or planned)

2. Community impacts

   Land use/long range plans/growth center-transit orientation
   Traffic pattern
   Environmental

3. Highway access: convenience for park & ride, drop-offs, and bus transit

4. Space for parking, bus turnaround and kiss & ride (drop-off lane)

5. Cost

6. Railroad agreement as to

   Tangent track
   Separation from crossovers, turnouts, etc.

APPENDIX D

What This Study Will Accomplish

Purpose: The Chittenden County Metropolitan Planning Organization (CCMPO) has engaged a team of consultants led by R.L. Banks & Associates, Inc., (RLBA) to assist CCMPO in determining the feasibility of passenger rail service in the Burlington-Essex corridor, an extension of the Charlotte-Burlington passenger rail project. The study will cost $239,241, principally from federal and state sources, and is to be completed by June 1, 1999. Federal "earmark" funding is available if passenger rail service is feasible.

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- Estimate the number of riders projected to use the passenger rail service
- Involve the public in the decision-making process
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- Relate study findings to existing and on-going Chittenden County corridor and transportation planning, including the CCTA Systems Plan and Operational Analysis and the transit funding study
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This study is not an alternatives analysis. Rather, it will evaluate the feasibility of passenger rail in the corridor, and provide an assessment of how passenger rail "fits" into the context of other existing Chittenden County and state transportation plans and studies.

Public Participation: The study includes public participation. At the beginning, middle and end of the study, there will be public meetings with opportunities for public comment. Furthermore, public input is invited at any time and may be provided to:

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Study Products: In addition to presentations and handouts at public meetings, describing study findings, there will be a written study report addressing conclusions and findings at the end of the project.

APPENDIX E

Questions, Comments, Concerns and Issues Arising from April Public Meetings

Regarding the potential extended passenger rail service to St. Albans and to Montpelier, would the fare be more expensive? For purposes of estimating ridership, a $1 fare was assumed, the same fare assumed in the Core Service, Charlotte-Burlington-Essex.

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Will ridership numbers be further refined? Yes.

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What is the funding source for rail? CMAQ (Congestion Mitigation/Air Quality) federal funds are the source of operating funds for three years of Charlotte-Burlington passenger rail service. A Congressional "earmark" has identified money specifically designated for Burlington-Essex Commuter Rail, and will pay for at least part of any implementation. If it is decided to implement passenger rail service on a permanent basis, a long-term source of funding must be identified.

How will rail and bus be coordinated? If the rail project is implemented, it will be fully coordinated with bus service so that the two are mutually supporting for optimum transit efficiency. For example, feeder bus service will assist in conveying passengers to and from rail stations.

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What about transportation to the train stations? Will parking be free at the train stations? Transportation to the train stations will be by foot for those that live close enough, otherwise by bicycle, car, or bus. It is recommended that parking be free at train stations.

What about emissions/air pollution? Locomotives are required by the U.S. Environmental Protection Agency (EPA) to reduce exhaust emissions of hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matter, in accordance with standards set by that agency in December 1997.

ACKNOWLEDGMENTS

R.L. Banks & Associates, Inc., (RLBA) and its subcontractors--Resource Systems Group, Inc.; Executype Services; EIV Technical Services, LLC; and Mudd & Associates, Inc.--gratefully acknowledge the assistance provided by many others in performing this study, including:

Jeanette Berry, CCTA
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Catherine Dimitruk, Northwest Regional Planning Commission
Barry Driscoll, AICP, VAOT
Bernie Ferenc, CCMPO
Steve Gladczuk, Central Vermont Regional Planning Commission
Dan Grahovac, P.E., VAOT
Stanton Hamlet, CCRPC
Brian Jackson, FTA
Chris Jolley, FHWA Vermont Division
Peter Keating, CCMPO
Dennis Lutz, Town of Essex
Andy Motter, FTA Region 1
Mike O'Brien, CCMPO Board and City of Winooski
Mike Olmstead, New England Central Railroad
Bob Penniman, CCMPO Board & CATMA
Peter Plumeau, Executive Director, CCMPO
Clay Poitras, VAOT
Charles Safford, Village of Essex Junction
Jeff Schulz, Village of Essex Junction
Joe Segale, CCMPO
Harry Smith, Town of Essex
Eugene Trombley, New England Central Railroad
Jim Trzepacz, City of Winooski
Lewis Wetzel, Colchester and CCRPC

APPENDIX C

A Phased Infrastructure Improvement Program

General

Chapter 3, Corridor Infrastructure and Safety Issues, assumes ability to fund the required infrastructure improvements prior to start of service. Some have indicated that Chittenden County and Vermont may wish to begin service with minumum capital outlay.

R.L. Banks & Associates, Inc., (RLBA) does not recommend the latter approach. RLBA is concerned that ridership will suffer, and the new service will be declared a failure, if the service does not provide a convenient alternative to the automobile. Further, RLBA believes that the new service will not provide a convenient alternative to the automobile unless it is time-competitive with the automobile and dependable. RLBA estimates that about $37 million (All Day Service Scenario) or $23 million (Moderate Service Scenario) of infrastructure improvements are required in order to make the service time-competitive with the automobile and dependable.

If, however, Chittenden County and Vermont choose to initiate passenger rail service without funding the infrastructure improvements recommended by RLBA, this appendix contains the minimum capital outlay necessary to provide minimally safe service. If this approach is taken, RLBA strongly recommends a phased funding program in which all recommended improvements are accomplished as rapidly as possible.

RLBA emphasizes that there is a considerable degree of risk in this approach—risk with regard to safety because of less safe trackage and absence of signalling, and risk with regard to people using the service because of longer, non-competitive travel times and absence of dependability when trains are delayed because of inadequate infrastructure.

Minimum Capital Outlay Approach

<u>Rail</u>

Were train speed limited to 40 mph, 1.2 miles of existing welded rail would be reused, reducing initial expenditures by $505,000.

Ties

The line needs ties. If maximum line speed is restricted to 40 mph, initial tie installations could be cut to 11,000, reducing cost by about $842,000.

Railway Signalling

As stated earlier, a railway signaling system provides important safety functions and installation of a signal system is strongly recommended. If it is decided to begin service without automatic block signals, turnout protection and a signal interlocking at Essex Junction (total of about $3.4 million including engineering and contingency), an interim solution costing $1 million would provide an interlocking at Essex Junction and advance turnout position indications (facing movement only) on the rest of the line between Essex and Burlington, giving the train operator warning and time to stop in the case of a mis-aligned switch. This would postpone an initial signal expenditure of about $2.7 million with net reduction in initial start-up expenditures of about $2.4 million. Little of the $281,000 turnout position expenditure would be salvageable. It is recommended that a firm commitment be made to install a signal system, as soon as possible, as part of any decision to implement passenger rail service.

Tunnel

Postponing any tunnel improvement (other than track) would require "walking speed" operation through the tunnel, located one mile north of Union Station, and would postpone the estimated expenditure of $5 million for tunnel improvements. This will have the effect of lengthening (i.e., slowing) passenger train running time.

Second Track Construction

This report recommends the addition of passing sidings, more or less, depending on the service scenario. In order to operate on 30-minute headways all day (the All Day Service Scenario), about one-half of the Burlington-Essex line must be double-tracked, and the estimated cost of doing this, $14.9 million, was displayed earlier in Table 26. In the Moderate Service Scenario (two trains operating every hour during peak periods only), the only double-tracking recommended is the addition of a short siding at Burlington Union Station at an estimated cost, with spring switches, of $1.9 million. A siding track at Burlington Union Station is very important for success of both service scenarios, as it allows two trains to pass one another at this highest-ridership-station-on-the-system without delays which would frustrate passengers if they were required to wait on a nearby siding. This is emphasized because it is understood that the owner of Burlington Union Station has development plans which may preclude space for a second track.

For 30 minute service frequency, additional sidings are necessary at the mid-points of the Burlington-Essex and Burlington-Charlotte rail lines. Eliminating the double track in favor of a short passing siding creates the risk that one late train will cause another train, and eventually all trains, to be late. To offset the flexibility sacrificed by eliminating the double track, recovery time of about four minutes should be added to train schedules. It is emphasized that this is only an interim solution. Longer schedule times mean fewer riders.

New England Central Mainline

The estimated cost of improving the half-mile of New England Central Railroad (NECR) track immediately north of Essex Junction, $0.2 million, could be postponed.

Power Plant Siding

Conflicts between wood chip trains and passenger trains at the power plant must be avoided by extending the existing siding so the unloading of wood chips may be accomplished without encroachment of the chip train onto the branch line. Absent an operational agreement with NECR assuring no interference of chip trains with passenger trains, the power plant siding must be extended (at an estimated cost of $4.2 million for the All Day Service Scenario, and $2.5 million in the case of the Moderate Scenario). Otherwise, delays would devastate passenger train ridership. This represents no change; the subject is reviewed here to emphasize the importance of insuring that there are no conflicts between passenger and wood chip trains.

Layover and Servicing Facilities

To avoid the entire cost of a new layover facility (overnight storage and train servicing) in the vicinity of Essex Park and Ride (near the intersection of VT 2A and the VT 289 Exit), trains could either layover on the proposed new station track at Burlington or on a track leased from Vermont Railway in its Burlington yards. Eliminating the proposed new trackage would reduce initial expenditures from $1.9 million to 0.6 million for layover utilities (see Table C-1) with a net reduction in start-up costs of $1.246 million. It should be stated that eliminating the proposed new trackage would also block the NECR main track at the park and ride station while awaiting the next scheduled departure from that station, since there is no place to store the train. This may be unacceptable to NECR, especially in the case of the All Day Service Scenario.

Table C-1
Layover Utilities Cost Estimate

	Mile Post	Mile Post	Quantity	Unit	Unit Cost	Item Subtotals $000
Add Layover Utilities						
Utilities	0	0.2	1	Sum	100,000	100
Layover electric power	0.1	0.2	1	Each	200,000	200
Locker and storage building	0.1	0.2	1	Each	50,000	50
Layover roadway, fencing and gates	0.1	0.2	1	Sum	53,000	53
Permitting	0	0.2	1	Sum	50,000	50
SUBTOTAL						$ 453
Engineering and project management				Percent	17%	77
Contingencies				Percent	20%	106
TOTAL						$ 636

Source: RLBA estimates.

It is understood that layover facilities planned for the Charlotte-Burlington service could be used for the Charlotte-Burlington-Essex service. If this is so, the $0.6 million figure could be reduced to zero.

Based on the foregoing discussion, Table C-2 shows the minimum recommended start-up cost. *It is emphasized that the improvements represented by costs in Table 32 remain the recommended improvements if the passenger rail service is to achieve ridership figures estimated earlier in this study report.* The limited improvements represented in Table C-2 are suggested only as an interim measure if full funding is not immediately available.

Table C-2
Estimated Improvement Costs by Scenario: Minimum Initial Funding Option
40 mph Maximum Train Speed
(in millions of dollars)

Improvement	All Day Scenario (30-minute headways)	Moderate Scenario (morning and evening service only)
Upgrade track/bridges, signals	$6.7	$6.7
Tunnel improvements	0.0	0.0
Highway crossing warning devices	1.7	1.7
Adding passing tracks	3.8	1.9
Chip train siding	4.2	2.5
Layover and servicing facilities	0.0	0.0
Upgrade main track between Essex Junction and Essex Park & Ride	0.0	0.0
Total estimated cost	$16.4	$12.8

Source: RLBA estimates.

It is emphasized that this option will have important consequences in terms of train delays (for example, waiting for meets) and reduced travel time. The effect of reduced travel time on ridership may be estimated. The uncertainty surrounding potential train delays cannot, but it is nonetheless a real and expected issue. Service reliability creates the basic framework for attracting a customer base. The ability to recover quickly from one-time events (for example, a train delay) adds customer confidence in the service. Especially in the 30-minute scenario, with four trains operating, a delay to an early train can affect the entire schedule if the operating system doesn't have the capacity to recover. The addition of passing tracks, to the extent of one-half the distance between Burlington and Essex Junction, should not be considered a luxury, but rather an indispensable component of reliable passenger train service.

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APPENDIX F

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BURLINGTON/ESSEX PASSENGER RAIL FEASIBILITY STUDY: Public Meetings to Present Draft Final Study Report

The Chittenden County Metropolitan Planning Organization (CCMPO) and R.L. Banks & Associates, Inc., the study consultant, announce the third set of meetings to inform the public of the Burlington-Essex Passenger Rail Feasibility Study and Corridor Analysis. The meetings will present the draft final study report for comment, including ridership projections, estimated project costs, and capital and operating plans and schedules.

The three evening meetings will begin at 7:00 p.m., and will be held as follows:

July 13 Winooski City Hall, 27 West Allen Street, Winooski

July 14 Union Station, 1 Main Street, Burlington

July 15 A.D. Lawton Middle School Cafeteria, 104 Maple Street, Essex Junction

These public meetings will include presentations by the R.L. Banks & Associates, Inc., (RLBA) consultant team, which has been engaged to perform the study. This series of three meetings will include a briefing on the study report, plus time for questions and answers.

CCMPO is responsible for performing continuous long- and short-range transportation systems planning and analysis for Chittenden County, Vermont. The proposed rail transit service between Essex and Burlington is considered to be an extension of the planned Charlotte-Burlington passenger rail project, studied earlier.

The purpose of the feasibility study is to provide CCMPO and the Vermont Agency of Transportation (VAOT) with a planning process which:

- Provides a logical structure to help the CCMPO Board and VAOT develop plans and, if appropriate, advance the Essex-Burlington rail transit system from initial concept to preliminary design,

- Provides technical information on costs, benefits, and impacts so that the CCMPO Board and VAOT can make informed choices, and

- Considers the role of passenger rail in a wider context that includes local, regional and state policies and goals related to land use, economic development, the environment, as well as multi-modal transportation.

Subconsultants assisting RLBA include Resource Systems Group Inc. of White River Junction, Vermont; Executype Services of Essex Junction, Vermont; EIV Technical Services LLC of Waterbury, Vermont; and Mudd & Associates Ltd. of Reston, Virginia. RLBA is a Washington, DC, firm.

Reasonable accommodations will be provided, upon request, to assure that meetings are accessible to all individuals regardless of disability. Please phone CCMPO at 660-4071 at least seven days before the scheduled meetings to arrange interpretation services for the hearing or visually impaired.

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