CHITTENDEN COUNTY RPC
Communities Planning Together

110 West Canal Street, Suite 202
Winooski, Vermont 05404-2109
802-846-4490
www.ccrpcvt.org

MEMORANDUM

TO: Chapin Spencer, Nicole Losch; Burlington Department of Public Works
FROM: Jason Charest, PE; CCRPC
DATE: 10/13/2016
RE: North Ave Benefit Cost Analysis

The Burlington Department of Public Works requested the Chittenden County Regional Planning Commission's assistance in conducting a benefit cost analysis 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 the benefits outweigh the costs with a benefit/cost ratio of 1.48 and an explanation of the analysis follows below.

Crash Reduction Benefits

Crash data was provided by the Burlington Police Department for the months of July, August, and September for calendar years 2012 – 2016. This data is summarized in the table below.

Table 1: North Avenue Crashes (VT 127 to Shore/Heineberg) from July - September

	2012	2013	2014	2015	2012-2015 Average	2016
Property Damage Only	10	9	8	9	9	6
Injury	3	1	0	3	1.75	0

The 2012-2015 average and 2016 data were extrapolated to provide an annual crash comparison and to show crash reductions since the 4-3 lane conversion. This is shown in Table 2 below.

Table 2: Annualized North Ave Crashes (VT 127 to Shore/Heineberg)

	2012-2015	2016	2016 Crash Reductions
Property Damage Only	36	24	12
Injury	7	0	7

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 crash reductions are shown in Table 3 below.

Table 3: Annualized Benefits of 2016 Crash Reductions

	2016 Crash Reductions	Cost Per Crash	Annualized Benefits
Property Damage Only	12	$8,900	$106,800
Injury	7	$78,900	$552,300
Total	19	$87,800	$659,100

Travel Time Costs

The CCRPC collected travel time data for before and during the pilot project. The largest average increase was 1 minute, 19 seconds per vehicle and was observed during the PM peak for the northbound direction. All other increases in average travel times were less than 20 seconds. So as to be sure to not underestimate increases in travel time, a 1 minute increase per vehicle for the AM and PM peak hours was assumed. No increases in travel time were assumed between the hours of 9:00 PM and 5:00 AM. All other hours of the day were assumed to incur a 15 second per vehicle increase in travel time. Again, this assumption is likely an overestimate based on the travel time data gathered in the peak hours. Once the total delay per day was calculated it was multiplied by 261 to account for all the work days in a calendar year. Any slight increases in weekend travel times are assumed to be absorbed by the overinflated travel time increases during the work week. The total annual delay calculated was 24,352.3 hours and is broken down in Table 4 on the following page.

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

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

Hour	Traffic Volume	Delay per Vehicle per Hour (min)	Total Delay Per Day (min)	Total Delay Per Day (hour)	Annual Delay (hour)
0	86	0	0.0	0.0	0.0
1	52	0	0.0	0.0	0.0
2	36	0	0.0	0.0	0.0
3	94	0	0.0	0.0	0.0
4	208	0	0.0	0.0	0.0
5	444	0	0.0	0.0	0.0
6	855	0.25	213.8	3.6	929.9
7	1028	1	1027.9	17.1	4471.2
8	877	0.25	219.3	3.7	954.1
9	855	0.25	213.8	3.6	929.9
10	868	0.25	217.1	3.6	944.4
11	991	0.25	247.8	4.1	1078.1
12	1107	0.25	276.8	4.6	1204.0
13	1096	0.25	273.9	4.6	1191.4
14	1094	0.25	273.4	4.6	1189.5
15	1157	0.25	289.3	4.8	1258.2
16	1290	0.25	322.4	5.4	1402.6
17	1413	1	1412.6	23.5	6145.0
18	1005	0.25	251.2	4.2	1092.6
19	786	0.25	196.6	3.3	855.3
20	649	0.25	162.3	2.7	706.1
21	456	0	0.0	0.0	0.0
22	283	0	0.0	0.0	0.0
23	169	0	0.0	0.0	0.0
Total	16900.0	5.3	5598.2	93.3	24352.3

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 an 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 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 for respective personal and business travel with the increase in annual delay of 24,352.3 hours, the annual costs associated with the increases in travel time equate to $436,920.29.

[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.

Benefit Cost Analysis

The crash reduction benefits and travel time costs previously calculated were analyzed over a 20 year time horizon with a discount rate of 1.2% 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 Savings	Discounted Crash Reduction Savings	Travel Time Increases	Discounted Travel Time Increases
0	$659,100.0	$659,100.0	$436,920.3	$436,920.3
1	$659,100.0	$651,284.6	$436,920.3	$431,739.4
2	$659,100.0	$643,561.8	$436,920.3	$426,620.0
3	$659,100.0	$635,930.7	$436,920.3	$421,561.2
4	$659,100.0	$628,390.0	$436,920.3	$416,562.5
5	$659,100.0	$620,938.7	$436,920.3	$411,623.0
6	$659,100.0	$613,575.8	$436,920.3	$406,742.1
7	$659,100.0	$606,300.2	$436,920.3	$401,919.1
8	$659,100.0	$599,110.9	$436,920.3	$397,153.2
9	$659,100.0	$592,006.8	$436,920.3	$392,443.9
10	$659,100.0	$584,987.0	$436,920.3	$387,790.4
11	$659,100.0	$578,050.4	$436,920.3	$383,192.1
12	$659,100.0	$571,196.0	$436,920.3	$378,648.3
13	$659,100.0	$564,422.9	$436,920.3	$374,158.4
14	$659,100.0	$557,730.2	$436,920.3	$369,721.8
15	$659,100.0	$551,116.8	$436,920.3	$365,337.7
16	$659,100.0	$544,581.8	$436,920.3	$361,005.7
17	$659,100.0	$538,124.3	$436,920.3	$356,725.0
18	$659,100.0	$531,743.4	$436,920.3	$352,495.0
19	$659,100.0	$525,438.1	$436,920.3	$348,315.2
20	$659,100.0	$519,207.6	$436,920.3	$344,185.0
Total	-------	$12,316,797.9	-------	$8,164,859.5

When including a project cost of $165,000 to the travel time cost, the resulting benefit/cost ratio is 1.48 indicating the project benefits outweigh the costs. It is important to note this is based on three months of crash data that were interpolated into annual figures. Therefore these results should be seen as a preliminary indication as to how the pilot is performing. Should the pilot remain for a longer duration, a more accurate evaluation could be conducted.

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