

Chittenden County Regional Planning Commission & City of Burlington

WINOOSKI AVENUE TRANSPORTATION STUDY REPORT

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Disclaimer

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CONTENTS

EXECUTIVE SUMMARY	IV
CORRIDOR VISION	IV
VALUE OF THE COMMUNITY	V
PROCESS	V
PREFERRED ALTERNATIVE	V
1.0 INTRODUCTION	1
1.1 WHAT IS THIS STUDY?	1
1.2 WHY ARE WE STUDYING WINOOSKI AVENUE?	2
1.3 STUDY OUTCOMES	2
1.4 CORRIDOR VISION	2
1.5 INTEGRATION OF MODES	4
1.6 PROJECT GOVERNANCE	4
2.0 LITERATURE REVIEW	5
2.1 STUDIES	5
2.2 PLANS	6
3.0 EXISTING CONDITIONS	9
3.1 LAND USE	9
HOUSING AND EMPLOYMENT	10

3.2 MULTIMODAL INFRASTRUCTURE	12
WALKING	13
BICYCLING	16
BIKESHARING	19
DRIVING	20
CARSHARING	24
DELIVERY VEHICLES	24
SHARED MOBILITY	25
TAKING TRANSIT	26
3.3 SAFETY	30
CRASH HISTORY	30
SPEEDS	34
3.4 PARKING ANALYSIS	35
ON-STREET PARKING	35
OFF-STREET PARKING	36
EXISTING DEMAND VS. SUPPLY	36
SMART USE	39
4.0 PUBLIC ENGAGEMENT	40
4.1 OVERVIEW	40

4.2 PROJECT ADVISORY COMMITTEE.....	40
4.3 PUBLIC MEETINGS.....	41
PUBLIC MEETING 1.....	41
PUBLIC MEETING 2.....	42
PUBLIC MEETING 3.....	43
4.4 STAKEHOLDER INTERVIEWS.....	43
VEHICLE PARKING.....	45
BICYCLE FACILITIES AND BICYCLE PARKING.....	45
PEDESTRIAN AMENITIES.....	45
ONE-WAY VERSUS TWO-WAY TRAFFIC PATTERN.....	45
TRANSIT.....	45
MAIN STREET TO PEARL STREET.....	46
OPEN STREETS BTV SUMMARY.....	46
OLD NORTH END BUSINESS SUMMARY.....	47
4.5 CONTINUOUS COMMUNICATION.....	47
4.6 SPECIFIC CHALLENGES WITHIN THE CORRIDOR.....	48
5.0 PROJECT ALTERNATIVES.....	50
5.1 OVERVIEW.....	50
5.2 INTERSECTIONS AND SEGMENTS.....	50
ROUNDBABOUTS.....	50
MINI-ROUNDBABOUTS.....	51
ROUNDBABOUTS AND BICYCLE LANES.....	51
PUTTING IT TOGETHER.....	51
5.3 SCHEMATICS.....	52
5.4 EVALUATING THE ALTERNATIVES.....	56
5.5 RECOMMENDED ALTERNATIVE.....	58
5.6 PREFERRED ALTERNATIVE.....	59
6.0 IMPLEMENTING THE PLAN.....	60
6.1 PREFERRED ALTERNATIVES SELECTION.....	60
6.2 PREFERRED ALTERNATIVES SUMMARY.....	60

INTERIM IMPROVEMENTS.....	60
SHORTER-TERM IMPROVEMENTS.....	61
LONGER-TERM IMPROVEMENTS.....	61
6.3 NORTHERN SEGMENT: RIVERSIDE AVENUE TO PEARL STREET.....	62
RIVERSIDE AVENUE TO UNION STREET/DECATUR STREET.....	62
PEARL STREET TO UNION STREET/DECATUR STREET.....	63
NORTH STREET INTERSECTION.....	64
UNION STREET INTERSECTION.....	65
PEARL STREET INTERSECTION.....	66
6.4 DOWNTOWN SEGMENT: PEARL STREET TO MAIN STREET.....	67
BANK STREET INTERSECTION/CITY MARKET DRIVEWAY.....	68
MAIN STREET INTERSECTION.....	68
6.5 SOUTHERN SEGMENT: MAIN STREET TO SAINT PAUL/HOWARD.....	69
MAIN STREET TO KING STREET.....	69
KING STREET TO MAPLE STREET.....	70
6.6 PROJECT COSTS.....	70
SHORTER TERM.....	70
LONGER TERM.....	70
6.7 IMPLEMENTATION TIMELINE.....	71
NORTHERN SEGMENT.....	71
DOWNTOWN SEGMENT.....	72
SOUTHERN SEGMENT.....	73
APPENDIX A. PROJECT ADVISORY COMMITTEE.....	A-1
APPENDIX B. PUBLIC COMMENTS.....	B-1
APPENDIX C. ALTERNATIVES EVALUATION.....	C-1
APPENDIX D. TRAFFIC ANALYSIS.....	D-1
APPENDIX E. OPINION OF PROBABLE COST.....	E-1
APPENDIX F. CITY COUNCIL RESOLUTION.....	F-1



LIST OF FIGURES

FIGURE 1: STUDY AREA	1
FIGURE 2: BURLINGTON'S MODE SHARE—PAST, PRESENT, AND FUTURE GOAL	3
FIGURE 3: PROJECT TEAM STRUCTURE	4
FIGURE 4: CITY ZONING DISTRICTS	9
FIGURE 5: HOUSING DENSITY AND LOCATIONS (2015)	10
FIGURE 6: EMPLOYMENT DENSITY AND LOCATIONS	11
FIGURE 7: CURB CUT (DRIVEWAY) DENSITY	11
FIGURE 8: CROSS-SECTION OVERVIEW	12
FIGURE 9: HOURLY PEDESTRIAN VOLUMES AT MAJOR INTERSECTIONS	14
FIGURE 10: EXISTING PEDESTRIAN QUALITY OF SERVICE ALONG WINOOSKI AVENUE	15
FIGURE 11: BICYCLE LTS USING CITY CRITERIA	18
FIGURE 12: GREENRIDE BIKESHARE HUBS IN BURLINGTON (PHASE 1)	19
FIGURE 13: TRAVEL PATTERNS OF VEHICLES ACCESSING WINOOSKI AVENUE	20
FIGURE 14: DAILY TRAFFIC VOLUMES (2016)	21
FIGURE 15: INTERSECTION LOS AND QUEUES IN AM PEAK HOUR	22
FIGURE 16: INTERSECTION LOS AND QUEUES IN PM PEAK HOUR	22
FIGURE 17: CARSHARE HUBS	24
FIGURE 18: GMT LOCAL BUS ROUTES	27
FIGURE 19: GMT BUS STOP DEMAND (2017)	27
FIGURE 20: HCLS	30
FIGURE 21: CRASH LOCATION TYPES ALONG WINOOSKI AVENUE (NOT INCLUDING PARKING LOTS)	31
FIGURE 22: HEAT MAP OF ALL CRASHES ALONG WINOOSKI AVENUE	32
FIGURE 23: HEAT MAP OF BICYCLE AND PEDESTRIAN CRASHES ALONG WINOOSKI AVENUE	32
FIGURE 24: COLLISION TYPES AT INTERSECTIONS	33
FIGURE 25: INJURIES AT INTERSECTIONS, BY MODE	33
FIGURE 26: SPEED STUDY OBSERVATIONS	34
FIGURE 27: ON-STREET PARKING REGULATIONS	36
FIGURE 28: OBSERVED ON-STREET PARKING OCCUPANCY	37
FIGURE 29: CCRPC SPECTRUM OF PARTICIPATION	40
FIGURE 30: PROJECT WEBSITE	47
FIGURE 31: WIKIMAPPING EXISTING CONDITIONS WEB SURVEY	48
FIGURE 32: CHALLENGES EXPERIENCED ON THE STUDY CORRIDOR	49
FIGURE 33: MAIN ST. ROUNDABOUT SKETCH—130' DIAMETER	51
FIGURE 34: SCHEMATIC—ALTERNATIVE 1	53
FIGURE 35: SCHEMATIC—ALTERNATIVE 2	54
FIGURE 36: SCHEMATIC—ALTERNATIVE 3	55
FIGURE 37: CORRIDOR EVALUATION SCORES	57
FIGURE 38: EVALUATION PROCESS	58
FIGURE 39: NORTH STREET INTERSECTION—SHORTER TERM	64
FIGURE 40: NORTH STREET INTERSECTION—LONGER TERM	64
FIGURE 41: UNION STREET INTERSECTION—SHORTER TERM	65
FIGURE 42: UNION STREET INTERSECTION—LONGER TERM	65

FIGURE 43: PEARL STREET LOADING ZONE POSSIBILITY	66
FIGURE 44: PEARL STREET INTERSECTION—SHORTER TERM	66
FIGURE 45: PEARL STREET INTERSECTION—LONGER TERM	66
FIGURE 46: MAIN STREET INTERSECTION—SHORTER TERM	68

LIST OF TABLES

TABLE 1: CONCEPT BUS STOP AMENITIES	28
TABLE 2: BUS STOP AMENITIES ON WINOOSKI AVENUE	28
TABLE 3: PARKING COUNT DATES	37
TABLE 4: ON-STREET VEHICLE PARKING OCCUPANCY (PERCENTAGE OF SPACES OCCUPIED)	38
TABLE 5: ALT 1 (BICYCLE LANES) BOARD	42
TABLE 6: ALT 2 (PROTECTED BICYCLE LANES) BOARD	42
TABLE 7: ALT 3 (TWO-WAY PROTECTED BICYCLE LANES) BOARD	43
TABLE 8: EVALUATION CRITERIA	56

LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
CCRPC	Chittenden Regional Planning Commission
GMT	Green Mountain Transit
HCL	High-Crash Location
LOS	Level of Service
LTS	Level of Traffic Stress
PAC	Project Advisory Committee
PMP	Parking Management Plan
SSTA	Special Service Transportation Agency
TAZ	Transportation Analysis Zone



EXECUTIVE SUMMARY

The Winooski Avenue Transportation Study has been conducted by the City of Burlington in partnership with the Chittenden County Regional Planning Commission. The study supports the City of Burlington's efforts to create multimodal Complete Streets throughout the City. The two-mile corridor from Riverside Avenue at the north end to Howard Street/Saint Paul Street to the south runs through the center of Burlington. It provides mobility to and from the City and access to homes, shopping, and employment.

Winooski Avenue is a gateway to the City. It connects diverse land uses along the corridor and those beyond. It contains 7 of the 20 priority intersections for safety improvements identified in planBTV Walk Bike. Sixteen percent of bicycle crashes and 17% of pedestrian crashes in the City in the past five years were along Winooski Avenue. The corridor also includes six Vermont Agency of Transportation High-Crash Locations.

This study aims to identify ways to address safety challenges, maintain a high level of multimodal mobility, and support community and economic development aspirations as set forth by the planBTV comprehensive plan for the City of Burlington.

CORRIDOR VISION

The vision developed during the study process guided the development and selection of a preferred alternative. The vision included the following elements:

- Traveling along and across Winooski Avenue will be safe, inviting, and convenient for people of all ages and abilities using any mode of transportation.
- Walking and bicycling will be viable and enjoyable ways to travel this corridor. Improvements will encourage active travel and alternatives to personal vehicle use.
- Businesses along and near Winooski Avenue will flourish with an activated streetscape and convenient access.
- The mobility and parking needs will be balanced for property owners, residents, businesses, and the greater transportation system.
- The street can adapt to changes to the transportation system and land use.



VALUE OF THE COMMUNITY

Public collaboration was integral throughout the study. Critical to the project's success was leveraging the power of a Project Advisory Committee (PAC). The PAC comprised local neighborhood planning assemblies, community organizations, elected City Council members, and local advocates and other experts to advise the project at key junctures. Their seven meetings were open to the public and helped engage a wide cross-section of the population. Three public meetings provided open forums for comments, insights, and the sharing of perspectives. The project team also connected directly through stakeholder interviews, drop-in opportunities at local businesses, library displays, and email communications.

Public feedback guided the development of the alternatives, the evaluation criteria, and ultimately the selection of a preferred alternative. Throughout the project and up through the final presentations to the Burlington City Council, there was a resounding resolve by the community to find solutions to this difficult and complex corridor. This report summarizes the existing challenges, the array of solutions investigated, and a preferred path forward.

PROCESS

The study evaluated existing conditions in the corridor to inform what improvements the alternatives should include. An iterative alternative development process occurred over several Advisory Committees and two public meetings. Extensive public engagement through focused interviews, web surveys, in-person discussions, email, and meetings provided additional guidance.

A preferred alternative emerged out of this process with a timeline and an implementation roadmap.

PREFERRED ALTERNATIVE

Interim Improvements

1. A comprehensive Parking Management Plan (PMP) is recommended to identify strategies for managing parking in the Pearl Street to Riverside Avenue study area. No changes to on-street parking will be made until agreement on the outcomes of the PMP.
2. Improve bicycle wayfinding between the southbound Winooski Avenue bicycle lane and the northbound Union Street bicycle lane.
3. Advance pilot projects or demonstrations to test mini-roundabouts on North Winooski Avenue. Explore other strategies for improving multimodal safety and performance at key intersections along the corridor.
4. Address commercial loading and driveway queuing on Winooski Avenue in the downtown.
5. Evaluate public safety impacts, traffic operations, driveway access, Marketplace Garage circulation, roadway dimensions, and VTTrans approvals for improvements that can reduce turning conflicts and prioritize protection for people walking and biking in the downtown.

Shorter-Term Improvements (2020–2021)

Northern Segment: Retain current vehicle pattern (two way north of Union Street/Decatur Street and one way southbound to Pearl Street). Stripe on-street bicycle lanes in both directions between Pearl Street and Riverside Avenue. On-street vehicle parking on the east side would be removed between Pearl Street and North Street and between Union Street/Decatur Street and Riverside Avenue. Implement the mini-roundabouts. Consider additional improvements for pedestrian safety at the intersections of Archibald Street and Riverside Avenue.

Downtown Segment: Restripe the roadway for one southbound vehicle lane, one northbound vehicle lane, a center turning lane, northbound and southbound bicycle lanes, and protection for pedestrians and bicyclists, when possible.

Southern Segment: Incorporate continuous bicycle lanes in both directions and remove east-side parking between King Street and Main Street.

Corridor-wide: Improve high-priority transit stops and pedestrian crossings.

Longer-Term Improvements (Beyond 2021)

Modify roadway for two-way traffic for all modes north of Pearl Street; add protected bicycle lanes, where feasible; bury utilities; incorporate stormwater management; improve transit stops; add street trees, benches, and other pedestrian amenities; and incorporate additional on-street parking, where feasible.



1.0 INTRODUCTION

The Winooski Avenue Transportation Study is a transportation corridor study of Winooski Avenue. The study supports the City of Burlington's efforts to create multimodal Complete Streets routes throughout the City.

As shown in Figure 1, Winooski Avenue stretches nearly two miles from Riverside Avenue in the Old North End to the Howard Street and St. Paul Street intersection in the South End. The corridor serves as the principal north-south connection through the heart of the City. It provides both access and mobility for residents, employees, visitors, and business users.

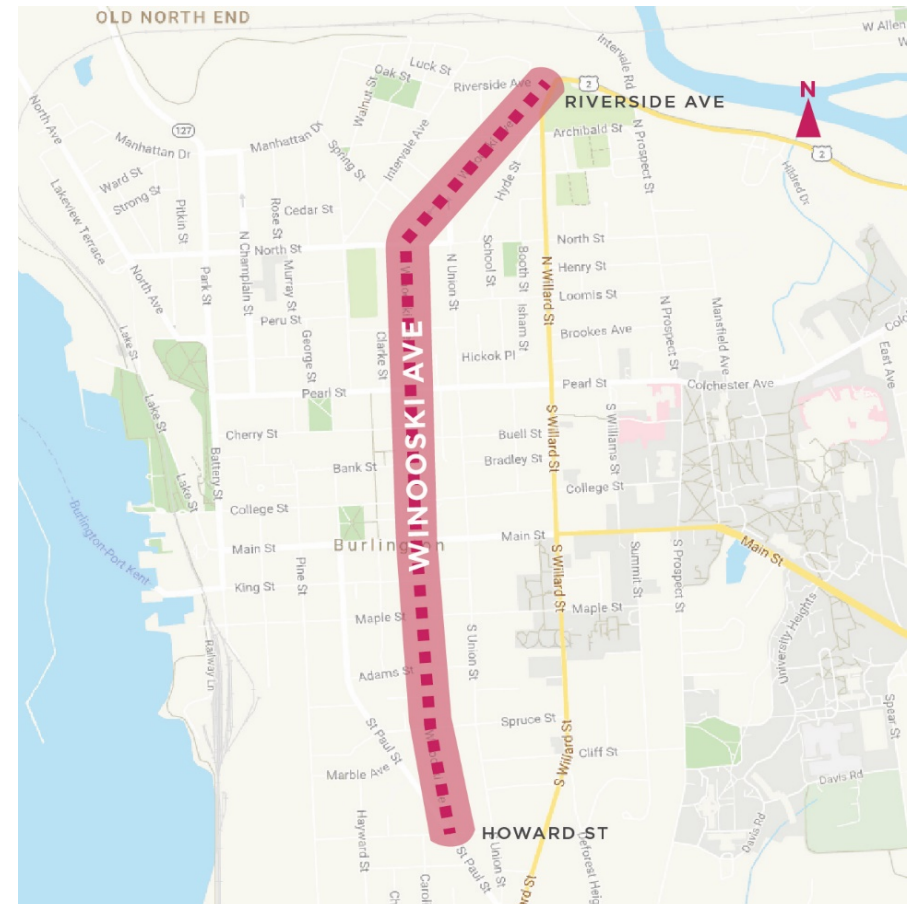
This study follows an earlier technical analysis of Winooski Avenue and Union Street that provided understanding of the vehicular traffic operational implications of five alternative traffic reconfigurations.¹ Of the five reconfigurations analyzed, Complete Streets improvements that maintain two-way vehicle travel while better serving all modes on Winooski Avenue would be the least disruptive to existing vehicle traffic in the downtown study area.

1.1 WHAT IS THIS STUDY?

This study is a comprehensive transportation study of the entire Winooski Avenue corridor. The study supports multimodal improvement strategies that address safety, capacity, and connectivity.

¹ Winooski Avenue Circulation Study. June 2017. <https://studiesandreports.ccrpcvt.org/wp->

FIGURE 1: STUDY AREA



“Complete Streets are corridors that provide safe, inviting, and convenient travel for all users of all ages and abilities—including motorists, pedestrians, bicyclists, and public transportation riders.”

—City of Burlington Public Works Complete Streets

<content/uploads/2017/07/Winooski-Avenue-Circulation-Study-Final-Report.pdf>

1.2 WHY ARE WE STUDYING WINOOSKI AVENUE?

Winooski Avenue is an important and heavily used corridor that features diverse land uses. Despite its importance, a comprehensive corridor study has not yet been conducted.

Although the corridor functions as a geographic gateway to the City, it does not feel that way. Its multimodal facilities are inconsistent and not intuitive to use.

Moreover, 7 of the 20 priority intersections identified in planBTV Walk Bike are along Winooski Avenue. And 16% of bicycle crashes and 17% of pedestrian crashes in the City in the past five years were along Winooski Avenue. Six VTrans High-Crash Locations (HCLs) also occur along the corridor—four intersections and two segments.

Earlier transportation plans identified that reconnecting Pine Street and St. Paul, both currently in design, would create additional opportunities for changes to Winooski Avenue.

In addition, planBTV Walk Bike called for protected bicycle lane(s) the entire length of the corridor in its five-year action plan. Despite planBTV's recommendation, a course of action and a holistic understanding of how to approach that concept have not yet been investigated.

1.3 STUDY OUTCOMES

This study seeks to identify how Winooski Avenue can become a Complete Street, providing “safe, inviting, and convenient travel for all users of all ages and abilities.” (Burlington Complete Streets Guidance)

- Study the feasibility of and implementation options for low-stress bicycle facilities along the entire corridor in the long term. (planBTV Walk Bike Master Plan, p. 82)
- Design Winooski Avenue as a self-enforcing 25-mph street. (planBTV Walk Bike Master Plan, p. 74)
- Study alternatives and make recommendations to improve safety at the seven priority intersections along Winooski Avenue identified in planBTV Walk Bike. (planBTV Walk Bike Master Plan, pp. 76-79)

This study also seeks to evaluate Winooski Avenue's relationship with parallel streets and the street network. It undertakes such an evaluation in terms of integration of transportation modes, connectivity, capacity, and safety. The goal is to develop alternatives that support improvement to these elements to the extent possible.

1.4 CORRIDOR VISION

The Project Advisory Committee (PAC) identified this vision for the corridor based on input from the community:

- Traveling along and across Winooski Avenue will be **safe, inviting, and convenient** for people of all ages and abilities using any mode of transportation.
- **Walking and bicycling will be viable and enjoyable** ways to travel this corridor. Improvements will encourage active travel and alternatives to personal vehicle use.
- **Businesses along and near Winooski Avenue will flourish** with an activated streetscape and convenient access.



- The **mobility and parking needs will be balanced** for property owners, residents, businesses, and the greater transportation system.
- The street can **adapt** to changes to the transportation system and land use.

The City of Burlington's planBTV Walk Bike Master Plan is an instrumental document that has set a bold and visionary mode share target for the City. Changing travel behavior is challenging and requires significant effort sustained over time.

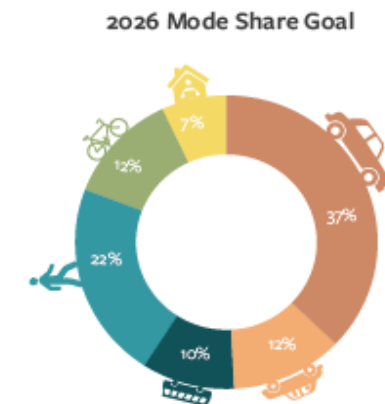
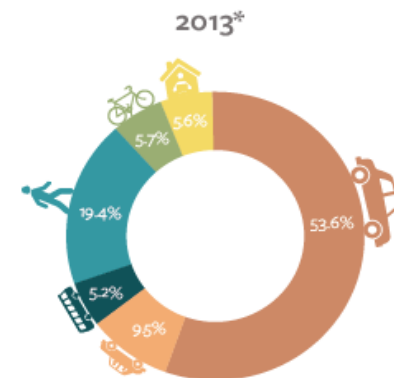
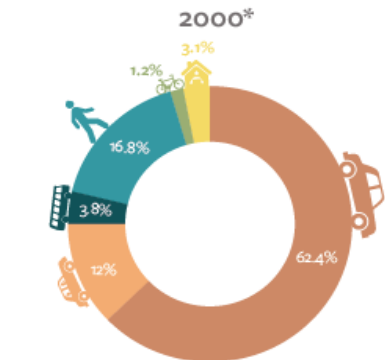
The planBTV Walk Bike Master Plan includes several actions that would bring about this change. Winooski Avenue is a focal point of these actions. To that end, Burlington has made significant investments in walking and bicycling infrastructure since 2000, with results evident in the following documented changes in mode share (Figure 2):

- In 2000, car modes were nearly 75%, walking nearly 17%, bus riding nearly 4%, and bicycling just over 1%.
- As of 2013, car modes were approximately 64%, bus riding at 5.2%, and active modes at 25%.
- The future combined mode share goals in 2026 for bicycling, walking, and bus riding are nearly double those reported in 2000.

To help the City meet its stated mode share goals, the Winooski Avenue Transportation Study must identify the challenges and find solutions to encourage more trips to be made by noncar modes.

FIGURE 2: BURLINGTON'S MODE SHARE—PAST, PRESENT, AND FUTURE GOAL

Journey to work



Source: planBTV Walk Bike

1.5 INTEGRATION OF MODES

Both the planBTV Walk Bike Master Plan and the Regional Active Transportation Plan identified integration of modes as a goal. The following points identify practical applications and meanings behind this concept:

- Safety for one mode supports safety for all modes.
- Intersections are where all modes meet and cross each other.
- Higher vehicle volumes negatively affect comfort and safety of other users, namely pedestrians and bicyclists.
- A good transit system needs good pedestrian infrastructure. Beyond accessible sidewalks in good condition, this means lighting, shelters, and benches.
- Bikeshare and carshare locations near transit support a systematic option to driving. Placing bus stops, bikeshare hubs, and carshare hubs close to each other allows each mode to support the use of other modes.
- Bicyclists and drivers benefit from quality pavement conditions. Both modes have safety risks associated with ruts, poor lane markings, and insufficient drainage.
- Using the public right-of-way for access and enjoyment of adjacent land is often at odds with using the space to facilitate through traffic. Integration of modes builds a platform for discussing and identifying solutions.
- Certain types of on-street parking spaces could be shared with each other. One example is sharing loading zones with ride-hailing drop-off/pickup activities since these uses occur at different times of day.

- Land-use site development polices can support transit, walking, and bicycling and encourage shared auto use.

1.6 PROJECT GOVERNANCE

The City and the Chittenden Regional Planning Commission (CCRPC) managed the project with the support from the project team. These entities formed the project steering committee.

A PAC comprised representatives of many organizations, businesses, nonprofits, local neighborhood associations, and other stakeholders identified by the steering committee. See Section 4.2 for additional information on the PAC.

The PAC provided input at key junctures and provided a communication conduit (two way) with the community. Figure 3 depicts the project team's structure.

FIGURE 3: PROJECT TEAM STRUCTURE



Source: RSG



2.0 LITERATURE REVIEW

Over the past two decades, segments and intersections of Winooski Avenue have been examined as part of stand-alone studies and included in larger plans. Relevant studies and plans informed this transportation study, incorporating findings from past analyses and ensuring consistency with guidelines set forth by public agencies.

2.1 STUDIES

Four studies of intersections or segments along Winooski Avenue are summarized below.

Winooski-Howard-St. Paul Intersection Scoping Study

City of Burlington, 2018

Description: Study of alternatives to improve bicycle and pedestrian mobility and safety at this five-way intersection in the South End.

Conclusions: The final recommendation was to construct a new signal system with pedestrian push buttons, an accessible crossing of South Winooski Avenue, and curb extensions. In the short term, do a semipermanent quick-build project, and in the medium term, construct an accessible pedestrian crossing of South Winooski Avenue.

Winooski Avenue Circulation Study Technical Assessment

CCRPC, 2017

Description: This is the technical assessment of five traffic circulation reconfigurations for Winooski Avenue (and consequently Union Street). It used three performance measures: delay, level of service (LOS), and queue length.

Conclusions: The Complete Streets reconfiguration was found to have the least impact on surrounding traffic and allow for two-way bicycle facilities along the entire corridor. It involves keeping vehicle directionality the same, converting the four-lane segment between Pearl Street and Main Street to three lanes (a northbound lane, southbound lane, and center turn lane), and removing parking in some corridor segments.

N. Winooski Avenue & Archibald Street Intersection: Pedestrian Safety and Mobility Evaluation

CCRPC, 2011

Description: A technical study of pedestrian improvements at this skew intersection in the Old North End.

Conclusions: Five options were offered, with the conclusion that all were viable. Corner radii reduction (Option E) was recommended for further exploration since it provided a cost-effective solution without creating significant vehicular or maintenance restrictions. These improvements have been implemented, including pedestrian push buttons and accessible crosswalks.

South Winooski Avenue Lane Reduction

CCRPC, 2002

Description: Studied a four- to three-lane conversion between Main Street and Pearl Street.

Conclusions: The study concluded that the conversion would work well and reduce crashes between College and Pearl Streets. Between College Street and Main Street, lane reduction was not recommended; study found it would significantly increase delays unless the green signal time was changed, which may then impact east-west travel on Main Street.

Downtown One-Way to Two-Way Conversion Memo

City of Burlington, 2000

Description: Traffic model and operational study identifying hourly flow changes for converting one-way streets to two way. Discussed pros and cons of one-way versus two-way streets. Study focused on South Winooski and South Union.

Conclusions: The study concluded that the two-way conversion would work reasonably well. Largest change in vehicle delay would occur at Union/Main Street intersection. South Winooski would see overall flows increase with a northbound option introduced. Street widths limit opportunity to provide two-way vehicle flow, on-street parking, and bicycle lanes.

2.2 PLANS

Various public agencies have put forth plans relevant to Winooski Avenue in recent years, including the City of Burlington, Green Mountain Transit, the Chittenden County Regional Planning Commission, and VTrans. These plans are summarized below.

Great Streets Downtown Standards

City of Burlington, Draft Status

Description: A set of standards to support Burlington's vision of having a vibrant, walkable, and sustainable downtown.

Relevant Guidance and Sections: Great Streets standards apply to downtown, which is defined as a 6 x 6 block grid bounded by Pearl, Maple, Battery, and Union streets. Chapter 2 includes existing conditions and design considerations of downtown streets, and Chapter 3 recommends street types of each street segment.

NextGen Transit Plan

Green Mountain Transit

Description: This plan provided a comprehensive analysis that revised the fixed route bus service that Green Mountain Transit (GMT) provides within its service area.

Relevant Guidance and Sections: Three service improvement scenarios have been developed for GMT's local routes serving Chittenden County. All scenarios include a mix of revised route alignments and schedule changes.

Major themes guiding the scenario development:

- Simplified service.
- Core network of major local routes.
- More evening service.
- Better weekend service.
- Minimum service frequencies.
- One-seat ride between Downtown Burlington and the Airport.

planBTV Walk Bike

City of Burlington, 2017

Description: The planBTV Walk Bike Master Plan identifies walking and bicycling infrastructure issues and priorities in Burlington. It identifies opportunities from pilot projects to long-term visions.

Relevant Guidance and Sections: Many sections of this plan are relevant to Winooski Avenue. They are identified by section and page number below.

- Engineering Action Plan (pp. 67–72).
- Slow Zone Priorities (p. 74).



- Priority intersections for safety upgrades (pp. 76–79).
- Proposed long-term network (p. 82).
- Priority Action List for Subarea 2 (p. 106).
- Project lists for years 2-5 in Subarea 2 (p. 108) and Subarea 3 (p. 131) (and following pages for details).
- Improvement Concepts (North Winooski Avenue Protected Bike Lane Concepts on pp. 117–118, South Winooski Avenue Bikeway Concept on p. 121, and South Winooski Avenue + Bank Street Intersection Upgrade Concepts on pp. 122–124).
- Vision Zero elements (pp. 140–144).
- Winter Cycling Action Plan (pp. 145–148).
- Bicycle Parking Action Plan (pp. 150–152).

Regional Active Transportation Plan

CCRPC, 2017

Description: Supports the regional ECOS (Environment. Community. Opportunity. Sustainability.) Plan and was developed in coordination with other concurrent local, regional, and state planning efforts. Includes a series of proposed infrastructure and noninfrastructure recommendations organized around the five E's: education, encouragement, enforcement, engineering, and evaluation.

Relevant Guidance and Sections: See p. 1 for important points and issues identified during the development of this plan.

Winooski Avenue is identified as a High-Priority corridor in the Proposed Regional Active Transportation Network. (p. 2)

VTrans On-Road Bicycle Plan Phase 1

VTrans, 2016

Description: A planning effort to categorize state roads into high, moderate, and low use/priority corridors based on current and potential bicycle use.

Relevant Guidance and Sections: The entire Winooski Avenue corridor is listed as a High-Use/High-Priority route.

Downtown Parking and Transportation Management Plan

City of Burlington, 2015

Description: A parking management plan (PMP) for downtown with parking occupancies, observations, and management proposals.

Relevant Guidance and Sections:

- Future land-use and parking demands. Recommendations based on summary of existing demand and supply. (See Section 3: Future Demand)
- Recommendations for future governance and management of parking data, collection, and analysis. (See Section 5: Parking and Transportation Management District)

planBTV Downtown & Waterfront

City of Burlington, 2013

Description: A comprehensive land-use and development plan focused on Burlington's Downtown and Waterfront.

Relevant Guidance and Sections:

- "Provide an integrated transportation system" was #3 of the Top 5 List of priorities the public wanted in this plan. (p. 43, "Burlington Values")
- Notes that "the streetscape created by the private realm is as important as any of the elements or provisions found in a conventional complete street package." (p. 68, "Themes in Detail")
- Connections through the former Town Center Mall were identified to reconnect Pine Street and St. Paul Street to repair the street grid and provide relief to Battery Street and South Winooski Street. (pp. 110–111)
- No specific section of the plan dedicated to Winooski Avenue.

Transportation Plan for the City of Burlington: Moving Forward Together

City of Burlington, 2011

Description: The initiation of a "living vision" for transportation in the City. Creates a multimodal perspective and starts to define priorities for specific facilities—setting up Complete Streets, Great Streets, and modal-focused streets.

Relevant Guidance and Sections:

- Street types within the City (Figure 2, p. 7). Winooski Avenue between Pearl and Main Streets is specified as a Complete Street. North and south of this, Winooski Avenue is classified as a bicycle street.
- Complete Street design guidance (p. 8).
- Defines indicators of progress toward goals of the plan (p. 11).



3.0 EXISTING CONDITIONS

3.1 LAND USE

Winooski Avenue is one of the few north-south streets within the City of Burlington. The variety and location of land uses along the corridor make it unique. The corridor has mixed-use and residential land uses along its length, with the mixed-use segment between Pearl Street and Main Street part of Burlington's downtown core.

The corridor comprises four general zones:

- **Far north:** neighborhood mixed use (commercial and residential).
- **North:** residential (medium and high density).
- **Central:** mixed use (downtown core).
- **South:** residential (medium density).

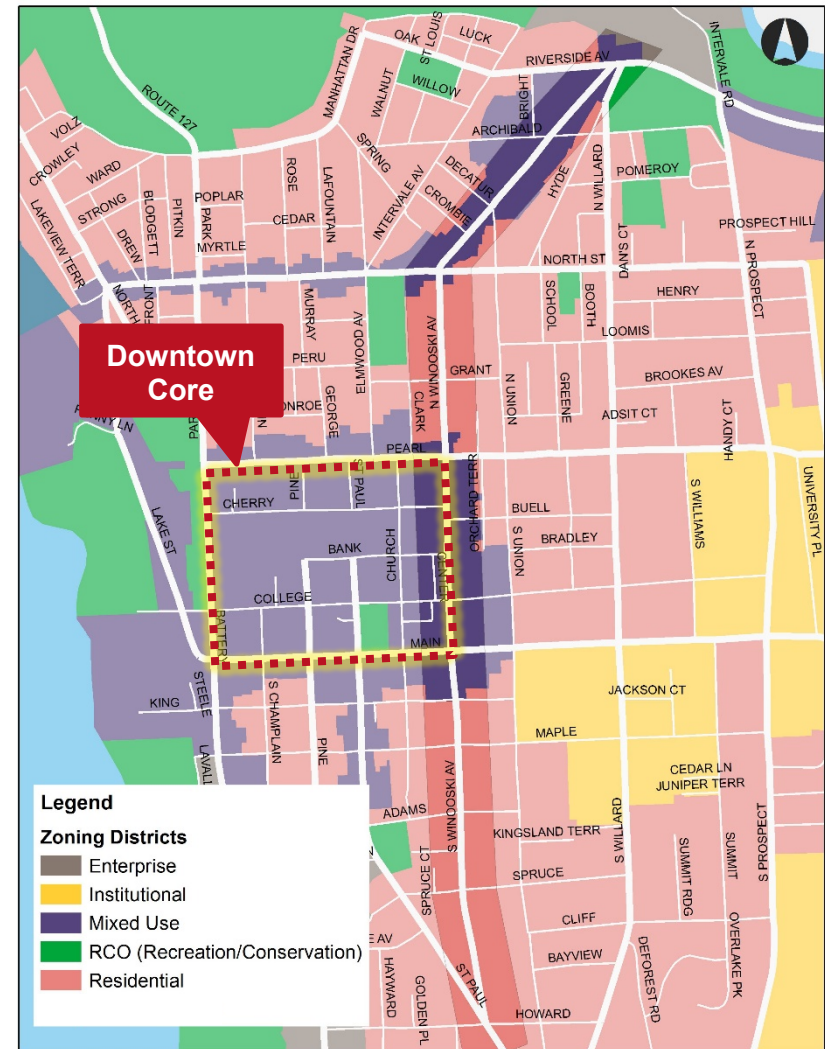
Figure 4 depicts Burlington's zoning districts.

The corridor serves two primary functions. It provides regional access to the core of the City, and it also provides local access for the residential and various commercial land uses located along the corridor.

These competing uses create tension. Such tension is common along transportation corridors that require both mobility and access within the same space. This tension manifests in competition for space among shorter- and longer-distance travelers and in the need for localized parking or placemaking.

Ultimately, land use is the fundamental input when determining the character and role of a corridor. The future alternatives must consider that tension and balance competing needs.

FIGURE 4: CITY ZONING DISTRICTS



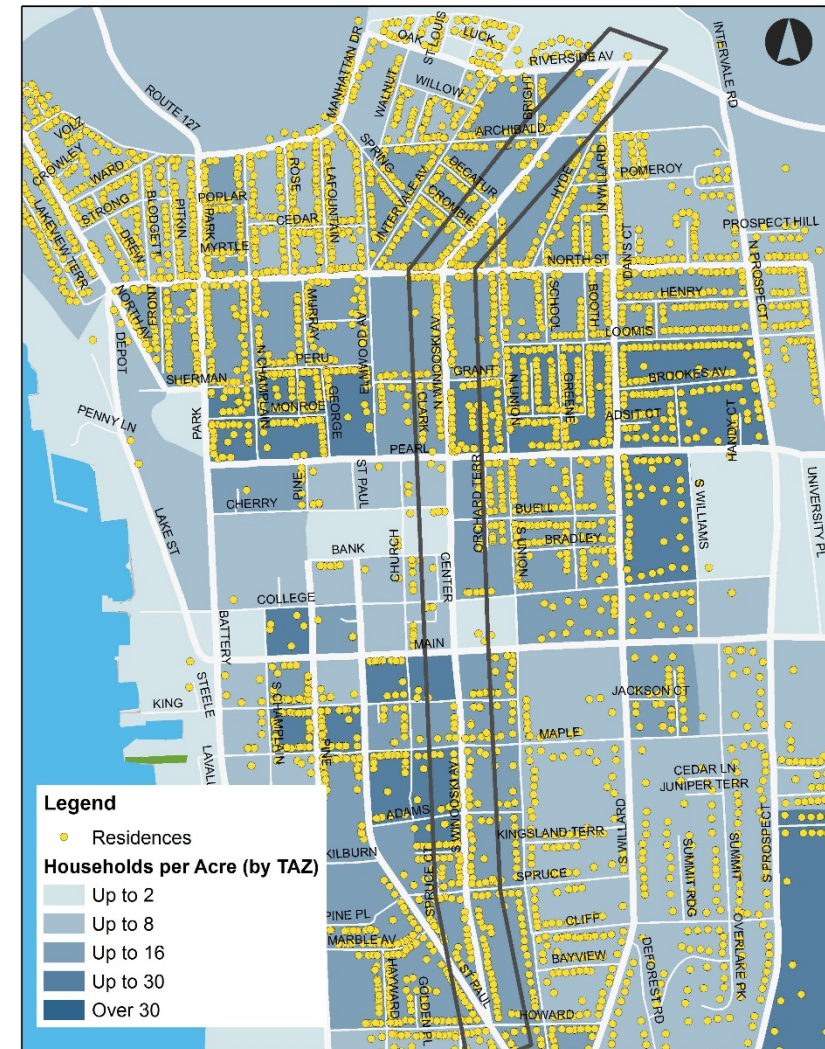
Source: City of Burlington Planning and Zoning

Housing and Employment

Determining the character of the Winooski Corridor requires understanding its current uses, including for housing and employment. To this end, analyzing housing and employment can reveal patterns and relationships at the root of travel demand. For instance, proximity between housing and employment can support walking, bicycling, and other active modes and indicate areas of parking demand.

Figure 5 depicts the housing and employment data by density in each transportation analysis zone (TAZ) used in the CCRPC's regional traffic model.² The residential zones along the corridor—north of Pearl Street and south of Main Street—are consistent with the rest of the City, with an average density of up to 16 households per acre.

FIGURE 5: HOUSING DENSITY AND LOCATIONS (2015)



Source: CCRPC and RSG

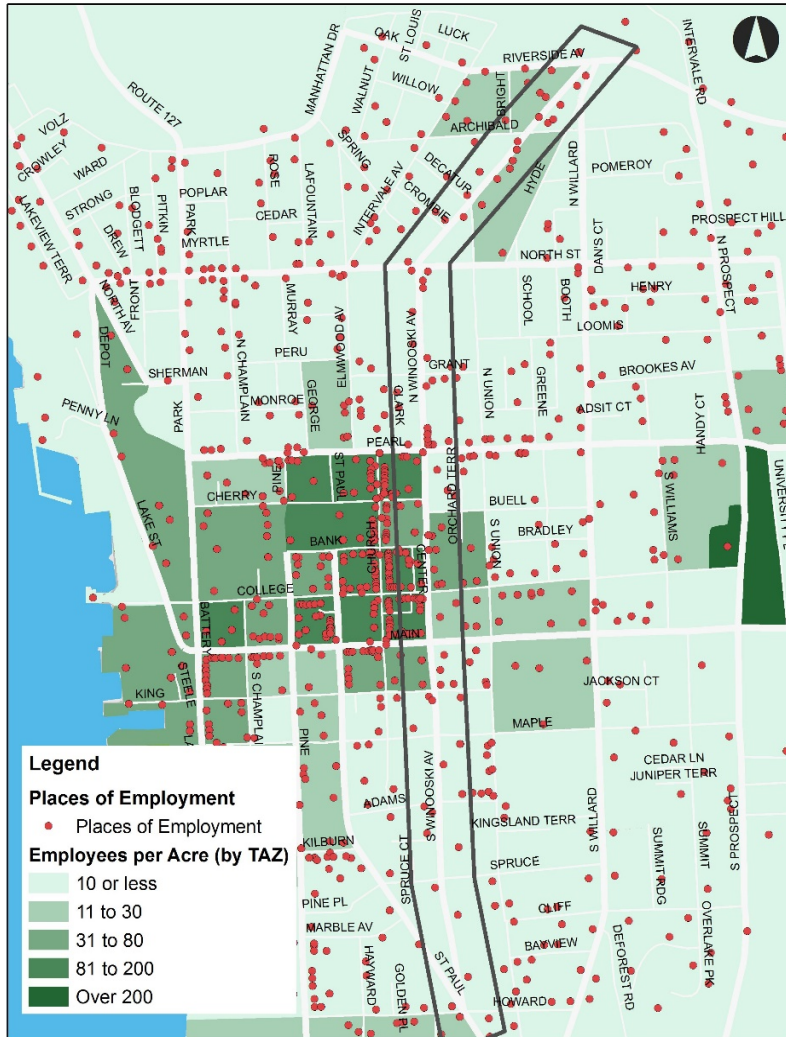
² The CCRPC Regional Travel Demand Model is not used in this study. However, it has been used in the Phase 1 study and is used

extensively in Chittenden County and Burlington to forecast traffic demands.



The employment density (Figure 6) is close to an inverse of the household density, with the downtown core providing most of the employment.

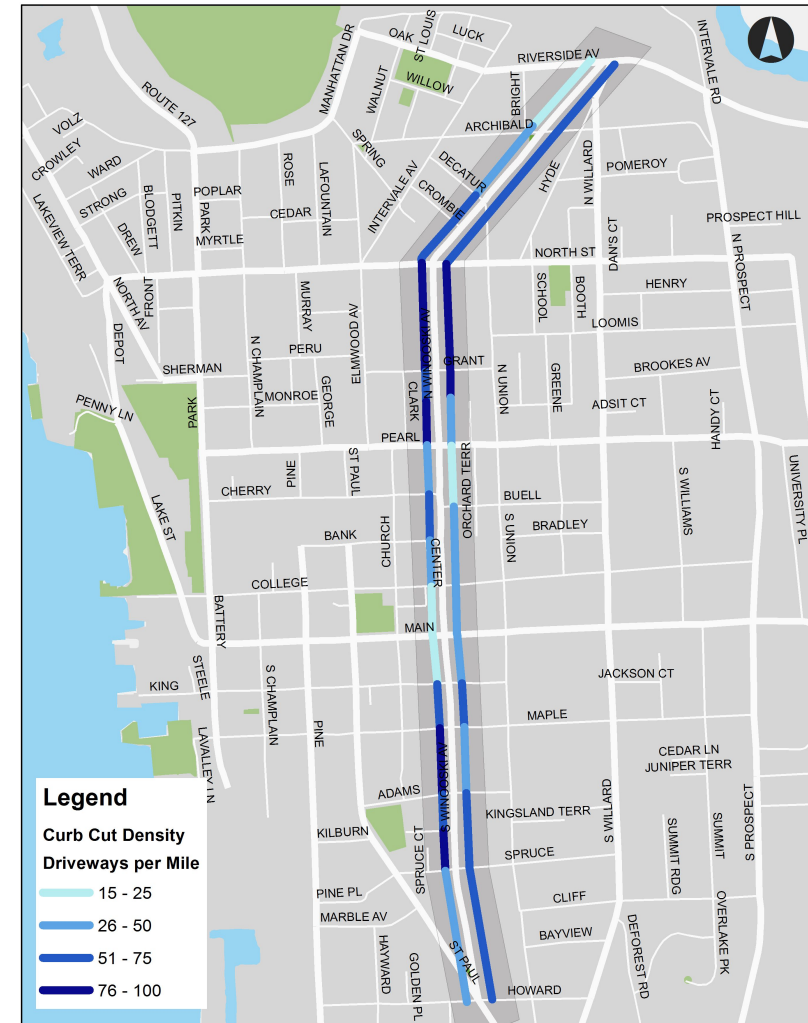
FIGURE 6: EMPLOYMENT DENSITY AND LOCATIONS



Data Source: CCRPC Regional Model

The curb cut density (Figure 7) demonstrates a correlation between density and the number of curb cuts. This information is particularly important when considering on-street parking, types of bicycle facilities, and number of conflict points along lengths of the corridor.

FIGURE 7: CURB CUT (DRIVEWAY) DENSITY



Source: RSG

3.2 MULTIMODAL INFRASTRUCTURE

Four corridors serve the primary north-south movement through Burlington:

- Battery Street/St. Paul Street/North Champlain Street.
- Winooski Avenue.
- Willard Street.
- Prospect Street.

Aside from Winooski Avenue, these corridors provide two-way mobility for vehicles and pedestrians along their lengths. None of these corridors provide bicycle facilities along their entire lengths.

Winooski Avenue's pavement width³ is 29 feet south of King Street and 36 to 43 feet north of King Street. It has six distinct cross sections, as shown in Figure 8, with differences in the presence, type, and directionality of travel lanes, bicycle facilities, and on-street parking. Sidewalks are on both sides of the street (outside of the paved width), but all other cross-section elements are inconsistent.

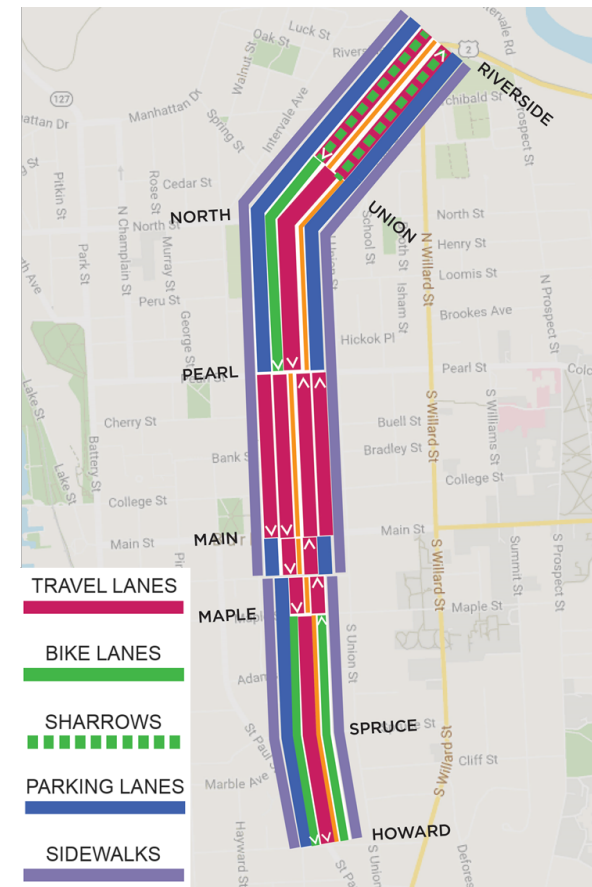
The inconsistency of travel lanes and bicycle facilities may make bicycling less desirable and both modes more confusing and less efficient. At intersections, changes from one cross-section to

On-street parking is inextricably linked to multimodal infrastructure and connectivity due to the space it consumes in the public right-of-way, and safety issues such as “dooring” that can occur when car doors are opened as a bicyclist is passing. Parking is discussed in Section 3.4.

another may cause additional confusion, which may lead to unexpected turning movements and crashes.

The following subsections dive into the primary modes used along Winooski Avenue—walking, bicycling, driving, and riding transit—and how the corridor is and is not currently meeting the needs of these modes and user groups.

FIGURE 8: CROSS-SECTION OVERVIEW



Source: RSG

³ Pavement width is the distance between curbs, including parking and travel lanes; it excludes sidewalks and green belts.

Walking

Walking is a fundamental mode of transportation and ensuring that safe and accessible pedestrian facilities are present throughout the corridor is essential.

Winooski Avenue has continuous and consistent sidewalks along the length of the corridor. The standard five-foot-wide sidewalk is the predominant facility type, with a handful of locations having slightly wider facilities.

Throughout most of the corridor, the sidewalks are buffered from travel lanes by a green belt at least five feet wide. No green belt exists between Pearl Street and Main Street except on the east side north of Bank Street, though some areas along this stretch have street trees in the sidewalk. Generally, areas with wider sidewalks do not have a green belt; one positive aspect is exchanged for another due to space constraints.

All signalized intersections in the study corridor, except for the southern terminus at Howard Street, have pedestrian push buttons and a walk phase. Some signals in the downtown core (Pearl Street to Main Street) have the pedestrian walk phase called during every signal phase (“recall”) regardless of whether a person pushes the button or not.



Wide sidewalk with street trees outside City Market, adjacent to four lanes of traffic on Winooski Avenue

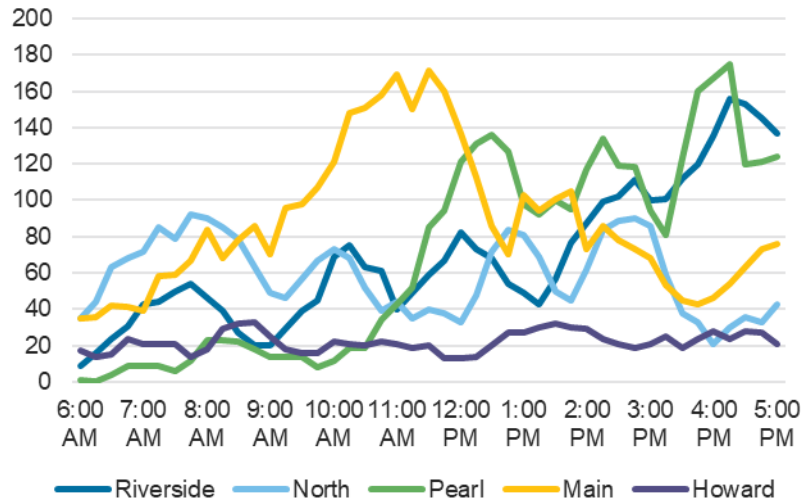


Typical sidewalk along Winooski Avenue outside of the downtown core

Pedestrian Volumes

Pedestrian volume data are available from turning-movement counts at major intersections along Winooski Avenue (Figure 9).

FIGURE 9: HOURLY PEDESTRIAN VOLUMES AT MAJOR INTERSECTIONS



Source: CCRPC and RSG

Figure 9 depicts how different locations along Winooski Avenue have different pedestrian demands, both in overall volume and by time of day.

- The **Howard Street** intersection in the mostly residential South End has a relatively steady pedestrian volume and lower pedestrian volume relative to the other intersections along the corridor.
- The **North Street** intersection has midrange volumes that follow school travel times.
- The **Pearl Street** and **Riverside Avenue** intersections (both in mixed-use areas) have increasing pedestrian

volumes as the day progresses, with peaks at commuting times and lunch time.

- **Main Street** has a clear peak volume at midday and has the highest total daily volume of these five intersections.

Sidewalk areas along Winooski Avenue exhibit signs of high demand and inadequate facilities, such as areas with trampled grass right next to the sidewalk. This was observed in several locations along the corridor.



Inadequate Sidewalk Width on Winooski Avenue (Left: North of Pearl Street, looking south; Right: North Winooski Avenue)

Rating Pedestrian Facilities

Factors that affect the experience of people using pedestrian infrastructure include demand (number of users), the width of the facilities, surface conditions, the distance and type of buffer between pedestrian facilities and the roadway, the comfort and exposure of adjacent land uses, and the speed and volume of adjacent vehicular traffic. At intersections, accessible curb cuts,

tactile ramps, and signal phasing are basic infrastructure that should be present throughout the corridor.

A pedestrian quality-of-service rating study was created to reflect criteria important to the City of Burlington. Figure 10 shows the pedestrian quality of service. The quality of service is a function of the physical elements rather than the number of pedestrians (e.g., density of users) given the scarcity of pedestrian count data.

Metrics used in the proposed pedestrian quality-of-service system include the following:

- Ratio of buffer width (including green belt, bicycle lanes, and parking lanes) and number of travel lanes.
- Buffer type (e.g., green belt, concrete).
- Street tree density.
- Percentage of block immediately adjacent to large parking lot.
- Sidewalk width lacking (generalizes that the entire segment between Main and Pearl Streets should be five feet wider).
- Longest curb cut.

FIGURE 10: EXISTING PEDESTRIAN QUALITY OF SERVICE ALONG WINOOSKI AVENUE



Source: RSG

Bicycling

Bicycling is gaining popularity as a form of transportation, and not just recreation, around the country and in Burlington. For many people, it is a primary way to move around town, whether due to its affordability, its convenience, or its health, social, or environmental benefits.

Why are walking and bicycling important for Burlington?

Excerpt from planBTV

“First, people care about it! Even with limited infrastructure and no comprehensive plan in place, census data shows that more Burlington residents are getting to work by bicycle or on foot. Second, safer walking and bicycling conditions will improve the quality of life for everyone. A growing body of data from around the country documents that growth in walking and bicycling brings a host of environmental and economic benefits tied to reduced traffic congestion, reduced vehicle emissions, lower road maintenance costs, savings in healthcare costs, increased independence for those who can't drive, and more.”

Winooski Avenue is a desirable corridor to ride a bicycle. It is a primary north-south corridor through Burlington that links neighborhoods and provides access to many businesses, homes, and services. It also has relatively flat terrain. However, the inconsistency of bicycle facilities, segments, and driveways with high volumes of vehicles, and challenging intersections, may result in people avoiding bicycling or feeling unsafe bicycling along parts of the corridor.

Bicycle facilities along Winooski Avenue include the following:

- Shared-lane markings (“sharrows”) between Riverside Avenue and Union Street/Decatur Street.
- A wide southbound bicycle lane between Union Street/Decatur Street and Pearl Street.
- No bicycle infrastructure between Pearl Street and Maple Street.
- Northbound (contraflow) and southbound bicycle lanes between Maple Street and Howard Street.



Rating Bicycle Facilities

The primary factors that make a roadway better or worse for bicycling include the bicycle facility type and the roadway context. Roadways are “rated” for bicycling according to the **level of stress** bicyclists may experience based on these factors.



Factors that affect the stress level of bicyclists can include the following:

- Vehicle traffic speed and volume.
- Heavy vehicle (truck) volumes.
- Separation of bicycle facilities from vehicular traffic—by distance or a physical buffer.
- Presence of on-street parking.
- Driveway density.
- Pavement condition.

For example, a roadway with high motor vehicle speeds and volumes would be a high-stress roadway to a bicyclist, while a quiet residential street would be low stress. On the quiet residential street, there may be no need for bicycle facilities, but on the more heavily trafficked street, unprotected or protected bicycle lanes may be necessary to reach a low-stress environment for bicyclists.

Bicycle Level of Traffic Stress (LTS)⁴ is one method used to “rate” bicycle facilities based on roadway context. The following are descriptions of each of the four traffic stress levels:

- **LTS 1:** Presenting little traffic stress and demanding little attention from cyclists, and attractive enough for a relaxing bicycle ride. Suitable for almost all cyclists, including children trained to safely cross intersections. Strong separation from all except low-speed, low-volume traffic. Simple crossings.
- **LTS 2:** Presenting little traffic stress and therefore suitable to most adult cyclists but demanding more

attention than might be expected from children. Except in low-speed/low-volume traffic situations, cyclists have their own place to ride that keeps them from having to interact with traffic except at formal crossings. Physical separation from higher-speed and multilane traffic. Crossings that are easy for an adult to negotiate.

- **LTS 3:** More traffic stress than LTS 2, yet markedly less than the stress of integrating with multilane traffic, and therefore welcome to many people currently riding bikes in American cities. Crossings may be longer or across higher-speed roads than allowed by LTS 2, but they are still considered acceptably safe to most adult pedestrians.
- **LTS 4:** A level of stress beyond LTS3. Involves interaction with higher-speed traffic or close proximity to high-speed traffic. (Note: not applicable to Winooski Avenue.)

In a region that experiences snow and freezing weather in winter, pavement condition and striping condition—both of which experience seasonal wear and tear—are particularly important factors.

The LTS system has a series of tables that can be used to determine the appropriate LTS for a given roadway segment. These evaluation criteria consider the number of travel lanes, bicycle lane width (or sum of bicycle lane width and parking lane width if next to a parking lane), prevailing speed, and amount of bicycle lane blockage (such as high parking turnover).

⁴ Mineta Transportation Institute. 2012. “Low-Stress Bicycling and Network Connectivity,”

<http://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf>.

Using these criteria tables alone, the LTS for segments along Winooski Avenue ranges from LTS 1 to LTS 3. This finding does not intuitively match the LTS descriptions above. This mismatch may stem from several factors:

- Winooski Avenue meets the system’s low-speed threshold with a speed limit of 25 mph (which vehicles largely conform to—see Section 3.3 of this report). However, relative to the rest of the City, 25 mph is typical and may still feel fast to some bicyclists, especially considering other factors such as traffic volume and number of driveways.
- The LTS tables use number of lanes rather than vehicle volume to make the ratings accessible without volume data. This can oversimplify the ratings.
- Separate tables are used to define LTS at intersections.⁵ As a result, a segment with higher-stress intersections throughout would *not* have a higher LTS to reflect that. Winooski Avenue has several high-stress intersections.

To better match the intention of the LTS ratings in a way that fits in the context of Burlington, the City has developed a draft set of criteria for rating level of stress:

- **LTS 1:** Bicycle paths, protected bicycle lanes, and greenways.
- **LTS 2:** Bicycle lanes and buffered bicycle lanes on lower-volume streets.*
- **LTS 3:** Bicycle lanes and buffered bicycle lanes on higher-volume streets* or shared-lane markings.

- **LTS 4:** No designated bicycle facilities or markings on higher-volume streets.*

**An annual average daily traffic (AADT) of 5,000 vehicles per day may be an appropriate threshold between lower-volume streets and higher-volume streets.*

FIGURE 11: BICYCLE LTS USING CITY CRITERIA



Source: RSG and City of Burlington

Although on-road northbound bicycling is not permitted between Pearl Street and Decatur Street, many people cycle northbound, either “salmoning” in the southbound bicycle lane or against traffic in the travel lane

⁵ High-stress intersections lack continuous infrastructure and have a greater number of vehicle conflicts.



Bikesharing

Bikesharing is an innovative transportation program, ideal for short-distance, point-to-point trips. Hub-based bikesharing allows users to pick up a bicycle at any self-serve bicycle station and return it to any other bicycle station located within the system's service area. Users can access the system through low-cost subscriptions ranging from a few dollars for one day use to annual memberships.

Greenride Bikeshare launched in Burlington, Winooski, and South Burlington in April 2018 with the first phase of a multiyear rollout. The Greenride system is currently a hub-based bikeshare model, requiring users to end their trip at a hub or pay an additional \$5 fee when locked away from a hub.

Greenride will eventually provide a high level of coverage throughout Burlington and adjacent communities. Phase 1 deployed 17 hubs. Phases 2 and 3 will introduce another 20–25 hubs and increased flexibility of “virtual hubs” (locations where dockless bikes can be parked), an additional 100 bikes, and a replacement to an all e-bike fleet.

One hub is located along the study corridor at 237 North Winooski Avenue, a building with 28 apartments and a yoga studio. Another two hubs are located nearby on Church Street. A map of existing Greenride hubs in Burlington is shown in Figure 12.



Greenride Bikeshare hub at 237 North Winooski Avenue

FIGURE 12: GREENRIDE BIKESHARE HUBS IN BURLINGTON (PHASE 1)



Source: Greenride Bikeshare

Driving

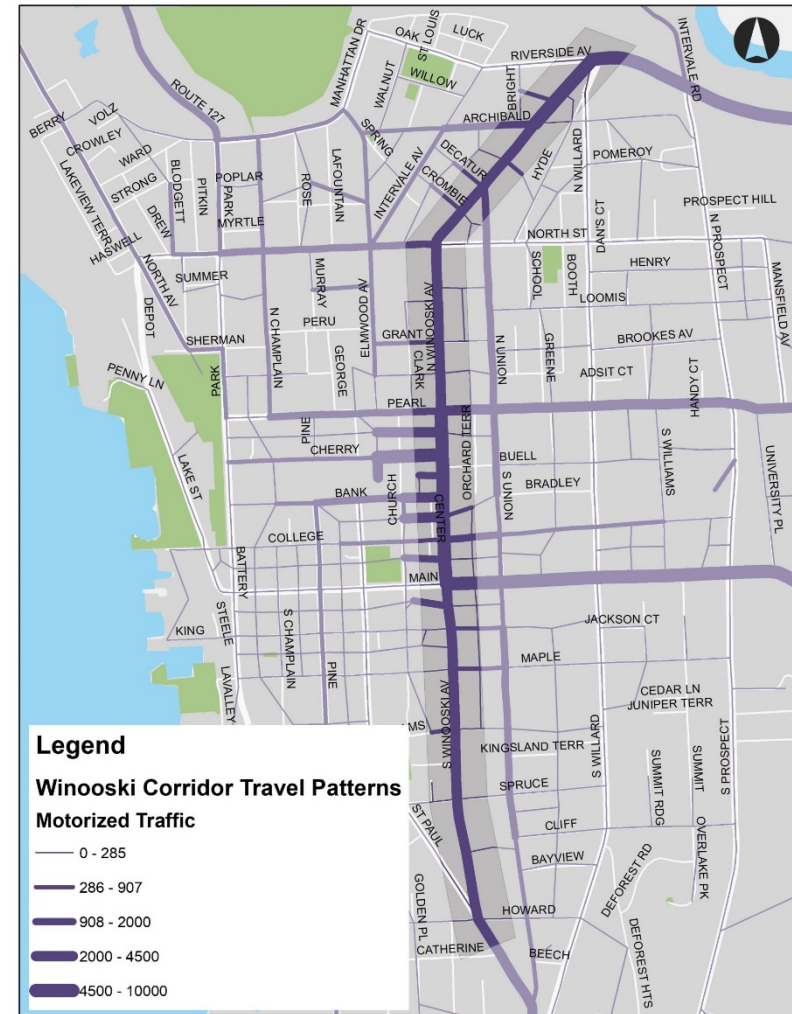
In recent years, the proportion of people using different modes of transportation has shifted. The result of this shift has been a reduction in driving, though it remains the predominant mode choice. In addition, many people who use other forms of transportation also occasionally drive. Most of the right-of-way along Winooski Avenue is designated for vehicles, whether in the form of travel lanes or parking.

Vehicle Volumes

Winooski Avenue is an important driving route to and through the core of Burlington. Figure 13 shows that most of the corridor's traffic enters and exits Burlington via Riverside Avenue, Pearl Street, and Main Street. Union Street is an important parallel street due to its function with Winooski Avenue as a one-way travel pair.

Along Winooski Avenue, the highest traffic volumes occur within the four-lane section between Pearl Street and Main Street, with an average annual daily traffic around 11,000 vehicles (Figure 14).

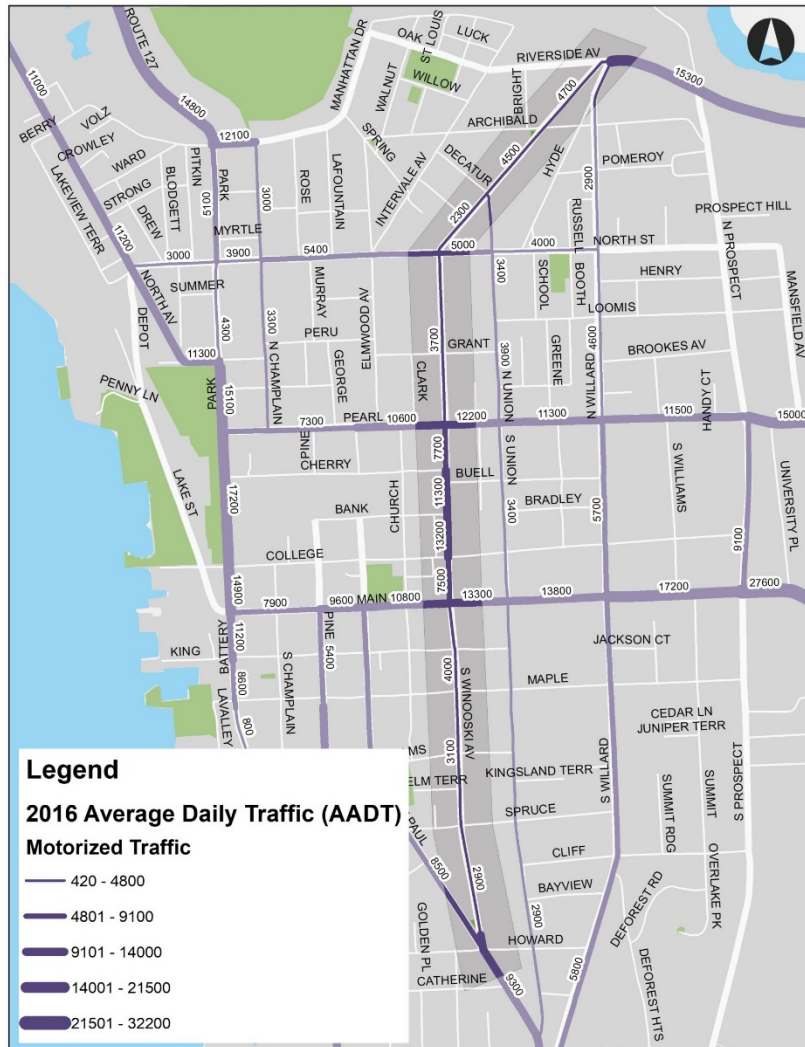
FIGURE 13: TRAVEL PATTERNS OF VEHICLES ACCESSING WINOOSKI AVENUE



Source: CCRPC Regional Traffic Model

This map is based on a "select link" analysis; the volumes shown only include vehicles that drive on Winooski Avenue as part of their trips

FIGURE 14: DAILY TRAFFIC VOLUMES (2016)



Data Source: VTrans

Rating Driving Facilities

Vehicle infrastructure can be rated using the LOS system at intersections, which is based on the average delay experienced by motorists during the peak hour of an average day. It runs on a scale from A (lowest delay) to F (highest delay). Delay is impacted by vehicle volumes, number of lanes (including turn lanes), traffic control type (e.g., signalized, unsignalized, and roundabout), and signal phasing.

In urban areas such as the project location, higher LOS ratings (signifying lower delay) are not necessarily desirable. The CCRPC and the City of Burlington generally aim for LOS D, and LOS E can even be acceptable. Within local permit applications, the City can determine acceptable levels of congestion. The City does not have a formally adopted congestion policy or guidance on when to use alternatives to the VTrans policy during statewide Act 250 permitting.

Figure 15 and Figure 16 show the LOS and queues at key intersections along the study corridor and pertinent adjacent streets during the weekday AM and PM peak hour, respectively.

The midday peak hour was not evaluated, though congestion can be observed in the downtown core during midday. Also, the City Market driveway and Marketplace Garage exit were modeled as intersections for traffic analysis but are not shown on the map or summaries within this report.

[illegible]22 

Legend

PM Peak LOS

- A
- B
- C
- D
- E

PM Peak Queues

Data Source: Microsimulation analysis performed by RSG

The traffic operations summarized in Figure 15 and Figure 16 provide a limited view of traffic operations within the study corridor.

The standard methodology (based on the Highway Capacity Manual) has limitations when conditions outside of the study, such as the frequent long queues along Main Street, impact the operations along Winooski Avenue. Queues can often extend from the “jug handle” at Main Street/Spear Street/East Avenue and continue westerly down the hill along Main Street. These queues can affect the ability for vehicles to exit Winooski Avenue onto Main Street.

The delay shown is averaged for a full hour of analysis, which does not explicitly account for short periods when average delays are much longer.

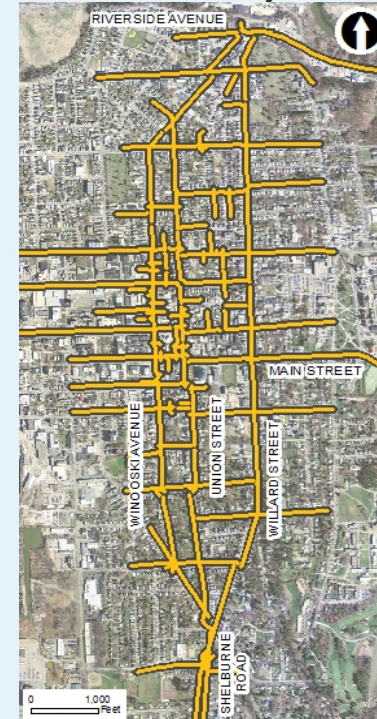
Even with these limitations, the modeling of operations within the corridor offers valuable insights into how changes in lane allocation, turn lanes, driveways, and future traffic demands may change relative to the current conditions.

About the Traffic Model

The traffic model that vehicle volume and LOS data in this report is based on is implemented in the TransModeler™ software program. It was originally developed as a subarea focus area from the CCRPC regional travel demand model.

The Winooski Avenue Traffic Microsimulation Model includes detailed information on roadway classifications, speeds, geometrics, intersection controls, signal timings, and traffic volumes. The Phase 1 Winooski Study included an assessment of existing conditions and several possible future configurations.

Extent of traffic analysis model





Midday queuing along Winooski Avenue (looking north from Bank Street intersection)

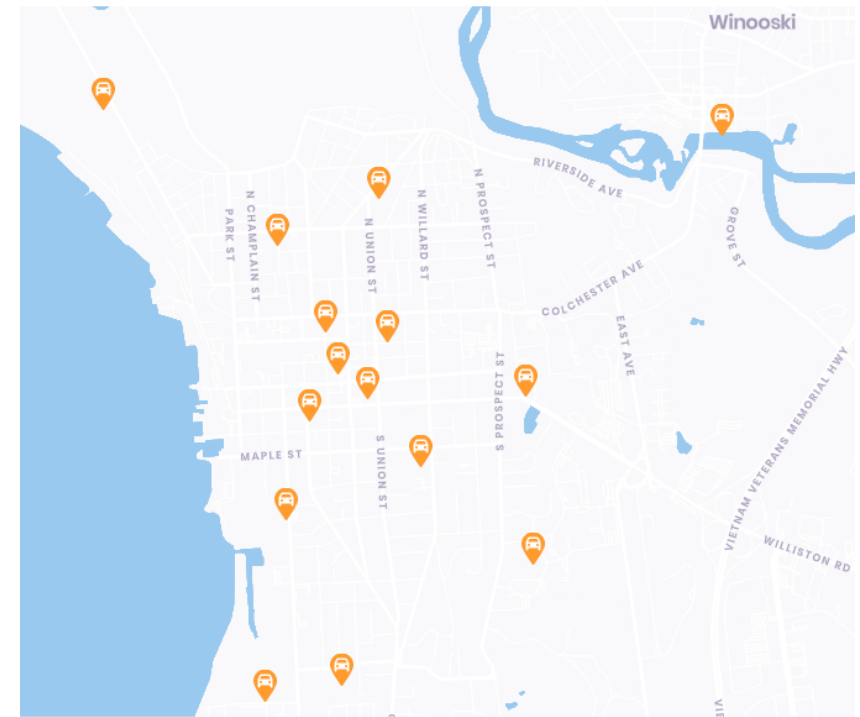
Carsharing

Carsharing allows people to rent cars for short periods of time, which can make it possible for households that use these services to own fewer personal vehicles. This service is available in Burlington through CarShare Vermont, which offers monthly and yearly memberships to access its fleet of vehicles parked in neighborhoods around the City and in nearby Winooski.

One hub is located along the study corridor at 258 North Winooski Avenue (Silversmith Commons), and six other hubs are available within a one-quarter-mile walk from Winooski Avenue. These hubs are all in high demand due to the high density of both residential and business user groups along Winooski Avenue and in downtown Burlington.

For carsharing to work efficiently and meet the needs of a community, it needs convenient, multimodal access to its hubs and safe, accessible locations for hubs. Bicycle parking is available at or adjacent to all the carshare hubs.

FIGURE 17: CARSHARE HUBS



Source: CarShare Vermont

Delivery Vehicles

Nonresidential land uses often require use of commercial delivery vehicles and benefit from dedicated loading zones. Zones identified by a loading zone sign prohibit noncommercial vehicles, or those with a loading zone permit or coupon, from using the space.





Informal loading zone on Winooski Avenue at the corner of Main Street

Locations such as in front of the eating and entertainment establishments just north of Pearl Street have high levels of on-demand mobility demand and the need for a loading zone. The two uses seldom overlap.



Loading zone on Winooski Avenue at the former Sam's Wood Furniture near Riverside Avenue

Shared Mobility

Transportation network companies (TNCs) such as Uber and Lyft have proliferated by offering new technologies to deliver on-demand car travel options. Traditional taxi companies have started using similar phone-based travel technology. TNCs and taxi companies provide car travel without the need to own a personal vehicle; these services also provide employment for the drivers. The vehicle-for-hire companies pay 25 cents per trip to the City of Burlington. From November 2016 through September 2017, there were 427,828⁶ vehicle-for-hire trips originating in Burlington.

⁶ Davis, Mark. 2017. "Uber Has Sped to the Top of Burlington's Ride-for-Hire Heap," <https://www.sevendaysvt.com/vermont/uber-has-sped-to-the-top-of-burlingtons-ride-for-hire-heap/Content?oid=9196614>.

On-demand delivery is starting to become more visible in Burlington. Mr. Delivery and Uber Eats are two example delivery services from restaurants that add to the already established and growing trend of grocery store deliveries from Price Chopper and Hannaford. All these services substitute an individual need for travel with an often more efficient delivery service combining several orders in one vehicle.

Both Uber⁷ and Lyft⁸ are experimenting with contracts with health providers to enable on-demand mobility for patients who may have limited travel options.

The on-demand economy, combined with the market penetration of smartphones, has increased the number of goods and services that can be procured and delivered, thereby reducing individual trips. At this time, Burlington does not have any parking designated for TNCs.

Taking Transit

GMT is a transit system like few others. It is a medium-sized system whose core services are focused on a small city and urban area, but one that has also grown rapidly over the past 15 years to provide service throughout much of northern and central Vermont.

Ridership and Connectivity

The Downtown Transit Center located on St. Paul Street between Cherry and Pearl Streets is the hub of the GMT local system. Buses traveling to and from here require travel across, if not on, Winooski Avenue.

GMT recently completed the NextGen Transit Plan, the first comprehensive evaluation of the complete transit system in many years. The reboot changed the routes on the Winooski Avenue corridor, which include the following:

Gold Line (City Loop)

- 30-minute service during weekdays and Saturday, 60-minute service on Sunday.
- 6:30 a.m. to 6:30 p.m. weekdays and Saturday, 8:30 a.m. to 6:30 p.m. on Sunday.

Green Line (Riverside/Winooski)

- 30-minute service during day and 60-minute service after 8:25 p.m. 6:00 a.m. to 11:00 p.m. weekdays.
- 30- to 60-minute service on Saturday. 6:00 a.m. to 11:00 p.m. Saturday. 60-minute service on Sunday, 7:40 a.m. to 6:00 p.m.

Blue Line (Essex-Shelburne via Downtown Burlington)

- Major Urban Local route.
- Weekday 20-minute service during day and 30- to 60-minute service at night. Service from 6:00 a.m. to 11:00 p.m.
- 30-minute service on Saturdays and 60-minute after 8:35 p.m. Service from 6:00 a.m. to 11:00 p.m.
- 45-minute service on Sundays between 8:35 a.m. and 7:00 p.m.

⁷ Uber Health uberhealth.com

⁸ *Forbes*. January 29, 2020.
<https://www.forbes.com/sites/brucejapsen/2020/01/29/lyft-signs-ride-share-deal-with-the-big-health-system-commonspirit/#6c135fc24593>

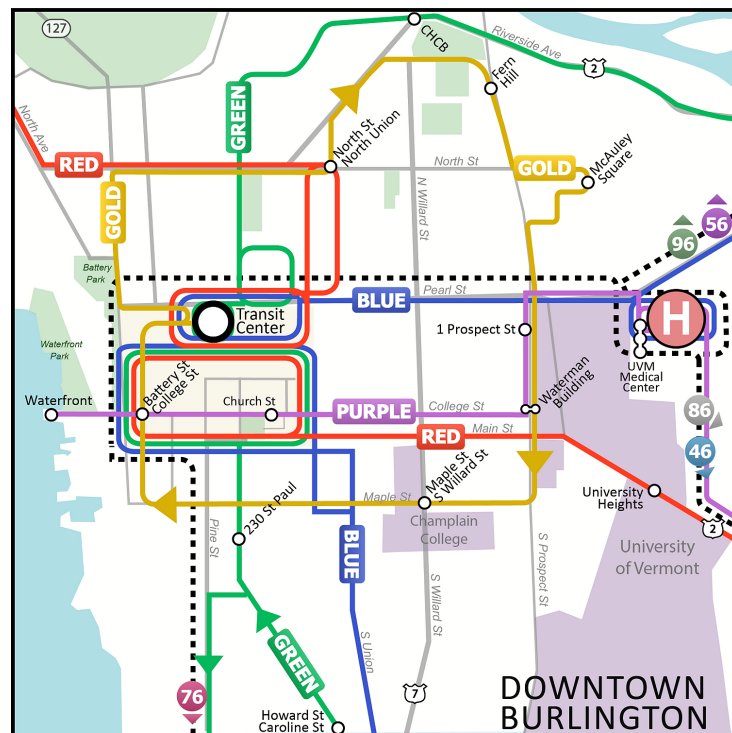


Red Line (North Avenue to Williston)

- Detailed schedule shows bus travels on Union Street and Winooski Avenue only between Pearl Street and North Street. 20-minute service during weekdays, 6:00 a.m. to 11:00 p.m. 30-minute service on Saturdays, 6:00 a.m. to 11:00 p.m. and 45-minute service on Sundays, 8:00 a.m. to 6:00 p.m.

Figure 18 shows the local routes in Burlington that travel along or across Winooski Avenue. No existing route travels exclusively along Winooski Avenue.

FIGURE 18: GMT LOCAL BUS ROUTES



Source: GMT

Figure 19 shows ridership data for the bus stops along Winooski Avenue, in the form of total boardings and alightings in one day. The places of high bus demand correlate with areas of high employment and mixed-use land development.

FIGURE 19: GMT BUS STOP DEMAND (2017)



Source: GMT and RSG

Bus Stop Infrastructure

Bus stop infrastructure varies along the corridor, with most stops consisting of a simple static sign and an informal waiting area on the sidewalk or greenbelt.

Table 1 shows a generalized concept of the type of amenities that could be at bus stops. A review of the bus stops along the corridor found that few of the standard amenities are present, and high-demand spots are particularly deficient. GMT is actively updating the Bus Stop Guidelines with target amenities based on location and ridership demand.

TABLE 1: CONCEPT BUS STOP AMENITIES

AMENITY	LOCAL STOP <40 BOARDINGS	LOCAL STOP > 40 BOARDINGS	COMMUTER STOP
Lighting	✓	✓	✓
Static sign	✓	✓	—
Dynamic sign	—	✓	✓
Shelter	—	✓	✓
Seating	✓	✓	✓
Trash/Recycling	—	✓	✓

Table 2 shows the amenities found at bus stops along Winooski Avenue.

TABLE 2: BUS STOP AMENITIES ON WINOOSKI AVENUE

Stop	Shelter	Bench	Schedule/ Map	Trash/ Recycling	Lighting
Community Health Center	No	No	Yes	No	No
Opp. Community Health Center	No	No	Yes	No	No
No. Winooski Ave @ Archibald St	Yes	In Shelter	Yes	No	In Shelter
No. Union St @ No. Winooski Ave	Yes	In Shelter	Yes	No	In Shelter
North St @ N Winooski Ave	No	No	No	No	No
North St @ N. Winooski Ave	No	No	No	No	No
No. Winooski Ave @ Grant St	No	No	No	No	No
No. Winooski Ave @ Pearl St	No	No	No	No	No
Pearl St @ N Winooski Ave	No	No	No	No	Yes
S. Winooski Ave @ Bank St	No	No	No	No	No
College St @ S Winooski Ave	No	No	No	No	No
Main St @ S. Winooski	No	No	No	No	No
S. Winooski Ave @ King St	No	No	No	No	No
S. Winooski Ave @ Maple St	No	No	No	No	No
Maple St @ S. Winooski Ave	No	No	No	No	No
Howard and Caroline Sts	No	No	No	No	No

Source: RSG

Stops in bold font have more than 40 boardings a day; “no” in red means that this amenity is not present but should be according to Table 1



Archibald Street bus stop with shelter



Bicycle parking is another frequent amenity to improve modal integration. Frequently, bicycle parking spaces are available within a few hundred feet of bus stops even though no bus stop appears to have bicycle parking immediately proximate.



SB Bus Stop near Bank Street: no schedule or map, and trampled grass is evidence of high demand

3.3 SAFETY

Section 3.2 discussed many of the factors that affect comfort and perceived safety for each mode of transportation. Safety can also be evaluated using historical crash data.

Crash History

Crash history is the primary metric used for understanding road safety and determining logical improvements. The following charts and information are based on a five-year window of crash data⁹ along Winooski Avenue, between January 1, 2013 and December 31, 2017. Crashes reviewed include crashes at intersections along Winooski Avenue that may have occurred on the cross streets. Any plan or study attempts to use the most current available data at that time, which may result in some variations in the analysis between the current study and past studies.

Winooski Avenue Crashes Relative to Local and State Data

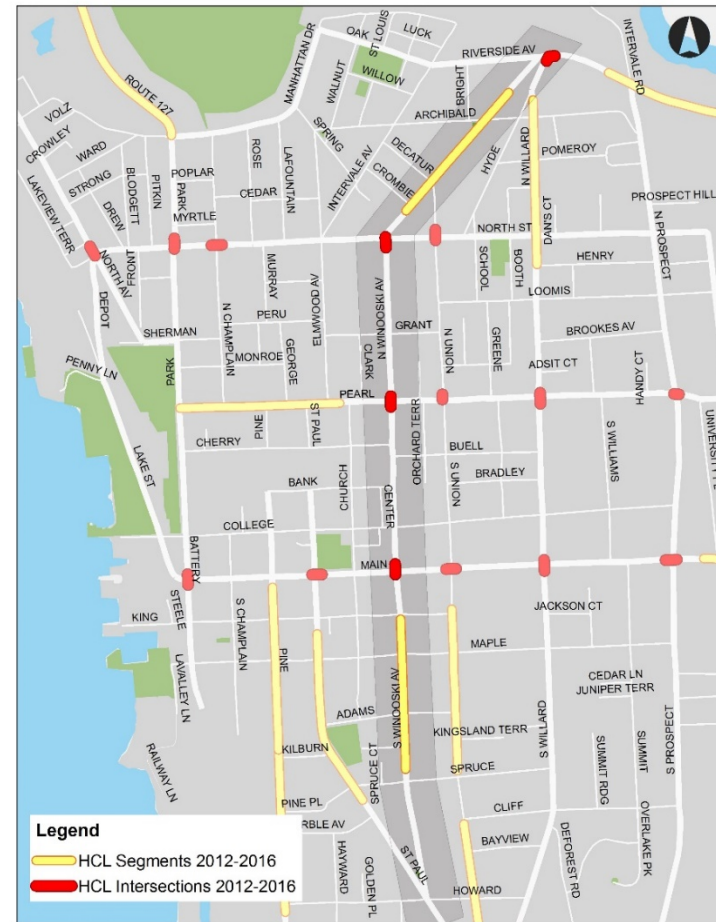
Crashes along Winooski Avenue account for the following:

- **10% of all crashes** in Burlington.
- **9% of injury crashes** in Burlington.
- **16% of bicycle crashes** in Burlington.
- **17% of pedestrian crashes** in Burlington.

HCLs are defined as intersections or segments where the actual average crash rate exceeds the statewide average crash rate for a similar roadway facility. These are shown in Figure 20.

⁹ Obtained via the VTrans Public Crash Data Query Tool, a database that includes crash data from both local and state police.
<http://apps.vtrans.vermont.gov/CrashPublicQueryTool>.

FIGURE 20: HCLs



Source: RSG



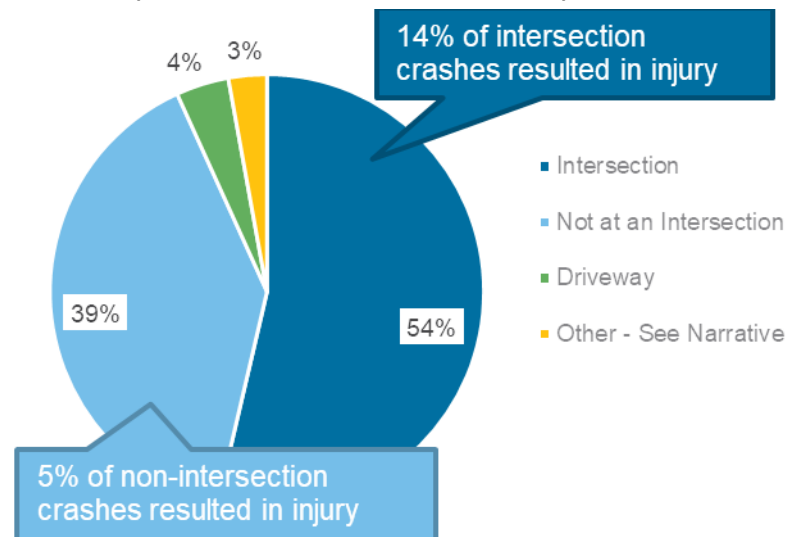
HCLs can help identify points of interest, but they do not always tell the full story. For example, the segment between Pearl Street and Main Street has the highest number of crashes along Winooski Avenue, yet it does not meet the requirements to be classified as an HCL.

The two-segment HCLs (north of North Street and south of King Street) are located along roadway segments with many curb cuts and on-street parking (see Figure 7), which introduce turning traffic and a higher number of conflict points.

Crashes Along Winooski Avenue

Excluding crashes in parking lots, 54% of crashes along Winooski Avenue occurred at intersections, 4% occurred at driveways, and 40% occurred away from driveways or intersections. Figure 21 summarizes crash location type.

FIGURE 21: CRASH LOCATION TYPES ALONG WINOOSKI AVENUE (NOT INCLUDING PARKING LOTS)



Source: VTrans Public Crash Data Query Tool

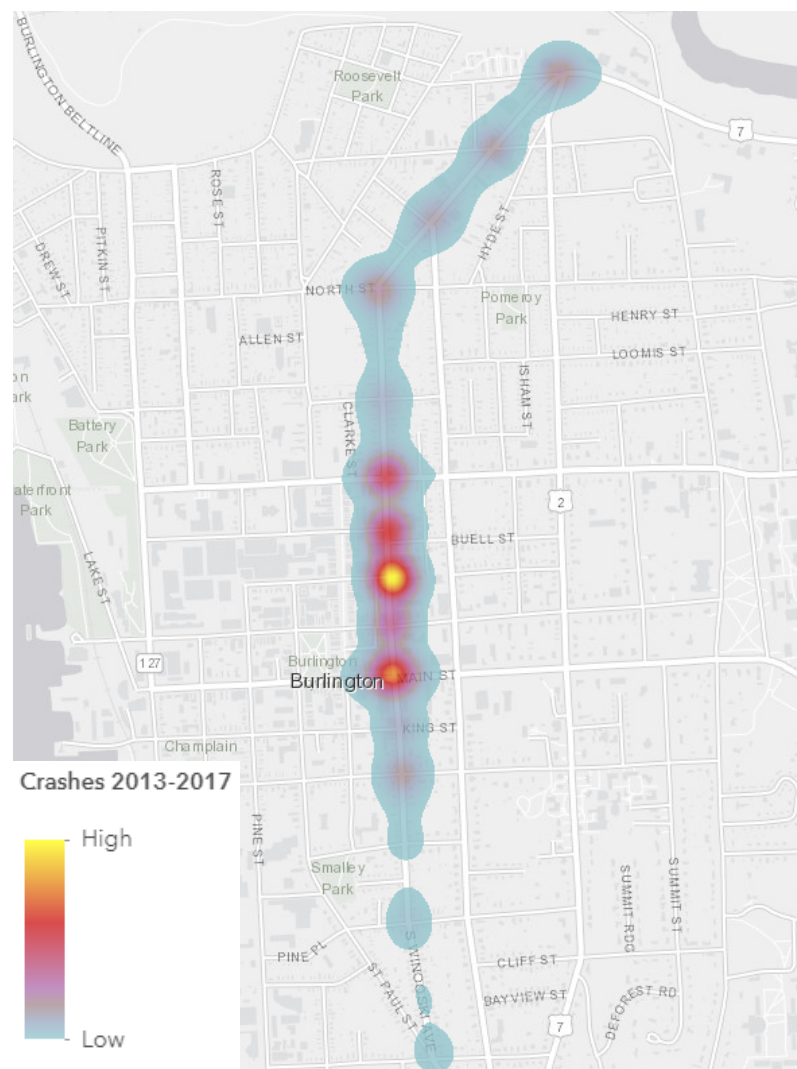
Figure 22 is a heat map that provides an overview of all crashes along Winooski Avenue. The four-lane segment between Pearl Street and Main Street has experienced the highest number of crashes along the corridor.

Figure 23 is a heat map of bicycle and pedestrian crashes along Winooski Avenue. Hot spots are centered at intersections, where bicyclists and vehicles must navigate lane changes, turning movements, and each other.

The busier and larger intersections along the four-lane segment have the highest number of bicycle and pedestrian crashes.

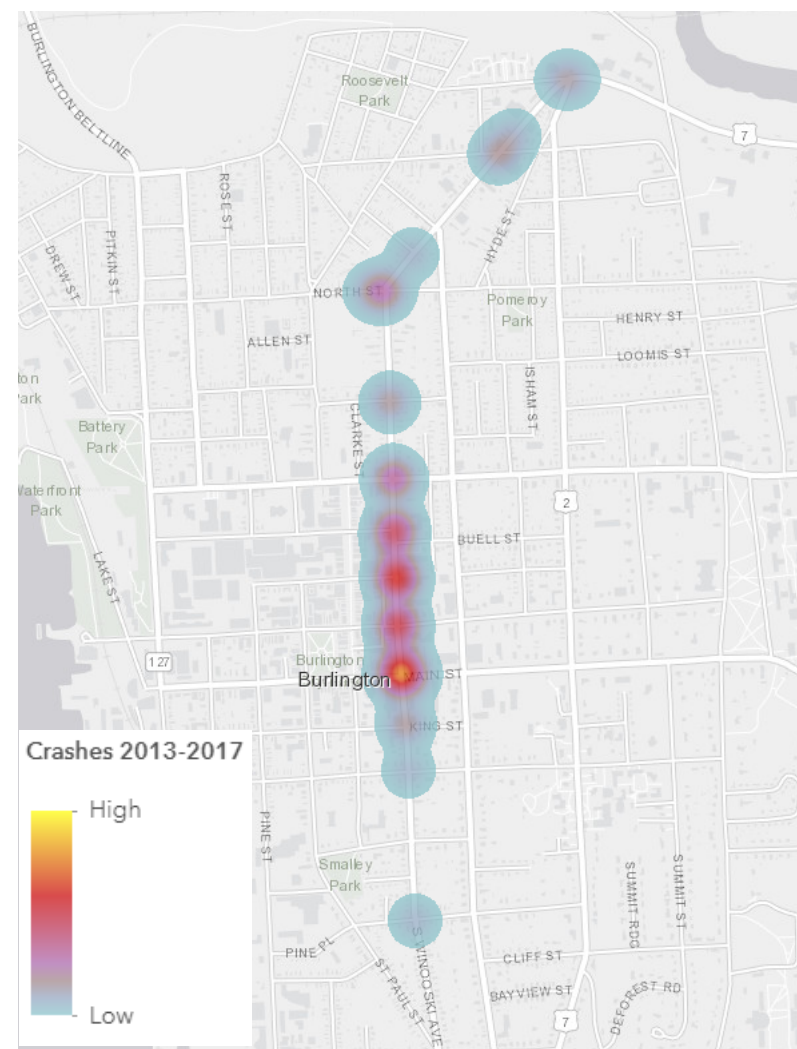
A heat map is a helpful visualization tool to quickly identify areas or locations with greater or lower intensities.

FIGURE 22: HEAT MAP OF ALL CRASHES ALONG WINOOSKI AVENUE



Source: VTrans Public Crash Data Query Tool

FIGURE 23: HEAT MAP OF BICYCLE AND PEDESTRIAN CRASHES ALONG WINOOSKI AVENUE

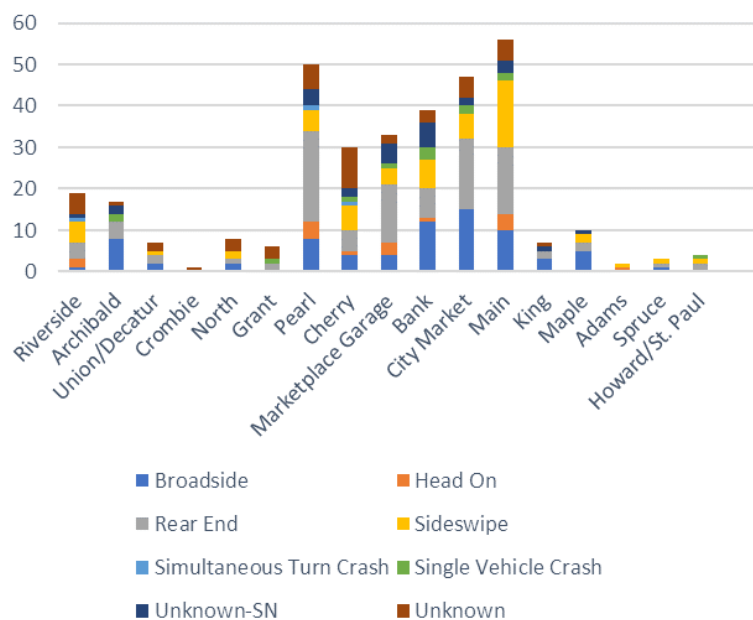


Source: VTrans Public Crash Data Query Tool

Note: "High" and "low" numbers of crashes are relative to the highest and lowest numbers along Winooski Avenue, not any other point of reference

Figure 24 displays details of crash types along Winooski Avenue.

FIGURE 24: COLLISION TYPES AT INTERSECTIONS



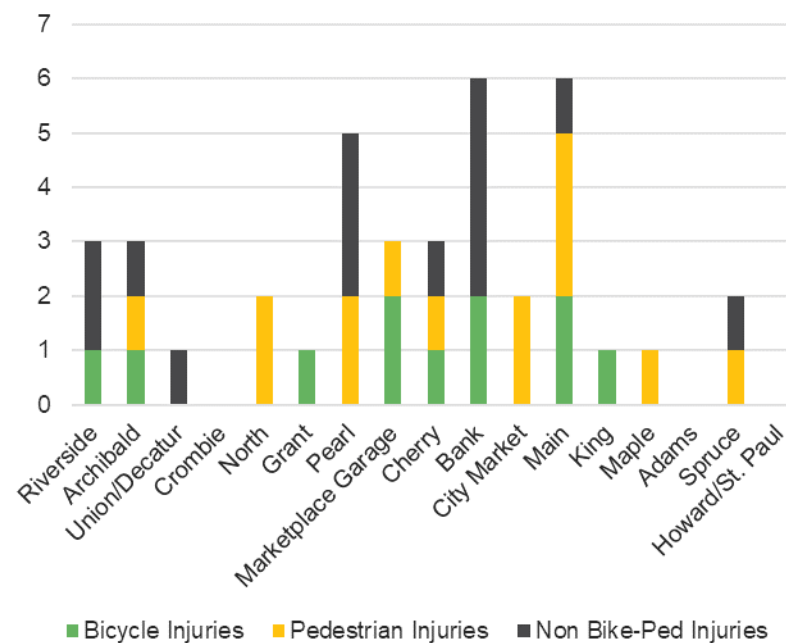
67% of injury crashes (excluding those in parking lots) occurred at intersections.

Source: VTrans Public Crash Data Query Tool
 “Unknown-SN” refers to crashes marked as “Other—See Narrative” in the crash database; the project team did not review narratives.

The intersection crash data indicate that congestion and lane configurations are the two most likely contributors to crashes; congestion can lead to rear-end crashes, and various lane configurations can result in sideswipes. Most intersection crashes occurred between Pearl Street and Main Street. City Market and Marketplace Garage exit have similar numbers of crashes as street intersections.

Injury crashes by mode at each intersection are shown in Figure 25.

FIGURE 25: INJURIES AT INTERSECTIONS, BY MODE



Source: VTrans Public Crash Data Query Tool

Bank Street, Main Street, and Pearl Street had the highest total number of injury crashes.

Note regarding City Market data: An additional 62 crashes at City Market were categorized as “Parking Lot” in the VTrans data. Parking lot crashes are assumed to be within the parking lot and not at the intersection of the roadway, but some may be at the roadway. The data have not been evaluated to this level of detail.



A bicyclist and vehicles navigate the City Market driveway at Winooski Avenue

Speeds

Vehicle speed is relevant to the safety of all modes of transportation. Vehicle speeds along Winooski Avenue appear to be consistent with the corridor's speed limit of 25 mph.

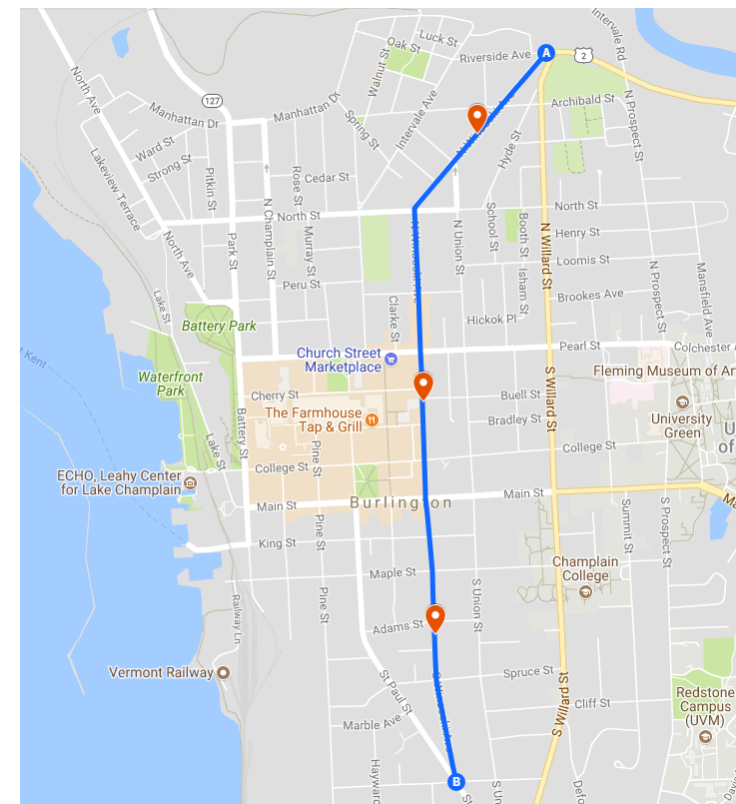
The 85th percentile speed—the speed at which 85% of drivers drive at or below—is a common metric used in speed studies rather than average or median (50th percentile) speed. This metric was found based on speed data collected at three locations along the corridor, described below and shown in Figure 26.

- Between Archibald Street and Decatur Street (Union Street) on North Winooski Avenue, where there are two travel lanes. This location is also along an HCL segment. **85th percentile speed, 2018: 25 mph**

- Between Bank Street and Cherry Street on South Winooski Avenue, where there are four lanes. **85th percentile speed, 2018: 25 mph**
- Between Adams Street and Elm Terrace on South Winooski Avenue, where there is one southbound travel lane. This location is also along an HCL segment. **85th percentile speed, 2014: 28 mph**

planBTV Walk Bike identifies priority streets for speed control. The plan recommends making Winooski Avenue a Corridor Slow Zone, to be designed for ≤ 25 mph.

FIGURE 26: SPEED STUDY OBSERVATIONS



Source: RSG



Corridor Slow Zone Streets (*planBTV Walk Bike*)

Corridor Slow Zone streets are categorized as such because they generally move higher volumes of traffic and connect multiple neighborhoods, provide a link to neighboring municipalities, feature a higher intensity of land use, and may have a crash history suggesting the need to control speeds. In these locations, street design should encourage a maximum speed of 25 mph.

3.4 PARKING ANALYSIS

This study identifies how the existing parking supply may be affected by possible changes to the roadway operation and design to achieve the multimodal goals for the corridor.

On-Street Parking

Winooski Avenue has 347 on-street parking spaces. Seventeen of these spaces have special permitted uses: loading zones, accessible spaces, or 15- minute parking. Of the 330 remaining spaces, 70% have no parking regulations, and the rest are metered or have 1- or 2-hour limits.

Intersection and adjacent streets with residential permit programs include the following:

- Grant Street between Winooski Avenue and Union Street: seven days a week all times of the year.
- Spruce Street between Winooski Avenue and Willard Street: weekdays from 6:00 a.m. to 6:00 p.m.
- Union Street between Pearl Street and Buell Street: seven days a week all times of the year.

Figure 27 shows parking regulation types along Winooski Avenue. No on-street parking exists along the four-lane segment between Pearl Street and Main Street. For one block north and south of the four-lane segment, there are metered spaces. In the residential areas south of King Street and between Grant Street and Archibald Street, there are no parking regulations. The segment between Archibald Street and Riverside Avenue has the most restrictive parking regulations with one-hour (only three spaces on the northern end) and two-hour parking for neighborhood commercial activities and community services.

The corridor includes four accessible parking spaces:

- One space in front of the McClure Community Resource Center on the corner King Street.
- One space in front of 35 North Winooski Avenue between Grant Street and Pearl Street.
- One space in front of Pathways Vermont Community Center just south of Archibald Street.
- One space in front of Legal Aid at 264 North Winooski between Union Street and Archibald Street.

FIGURE 27: ON-STREET PARKING REGULATIONS



Source: RSG

General unrestricted parking encompasses the majority of spaces, although there are some locations with loading, accessible, and other specific regulations.

Off-Street Parking

The **Marketplace Garage**, which occupies most of the block between Bank Street and Cherry Street, exits onto Winooski Avenue and has 389 parking spaces. The garage also houses a two-vehicle CarShare Vermont hub, covered bicycle parking, and secure bicycle parking lockers with spaces for up to 10 bikes.

City Market is a landmark in downtown Burlington. The grocery store co-op generates a substantial amount of travel demand from all modes. The contiguous lot has nearly 100 parking spaces, split between the private City Market entity and publicly available spaces.

The **Main Street lot** has 42 public parking spaces charged at \$1.50 per hour.

The **Center Street lot** is a private lot with 35 public parking spaces charged at \$4.00 per hour.

Courthouse Plaza Garage is a private lot with 284 spaces available to the public for \$3.00 per hour all day Saturday and Sunday to Friday from 1:00 p.m. to 2:00 a.m.

Existing Demand vs. Supply

Properties north of Pearl Street are generally on larger lots that have some supply of parking off the street. Some commercial land uses between North Street and Riverside Avenue have been identified as locations with limited off-street parking supply.

South of Maple Street, the corridor is residential in nature and appears to have smaller lots and less space for off-street parking. The topography of the hill, the high residential density, and smaller lots all create a higher overall demand for the on-street parking spaces.

On-Street Vehicle Parking Occupancy—Observations

Vehicle parking counts were conducted over seven periods over the second half of 2018 (Table 3).

TABLE 3: PARKING COUNT DATES

DAY OF WEEK (TIME)	DATE
Sunday AM (11:00 a.m.)	7/22/18
Friday AM (11:15 a.m.)	8/10/19
Monday AM (11:15 a.m.)	10/1/18
Monday PM (3:00 p.m.)	10/1/18
Wednesday PM (7:15 p.m.)	10/17/18
Saturday AM (10:00 a.m.)	11/3/18
Saturday PM (5:30 p.m.)	11/3/18

The observations captured several days and the effects of summer and school period demands for on-street parking.

Discussion

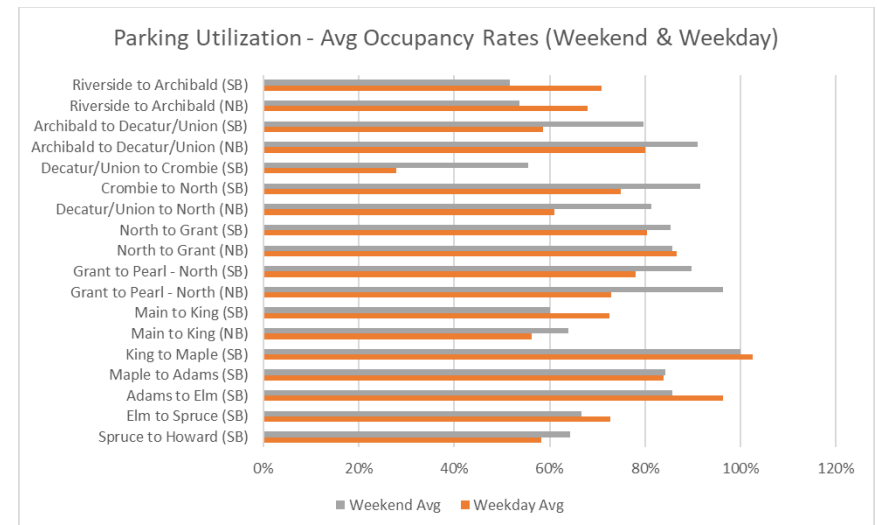
Vehicle parking is a sensitive topic as land uses have developed over time, sometimes without sufficient off-street space to accommodate the associated vehicle parking. Over time, businesses and residents alike have grown accustomed to using the public right-of-way for long-term vehicle parking. However, parking consumes valuable public space that can be used to meet other needs of the transportation system and the social fabric of the community.

The City has modal objectives to reduce reliance on the single-occupancy vehicles and to encourage carpooling, taking transit, walking, and bicycling. However, this process requires time for personal behavior to change and these options to become viable. This temporal disconnect creates a “chicken-or-the-egg” dilemma to urban transportation.

The vehicle parking demand along the Winooski corridor is evident, although the patterns are difficult to discern and do not lend themselves to a simple explanation.

Areas managed by time-limited or metered parking have lower parking utilization, given the turnover encouraged. Several segments (both on the northern and southern) outside the downtown area show higher demands during the weekdays than on weekends. The segment between Pearl Street and Archibald Street indicates that weekend use is higher than weekday use; this suggests residential land uses rather than commercial uses.

FIGURE 28: OBSERVED ON-STREET PARKING OCCUPANCY



Source: RSG

TABLE 4: ON-STREET VEHICLE PARKING OCCUPANCY (PERCENTAGE OF SPACES OCCUPIED)

SEGMENT	CURB	DIRECTION	SUNDAY AM	FRIDAY LATE AM	MONDAY LATE AM	MONDAY LATE AFTERNOON	WEDNESDAY PM	SAT AM	SAT AFTERNOON	OVERALL AVG	WEEKDAY AVG	WEEKEND AVG
Spruce to Howard (SB)	West	SB	79%	60%	45%	43%	86%	57%	57%	61%	58%	64%
Elm to Spruce (SB)	West	SB	64%	27%	91%	73%	100%	73%	64%	70%	73%	67%
Adams to Elm (SB)	West	SB	86%	114%	100%	86%	86%	100%	71%	92%	96%	86%
Maple to Adams (SB)	West	SB	76%	100%	88%	100%	47%	82%	94%	84%	84%	84%
King to Maple (SB)	West	SB	100%	100%	100%	100%	110%	100%	100%	101%	103%	100%
Main to King (NB)	East	NB	42%	42%	58%	67%	58%	42%	108%	60%	56%	64%
Main to King (SB)	West	SB	60%	60%	90%	50%	90%	40%	80%	67%	73%	60%
Grant to Pearl - North (NB)	East	NB	54%	75%	35%	75%	107%	114%	121%	83%	73%	96%
Grant to Pearl - North (SB)	West	SB	61%	93%	48%	71%	100%	100%	108%	83%	78%	90%
North to Grant (NB)	East	NB	68%	86%	86%	82%	93%	93%	96%	86%	87%	86%
North to Grant (SB)	West	SB	81%	69%	84%	91%	78%	88%	88%	83%	80%	85%
Decatur/Union to North (NB)	East	NB	80%	36%	52%	68%	88%	76%	88%	70%	61%	81%
Crombie to North (SB)	West	SB	75%	50%	75%	75%	100%	100%	100%	82%	75%	92%
Decatur/Union to Crombie (SB)	West	SB	44%	33%	22%	11%	44%	67%	56%	40%	28%	56%
Archibald to Decatur/Union (NB)	East	NB	80%	47%	67%	87%	120%	93%	100%	85%	80%	91%
Archibald to Decatur/Union (SB)	West	SB	83%	43%	57%	39%	96%	70%	87%	68%	59%	80%
Riverside to Archibald (NB)	East	NB	33%	72%	50%	61%	89%	56%	72%	62%	68%	54%
Riverside to Archibald (SB)	West	SB	39%	77%	68%	84%	55%	32%	84%	63%	71%	52%



Smart Use

The City of Burlington is taking a smart use approach to the management of its parking supply. The Downtown Parking Plan states the following:

A “smart use” philosophy, on the other hand, acknowledges that parking is a critical asset to the health and vitality of a downtown but is more entrepreneurial in its approach. Parking is part of a total accessibility strategy that also incorporates alternative modes of transportation for bringing citizens and visitors to and from the downtown. “Smart use” promotes active management of existing assets; with the development of new parking facilities only occurring once all existing assets are utilized to their maximum potential. Under a “smart use” approach, the true cost to provide parking is incorporated parking prices, to make sure the system is fiscally sustainable.¹⁰

The segments with parking meters within the corridor appear to be under the 85th percentile occupancy often used in the “smart use” philosophy as the target occupancy for managed parking.

¹⁰ Park Burlington, <https://parkburlington.com/> see the Downtown Parking Transportation Plan. [https://parkburlington.com/wp-](https://parkburlington.com/wp-content/uploads/2015/12/Downtown-Parking-Transportation-Plan-Final-Draft-V.5.pdf)

[content/uploads/2015/12/Downtown-Parking-Transportation-Plan-Final-Draft-V.5.pdf](https://parkburlington.com/wp-content/uploads/2015/12/Downtown-Parking-Transportation-Plan-Final-Draft-V.5.pdf).

4.0 PUBLIC ENGAGEMENT

4.1 OVERVIEW

The project team developed a Public Participation Plan (Appendix B) that was informed by the CCRPC's Public Participation Plan¹¹ and the City of Burlington Public Works' Public Engagement Plan.¹²

Public participation objective: *The public will be engaged during every stage of the study using a variety of tools and formats to arrive at recommendations that reflect the needs of the community and minimize undesirable impacts.*

The project team and steering committee partnered with the public in each aspect of the decision-making, including the development of alternatives and the identification of the preferred solution. These activities were guided by the **Collaborate** approach identified within the spectrum of participation (Figure 29).

The public engagement process was guided by these four elements:

1. PAC.
2. Public Forums.
3. Stakeholder Interviews.
4. Continuous Communication.

¹¹ Chittenden County Regional Planning Commission. 2014. "2014 Public Participation Plan," http://www.ccrpcvt.org/wp-content/uploads/2016/01/CCRPC_2014_PPP_Amended_2017.pdf.

FIGURE 29: CCRPC SPECTRUM OF PARTICIPATION

Spectrum of Participation				
INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
The CCRPC will provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	The CCRPC will obtain public feedback on analysis, alternatives and/or decisions.	The CCRPC will work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered. <i>At the INVOLVE level and above, staff will complete the CCRPC Equity Impact Worksheet.</i>	The CCRPC will partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	The CCRPC will place final decision-making in the hands of the public.
CHARACTERISTICS OF PARTICIPATION				
· Primarily one-way channel of communication	· Primarily one-way channel of communication	· Two-way channel of communication	· Two-way channel of communication	· Two-way channel of communication
· One interaction	· One to multiple interactions	· Multiple interactions	· Multiple interactions	· Multiple interactions
· Term-limited to event	· Short to medium-term	· Medium to long-term	· Medium to long-term	· Medium to long-term
· Addresses immediate need of county and community	· Shapes and informs county programs	· Advancement of solutions to complex problems	· Advancement of solutions to complex problems	· Advances solutions to complex problems
STRATEGIES OF PARTICIPATION				
Website & online calendar, database, informational brochures, posters and flyers, display ads, press releases, social media, email announcements, newsletters	Public hearings & legal ads, work groups, comment forms, surveys and questionnaires, visualization techniques, analysis reports, technical assistance studies	Advisory/steering committees, project meetings/workshops/open houses/forums, direct mailings, staff outreach, CCRPC Equity Impact Worksheet	Community or co-led committees, advisory boards, coalitions and partnerships, policy development and advocacy	Community-led planning efforts, community-hosted forums

Source: International Association of Public Participation; www.iap2.org

4.2 PROJECT ADVISORY COMMITTEE

The project was guided by the PAC that represents various City and community entities. Meetings with the PAC occurred at strategic points within the overall project to obtain input on draft deliverables and upcoming steps. The following groups were represented on the PAC:

- Department of Planning and Zoning.
- City Council.

¹² City of Burlington, Department of Public Works. 2017. "Public Engagement Plan," https://www.ccrpcvt.org/wp-content/uploads/2017/08/BurIDPW_Public_Engagement_Plan_20171207.pdf.



- Community and Economic Development Office.
- Burlington Business Association.
- Church Street Marketplace.
- Old North End Arts and Business Network.
- Burlington Walk/Bike Council.
- GMT.
- AARP Vermont.
- Central District: one resident representative.
- East District: one resident representative.
- South District: one resident representative.

The PAC met seven times over the course of the project at critical junctures within the study process.

- **Meeting 1** (May 2, 2018): Reviewed the history of plans and studies of Winooski Avenue and relevant City and regional plans that informs the scope of work for this study.
- **Meeting 2** (July 23, 2018): Reviewed the existing conditions along Winooski Avenue.
- **Meeting 3** (Oct. 23, 2018): Summarized public engagement and stakeholder interviews. Established study vision and initial intersections and segments for improvement alternatives.
- **Meeting 4** (January 29, 2019): Identified preliminary options for improving the corridor to address existing issues and challenges identified during the public engagement.
- **Meeting 5** (March 26, 2019): Developed refined options with three primary alternatives and subalternatives. The

meeting summarized additional data collected, such as parking and additional public comments. Initial evaluation criteria were reviewed.

- **Meeting 6** (Oct. 22, 2019): Reviewed the alternatives and the evaluation results to recommend a set of options to be presented at Public Meeting 3.
- **Meeting 7** (Jan 28, 2020): Reviewed the recommended alternatives and the feedback at the Public Meeting 3 and selected a preferred alternative to carry into the City approval process.

4.3 PUBLIC MEETINGS

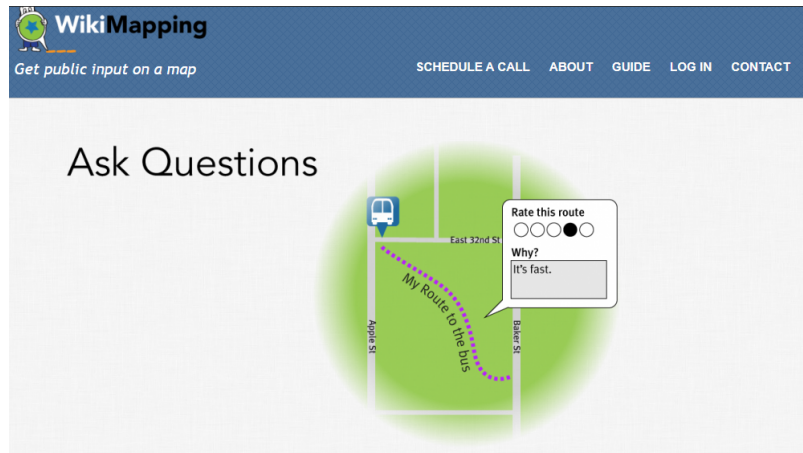
The project convened three public meetings that provided a widely accessible forum that engaged and solicited a wide set of input and opinion from a diverse stakeholder group. The three meetings were held at key deliverable points within the study: existing conditions, development of alternatives, and feedback on the recommended alternative. Public meetings were advertised using Front Porch Forum announcements, fliers on building doors and cars along the corridor, the project website, the project's email database, direct emails to stakeholder groups and City committees, online meeting and event calendars, and more.

Public Meeting 1

The first public meeting was held on September 5, 2018 in the Contois Auditorium. The meeting focused on the project team providing a technical review of the existing conditions observed within the study corridor. The meeting ended with participants submitting concerns, challenges, and other comments into a WikiMaps existing conditions web survey. Prior to the meeting, the project team staffed an information table at City Market

grocery store on Winooski Avenue to share project information with customers. The project team also led a walking tour along part of the corridor to discuss various issues with the public and listen to their experiences, concerns, and ideas (Section 4.6).

WikiMapping is an online survey and public engagement platform using maps to obtain input.



Public Meeting 2

The second public meeting was held on June 4, 2019 in the Old North End Community Center. The meeting focused on soliciting feedback on the array of alternatives considered, whether additional alternatives should be considered, and the evaluation criteria that will be used to evaluate alternatives.

Comments posted that could apply to any alternative:

- “Underground utilities. Ornamental lights. District heating infrastructure.”
- “Please prioritize street trees in corridor design! Street trees improve health, raise property values, mitigate storm water, reduce crime rates, improve mental health, etc etc etc. They are not an afterthought.”

- “Don’t reduce parking before reducing parking demand. Focus on long term how to reduce parking demand.”

TABLE 5: ALT 1 (BICYCLE LANES) BOARD

CONCEPT	# OF RELATED COMMENTS
Not enough protection for bicyclists	3
Opposed to sharrows	2
Reduce the speed limit	2
Need two-way car travel between Pearl and North	1
Need parking on both sides Pearl to Riverside	1

Unique and constructive comments:

- Does not achieve key criteria of safe, low-stress bicycling.
- Two-way Winooski Avenue connects ONE to downtown.

As part of public outreach for the initial alternatives, a project display was available at the public library for one week, with project staff available during certain times. Staff also hosted a drop-in opportunity at a local business on Winooski Avenue as another way to answer questions and gather public feedback.

TABLE 6: ALT 2 (PROTECTED BICYCLE LANES) BOARD

CONCEPT	# OF RELATED COMMENTS
Opposed to loss of parking (bad for business)	5
Do not remove or minimize trees or green belt	4
“Best” alternative	3



TABLE 7: ALT 3 (TWO-WAY PROTECTED BICYCLE LANES) BOARD

CONCEPT	# OF RELATED COMMENTS
Good/safe for bicyclists	7
Alt 3 is the “best”	6
Concerned about turning bicyclists	6
Better for bicyclists accessing City Market	3
Combined bicycle lanes are snow-plow friendly	2
Keep/need street trees	2

Public Meeting 3

The third public meeting was held on November 13, 2019 in the Old North End Community Center. The meeting focused on presenting the recommended alternative and receiving comments.



As with Public Meeting 2, additional public outreach included a project display at the public library for one week, and another drop-in opportunity at a local business on Winooski Avenue to answer questions and gather public feedback.

Public comments were submitted both through email and printouts from a period spanning from September 21, 2019 to December 5, 2019. Appendix B includes the public comments received. The project team collected the following statements:

- Stressed the need for continuous bicycle lanes throughout the corridor.

- Most (although not all) prefer protected bicycle lanes for safety reasons, and several commenters shared that they had felt unsafe or had been injured while cycling along the corridor.
- Commonly reasons for support include safety, accessibility, and equity.
- Many argued that on major arteries like Winooski Avenue the public right-of-way should be prioritized over private vehicle storage.
- Argued loss of parking would negatively impact local business (including landlords who would struggle to lease units without parking), especially since there is limited off-street parking in the area.
- Argued that cyclists are in the minority and bicycle infrastructure goes unused during the winter.
- Common reasons for concern included accessibility and equity, particularly that the loss of parking will limit accessibility to nonprofits in the area (e.g., Howard Center, Community Health Center, Feeding Chittenden) especially for the disabled.

Even those who had concerns with Winooski Avenue expressed support for moving ahead with improvements to the corridor section between Main Street and Pearl Street (cited as the most dangerous stretch).

4.4 STAKEHOLDER INTERVIEWS

The project benefits from having a diversity of interests represented on the PAC and from numerous public engagement opportunities. However, to ensure the project team heard from as many interests as possible, members of the project team

identified other stakeholders to better understand Winooski Avenue through their perspectives.

All thoughts, suggestions, and ideas discussed in the following sections were raised by interview participants and paraphrased (or, when possible, directly attributed).

As part of the Existing Conditions process, the project team conducted conversational interviews with people from the following organizations:

- University of Vermont
- Howard Center
- Champlain College
- Chittenden Area Transportation Management Association (CATMA)
- City Market
- Burlington Fire Department
- Burlington School District Transportation
- Parents from Integrated Arts Academy
- GMT
- Association of Africans Living in Vermont (AALV)
- North End Studios
- Vermont Department of Health
- Radio Bean/ ¡Duino! (*Duende*)
- Old Spokes Home
- Local Motion
- African Market
- Shinjuku Station

- East West Cafe

Several themes emerged from these conversations. Many interviewees view Winooski Avenue as a central corridor that provides access to and from the City, but the four-lane section between Main Street and Pearl Street is challenging for all users (walkers, bikers, transit, autos). It sends the message that the person is getting to someplace else and serves as access to other places, rather than being a “place” or destination of its own.

People also like the vibrancy and sense of place of the Old North End and its diversity of people and businesses. The businesses on North Winooski are “in the spirit” of the Old North End, and a desire exists to build community and culture around them and their unique aesthetic. Strong sentiments were not expressed about the residential neighborhood south of Maple Street. People like that it feels “calm, peaceful, quieter” than the four-lane section between Main Street and Pearl Street, and that it has two-way bicycle facilities. However, the contraflow lane (heading northbound) might cause confusion for people driving. One person, however, noted that the section between Main and King streets “feels weird,” like a person is not supposed to go into that southern neighborhood. That section of Winooski Avenue has parking on both sides of roadway and then transitions to one way southbound with two-way bicycle traffic.

One question asked of stakeholders was, “What is the first word (or three) that comes to mind when you think about Winooski Avenue?” Some themes about the corridor that emerged from these comments include that it is a City gateway, it traverses different neighborhoods that continue to evolve and grow, the traffic patterns can be confusing, there’s a lack of continuity, and the downtown section is intimidating and ugly.



Discussion of specific themes and issues are summarized as follows.

Vehicle Parking

Interviewees expressed diverging interests in either the need to keep on-street parking or remove it to provide additional roadway space for other uses like bicycle infrastructure. As one person put it, “This study will come down to a trade-off between on-street parking and on-road use like bike lanes.” They expressed a need for more short-term parking spaces for customers and deliveries, clarity about where parking is legal or illegal, adequate width to pass when snow accumulation causes parked cars on both sides of street to creep away from the curb into the roadway, opportunities for public access to nearby parking lots, and consideration for additional parking on nearby streets if it is removed from Winooski Avenue.

Bicycle Facilities and Bicycle Parking

Interviewees generally appreciated that there is bicycle infrastructure in the south and north ends of Winooski Avenue. However, interviewees expressed that any bicycle-related changes need to be consistent throughout the corridor, such as bicycle lanes on both sides of the roadway, or a protected two-way bicycle lane on one side. Most people noted the lack of any bicycle infrastructure between Main and Pearl streets. Specific challenges for people bicycling were noted at the Riverside/Winooski Avenue intersection and downtown between Main and Pearl streets. Loading zone conflicts with bike parking near Radio Bean should be improved. Beyond infrastructure, education was suggested so that people on bikes know the rules of the road.

Pedestrian Amenities

While there is a connected sidewalk network throughout the corridor, interviewees noted an absence of benches, green space, and the close proximity to the roadway downtown even though the sidewalks are wide. People liked the landscaping in front of Howard Center, City Market, and the Ronald McDonald House, as well as the public art and murals, quirky character, lighting, and aesthetics of downtown. Street trees could make the downtown section feel “denser and tighter” to reduce speeding and improve the downtown aesthetics. Intersections are challenging in many ways: pedestrian crossing times could be longer for people with disabilities, Grant Street and Decatur Street do not feel safe to cross, the Pearl/Winooski intersection is not well known as an all-way pedestrian crossing, and the Archibald/Winooski intersection is large and intimidating.

One-Way Versus Two-Way Traffic Pattern

People noted that the inconsistent traffic configuration can be confusing for tourists and limit access to neighborhoods. Turning North Winooski from Pearl to Union into a two-way street would open access to Old North End and businesses, help the northern section feel “less desolate,” and help address wrong-way bicycling. However, others noted this one-way section is “slower,” feels more bicycle/pedestrian friendly, and could become the “traffic dump” to access the City of Winooski if it were two-way traffic.

Transit

Existing GMT service only uses a portion of Winooski Avenue, and GMT staff noted that they would prefer to utilize Winooski Avenue more as a north/south route. One-way streets such as parts of North and South Winooski are not insurmountable for transit service, but these streets are not ideal for passenger

pickup/drop-off. Lane width can be tight for transit between Cherry and Main streets and stopped vehicles on narrow Union Street delays transit service.

Main Street to Pearl Street

Interviewees expressed many opinions about the four-lane section between Main Street and Pearl Street, including left-turning traffic blocking the inside travel lanes, weaving traffic, Special Service Transportation Agency (SSTA) and deliveries blocking lanes, lack of bicycle infrastructure, unwelcoming feel for people walking, large and wide curb cuts, jaywalking near City Market, challenging left turns out of driveways, parking garage and driveway conflicts, buses changing lanes between College Street and Main Street, gas stations feel out of place, and it feels like an alley for other businesses.

People expressed concerns about adding new bicycle lanes on South Winooski, especially on the City Market side given the existing challenges (e.g., turning traffic, delivery trucks, proximity of signals, jaywalking, SSTA blocking a lane).

People offered potential solutions, including the following:

- Make City Market entrance from Winooski Avenue one way, make parking lot spaces angled, exit onto Union Street, then make Buell Street two way to get back to Winooski Avenue.
- Consider opening up the entrance to Orchard Terrace from City Market parking lot.
- Connect City Market parking lot to UPS lot and make four-way signalized intersection at Bank Street.

- Incorporate roundabouts throughout the Winooski Avenue corridor.
- Add an artistic structure or something else at the corner of Winooski Avenue and Main Street to convey it as a gateway intersection to the central business district.

Other general suggestions are the need to consider traffic flows with future developments like CityPlace Burlington, UVM's multipurpose center, and the new YMCA. Interviewees expressed a desire to use pop-up projects to get real-world experience and feedback on project recommendations.

Open Streets BTV Summary

The project team also hosted a public information table at Burlington's Open Streets event on September 30, 2018. The table was located on North Winooski Avenue at the intersection with North Union Street and Decatur Street in the heart of the Old North End. Project team members spoke with people as they enjoyed Open Streets activities in the public space, asked them what they liked about Winooski Avenue and what they would change about it, and asked them to write comments and draw on maps and paper.¹³

People commented that they liked the sense of community in the Old North End, being close to neighborhood schools, the proximity and diversity of businesses and restaurants, the newly created Old North End Greenway and planters, street trees, and the bicycle lane on North Winooski. They noted that Winooski Avenue between Main and Pearl streets is difficult for people walking and bicycling.

¹³ Comments are available on the project website (tiny.cc/WinooskiAveStudy).



People wanted to see a protected bicycle lane the length of the corridor and safe intersections for bikers, consideration of roundabouts, parking available for residents, and more Community Health Center parking at Riverside. People also noted the need for more affordable housing. People offered suggestions to slow down traffic through the neighborhood and the desire for more trees and grass.

Old North End Business Summary

The project team met with Old North End businesses at Butch & Babes on November 6, 2019. Facilitated by Jane Knodell, the project team heard concerns for current parking capacity, concerns for any recommendations to remove parking, and interest in a parking study to understand the impact of parking removal.

4.5 CONTINUOUS COMMUNICATION

The project steering committee maintained contact with the relevant neighborhood planning assemblies and the many organizations and interested parties throughout the corridor. Individual meetings were held to solicit input on the alternatives under consideration and the alternatives that were refined after the evaluation process. The project website¹⁴ was an important resource highlighting the most recent project information. Project updates and opportunities to provide public comment were communicated via the Constant Contact email platform to a contact database with more than 500 recipients.

¹⁴ Chittenden County Regional Planning Commission. "Winooski Avenue Corridor Study," [https://www.ccrpcvt.org/our-](https://www.ccrpcvt.org/our-work/transportation/current-projects/corridors-circulation/winooski-avenue-corridor-study/)

FIGURE 30: PROJECT WEBSITE

WINOOSKI AVENUE CORRIDOR STUDY

LATEST NEWS

The [final PAC meeting](#) is scheduled for Tuesday, January 28, 7-9 p.m., Firehouse Gallery, Second Floor, 135 Church St at which they will review the [draft implementation plan](#) with near and long-term options.

View the November 13 public meeting [presentation](#) and download the [near-term corridor option](#) (large 23 Mb file).

Use this [3D Visualization Tool](#) to view the draft alternative concepts. [Click here for a quick overview](#) on using the 3D tool.

To view all past meeting materials and current project documents, [click here »](#)

NOTE: you may have seen recent Front Porch Forum paid ads to download the Consensus app; this is an advertisement from a non-affiliated business and is not sponsored by the City or CCRPC.

Source: CCRPC

[work/transportation/current-projects/corridors-circulation/winooski-avenue-corridor-study/](https://www.ccrpcvt.org/our-work/transportation/current-projects/corridors-circulation/winooski-avenue-corridor-study/).

4.6 SPECIFIC CHALLENGES WITHIN THE CORRIDOR

The project team conducted a survey of existing issues using the WikiMaps platform (wikimapping.com) to canvas the community (see screenshot in Figure 31) on what issues and challenges they experienced while traveling along or through the corridor. The respondents could identify a specific location, a segment of the corridor, or the entire corridor. The project team summarized the comments by travel model and by location in the corridor, as shown in Figure 32.

FIGURE 31: WIKIMAPPING EXISTING CONDITIONS WEB SURVEY

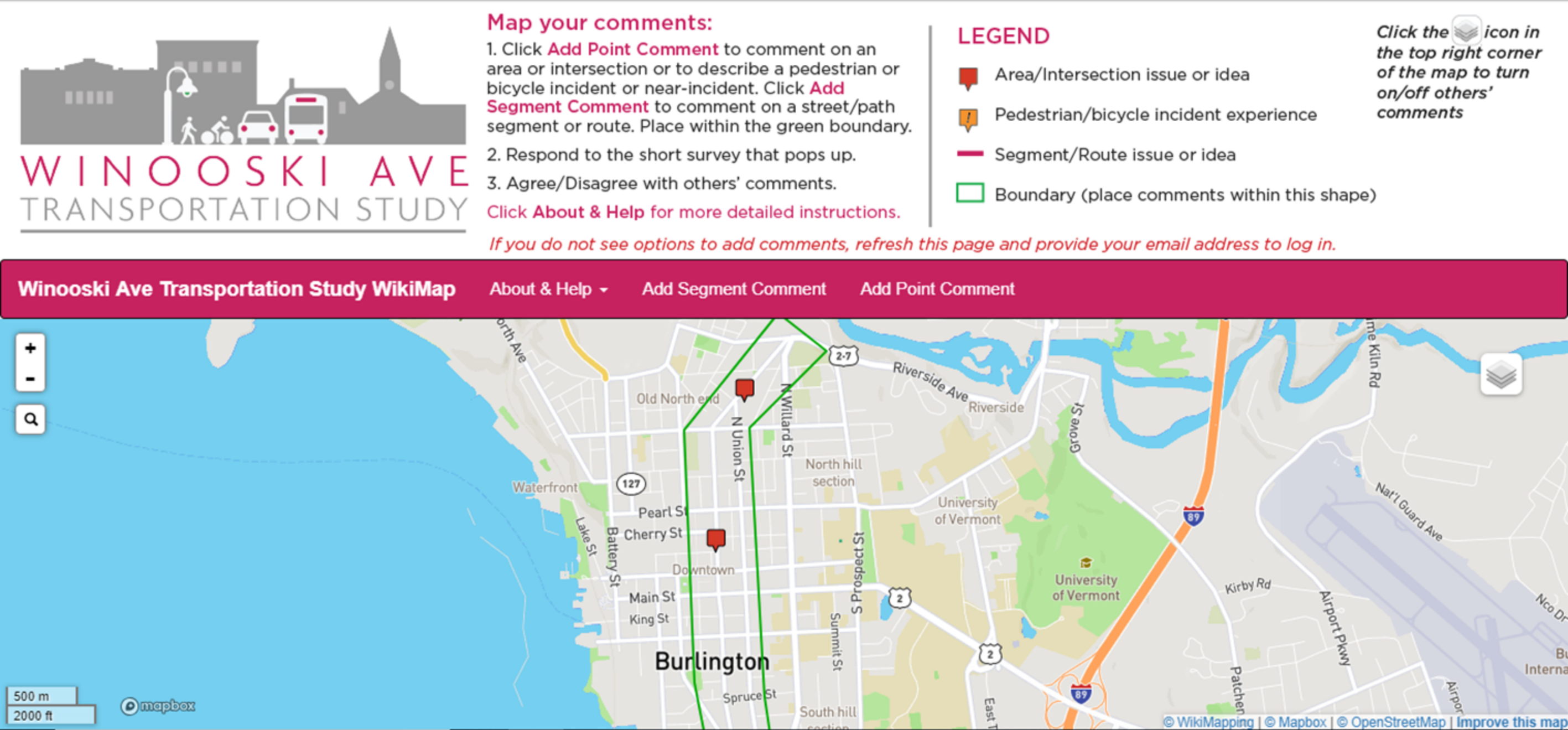


FIGURE 32: CHALLENGES EXPERIENCED ON THE STUDY CORRIDOR

Riverside Ave to North St		North St to Pearl St		Pearl St to Main St		Main St to Howard St		General/Entire Corridor	
Better Bicycle Infrastructure									
5	No safe transition from bike path to street Bicycles are often travelling in both directions even though it's one way Sharrows are not suitable for this segment; need real bike lanes Need a bike box for bicycles turning onto Decatur from Winooski Ave								
2	Weight sensors do not work for cyclists at light @ Riverside Riverside Ave intersection - difficult for bikers and walkers to cross Riverside Ave intersection - better markings for bicycles and cars Almost hit by a door in the bike lane Add two-way separated bike lane to terminus of Winooski Ave								
2	Don't drop the bike lane at Pearl Street Like the bike box at Winooski/North St								
2	Door zone bike lane is scary to bike in Bike lanes both ways through this section North St intersection - bike lane markings/car markings are not clear North St intersection - serious danger for right-hooks								
2	Remove parking on N Winooski Ave and add bike lanes Leave car traffic one-way, remove parking and add bike lanes Pearl St intersection - add bike signal or bike box Pearl St intersection - confusing for bikes and drivers Make a place for bicycles that is not the sidewalk (or the street in traffic) Extend the one way traffic and prioritize bus flow At Pearl/Winooski - markings for bicycles turning onto Pearl from Winooski Ave More bike racks everywhere Bike crossing at Bank/Winooski Add a protected bike lane Good section but needs protected bike lane Need bike lanes around Edmunds and Champlain College Signage for bikes turning against traffic Like the two way bike lanes (contra flow) Bicycle lanes should be protected Main St intersection - add bike box or bike signal King St intersection - hard for bicycles because of grade, but a common route Abrupt ending to NB bike lane at Maple St - only way to go is up Maple St (very steep) Continue bike lanes from Maple to Main Cars often stop in the bike lanes and block them Cyclists shouldn't have to stop at stop signs through this section Difficult to bike up Howard St and take a left onto bike lane on S Winooski Maintaining bike lanes - potholes are dangerous Adopt new bike lanes from the ONE All bicyclists should be on the street, not sidewalks, if over the age of 12 Bike path to bike lane connection Enforce 4 ft passing law Create a good module for bike safety and education Make bicycle and car safety compulsory in schools Make a nearby road a bicycle thoroughfare (bikes only) Connect the bike lanes in the north end and south end Remove parking and add more bicycle facilities Want to see more changes like the ones on Pearl St at Willard								
6	Add protected bike lanes along the entire corridor								
Pedestrian & Streetscape Improvements									
2	N Winooski/Archibald intersection - takes forever to cross as a pedestrian Like the public art near North St Improve the park at Riverside Ave Sight distance turning right from Hyde St to Riverside Ave - many near misses with pedestrians Archibald St intersection is too big, improve with rain gardens or bump outs								
2	Underutilized parking lot @ North End Studios - use as parking for businesses?								
4	Make "diagonal" crossings at N Winooski/Pearl St or grid entire intersection Old North End Variety Store has underutilized parking lot - add parklet? Utility poles on both sides of street - unattractive Pearl St intersection - pedestrian light doesn't work (E/W walk signal shows red during ped phase) "Soul-killing parking lot, derelict motel, please do better!" at S Winooski/Main St Only pedestrian crossing light is at Bank St Parking garage intersection is dangerous Good sidewalks Ped signals would help at S Winooski/Howard intersection Pedestrian crossing is not good at Spruce St intersection - steep angle and slippery Exclusive pedestrian phase at S Winooski/Howard intersection Improve lighting from S Winooski from King St to Adams St (trees block out light) King St intersection - add rain gardens or bump outs Howard St intersection - too big, needs bump outs Howard St intersection - No pedestrian route crossing Winooski Ave Howard St intersection - long wait times, confusing to know when bikes and peds should cross Clearer signage Too many distractions More trees More crossings Improve lighting, especially on bike lanes More space for people, less space for parked vehicles Less tobacco use at N Winooski and Pearl Ticket jay walkers								
Better Transit									
	Extend the one way traffic and prioritize bus flow Bus stop on Winooski Ave near Buell St is in a bad spot Pearl St intersection - relocate bus stop on NW side of intersection								
5	Light rail/street cars or elevated line N-S and E-W								
Improve the Traffic Circulation									
	Need a simple way out of the old north end (from N Winooski)								
2	North St/Winooski Ave intersection has poor visibility + confusing traffic pattern Pearl St & Winooski intersection is very important route for cars getting from center of town to ONE Grant St to Pearl St should be two way								
3	Consider two way traffic for all forms of transportation Pearl St intersection - consider a roundabout Many conflicts along this segment								
9	City Market: priority, access, safety, flow issues Extend the one way traffic and prioritize bus flow Make this segment 3 lanes: 2 SB lanes (one transit only) and 1 NB lane Set cross turn rules to not allow favoring peak traffic times - eg no left turns 7-9AM								
6	Rethink traffic circulation in this section (road diet?) No left turn in or out from City Market								
2	Parking garage intersection is dangerous Enter & exit City Market from Union St Only College St intersection - left green arrow from Winooski Ave onto College St Delivery trucks block the road near College St intersection Crossing area near the co-op turn in Main St intersection - roundabout Stop signs are annoying for all users - what about mini roundabouts? Main St/Winooski Ave intersection - cars run this red light often Almost impossible to turn left onto Winooski Ave from Main St eastbound Main St intersection - congested and dangerous for everybody Why is there two-way traffic Maple to Main? Eliminate one way streets Corridor should be continuous								
Traffic Calming									
2	N Winooski/Unionr intersection: Union to Winooski acts as a yield instead of stop								
2	Need to slow down traffic from Pearl to Main - this is downtown Observe lots of speeding Adams St to Spruce St is a speedway for cars Slow traffic down Make the speed limit 15 mph Red light and speed cameras Speed humps								
This list aggregates comments from our City Market outreach, the public meeting, and the Wikimap. Bolded comments were mentioned multiple times									

Source: RSG

5.0 PROJECT ALTERNATIVES

5.1 OVERVIEW

The project team developed an array of alternatives for the study corridor based on the existing conditions outlined in Section 3.0 and the public input received through meetings, forums, web surveys, and comments sent to the project team.

The project alternatives focused on infrastructure improvements that would mitigate existing deficiencies, address challenges and issues identified by the public, and align with the vision and goals of the project.

Initially, the focus was on specific segments and intersections within the corridor. It became apparent that a corridor-wide lens was necessary to develop options that can make localized improvements but also remain consistent at a corridor level.

Thirteen alternatives were ultimately developed that articulated a complete solution at the corridor level but had differences in specific locations or segments along the corridor.

The 13 alternatives were evaluated and refined to create shorter- and longer-term options for the three primary segments within the corridor: northern (between Riverside Avenue and Pearl Street), downtown (between Pearl Street and Main Street), and southern (between Main Street and Howard Street/St. Paul Street).

5.2 INTERSECTIONS AND SEGMENTS

The first set of alternatives developed for future improvements in the corridor looked at identifying key nodes within the study area. These included: north of Union Street, Union Street intersection, downtown (including Pearl Street intersection through to include Main Street intersection), and south of Main Street. The nodes were further explored to identify how the downtown intersections can be designed to improve pedestrian and bicycle safety while maintaining adequate mobility.

Roundabouts

This investigation was critical to identify that single-lane roundabouts, while able to provide sufficient capacity for all modes, would require additional right-of-way to be purchased in the downtown area. Purchasing right-of-way in the downtown area is outside of the scope of this project and, in some cases, may be costly or affect significant structures. Full roundabouts at Pearl Street, Bank Street, and College Street all would impact existing structures and require additional right-of-way. Mini-roundabouts would not impact existing structures at Bank Street and College Street, but pedestrian volumes and proximity to adjacent intersections limited the capacity of mini-roundabouts at these locations.

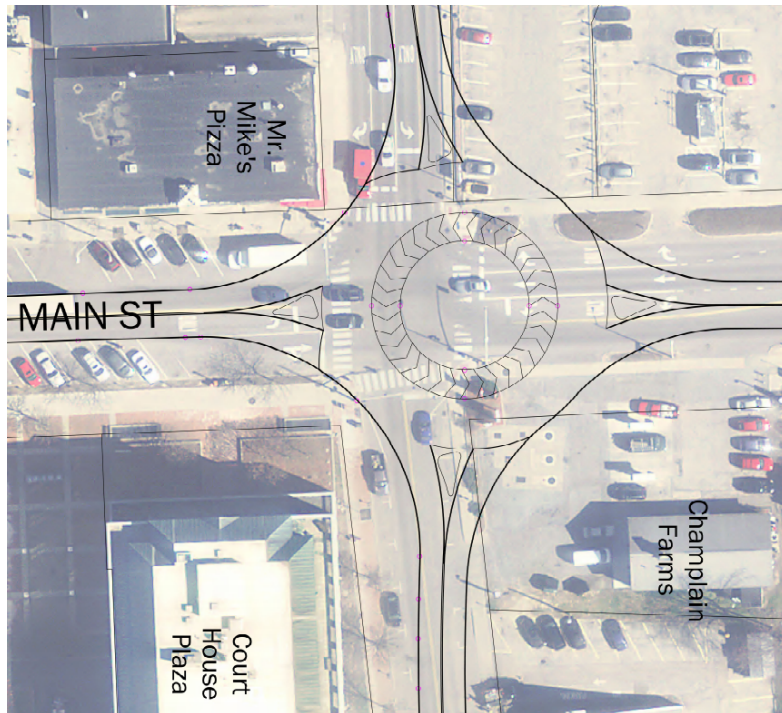


Main Street

A single-lane roundabout at Main Street, at a size to accommodate trucks with 53-foot trailers, would also require right-of-way from the gas station on the southeast corner and land from the publicly owned parking lot on the northeast corner. Main Street is the subject of an upcoming Great Street project that will develop short- and long-term improvements along the Main Street corridor.

The concept for the 130-foot inscribed diameter for the roundabout is shown in Figure 33. A small roundabout may work; however, mountable curbs would be necessary to accommodate the larger 53-foot trailers that are common on Winooski Avenue.

FIGURE 33: MAIN ST. ROUNDABOUT SKETCH—130' DIAMETER



Source: D&K

Mini-Roundabouts

Mini-roundabouts are a smaller option with less capacity than single-lane roundabouts. These are most often found in suburban or in locations with fewer pedestrian, bicycle, and vehicle demands than the downtown area of the corridor.

Mini-roundabouts are planned at North Street and the Union Street/Decatur Street intersections. A mini-roundabout is designed to reduce vehicle delay (relative to signals or the all-way stop at Union Street), provide pedestrians priority (pedestrians have the right-of-way across the legs of the intersections), and provide calming effects by slowing speeds.

Roundabouts and Bicycle Lanes

The constrained corridor challenges implementation of bicycle lanes and roundabouts, particularly for a two-way bicycle track (two-way bicycle lanes together on one side of the street). Bicycle track facilities would typically continue along the outside of a roundabout (at the sidewalk level) and have a special crossing of any legs of the roundabout. The space required would exceed the limited right-of-way (nominally 66 feet) in the Winooski Avenue corridor.

Putting it Together

The space constraints limit the applications of roundabouts within much of the corridor and affect the types of cross sections and bicycle facilities that can be introduced. This insight resulted in a shift in focus to the cross sections that could fit within the corridor.

5.3 SCHEMATICS

The project team developed improvement alternatives within the corridor into a set of schematics. These schematics offered a high-level representation of the types of facilities to accommodate specific modes of travel in the corridor.

Using the existing conditions schematic (see Figure 8) as the base, future alternatives change the facilities throughout the corridor. In all, the project team developed 13 variations and organized these into three overall alternatives:

- **Alternative 1: basic bicycle facilities** are added into the corridor (Figure 34).
- **Alternative 2: protected bicycle lanes** are added into the corridor (Figure 35).
- **Alternative 3: two-way bicycle track** is added to the east side of the corridor (Figure 36).

Many subalternatives were created to incorporate additional vehicle parking, possible widening of the roadway (while avoiding additional right-of-way), protecting bicycle lanes with bollards or with vehicles, and changing the vehicle lanes.

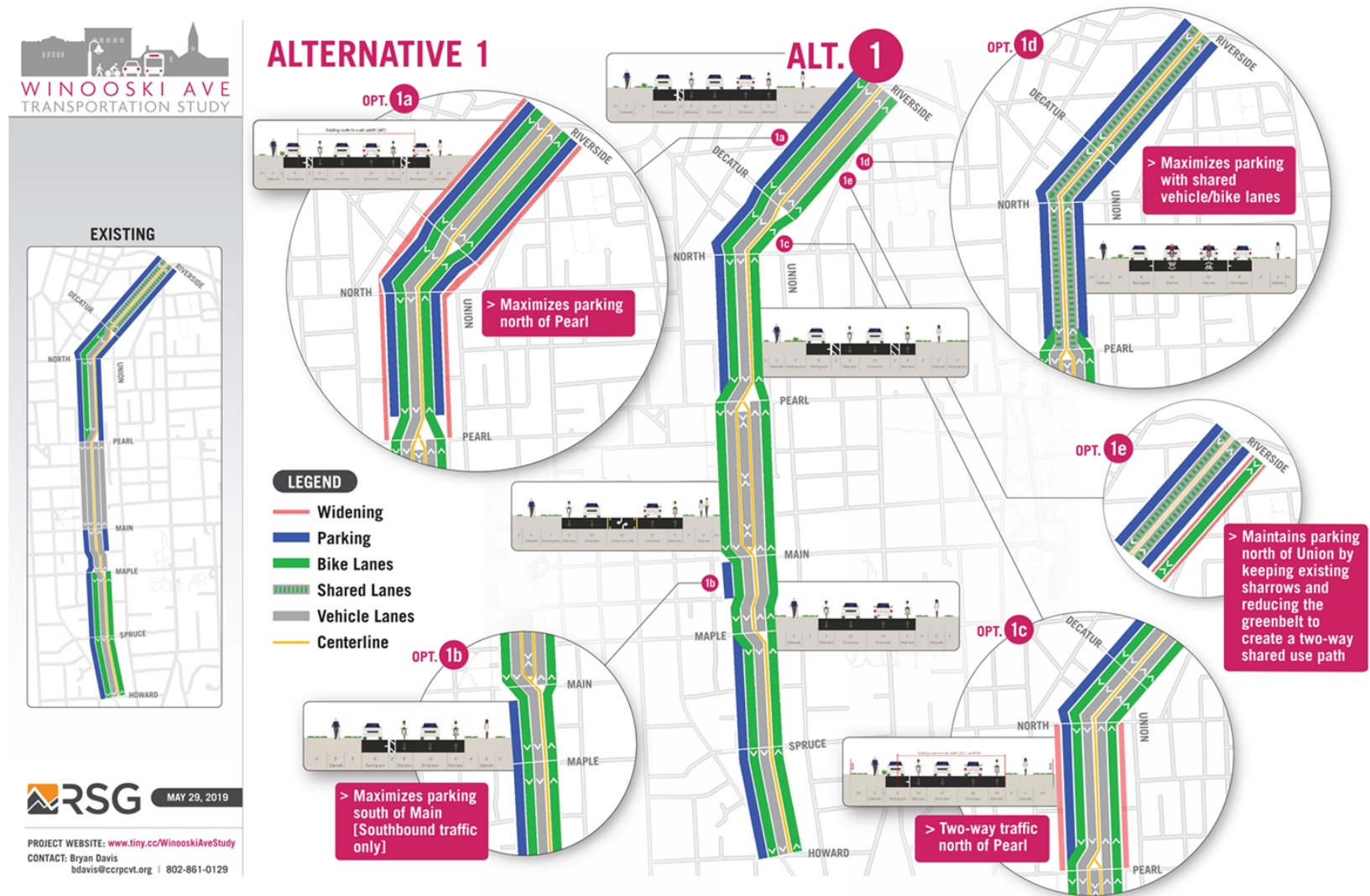
The alternatives were developed to respond to the many varied yet common themes that emerged from the public engagement process throughout the project. Many of these recurring themes included the following:

- Continuous, dedicated bicycle lanes are critical, and protected is preferred.
- High demand exists for parking, especially on North Winooski.
- Pearl Street to Main Street is aggressive, stressful, dangerous, and unattractive.

- Street tress and green strips (for locating benches and other amenities) are crucial for an inviting corridor.



FIGURE 34: SCHEMATIC—ALTERNATIVE 1



Source: RSG

FIGURE 35: SCHEMATIC—ALTERNATIVE 2

WINOOSKI AVE
TRANSPORTATION STUDY

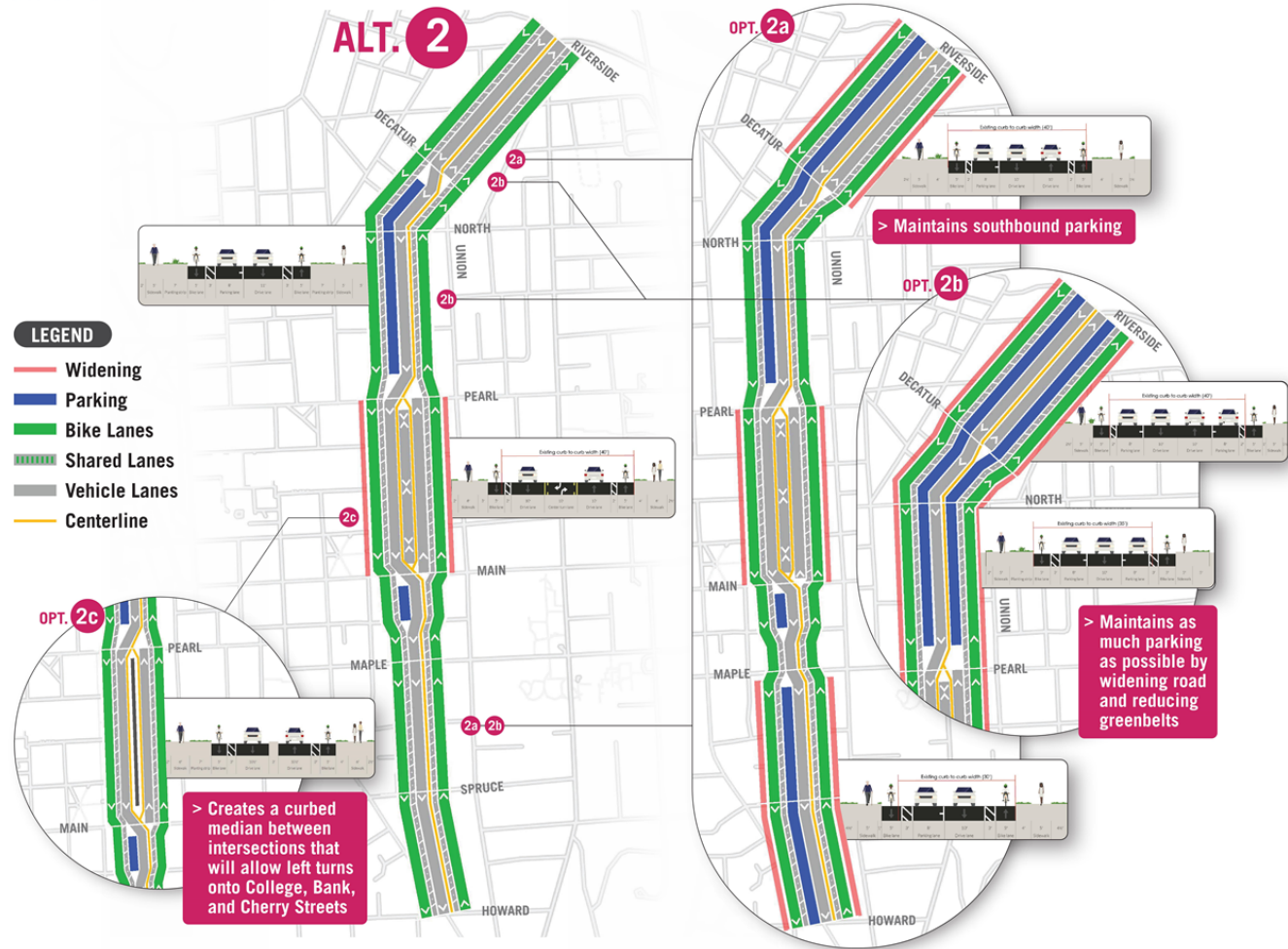
EXISTING



MAY 29, 2019

PROJECT WEBSITE: www.tiny.cc/WinoskiAveStudy
CONTACT: Bryan Davis
bdavis@ccrpsvt.org | 802-861-0129

ALTERNATIVE 2



Source: RSG



FIGURE 36: SCHEMATIC—ALTERNATIVE 3

WINOOSKI AVE
TRANSPORTATION STUDY



RSG MAY 29, 2019

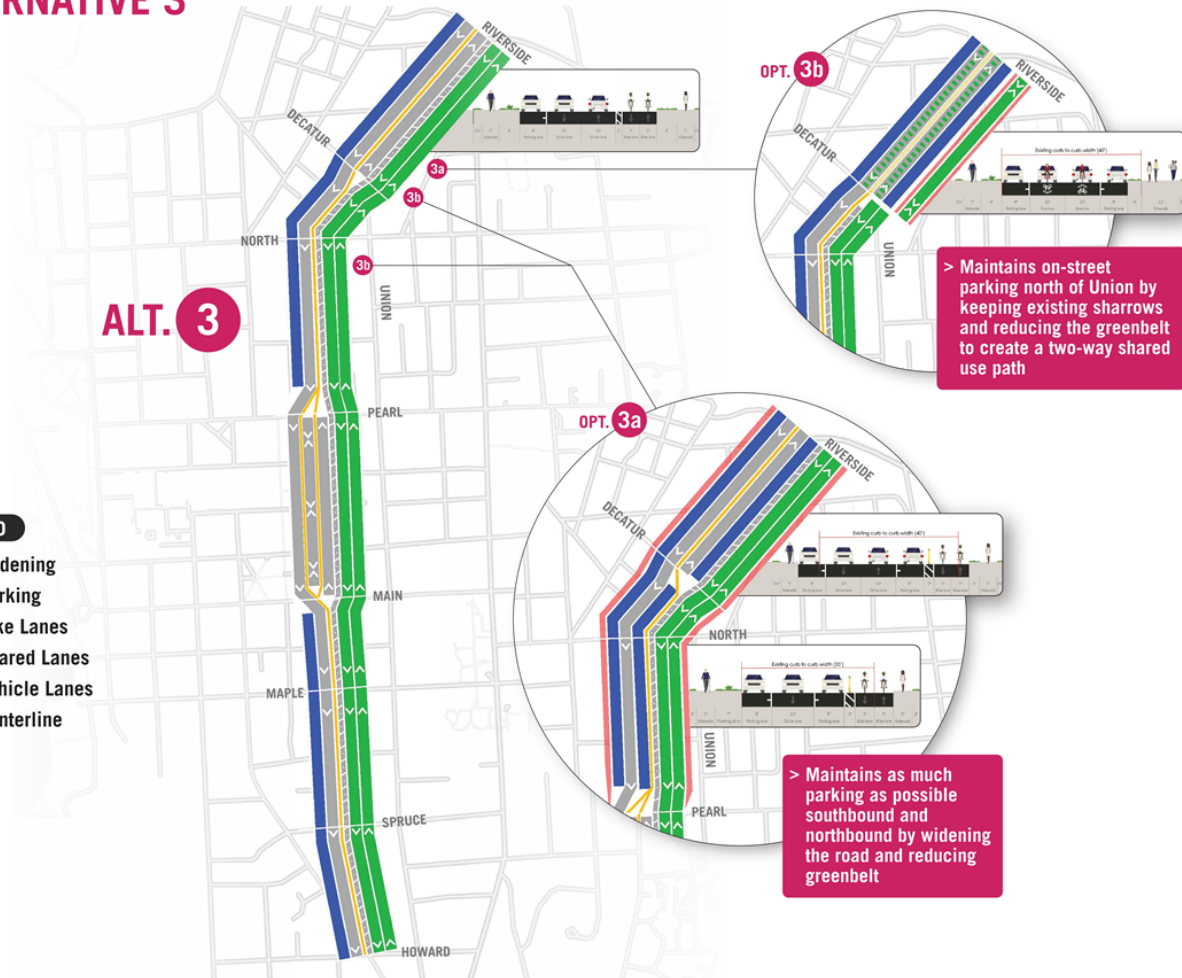
PROJECT WEBSITE: www.tiny.cc/WinoskiAveStudy
CONTACT: Bryan Davis
bdavis@ccrjpcvt.org | 802-861-0129

ALTERNATIVE 3

LEGEND

- Widening
- Parking
- Bike Lanes
- Shared Lanes
- Vehicle Lanes
- Centerline

ALT. 3



Source: RSG

5.4 EVALUATING THE ALTERNATIVES

The project team identified common themes that emerged from the engagement process (see Chapter 4.0) to evaluate how well the alternatives achieve the study vision and meet the goals and objectives set for the project. (Refer to Appendix C for more detail on the evaluation process.)






The evaluation criteria were presented at the second public meeting and they were rated as appropriate and acceptable by nearly all the public feedback received. Climate change was not explicitly considered since it is assumed that the vehicle volumes along the corridor would remain the largely the same, thus no difference in vehicular emissions.¹⁵

The existing conditions analysis showed that the character of Winooski Avenue changes significantly throughout the corridor. To account for this changing context, the alternatives were evaluated on a section-by-section basis. The sections are as follows:

- Riverside Avenue to Union Street/Decatur Street.
- Union Street/Decatur Street to Pearl Street.
- Pearl Street to Main Street.
- Main Street to Maple Street.
- Maple Street to Howard Street.

¹⁵ There will be minor differences in vehicle delay during peak periods. Shifting from signals to mini-roundabouts may improve flow in the northern segment. Removing a vehicle lane in the south may increase vehicle miles and detours, thereby increasing emissions. The downtown segment may have slightly more delay at certain

TABLE 8: EVALUATION CRITERIA

	<p>City of Burlington's Bicycle LTS & Safety Criteria:</p> <ul style="list-style-type: none"> • LTS 1: Bicycle paths, protected bicycle lanes, greenways. • LTS 2: Bicycle lanes and buffered bicycle lanes on lower-volumes streets (AADT<5,000). • LTS 3: Bicycle lanes and buffered bicycle lanes on higher-volume streets (AADT>5,000). • LTS 4: No designated facilities or markings on higher-volumes streets. <p>Driveways increase the number of potential crossing conflicts. The LTS was adjusted to account for relative number of driveways.</p>
	<p>Pedestrian Quality of service: A metric like bicycle LTS that accounts for sidewalk presence and width, street trees, number of curb cuts, quality of sidewalk, and lateral distance to moving vehicles.</p>
	<p>Change in Parking spaces: Number of parking spaces lost as a result of the project alternative.</p>
	<p>Street Trees Impacted: The number of street trees that may be affected by the project alternative.</p>
	<p>Change in Green Strip Width: The number of feet that moving the curb and widening the road will reduce the green strip.</p>

intersections and driveways during the busiest parts of the day. Overall, the daily volumes are not expected to change in any meaningful amount. Thus, there will be minimal impact on net GHG emissions associated with vehicles on the corridor.





Cost: A preliminary estimate of project costs for the improvements in the project alternative.



Neighborhood Access: The degree to which users can directly access land uses along the corridor without detours. For example, one-way vehicle lanes provide less access than two-way vehicle lanes.



Vehicle Operations and Safety: The degree to which safety is enhanced or deteriorated by the changes.



Transit Quality of Service: How is transit (through mobility and bus stop access) affected by the changes?

A spreadsheet tool with each alternative and its “score” based on these criteria helped the project team quantify the pros and cons of each project alternative. Each of the criteria were evenly weighted.

The evaluation of the alternatives identified that Alternative 1 variations (see above, Section 5.3) scored the highest when aggregated over the corridor. Each alternative was scored for each of the five segments identified above. Across each of the five segments, the project team averaged the scores for all the alternatives.

For each alternative, the project team divided the evaluation score by the corridor average score. This new normalized score is summed across the segments to create an overall corridor score.

FIGURE 37: CORRIDOR EVALUATION SCORES

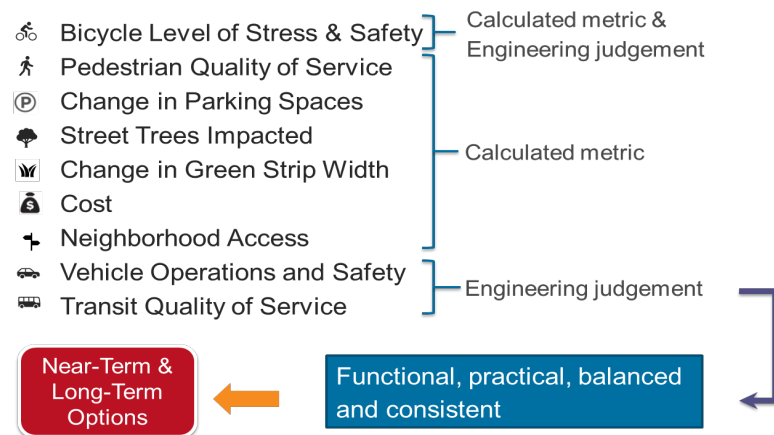
Bike LTS with a Driveway Density Factor	Pedestrian Quality of Service	Parking Spaces Impacted	Street trees impacted	Change in green strip width	Cost	Neighborhood Access	Veh Operations & Safety	Transit	Evaluation Ranking	Alt.
									1	1
									8	1A
									2	1B
									5	1C
									4	1D
									3	1E
									7	2
									11	2A
									13	2B
									6	2C
									9	3
									10	3A
									12	3B



The evaluation scoring is represented in the color scale in Figure 37. The scale indicates how far Good (Green) or Poor (Red) the alternative performs relative to the average. The blue to red scale on the right shows the overall evaluation ranking.

To supplement this empirical approach to evaluating the alternatives, the project team worked through a thorough vetting of the alternatives using engineering judgment, assessing the functionality, practicality, and consistency within the overall corridor. The flow chart is shown in Figure 38.

FIGURE 38: EVALUATION PROCESS



Source: RSG

5.5 RECOMMENDED ALTERNATIVE

The project alternative coming out of the evaluation process included elements of various alternatives, depending on the specific segment. The highlights of the alternative included the following elements:

- Improved safety and convenience for all users by reallocating road space between Pearl Street and Main Street and enhanced pedestrian safety at several intersections by narrowing crossings and reducing vehicle speeds.
- Connected, contiguous north-south bicycle facilities along the corridor.
- Retained existing vehicle parking along the west side of the avenue. Removing up to 111 vehicle spaces north of Pearl Street and 12 spaces south of Main Street of the 347 total spaces existing on Winooski Avenue.
- Improved business and resident access for all modes by making it a two-way street north of North Street in the shorter term and a two-way street between Riverside Avenue and Main Street in the longer term.

The project team presented the recommended alternative at the PAC's sixth meeting on October 13, 2019. The PAC identified that the corridor improvements represented an actionable and feasible plan. This determination was based on the possibility, in the shorter term, to avoid roadway widening, implement complete north-south bicycle connectivity, and remove vehicle parking spaces on the east side of Winooski Avenue between Riverside Avenue and Pearl Street.

The option was a compromise between a long-term vision for a complete multimodal facility complete with protected bicycle facilities and the reality on the ground today. Few options for protection exist without widening or without removing additional vehicle parking spaces.

The removal of parking in the alternative was identified by the PAC as a major point of concern. Subsequent feedback submitted by businesses and organizations in the Old North End (northern study area) received by the project team reiterated this concern. Businesses and organizations expressed concerns for their viability if parking were removed on the east side.

The level of concern about on-street parking resulted in the introduction of a PMP to be introduced as an interim step prior to any physical changes to the existing vehicle parking supply. A PMP is a stand-alone evaluation of vehicle parking demands and how those demands compare to the available supply and what management options can reduce demand or improve the utilization of the parking supply.

The recommended alternative was presented at the third public meeting, held November 13, 2019, where there were several comments on the alternative. Comments are summarized in Section 4.3 and included in Appendix B.

5.6 PREFERRED ALTERNATIVE

The project team revised the alternative based on feedback provided by the PAC, stakeholders, and the public on the recommended alternative.

The three segments—northern, downtown, and southern—have shorter-term and longer-term options that achieve the study vision:

- Traveling along and across Winooski Avenue will be **safe, inviting, and convenient** for people of all ages and abilities using any mode of transportation.
- **Walking and bicycling will be viable and enjoyable** ways to travel this corridor. Improvements will encourage active travel and alternatives to personal vehicle use.
- **Businesses along and near Winooski Avenue will flourish** with an activated streetscape and convenient access.
- The **mobility and parking needs will be balanced** for property owners, residents, businesses, and the greater transportation system. The preferred alternative included a revision to the shorter-term improvements that retained 25 spaces between North Street and Union Street. A PMP would guide when and if other on-street parking can be removed to facilitate the short-term improvements identified.
- The street can **adapt** to changes to the transportation system and land use.

6.0 IMPLEMENTING THE PLAN

This chapter outlines a set of actions to turn the project alternatives into physical improvements on the ground. These actions represent the preferred alternatives selected by the PAC and endorsed by the Burlington City Council after considering public input and alignment with the vision and goals for the corridor.

Three corridor segments emerged as having distinctly different opportunities to advance toward implementation:

- Northern Segment: Riverside Avenue to Pearl Street.
- Downtown Segment: Pearl Street to Main Street.
- Southern Segment: Main Street to St. Paul/Howard.

Implementing any project is a complex and lengthy process that requires a plan, actions, and a process to evaluate and respond to challenges and changing conditions. Each of these segments are explored in further detail below and have recommendations for interim actions before shorter- and longer-term implementation of the preferred alternatives.

6.1 PREFERRED ALTERNATIVES SELECTION

The PAC unanimously agreed to the preferred alternative that was sent to the Transportation, Energy, and Utility Committee (TEUC). The TEUC held an open meeting to solicit further public input on the preferred alternative and the implementation plan. The TEUC voted on February 4, 2020, recommending that the Burlington City Council adopt a resolution progressing the preferred alternative.

The Burlington City Council approved a resolution (Appendix F) on March 9, 2020 where the preferred alternative will be initiated, including initiating a PMP. The resolution states that a City Councilor-Stakeholder Committee will be formed to review and approve the scope of work, methodology, and public engagement plan for the PMP. The Committee will also receive periodic updates and review recommendations of the plan. The final PMP shall be approved by the Public Works Commission and the City Council prior to any revision to the lane configuration north of Pearl Street.

6.2 PREFERRED ALTERNATIVES SUMMARY

Interim Improvements

1. A comprehensive PMP is recommended to identify strategies for managing parking in the Pearl Street to Riverside Avenue study area. No changes to on-street parking will be made until agreement on the outcomes of the PMP.
2. Improve bicycle wayfinding between the southbound Winooski Avenue bicycle lane and the northbound Union Street bicycle lane.
3. Advance pilot projects or demonstrations to test mini-roundabouts on North Winooski Avenue. Explore other strategies for improving multimodal safety and performance at key intersections along the corridor.
4. Address commercial loading and driveway queuing on Winooski Avenue in the downtown.
5. Evaluate public safety impacts, traffic operations, driveway access, Marketplace Garage circulation,



roadway dimensions, and VTrans approvals for improvements that can reduce turning conflicts and prioritize protection for people walking and biking in the downtown.

Shorter-Term Improvements

Northern Segment: Retain current vehicle pattern (two-way north of Union Street/Decatur Street and one way southbound to Pearl Street). Stripe on-street bicycle lanes in both directions between Pearl Street and Riverside Avenue. On-street vehicle parking on the east side would be removed between Pearl Street and North Street and between Union Street/Decatur Street and Riverside Avenue. Implement the mini-roundabouts. Consider additional improvements for pedestrian safety at the intersections of Archibald Street and Riverside Avenue. The PMP will guide the eventual design of the short-term improvement in the northern segment.

Downtown Segment: Restripe the roadway for one southbound vehicle lane, one northbound vehicle lane, a center turning lane, northbound and southbound bicycle lanes, and protection for pedestrians and bicyclists, when possible.

Southern Segment: Incorporate continuous bicycle lanes in both directions and remove east-side parking between King Street and Main Street.

Corridor-wide: Improve high-priority transit stops and pedestrian crossings.

Longer-Term Improvements

Modify roadway for two-way traffic for all modes north of Pearl Street, protected bicycle lanes where feasible, underground utilities, incorporate stormwater management, improve transit stops, add street trees, benches and other pedestrian

amenities, and incorporate additional on-street parking wherever possible.

PARKING MANAGEMENT PLAN (PMP)

A PMP identifies the current supply of parking in the study area (public lots, private lots, and on-street), evaluates the current demand for vehicle parking, and identifies ways to utilize the existing supply more efficiently.

This PMP will cover the linear study area from Riverside Avenue to Pearl Street, with the potential to address North Street to Pearl Street and Riverside Avenue to North Street as two study areas. The PMP will extend one block either side of Winooski Avenue and will include interviews and intercept surveys with people visiting, living, and working in the study area.

The PMP will identify what type of parking management strategies are needed in the study area. It will also identify whether management alone (e.g., time-restricted parking to encourage turnover for neighborhood businesses, new loading zones, shared parking arrangements off-street) may be sufficient to offset the loss of on-street parking suggested by the alternatives.

A goal of the PMP is to identify practical strategies for balancing parking supply and demand north of Pearl Street with the goal of meeting essential parking needs through proactive corridor management.

6.3 NORTHERN SEGMENT: RIVERSIDE AVENUE TO PEARL STREET

The northernmost segment of the corridor extends from Riverside Avenue to Pearl Street and includes key intersections at North Street, Union/Decatur Street, Archibald Street, and Riverside Avenue.

Preferred alternative: Two-way traffic for all modes between Union Street and North Street.

Riverside Avenue to Union Street/Decatur Street

Shorter Term

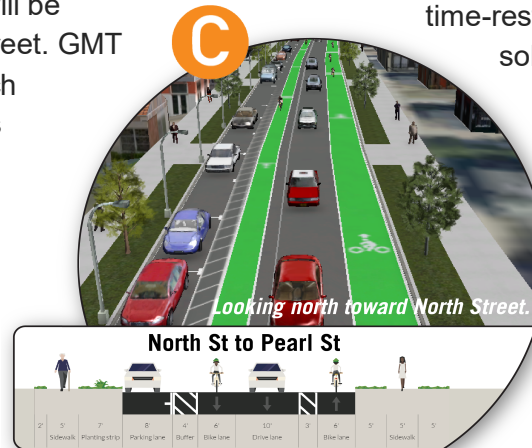
- Use the PMP to identify and create new loading zones, accessible spaces, time-restricted parking, opportunities for parking in place of greenbelts, and other parking strategies to mitigate impacts of on-street parking loss.
- Remove the east-side on-street parking, providing space to shift the centerline and accommodate on-road bicycle lanes on both sides.
- Bus stop improvements for Riverside Avenue bus stop (Green Line) outside the Community Health Center. This stop has high ridership demand and minimal amenities. Other northbound stops for the Gold Line should be evaluated based on amenity guidelines set by GMT.



- The midblock crossing north of Union Street should be reevaluated given pedestrian demands, lighting, visibility, and other considerations.
- Signal improvements to improve bicycle detection should be considered at Riverside Avenue to improve bicycle mobility between Winooski Avenue and the shared-use path along Riverside Avenue.

Longer Term

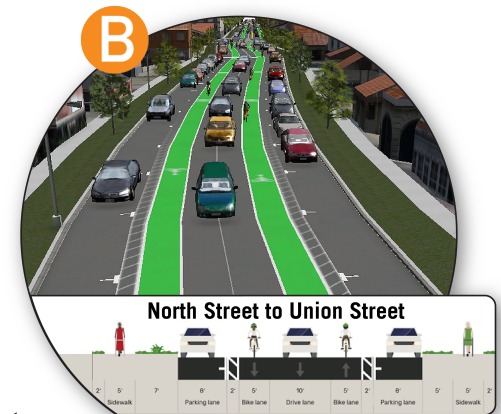
- Modify the roadway to accommodate protected bicycle lanes or additional on-street parking, underground utilities, and additional street trees.
- Mitigate any impacts of widening by also doing “bulb-outs” with stormwater treatment and detention.
- In the longer term, two-way vehicle travel will be possible from Riverside Avenue to Main Street. GMT could initiate new southbound service, which would require identifying and improving bus stops.



Pearl Street to Union Street/Decatur Street

Shorter Term

- Before making changes to parking, wayfinding can be improved from Winooski Avenue onto Union Street to enhance the user experience for northbound bicycle travel via Union Street.
- Use the PMP to preserve parking and mitigate the loss of parking, create new loading zones, accessible spaces, time-restricted parking, and other management solutions.
- Maintain southbound-only motor vehicle travel and remove east-side on-street parking (45 spaces) between North Street and Pearl Street to accommodate the additional on-road bicycle capacity.



Longer Term



- Modify the roadway to accommodate two-way travel for all modes, including transit, or protected bicycle lanes, underground utilities, and additional street trees.
- Remove the east-side parking (26 spaces) between Union Street/ Decatur Street to North Street to accommodate two-way travel for all modes, including transit, and buffered bicycle lanes.
- In the longer term, two-way vehicle travel will be possible from Riverside Avenue to Main Street. GMT could initiate new northbound service, which would require identifying and improving bus stops.

North Street Intersection

Preferred alternative: Replace the signalized intersection with a mini-roundabout to reinforce slow speeds on North Street and Winooski Avenue and reduce delay for vehicles and pedestrians.

Shorter Term

- Pilot the mini-roundabout with southbound-only vehicle and bicycle lanes to monitor the physical geometry, Fire Department access, and the interaction between the pedestrians, bicyclists, and vehicles. See Figure 39.

Longer Term

- Upgrade the southern leg to reflect the two-way vehicle lanes. See Figure 40.

FIGURE 39: NORTH STREET INTERSECTION—SHORTER TERM

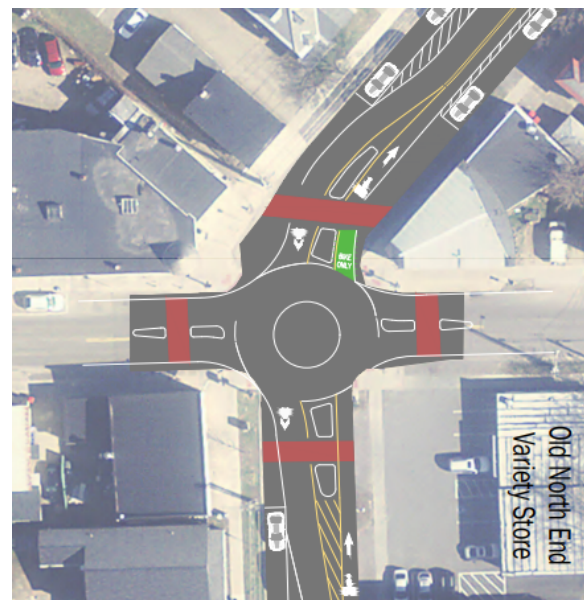
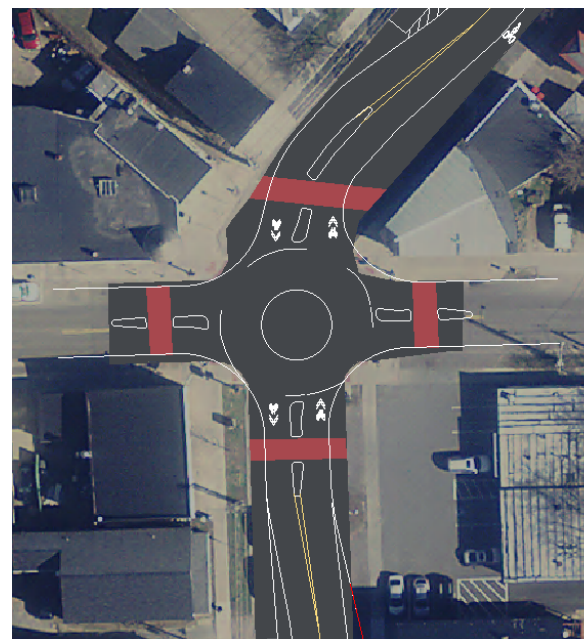


FIGURE 40: NORTH STREET INTERSECTION—LONGER TERM



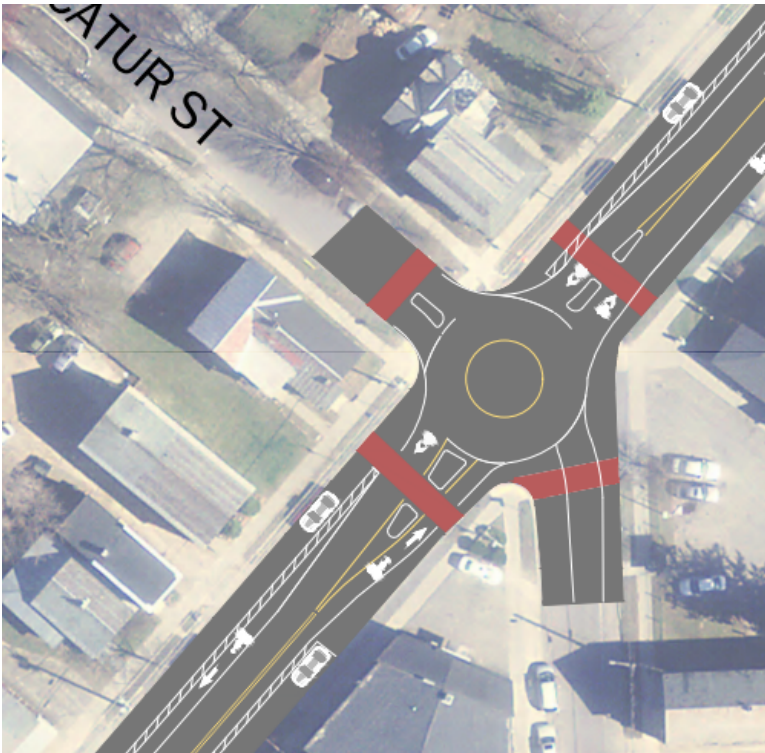
Union Street Intersection

Preferred alternative: Replace the all-way stop controlled intersection with a mini-roundabout to reduce vehicular and bicycle delay, create a more logical control for Winooski Avenue, and maintain pedestrian right-of-way at the crossings.

Shorter Term

- Pilot the mini-roundabout to evaluate how the intersection change performs and accommodates the needs of all users.
- Implement the mini-roundabout upon a successful pilot. See Figure 41.

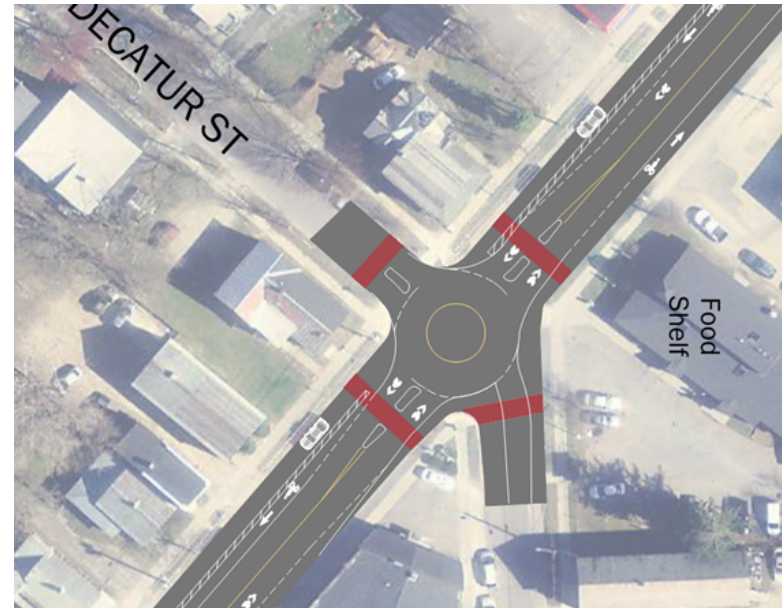
FIGURE 41: UNION STREET INTERSECTION—SHORTER TERM



Longer Term

- Upgrade the southern leg to reflect the two-way vehicle lanes. See Figure 42.

FIGURE 42: UNION STREET INTERSECTION—LONGER TERM



Pearl Street Intersection

Shorter Term

- Relocate the east-side loading zones to the west side in the area near in the red box in Figure 43.

FIGURE 43: PEARL STREET LOADING ZONE POSSIBILITY



- As part of the Northern Segment improvements, remove east-side on-street parking to accommodate the additional on-road bicycle capacity. The southbound approach would consolidate the lanes to a dedicated left and a shared right-through lane (Figure 44).

FIGURE 44: PEARL STREET INTERSECTION—SHORTER TERM



Longer Term

- Modify the roadway to accommodate two-way travel for all modes, including transit, or protected bicycle lanes (Figure 45).

FIGURE 45: PEARL STREET INTERSECTION—LONGER TERM



6.4 DOWNTOWN SEGMENT: PEARL STREET TO MAIN STREET

Preferred alternative: Restripe the road to create one southbound vehicle lane, one northbound vehicle lane, a center turning lane, and northbound and southbound bicycle lanes (five-lane cross-section).

Shorter Term

- Restripe the roadway to remove the four-lane configuration and create the five-lane cross-section.
- Enhance the significant southbound transit stop near Bank Street with a shelter and other amenities, as appropriate.
- Evaluate the operations and safety of a median and other streetscape enhancements.
- Prioritize protection for people walking and bicycling.
- Add street trees where possible and improve the pedestrian experience with benches, trees, and other amenities within the right-of-way.

Longer Term

- Modify the roadway to accommodate underground utilities, additional street trees, stormwater detention and treatment, or protected bicycle lanes.
- Implement other enhancements or pilot a center median if the evaluation warrants further consideration.
- GMT may route northbound buses along the corridor in the long term given two-way vehicle travel north of

Pearl Street. Bus stops will be identified at that point for improvement.



Bank Street Intersection/City Market Driveway

The Marketplace Garage entrance on Bank Street periodically queues from Bank Street back into Winooski Avenue, affecting safety and operations for all modes. The reasons vary, but queues often occur when the garage is full and drivers are not sure where to go.

With fewer vehicle lanes on Winooski Avenue, that blockage may cause additional queuing. However, it should be safer because people will not have the space or additional lanes to weave around queued vehicles.

The queuing from the garage can compound an already busy driveway at the City Market entrance just south of Bank Street. The two-way driveway has a high demand of turning vehicles in and out, as well as walkers/bikers across and into the driveway. These turning vehicles can use the future center turning lane, but the queuing space is limited.

Shorter Term

- Investigate ways to reduce queuing associated with the Marketplace Garage Bank Street entrance. Improved signage and wayfinding can provide warnings in advance when the garage is full and can direct patrons to the Cherry Street entrance or to other parking options.
- Collaborate with City Market to improve the operations and safety at their driveway onto Winooski Avenue.
- Collaborate with City Market and SSTA/Paratransit curbside pickup at Howard Center (102 South Winooski Avenue) to replace on-curb pickup and loading in front of Howard Center with a parking space in City Market for SSTA operations, when possible.

Main Street Intersection

The Main Street intersection is the focus of a Great Street project along Main Street. Modest changes can be implemented until more substantial changes are undertaken.

Shorter Term

- As part of the Downtown Segment restriping, reduce the pedestrian crossing widths by removing the dedicated right-turn lanes for southbound right and westbound right turns (Figure 46).
- Restrict commercial loading on the western curb on Winooski Avenue and relocate to occur on Main Street.

FIGURE 46: MAIN STREET INTERSECTION—SHORTER TERM



6.5 SOUTHERN SEGMENT: MAIN STREET TO SAINT PAUL/HOWARD

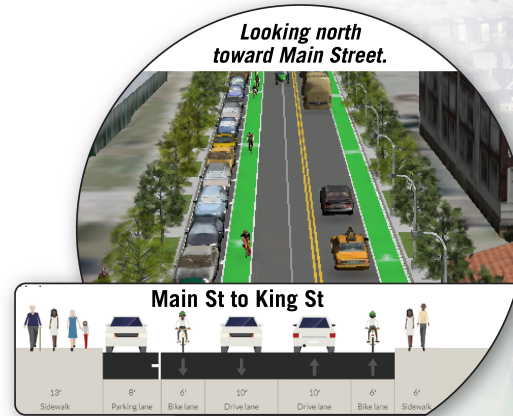
The corridor south of Maple Street is planned to remain in its current configuration.

Preferred alternative: Incorporate continuous bicycle lanes in both directions.

Main Street to King Street

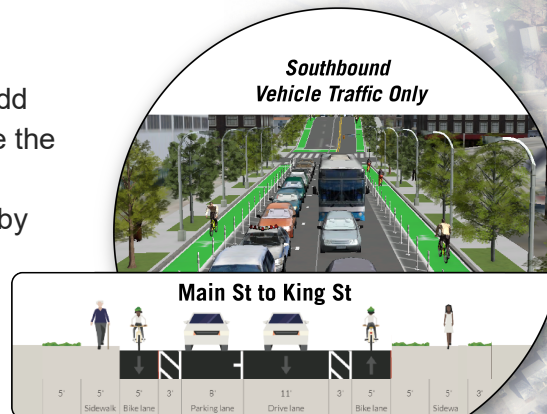
A Shorter Term

- Shift the center line of the street and incorporate northbound and southbound bicycle lanes.
- Maintain both southbound and northbound travel lanes.
- Remove the 12 metered curbside parking spaces on the east side.



B Longer Term

- Remove the northbound travel lane and add protected bicycle lanes, which will improve the operational efficiency at the Main Street–Winooski Avenue signalized intersection (by removing an approach lane to the signal).

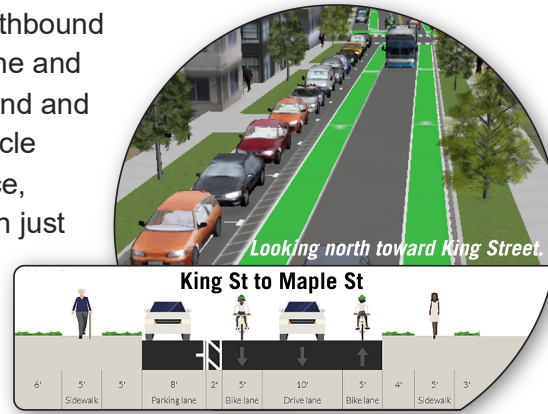




King Street to Maple Street

Shorter Term

- Remove the northbound vehicle travel lane and create southbound and northbound bicycle lanes. In essence, the cross-section just south of Maple Street will be extended north through this segment of the corridor.



Longer Term

- Explore roadway modifications between Main Street and King Street to create on-street parking spaces.

6.6 PROJECT COSTS

The preferred alternative construction costs are divided into the three project implementation segments for the shorter- and longer-term time periods.

Basic costs include just those physical works needed to remove the existing strips and replace new strips in the new configuration. Reconstruction costs assume the roadway surface is replaced, which VTrans is scheduled to undertake in 2022 along the entire corridor.

¹⁶ The cost could increase dramatically with contaminated soil, electrical components affecting right-of-way, and replacing and upgrading stormwater systems.

Shorter Term

Northern Segment (Riverside Avenue to Pearl Street)

- Union Street mini-roundabout: \$115,000.
- North Street mini-roundabout: \$150,000.
- Striping Only (remove & restripe): \$45,000.

Downtown Segment (Pearl Street to Main Street)

- Striping Only (remove & restripe): \$53,000.

Southern Segment (Main Street to Maple Street)

- Striping Only (remove & restripe): \$10,500.

Longer Term

The longer-term cost estimates in the northern segment include potential widening of the roadway and possibly undergrounding the existing overhead utilities. The southern segment is only revising the lane configuration between King Street and Main Street.

Northern Segment (Riverside Avenue to Pearl Street)

- Without Utility Undergrounding: \$2.38 million.
- With Utility Undergrounding: \$10+ million.¹⁶

Southern Segment (Main Street to King Street)

- Striping Only (remove & restripe): \$10,000.



6.7 IMPLEMENTATION TIMELINE

Although there are efficiencies of scale for planning, designing, and constructing, each of the three segments can be implemented concurrently or independently of each other.

Northern Segment

2020

- Conduct the PMP for the two study areas: Pearl Street to North Street and North Street to Riverside Avenue. Identify management or solutions to mitigate the loss of on-street vehicle parking by 2021.
- Conduct pilots for the two mini-roundabouts at North Street and Union Street. Explore other strategies for improving multimodal safety and performance at key intersections along the corridor.
- Initiate preliminary design and engineering. Develop plans for revising signage, striping, stormwater drains, and other infrastructure in the corridor. Identify where minor curb movement might accommodate some indented on-street vehicle parking spaces.
- Develop wayfinding signs for parking and bicycle travel to increase the use of the Union Street bicycle lanes in the near-term prior to any changes in on-street parking.

2020–2021

- Initiate permanent installs of the mini-roundabouts upon successful trials.
- Consider additional improvements for pedestrian safety at the intersections of Archibald Street and Riverside Avenue.

2021

- Complete physical work upon agreement on PMP outcomes. Retain current vehicle travel patterns, stripe bicycle lanes in both directions between, and remove east-side parking between North Street to Pearl Street and Riverside Avenue to Union Street.
- Improve transit stops outside the Community Health Center, reevaluate the midblock crossing north of Union Street, and improve bicycle detection at the Riverside Avenue traffic signal.

Beyond 2021

- Identify funding to modify the roadway for longer-term improvements, such as two-way traffic for all modes north of Pearl Street; expanded transit service; protected bicycle lanes, where feasible; underground utilities; incorporate stormwater management;

improve transit stops; add street trees, benches, and other pedestrian amenities; and incorporate additional on-street parking, wherever possible.

Downtown Segment

2020

- Initiate preliminary design and engineering for one southbound vehicle lane, one northbound vehicle lane, a center turning lane, northbound and southbound bicycle lanes, revised signal designs and signal timings, stormwater drains, and other infrastructure in the corridor.
- Prioritize protection for people walking or bicycling.
- Develop wayfinding signs for City parking and bicycle travel.
- Assess Marketplace Garage entrance options.
- Engage with City Market and other property owners along the corridor.
- Evaluate the operations and safety of a raised median and other streetscape enhancements.
- Finalize design for the corridor changes and implement or pilot as much as possible in 2020.

2020–2021

- Complete physical works.
- Install additional streetscape and safety enhancements and make final adjustments to shorter-term improvements in advance of roadway paving in 2022. Enhance the Bank Street transit stop, add street trees, and improve the pedestrian experience with benches, trees, and other amenities. Consider a median in place of the center turn lane.

Beyond 2021

- Identify funding to modify the roadway for longer-term improvements such as protected bicycle lanes, expanded transit service, underground utilities, stormwater management, and a median.



Southern Segment

2020–2021

- Initiate preliminary design and engineering to include bicycle lanes in both directions.
- Engage with property owners and neighborhoods affected by change in parking and change in vehicle lanes.
- Complete the shorter-term projects and restriping of lanes, implementing as much as possible in 2020.
- Make final adjustments to shorter-term improvements in advance of roadway paving in 2022.

Beyond 2021

- Identify funding to modify the roadway for longer-term improvements such as protected bicycle lanes, parking, two-way travel for all modes, underground utilities, and stormwater management.



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