CHITTENDEN COUNTY RPC
Communities Planning Together

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MEMORANDUM

TO: Chapin Spencer, Nicole Losch; Burlington Department of Public Works
FROM: Jason Charest, PE; CCRPC
DATE: 7/6/2017
RE: North Ave Benefit Cost Analysis

The Burlington Department of Public Works requested the Chittenden County Regional Planning Commission's assistance in updating the previous benefit cost analysis dated 10/13/2016 for the North Avenue Pilot Project. The analysis compared the benefits associated with crash reductions to the costs associated with the pilot's implementation and increases in travel times to the traveling public. This was specific to the 0.8 mile section of North Ave from VT 127 to the Shore/Heineberg intersection that was subject to the 4 to 3 lane conversion. It was found that with the additional data and further analysis the benefits outweigh the costs with a benefit/cost ratio of 1.25. This represents a decrease in the previously calculated benefit/cost ratio of 1.48. An explanation of the analysis follows below.

Crash Reduction Benefits

Crash data from the Burlington Police Department memorandum to the Burlington City Council dated June 28, 2017 was utilized for this analysis. The data contained the number and type of crashes from July 1 to June 26 for respective years and is summarized in the table below.

Table 1: North Avenue Crashes (VT 127 to Shore/Heineberg) from July 1 – June 26

	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2012-2016 Average	2016/ 2017	2016/2017 Crash Reductions
Property Damage Only	25	25	24	16	22.5	20	2.5
Injury	6	6	6	12	7.5	2	5.5
Total	31	31	30	28	30	22	8

The Vermont Agency of Transportation (VTrans) utilizes National Safety Council cost figures as part of their High Crash Location Report to quantify the monetary impacts of crashes throughout Vermont. The figures used in the latest High Crash Location Report (2010-2014) are from 2012 and were used in this analysis. They list the cost of an injury crash at $78,900 and property damage only crash at $8,900[1]. The annual benefits associated with the 2016/2017 crash reductions are shown in Table 2 on the following page.

[1] http://vtrans.vermont.gov/sites/aot/files/planning/2010-2014%20Formal%20High%20Crash%20Location%20Report.pdf

Table 2: Annualized Benefits of 2016/2017 Crash Reductions from the 2012-2016 Average

	2016/2017 Crash Reductions	Cost Per Crash	Annualized Benefits
Property Damage Only	2.50	$8,900	$22,250
Injury	5.50	$78,900	$433,950
		Total	$456,200

Travel Time Costs

The CCRPC collected travel time data before and during the pilot project. Data was collected from 7:00 – 8:30 AM and 4:30 – 6:00 PM. The largest average increase in travel time was 1 minute, 28 seconds per vehicle and was observed during the 5 o'clock hour for the northbound direction. All other increases in average travel times can be seen in Table 3 below. Data collected from 8:00 – 8:30 AM and 4:30 – 5:00 PM was assumed to be representative of the entire 8 and 4 o'clock hours respectively. No increases in travel time were assumed between the hours of 7:00 PM and 6:00 AM. All other hours of the day were assumed to incur a 10 second per vehicle increase in travel time. This represents a 5 second decrease from the 10/13/2016 memo and was based on the additional data collection and analysis. The volume of traffic used for the entire corridor was taken from the higher volume southern section between Ethan Allen Parkway and VT 127 intersections. The assumptions of off-peak travel time increases and corridor volumes are likely yielding overestimated travel time costs. This likely overestimation is thought to account for any slight increases in weekend travel times.

Table 3: Average Increases in Travel Time

	Average Increases in Travel Time (minutes : seconds)			
Hour	7:00 AM	8:00 AM	4:00 PM	5:00 PM
Northbound	00:16	00:10	00:36	01:28
Southbound	00:25	00:02	00:21	00:05

Once the total delay per day was calculated it was multiplied by 261 to account for all the traditional work days in a calendar year. The total annual delay calculated was 19,870.8 hours and is broken down in Table 4 on the following page.

Table 4: North Ave (VT 127 to Shore/Heineberg) Annualized Delay Increases

Hour	Average SB Weekday Traffic Volume	Average NB Weekday Traffic Volume	SB Delay per Vehicle (min)	NB Delay per Vehicle (min)	Daily SB Vehicle Delay (hour)	Daily NB Vehicle Delay (hour)	Annual SB Vehicle Delay (hour)	Annual NB Vehicle Delay (hour)
0	26	52	0	0	0.0	0.0	0.0	0.0
1	15	29	0	0	0.0	0.0	0.0	0.0
2	16	24	0	0	0.0	0.0	0.0	0.0
3	23	15	0	0	0.0	0.0	0.0	0.0
4	67	17	0	0	0.0	0.0	0.0	0.0
5	202	43	0	0	0.0	0.0	0.0	0.0
6	474	96	0.17	0.17	1.3	0.3	343.9	69.5
7	1067	340	0.42	0.27	7.4	1.5	1933.9	394.9
8	834	378	0.03	0.17	0.5	1.1	121.0	274.1
9	619	374	0.17	0.17	1.7	1.0	448.6	271.4
10	530	432	0.17	0.17	1.5	1.2	384.0	313.3
11	526	519	0.17	0.17	1.5	1.4	381.1	376.1
12	513	572	0.17	0.17	1.4	1.6	371.8	414.4
13	522	560	0.17	0.17	1.5	1.6	378.6	406.0
14	571	607	0.17	0.17	1.6	1.7	413.7	440.1
15	589	801	0.17	0.17	1.6	2.2	427.3	580.6
16	529	929	0.35	0.60	3.1	9.3	805.1	2424.7
17	547	1073	0.08	1.47	0.8	26.2	198.4	6847.0
18	457	717	0.17	0.17	1.3	2.0	331.6	519.7
19	364	530	0	0	0.0	0.0	0.0	0.0
20	253	428	0	0	0.0	0.0	0.0	0.0
21	184	310	0	0	0.0	0.0	0.0	0.0
22	118	191	0	0	0.0	0.0	0.0	0.0
23	66	144	0	0	0.0	0.0	0.0	0.0
Total	9112	9179	2.4	4.0	25.1	51.1	6539.0	13331.7

The American Communities Survey estimates the median income for the New North End at $64,902[1]. When accounting for 52 weeks per year and a 40 hour work week, this converts into a median hourly wage rate of $31.20 ($64,902/2080 hours worked per year). The US DOT recommends using a rate of 50% of earnings for personal travel and 100% of earnings for business travel[2]. Based on truck and bus data from the vehicle counts it was estimated

[1] http://factfinder.census.gov/bkmk/table/1.0/en/ACS/14_5YR/S1901/8600000US05408

[2] Trottenberg, P., and P. Belenky. Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis. , 2011.

that 15% of the travel on North Ave qualifies as business travel with the remainder being personal travel. By using the hourly wage rate of $31.20, accounting for the business/personal travel split, and the increase in annual delay for respective travel directions, the annual costs associated with the increases in travel time equate to $356,514.59.

Benefit Cost Analysis

The crash reduction benefits and travel time costs previously calculated were analyzed in Table 5 below over a 20 year time horizon with a discount rate of 0.5% which is consistent with real interest rates published by the U.S. Office of Management and Budget[1].

Table 5: North Ave (VT 127 to Shore/Heineberg) Benefit Cost Analysis

Year	Crash Reduction Benefits	Discounted Crash Reduction Benefits	Travel Time Costs	Discounted Travel Time Costs
0	$456,200.0	$456,200.0	$356,514.6	$356,514.6
1	$456,200.0	$453,930.3	$356,514.6	$354,740.9
2	$456,200.0	$451,672.0	$356,514.6	$352,976.0
3	$456,200.0	$449,424.9	$356,514.6	$351,219.9
4	$456,200.0	$447,188.9	$356,514.6	$349,472.5
5	$456,200.0	$444,964.1	$356,514.6	$347,733.9
6	$456,200.0	$442,750.3	$356,514.6	$346,003.9
7	$456,200.0	$440,547.6	$356,514.6	$344,282.4
8	$456,200.0	$438,355.8	$356,514.6	$342,569.6
9	$456,200.0	$436,175.0	$356,514.6	$340,865.3
10	$456,200.0	$434,004.9	$356,514.6	$339,169.4
11	$456,200.0	$431,845.7	$356,514.6	$337,482.0
12	$456,200.0	$429,697.2	$356,514.6	$335,803.0
13	$456,200.0	$427,559.4	$356,514.6	$334,132.3
14	$456,200.0	$425,432.3	$356,514.6	$332,470.0
15	$456,200.0	$423,315.7	$356,514.6	$330,815.9
16	$456,200.0	$421,209.6	$356,514.6	$329,170.1
17	$456,200.0	$419,114.1	$356,514.6	$327,532.4
18	$456,200.0	$417,028.9	$356,514.6	$325,902.9
19	$456,200.0	$414,954.1	$356,514.6	$324,281.5
20	$456,200.0	$412,889.7	$356,514.6	$322,668.1
Total	-------	$9,118,260.6	-------	$7,125,806.6

[1] https://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

Conclusion

When including a project implementation cost of $165,000, the total costs equate to $7,290,806.6; while the total benefits equate to $9,118,260.6. The resulting benefit/cost ratio is 1.25 indicating the project benefits outweigh the costs. It is important to note this is based on one year of crash data. Therefore, these results are a preliminary indication as to how the pilot is performing. Should the pilot remain for a long enough duration to provide crash data with a degree of statistical significance, a more accurate evaluation could be conducted.