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Chapin Spencer
DIRECTOR OF PUBLIC WORKS

To: Burlington City Council

Fr: Chapin Spencer, DPW Director

Re: **North Avenue Pilot: 1st Quarter Update**

Date: October 7, 2016

NORTH AVENUE PILOT PROJECT: JULY - SEPTEMBER

EXECUTIVE SUMMARY

The North Avenue pilot was installed in July. Since that time the Department of Public Works (DPW) has worked with the Chittenden County Regional Planning Commission (CCRPC) to evaluate traffic impacts, Burlington Police Department (BPD) to evaluate crashes, Cindy Cook of Adamant Accord on public outreach, and RSG Inc. on a community survey. As requested by City Council, this memo and presentation provides an update on the pilot and the community's opinions thus far.

This packet includes a memo from the DPW to provide an Executive Summary of our recommendations, highlights of the Project Background and Data, and additional detail on staff recommendations and next steps. Attached memos from supporting agencies provide full detail on traffic data, crash data, benefit/cost analysis, and the public survey. Please note that the Public Opinion Survey Report

Appendices are available online but were not included in this packet (www.burlingtonvt.dpw/north-avenue-pilot-project).

Based on the initial crash reports, preliminary traffic analysis, and the first community survey results, DPW staff recommend:

- Removing the protected bike lane bollards and "armadillos" prior to the planned removal date, and not reinstalling bike lane bollards and "armadillos" on this section of North Avenue.
- Evaluate other bike lane materials and configurations that enhance the safety of North Avenue while respecting the questions and concerns we have heard over the last three months (emergency responders, visibility of materials, and aesthetics). Protected bike lanes can be a critical tool for improving safety and bike usage that the City will continue to consider.
- Monitoring Route 127 / North Avenue intersection performance over the winter and spring and evaluate possible modifications to the intersection in 2017.
- Monitoring all intersections to minimize rush hour travel times.
- Retaining the existing lane configurations through early summer 2017 to continue crash analysis, data collection, and launch the Phase 2 community survey with phone and paper options available to all residents.
- Continuing to monitor the project, measure impacts, and make adjustments as feasible.
- Returning to Council in June 2017 with full survey results, additional traffic and safety data, and a final recommendation for the configuration of North Avenue.

PROJECT BACKGROUND

North Avenue Corridor Study and Council Resolution

The North Avenue pilot project was a recommendation in the 2014 North Avenue Corridor Study – a report that was the result of a two-year public planning process. This process reached more than 160 people at three public workshops and two focus groups, with augmented interactions through an online voting tool as concepts were considered. A November 2014 City Council resolution accepted the North Avenue Corridor Study and the recommendation for a pilot project between Plattsburg Avenue and Washington Street, along with amended language in the resolution that emphasized NNE residents need to support the pilot for its continuation.

Pilot Goals and Installation

The goal of the pilot is to evaluate whether safety for all modes can be improved along North Avenue while maintaining good vehicle mobility. The State has identified four locations along North Avenue as high crash locations (HCLs).

The pilot project components were vetted in collaboration with the North Avenue Task Force. The Task Force was created through the 2014 City Council resolution and disbanded as the project design was finalized for installation. The project was implemented with removable materials over several weeks in late June. Paint, signs, signalization changes, and modular infrastructure were installed along three sections of the corridor: the 4-lane section was reconfigured to 3-lanes, buffered bike lanes replaced parking north of Shore Road (parking in front of St. Mark's Church was retained), a protected bike lane replaced parking between Route 127 and Institute Road, travel lanes were narrowed and buffered bike lanes created between Institute Road and Washington Street, and the Route 127 intersection was reconfigured as a 4-way intersection.

Measuring Impacts

The DPW, CCRPC, and North Avenue Task Force identified metrics to measure impacts of the pilot projects. Three of these metrics were crucial for immediate assessments: intersection operations / side street wait times, crashes / safety observations, and travel times.

Community Input and Project Adjustments

The "northavepilot" project email address allowed the community to submit comments, questions, and general feedback about the pilot. This helped refine areas for improvements and modifications made since late June:

- A bus pull-in was constructed at Ethan Allen Shopping Center
- Many bollards and armadillos in the protected bike lane section were removed to reduce visual clutter and to improve the ability of vehicles to pull-over when emergency vehicles are present
- Most signals in the project area were re-timed to adjust to pilot conditions
- Bollards and striping around Route 127 intersection were adjusted to improve operations and clarity
- Pedestrian crosswalk buttons were added at the Shore / Heineberg intersection
- "Wrong Way, Ride With Traffic" signs were installed to better address concerns for people bicycling in the wrong direction
- "Scarified Pavement" warning signs were installed for motorcyclists' safety

DPW staff also attended many regular events, meetings, and other opportunities, including Ward 4/7 Neighborhood Planning Assembly (NPA) meetings in July, August, and September; Ward 2/3 NPA meeting in September (after their summer break); July tabling at Leddy Beach Bites; North Avenue News monthly updates since June; Burlington School District "Spotlight" in their September newsletter; with Mayor Weinberger at The Bagel; Front Porch Forum updates; and a project-specific public forum on September 20.

DATA HIGHLIGHTS

Detailed data analysis is included in the attached memos from the Regional Planning Commission, Police Department, and RSG Inc. Key findings, summarized below, guided staff recommendations for the pilot project.

Crashes

While crashes citywide increased by 4% between July 1 and September 30, 2016, the number of crashes on North Avenue since the pilot installation have decreased 49% corridor-wide and 44% in the former 4-lane section. Of these, injury-resulting crashes decreased 67% and 100% respectively. The reduction in injuries may be related to the change in crash types, and the crash types may be related to the reduction in travel lanes (fewer broadsides, head-on collisions, and sideswipes occur with fewer travel lanes); but some of the crash reduction could simply be this limited 3-month time period and the corresponding limited sample size. Three months is a short window to try and discern crash trends. This is a significant reason why we recommend continuing the pilot for a 1-year duration.

While the number of crashes has reduced overall, there has been an increase in rear-end collisions. This is not unexpected, as quick-braking and distracted driving may be more prevalent with new signalization changes, longer lines of traffic where none existed previously, and a general adjustment to the new roadway configuration. Although rear-end collisions have increased, these are generally less serious than broadsides or head-on collisions.

Traffic Impacts

Travel Times

Average travel times through the 4-lane section of North Avenue in November 2015 were slightly under 2 minutes northbound and slightly over 2 minutes southbound during morning commutes, and over 2 minutes in each direction during evening commutes. As we prepared for the pilot, we projected a travel time increase of up to 2 minutes in either direction.

With the pilot configuration in September 2016, average travel times in this section of North Avenue increased by 21 seconds northbound / 32 seconds southbound during morning rush hour and 1 minute 10 seconds northbound / 13 seconds southbound during evening rush hour. The maximum travel time increased by 51 seconds northbound / 2 minutes 33 seconds southbound during morning rush hour and 3 minutes 37 seconds northbound / 58 seconds southbound during evening rush hour.

Intersection Operations and Wait times

Intersections were projected to see increased wait times and longer queues of traffic, with traffic during rush hour queueing near but not to the next intersection downstream. After signal modifications, traffic observations indicate wait times and queues in line with projections for northbound traffic, and better than projected for other directions.

Wait times were also calculated for traffic trying to enter North Avenue from side streets at Saratoga Avenue, Killarney Drive, Village Green, and Lakewood Parkway. The weighted average wait times increased 6.1 seconds during morning rush hour and 12.3 seconds during evening rush hour. These measurements were taken while the Ethan Allen Parkway signal detection was not operating at full capacity, which has since been resolved.

Traffic speeds and volumes

While average traffic speeds on North Avenue near Saratoga Avenue and near Shore Road did not decrease (continuing to average 34 miles per hour (mph) and 29 mph respectively), the percentage of traffic speeding in these areas decreased 2% near Saratoga Avenue and 4% near Shore Road. The daily traffic counts also indicate that traffic continues to use North Avenue rather than diverting to Route 127.

Pedestrian and bicycle counts at intersections indicate a moderate increase in people walking and a more substantial increase in people bicycling, with a concurrent decrease in people bicycling on sidewalks.

Phase 1 Survey Results

While DPW received over 350 emails and phone calls about the pilot project, these were unsolicited comments and may not be representative of the community. To begin to understand public opinion on the pilot and the various project components, an online survey was conducted by RSG, Inc. between September 13 – October 2, 2016.

The community requested the survey begin after school traffic resumed and Council requested a check-in 4-months into the pilot project. The DPW also needed time after the Council check-in to make any roadway changes that would be restricted by winter weather. Neither paper nor phone surveys could be distributed, completed, and processed within these time constraints. As a result, an online survey was utilized and augmented with over-the-phone completion and in-person computer access for those with limited computer access.

The survey was designed and administered to obtain a representative sample of residents to better understand public opinion of the pilot project, its various components, respondents' travel behaviors, and their level of satisfaction, while clearly distinguishing the New North End (NNE) feedback from the rest of the community and commuters. The survey was advertised through Front Porch Forum, on DPW's website and social media, on two electronic message signs entering North Avenue, and through flyers and direct emails to project stakeholders.

More than 2,700 people responded to the survey directly online or with assistance from the CCRPC. Only 40 responses were removed for obvious patterns of identical names, digital fingerprints, and/or invalid names (e.g. "None of your business"). The CCRPC made contact with 39 of the 43 residents who

requested assistance with the survey, and of those 39: phone surveys were facilitated for 9 people, direct survey links were sent to 13 people, 5 received voicemails with all options to take the survey, and 12 confirmed they had been able to access the survey on their own. In addition, 8 surveys were completed at the Heineberg Senior Center and additional surveys were completed at the September 20 public forum hosted by the DPW at the Miller Center.

The survey results were weighted by age and gender to represent the population of the NNE and Burlington.

- A narrow margin separates those dissatisfied or satisfied with the 4-lane to 3-lane conversion (49% NNE dissatisfied / 45% satisfied / 6% neutral or not sure; 44% all respondents dissatisfied / 50% satisfied / 6% neutral or not sure)
- A majority of respondents are satisfied with the removal of on-street parking and a slight majority of NNE residents and all respondents are satisfied with the buffered bike lanes in place of parking
- A majority of all respondents are dissatisfied with the protected bike lanes
- A majority of all respondents are dissatisfied with the modifications at Route 127.

All NNE respondents drive North Avenue, 40% bike, 43% walk/run, and 10% took the bus. Of all respondents, 95% drive, 45% bike, 37% walk/run, and 9% bus. DPW plans to launch an additional survey in spring 2017. A paper survey will be distributed and a phone survey can provide statistically significant results for comparison.

Benefit / Cost Analysis

The increase in travel time and the decrease in crashes can be analyzed for their costs and benefits. For the former 4-lane section of North Avenue, the benefits outweigh the costs with a benefit/cost ratio of 1.48.

Emergency Services

The DPW staff regularly checked in with representatives of the Police and Fire Departments to understand whether there were concerns with emergency response times. The Police Department did not express any concerns with the pilot project. Chief Locke from the Fire Department stated that the 4-to-3 lane section appeared to work well for them as the center lane provided a clear path for emergency responders, but some BFD staff expressed concern in the protected bike lane section with other drivers' limited ability to pull curbside. In response to these concerns and similar feedback from the community, the protected bike lane was modified twice to ultimately increase the spacing of the bollards to their maximum recommended spacing.

STAFF RECOMMENDATIONS

Reconfiguration of roadways involves tradeoffs and comparisons. We can objectively measure congestion, traffic speeds and volumes, the numbers of people using the roadway, crash volumes and patterns, and even the community's perceived impact of these measurements, but balancing the tradeoffs between these benchmarks can be subjective. The Benefit Cost Analysis undertaken by the CCRPC is one tool that seeks to compare the relative benefit (reduction of crashes) with the relative cost (increased travel times).

Given that 1) the initial Benefit Cost Analysis indicates a net positive result with a significant apparent increase in public safety, 2) the traffic data collected thus far is largely consistent with pre-pilot projections and does not indicate imminent operational failure, and 3) that the survey does not indicate overwhelming opposition to the entire pilot project, the DPW staff recommends:

- Removing the protected bike lane bollards and "armadillos" prior to the planned removal date, and not reinstalling bike lane bollards and "armadillos" on this section of North Avenue.
-
- Monitoring Route 127 / North Avenue intersection performance over the winter and spring and evaluate possible modifications to the intersection in 2017.
- Monitoring all intersections to minimize rush hour travel times.
- Retain the existing lane configurations through early summer 2017 to continue crash analysis, data collection, and launch the Phase 2 community survey with phone and paper options available to all residents.
- Continue to monitor the project, measure impacts, and make adjustments as feasible.
- Return to Council in June 2017 with full survey results, additional traffic and safety data, and a final recommendation for the configuration of North Avenue.
- Use the winter season to identify additional improvements to the pilot or the corridor:
    - Evaluate other bike lane materials and configurations that enhance the safety of North Avenue while respecting the questions and concerns we have heard over the last three months (emergency responders, visibility of materials, and aesthetics). Protected bike lanes can be a critical tool for improving safety and bike usage that the City will continue to consider.
    - Work with the neighborhood to prepare additional features to beautify the corridor and build on the North End community (benches, landscaped planters).
    - Develop improved sign and marking plans if the reconfiguration is retained long-term.
    - Continue to coordinate new crosswalk installations at 5 locations along North Avenue.

Let me know if we can provide additional information. Thank you.

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MEMORANDUM

To: Burlington City Council
Fr: Eric Fowler, Crime Analyst
Re: North Avenue Crash & Injury Data
October 12, 2016

Our department was asked to compile and review crash and injury data related to the North Avenue Pilot Project. This memorandum provides a summary of our work and findings.

Overview of Crash Data Compilation:

- Gathering the data to perform the following analyses was a multiple-step process.
    1. I extracted all car crash incidents from Valcour (the BPD's record management system) in the city of Burlington during the period 7/1-9/30 for each year from 2012 to 2016. This made up the city-wide crash sample.
    2. From this sample, I extracted all crashes that occurred in North Avenue Area A (Washington St to Plattsburg Ave) using the street address connected to the incident.
    a. I then manually vetted each incident file on Valcour individually, examining the incident narrative as well as a scanned copy of the police report or ticket, to determine if the crash took place on a public area of the North Avenue Area A stretch or if it occurred in an adjacent parking lot or driveway. Incidents that occurred in these private areas were eliminated from the sample.
    b. I also used this process to ascertain the type of crash that occurred and whether or not there were injuries.
    3. From this scrubbed sample I created a subset for North Avenue Area B (Route 127 to Shore Rd) using the street address connected to the incident.
    4. From here, I performed simple analyses on each sample to produce raw counts of crashes city-wide, on North Ave A, and on North Ave B as well as raw counts of crash types and crashes involving injuries for North Ave A and North Ave B.
    5. Below, I present analyses comparing these counts across years.

Summary of Crash Data:

Crashes by Year (7/1-9/30)

	2012	2013	2014	2015	2016	Change from Average
Citywide	475	513	511	503	520	+4%
North Ave A	18	18	19	23	10	-49%
Type of Crash						
Backing Into	1	0	1	0	1	0%
Broadside	7	4	2	4	1	-76%
Head On	1	1	2	2	0	-100%
Rear End	4	4	5	6	7	+47%
Roadside Obst	2	1	2	4	0	-100%
Sideswipe	2	3	5	4	1	-71%
Other/Unknown	1	5	2	3	0	-100%
North Ave B (subset of A)	13	10	8	12	6	-44%
Type of Crash						
Backing Into	1	0	0	0	0	0%
Broadside	6	2	1	3	0	-100%
Head On	1	0	2	1	0	-100%
Rear End	2	1	3	3	5	+122%
Roadside Obst	1	0	0	2	0	-100%
Sideswipe	2	2	1	2	1	-43%
Other/Unknown	0	4	1	1	0	-100%

- All crashes that occurred from **7/1-9/30** of 2012 through 2016 **CITY WIDE** including a metric comparing crashes in 2016 to the 4 year average
- All crashes that occurred from **7/1-9/30** of 2012 through 2016 in the **public** areas of **NORTH AVE A (Washington St to Plattsburg Ave)** and its encompassing intersections including a metric comparing crashes in 2016 to the 4 year average (crashes occurring in parking lots, driveways, or on adjacent streets are removed).
- A descriptive breakdown reflecting types of crashes per year in North Ave A area including a metric comparing counts of each crash type in 2016 to the 4 year average
- All crashes that occurred from **7/1-9/30** of 2012 through 2016 in the **public** areas of **NORTH AVE B - Subset of A (Route 127 to Shore Rd)** and its encompassing intersections including a metric comparing crashes in 2016 to the 4 year average (crashes occurring in parking lots, driveways, or on adjacent streets are removed).
- A descriptive breakdown reflecting types of crashes per year in North Ave B – Subset of A area including a metric comparing counts of each crash type in 2016 to the 4 year average

Crashes Involving Injuries by Year (7/1 – 9/30)

	2012	2013	2014	2015	2016	Change from Weighted Average
North Ave A	18	18	19	23	10	-49%
Injuries	3	3	0	4	1	-60%
North Ave B (subset of A)	13	10	8	12	6	-44%
Injuries	3	1	0	3	0	-100%

- All injuries that occurred from **7/1-9/30** of 2012 through 2016 in the **public** areas of **NORTH AVE A (Washington St to Plattsburg Ave)** and its encompassing intersections including a metric comparing injuries in 2016 to the 4 year average (injuries occurring in parking lots, driveways, or on adjacent streets are removed).
- All injuries that occurred from **7/1-9/30** of 2012 through 2016 in the **public** areas of **NORTH AVE B - Subset of A (Route 127 to Shore Rd)** and its encompassing intersections including a metric comparing injuries in 2016 to the 4 year average (injuries occurring in parking lots, driveways, or on adjacent streets are removed).

Analysis:

- Crashes were up slightly city-wide during the intervention period (+4%) but down considerably in both North Ave segments (-49% and -44%).
- Injuries were down during the intervention period in both North Avenue segments (-60% and -100%) indicating that crashes in 2016 were not only fewer in number, but also less severe.
- The one exception to the overall decrease in crashes was for rear-end collision crashes, which increased 47% and 122% in the North Ave A and B respectively.
- Because of the small sample size and short duration of the pilot project, it is not possible to conclude to a degree of statistical significance that the intervention itself is the cause, and the only cause, of the reductions in crashes in the intervention areas.
- Additionally, because of the very small sample size and the short duration, it is not possible to conclude the intervention had an effect on crashes involving injuries. However, it may be interesting to note that there was only 1 accident where an injury was reported in the entirety of the intervention area during the project period 2016. That same incident involved an operator on a bicycle (the only such incident in 2016).
- Given the initial data appears to indicate a large reduction in crashes and fewer injuries along the North Avenue corridor during the intervention period, our department supports continuing the pilot project through the upcoming winter so that we can collect additional data and better evaluate the pilot's long-term safety impacts.

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MEMORANDUM

TO:	Chapin Spencer, Nicole Losch; Burlington Department of Public Works
FROM:	CCRPC Transportation Staff
DATE:	October 13, 2016
RE:	North Avenue Pilot Project Data Collection

Transportation staff from the Chittenden County Regional Planning Commission (CCRPC) have been assisting the City of Burlington with data collection to evaluate the implementation of the North Avenue Pilot Project. The CCRPC collected bicycle, pedestrian and vehicular traffic data as part of the quantitative metrics for this project. The initial phase of this process involved pre-pilot conditions data collection. Once the pilot was installed, the CCRPC replicated the data collection process that was used during the first phase to collect data during the pilot. The following paragraphs provide an overview of the data that were collected before and during the pilot.

Travel Times

The CCRPC collected travel time data before and during the pilot project. The data was collected from 7:00 - 8:30 AM and 4:30 - 6:00 PM for respective AM and PM peak travel times in June and November 2015 (before the pilot) and August and September 2016 (during the pilot). This was conducted by traveling the corridor in a vehicle and recording the time in which it took to traverse the section of North Avenue between the VT 127 and Shore/Heineberg intersections. Drivers were instructed to keep pace with traffic and not to exceed 35 miles per hour (mph). Before the pilot, drivers did pass vehicles on rare occasions such as a bus stopping or if a vehicle traveling below the posted speed limit of 30 mph was impeding normal traffic flow. During the pilot, drivers passed stopped busses when safe to do so. Time spent waiting at a red light or in a queue upon entering the corridor was included as part of the travel time. It is important to note that the northbound signal detection at the Ethan Allen Parkway intersection was not operating correctly when the August 2016 data was collected and resulted in some extensive traffic backups in the PM Peak. As a point of reference, if a vehicle were to travel the 0.8 mile section of roadway at 30 mph unimpeded (i.e. all green lights and no delays due to traffic) it would take 1 minute and 36 seconds.

Prior to implementing the pilot the expectation was set that, on average, drivers could see their travel times increase by 1 to 2 minutes. During the pilot, the largest increase in average travel time was observed during the PM peak when the Ethan Allen Parkway signal detection was not operating properly and was 1 minute, 28 seconds. Since the detection was fixed, this has been reduced to 1 minute, 10 seconds. The next largest increase in average travel times was for southbound travel during the AM peak with school in session. This was 33 seconds. These

increases are either consistent or less than the expectations that were set in advance of the pilot. Tables 1 and 2 display AM and PM peak travel times respectively.

Table 1: AM Peak Travel Times

		AM Peak Travel Times (minutes : seconds)			
		Before Pilot		During Pilot	
		6/17/2015	11/4/2015	8/4/2016	9/21/2016
Northbound	Average	01:53	01:55	02:01	02:16
	Max	02:32	02:27	03:26	03:18
Southbound	Average	01:59	02:06	02:04	02:38
	Max	03:06	02:59	03:14	05:32

Table 2: PM Peak Travel Times

		PM Peak Travel Times (minutes : seconds)			
		Before Pilot		During Pilot	
		6/16/2015	11/4/2015	8/3/2016	9/20/2016
Northbound	Average	02:01	02:01	03:29	03:11
	Max	02:54	02:24	07:10*	06:01
Southbound	Average	02:11	02:25	02:33	02:38
	Max	03:09	03:58	03:22	04:56

*Ethan Allen Parkway signal detection issue – since resolved

Side Street Delay

Side street delay (i.e. the time in which it takes a vehicle to enter the corridor from a side street) were measured at four unsignalized North Avenue intersections (Village Green, Killarney Dr, Lakewood Pkwy and Saratoga Ave). This was done through the use of counting software where an individual records the time in which each vehicle stops at a stop sign (or in a queue if there are multiple vehicles waiting to turn) and the time in which they enter the corridor. Data collection occurred from 7:00 - 8:30 AM and 4:30 - 6:00 PM for respective AM and PM peak travel times.

Increases in side street delay are a known trade off in 4 to 3 lane conversions and it was important to monitor this to determine how greatly the side streets were impacted. The side streets evaluated are concentrated towards the southern end of the corridor as this is where traffic is heaviest and would offer fewer gaps in traffic to turn onto North Avenue. The largest increases in delay were observed at Village Green for both the AM and PM peaks. This has not been reevaluated in the PM peak since the Ethan Allen Parkway signal detection has been fixed. It is anticipated that the delay will have decreased. Interestingly, Saratoga Drive did not experience as much of an impact. The greater impacts to Village Green is therefore most likely related to its close proximity to the Ethan Allen Parkway signal and its associated signal cycle

length changes as a result of the pilot's implementation. Tables 3 and 4 below display AM and PM peak side street delay respectively.

Table 3: AM Peak Side Street Delay (seconds)

	Before Pilot	During Pilot	Delay Increase
Killarney	10.6	19.1	8.5
Lakewood	6.8	9.3	2.5
Saratoga	12.6	16.2	3.6
Village Green	8.6	17.8	9.2
Weighted Average	9.3	15.4	6.1

Table 4: PM Peak Side Street Delay (seconds)

	Before Pilot	During Pilot	Delay Increase
Killarney	19.2	26.7	7.5
Lakewood	8.9	19.4	10.5
Saratoga	17.5	24.3*	6.8
Village Green	15.0	36.5*	21.6
Weighted Average	14.0	26.4	12.3

*Ethan Allen Parkway signal detection issue – since resolved

Speed and Volume Metrics

Speed and volume data were collected using Automated Traffic Recorders (ATRs). These devices measure speed, volume and vehicle type, and collect data 24 hours per day. Data were collected at various sites and various times throughout both pre-pilot and during pilot.

The data indicate that speeds have remained relatively constant with minor reductions in the percent of vehicles exceeding the posted speed limit. A concern prior to implementing the pilot was whether or not traffic would choose to take VT 127 and avoid the corridor. Based on the data this has not been shown to have happened with the volumes remaining relatively constant in both the northern and southern sections. All data at respective sites were aggregated and are presented in Table 5 on the following page.

Table 5: North Ave Speed and Volume Data

		Speed and Volume	
		Before Pilot	During Pilot
Saratoga	85th Percentile	38 mph	39 mph
	Average	34 mph	34 mph
	Percent exceeding posted speed limit (30 mph)	86%	84%
	Volume (AADT)	16,200	16,900
Shore	85th Percentile	34 mph	33 mph
	Average	29 mph	29 mph
	Percent exceeding posted speed limit (30 mph)	46%	42%
	Volume (AADT)	14,500	14,200

AADT - Annual Average Daily Traffic

85th percentile - The speed at which 85% of the vehicles are travelling at or below.

Bicyclist and Pedestrian Counts

A snapshot of bicyclist and pedestrian travel was extracted from turning movement counts, which included these modes in addition to vehicles. These data represent average per intersection totals at peak hours. The four intersections counted were North Ave/VT 127, North Ave/Ethan Allen Pkwy, North Ave/Ethan Allen Shopping Center and North Ave/Shore Rd. The peak hours for these data sets were from 7:00 - 9:00 AM in the morning and from 4:00 - 6:00 PM in the afternoon (Note: the VT 127 intersection also contained data from 2:00 - 4:00 PM). Counts were conducted for one midweek day (Tuesday – Thursday) before and during the pilot under favorable weather conditions (i.e. no rain, comfortable temperatures).

The data indicates an increase in the number of on road bicyclists, a decrease in bicyclists using the sidewalk, and an increase in pedestrian travel.

		Average Volumes by mode*	
		Before Pilot	During Pilot
Bicycles	On road	36	69
	On sidewalk	33	13
Pedestrians		77	85

*Averages were derived from both the AM and PM peak, totaling 4 hours per day (6 for VT 127 intersection) and were aggregated from all four intersections listed above.

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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

REPORT

NORTH AVENUE PILOT PROJECT PUBLIC OPINION SURVEY

RSG
the science of insight

10.12.2016

PREPARED FOR:
CHITTENDEN COUNTY RPC

SUBMITTED BY:
RSG

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NORTH AVENUE PILOT PROJECT PUBLIC OPINION SURVEY

PREPARED FOR:
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1.0 INTRODUCTION

The Burlington Department of Public Works (DPW) implemented the North Avenue Pilot Project in July of 2016, which made significant changes to the North Avenue corridor between Washington Street and Plattsburg Avenue. Changes include reducing the number of vehicle lanes from four to three, adding buffered or protected bicycle lanes as corridor geometry allows, the addition of a crosswalk at the EA Shopping Center, and changing intersection geometries and signalization at various intersections along the corridor.

Resource Systems Group (RSG) was retained by the Chittenden County Regional Planning Commission (CCRPC) to conduct a comprehensive survey of users and residents along the North Avenue corridor that would be used to inform future decision-making around the North Avenue reconfiguration. The public opinion survey was designed and administered to obtain a representative sample of residents to better understand public opinion of the North Avenue Pilot Project, and in particular how that opinion may differ between residents of the New North End (NNE) adjacent to the Pilot Project corridor (Wards 4 and 7) and all other residents of Burlington and non-resident visitors.

To assess the public's opinion of the North Avenue Pilot Project, RSG worked closely with the project team to design an online survey instrument to collect data on respondents' current travel behaviors along the corridor, their opinions on different components of the North Avenue Pilot Project and their level of satisfaction with using different modes to travel on North Avenue. The survey was programmed and administered entirely online using RSG's proprietary and customizable web-based platform, which presents questions based on respondents' previous answers and allows for an accurate and efficient means of data collection.

A total of 2,763 completed surveys were collected from September 13th to October 3rd, 2016. The final survey data was weighted by age and gender to represent the population of the New North End and the City of Burlington. After weighting, descriptive tabulations of the data were prepared for responses to each question and selected cross-tabulations were prepared to evaluate relationships among key variables.

This report documents the development and administration of the survey questionnaire and presents the survey results. Complete records of survey screen captures, response tabulations, and respondents' comments about the project, uncategorized and unedited by RSG, are included as appendices.

2.0 SURVEY QUESTIONNAIRE

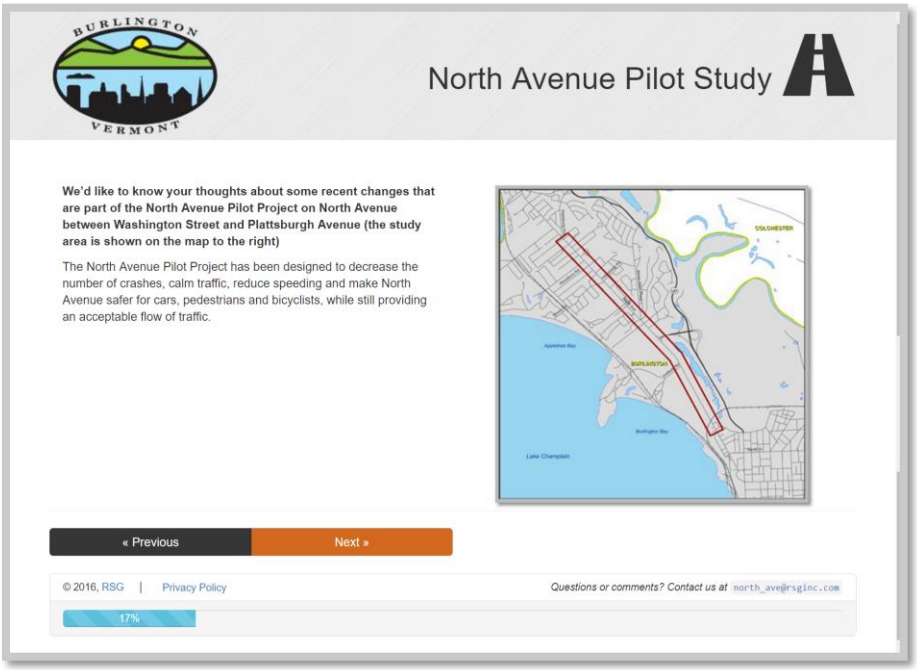
RSG and the Chittenden County Regional Planning Commission (CCRPC) worked closely with other project team members who included Department of Public Works (DPW) staff, Mayor's office staff, and Burlington City Councilors, to develop the public opinion survey questionnaire. Basic demographic background information was collected to understand how public opinion varies across different segments of the population, such as area of residence, age, gender, and mode of travel in the corridor.

RSG developed an intuitive and easy-to-follow online survey using our custom survey software platform. The online instrument validated all answers to ensure that a response was given and that the response made logical sense (e.g., a text response was not given in a numeric field, the range of a numeric response was reasonable). This validation ensured that all surveys submitted using the online instrument were 100% complete. The complete set of survey questions as they appeared to respondents on-screen is included in Appendix A.

At the beginning of the questionnaire, respondents were presented with an introduction to the purpose of the survey, the estimated time required to complete the questionnaire, and instructions for how to navigate the computer-based instrument. A "Contact Us" link to a project email address was included on this and all subsequent screens to provide respondents with a way to contact the research team with any technical questions about the survey.

The subsequent screen introduced respondents to the North Avenue Pilot Project and provided information, along with a map, about the study corridor (Figure 2-1).

FIGURE 2-1: SURVEY SCREEN CAPTURE: PROJECT INFORMATION AND MAP



Next, all respondents were asked about their level of satisfaction with the different North Avenue Pilot Project components (Figure 2-2). To complement the individual descriptions, clickable pop-up icons with definitions and photographs were added to clearly communicate project features that were not likely to be universally understood by the general public (Figure 2-3).

FIGURE 2-2: SURVEY SCREEN CAPTURE: OPINION OF PROJECT COMPONENTS

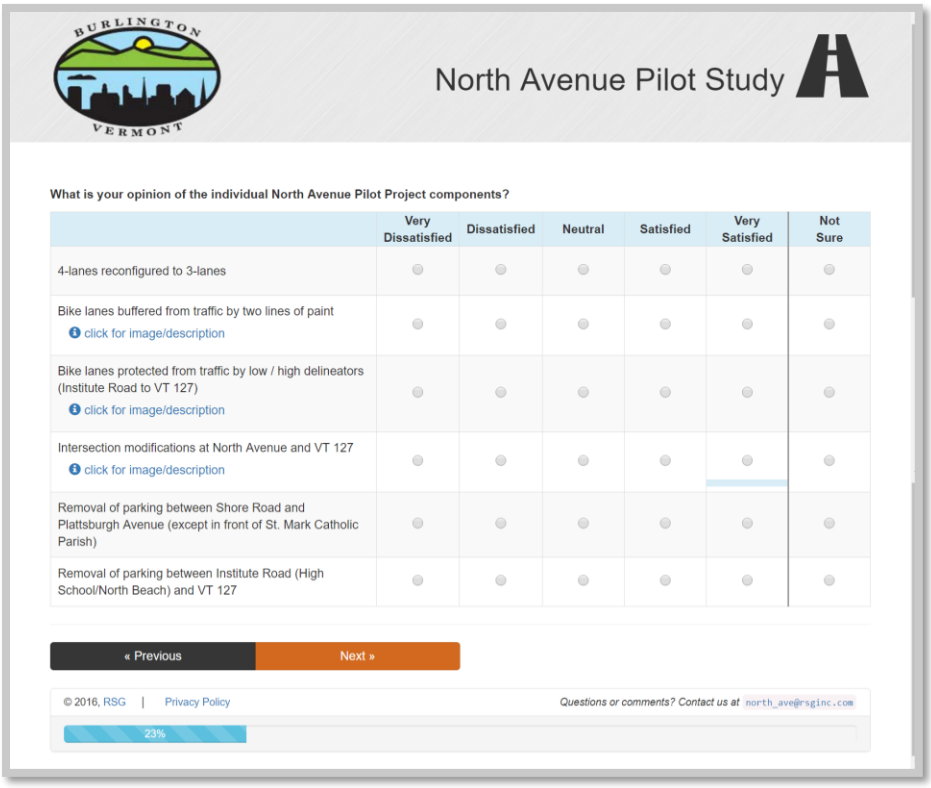
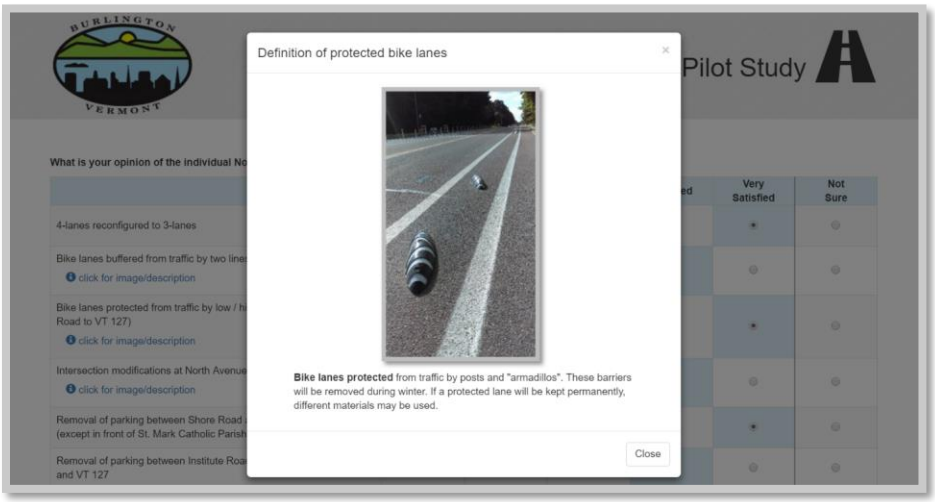


FIGURE 2-3: SURVEY SCREEN CAPTURE: POP-UP INFORMATION FOR PROTECTED BIKE LANES

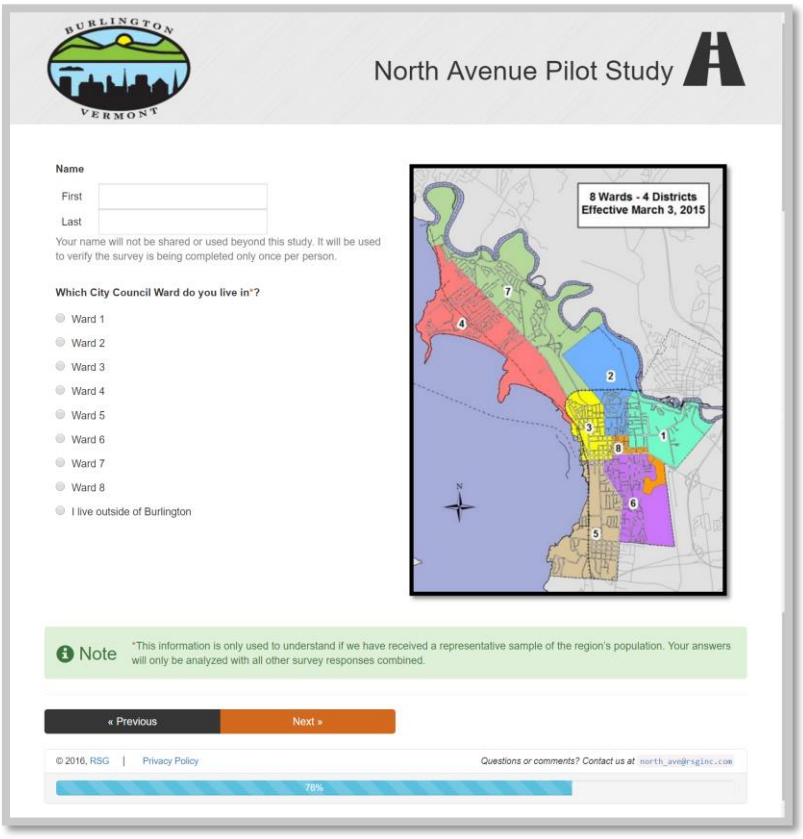


All respondents were next asked to indicate the different travel modes they had used along the North Avenue Corridor over the past month. Respondents were then asked to indicate whether their perception of safety on North Avenue had changed since the Pilot Project began for each of the modes they had indicated as recently used.

Next, for each of the modes they had previously selected, respondents were asked to indicate their level of satisfaction with experiential aspects of traveling on or along North Avenue. Separate sets of satisfaction questions were shown for each of the modes. A follow-up set of questions next asked respondents how frequently per month they make trips on North Avenue for each of the modes they had selected, and the primary purposes of their trips made on North Avenue.

Because the survey was distributed using open links and was not password-protected, it was necessary to deter repeat respondents who may have attempted to dishonestly influence the study's findings. All respondents were asked to include their first and last name, their street of residence and their city ward to help verify records and to minimize illegitimate duplicate responses (Figure 2-4). Respondents who did not live in any of Burlington's wards were asked to provide their home ZIP code.

FIGURE 2-4: SURVEY SCREEN CAPTURE: RESPONDENT IDENTIFICATION



To confirm the sample contained a diverse representation of residents from both the New North End (NNE) and Burlington as a whole, and to verify demographic dimensions for survey

weighting procedures, respondents were asked to indicate their age and gender. Finally, respondents were asked about their willingness to participate in future studies about the Pilot Project and to leave an email address where they could be contacted. Before exiting the survey, respondents were given the opportunity to leave comments about the survey or the project. These open-ended comments are provided in Appendix C.

3.0 SURVEY METHODOLOGY AND ADMINISTRATION

3.1 | SURVEY SAMPLING METHODOLOGY AND APPROACH

There are two primary population segments of interest in the survey effort:

1. Residents of the New North End (Wards 4 and 7)
2. Residents of other parts of Burlington or non-resident visitors

NNE residents are of particular importance to this study as the November 2014 City Council resolution called for public input from the NNE to be measured.

Based on the populations of the NNE and the City of Burlington obtained from the American Community Survey five-year estimates at the ZIP code tabulation area (ZCTA) geography, the survey sampling was designed for a minimum sample size of 370 complete surveys, in order to achieve results at a 95% confidence level with a confidence interval of +/- 5%. Other Burlington residents and non-resident visitors had a targeted sample size of 200 complete surveys, for a confidence interval of +/-7% at the 95% confidence level.

3.2 | SURVEY ADMINISTRATION

The survey administration began on September 13th, 2016 when links were shared using Burlington and NNE Front Porch Forum (FPF), and closed on October 3rd. During that time, 2,763 completed questionnaires were collected, 1,853 of these from residents of Wards 4 and 7 in the NNE.

The web-based survey was administered using a convenience-based sampling approach, with the aim to gather as many responses as possible from residents and other regular travelers on North Avenue in the required survey timeframe. To facilitate the data collection effort, RSG distributed several customized open links, where responses from each link were separately tracked to assess the impact of each distribution source. Specific, traceable survey links were distributed to the following two platforms:

- Front Porch Forum (FPF): A widely distributed email newsletter available in all Burlington neighborhoods that helps people connect with their neighbors and learn about what is happening in their community. The City of Burlington posted advertisements on FPF that included a link to the survey website. The advertisement was posted starting on Tuesday, September 13th.
- Local Motion Listserv: A non-profit organization that promotes active transportation in Vermont distributed a link via email to its Burlington member listservs.

A single general link was shared across multiple platforms and outreach efforts, including:

- Burlington Department of Public Works (DPW) Website.
- City Councilors from Wards 4 and 7 distributed survey links to their constituents via email.
- Local and State media organizations, including NBC affiliate WTPZ and VT Digger, ran stories about the North Avenue Pilot project and shared the link for readers to take the survey.
- The CCRPC conducted in-field outreach at senior centers and public meetings, using laptops to obtain web-based survey input from populations that may otherwise have had limited computer access or understanding of the survey effort.

During the initial week of administration, it was observed that some respondents incorrectly shared the survey link by directly copying and distributing the URL from their browsers. To reduce these instances, RSG added a functioning survey link and instructions how to share the URL on both the first and final screens of the survey.

Because the links could be freely distributed and the survey was accessible without a password, only an approximation of completes by distribution source is possible, shown in Table 3-1 .

TABLE 3-1: APPROXIMATE NUMBER OF COMPLETES BY DISTRIBUTION SOURCE

Source	Count	Percent
City website/Social Media/Public Meetings	1,809	65%
Front Porch Forum	876	32%
Local Motion	76	3%
GMT/Other	2	0%
Total	**2,763**	**100%**

4.0 DATA PROCESSING AND RESULTS

4.1 | DATA CLEANING ANALYSIS

After data collection efforts concluded on October 3rd, 2016, the initial raw dataset included 2,763 records. The survey data was analyzed to flag records that were clearly completed by the same person more than once, or cases where respondents did not leave the required information to verify their survey represented a distinct person. Although the survey contained text to remind individuals not to complete the survey more than once, after reviewing and analyzing all completed questionnaires, the following records were removed:

- **16 records with identical names and email addresses:** A total of 16 respondents were identified as completing the questionnaire twice by entering an identical name and email address in two distinct records. In each of the 16 cases, the survey with the earlier date stamp was retained while the second record was removed from further analysis.
- **Seven records with a matching digital fingerprint & nearly identical survey responses:** Metadata was collected from each electronic device used to complete the survey, including IP address, browser version/type and screen resolution, to form a digital 'fingerprint'. Survey records were analyzed for duplicate digital fingerprints. Although more than 70 digital fingerprint pairs or series were identified, only one fingerprint, with eight instances of nearly identical responses to survey questions, was flagged for removal. The survey with the earliest date stamp was retained, while the remaining seven records with non-distinct digital fingerprints were removed from the final analysis.
- **17 records where the respondent left an invalid first and last name:** First name, last name and street of residence were collected from all respondents as a way to deter repeat survey takers. Cases where respondents left phrases or sentences in place of a first and last name, and therefore an incomplete questionnaire, were removed from the final analysis.

After conducting the data cleaning analysis, 40 distinct records were removed from the final dataset, representing just over 1% of all completed surveys. The dataset used for final analysis contained 2,723 completed survey records.

4.2 | WEIGHTING

In order to more closely reflect the true populations of residents in the New North End and Burlington as a whole, the collected survey data was weighted to match the age and gender distributions for the NNE ZIP code tabulation area (ZCTA 05408) and for the combined ZCTAs of Burlington proper (05401 and 05408). Each population was analyzed separately, necessitating unique weighting schemes for the NNE and for Burlington. The ZCTA demographic control data was acquired using the 2014 5-year American Community Survey (ACS) estimates, the most recent available ACS dataset. Weighting helps to correct for segments of the population that may have been underrepresented or overrepresented in the survey sample. Prior to weighting, RSG removed records for respondents who did not indicate a gender and for respondents under the age of 18 (after weighting, these respondents were entered back into the final dataset with a

weight of 1), and used a joint-distribution approach to weight the sample for the combined gender and age of both Burlington ZIP codes and of the NNE's ZIP code. Table 4-1 summarizes the weighting for NNE residents, and Table 4-2 summarizes the weighting applied to all respondents.

TABLE 4-1: SUMMARY OF WEIGHTS BY AGE AND GENDER FOR NEW NORTH END RESIDENTS

		Survey Sample	Control Percent	Weight
Men	18-24	2.2%	3.3%	1.49
	25-34	6.8%	6.3%	0.92
	35-44	9.0%	8.1%	0.90
	45-54	8.5%	9.6%	1.12
	55-64	8.8%	10.7%	1.21
	65-74	5.8%	4.2%	0.73
	75+	2.1%	4.9%	2.31
Women	18-24	3.3%	3.2%	0.96
	25-34	9.7%	7.3%	0.75
	35-44	10.4%	8.1%	0.78
	45-54	13.2%	9.7%	0.74
	55-64	9.9%	10.7%	1.09
	65-74	7.5%	5.8%	0.77
	75+	2.7%	8.2%	3.05

TABLE 4-2:SUMMARY OF WEIGHTS BY AGE AND GENDER FOR ALL RESPONDENTS

	Age	Survey Sample	Control Percent	Weight
Men	18-24	4.1%	14.6%	3.53
	25-34	8.5%	10.9%	1.29
	35-44	9.9%	6.7%	0.68
	45-54	8.6%	6.1%	0.70
	55-64	7.9%	5.9%	0.74
	65-74	4.8%	2.7%	0.56
	75+	1.5%	2.6%	1.69
Women	18-24	3.6%	14.6%	4.08
	25-34	11.3%	10.4%	0.92
	35-44	10.5%	5.6%	0.54
	45-54	11.8%	6.2%	0.53
	55-64	9.4%	6.1%	0.65
	65-74	6.1%	3.2%	0.52
	75+	2.0%	4.5%	2.22

4.3 | RESULTS

CONFIDENCE LEVEL AND CONFIDENCE INTERVALS

Actual survey response rates exceeded the original sampling goals, which allowed for a narrower confidence interval for the entire sample and for residents of the NNE.

Based on population estimates from the American Community Survey five-year estimates, the population of the NNE ZIP code tabulation area (ZCTA 05408) is 9,921, with an 18-and-older population of 7,745. The population of Burlington (ZCTAs 05401 and 05408 combined) is 38,178, with an 18-and-older population of 32,741. Based on these figures, Table 4-3 shows the confidence interval at the 95% confidence level for data representing NNE adult residents and all adult respondents in response to a hypothetical question where answers are dichotomously split 50/50, a worst-case scenario where the margin of error would be highest.

TABLE 4-3:STATISTICAL CONFIDENCE

Area	18+ Population	Sample Size	95% Confidence Interval
New North End Residents	7,745	1,822	+/- %2.01
All Respondents (Burlington)	32,741	2,723	+/- %1.8

PARTICIPANT PROFILE

As described above, the demographic characteristics of the sample were weighted to the control totals to ensure the sample more closely reflects the population of Burlington and the New North End. Only very basic demographic information (age, gender and ward of residence) was used to confirm the survey collected a representative sample of residents from the NNE and Burlington proper. Figure 4-1 summarizes the unweighted age distribution for all respondents.

FIGURE 4-1:UNWEIGHTED AGE DISTRIBUTION FOR ALL RESPONDENTS

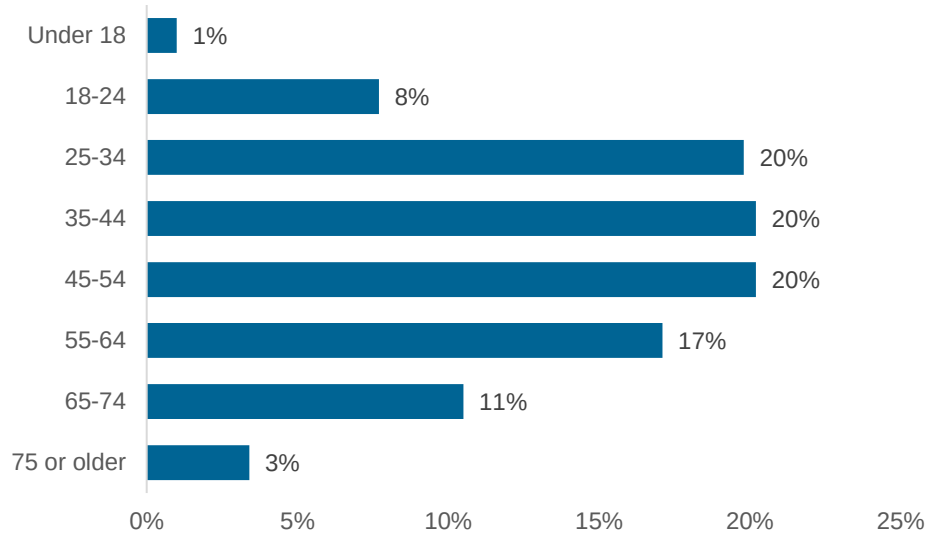


Table 4-4 shows the number of completed surveys by city ward. The NNE wards 4 and 7 contributed approximately 67% of all survey responses.

TABLE 4-4: WARD OF RESIDENCE

Ward #	Count	Percent
Ward 1	97	4%
Ward 2	90	3%
Ward 3	207	8%
Ward 4	1,055	39%
Ward 5	131	5%
Ward 6	100	4%
Ward 7	767	28%
Ward 8	44	2%
Outside Burlington	232	9%
Total	**2,723**	**100%**

SEGMENTS FOR REPORTING

Responses to the survey questions are presented for residents of the NNE, weighted by the age and gender characteristics of ZCTA 05408, and for All Respondents, weighted by the age and gender characteristics of Burlington's two combined ZCTAs (05408 and 05401). The NNE and All Respondent segments are not mutually exclusive; respondents who reside in Burlington wards 4 and 7 are included in both segments.

OPINION OF PILOT PROJECT

Respondents were asked to give their opinions about six of the main features of the North Avenue Pilot Project on a five-point scale from 'Very Dissatisfied' to 'Very Satisfied,' with a final

category for 'Not Sure'. For the following figures, the response categories have been combined to create a three-point scale, consisting of 'Dissatisfied' (which includes responses of 'Very Dissatisfied' and 'Dissatisfied'), 'Satisfied' (which includes responses of 'Very Satisfied' and 'Satisfied') and 'Neutral/Not Sure' (which includes responses of 'Neutral' and 'Not Sure').

Figure 4-2

FIGURE 4-2: PROJECT OPINION: 4-LANES RECONFIGURED TO 3-LANES

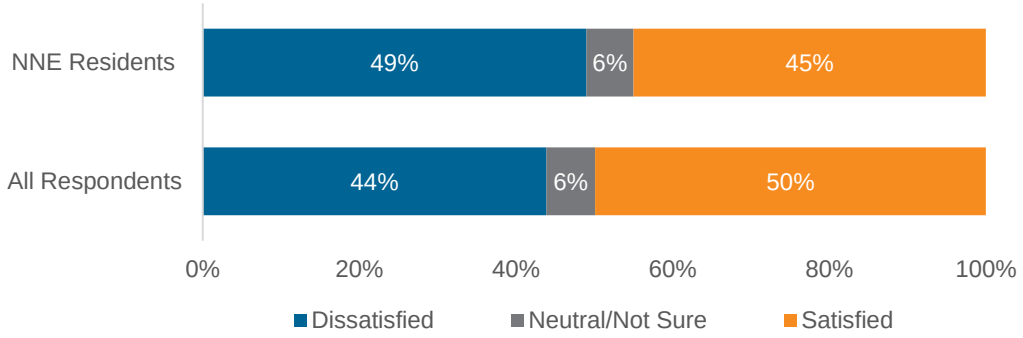


Figure 4-3 summarizes NNE Residents' and All Respondents' levels of satisfaction regarding bike lanes buffered from traffic by two lines of paint on North Avenue.

FIGURE 4-3: PROJECT OPINION: BIKE LANES BUFFERED FROM TRAFFIC BY TWO LINES OF PAINT

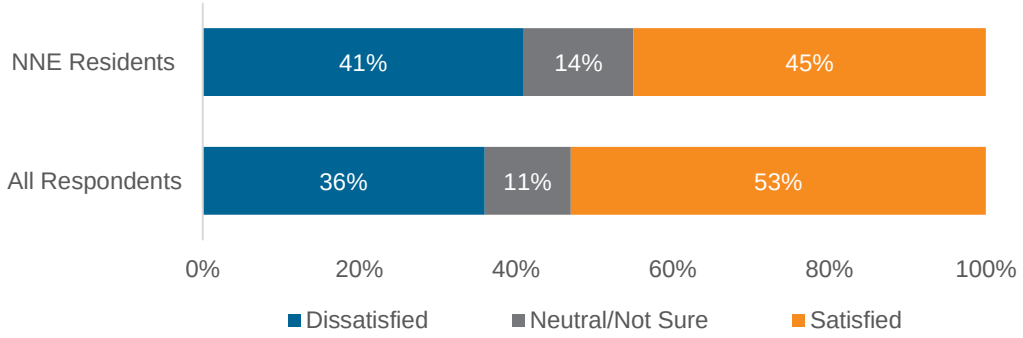


Figure 4-4 summarizes NNE Residents' and All Respondents' level of satisfaction regarding the bike lanes protected from traffic by low/high delineators on North Avenue.

FIGURE 4-4: PROJECT OPINION: BIKE LANES PROTECTED FROM TRAFFIC BY LOW/HIGH DELINEATORS

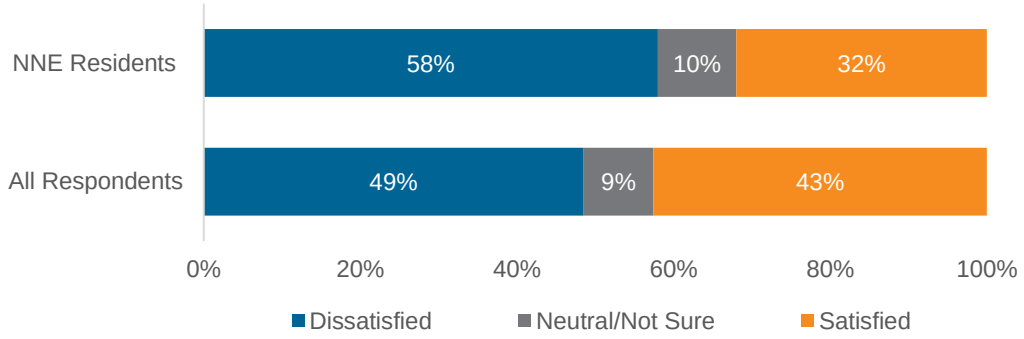


Figure 4-5 summarizes NNE Residents' and All Respondents' levels of satisfaction regarding the intersection and signal modifications on North Avenue and VT 127.

FIGURE 4-5: PROJECT OPINION: INTERSECTION MODIFICATIONS AT NORTH AVENUE AND VT 127

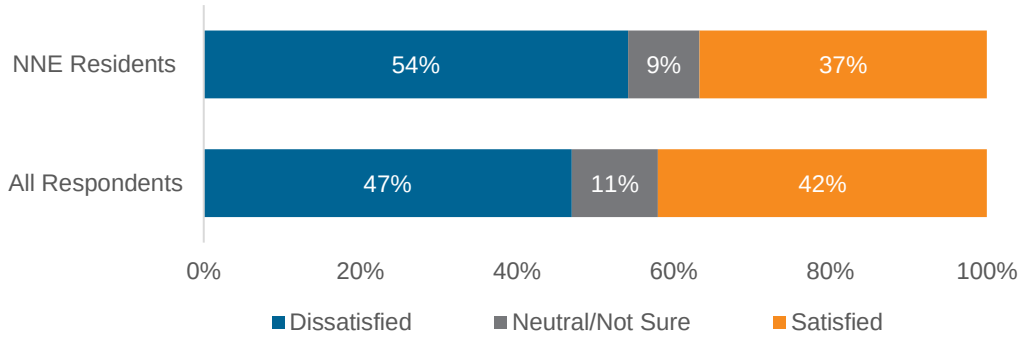


Figure 4-6 summarizes NNE Residents' and All Respondents' levels of satisfaction regarding the removal of on-street parking spaces between Shore Road and Plattsburg Avenue.

FIGURE 4-6: PROJECT OPINION: REMOVAL OF ON-STREET PARKING BETWEEN SHORE ROAD AND PLATTSBURG AVENUE

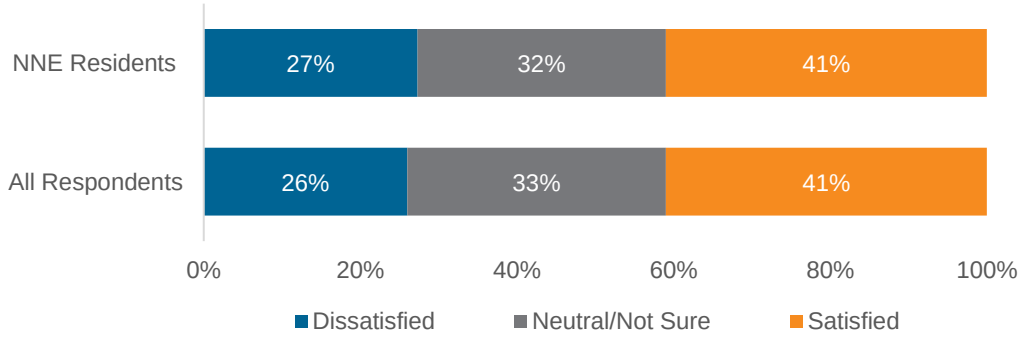
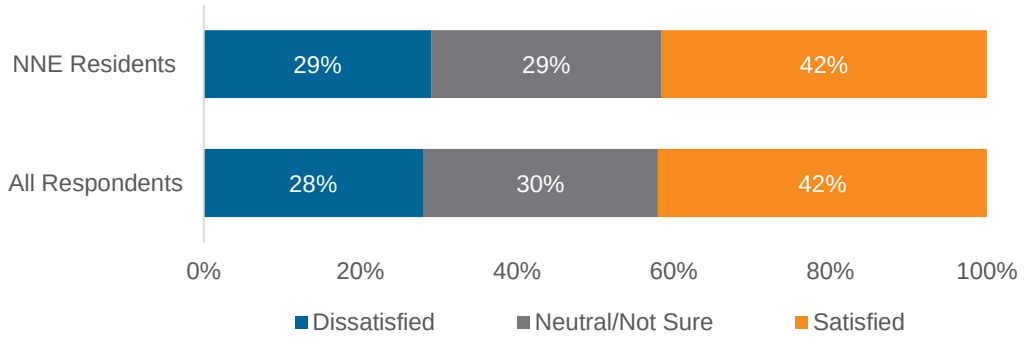


Figure 4-7 summarizes NNE Residents' and All Respondents' levels of satisfaction regarding the removal of on-street parking between Institute Road and VT 127.

FIGURE 4-7: PROJECT OPINION: REMOVAL OF ON-STREET PARKING BETWEEN INSTITUTE ROAD AND VT 127



MODE USE ON NORTH AVENUE

Table 4-5 shows the distribution of different modes respondents reported to have used in the past thirty days to travel on North Avenue, for both NNE Residents and All Respondents. The number of times each mode was selected adds up to more than the total number of respondents in either segment because each respondent could select more than one mode.

TABLE 4-5: MODE USE ON NORTH AVENUE (SELECT ALL THAT APPLY)

Mode	NNE Residents		All Respondents	
	Count	Percent of Respondents	Count	Percent of Respondents
Car	1,813	100%	2,614	96%
Bike	734	40%	1,233	45%
Walk/Run	787	43%	1,011	37%
Bus	176	10%	250	9%
No recent trips	1	0%	11	0%

SAFETY PERCEPTION

Respondents indicated how their perception of using each mode has changed since the North Avenue Pilot Project started in June 2016.

Figure 4-8 shows how safety perceptions for the 1,813 NNE Residents and the 2,614 total respondents who have recently driven on North Avenue have changed since the Pilot Project started.

FIGURE 4-8: SAFETY CHANGES: DRIVING

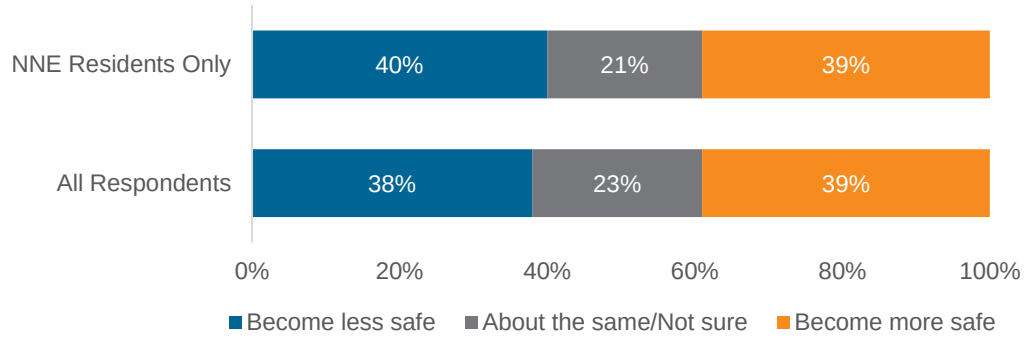


Figure 4-9 shows how safety perceptions for the 734 NNE Residents and the 1,233 total respondents who have recently used a bike on North Avenue have changed since the Pilot Project started.

FIGURE 4-9: SAFETY CHANGES: BIKING

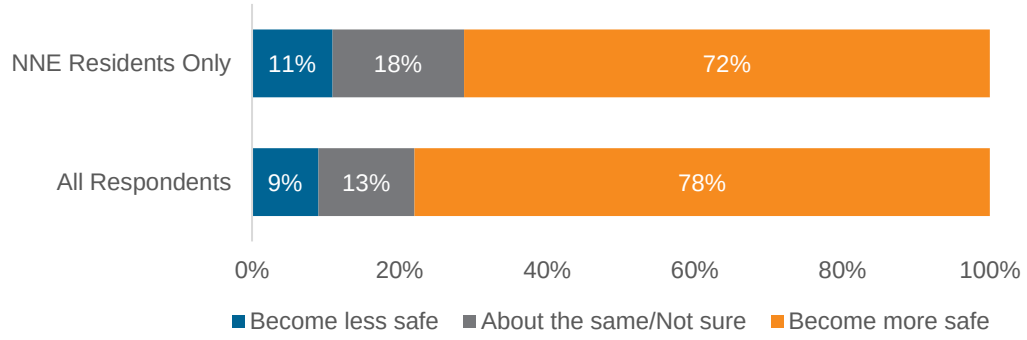


Figure 4-10 shows how safety perceptions for the 787 NNE Residents and the 1,011 total respondents who have recently walked or run along North Avenue have changed since the Pilot Project started.

FIGURE 4-10: SAFETY CHANGES: WALKING/RUNNING

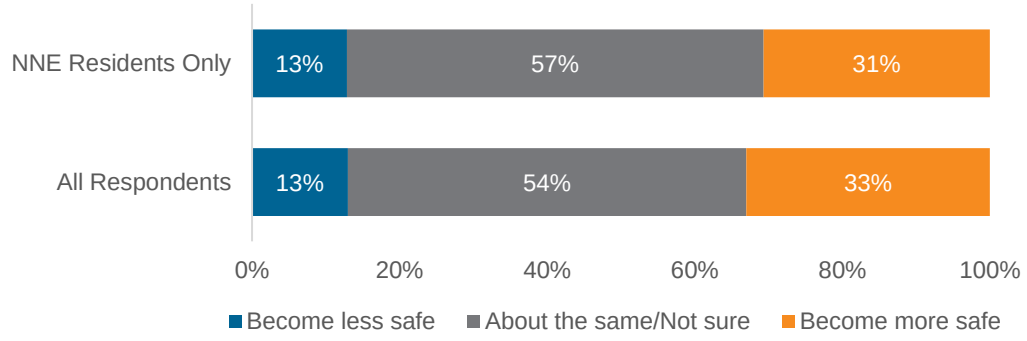
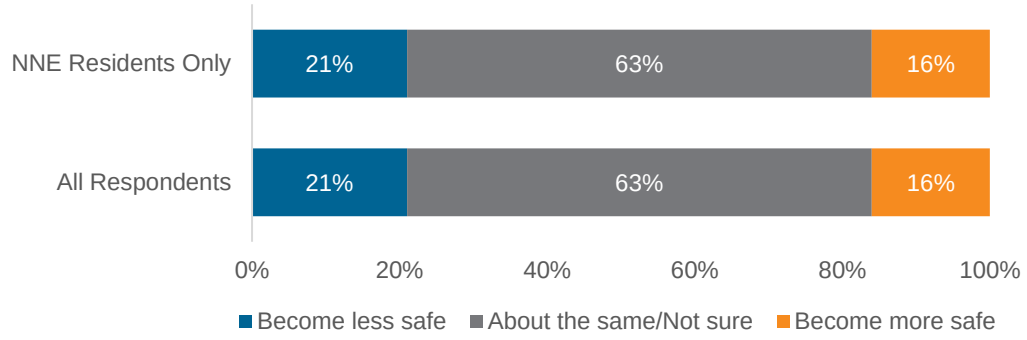


Figure 4-11 shows how safety perceptions for the 176 NNE Residents and the 250 total respondents who have recently used transit on North Avenue have changed since the Pilot Project started.

FIGURE 4-11: SAFETY CHANGES: BUS



MODE USE AND SATISFACTION

For each mode they selected, respondents were asked a series of follow-up questions to determine their levels of satisfaction across different user experiences when traveling on North Avenue since the Pilot Project began.

Figure 4-12 shows how satisfied the 1,813 NNE Residents who have recently driven on North Avenue are with various driving experiences since the Pilot Project started.

FIGURE 4-12: DRIVER SATISFACTION: NNE RESIDENTS

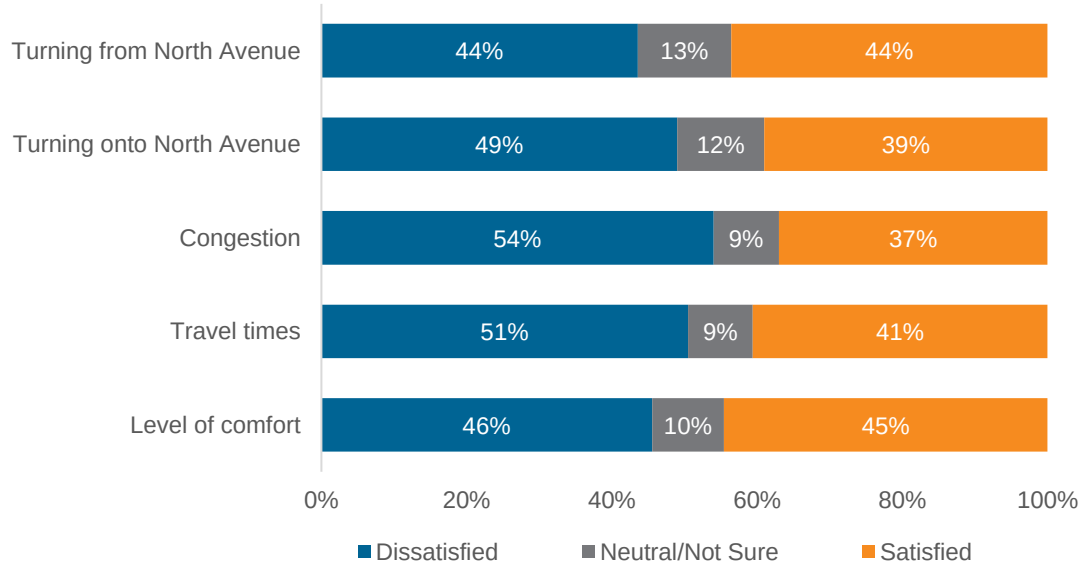


Figure 4-13 shows how satisfied the 2,614 respondents from the entire sample who have recently driven on North Avenue are with various driving experiences since the Pilot Project started.

FIGURE 4-13: DRIVER SATISFACTION: ALL RESPONDENTS

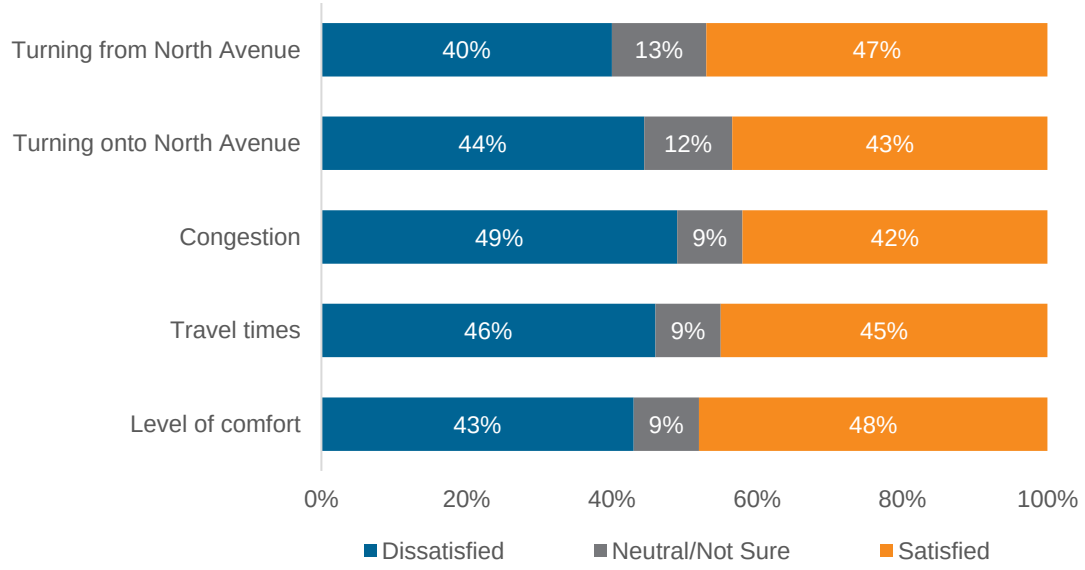


Figure 4-14 shows how satisfied the 734 NNE Residents who have recently bicycled on North Avenue are with various bicycling experiences since the Pilot Project started.

FIGURE 4-14: BICYCLE SATISFACTION: NNE RESIDENTS

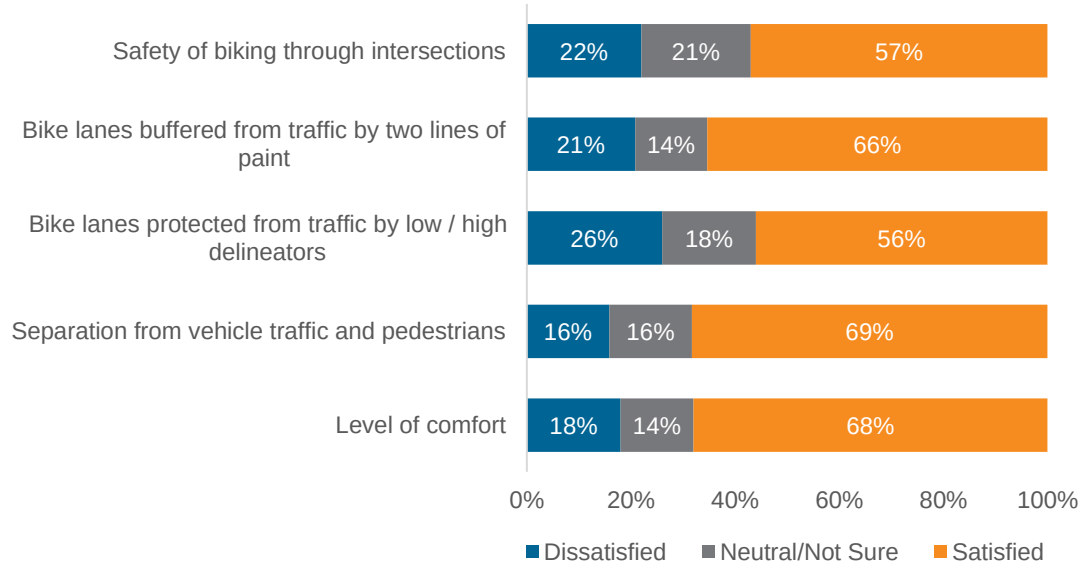


Figure 4-15 shows how satisfied the 1,233 respondents from the entire sample who have recently bicycled on North Avenue are with various bicycling experiences since the Pilot Project started.

FIGURE 4-15: BICYCLE SATISFACTION: ALL RESPONDENTS

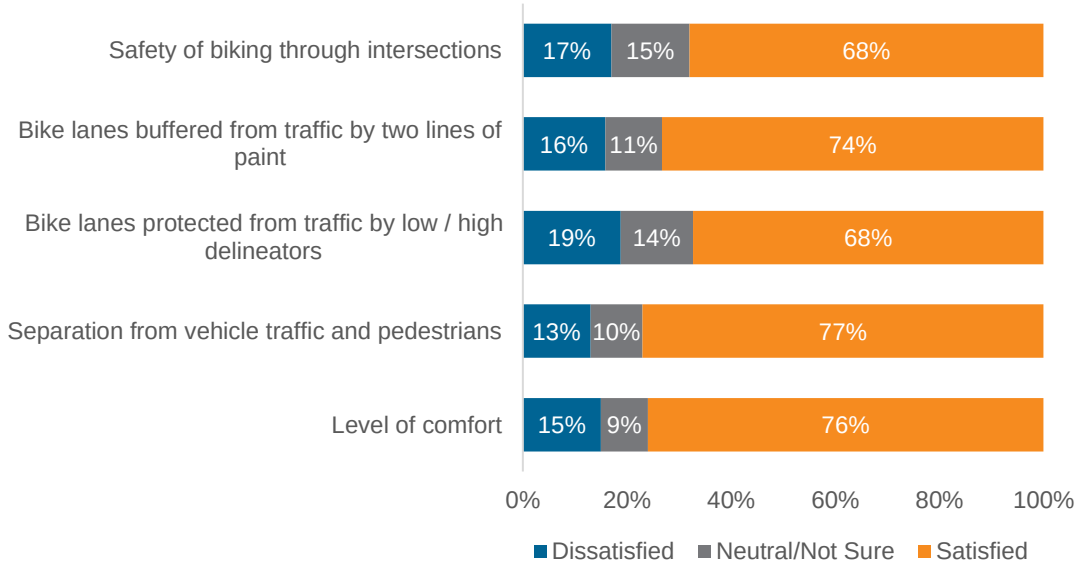


Figure 4-16 shows how satisfied the 787 NNE Residents who have recently walked or run along North Avenue are with various pedestrian experiences since the Pilot Project started.

FIGURE 4-16: PEDESTRIAN SATISFACTION: NNE RESIDENTS

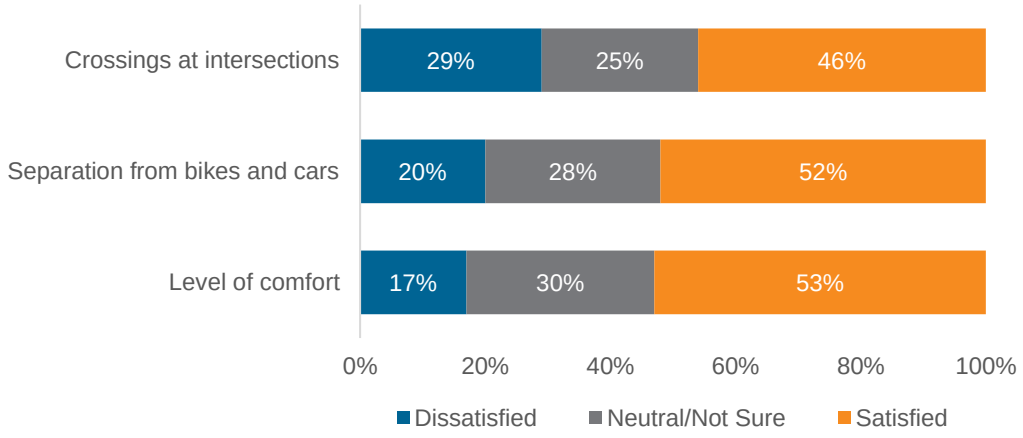


Figure 4-17 shows how satisfied the 1,011 respondents from the entire sample who have recently walked or run along North Avenue are with various pedestrian experiences since the Pilot Project started.

FIGURE 4-17: PEDESTRIAN SATISFACTION: ALL RESPONDENTS

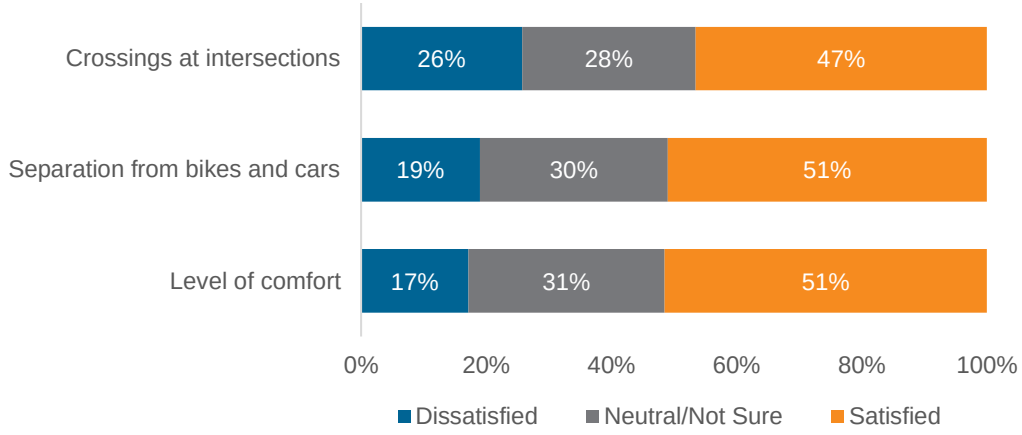


Figure 4-18 shows how satisfied the 176 NNE Residents who have recently used a bus on North Avenue are with various transit experiences since the Pilot Project started.

FIGURE 4-18: BUS SATISFACTION: NNE RESIDENTS

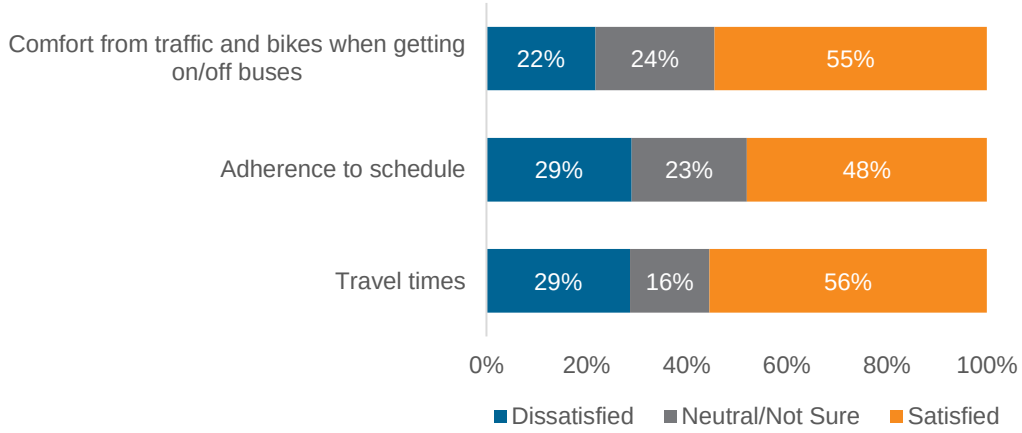
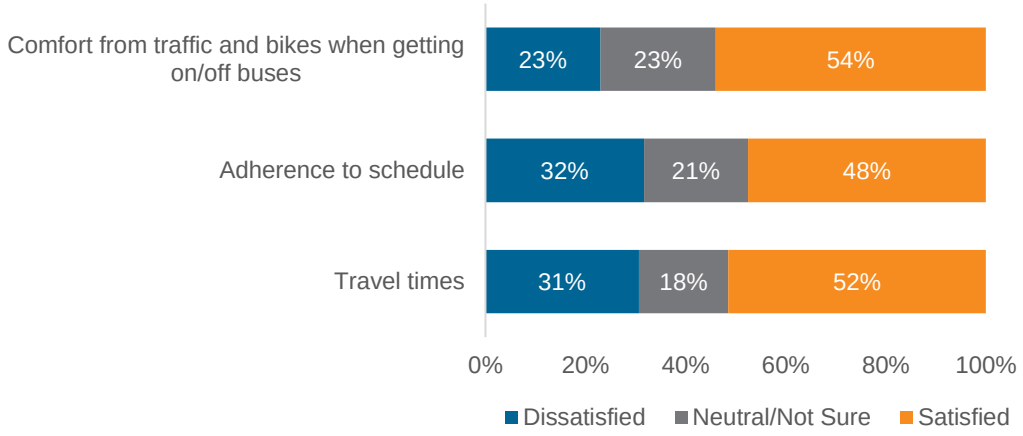


Figure 4-19 shows how satisfied the 250 respondents from the entire sample who have recently used a bus on North Avenue are with various transit experiences since the Pilot Project started.

FIGURE 4-19: BUS SATISFACTION: ALL RESPONDENTS



For all modes that respondents selected, they were asked to indicate the number of times they had used each in the past month to travel the North Avenue corridor. Figure 4-20 and Figure 4-21 show the number of times per month NNE Residents and All Respondents use different modes of travel on North Avenue, respectively.

FIGURE 4-20: FREQUENCY OF MODE USE FOR NNE RESIDENTS

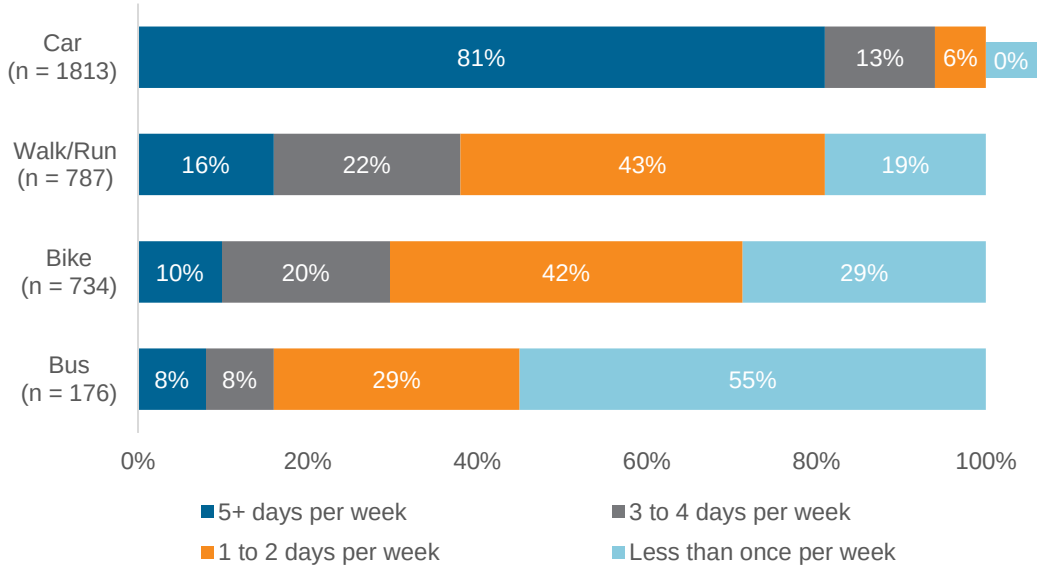
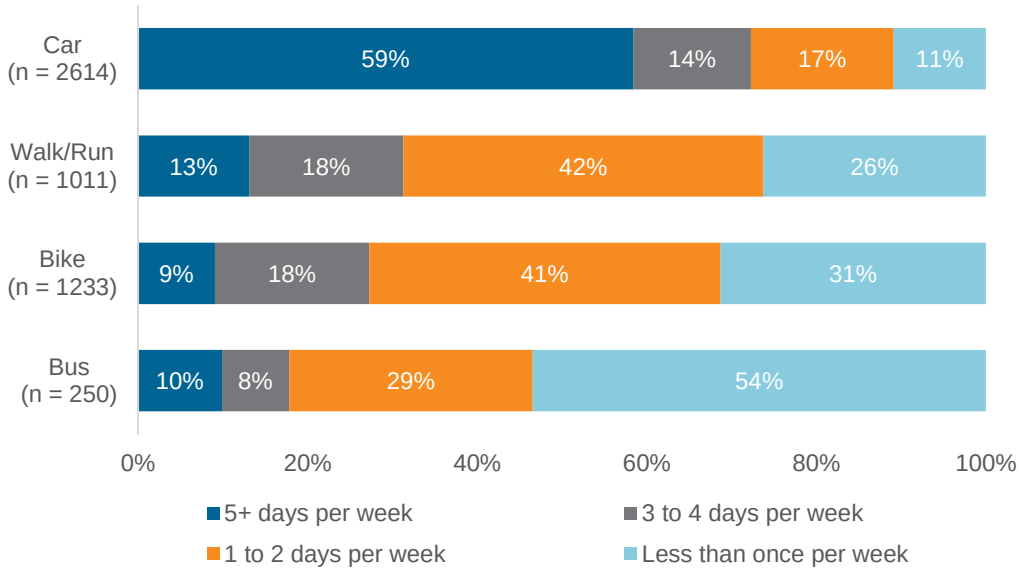


FIGURE 4-21: FREQUENCY OF MODE USE FOR ALL RESPONDENTS



5.0 SUMMARY

Resource Systems Group (RSG) was retained by the Chittenden County Regional Planning Commission (CCRPC) to conduct a comprehensive survey of users and residents along the North Avenue corridor that would be used to inform future decision-making around the North Avenue reconfiguration. The Burlington Department of Public Works (DPW) implemented the North Avenue Pilot Project in July of 2016, making significant changes to the North Avenue corridor between Washington Street and Plattsburg Avenue. Changes included reducing the number of vehicle lanes from 4 to 3, adding buffered or protected bicycle lanes as corridor geometry allows, and changes to intersection geometries and signalization at various intersections along the corridor.

The North Avenue pilot project opinion survey was distributed in the fall of 2016, with 2,763 total responses and 1,853 responses from the NNE collected between September 13th and October 3rd. This sample size allowed for a margin of error of +/- 2% at the 95% confidence interval. The survey data were weighted to reflect the joint distribution of gender and age of residents in the New North End of Burlington, as well as residents in the City as a whole. The survey data and results are one input that the city will consider when evaluating the Pilot Project and future planning in the North Avenue corridor