REGIONAL PASSENGER RAIL FORECASTS

To: Costa Pappis, AICP
Vermont Agency of Transportation

Date: January 28, 2015

From: Joseph Barr, AICP
Parsons Brinckerhoff
Andreas Aeppli
Cambridge Systematics

Project: Vermont State Rail Plan

This memo describes the passenger rail forecasting process for the Vermont Statewide Rail Plan including the identification of base data, pivot and growth factors applied, and the final results. The memo describes both ridership forecasts and financial forecasts.

Forecasting approach

The ridership forecasts in this document were not developed with a travel demand or sketch model but instead were derived using existing forecast results, latest ridership data, and professional opinion. The forecasting approach leveraged estimates from several prior studies, primarily:

- *Northern NE High Speed Rail Study*[1]
- *Knowledge Corridor Study*[2]
- *Bi-State Intercity Passenger Rail Study*[3]
- *Vermont Statewide Intercity Bus Study Update*[4]

In addition to these studies, the forecasts were derived by factoring the current ridership of Amtrak's Ethan Allen and Vermonter with a trip end or beginning in Vermont.[5]

The key factors used to synthesize and normalize estimates from previous studies and existing ridership are described below.

---

[1] http://www.massdot.state.ma.us/Portals/39/Docs/ServiceLeveland_April%2022_2014_small.pdf
[2] http://www.crcog.org/publications/CommDevDocs/Sustainable%20Communities/Sustainable%20Knowledge%20Corridor/CTKC_Final_Plan_130917.pdf
[3] http://ny-vt-passengerrail.org/documents/Environmental%20Assessment%20(9%20MB)%20-%20July%202014.pdf
[4] http://publictransit.vermont.gov/sites/aot_public_transit/files/Vermont%20Final%20Report%2001%202013%20for%20Web.pdf
[5] *In several cases, ridership associated with stations not in Vermont was included in the analysis. This includes stations in Mechanicville, NY; Claremont, NH; and Montreal, PQ. The logic of including these stations was that the responsibility for serving these stations and associated cost would be Vermont's.*

REGIONAL PASSENGER RAIL FORECASTS

Annual Growth Factor

All forecasts assume that current service reliability is maintained and that demand is not capacity constrained, which is not necessarily true. But, by assuming that growth would not be capacity constrained, the forecasts can be used to evaluate how well existing and planned services can accommodate future demand.

Ridership is assumed to increase at a rate of 1.7%, compounded annually, given no change in service frequencies, travel times, or reliability. This is more conservative than the two percent annual growth rate that Amtrak assumes to forecast fleet requirements.[6] The 1.7% annual growth is a conservative assumption considering that overall Amtrak ridership grew by 55% between 1997 and 2012, an annual compound growth rate of almost 3%.[7] 1.7% annual growth forecasts ridership in 2035 to be 45% higher than 2013, which is the most recent ridership data available. In addition, sensitivity analyses have been presented which provide 3% and 5% scenarios.

Service Frequency

When a scenario differs in service levels from a previous study, a 0.95 factor is used to account for the change in ridership in response to a change in service levels. This factor implies that, for every doubling of frequency, the ridership would increase by 95%. This factor is consistent with the *Knowledge Corridor Study* and is appropriate for service changes to low frequency routes, such as the Vermonter and Ethan Allen.

Transfer

Where a service change introduces a transfer, a factor of -0.32 is applied to trips requiring the transfer. In effect, each additional transfer reduces rail ridership by 32%. This factor is consistent with Amtrak's key line haul elasticities of demand.[8]

Forecast Scenarios, Method, and Results

2035 forecasts were developed for a set of rail and bus scenarios. In addition to the No Build scenario, rail forecasts were developed for four scenarios on the Vermonter corridor and three scenarios on the Ethan Allen / Western corridor. The scenarios forecast are shown in Table 1.

[6] *Amtrak Fleet Strategy v3.1, pg 32. http://www.amtrak.com/ccurl/36/921/2012-Amtrak-Fleet-Strategy-v3.1-%2003-29-12.pdf Accessed September 24, 2014*

[7] *A New Alignment: Strengthening America's Commitment to Passenger Rail U.S. Passenger Rail Ridership, Brookings Institute. 2013.*

[8] *NHHS SDP Appendix, pg 39*

REGIONAL PASSENGER RAIL FORECASTS

Table 1: Forecast Scenarios

Rail Scenarios	
No Build	
Vermonter Corridor	Knowledge Corridor Realignment
	Vermonter day train extension to Montreal
	Vermonter day train extension to Montreal (2 trains / day)
	Boston to Montreal High-Speed Rail via Springfield
Ethan Allen / Western Corridor	Albany to Bennington Shuttle Service
	Ethan Allen extension to Burlington
	Western Corridor: Albany - Burlington via Bennington
	Western Corridor: Albany - Burlington via Bennington and Ethan Allen extension to Burlington
Bus Scenarios	
Albany - Bennington Shuttle Service	
Springfield to White River Junction	

The following sections describe each scenario, source data, forecast method and present results.

No Build

This scenario assumes that current service times and reliability are maintained and that future demand does not exceed capacity.

Source Data

- FY2013 ridership with at least one trip end in Vermont.

Method

A 1.7% annual growth rate is applied to the FY2013 ridership, which produces a 45% increase in ridership. In addition, 3% and 5% scenarios have been presented.

REGIONAL PASSENGER RAIL FORECASTS

Results

The forecast ridership is shown in Table 2. The No Build scenario assumes uniform growth across all stations so the station rankings are unchanged. The busiest four stations in Vermont (Rutland, Essex Jct., White River Jct., and Brattleboro) are forecast to have higher passenger activity in 2035 than the FY2013 Essex Jct., which is currently the busiest station.

Table 2: No Build Ridership Forecast

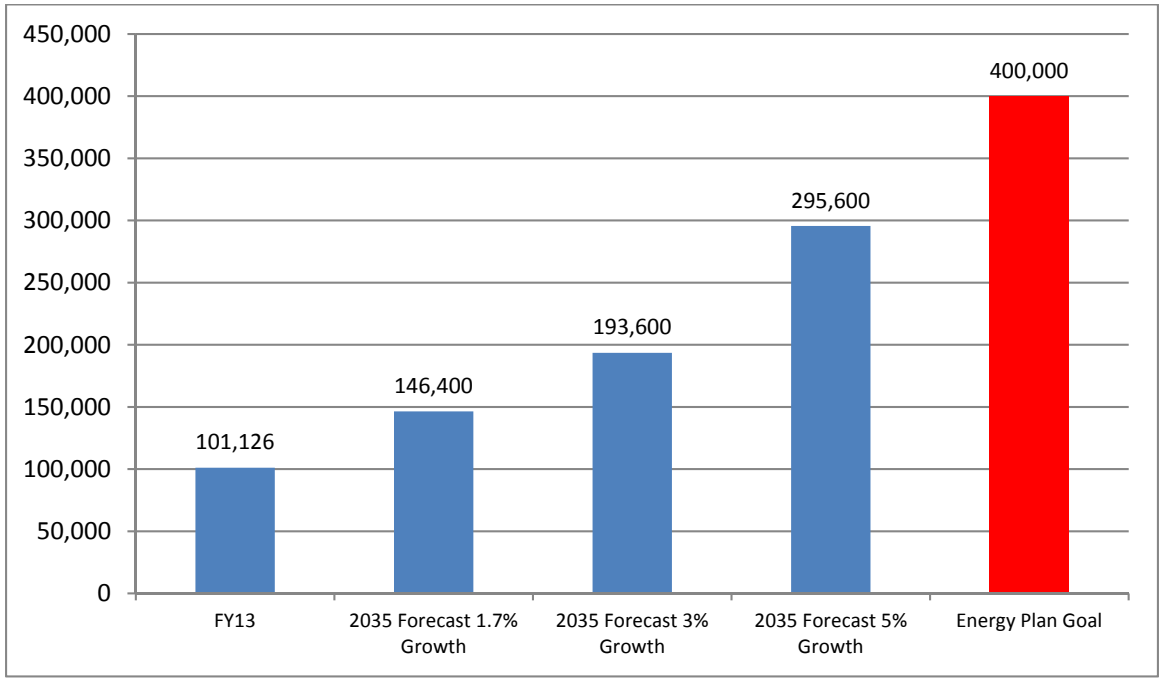
Route/Station	FY13 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
Ethan Allen Express				
Castleton, VT	4,211	6,100	8,100	12,300
Rutland, VT	16,815	24,400	32,300	49,300
Vermonter				
St. Albans, VT	3,592	5,200	6,900	10,500
Essex Jct., VT	20,579	29,800	39,400	60,200
Waterbury, VT	5,501	8,000	10,600	16,200
Montpelier Jct., VT	8,081	11,700	15,500	23,600
Randolph, VT	2,009	2,900	3,800	5,900
White River Jct., VT	15,480	22,400	29,600	45,200
Windsor-Mt. Ascutney, VT	1,126	1,600	2,100	3,200
Claremont, NH	297	400	500	800
Bellows Falls, VT	4,774	6,900	9,100	13,900
Brattleboro, VT	18,661	27,000	35,700	54,500
Total	**101,126**	**146,400**	**193,600**	**295,600**

The State's greenhouse gas reduction plan envisions increasing passenger rail traffic to 400,000 trips by year 2030, which represents a four-fold increase from volumes seen in 2011.[9] As shown in Table 2 and Figure 1, even under high ridership growth scenarios, the level of on and offs at Vermont stations never reaches the goal of 400,000.

[9] *Vermont Department of Public Service, Comprehensive Energy Plan 2011, December 2011*

REGIONAL PASSENGER RAIL FORECASTS

Figure 1: Intercity Passenger Rail No-Build Scenarios - On and Offs at Vermont Stations



Realignment

To forecast this scenario, it is assumed that the new service matches the Case 1a – Vermonter Realignment to the Connecticut River Line scenario defined in the *Knowledge Corridor Passenger Rail Study*, which states:

> This case represents the single change to the system of re-routing the present day Vermonter service to use the Pan Am Railways Connecticut River line between Springfield and East Northfield. This change realigns the service onto its pre-1989 routing. The train operated all the way to Montreal as the Montrealer, and replaces the station stop at Amherst with one in Northampton last used in 1987. The name of the service was changed in 1995 from the Montrealer to the Vermonter to reflect the discontinuation of service to Montreal. In addition, new station stops at Holyoke and Greenfield are proposed and tested in this case. The route is 11 miles shorter and the assumed operating speeds of 60 mph allow a time savings of up to 43 minutes versus Case 0 between Springfield and Brattleboro [via Amherst]. Service is assumed to continue operating all the way through (one-seat ride) to Washington. The realignment removes a time consuming reverse move at Palmer, and the need to operate two

REGIONAL PASSENGER RAIL FORECASTS

locomotives or a cab car, to allow double-ended operation, although a relatively short backup into Union Station is still required in Springfield.[10]

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Knowledge Corridor Passenger Rail Study (2009)

Method

The Knowledge Corridor Passenger Rail Study 2030 Realignment forecasts are first normalized to the 1.7% annual growth factor used in this analysis. Next, ridership above Brattleboro, which is not broken out in the Knowledge Corridor Passenger Rail Study, is distributed proportionally using the current ridership patterns. Finally, the 2030 forecasts are grown to 2035.

Results

The forecast ridership is shown in Table 3. In this forecast, 2035 passenger activity at White River Jct. would exceed that at Brattleboro.

Table 3: Realignment Ridership Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
St. Albans, VT	3,592	7,400	9,800	14,900
Essex Jct., VT	20,579	42,200	55,800	85,200
Waterbury, VT	5,501	11,300	14,900	22,800
Montpelier Jct., VT	8,081	16,600	22,000	33,500
Randolph, VT	2,009	4,100	5,400	8,300
White River Jct., VT	15,480	31,700	41,900	64,000
Windsor-Mt. Ascutney, VT	1,126	2,300	3,000	4,600
Claremont, NH	297	600	800	1,200
Bellows Falls, VT	4,774	9,800	13,000	19,800
Brattleboro, VT	18,661	27,600	36,500	55,700
Total	**80,100**	**153,600**	**203,100**	**310,000**

[10] *Knowledge Corridor Passenger Rail Study, pg 4-8*

REGIONAL PASSENGER RAIL FORECASTS

Vermonter day train extension to Montreal

This scenario assumes that the Vermonter is extended to Montreal as a day train. The forecast method implies inclusion of the *Northern New England Intercity Rail Study* assumptions, which are:

> All scenarios assume full implementation of the New Haven-Hartford-Springfield service at 23 round trips between Springfield and New Haven, with a mix of Intercity Regional Service, Inland Route Service, and Hartford Commuter Service.[11]

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Knowledge Corridor Passenger Rail Study (2009)
- Northern New England Intercity Rail Study (2014)

Method

The Local service, 60mph alternative forecasts from the *Northern New England Intercity Rail Study* were used as the baseline ridership. These forecasts, however, were developed with 4 daily round trip trains between Boston and Montreal, via Springfield. To account for the reduced frequency, a 0.95 frequency elasticity was applied, which is consistent with the elasticity used in the *Knowledge Corridor Passenger Study*. Therefore, reducing service from 4 trains to 1 effectively reduces ridership by approximately 74%. Another difference between this scenario and the Northern NE study is that trips between the Boston to Springfield leg and Vermont or Montreal would require a transfer. A transfer factor of -0.32 is applied to those trips. The refactored ridership increase is then added to the forecasts from the Realignment scenario.

Results

The forecast ridership is shown in Table 4. Stations serving larger population centers in Vermont see the largest increase in ridership. The forecast ridership at Montreal of 72,400 is lower than the 2013 ridership of 89,082[12]. This is not unreasonable, considering that the extended Vermonter would arrive and depart Montreal at similar times of day as the current Adirondack route.

[11] *Northern New England Intercity Rail Initiative, pg. 15*
[12] *http://www.greatamericanstations.com/Stations/MTR*

REGIONAL PASSENGER RAIL FORECASTS

Table 4: Vermonter Day Train Extension to Montreal Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
St. Albans, VT	3,592	9,100	12,000	18,400
Essex Jct., VT	20,579	52,400	69,300	105,800
Waterbury, VT	5,501	14,300	18,900	28,900
Montpelier Jct., VT	8,081	19,900	26,300	40,200
Randolph, VT	2,009	4,200	5,600	8,500
White River Jct., VT	15,480	41,800	55,300	84,400
Windsor-Mt. Ascutney, VT	1,126	2,400	3,200	4,800
Claremont, NH	297	2,000	2,600	4,000
Bellows Falls, VT	4,774	10,100	13,400	20,400
Brattleboro, VT	18,661	43,000	56,900	86,800
Total	80,100	199,200	263,500	402,200

Vermonter day train extension to Montreal (2 trains / day)

This scenario is identical to the preceding scenario except that there are two daily trains operating across the entire route between Montreal, Springfield, New Haven and Washington.

Method

The increased frequency over the Vermont day train extension to Montreal is accounted for by applying a 0.95 factor to the single train scenario forecast ridership. Thus, the estimate does not take into account differences in time of day during which the trains may operate, or the presence of different services between the two trains, such as the presence of sleeping cars on an overnight train.

Results

The forecast ridership is shown in Table 5. The extension and additional service, combined with the improvements from the realignment, are estimated to increase ridership by nearly 5-fold over the existing Vermonter service.

REGIONAL PASSENGER RAIL FORECASTS

Table 5: Vermonter Day Train Extension to Montreal Forecast (2 trains / day)

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
St. Albans, VT	3,592	17,700	23,400	35,700
Essex Jct., VT	20,579	102,100	135,000	206,100
Waterbury, VT	5,501	28,000	37,000	56,500
Montpelier Jct., VT	8,081	38,800	51,300	78,300
Randolph, VT	2,009	8,200	10,800	16,600
White River Jct., VT	15,480	81,600	107,900	164,700
Windsor-Mt. Ascutney, VT	1,126	4,600	6,100	9,300
Claremont, NH	297	3,900	5,200	7,900
Bellows Falls, VT	4,774	19,600	25,900	39,600
Brattleboro, VT	18,661	83,800	110,800	169,200
Total	80,100	388,300	513,400	783,900

Boston to Montreal High-Speed Rail

This scenario is assumed to match the Local Service, 79mph scenario modeled in the Northern NE study. This scenario includes 7 daily round-trip trains between Boston and Montreal with Local stops in Vermont and an increase in track speeds to 79mph speeds through Vermont.

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Knowledge Corridor Passenger Rail Study (2009)
- Northern New England Intercity Rail Study (2014)

Method

The Local service, 79mph alternative forecasts from the Northern New England Intercity Rail Study were used as the baseline ridership. These forecasts are added to the forecasts from the Realignment scenario.

Results

The forecast ridership is shown in Table 6. Ridership on this corridor in Vermont increases by an order of magnitude and almost half of the trips have an end in Montreal. Again, stations

serving larger population centers in Vermont see the largest increase in ridership. Brattleboro is forecast to be the busiest station in Vermont.

Table 6: Boston to Montreal HSR Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
St. Albans, VT	3,592	18,300	24,200	36,900
Essex Jct., VT	20,579	108,100	142,900	218,200
Waterbury, VT	5,501	30,500	40,300	61,600
Montpelier Jct., VT	8,081	37,200	49,200	75,100
Randolph, VT	2,009	4,600	6,100	9,300
White River Jct., VT	15,480	94,800	125,400	191,400
Windsor-Mt. Ascutney, VT	1,126	2,600	3,400	5,200
Claremont, NH	297	9,000	11,900	18,200
Bellows Falls, VT	4,774	11,300	14,900	22,800
Brattleboro, VT	18,661	124,100	164,100	250,500
Total	80,100	440,500	582,400	889,200

Ethan Allen extension to Burlington, VT

Under this scenario, the Ethan Allen would be extended to Burlington from its current terminus at Rutland with a station stop in Middlebury, VT. It is assumed that the tracks between Rutland and Burlington will be upgraded to support 59mph operation and the travel time will be approximately 90 minutes. Specific station locations and other aspects of operation are assumed to be consistent with the Preferred Alternative defined in the *Environmental Assessment: Rutland – Burlington High-Speed Intercity Passenger Rail* (2009).

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Environmental Assessment: Rutland – Burlington High-Speed Intercity Passenger Rail (2009) (Western Corridor EA)

Method

The Western Corridor EA forecasts are first normalized to the FY2013 actual ridership. The updated baseline is then grown using the 1.7% annual growth factor to 2035 ridership. Sensitivity analyses with 3% and 5% growth rates are also presented.

Results

REGIONAL PASSENGER RAIL FORECASTS

The forecast ridership is shown in Table 7. Rutland is still forecast to be the station with the highest activity on the Ethan Allen, with Burlington a close second.

Table 7: Ethan Allen extension to Burlington, VT Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
Burlington	0	21,000	27,800	42,400
Middlebury	0	7,000	9,300	14,100
Rutland	16,815	25,400	33,600	51,300
Castleton	4,211	6,400	8,500	12,900
Total	21,026	59,800	79,200	120,700

Western Corridor: Service from Albany, NY to Burlington, VT via Bennington, VT

In this scenario a new service would operate a daily train between Albany, NY and Burlington, VT via Bennington, VT, in addition to the existing Ethan Allen service. It is assumed that operation north of Rutland would be similar to that described in the Western Corridor EA and operation between Albany and Rutland would be similar to that analyzed in the Bi-State Study.

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Environmental Assessment: Rutland – Burlington High-Speed Intercity Passenger Rail (2009) (Western Corridor EA)
- Environmental Assessment: New York – Vermont Bi-State Intercity Passenger Rail Study (2014) (Bi-State Study)

Method

There are several steps to generating the forecast for this scenario because a direct forecast is not available so the results from two studies need to be combined. The steps are as follows:

1. Bi-State and Western Corridor study forecasts are normalized to the FY2013 actual ridership.
2. Transferring ridership is identified and forecasts are adjusted to account for the transfer at Albany.
3. Additional ridership at Rutland, which would be served by 2 daily trains, are identified.

REGIONAL PASSENGER RAIL FORECASTS

4. Additional demand between Manchester, N. Bennington, and Mechanicville and Middlebury and Burlington are derived.

5. The updated baseline is then grown using the 1.7% annual growth factor to 2035 ridership.

Results

The forecast ridership is shown in Table 8. Rutland benefits from the additional service and the three new stations between Albany and Rutland account for more ridership than Middlebury and Burlington.

Table 8: New daily service from Albany, NY to Burlington, VT via Bennington, VT Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
Burlington	0	14,400	19,000	29,100
Middlebury	0	4,800	6,300	9,700
Rutland	16,815	32,000	42,300	64,600
Castleton	4,211	6,100	8,100	12,300
Manchester	0	7,400	9,800	14,900
N. Bennington	0	11,000	14,500	22,200
Mechanicville	0	7,800	10,300	15,700
Total	21,026	83,500	110,300	168,500

Western Corridor: service from Albany, NY to Burlington, VT via Bennington, VT and Ethan Allen Extension to Burlington

This scenario is a combination of the prior two scenarios: Ethan Allen Extension to Burlington and the Western Corridor service from Albany, NY to Burlington, VT via Bennington, VT. The net service gain would be two daily trains between Rutland and Burlington instead of just one in the two prior scenarios.

Method

The two previous forecast results are combined for Middlebury and Burlington, which implies an elasticity of 1.0 with respect to frequency. This is not unreasonable, considering that the accepted factor for low frequency service is 0.95. The forecast from the Western Corridor scenario is used for Rutland because it already accounts for the 2 trains/day. Forecasts for all the other stations are taken from the respective scenario.

REGIONAL PASSENGER RAIL FORECASTS

Results

The forecast ridership is shown in Table 9.

Table 9: Western Corridor and Ethan Allen to Burlington service

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
Burlington	0	35,500	46,900	71,700
Middlebury	0	11,800	15,600	23,800
Rutland	16,815	32,000	42,300	64,600
Castleton	4,211	6,400	8,500	12,900
Manchester	0	7,400	9,800	14,900
N. Bennington	0	11,000	14,500	22,200
Mechanicville	0	7,800	10,300	15,700
Total	21,026	111,900	147,900	225,800

New daily service from Albany, NY to Bennington, VT

In this scenario a new service would operate one daily train between Albany, NY and Bennington, VT. It is assumed that operation would be similar to that described in the Bi-State Study.

Source Data

- FY2013 ridership with at least one trip end in Vermont.
- Environmental Assessment: New York – Vermont Bi-State Intercity Passenger Rail Study (2014) (Bi-State Study)

Method

Similar to the new service from Albany, NY to Burlington, VT via Bennington, VT, the Bi-State study forecasts are normalized to the FY2013 actual ridership and trips requiring transfers are derived and factored. Next, trips to Rutland and Manchester, VT are derived and removed from the N. Bennington and Mechanicville ridership before the updated baseline is grown to 2035 ridership.

Results

The forecast ridership is shown in Table 10.

REGIONAL PASSENGER RAIL FORECASTS

Table 10: New daily service from Albany, NY to Bennington, VT Forecast

Station	FY2013 Ridership	1.7% Growth 2035 Forecast	3% Growth 2035 Forecast	5% Growth 2035 Forecast
Rutland	16,815	24,400	32,300	49,300
Castleton	4,211	6,100	8,100	12,300
N. Bennington	0	10,200	13,500	20,600
Mechanicville	0	7,300	9,700	14,700
Total	21,026	48,000	63,600	96,900

Bus service from Albany, NY to Bennington, VT

In this scenario a non-intercity bus service would operate between Albany, NY and Bennington, VT. There is currently a bus operated by Yankee Trails on this route, but ridership data is not available. Assuming that the future service would be as well advertised as a rail service with similar service times, rail forecasts can be used as a proxy for the bus ridership.

Source Data

- Environmental Assessment: New York – Vermont Bi-State Intercity Passenger Rail Study (2014) (Bi-State Study)

Method

Similar to the new service from Albany, NY to Burlington, VT via Bennington, VT, the Bi-State study forecasts are normalized to the FY2013 actual ridership and trips requiring transfers are derived and factored. Next, trips to Rutland, Mechanicville, and Manchester, VT are derived and removed from the North Bennington ridership before the updated baseline is grown to 2035 ridership.

Results

The forecast ridership is shown in Table 11.

Table 11: Bus service from Albany, NY to Bennington, VT Forecast

Route	2035 Forecast
Albany, NY to Bennington, VT	10,200

REGIONAL PASSENGER RAIL FORECASTS

Bus service from Springfield, MA to White River Jct., VT

In this scenario a non-intercity bus service would operate between Springfield, MA and White River Jct., VT with stops in Brattleboro, VT and Bellows Falls, VT.

Source Data

- Vermont Statewide Intercity Bus Study Update (2013)

Method

The Non-Intercity Bus Operator average estimated ridership from the Intercity Bus Study White River Jct. to Springfield alternative were grown to 2035 using the 1.7% annual growth factor.

Results

The forecast ridership is shown in Table 12.

Table 12: Bus service from Albany, NY to Bennington, VT Forecast

Route	2035 Forecast
White River Jct. to Springfield	4,500

Rail Scenario Summary

This section first presents a side-by-side comparison of the various scenarios, along with further discussion of the forecast results for the rail scenarios. The section concludes with a summary of the state's Base Case vision for passenger rail, and how varying growth rates and services will affect Vermont's ability to achieve its passenger volume goals.

Tables 13 (Vermonter) and 14 (Ethan Allen) summarize 2013 base year and projected 2035 passenger volumes by station along the two corridors for the various scenarios presented in this memorandum. The forecasts are presented using cumulative annual growth rates (CAGR) of 1.7%, 3% and 5% of which the 1.7% rate represents the most conservative assumption.

REGIONAL PASSENGER RAIL FORECASTS

Table 13: Vermonter Corridor Forecasts

Station	FY2013	No Build	2035 Realignment	2035 Vermonter Extension to Montreal	2035 Extension to Montreal with 2nd Frequency	2035 Boston – Montreal High Speed Rail
1.7% Growth						
St. Albans	3,592	5,200	7,400	9,100	17,700	18,300
Essex Jct	20,579	29,800	42,200	52,400	102,100	108,100
Waterbury	5,501	8,000	11,300	14,300	28,000	30,500
Montpelier Jct	8,081	11,700	16,600	19,900	38,800	37,200
Randolph	2,009	2,900	4,100	4,200	8,200	4,600
White River Jct	15,480	22,400	31,700	41,800	81,600	94,800
Windsor-Mt. Ascutney	1,126	1,600	2,300	2,400	4,600	2,600
Claremont, NH	297	400	600	2,000	3,900	9,000
Bellows Falls	4,774	6,900	9,800	10,100	19,600	11,300
Brattleboro	18,661	27,000	27,600	43,000	83,800	124,100
Total	**80,100**	**115,900**	**153,600**	**199,200**	**388,300**	**440,500**
3% Growth						
St. Albans	3,592	6,900	9,800	12,000	23,400	24,200
Essex Jct	20,579	39,400	55,800	69,300	135,000	142,900
Waterbury	5,501	10,600	14,900	18,900	37,000	40,300
Montpelier Jct	8,081	15,500	22,000	26,300	51,300	49,200
Randolph	2,009	3,800	5,400	5,600	10,800	6,100
White River Jct	15,480	29,600	41,900	55,300	107,900	125,400
Windsor-Mt. Ascutney	1,126	2,100	3,000	3,200	6,100	3,400
Claremont, NH	297	500	800	2,600	5,200	11,900
Bellows Falls	4,774	9,100	13,000	13,400	25,900	14,900
Brattleboro	18,661	35,700	36,500	56,900	110,800	164,100
Total	**80,100**	**153,200**	**203,100**	**263,500**	**513,400**	**582,400**
5% Growth						
St. Albans	3,592	10,500	14,900	18,400	35,700	36,900
Essex Jct	20,579	60,200	85,200	105,800	206,100	218,200
Waterbury	5,501	16,200	22,800	28,900	56,500	61,600
Montpelier Jct	8,081	23,600	33,500	40,200	78,300	75,100
Randolph	2,009	5,900	8,300	8,500	16,600	9,300
White River Jct	15,480	45,200	64,000	84,400	164,700	191,400
Windsor-Mt. Ascutney	1,126	3,200	4,600	4,800	9,300	5,200
Claremont, NH	297	800	1,200	4,000	7,900	18,200
Bellows Falls	4,774	13,900	19,800	20,400	39,600	22,800
Brattleboro	18,661	54,500	55,700	86,800	169,200	250,500
Total	**80,100**	**234,000**	**310,000**	**402,200**	**783,900**	**889,200**

REGIONAL PASSENGER RAIL FORECASTS

The Knowledge Corridor improvements that are presently underway along the Vermonter route in Connecticut and Massachusetts are forecast to contribute substantially to the projected ridership growth. The primary benefit will be a significant reduction in travel time between New Haven and Brattleboro, which would result in annual Vermont ridership approaching 154,000 by 2035 under a 1.7% CAGR scenario. The extension of the Vermonter, a single train, to Montreal would add another 45,000 Vermont riders, largely due to the sheer size of the Montreal metro area and its concomitant traffic draw. This effect is doubly evident if the frequency were expanded to two daily trains. If historical growth trends of 3% or more were sustained through 2035, then the ridership of two daily Montreal services would reach over 500,000.

Table 14: E than Allen / Western Corridor Forecasts

Station	FY2013	2035 No Build	Ethan Allen Extension to Burlington	Albany - Burlington via Bennington	Western Corridor: Alabany - Burlington via Bennington	Albany - Bennington Shuttle Service
1.7% Growth						
Burlington	0	0	21,000	14,400	35,500	0
Middlebury	0	0	7,000	4,800	11,800	0
Rutland	16,815	24,400	25,400	32,000	32,000	24,400
Castleton	4,211	6,100	6,400	6,100	6,400	6,100
Manchester	0	0	0	7,400	7,400	0
N. Bennington	0	0	0	11,000	11,000	10,200
Mechanicville, NY	0	0	0	7,800	7,800	7,300
Total	**21,026**	**30,500**	**59,800**	**83,500**	**111,900**	**48,000**
3% Growth						
Burlington	0	0	27,800	19,000	46,900	0
Middlebury	0	0	9,300	6,300	15,600	0
Rutland	16,815	32,300	33,600	42,300	42,300	32,300
Castleton	4,211	8,100	8,500	8,100	8,500	8,100
Manchester	0	0	0	9,800	9,800	0
N. Bennington	0	0	0	14,500	14,500	13,500
Mechanicville, NY	0	0	0	10,300	10,300	9,700
Total	**21,026**	**40,400**	**79,200**	**110,300**	**147,900**	**63,600**
5% Growth						
Burlington	0	0	42,400	29,100	71,700	0
Middlebury	0	0	14,100	9,700	23,800	0
Rutland	16,815	49,300	51,300	64,600	64,600	49,300
Castleton	4,211	12,300	12,900	12,300	12,900	12,300
Manchester	0	0	0	14,900	14,900	0
N. Bennington	0	0	0	22,200	22,200	20,600
Mechanicville, NY	0	0	0	15,700	15,700	15,700
Total	**21,026**	**61,600**	**120,700**	**168,500**	**225,800**	**96,900**

REGIONAL PASSENGER RAIL FORECASTS

The forecast 2035 western corridor ridership with the additional service between Albany and Burlington via Bennington is comparable to the present day Vermonter ridership. With this full build out of the Ethan Allen, the rail miles operated in Vermont would be comparable to the Vermonter as well.

Note that the Burlington metro area is served in the forecasts by two stations: the existing station at Essex Junction on the Vermonter and the proposed downtown Burlington station on the Ethan Allen. The forecast for Burlington is slightly lower than the forecasts for Essex, Jct. on the Vermonter in the No Build scenario. But, when a transfer is added, as in the Albany-Burlington via Bennington scenario, the Burlington ridership drops sharply.

It is important to consider that the results were developed from available analysis that for the most part did not specifically evaluate the services described above. Nevertheless, while these estimates should be considered approximate, they are also conservative, given both the underlying assumptions in their development as well as the modest 1.7% CAGR applied to estimate 2035 volumes, which is substantially below long-standing actual trends for passenger rail volume growth in Vermont and throughout the nation. Therefore, 3% and 5% sensitivities have been presented.

Vermont's Base Case Rail Vision

A central element in considering the relevance and utility of rail service is the degree to which it contributes to accomplishing Vermont's goals for increasing multi-modal options and reducing the environmental impacts of transportation in the state. The State's greenhouse gas reduction plan envisions increasing passenger rail traffic to 400,000 trips by year 2030, which represents a four-fold increase from volumes seen in 2011.[13] Accomplishing this goal will require some expansion beyond the existing and committed services, which are comprised of single daily service available along the Western Corridor between Albany, Bennington, Rutland, and extension of the Vermonter to Montreal. Assuming the conservative growth rate of 1.7%, the combination of these services would generate Vermont-related ridership totaling 282,700 by 2035, while at 3% CAGR ridership would grow to 373,800 (see Table 15, below).

[13] *Vermont Department of Public Service, Comprehensive Energy Plan 2011, December 2011*

REGIONAL PASSENGER RAIL FORECASTS

Table 15: Route-Level Summaries for 2035

	Vermonter		Ethan Allen / Western Corridor		
Annual Growth Rate	Vermonter extension to Montreal	Vermonter extension to Montreal (2 trains / day)	Ethan Allen Extension to Burlington	Western Corridor: Albany - Burlington via Bennington	Western Corridor: Albany - Burlington via Bennington AND Ethan Allen Extension to Burlington
1.70%	199,200	388,300	59,800	83,500	111,900
3.00%	263,500	513,400	79,200	110,300	147,900
5.00%	402,200	783,900	120,700	168,500	225,800

Achieving the goal of 400,000 or more riders boarding and/or alighting in Vermont can be attained through a combination of service increases on the Vermonter and Western Corridor routes. For example, at a base CAGR of 1.7%, a second frequency along the Vermonter route, combined with the Western Corridor buildout would boost total Vermont ridership to 471,800.

Forecast Subsidy Requirements for Vermont's Base Case Scenario

Sketch level estimates for forecast costs and required subsidies have been developed for each of the base case scenarios. These have been developed using the Fiscal Year 2015 Amtrak PRIIA 209 State Payment Forecasts for the Ethan Allen and the Vermonter, as well as applicable studies regarding these initiatives. All forecast costs and subsidies reflect 2035 ridership levels with a 1.7 percent growth rate but 2015 dollars. No effort has been made to forecast changes in Amtrak unit costs. Recently, these have increased at a rate of 3 percent per year, a rate higher than inflation. Operating costs associated with service extensions have been assumed to vary by train-miles. Also, a portion of costs are assumed to change with ridership. Revenues are assumed to increase in direct proportion to ridership. Because revenues are estimated to increase faster than costs with increased ridership, ridership growth in existing services is forecast to improve the financial performance of routes.

Vermonter Extension to Montreal

The operating costs of extending the Vermonter to Montreal are subject to uncertainty. For other U.S./Canada routes such as the Adirondack service to Montreal, the Maple Leaf service to Toronto, or the Cascades service to Vancouver, sponsoring agencies in the U.S. subsidize the service into Canada. Furthermore, Amtrak must contract with VIA Rail to provide ticketing, baggage handling, and other services at stations in Canada, which is costly. For the Cascade service, immigration and naturalization functions are performed in Vancouver. Customs inspection is performed in Vancouver for northbound trains but at the U.S./Canada border for

southbound trains. For other U.S./Canada services, customs, immigration and naturalization is performed at the border. The cost of stopping trains at the border would add costs. If a requirement were imposed to rely on Canadian train crews, this would further increase costs.

For the purposes of this estimate, Vermont is assumed to only be responsible for subsidies to the U.S./Canada border. The service is assumed to pay for the operation of customs and border protection. Estimated costs, revenues, and subsidies are as follows.

- 2035 Costs: $11.0 million
- 2035 Revenues: $6.1 million
- 2035 Subsidies: $4.9 million

Vermonter Extension to Montreal (2 Trains per Day)

Reviewing the cost structure of the Vermonter service from the PRIIA 209 State Payment Forecasts, nearly all costs of the service are variable. Major cost elements are train and engine crews, on board services, payments to host railroads, fuel and power, maintenance of equipment, yard services, none of which would be shared by a second Vermonter frequency. Therefore, the cost of adding a second frequency is assumed to be 95 percent the first frequency, as are the revenues and subsidies.

- 2035 Costs: $21.5 million
- 2035 Revenues: $11.9 million
- 2035 Subsidies: $9.6 million

Ethan Allen Extension to Burlington

The cost of extending the Ethan Allen service is assumed to be proportional to the increased mileage. Furthermore, there is an incremental cost to accommodate increased ridership as a result of the service extension and as a result of growth in ridership to 2035. The resulting estimated costs, revenues, and subsidies are below.

- 2035 Costs: $5.5 million
- 2035 Revenues: $4.0 million
- 2035 Subsidies: $1.6 million

REGIONAL PASSENGER RAIL FORECASTS

Western Corridor: Albany to Burlington via Bennington

Costs and revenues are derived from the Bi-State Study. Revenues have been adjusted to account for additional riders at Middlebury and Burlington. Costs have been adjusted to account for the additional mileage to Burlington beyond the service analyzed in the Bi-State Study. All revenues and costs have been adjusted to account for growth to 2035 as expressed in 2015 dollars. The results of these estimates are below (totals are rounded). Revenues and costs are calculated as incremental to existing services.

- 2035 Costs: $5.2 million ($9.6 million including forecasted Ethan Allen costs)
- 2035 Revenues: $1.2 million ($4.1 million including forecasted Ethan Allen revenues)
- 2035 Subsidies: $4.0 million ($5.5 million including forecasted Ethan Allen subsidies)

Western Corridor: Albany to Burlington via Bennington AND Ethan Allen Extension to Burlington

It is assumed that the opportunities for cost sharing for an extended Ethan Allen and a new service between Albany and Burlington via Bennington would be minimal. Therefore, both revenues and operating costs of the previous two scenarios are added.

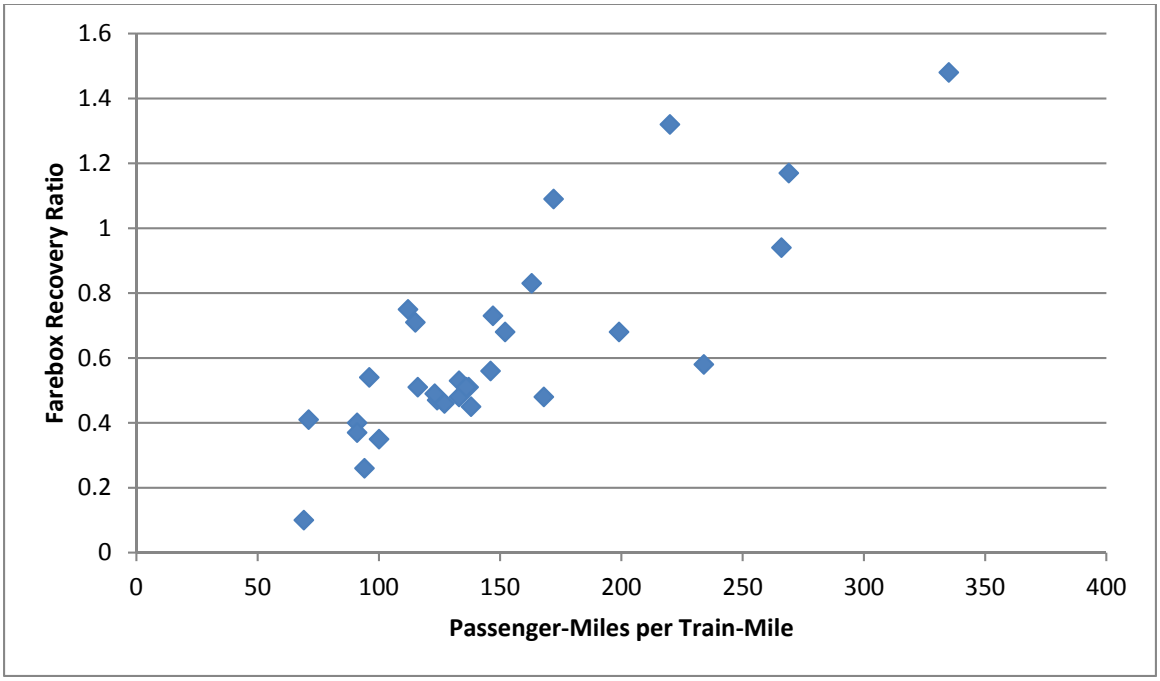
- 2035 Costs: $10.7 million
- 2035 Revenues: $5.2 million
- 2035 Subsidies: $5.5 million

Financial Performance as a Function of Service Density

One logical question to ask regarding the above financial estimates is whether they are reasonable. The financial performance of passenger rail routes is determined by a broad range of factors. But similar to the case of carloads per mile for freight rail, there appears to be a relationship between passenger rail financial performance and route density. Figure 2 displays a plot of state-supported Amtrak routes with data from the FRA/Amtrak *Rail Service Metrics and Performance: Quarter Ended June, 2014* report. On the horizontal axis are passenger-miles per train-mile of state-supported routes. This essentially represents the average number of passengers on a train at any given time. On the vertical axis are farebox recovery ratios for these routes, (revenues divided by the fully allocated operating expenses). As shown, routes with high passenger-miles per ton-mile tend to have favorable farebox recovery ratios, at or near 1, whereas those with low passenger-miles per ton-mile tend to have low farebox recovery ratios. Generally, the farebox recover ratio exceeds 1 (operating revenues cover operating expenses) when passenger-miles per train-mile is somewhere over 200. When passenger-miles per train-mile are less than 100, farebox recover ratio tends to be less than 50 percent.

REGIONAL PASSENGER RAIL FORECASTS

Figure 2: Relationship of Farebox Recover Ratio and Passenger-Miles per Train-Mile



Reviewing the proposed passenger rail services under the Vermont base case rail vision, forecasted financial performance appears to be generally consistent with forecast load factors. Services with higher load factors have higher estimated farebox recovery ratios.

Table 16: Base Case Rail Vision

Item	Vermonter Extension to Montreal	Ethan Allen Extension to Burlington	Western Corridor: Albany to Burlington Service via Bennington*
Passenger-miles per ton-mile	173	207	72
Farebox Recover Ratio	56%	72%	22%

* Passenger mileage and train mileage based on traffic within Vermont

Summary of Proposed Build Out Options

Figure 3 below summarizes build out options, both in terms of on and offs and in terms of financial performance.

REGIONAL PASSENGER RAIL FORECASTS

Figure 3: Proposed Service Build Out Options – On and Offs at Vermont Stations in Year 2035