

**Working
DRAFT**

Chittenden County Regional Planning Commission & City of Burlington

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180 Battery Street, Suite 350
Burlington, VT 05401
802.383.0118
www.rsginc.com

PREPARED FOR:
CHITTENDEN COUNTY REGIONAL PLANNING COMMISSION & CITY OF BURLINGTON
SUBMITTED BY:
RSG
IN COOPERATION WITH:
DUBOIS & KING, STREETPLANS, THIRD SECTOR ASSOCIATES



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LIST OF ABBREVIATIONS

- BBA – Burlington Business Association
- CATMA: Chittenden Area Transportation Management Association
- CCRPC – Chittenden County Regional Planning Commission
- GMT – Green Mountain Transit
- HCL – High Crash Location
- TAZ – transportation analysis zone
- VTrans – Vermont Agency of Transportation



1.0 INTRODUCTION

The Winooski Avenue Transportation Study is a transportation corridor study of Winooski Avenue as the City of Burlington looks to create multimodal Complete Street routes throughout the City.

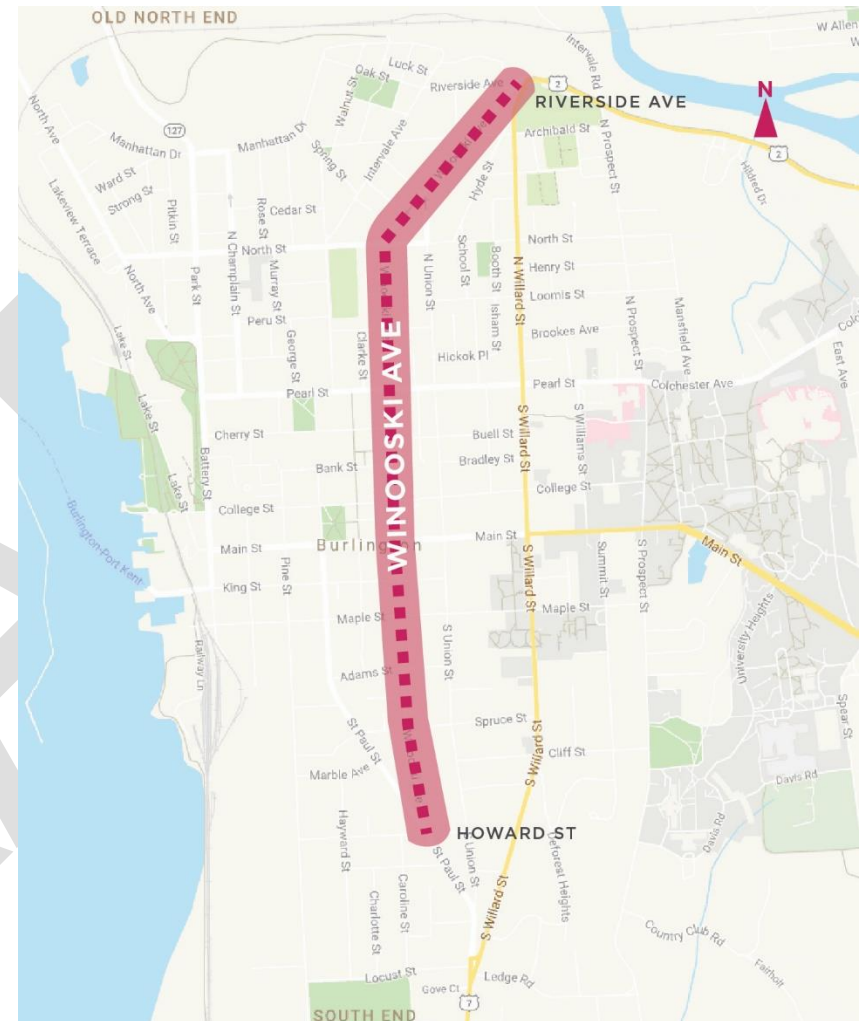
As shown in **Figure 1-1**, Winooski Avenue stretches nearly two miles from Riverside Avenue in the Old North End to the Howard Street and St. Paul Street intersection in the South End. The corridor serves as the principal north-south connection through the heart of the City. It provides both access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

This study follows a 2015 technical analysis of Winooski Avenue and Union Street that provided understanding of the vehicular traffic operational implications of five alternative traffic reconfigurations. 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.

“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

FIGURE 1-1: STUDY AREA



1.2 WHY ARE WE STUDYING WINOOSKI AVENUE?

- It is an important and heavily used corridor featuring diverse land uses, but a comprehensive corridor study has not yet been conducted.
- It is a geographic gateway to the City but does not feel that way.
- Its multimodal facilities are inconsistent and not intuitive to use.
- Seven of the 20 priority intersections identified in planBTV Walk Bike are along Winooski Avenue.
- 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 occur along the corridor – four intersections and two segments.
- Earlier transportation plans identified that reconnecting Pine St, St. Paul would create additional opportunities for changes to Winooski Avenue.
- planBTV Walk Bike calls for protected bike lane(s) the entire length of the corridor in its 5-year action plan, but a course of action and a holistic understanding of how to approach that goal have not yet been investigated.

1.3 CORRIDOR 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 increase demand for active transportation and other options

to personal vehicle use. Businesses along and near Winooski Avenue will flourish with an activated streetscape and convenient access. The mobility and parking needs of property owners and residents will be balanced with the mobility and parking needs of the greater transportation system. The street will support or be adaptable to projected changes to the transportation system and land use.

1.4 STUDY OUTCOMES

- 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 page 82)
- Design Winooski Avenue as a self-enforcing 25-mph street. (planBTV Walk Bike page 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 page 76-79)
- Study Winooski Avenue’s relationship with parallel streets and the street network as a whole in terms of integration of transportation modes, connectivity, capacity, and safety. Develop alternatives accordingly to improve these elements as best as possible.

2.0 LITERATURE REVIEW

Over the past two decades, segments and intersections of Winooski Avenue have been examined as part of various standalone studies and included in numerous larger plans. Relevant studies and plans have been reviewed to inform this transportation study to learn from past analyses and ensure consistency with guidelines set forth by public agencies.

2.1 STUDIES

Four studies of intersections or segments along Winooski Avenue were reviewed and 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 crosswalk of South Winooski Ave, and curb extensions. In the short term, do a semi-permanent quick build project, and in the medium term, construct an accessible pedestrian crossing of S. Winooski Ave.

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, and queue length.

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

N. Winooski Ave & 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 are viable but corner radii reduction (Option E) was recommended for further exploration since it provides 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 4-to-3 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 and Main Streets, lane reduction was not recommended; 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 vs. 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 bike lanes.

2.2 PLANS

Various public agencies have put forth plans relevant to Winooski Ave 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

GMT, Ongoing

Description: This plan will help identify ways to better match transit service with current needs, make service simpler, more direct, faster, and more convenient. It will also better integrate urban and rural services.

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: planBTV Walk Bike 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 (pages 67-72)
- Slow Zone Priorities (page 74)

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

Regional Active Transportation Plan

CCRPC, 2017

Description: Supports the regional ECOS Plan and was developed in coordination with other concurrent local, regional and state planning efforts. Includes a series of proposed infrastructure and non-infrastructure recommendations organized around the five E's—education, encouragement, enforcement, engineering, and evaluation.

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

Winooski Ave is identified as a High Priority corridor in the Proposed Regional Active Transportation Network. (page 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 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. (page 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.” (page 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. (pages 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, page 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 (page 8)
- Defines indicators of progress toward goals of the plan (page 11)

3.1 HOUSING AND EMPLOYMENT

Analyzing housing and employment can bring out patterns and relationships at the root of travel demand. Proximity between housing and employment can support walking and biking and other active modes as well as indicate where parking may be in demand.

The housing and employment data are shown by density in each transportation analysis zone (TAZ), geographic boundaries that are the basis of the CCRPC's regional traffic model.

The residential zones (Figure 3-2) 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.

The employment density (Figure 3-3) is close to an inverse of the household density, with the downtown core providing most of the employment.

The curb cut density map (Figure 3-4) shows a correlation between the residential density and the number of curb cuts. This data is particularly important when considering on-street parking, types of bicycle facilities, and number of conflict points along lengths of the corridor.

FIGURE 3-2: HOUSING DENSITY AND LOCATIONS (2015)

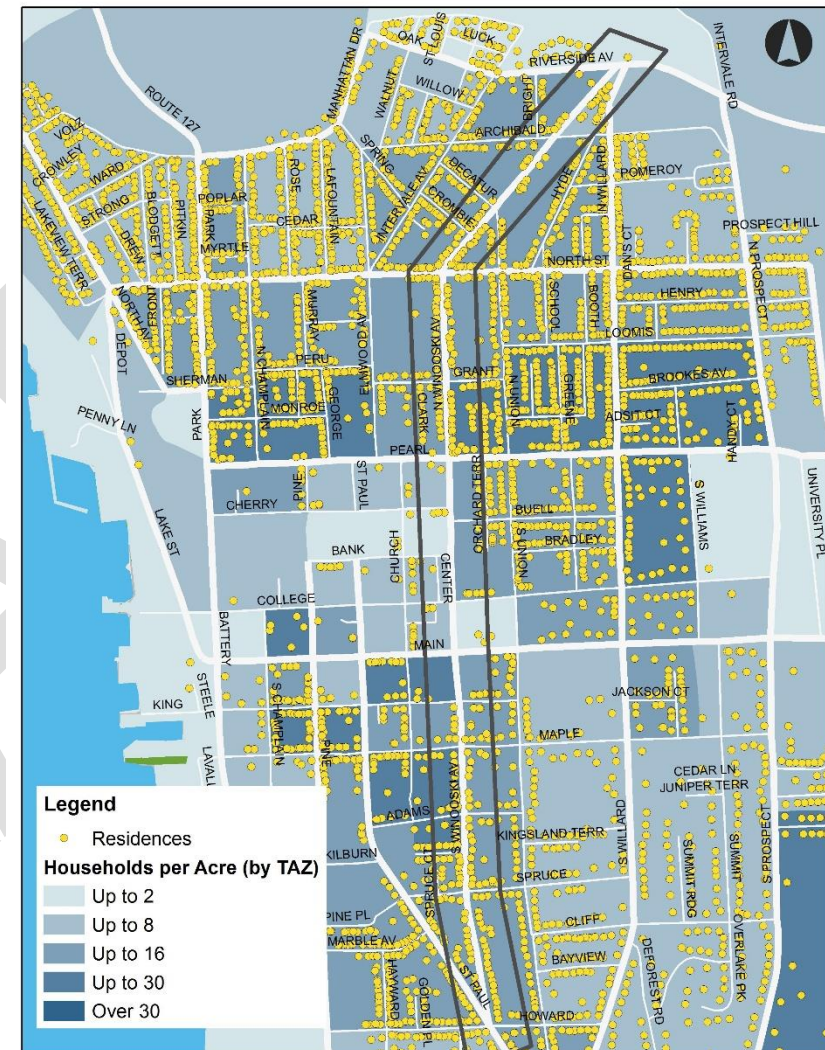
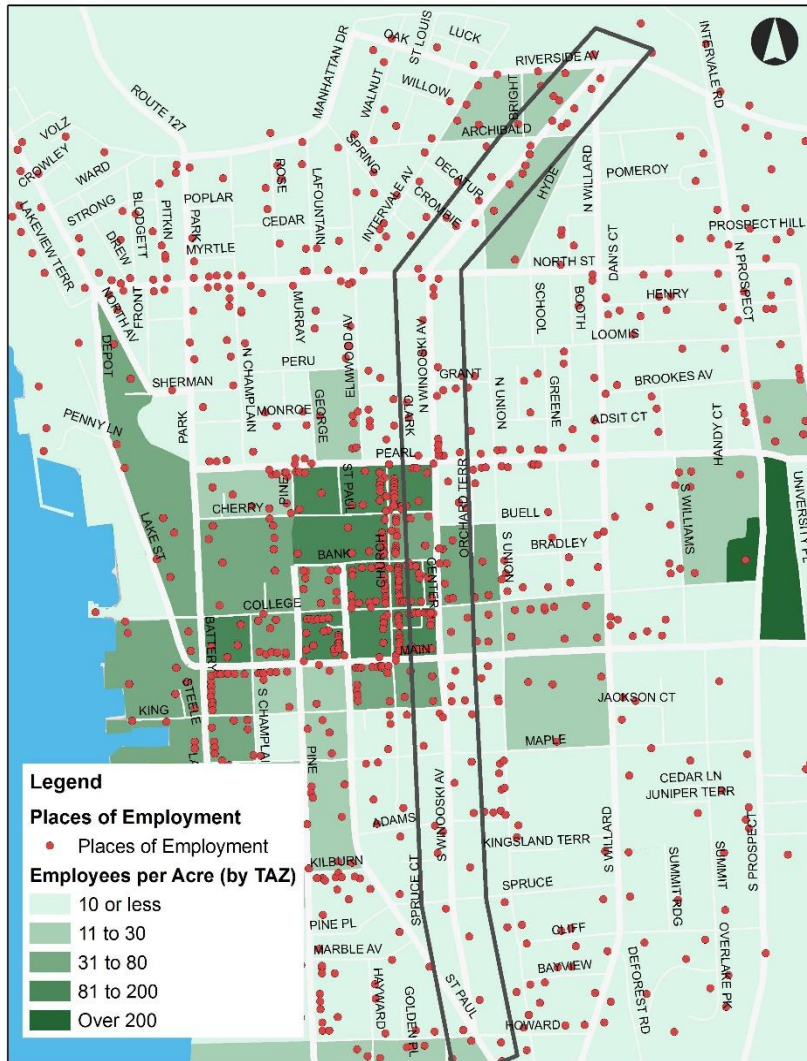
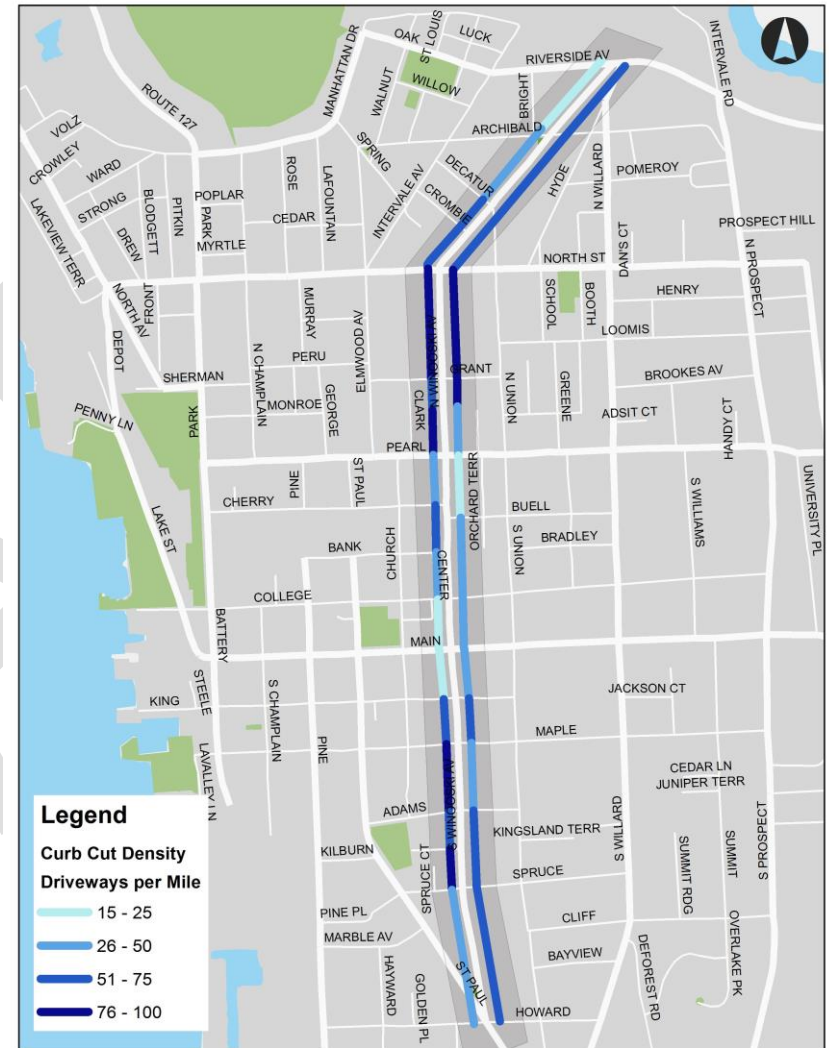


FIGURE 3-3: EMPLOYMENT DENSITY AND LOCATIONS



Data Source: CCRPC Regional Model

FIGURE 3-4: CURB CUT (DRIVEWAY) DENSITY



Source: RSG

4.0 MULTIMODAL INFRASTRUCTURE

Four corridors serve the primary north-south movement through Burlington: Battery Street/St. Paul Street/North Champlain Street, Winooski Avenue, Willard Street, and 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 width¹ 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 4-1, 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.

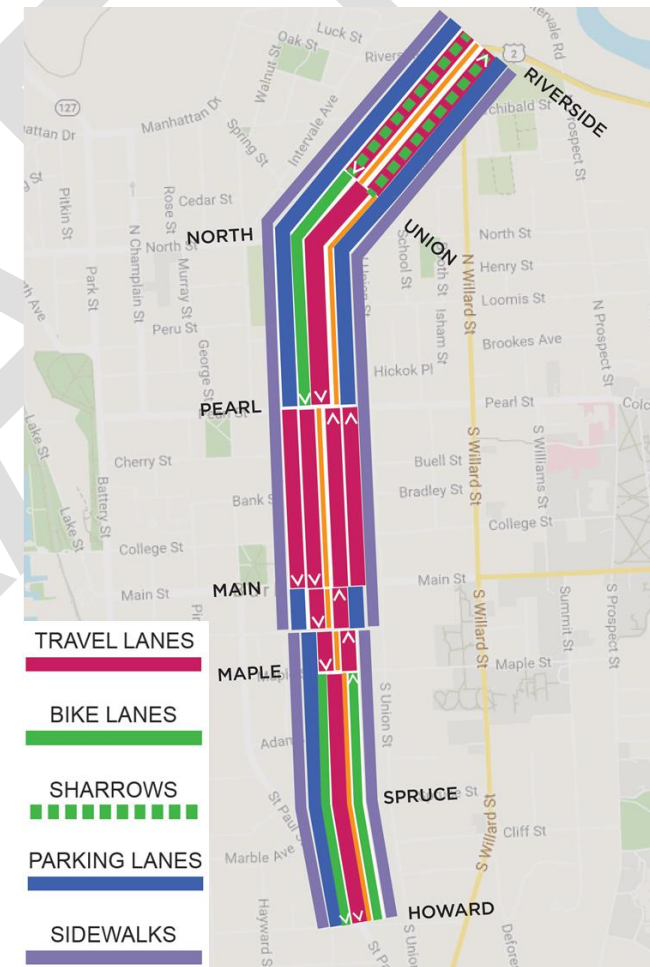
On-street parking is inextricably linked to multimodal infrastructure and connectivity due to the space it consumes in the public right of way, and safety issues such as “dooring” that can occur when car doors are opened as a bicyclist is passing. Parking is discussed in Section 6.0.

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

The following sub-sections 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. Integration of modes, an important aspect of transportation planning included in both planBTV Walk Bike and the Regional Active Transportation Plan, is discussed at the end of this section.

FIGURE 4-1: CROSS-SECTION OVERVIEW



¹ Pavement width is the distance between curbs including parking and travel lanes; excluding sidewalks and green belts.

The City of Burlington's planBTV Walk Bike 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.

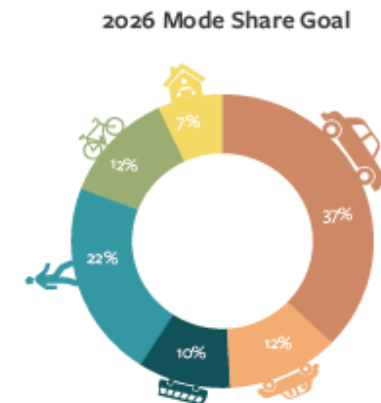
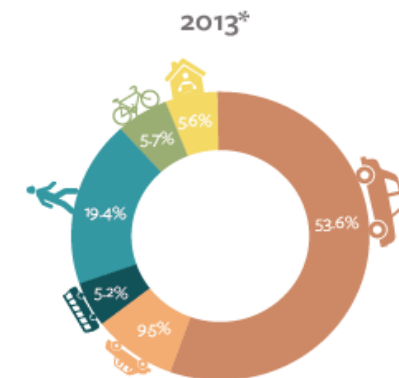
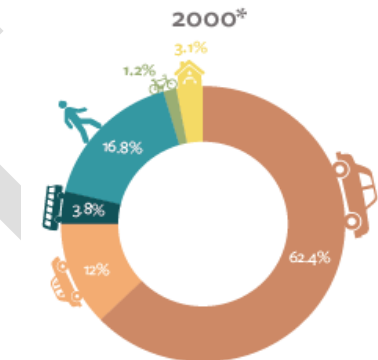
planBTV Walk Bike includes a number of actions that would bring about this change, with Winooski Avenue being an important place to see these actions occur. Burlington has made significant investments in walking and biking infrastructure since 2000 with results evident in the changes in mode share.

- In 2000, car modes were nearly 75%, walking nearly 17%, bus riding nearly 4%, and biking 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 biking, 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 non-car modes.

FIGURE 4-2: BURLINGTON'S MODE SHARE: PAST, PRESENT, AND FUTURE GOAL

Journey to work



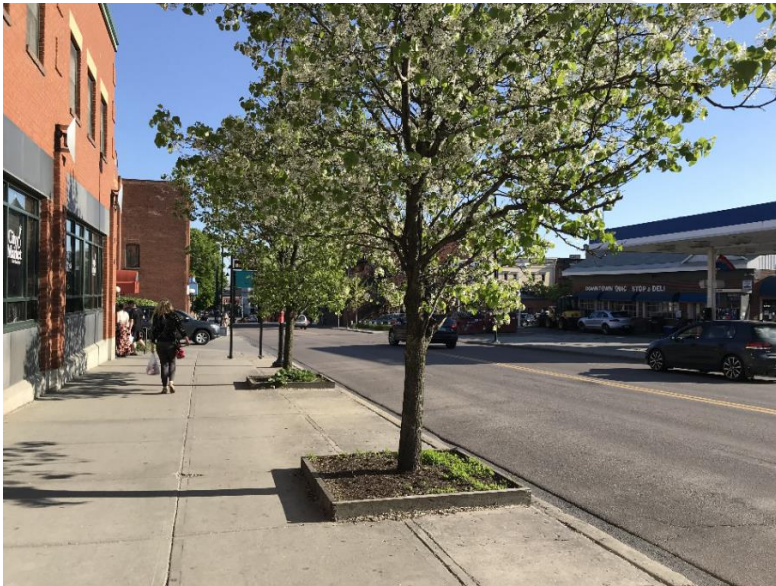
Source: planBTV Walk Bike

4.1 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 predominate 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. There is no green belt 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.



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

All signalized intersections in the study corridor have pedestrian push buttons and a walk phase except for the southern terminus at Howard Street. 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.

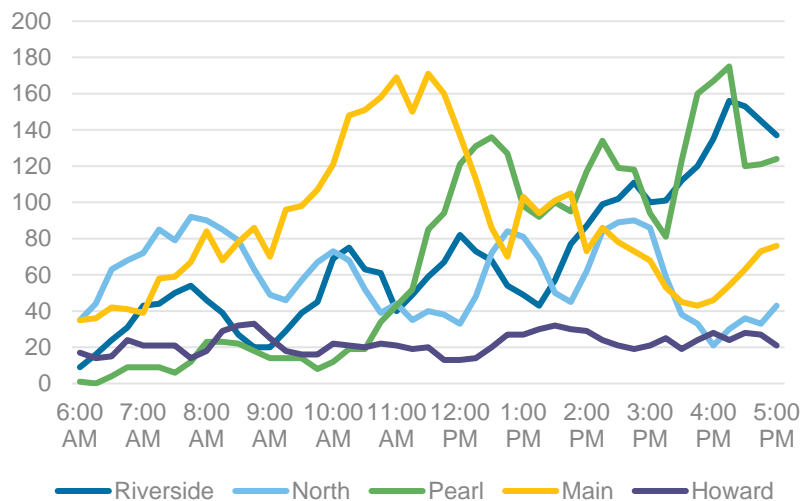


Typical sidewalk along Winooski Avenue outside of the downtown core

Pedestrian Volumes

Pedestrian volume data is available from turning movement counts at major intersections along Winooski Avenue and shown in Figure 4-3.

FIGURE 4-3: HOURLY PEDESTRIAN VOLUMES AT MAJOR INTERSECTIONS



This chart shows how different locations along Winooski Avenue have different pedestrian demands, both in overall volume and 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 mid-range volumes that wax and wane throughout the day.
- 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.

There are sidewalk areas along Winooski Avenue with physical 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, as shown in Figure 4-4.

FIGURE 4-4: INADEQUATE SIDEWALK WIDTH ON WINOOSKI AVENUE



Left: North of Pearl Street, looking south. Right: North Winooski Avenue.

Rating Pedestrian Facilities

Factors that impact 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 rating system to determine pedestrian quality of service was created as part of this study, the results of which are shown in Figure 4-5. Pedestrian volume data is not available except at major intersections along the study corridor, so the system is based on physical elements and adjacent land use rather than a density based on area and demand.

Metrics used in the proposed pedestrian quality of service system are:

- Ratio of buffer width (including green belt, bike lanes, and parking lanes) and number of travel lanes
- Buffer type (e.g. green belt, concrete)
- Street tree density
- Percent 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 4-5: PEDESTRIAN QUALITY OF SERVICE ALONG WINOOSKI AVENUE (PROPOSED)



Source: RSG

4.2 BICYCLING

Bicycling is gaining popularity as a form of transportation – 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 biking 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 bike or on foot. Second, safer walking and biking conditions will improve the quality of life for everyone. A growing body of data from around the country documents that growth in walking and biking 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.”

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

Bicycle facilities along Winooski Avenue include:

- 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 (contra-flow) and southbound bicycle lanes between Maple Street and Howard Street



At intersections along Winooski Avenue, there are no designated bicycle facilities, such as crossing markings, pocket bike lanes (between the right turn lane and the through lane), or bike boxes. Treatments like these could be considered at the larger intersections.

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.

For example, a roadway with high motor vehicle speeds and volumes would be a high-stress roadway to a person riding a bicycle, 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, bike lanes or protected bike lanes may be necessary to reach a low-stress environment for people riding bicycles.

Factors that impact the stress level of people bicycling can include:

- 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

At intersections, well-designed marked transitions can guide bicyclists and motorists through turns and through movements.

Bicycle Level of Traffic Stress (LTS)² 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 bike 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 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, based on the number of travel lanes, bicycle lane width (or sum of bike lane width and parking lane width if next to a parking lane), prevailing speed, and amount of bike lane blockage (such as high parking turnover).

Using these criteria tables alone, the LTS for segments along Winooski Avenue ranges from LTS 1 to LTS 3, which do not intuitively match the LTS descriptions above. This mismatch may be a result of several things:

² <http://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf>

- Winooski Avenue meets the system's low-speed threshold with a speed limit of 25 mph (which vehicles largely conform to - see Section 5.2 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 as a way to make the ratings accessible without volume data. This can oversimplify the ratings.
- Separate tables are used to define LTS at intersections, so a segment with higher-stress intersections throughout would not have a higher LTS to reflect that. Winooski Avenue has several high-stress intersections along it.

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:** Bike paths, protected bike lanes, and greenways
- **LTS 2:** Bike lanes and buffered bike lanes on lower-volume streets*
- **LTS 3:** Bike lanes and buffered bike lanes on higher-volume streets* or shared lane markings
- **LTS 4:** No designated bike facilities or markings on higher-volume streets*

**An AADT of 5,000 vehicles per day may be an appropriate threshold between lower-volume streets and higher-volume streets.*

FIGURE 4-6: BICYCLE LEVEL OF TRAFFIC STRESS USING DRAFT CITY CRITERIA



Source: RSG and City of Burlington

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

Bike Sharing

Greenride Bikeshare launched in Burlington, Winooski and South Burlington in April 2018 with the first phase of a multi-year rollout. The Greenride system is currently a hub-based bikeshare model. With 17 hubs in Phase 1 with another 30 hubs planned in Phases 2 and 3, Greenride will provide a high level of coverage throughout Burlington and adjacent communities.

Bike sharing is an innovative transportation program, ideal for short distance, point-to-point trips providing users the ability to pick up a bicycle at any self-serve bike station and return it to any other bike 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.

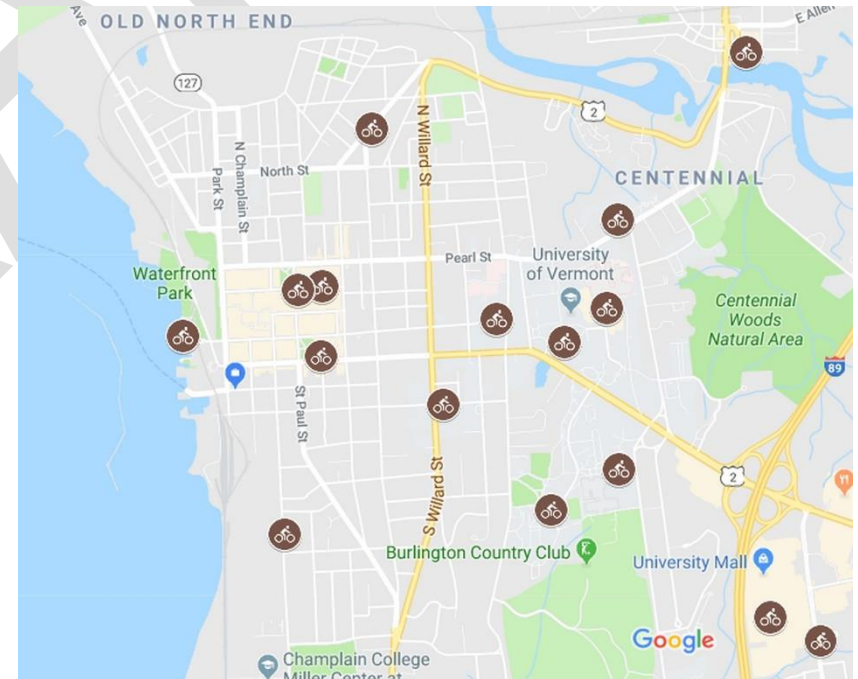
The Greenride system is hub-based, requiring users to end their trip at a hub. While the technology of the bikes may eventually allow it to evolve into a 'dockless' system, this is not the current design as it results in an additional \$5 fee when locked away from a hub.

One hub is located immediately on 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 4-7.



Greenride Bikeshare hub at 237 North Winooski Avenue

FIGURE 4-7: GREENRIDE BIKESHARE HUBS IN BURLINGTON (PHASE 1)



4.3 DRIVING

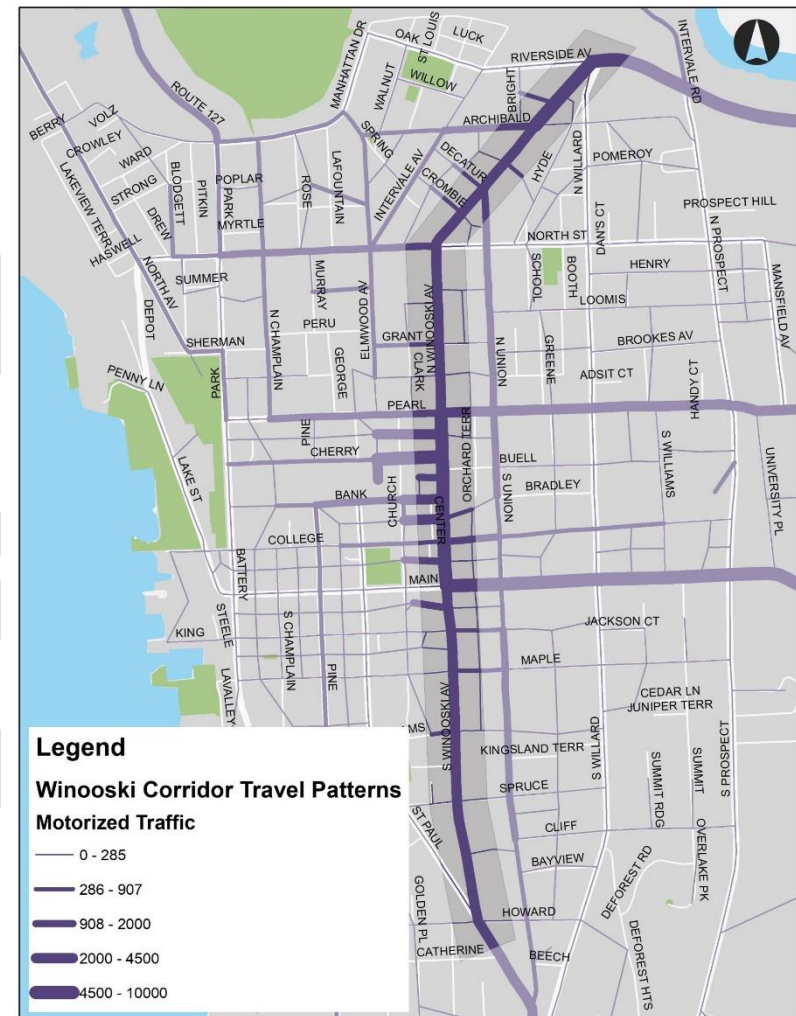
Although the proportion of people using different modes of transportation has shifted in recent years resulting in a reduction in driving, it remains the predominant mode choice. In addition, many people who use other forms of transportation also drive at least occasionally. Most of the right of way 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 4-8** shows that the majority of the corridor's traffic enters and exits Burlington via Riverside Avenue, Colchester Avenue, 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 4-9**).

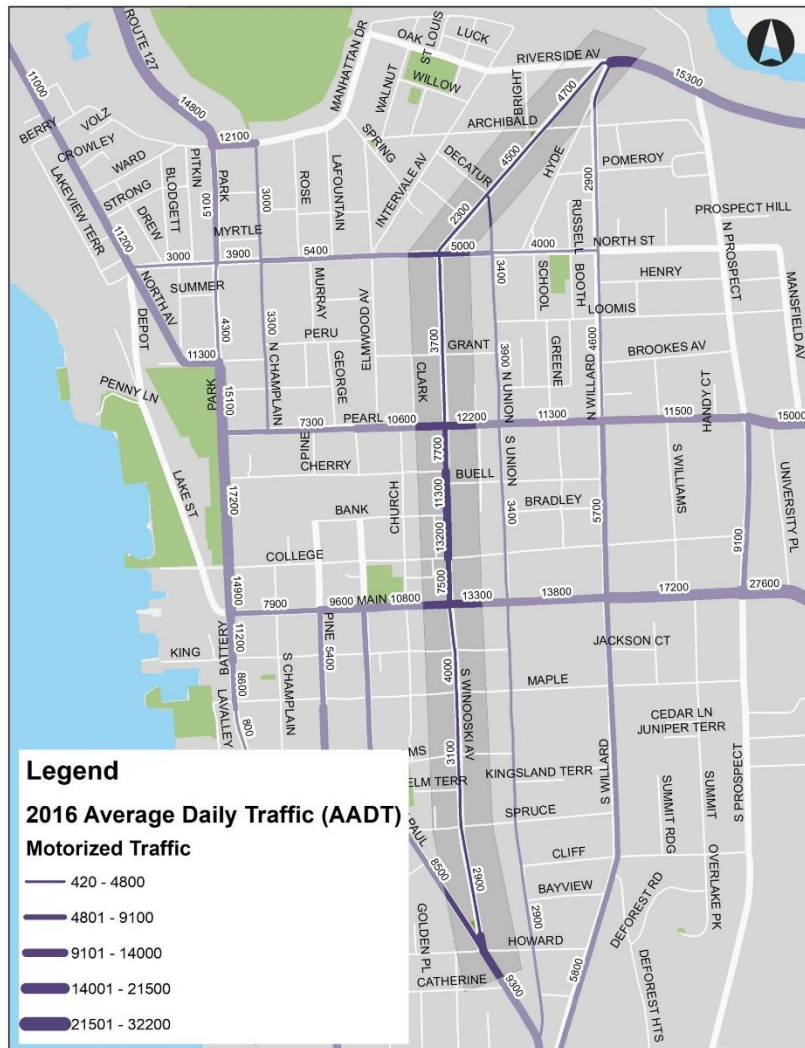
FIGURE 4-8: TRAVEL PATTERNS OF VEHICLES ACCESSING WINOOSKI AVENUE



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 4-9: DAILY TRAFFIC VOLUMES (2016)



Data Source: VTrans.

Rating Driving Facilities

Vehicle infrastructure can be rated using the **level of service (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 4-10 and Figure 4-11 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 it should be noted that congestion can be observed in the downtown core during midday.

The traffic operations summarized in the above graphics provide a limited view of traffic operations within the study corridor itself.

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 “jughandle” at Main Street/Spear Street/East Ave. westerly down the hill along Main Street and affect the ability for vehicles to exit Winooski Avenue onto Main Street.

The delay shown is averaged for a full hour of analysis, which doesn’t explicitly account for short periods of times where average delays are much longer.

Even with these limitations, the modeling of operations within the corridor are valuable insights into how changes in lane allocation, turn lanes, driveways, as well as 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 Ave (looking north from Bank Street intersection)



City of Burlington Traffic Signal Engineer David Garen

Signal Timing

Nine intersections along the corridor are controlled by traffic signals. All of these signals are actuated by detecting vehicles, bicyclists, or pedestrians.

The traffic signals along Winooski Avenue are coordinated between Cherry Street and Main Street. The afternoon peak hour has cycle lengths of 90 seconds, and 70 seconds in the morning and mid-day. The Pearl Street signal runs in isolation.

North Street, Peal Street, and Archibald Street signals have exclusive pedestrian phases during the signal cycle, giving pedestrians fully protected crossings with no vehicle movement.

Car Sharing

Car sharing allows people to rent cars for short periods of time, which can make it possible for members 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, as well as one in Winooski.

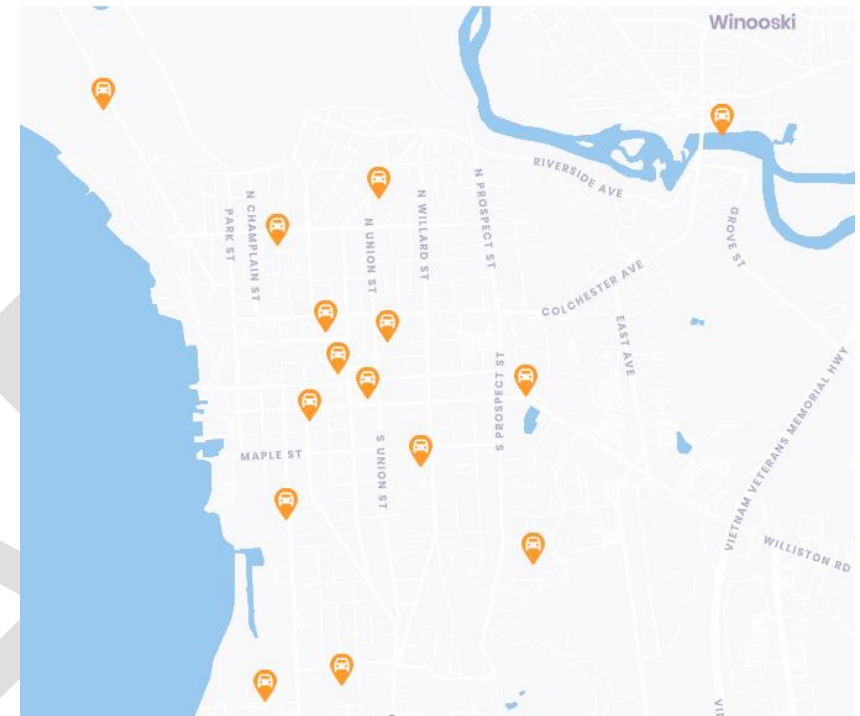
One pod is immediately on the study corridor at 258 North Winooski Avenue (Silversmith Commons), and six other pods within a quarter-mile walk from Winooski Avenue. These pods are all in high demand due to the high density of both residential and business user groups along Winooski Avenue and in downtown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

For car sharing to work efficiently and meet the needs of a community, it needs convenient, multimodal access to its pods and safe, accessible locations for pods.

CarShare Vermont Facts:

- 65 percent of members chose to get rid of a vehicle or not to replace a vehicle when joining.
- 87 percent of members are zero- or one-car households.
- The average trip length is 3.5 hours.
- One carshare car replaces 15 privately owned cars, and can serve 60 people in a neighborhood.
- Members use cars for a range of purposes, but mostly for grocery shopping, running errands, going to meetings, and socializing.

FIGURE 4-12: CAR SHARE POD LOCATIONS



Delivery Vehicles

Non-residential land uses often require use of commercial delivery vehicles and benefit from dedicated loading zones. The City of Burlington Public Works Commission controls the placement and regulation of loading zones. Zones identified by a loading zone sign prohibit non-commercial vehicles, or those with a loading zone permit or coupon, from using the space.

Loading zones typically are an underutilized reserved space. There may be opportunities to identify land uses or work with specific property owners to identify shared uses for loading zones or identify specific time of day requirements to limit commercial deliveries outside of peak hours or conducted outside of periods of high parking demand.

An example of a shared use arrangement may be to identify loading zones also designated for on-demand mobility (i.e., Uber, Lyft) use. The City has already designated some loading zones available to all outside of the delivery times. An example on the corridor is the loading zone in front of the Butch + Babe's restaurant.

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



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

Shared Mobility

Transportation network companies (TNCs) such as Uber and Lyft have evolved by creating new technologies to provide on-

demand car travel options. Traditional taxi companies have started using similar phone-based travel technology. TNCs and taxi companies not only provide car travel without the need to own a personal vehicle, but they 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 427,828³ vehicle-for-hire trips originating in Burlington.

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 of these services substitute an individual need for travel with an often more efficient delivery service combining several orders in one vehicle.

Both Uber and Lyft 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 smart phones, has increased the number of goods and services that can be procured and delivered rather than requiring an individual to travel.

Most of these services requires an individual to have a smart phone and have a bank account or credit card. The City must ensure that reliable travel options remain viable for those that may not have access to these on-demand services.

³ <https://www.sevendaysvt.com/vermont/uber-has-spied-to-the-top-of-burlingtons-ride-for-hire-heap/Content?oid=9196614>

4.4 TAKING TRANSIT

Green Mountain 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.

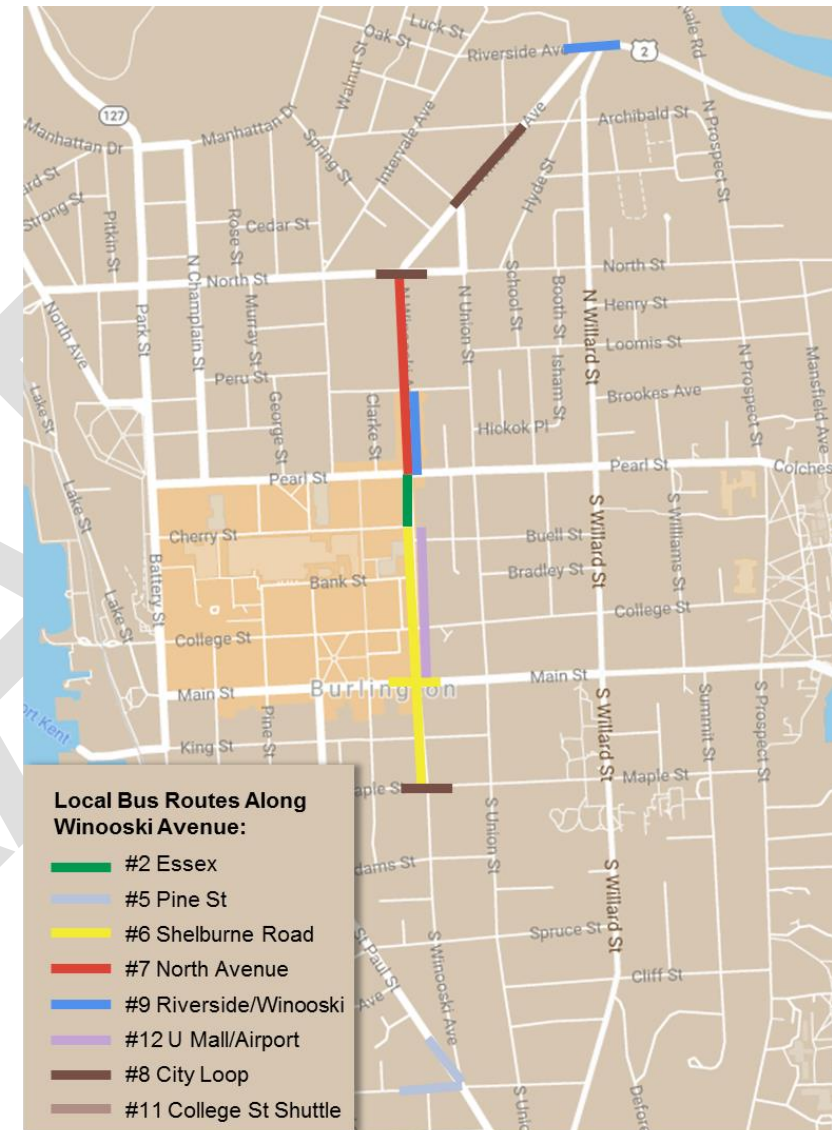
Ridership and Connectivity

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.

Figure 4-13 shows the local routes in Burlington that travel along or across Winooski Avenue. No existing route travels exclusively along Winooski Avenue.

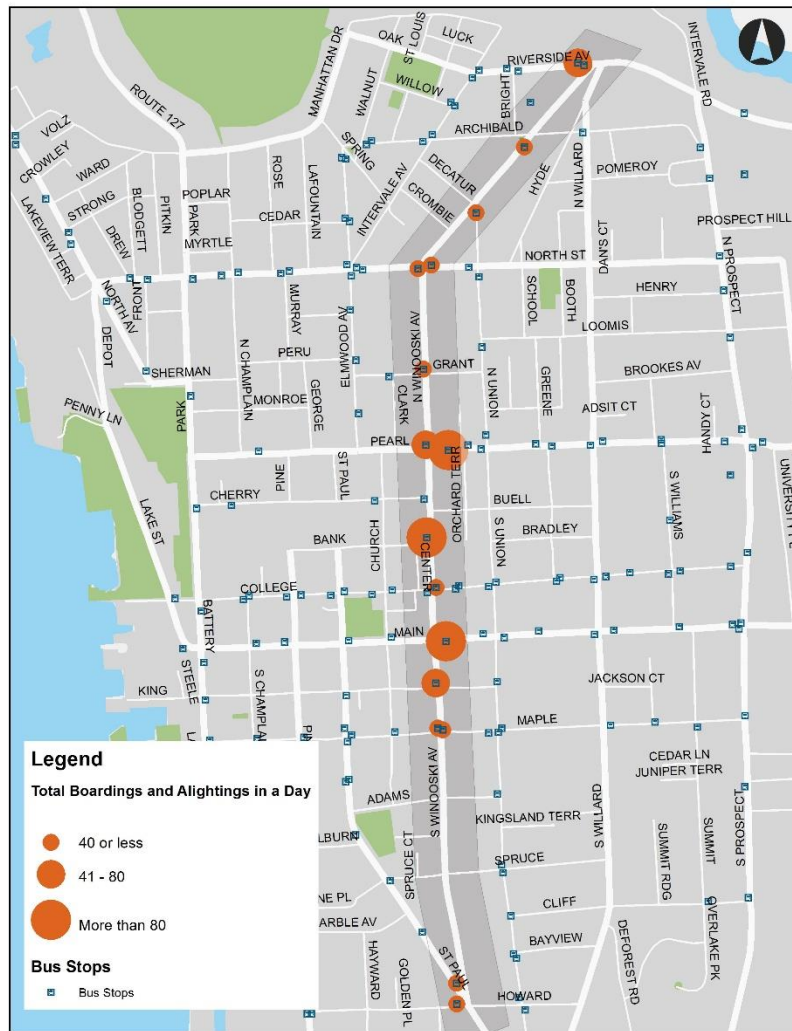
Ridership data for the bus stops along Winooski Avenue, in the form of total boardings and alightings in one day, is shown in Figure 4-14. The places of high bus demand correlate with areas of high employment and mixed-use land development.

FIGURE 4-13: GMT LOCAL BUS ROUTES



Data Source: Chittenden County Sustainable Transportation Map (CATMA)

FIGURE 4-14: GMT BUS STOP DEMAND (2017)



Source: GMT

NextGen Plan

GMT is finalizing the NextGen Transit Plan, the first comprehensive evaluation of the complete transit system as it exists today. Each route is evaluated, a market analysis is

conducted, and the public is engaged through meetings and surveys to develop recommendations to the GMT system.

Revisions to the bus routes appear to increase bus service along Winooski Avenue, particularly between Pearl Street and Riverside Avenue.

Route 8: City Loop

- 30 minute service during weekdays, 60 minute service on weekends
- 6am to 7pm weekdays, 7am to 7pm Sat, 8:30am to 7pm Sunday

Route 9: Riverside/Winooski

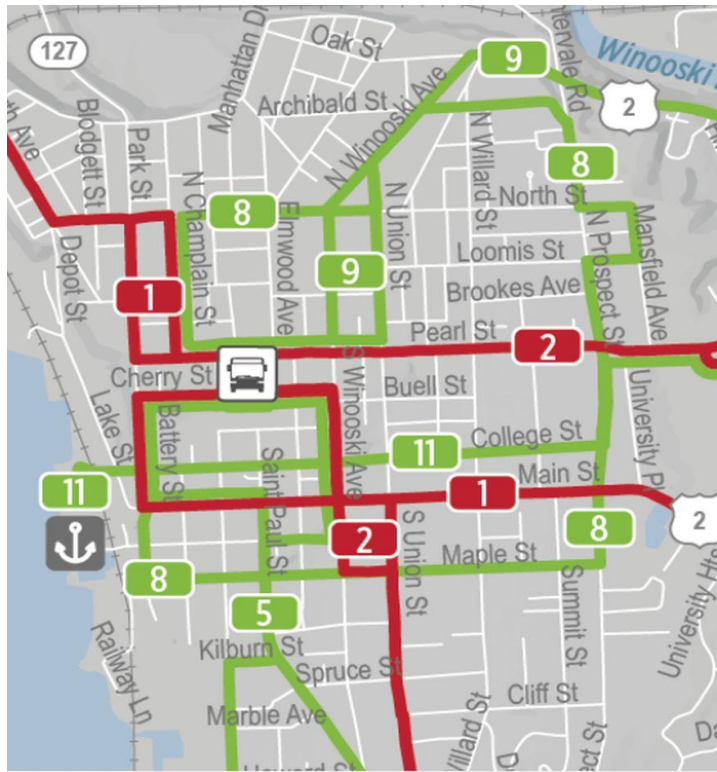
- 30 minute service during day and 30 to 60 minute service at night. 6am to 11pm weekdays.
- 30 to 60 minute service on Saturday. 7am to 9pm Saturday. No Sunday

Route 2: Essex-Shelburne via Downtown Burlington

- Major Urban Local route
- 20 minute service during day and 30 to 60 minute service at night
- 30 to 60 minute service on weekends
- Service until 11pm weekdays

The recommended routes are shown in [Figure 4-15](#).

FIGURE 4-15: NEXTGEN BUS ROUTES (PROPOSED)



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 4-1 shows a generalized concept of the type of amenities that should 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.

Table 4-2 shows the amenities found at bus stops along Winooski Avenue.

TABLE 4-1: CONCEPT BUS STOP AMENITIES

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

TABLE 4-2: 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 due according to Table 4-1.

Bicycle parking is another frequent amenity to improve modal integration. While no bus stop appears to have bike parking immediately proximate, very often, there are bicycle parking

spaces available within a few hundred feet. See [Figure 4-16](#) for an integration of bike parking, bus stops, and carshare pods.

GMT is currently in the process of formalizing its own bus stop guidelines.



Bank Street bus stop: no schedule or map, and trampled grass is evidence of high demand.



Archibald Street bus stop with shelter

4.5 INTEGRATION OF MODES

Integration of modes was identified as a goal in both planBTV Walk Bike and the Regional Active Transportation Plan. 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, this means lighting, shelters, and benches. Bikeshare and car share locations near transit support a systematic option to driving.
- Placing bus stops, bikeshare hubs, and carshare pods close to each other allows each mode to support each other's use.
- Bicycling and vehicles 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 versus 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/pick up 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.

Figure 4-16 shows the locations of CarShare Vermont pods, secure bicycle parking, and GMT bus stops in Burlington, as well as bike parking along Winooski Avenue.

FIGURE 4-16: SHARED MOBILITY AND TRANSIT



Data source: CATMA & RSG

5.0 SAFETY

While Section 4.0 discussed many of the factors that affect comfort and perceived safety for each mode of transportation, safety can also be evaluated in depth based on historical crash data.

5.1 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 data⁴ 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. Note that 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 this study and past studies.

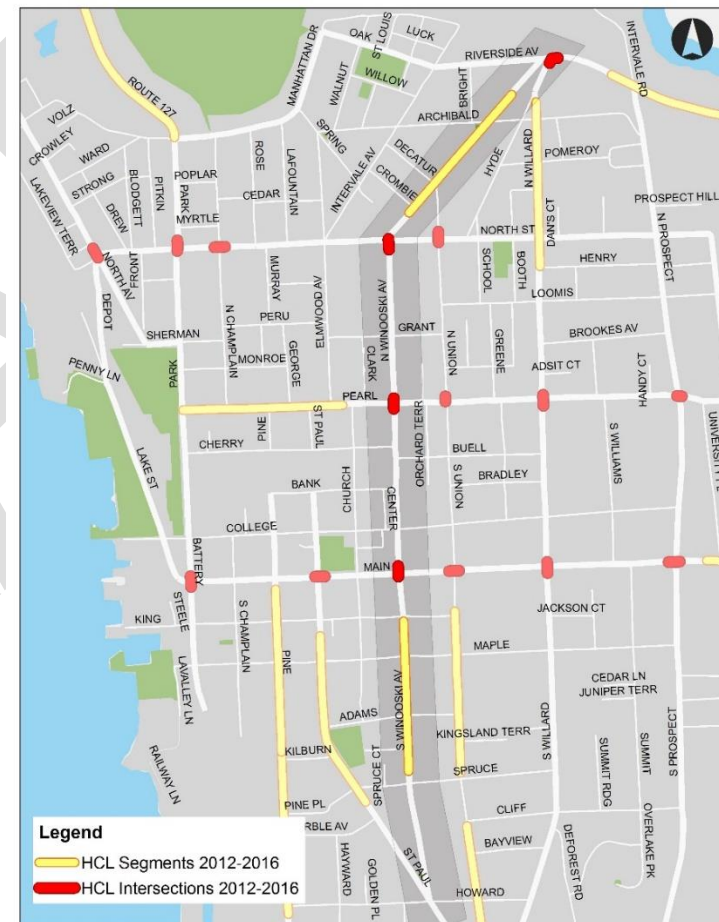
Winooski Avenue Crashes Relative to Local and State Data

Crashes along Winooski Avenue account for:

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

High crash locations (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 5-1](#).

FIGURE 5-1: HIGH CRASH LOCATIONS (HCLs)



⁴ 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>

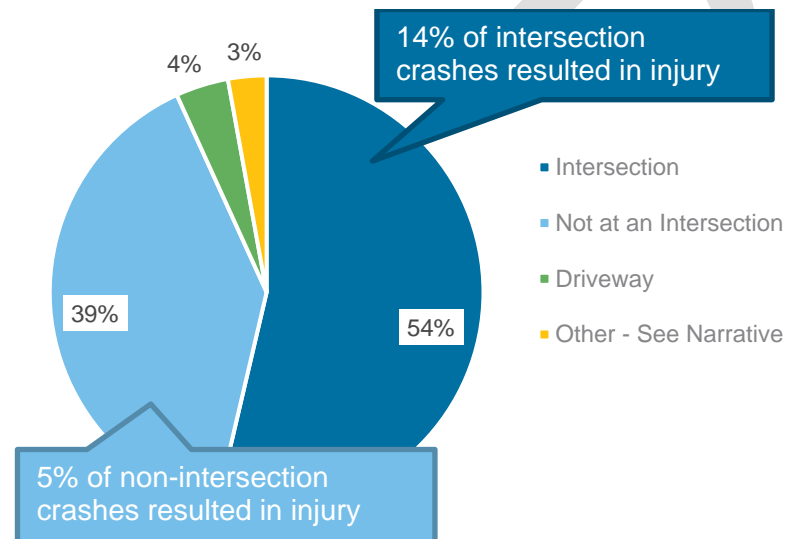
High Crash Locations can help identify points of interest, but they don't always tell the full story. For example, the segment between Pearl Street and Main Street has the highest number of crashes along Winooski Avenue, yet does not meet the requirements to be an HCL.

The two segment HCLs (north of North Street and south of King Street) are located along roadway segments with many curb cuts (see Figure 3-4) which introduce turning traffic and a higher number of conflict points.

Crashes Along Winooski Avenue

Excluding crashes recorded as being in parking lots, 54% of crashes along Winooski Avenue occurred at intersections, 4% occurred at driveways, and 40% occurred away from driveways or intersections. Crash location type is summarized in Figure 5-2.

FIGURE 5-2: CRASH LOCATION TYPES ALONG WINOOSKI AVENUE (NOT INCLUDING PARKING LOTS)



Source: VTrans Public Crash Data Query Tool

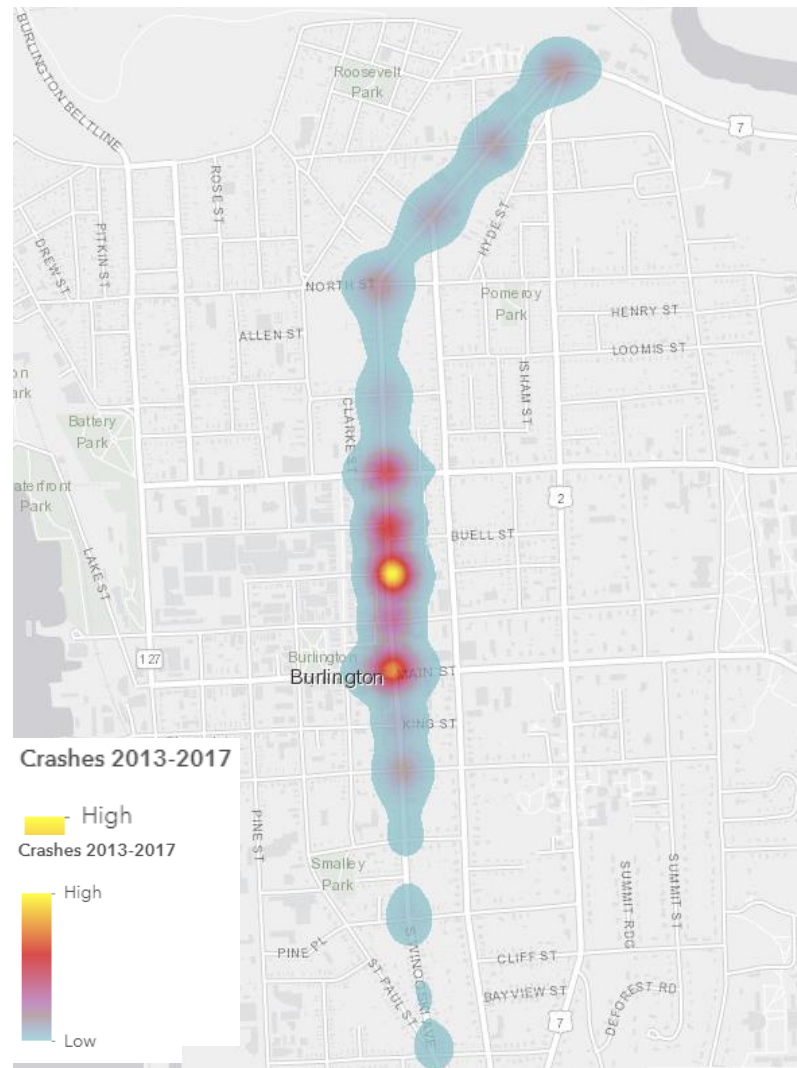
Figure 5-3 is a heat map that provides an overview of all crashes along Winooski Avenue. The four-lane segment between Pearl Street and Main Street has experienced the highest number of crashes along the corridor.

Figure 5-4 is a heat map of just 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.

All maps and crash details are summaries of the VTrans crash data between January 1, 2013 and December 31, 2017.

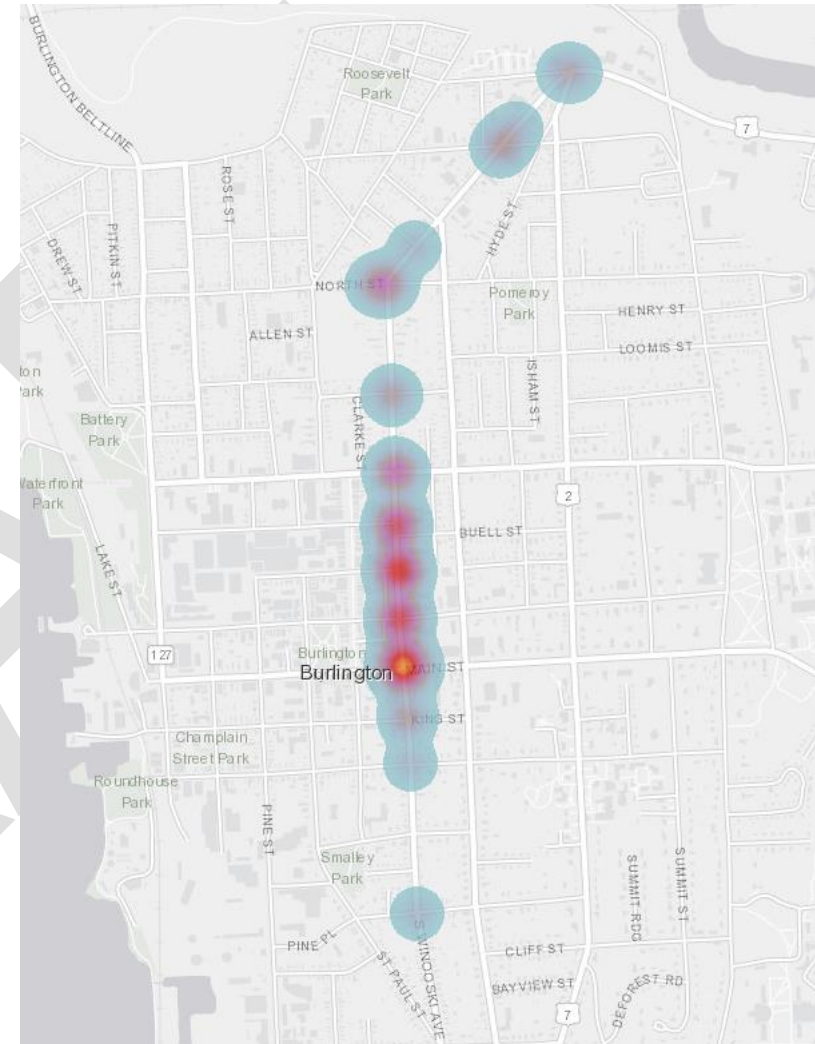
A heat map is a helpful visualization tool to quickly identify areas or locations with greater or lower intensities.

FIGURE 5-3: HEAT MAP OF ALL CRASHES ALONG WINOOSKI AVENUE



Source: VTrans Public Crash Data Query Tool

FIGURE 5-4: HEAT MAP OF BICYCLE AND PEDESTRIAN CRASHES ALONG WINOOSKI AVENUE

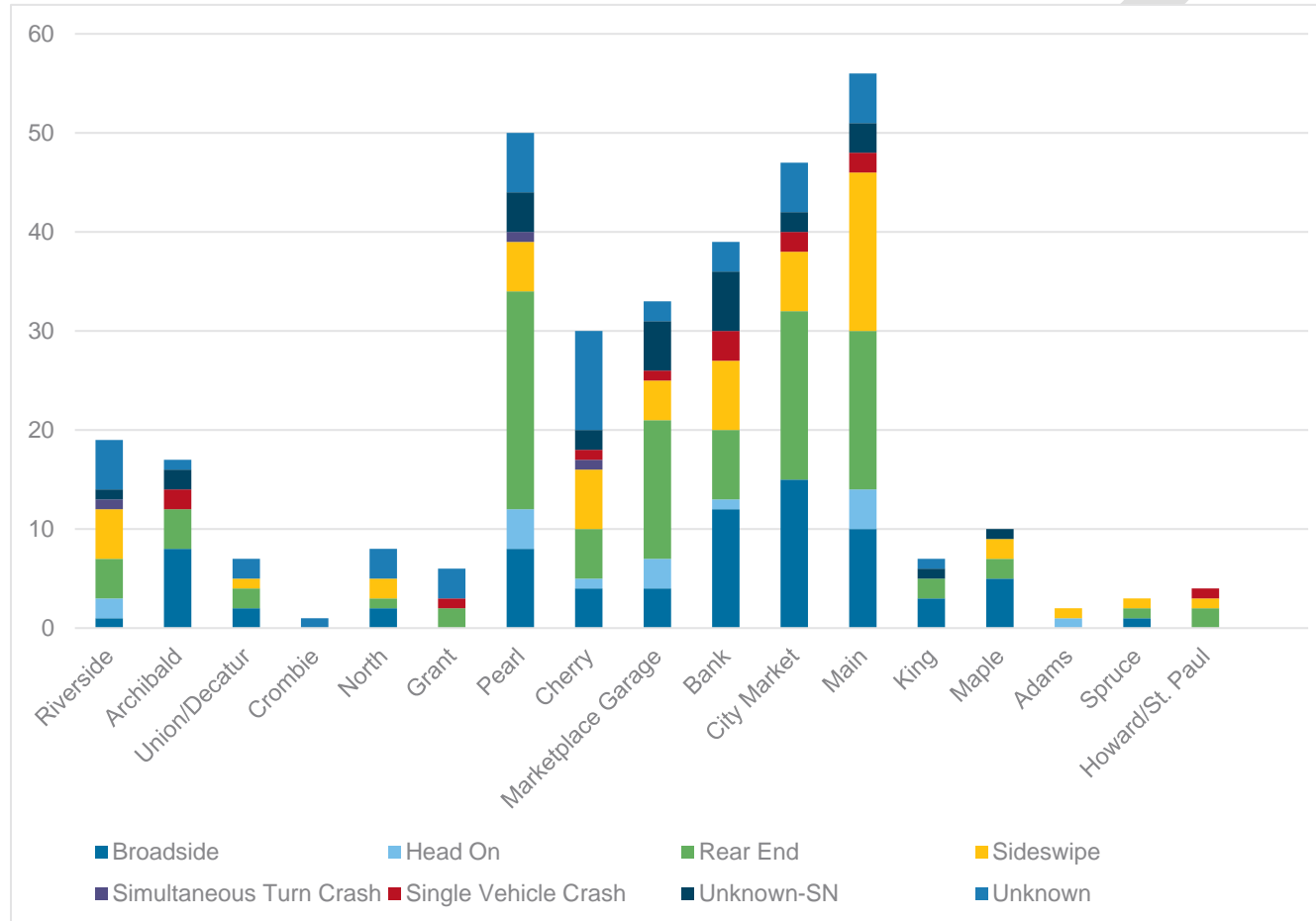


Source: VTrans Public Crash Data Query Tool

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

Details of crash types along Winooski Avenue are shown in Figure 5-5.

FIGURE 5-5: COLLISION TYPES AT INTERSECTIONS



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

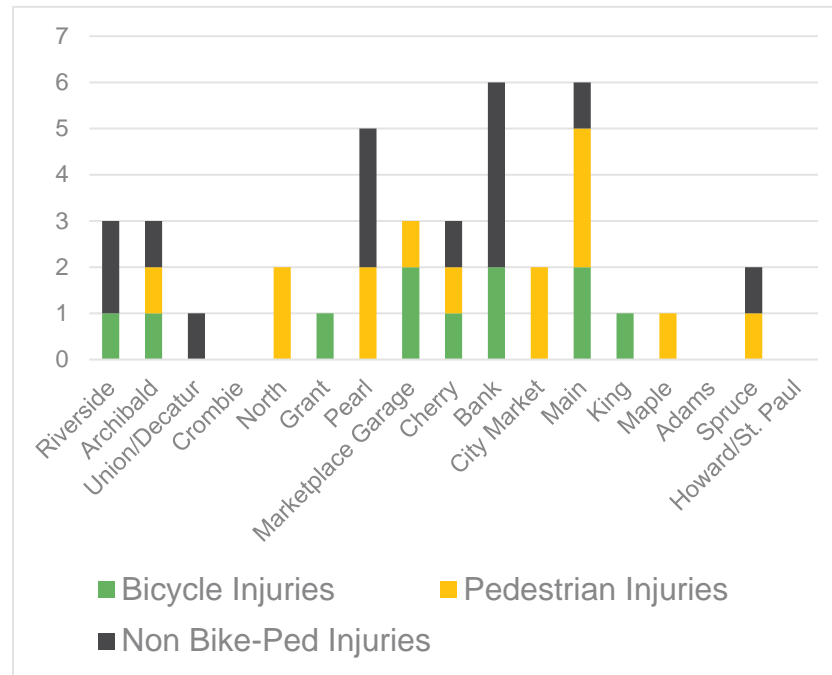
configurations can result in sideswipes. Most intersection crashes occurred between Pearl Street and Main Street. City Market and Marketplace Garage have similar numbers of crashes as street intersections.

Source: VTrans Public Crash Data Query Tool

“Unknown-SN” refers to crashes marked as “Other - See Narrative” in the crash database. Narratives were not reviewed at this time.

Injury crashes by mode at each intersection are shown in Figure 5-6.

FIGURE 5-6: INJURIES AT INTERSECTIONS BY MODE



Source: VTrans Public Crash Data Query Tool

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

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

Note regarding City Market data: There were an additional 62 crashes at City Market that 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



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

some may actually be at the roadway. The data has not been evaluated to this level of detail.

5.2 SPEEDS

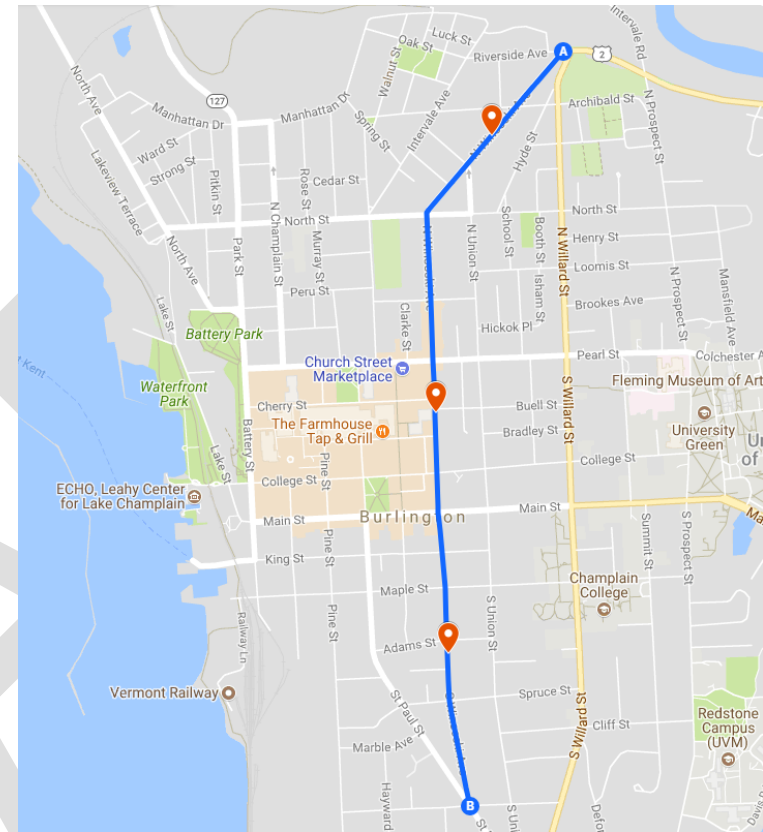
Vehicle speed is relevant to the safety of all modes of transportation. Vehicle speeds along Winooski Avenue appear to be consistent with the corridor's speed limit of 25 mph.

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 5-7.

- Between Archibald Street and Decatur Street (Union Street) on North Winooski Avenue, where there are two travel lanes. This location is also along a high crash location 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 a high crash location 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. If a 20 mph speed limit is determined to be desirable along parts or all of Winooski Avenue, the roadway design should be re-evaluated for encouraging lower speeds than existing.

FIGURE 5-7: 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 25mph.

6.0 PARKING ANALYSIS

Vehicle parking is a sensitive topic that will be a continued focus throughout this study. Over time, businesses and residents alike have grown accustomed to using the public right of way for long-term vehicle parking as densities have grown and the demand for car parking has increased. However, parking consumes valuable public space that can be used to meet other needs of the transportation system.

The City has modal objectives (see Figure 4-2) to reduce reliance on the single occupant vehicle 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 and the egg' challenge to urban transportation.

This study will identify 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.

Operational changes will be explored as to best utilize what we have using shared space arrangements or time of day policies.

The City Place development on Church Street will add a number of new parking spaces associated with the new land use development. No other significant changes to the on-street or off-street parking supply are anticipated at this time.

6.1 ON-STREET PARKING

Winooski Avenue has 340 total on-street parking spaces. Ten of these 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 are:

- Grant Street between Winooski Ave and Union Street: seven days a week all times of the year.
- Spruce Street between Winooski Ave and Willard Street: weekdays from 6am to 6pm.
- Union Street between Pearl Street and Buell Street: seven days a week all times of the year.

Figure 6-1 shows parking regulations types along Winooski Avenue. There is no on-street parking 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 1-hour and 2-hour parking.

There are four handicapped parking spaces along the corridor:

- 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 and Pearl Streets,
- One space in front of Pathways Vermont Community Center just south of Archibald Street, and
- One space in front of Legal Aid at 264 North Winooski between Union and Archibald Streets.

FIGURE 6-1: ON-STREET PARKING REGULATIONS



Source: RSG

Bicycle Parking

17 bike parking locations holding 32 bike racks are located on the corridor. Some of these locations are single “U” bike racks, while some, like at the Food Shelf, have 3 “U” bike racks.

FIGURE 6-2: BICYCLE PARKING



Source: RSG

6.2 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 2-vehicle CarShare Vermont pod 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** has 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 1pm to 2am.

Field observations suggest that the land uses north of Pearl Street are generally on larger lots that have reasonable space and supply of parking off the street. Some commercial land uses such as Barrio Bakery and 337 Winooski Ave (Pho Hong a laundromat, and Good News Garage) 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.

6.3 EXISTING DEMAND VS. SUPPLY

To incorporate additional data on the demand of parking in the study area. This will come from active work being done by the

BBA, { BBA has indicated by Dec 2018 there will be some parking results within the urban core which abuts Winooski Avenue }

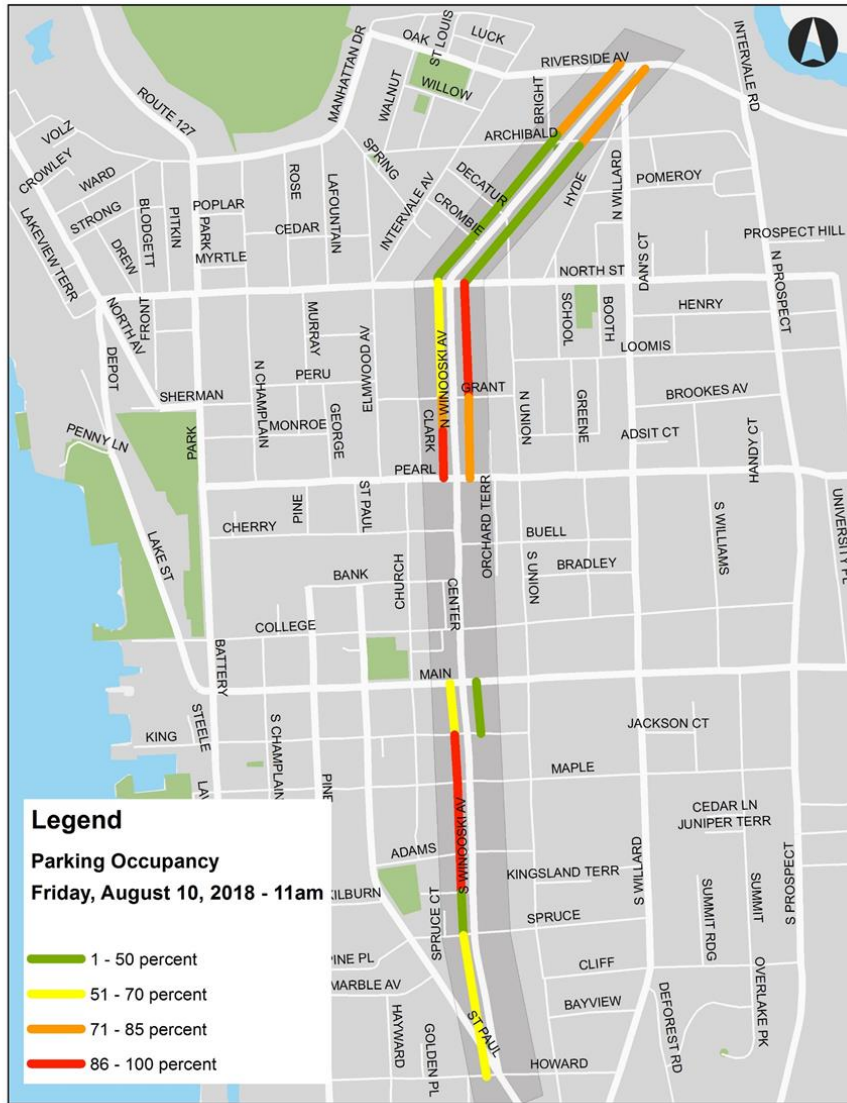
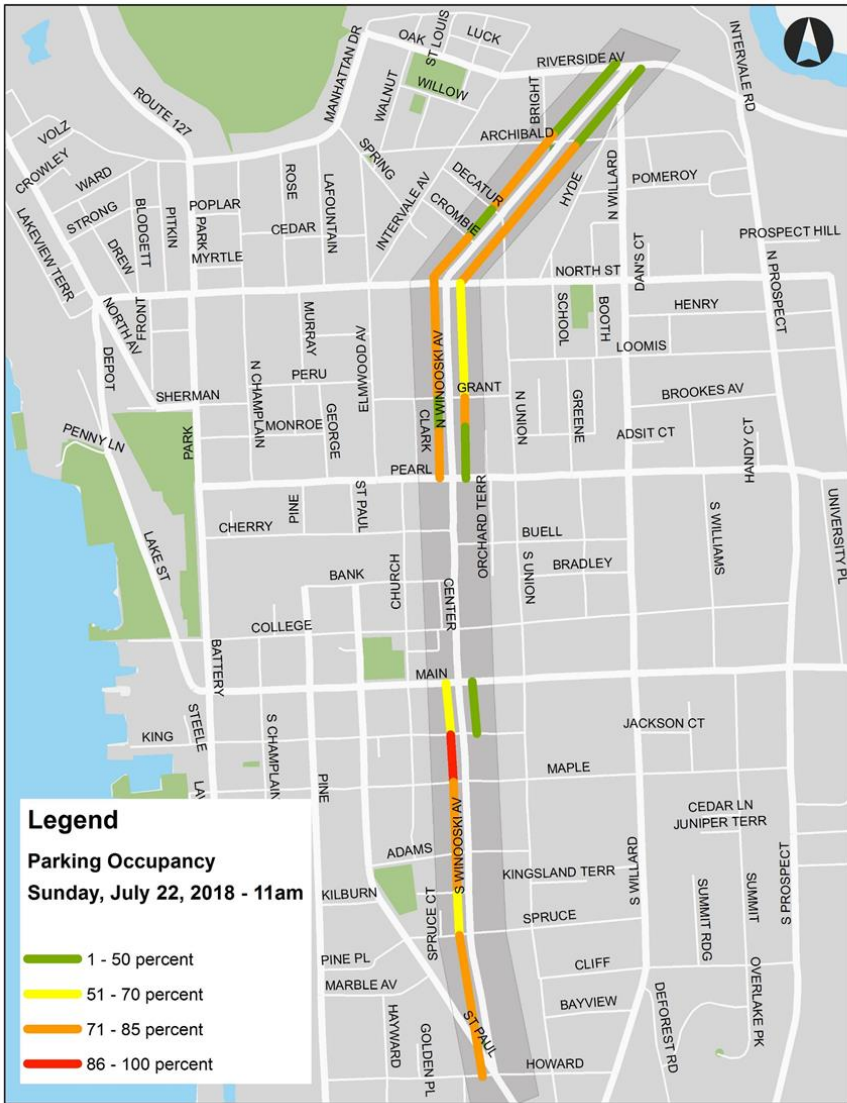
some on-street observations by the CCRPC, and the Project Team.

Summer 2018 Parking Occupancy

Parking counts were conducted during late morning on a Sunday and a Friday in the summer of 2018. Both periods had an average parking utilization rate of 65% and 67%, respectively, along Winooski Avenue.

Parking occupancy by individual block and side of the street vary from 33% to 100% occupancy, as shown in Figure 6-3. However, by larger segment split where regulations change, the highest occupancy was 81% (between Grant and Pearl on Friday).

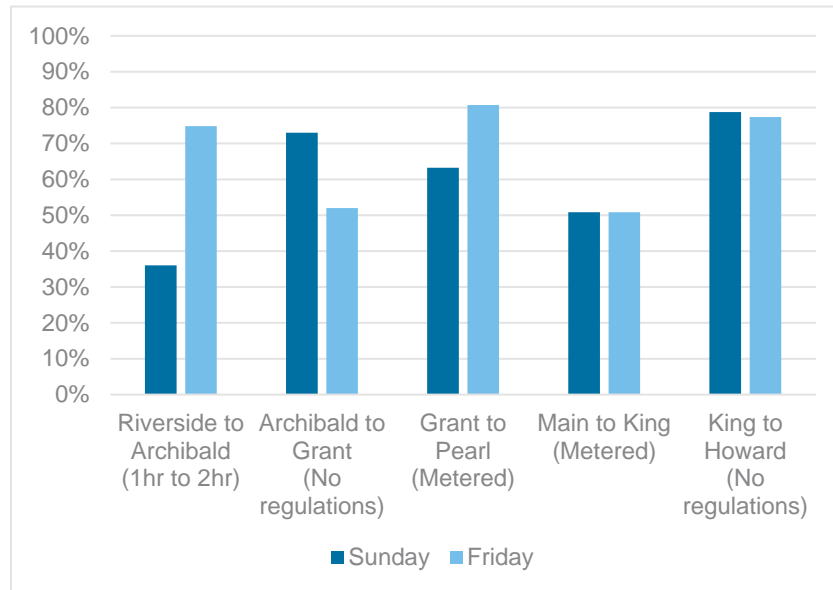
FIGURE 6-3: SUMMER PARKING OCCUPANCY (2018)



Data Sources: Sunday data from RSG; Friday data from CCRPC.

Figure 6-4 summarizes the parking occupancy on each day by street segment between where parking regulations change.

FIGURE 6-4: PARKING OCCUPANCY SUMMER 2018 BY REGULATION SEGMENT



Data Sources: Sunday data from RSG; Friday data from CCRPC

On both Friday and Sunday, the segments with the highest occupancy were in the non-regulated segments between Archibald and Grant Streets and between King and Howard Streets. The 1-hr and 2-hr limited segment between Riverside Avenue and Archibald Street was also high on Friday, but on Sunday, this segment had the lowest occupancy (36%).

The metered segment between Main and King Streets was 51% on both days.

Discussion

There appears to always be parking spaces available in any segment of Winooski Avenue during the summer in late

morning. On Friday, this accounts for people parking during typical work hours.

{ Additional parking occupancy counts will be conducted in the Fall of 2018, when school is in session. 90% of observations completed as of 11/11/2018 }

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."

See Park Burlington for more information:

<https://parkburlington.com/>

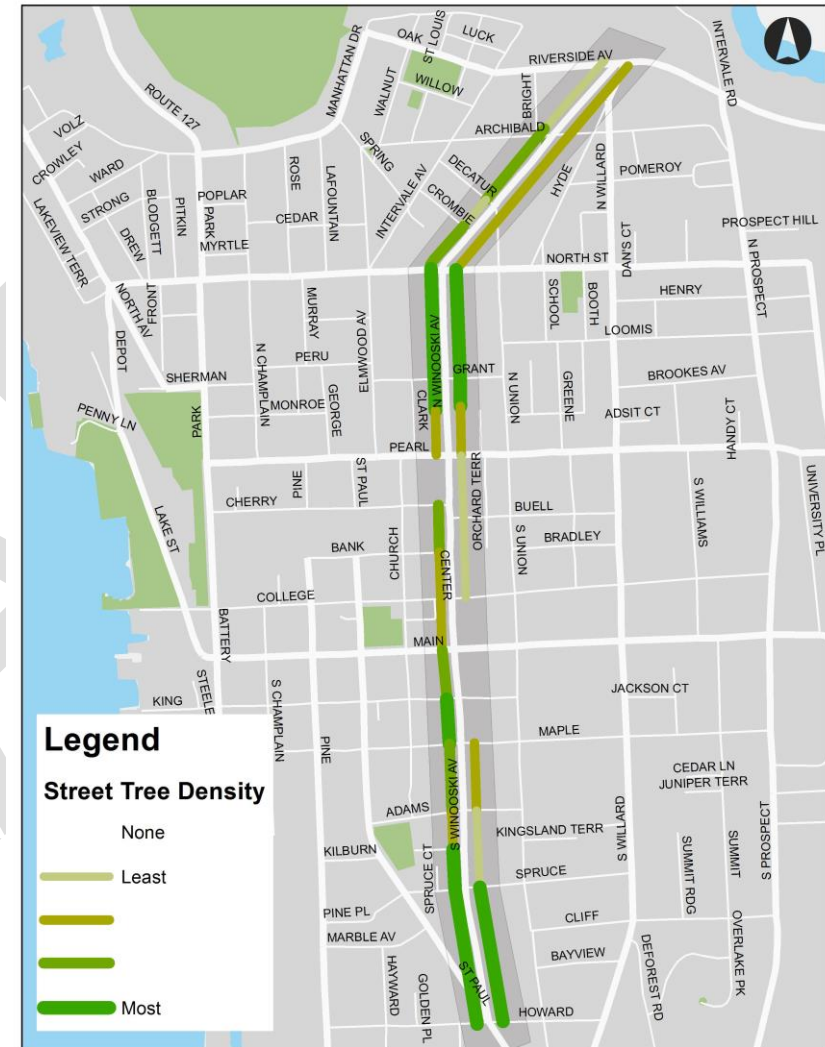
The 'smart use' approach will be incorporated into the analysis and review of the demand versus supply of parking in future Winooski Corridor alternatives.

7.0 OTHER INFRASTRUCTURE

Additional street infrastructure includes street trees and overhead utilities, including overhead lighting. These are shown in Figure 7-1 and Figure 7-2, respectively.

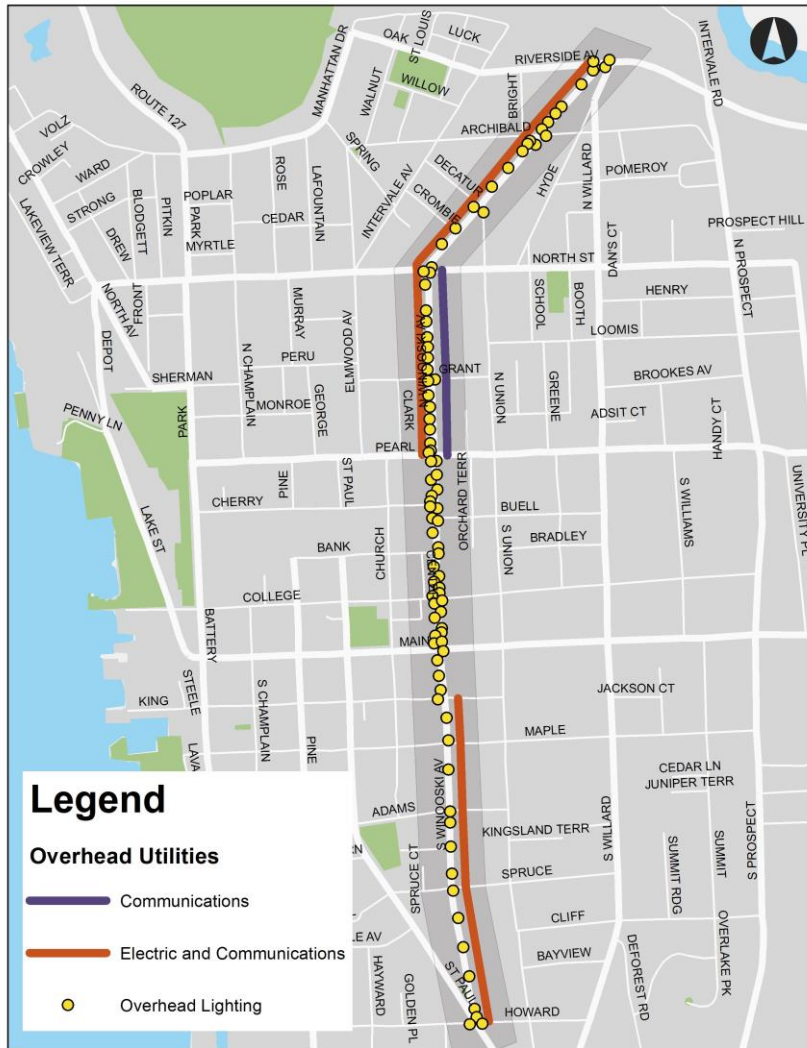
Street trees have numerous benefits; they provide shade, stormwater management, a sense of place, a buffer between pedestrians and vehicles, and more. They are most dense in the residential areas between Grant and North Streets and between Howard and Spruce Streets.

FIGURE 7-1: STREET TREE INTENSITY



Source: RSG

FIGURE 7-2: OVERHEAD UTILITIES



Source: RSG

8.0 STAKEHOLDER INTERVIEWS

The project benefits from having a diversity of interests represented on the Project Advisory Committee, as well as from numerous public engagement opportunities, but to ensure the project team is hearing from as many interests as possible, we identified other stakeholders from whom we wanted to better understand Winooski Avenue through their particular lens. As part of the Existing Conditions process, conversational interviews were conducted with people from the following entities:

- 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
- Green Mountain Transit
- 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. We heard that Winooski Avenue is viewed as a central corridor that provides access to and from the City, but the four-lane section between Main and Pearl streets is challenging for all users (walkers, bikers, transit, autos). It sends the message that you're getting to someplace else and serves as access to other places, rather than being a "place" or destination of its own. People 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 there's a desire to build community and culture around them and their unique aesthetic. There wasn't a lot of strong sentiments expressed about the residential neighborhood south of Maple Street. People like that it feels "calm, peaceful, quieter" than the four-lane section between Main and Pearl, and that is has two-way bike facilities, although the contraflow lane (heading northbound) might cause confusion to people driving. One person, however, noted that the section between Main and King streets "feels weird" like you're not supposed to go into that southern neighborhood. That section of Winooski Avenue has parking on both sides of roadway, then transitions to one-way southbound with two-way bike traffic.

Discussion of specific themes and issues are summarized as follows:

Vehicle parking

People expressed diverging interests in either the need to keep on-street parking or remove it to provide additional roadway space for other others uses like bike 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." Several business people noted that keeping and adding more short-term parking spaces for customers and deliveries would be helpful.

One person noted there is some ambiguity about where parking is legal or illegal. Fire Department staff noted that snow accumulation can impact roadway width, especially when there's parking on both sides of street – cars tend to creep away from the curb and into the roadway. They've noticed less of an impact with parking only on one side. It was suggested to make the Howard Center parking lot public (operated by the City) and shared with others like The YMCA. Other shared parking agreements could be useful. If parking is removed from Riverside to Archibald (to add bike infrastructure), consider how to add parking to other nearby streets.

Bike facilities and bike parking

People generally like that there is bike infrastructure in the south and north ends of Winooski Avenue, but any bike-related changes need to be consistent throughout the corridor, such as bike lanes on both sides of the roadway, or a protected two-way bike lane on one side. Most people noted the lack of any bike infrastructure between Main and Pearl streets. We also heard that there needs to be a change in attitude so that people on bikes know that the laws apply to them. Specific challenges for people biking were noted at the Riverside/Winooski Ave intersection and downtown between Main and Pearl streets. There is interest to return the on-street bike rack in front of The Light Club Lamp Shop back to a loading zone, with the suggestion to add bike parking on the other side of street at the chained off driveway to Act One, or to put bike hitches on parking meters.

Pedestrian amenities

While there is a connected sidewalk network throughout the corridor, people pointed out that there isn't much green space downtown even though the sidewalks are wide, as well as the lack of benches. People like the landscaping in front of Howard Center, City Market, and the Ronald McDonald House, as well as the public art and murals, quirky character and aesthetics of downtown. Lighting downtown seems pretty good, but the sidewalks are next to the busy roadway which isn't enjoyable. More street trees or other things would help make the downtown section feel "denser and tighter" to reduce speeding.

Flowing trees in warmer months and decorative lights in trees would add to the downtown aesthetics. People thought the pedestrian crossing times at signals may not be long enough for people with disabilities and suggested that other signs/flashing lights might make some intersections, like at Grant Street and Decatur Street, safer for people walking. People don't know that the Pearl/Winooski intersection is all-way pedestrian crossing so consider pavement markings or signal changes to let people know. Similarly, the Archibald/Winooski intersection is challenging because it's so large and intimidating; consider making it an all-way pedestrian crossing.

One-way versus two-way traffic pattern

The current traffic pattern along Winooski Avenue varies, with southbound one-way sections on North Winooski between Pearl and Decatur, and on South Winooski between Maple and Howard. The downtown section between Main and Pearl is two-way, with two lanes in each direction (four lanes total). People noted that this inconsistent configuration can be confusing for tourists and limit access to neighborhoods.

People discussed the idea of turning North Winooski from Pearl to Union into a two-way street. Some people think it would open up access to Old North End and businesses, help the northern section feel "less desolate," and would help address wrong-way bike riding. One business owner said that the traffic pattern in the one-way section between North Union and Pearl feels "slower" and feels more bike/ped friendly and if it was turned into two-way it would become the "traffic dump" to access the City of Winooski. Some people pointed out that some on-street parking might need to be removed to accommodate two-way car and bike traffic. This might also help the Fire Department access the Old North End.

Transit

Existing Green Mountain Transit (GMT) service only uses a portion of Winooski Avenue, and GMT staff noted that they would prefer to utilize Winooski Ave more as a north/south route. One-way streets such as parts of North and South Winooski aren't insurmountable for transit service but they're

not ideal for passenger pick up/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

There was significant discussion about the four-lane section between Main Street and Pearl Street. Some of the issues brought up include: left turning vehicles on Winooski Avenue block the inside travel lanes; other drivers weave to get around those vehicles; SSTA vehicles block the lane in front of Howard Center; there is no bike infrastructure downtown; it doesn't feel welcoming to people walking; gas stations feel out of place; it feels like an alley for other businesses; the curb cuts are large and wide; the parking garage and City Market add to challenges; left turns out of City Market and Howard Center are challenging; vehicle conflicts entering/exiting the alley between Howard Center and Roxy Cinemas; people don't cross at signalized intersections near City Market; truck deliveries block lane near corner of College Street; buses have to change lanes between College and Main.

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

People offered potential solutions including:

- 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
- There was a desire for artistic structure or something else at the corner of Winooski 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. There is a desire to use pop-up projects to get real -world experience and feedback on project recommendations. These need to be in place long enough to gauge their functionality and to maintain public and stakeholder interest between the planning study and actual construction.

One question asked of stakeholders was, "What is the first word (or 3) that comes to mind when you think about Winooski Avenue?" Responses included:

- Traffic; neighborhood; disconnected. Non-continuous.
- It's interesting that the corridor goes through different zones, commercial and residential.
- I think of Winooski Ave as lots of different corridors rather than one long one.
- Connection to downtown, pretty easy connection to downtown because signals work pretty well, and sometimes when coming out of downtown take Union to Winooski to Riverside because it's more bearable than Colchester Ave; it's a growing area with more restaurants and housing, it's a positive changing environment; and mentally Winooski Ave ends at Main St; and diverse with colorful houses, new developments/apartments, food.

- It's the gateway to our part of the city (ONE), going in and out.
- Traffic flow is convoluted. It's the way people get in and out – but they can't.
- We lived here right before it became one way about 20 years ago or so.
- Since the change to one-way it's been clear that unless you know your way around, it's confusing. Not intuitive.
- Emerging, in terms of development patterns. It's not getting the full benefit of being a corridor.
- Diverse in terms of land use patterns, parking, bike lanes.
- Centralized, sectional, emerging.
- How different it is along corridor
- nerve-wracking downtown on a bicycle
- from Pearl to Main is hairy and scary.
- Confusing, dangerous, ugly. Desire/potential for continuity.
- Start/stop, dangerous
- Growing. Artsy. Community, neighborhood-y
- Connection. Access. Connecting Winooski, Burlington, South Burl. Inconsistent, patchy. Very, very patchy.

Open Streets BTV Summary

The project team also had a public information table at Burlington's Open Streets event (<https://www.openstreetsbtv.com/>) on September 30, 2018. We were on North Winooski Avenue at the intersection with North Union Street and Decatur Street in the heart of the Old North

End. We talked about the project 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. Comments are available on the project website (tiny.cc/WinooskiAveStudy).

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 bike lane on North Winooski. They noted that Winooski Avenue between Main and Pearl streets is difficult for people walking and biking.

People we talked to would like to see a protected bike lane the length of the corridor and safe intersections for bikers, consideration of roundabouts, the need to keep parking available for residents and for more Community Health Center parking at Riverside, as well as the need for more affordable housing. People also offered suggestions to slow down traffic through the neighborhood and the desire for more trees and grass.

9.0 SPECIFIC CHALLENGES WITHIN THE 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					
		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 out City Market outreach, the public meeting, and the Wikimap. Bolded comments were mentioned multiple times				

DRAFT

DRAFT



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180 Battery Street, Suite 350

Burlington, VT 05401

802.383.0118

www.rsginc.com



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