

NORTHBOROUGH,  
MASSACHUSETTS

# Downtown Revitalization Plan Report

JANUARY 8, 2024



Weston & Sampson<sup>SM</sup>  
design studio  
**RKG**  
ASSOCIATES INC





View of Town Hall

## ACKNOWLEDGMENTS

We would like to thank every stakeholder, Town employee, public official, Master Plan Implementation Committee (MPIC) member, and resident who contributed their time and input through online surveys, public meetings, and conversations as the vision planning process progressed. Your participation, knowledge, and dedication has been instrumental in guaranteeing that this plan is reflective of the needs and desires of the Town of Northborough. Your work on the Northborough Downtown Revitalization project will ensure that future growth and development will align with the visions developed during this process.



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# 1. INTRODUCTION

The Town of Northborough (herein Town) has conducted a study of their Downtown area and identified strategies to encourage the types of development the Town and community would like to see in this area and to meet the goals of the Northborough 2020 Master Plan. The results of that work are contained in this Downtown Revitalization Plan Report.

The Downtown Revitalization Plan compiles new analysis conducted as part of the project with historical work that has been done previously by various parties to develop a cohesive, implementable strategy for Downtown Northborough that will guide Town departments, boards and commissions, private property owners and investors, and state agencies.

The overall project consisted of an existing conditions assessment, the implementation of an extensive public engagement strategy, stakeholder engagement, market analysis, and a final report providing a full analysis of site conditions and implementation strategies.

## 1.1 EXECUTIVE SUMMARY

The Northborough Downtown Revitalization Plan outlines a potential strategy for the revitalization of the downtown area of Northborough. This study was undertaken in response to the great interest in this topic expressed during the development of the most current Northborough Master Plan completed in 2020. To better inform the recommendations presented in the Plan, public input was solicited through surveys and four in-person public meetings during which the current status of the Plan was presented, and public comment was encouraged and received.

The Plan focuses on three geographic areas of downtown Northborough that have potential for redevelopment:

**Scenario 1: The area on Blake Street from Main Street to Pierce Street, including the current fire station which will become vacant when the new fire station is built:** The focus of this area is dining and entertainment with the possibility of apartments or condos on the upper floors of some new 3-story buildings. A key decision factor in this scenario deals with the future use of the building at 4 West Main Street. This keystone building along with the reuse of

the Pierce Street Fire Station can act as catalysts for the downtown revitalization effort. As such, the work of the Town Office Reuse Committee should be carefully coordinated with the Downtown Revitalization effort.

**Scenario 2: The area on Main Street bordering the Assabet River, currently used by Harvey Corp. for dumpster storage:** This area has great potential for redevelopment as park space by the river, residential development, and restaurants or shops. Since the area is totally self-contained and owned by one entity, acquisition and redevelopment would be the most straightforward of the three areas described in the Plan. This area is three-tenths of a mile from the center of Town and would tie in well with other redevelopment efforts in the center.

**Scenario 3: The area south of Main Street, bordered by South Street to the east, Gale Street to the south, and the Town Common to the west:** The Plan details a substantial redevelopment effort including new retail and residential uses. It would be the most complicated to complete due to multiple property owners and the extensive amount of demolition and redevelopment needed.

The revitalization scenarios summarized above are explained in detail in the Plan (chapter 6) and a suggested order of implementation priorities is presented (chapter 7). Also included in the Plan is a significant amount of information about current conditions in the Northborough Downtown area (chapters 3 and 4). Lastly, a detailed market analysis highlights areas of opportunity that the Town could pursue to create a more vibrant, revitalized downtown that meets the needs of Northborough's residents and attracts those living further afield (chapter 5).

A traffic analysis (chapter 4) completed as part of this study indicates that significant modifications to Route 20 in the center of Town are not recommended due to the major increases in congestion and delay that would occur if the number of lanes were reduced, or the roadway narrowed to allow for wider sidewalks and/or on-street parking. The proposed redevelopment of the areas in Scenarios 1 and 2, mentioned above, are possible with little impact to Route 20 and present the best opportunities for revitalization in the short term.

Sentiment was expressed at the public meetings in

favor of placing electric, telephone and cable services, now on poles in the downtown, underground in order to improve the streetscape. The Plan discusses the pros and cons of underground utilities, estimates the cost of placing the utilities underground at about \$3 million, and recommends that this work be deferred until major Route 20 reconstruction is needed. It is important to note that the Route 20 right-of-way (ROW) is owned and managed by the State through the Massachusetts Department of Transportation (MassDOT). Any work performed within the ROW must be authorized by the State before it can proceed. Since buried utilities are often placed beneath sidewalks in an urban setting, MassDOT will likely have issue with doing this work when the existing sidewalks are in good condition.

The Plan recommends that the Town consider zoning changes to diversify the types of uses allowed and increase overall density so as to create a more successful downtown that is more in keeping with the character of a classic New England town center. These zoning modifications would enable buildings to be located along the sidewalk edge, restaurants, and cafes to have patio seating along the street, and higher density, multi-family housing to be built above first floor retail, office, or restaurant spaces. Off-street parking regulations would be relaxed to take into account shared parking between uses, municipal parking accommodations and the presence of on-street parking.

Finally, the Plan recommends that the Town consider adding a new economic development staff position and the creation of a downtown management group to coordinate downtown revitalization activities. They would work with downtown business owners and private developers to take the steps necessary to implement the actions recommended in the Plan. Other similarly sized communities have implemented these steps to effectively advance revitalization plans from concept to reality.

This Plan sets forth the vision of the Northborough citizenry as interpreted by the consultants hired to complete it, reflecting the consultants' expertise and experience in developing downtown revitalization plans for other communities. The Plan is meant to guide the Town of Northborough in its efforts to improve the downtown, a significant goal expressed by Town residents in the 2020 Master Plan. It is not expected

that the results of revitalization efforts undertaken by the Town will exactly match the scenarios presented in the Plan, especially since the Town has limited influence over land owned by private interests. Nor will the timeframes for implementation exactly match the suggested time frames in the 10-Year Downtown Revitalization Implementation Strategy. Consequently, the Implementation Strategy is subject to revision and should be reviewed annually and modified as needed to respond to special opportunities, unforeseen obstacles, and shifting priorities.

Northborough has a unique opportunity to implement some of the key recommendations in the Plan in the short-term and set the stage for downtown revitalization efforts. Reuse of Town-owned property (4 West Main Street, the former fire station at 13 Church Street, and the current fire station at 11 Pierce Street), the provision of public parking at the new fire station, the beautification of the downtown streetscape, and improving building facades and signage are all important initial actions that the town can take.

A key issue that needs to be resolved concerns the amount and type of housing recommended in the Plan. The consultants' conviction that vibrant, pedestrian-friendly downtowns include multi-family housing, usually located on upper floors of buildings with shops or restaurants on the first floor, is based upon their professional experience, expertise, and knowledge. They are confident that increased housing density is key to creating the demand necessary to entice developers to build out the vision and recruit restaurants, breweries, and retailers to locate in downtown storefronts. A consensus will need to be reached between the Select Board, land use boards, the Town staff, and the citizenry regarding the type and quantity of housing that is desired and can be fiscally supported downtown. Community decisions will be necessary to determine the balance between "vibrancy" and housing density in the downtown.

Throughout the planning process there was strong sentiment that a traditional "New England" look and feel for the downtown area was desired. The images in the Plan show the relative size and massing of buildings to be included in the scenarios but do not show what these buildings should look like. Current design standards within the Zoning Bylaws contain minimal information about the design of downtown

commercial buildings and do not define traditional “New England” character nor mandate that commercial buildings conform to that standard. To ensure that the Town is giving clear and consistent direction to the development community before embarking on any significant revitalization efforts, it will be important to develop a consensus on the “look and feel” of the downtown and codify standards and design guidelines that reflect that vision.

In summary, the Plan meets the objectives outlined when the Town sought consulting services to determine approaches to make the downtown a more vibrant, attractive, and pedestrian friendly environment. It was hoped that Route 20 could be modified to reduce the impact of vehicles on the downtown, but traffic analysis showed that this is not recommended. Scenarios 1 and 2 provide approaches north of Route 20 to introduce the types of improvements residents indicated were important to them and limit the impact of Route 20. Concerns around housing density, differing opinions about what should be done in the short term, and concerns about the desired “look and feel” of the downtown need to be considered and decisions reached before revitalization work begins. As these decisions are reached, the Plan will be a good resource to guide future activity.

This Executive Summary was prepared by the Northborough Master Plan Implementation Committee and Northborough Planning Director.

## 1.2 PURPOSE OF THE PLAN

The Town of Northborough prepared a Downtown Revitalization Plan to encourage the type of development the Town and community would like to see along Route 20 and meet the goals of the 2020 Northborough Master Plan. This plan combines new analysis conducted as part of the project with work that has been done previously by various parties to develop a cohesive, implementable strategy for Northborough’s Downtown that will guide Town departments and the Planning Board, private property owners and investors, and state agencies.

The impetus for the Downtown Revitalization Plan stems from the goals set forth in the 2020 Northborough Master Plan. This town-wide Master Plan identified specific goals and recommendations to improve the appearance, economic vitality, and function of Downtown Northborough. These recommendations led to the development of the Master Plan Implementation

Committee, a Town Committee consisting of members representing the Board of Selectmen, Planning Board, Zoning Board of Appeals, Historic District Commission, Open Space Committee, Design Review Committee, Recreation Commission, Northborough Housing Corporation, Council on Aging, Financial Planning Committee, business owners, and residents seeking to implement the revitalization efforts proposed in the 2020 Northborough Master Plan.

This report consists of an existing conditions inventory and analysis, a market analysis, results of the project’s public and stakeholder engagement process, culminating in design scenarios and implementation strategies. It synthesizes the information gathered during the analysis phase of the project and outlines the conceptual design scenarios and implementation strategies developed during the course of the project.

***Enhance Downtown by promoting a pleasing and welcoming appearance – one that promotes a sense of place – enabling it to become the community’s proud central gathering area for residents and visitor alike.***

Town of Northborough 2020 Master Plan



## 2. PROJECT AREA AND APPROACH

The overall approach to the Northborough Downtown Revitalization Strategy and Design Report was to first understand prior efforts undertaken by the Town of Northborough with regards to its downtown area. This consisted of a thorough review of existing data, plans, field observations, and other relevant documents. It was first important to compile available baseline information and to review any already established project goals and objectives. The Town had already dedicated a significant effort to the downtown area in its 2020 Master Plan and this project was intended to take those initial findings and goals/objectives and move them forward towards implementation.

To assist the Town with achieving the goals set forth in the 2020 Master Plan for the downtown area, an overall project approach was established with the Northborough Master Plan Implementation Committee to guide the future actions of municipal staff, boards, commissions, committees, and citizens. The approach was formed around a series of objectives:

- Achieve a high level of community involvement and public participation
- Remain consistent with the goals, vision, and aspirations that the community articulated in the 2020 Northborough Master Plan
- Celebrate the unique heritage and culture of Northborough
- Identify and address infrastructure needs and deficiencies
- Build on existing plans and reports
- Incorporate measures that mitigate climate change and Complete Streets design principles

### 2.1 PROJECT AREA

The project area is comprised of what is often referred to as Northborough's Downtown (herein the "Downtown"). It consists of an approximate half mile stretch of Route 20 bound on the west by the Northborough Town Common and to the east by the Assabet River. Route 20, also known as West Main Street (until it meets South Street and changes to Main Street), is a principal arterial roadway that provides access to and connectivity across the central portion of town, running east/west. The project area is bound to the north by Pierce Street at the intersection of Hudson Street and to the south where Gale Street intersects with South Street. The current zoning in the

project area is a mix of Downtown Business, Downtown Neighborhood, and Main Street Residential (see Section 3.4.1 for more information about the zoning designations in the project area and their specific requirements). The Town developed incrementally over time without the benefit of an overarching plan to ensure the highest and best use of the land. The result is a mix of housing, including multi-family, two-family and single-family, interspersed with businesses including gas stations, convenience stores, a pharmacy, restaurants, personal care services, and professional offices. Residential development primarily surrounds Downtown instead of existing within it. The homes associated with Downtown are located primarily in older neighborhoods that are densely developed, although newer townhouse and multi-family developments can be found on Blake and Hudson Streets.

The project area lacks safe internal connectivity and is auto centric with insufficient pedestrian accessibility. Pedestrian access to Downtown from surrounding residential areas is impeded by an inconsistent and fragmented sidewalk network and a lack of safety accommodations for pedestrians and bicyclists. Likely due to the way it was developed, the area lacks an overall cohesive character that is appropriate for the history and culture of Northborough.

***The Downtown area has continued to suffer with respect to its ability to attract businesses, residents, and visitors since the Town's last Master Plan. This area demonstrates an inconsistent urban design and is perceived as automobile-centric with limited walkability and connectivity.***

Town of Northborough 2020 Master Plan

## 2.2 VISUAL AND DESKTOP ANALYSIS

The Northborough Downtown Revitalization study began with a site visit of the Downtown. This was an important first step for the project, initiating the existing conditions analysis to inventory what presently exists in the Downtown. The site visit occurred on September 28, 2022, and included members of Weston & Sampson, RKG Associates, and the Northborough Master Plan Implementation Committee. An additional site visit was conducted by the Weston & Sampson project team with members of the Northborough Master Plan Implementation Committee on May 26th, 2023. During these site visits the group observed existing conditions in the Downtown relating to traffic, pedestrian amenities, green space, parking, wayfinding, building design and location, and general character. Specific consideration was given to traffic speed on Route 20, pedestrian safety, and the architecture of existing buildings.

The site visits were supplemented by an extensive desktop analysis of the Downtown using Google Earth, to better understand the existing roadway, sidewalk, and building conditions.

These site observations, both in person and virtually, built the foundation for the Downtown's existing conditions analysis within this report. These baseline observations assisted in informing the recommended strategies for implementation.

## 2.3 EXISTING REPORTS AND STUDIES

An important component of this project was to collect and review existing plans and information related to the Downtown area. This area of Northborough is important to the community as it contains the Town Offices, Town Common, Assabet Park, the Free Library, Fire Department Headquarters, and a variety of businesses and institutional uses utilized by the community. It represents an important congregation of businesses, open space, institutional uses, and municipal services. The Town's 2020 Master Plan mentions the Downtown area no less than 199 times within the 238-page document, making it a prominent feature of the Master Plan. It is important that the findings of this report consider the previous work that has been done by the Town regarding the Downtown. The findings of this report are intended to complement

that work and to further the goals and actions identified in the Master Plan.

### PLANS AND REPORTS

The Town of Northborough has identified the downtown area as a focal point for future development, recreation, walkability, historic resources, and an important component in the character of the community. The downtown area is addressed in multiple plans and reports developed by the town over the last several years. This section provides an overview of those plans and reports as they relate to the downtown area, with a specific focus on the 2020 Master Plan. As an important component of this project, the following reports and plans were reviewed:

- 2020 Master Plan
- Zoning Bylaw and Design Guidelines
- 2020 Open Space and Recreation Plan
- Complete Streets Policy and Prioritization Plan
- Historic Preservation Plan

#### Northborough 2020 Master Plan:

The Master Plan provides a detailed assessment of current conditions and identification of issues and opportunities in the Downtown, as well as specific goals and actions to address those issues and capitalize on the opportunities. Table 2.1 provides an overview of the goals and actions initiated in the Master Plan that have been furthered or accomplished through this project.

#### 2020 Open Space and Recreation Plan:

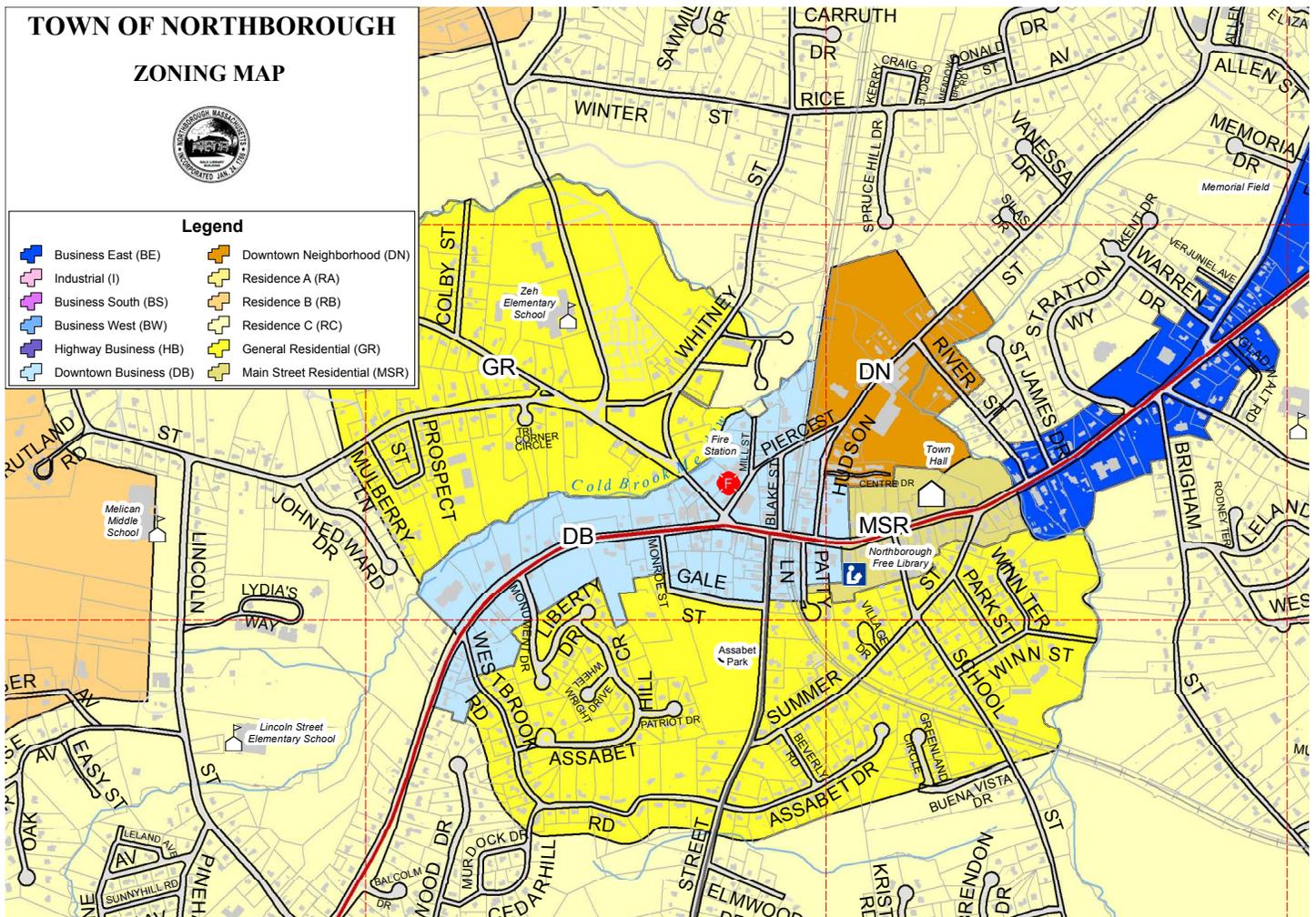
The 2020 Open Space and Recreation Plan serves as the primary inventory and priority planning document related to the town's open space and recreational facilities. The document serves as a road map to guide Northborough's investment in these important features and facilities. This plan highlights the importance of sidewalks in the downtown area, recognizing that they are often narrow and worn and lack connections that make the town truly "walkable" for commuting to work or completing local errands.

#### Complete Streets Policy and Prioritization Plan:

In 2022 the town adopted a Complete Streets policy to accommodate all road users by creating a road network that meets the needs of individuals utilizing a variety of transportation modes. The Town will, to the maximum

Plan Section	Goal or Action	Status
<b>Land Use</b>		
LU-G2	Enhance Downtown by promoting a pleasing and welcoming appearance – one that promotes a sense of place – enabling it to become the community's proud central gather area for residents and visitors alike.	Furthered by this project
LU2-1	Conduct a design study of the Downtown to help focus ideas and develop a clear vision for the area.	Achieved by this project
LU2-2	Conduct a visual preference survey with the community to determine what kinds of development it prefers in Downtown and review the Town's Zoning Bylaw for opportunities to accommodate these preferred development types.	Partially achieved by this project
LU2-3	Review the Town's Zoning Bylaw for opportunities to consider mixed-uses in Downtown that can promote and support walkability.	Partially achieved by this project
LU2-4	Investigate the merits of density bonuses and/or density transfer credits that could promote reasonably higher densities in the Downtown in exchange for public benefits.	
LU2-5	Develop a program to promote the planting and sustained growth of street trees, landscaping, and other green infrastructure in Downtown in concert with the development and fostering of partnerships, including with the Northborough Garden Club. As part of the program, undertake a tree inventory along the major corridors in Town.	
LU2-6	Explore opportunities to create walking paths/routes along brooks/river and connecting historic properties to enhance the beauty of historic Downtown	Partially achieved by this project
LU2-7	Take advantage of the Department of Housing and Community Development's Massachusetts Downtown Initiative that provides services and technical assistance to communities on revitalizing their downtowns.	
LU2-8	Evaluate how Community Preservation Act funding and other funding sources can be used to support Downtown enhancement.	
<b>Natural, Cultural, and Historic Resources</b>		
NCH4-3	Work with the Downtown planning/revitalization committee to avoid and mitigate potentially adverse impacts on historic homes along Main Street and neighboring streets.	
<b>Housing</b>		
H2-4	Guided by zoning, design standards, and the Downtown visualization study, incorporate housing into Downtown to attract a sufficient number of residents that can supplement and support the area's economic viability while maintaining the existing charact of Downtown neighborhoods.	Furthered by this project
<b>Economic Development</b>		
ED-G1	Define Downtown in terms of its geography (e.g., Downtown Business District), appearance, branding, and function.	Achieved by this project
ED1-1	Create a Downtown planning/revitalization committee made up of residents, Downtown business owners, representatives from Town boards, and other stakeholders that will recommend the boundaries of Downtown, support the Town's Planning office, assist in proposing and overseeing plans to enhance the Downtown, and pursue Community Preservation Act funding and other funding sources to enable this enhancement.	
ED1-2	Explore potential acquisitions or land deals to appropriately scale the Downtown.	
ED1-3	Explore options for creating a fresh and cohesive identity or brand for the new Downtown area such as unified signage and facades, including wayfinding and marketing materials. Use signage to clarify the boundaries of the new Downtown.	
ED1-4	Conduct a parking study to assess and address parking activity and pedestrian issues in Downtown, and to plan for future needs - Furthered by this project.	Furthered by this project
ED1-5	Explore the potential for repurposing 4 West Main Street (the Old Town Hall site) as an anchor for the Downtown. Conduct a feasibility study to identify options and recommendations.	Furthered by this project
ED1-6	Undertake a study to explore the potential of designating Downtown as a Business Improvement District, which would create a special assessment district where property owners would agree to organize and finance services above and beyond those already provided by the Town.	
ED1-7	Look for opportunities to incorporate other public gathering places, such as the Town Common and Library, into the Downtown framework. Advance efforts to connect gathering places and businesses for improved walkability and accessibility.	Furthered by this project
<b>Transportation</b>		
T2-3	Evaluate opportunities for routes alternate to Main Street to help reduce congestion in the Downtown and foster development opportunities.	

**Table 2.1:** Overview of goals from Northborough 2020 Master Plan



**Figure 2.2:** Zoning Map of Downtown Northborough

extent practicable, design, construct, maintain, and operate all streets to provide for a comprehensive and integrated street network of facilities that are safe for all users.

The importance of this approach has been highlighted throughout this project as the community has expressed a desire for the downtown area to be more walkable and user friendly for those utilizing alternative modes of transportation.

**Historic Preservation Plan:**

The town recently adopted a Historic Preservation Plan in 2022. This plan was based on the 2020 Master Plan, which identified the goals and recommendations for future historic preservation. The Historic Preservation Plan identifies specific tasks and the proposed schedule to obtain the desired preservation goals, many of which are related to the downtown area.

**LOCAL POLICY REVIEW**

Weston & Sampson conducted a review of Northborough’s municipal documents including sections of the Town’s Zoning Bylaw. Sections of the Zoning Bylaw reviewed as part of this analysis include:

- Chapter 7-03-060 Design review
- Chapter 7-05-030 Table of uses
- Chapter 7-09-020 Site design standards
- Chapter 7-09-030 Off-street parking and loading
- Chapter 7-09-040 Signs

**ZONING BY-LAW**

The Northborough Zoning Bylaw is designed to regulate development and implement the goals and objectives of the Master Plan. The prominent districts in the Downtown are :

- Downtown Business which is the predominant

zoning for parcels along West Main Street from just west of Westbrook Drive to just east of Hudson Street.

- Main Street Residential from just east of Hudson Street to just west of River Street.
- General Residential which occupies the residential areas immediately to the south and northwest of the Downtown Business District.
- Downtown Neighborhood which occupies a small section north of the Main Street Residential District.

Detailed information about these Zoning Districts, including allowed uses and dimensional requirements appears in Chapter 3.

The Zoning Bylaw contains a provision for a design review process that is administered by the Design Review Committee. This requirement is intended to help address issues of site design and aesthetic quality that are known concerns in the Downtown. Design Guidelines were adopted in 2012, applying to new construction and exterior alterations and expansions triggering site plan review of commercial, municipal, institutional, and multi-family structures. These Design Guidelines cover aspects such as building materials, massing, placement and orientation, storefront design, exterior lighting, setbacks, open space, landscaping, pedestrian accommodations, and parking among other common design concerns. Supplemental design guidelines for duplexes were adopted by the Planning Board in 2022.

The Design Guidelines provide best practice recommendations related to building and site design, as well as amenities. These design guidelines supplement the design standards found in the Development Regulations section (Chapter 7-09) of the Zoning Bylaws. The primary difference between design guidelines and design standards are that the design guidelines provide voluntary suggestions

and best practice examples aimed at improving the design of a project above a bare minimum and design standards are mandatory obligations applied to a project similar to the requirements in the building code, fire code or electrical code aimed at ensuring that projects achieve a minimum quality of design. The Design Review Committee, which consists of design professionals and a member of the Planning Board, provides their recommendations on a project to the Site Plan Approval authority as part of that permitting process. The Site Plan Approval authority can then mandate compliance with the Design Review Committee's recommendations if they choose to do so.

## 2.4 STAKEHOLDER AND PUBLIC ENGAGEMENT

The public interest is served through continuous and open discussion. Opportunities for public engagement were provided throughout the development of this plan, with meaningful input made by citizens and stakeholders on the issues, challenges, and opportunities within the Downtown.

Public outreach, education, and information sharing are an important aspect of successful downtown revitalization planning. Doing so effectively requires communicating with a variety of constituencies and often necessitates a variety of approaches. For this project, a multi-faceted public engagement process collected the opinions and experiences of over 700 people. These approaches included:

- Staffing a booth at Applefest in the Fall 2022 to engage residents in the process;
- Developing and administering an online survey which was posted on the Town's website and distributed through various mediums;

**Below:** First community engagement event held on January 26, 2023.



- Hosting three in-person community engagement meetings to gather input from residents and local business owners;
- Hosting a focus group to hear from downtown business owners about their experiences in the Downtown area and to identify issues and opportunities important to them;
- Email blasts and fliers distributed to community leaders, businesses and residents that highlight engagement opportunities and raise project awareness;
- Notifications and articles about downtown revitalization community outreach activities printed in the Community Advocate, the local newspaper.

## PUBLIC ONLINE SURVEY

From September 2022 until December 2022, a short 12-question digital survey collected input online and received 636 responses. Key questions from the survey are summarized below. The full results from the survey are included in Appendix A:

- Are you a resident, business owner, or visitor of Northborough?
- If you are a resident, how long have you lived in Northborough?
- What is your resident status?
- When focusing on revitalization of the Northborough Downtown area, what are your top priorities?
- Please provide a word or phrase that you feel best describes Downtown Northborough today.
- How would you rate the current transportation conditions of the Downtown area?
- If you do not like going Downtown, please tell us why.
- In the Downtown area, what are the important factors that you would like to see improved or addressed?
- What types of development and services do you feel Downtown needs more of, less of, or the same amount of?

- What types of initiatives can the town prioritize through new programs, investment of tax dollars, or changes in policy?

A majority of survey respondents (98%) reported living in Northborough, with approximately 40% indicating they have lived in Northborough for more than 20 years. These statistics show that there is a long-term investment in the Town's growth and an overall enthusiasm for the public process. The online survey also asked other optional questions about participants' resident status, whether they own or rent property, as well as offering an opportunity to share contact information for participants to receive updates and information on future public meetings about the Northborough Downtown Revitalization project.

The main focus of the online survey was to understand respondent's current experiences in Downtown as they relate to traveling through and around the Downtown both in a car and as a pedestrian. Understanding how people perceive the Downtown helped to identify top priorities for revitalization. The primary concerns among residents related to the Downtown included:

- Overall traffic flow through downtown is inefficient
- There is a lot of congestion that makes the area difficult to navigate
- There are not enough destinations to draw people to the area
- There is not adequate public transportation to and from Downtown and adjacent areas

In terms of future use, questions were framed to offer specific amenities for respondents to choose from while also allowing respondents to write in their own responses. Some of the top priorities for improvements to downtown includes: more restaurants and cafes, attracting and retaining downtown businesses, attractive storefronts and building improvements, pedestrian streetscape improvements and walkability.

## COMMUNITY EVENTS AND PUBLIC MEETINGS

Residents had several opportunities to provide in-person feedback throughout this planning process. A booth was set up at Applefest on September 16, 2022 providing participants with a platform to express their opinions about Northborough's Downtown. Approximately 150 residents who stopped by the

booth were given hard copies of the online survey questions and information that included a link to the online option. They could also view an existing plan of downtown Northborough and precedent image boards.

The first in-person public meeting was held on January 26, 2023, at the Algonquin High School library. Around 70 participants attended the event. At this meeting, an introductory presentation explained the premise behind the project and then participants were asked to place icon stickers, representing various amenities and land use options, on four different maps showcasing specific geographic locations of the Downtown study areas. There was also an opportunity to use a colorful dot for voting on precedent image boards to highlight which and what type of amenities were preferred. The use of the graphic based colored icon stickers was a simple and effective way for attendees to provide their input to the design team. The icon stickers covered the following elements:

Multi-family housing	Mixed-use housing	Adaptive reuse housing
Pedestrian streets	On-street parking	Parking lot
Outdoor dining	Restaurants	Food trucks
Bars	Retail	Fitness
Flexible Gathering	Green infrastructure	Art
Car Charging	Trails	Accessibility
Complete Streets	Bike lanes	Pocket park
Flexible Plaza	Improved lighting	Wayfinding
Water feature	Your idea	Your idea

The second in-person public meeting occurred on May 11, 2023, at the Northborough Free Library on Main Street. Approximately 55 participants attended. The goal of this meeting was to share the design scenarios that the project team developed in response to the online survey and feedback collected during the first public meeting. The meeting included a presentation highlighting the three different preliminary design scenarios and details of the market analysis and traffic assessment of Route 20. The presentation was followed by a question-and-answer period that allowed for an exchange of ideas and concerns between participants, the Town, and the Weston & Sampson project team.

The project team incorporated the feedback collected at this event into refined preliminary design scenarios and presented the final design proposals at a third in-person community meeting held on June 20, 2023, at the Algonquin High School library. Following the presentation, approximately 50 participants shared their feedback. Overall, the attendees were supportive

of the final designs that were presented for the four (4) scenarios

## DOWNTOWN BUSINESS FOCUS GROUP FEEDBACK

The project team conducted a business focus group on February 7, 2023, at the Northborough Free Library. Approximately 5-6 business owners attended the meeting and shared feedback about the challenges and benefits of owning and operating a business in downtown Northborough. Feedback from this meeting included: there is not enough diversity of business downtown, building signage is not consistent or effective, walkability is a challenge, among other issues.

## COLLATED PUBLIC FEEDBACK FROM ALL EVENTS

The following comments are a result of the feedback received from the public online survey, interviews with key stakeholders, community events, and public and focus group meetings.

### Downtown Issues:

- In the future, e-vehicle charging stations will be needed at downtown parking lots. Should be part of the Town’s capital improvement plan. Grant funding is available for installing these charging stations, so this improvement could be part of the short-term implementation plans
- Public parking is not appropriately located where it’s needed. It’s hard for people to find—most people don’t know that there is public parking up Pierce Street.
- Traffic travels at high speeds through downtown so traffic calming measures would be beneficial to slow them down.
- Wayfinding signage is needed to direct users to key municipal destinations (e.g., the library, municipal parking lots).
- Very strict signage requirements for businesses. The Town needs to be more flexible in working with local businesses and their signage needs.
- Parking might be the biggest challenge, and a lot of people just drive through downtown to get to Highway 290 instead of visiting local businesses and participating in downtown activities.
- Too many gas stations.
- Pedestrian accessibility needs improvements.

### Revitalization Challenges:

- Downtown does not have a continuous look to it, and every business has its own look.



Community Meeting #1: January 26, 2023.



Above: Examples of sticker symbols used at first community engagement event to obtain public feedback.



Community Meeting #2: May 11, 2023



Community Meeting #3: June 20, 2023

- The business mix is not diverse enough and the offering should expand to attract more people.
- The downtown's walkability is limited by a lack of sidewalks, and it encourages people to get back in their cars and drive rather than walk downtown.
- The wait time for the stop lights at Main Street crossings for pedestrians is too long. At South Street, the crossing is dangerous for pedestrians. Some lights do not work. We need general improvements to the crossings. Pedestrians also need shade at the crossing at South Street and Main Street.
- Improvements to sidewalks should allow people to walk throughout the downtown area and we should have attractive businesses in the right locations.
- There is a lack of bike lanes downtown, which could improve the bicyclist safety and exposure of local businesses to people riding bikes.

### **Revitalization Opportunities:**

- The general public is open and supportive of the local businesses and the financial stability of households in town can support a variety of businesses.
- The public is aware of what is available downtown—but there needs to be more promotion of who we are and what we can offer.
- Downtown has some awesome destinations that are unique to Northborough apart from the downtown, and they can be tied into the downtown for people to walk to (e.g., Assabet River waterfalls). The Town should explore the potential to uncover these assets (e.g., a downtown river trail).
- Maybe we can get rid of some traffic lanes and on-street parking and find opportunities to create municipal off-street parking facilities. This might encourage people to walk more downtown and could increase the visibility of local businesses.

### **Business Mix and Diversity:**

- We need more businesses providing entertainment and food/drink, e.g., restaurants, bars, etc.).
- Would like to see bookstores (e.g., bookstores in coffee shops), and they could host events (e.g., weekly book club meetings, lecture series, etc.).
- We need a community center or a performance venue that can be a gathering place for the community and place for entertainment.
- We could support a local general store in the center of town, like general goods, souvenirs, etc.
- A lot of local and independent businesses have closed or moved because of downtown traffic and parking issues.

### **Things That You Would Change Downtown:**

- Parking.
- Traffic calming, improve general walkability and attractiveness of downtown (e.g., street trees, building appearance and consistency).
- Attract people to live downtown.
- Increase housing opportunities downtown, but there needs to be controls to limit balconies along the main street.
- We need more special events that are like Applefest and maybe we need a town department or nonprofit organization dedicated to planning and coordinating these events.

## **ACHIEVING BALANCE**

All public input was carefully weighed and considered and incorporated in the design iterations. Some of the proposed ideas drew a passionate mix of enthusiasm and skepticism. Participants felt protective of their beloved community. Overall, there was general support for revitalizing the downtown, providing more opportunities for restaurants, entertainment, and shopping downtown, and improving walkability. Participants were excited about the potential for Downtown Northborough to be a travel destination .

## **SUMMARY OF FINDINGS**

The following is a summary of some of the key findings from the stakeholder and public engagement process. We have broken this feedback into the four (4) individual study areas:

### **Study Area #1 - Fire Station / Cold Harbor Brook:**

- Most interest overall in bars, outdoor dining, parking lots, restaurants, multi-family housing, trails, and complete streets.
- Multi-family housing along Main Street and near the fire station.
- Cold Harbor Brook Stream is an under-utilized area. Restaurants and bars with views of this area connected by trails.
- Burying utilities underground.
- Improve downtown character through sidewalk and aesthetic improvements.
- Improving the Church Street / West Main Street intersection.

### **Study Area #2 - South Street / Gale Street:**

- Most interest overall in municipal parking lots, food trucks, outdoor dining, restaurants, green infrastructure, and improved lighting.
- Concerns with aesthetics of this area: consider

new sidewalks, granite curbing, nicer looking architecture, street trees, lantern street lights.

- Improve sidewalks. They are currently disconnected and inconsistent.
- The empty buildings in this area are crying out for re-purposing.

**Study Area #3 - Blake Street / Downtown Core:**

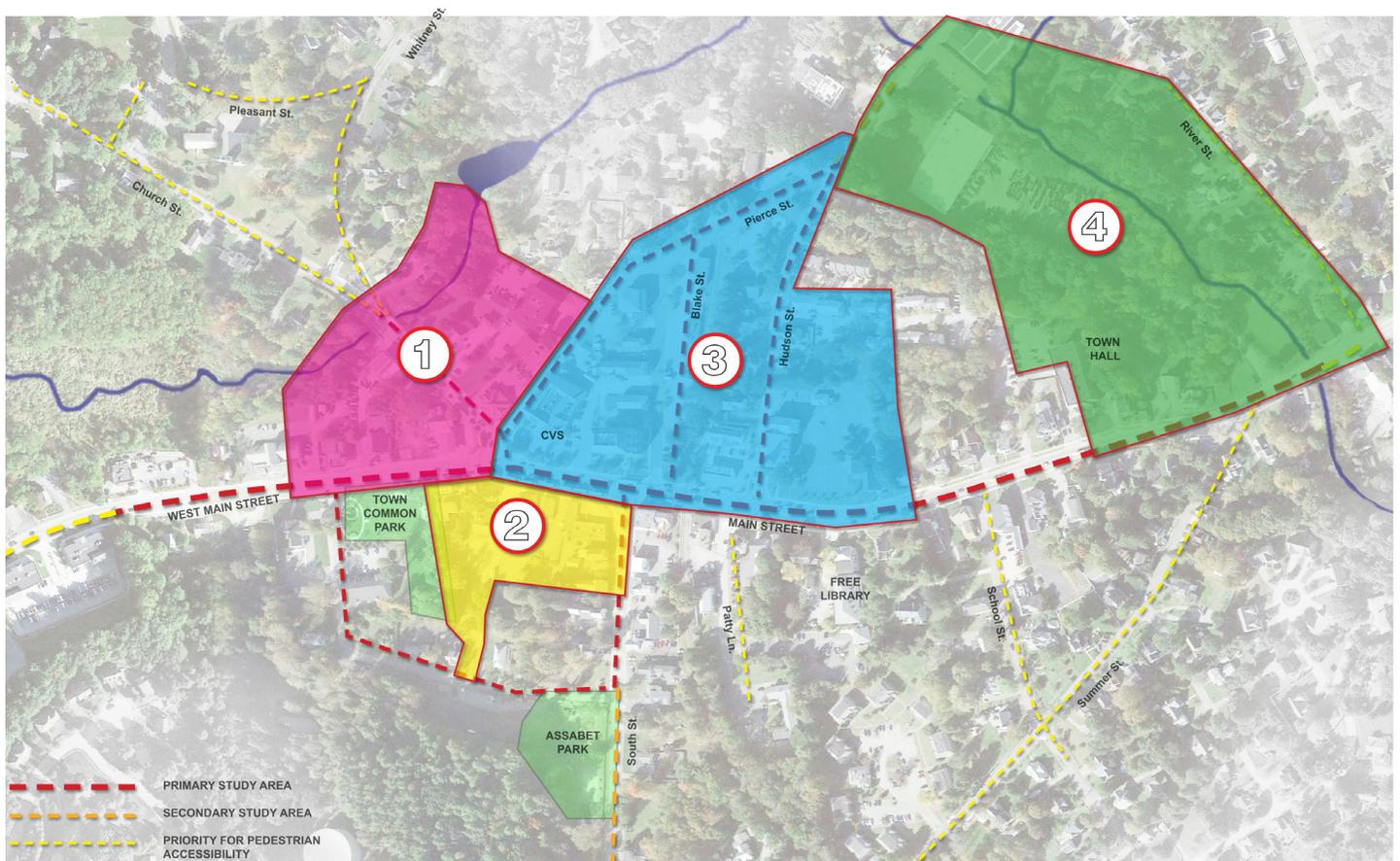
- Most interest overall in restaurants, closed pedestrian streets, bars/breweries, outdoor dining, art, car charging, and municipal parking lots.
- Need for parking lots off Main Street.
- Improved sidewalks.
- Improve traffic flow.
- Public gathering spaces.

**Study Area #4 - Harvey's Site:**

- Most interest overall in trails, flexible gathering spaces, mixed-use housing, and pocket parks.
- Make Assabet River an amenity by adding a riverwalk, restaurants along the water, enhance scenic views.
- Improved connections to the 'downtown' core area.

**OVERALL THOUGHTS**

- Empty area's are prime locations for re-purposing.
- There is a lot of public interest in making Downtown Northborough feel like a quaint New England downtown.
- New development should maintain relatively short building heights.
- There were varying levels of support for providing housing opportunities Downtown. Some participants were in favor and thought providing housing would create a livelier Downtown. Others feared increasing housing would put a strain on the Town's resources.
- There is general interest in providing eating establishments and places of entertainment in Downtown.
- More parking is desired in downtown.
- Making downtown more desirable for walking and pedestrian gathering.
- Include design measures to help offset the future impacts of climate change on Downtown.



**Above:** Map of the four (4) individual study areas



# 3. EXISTING CONDITIONS AND PROJECT AREA ANALYSIS

## 3.1 INFRASTRUCTURE: CIRCULATION

The term circulation refers to the transportation mechanisms and systems (e.g., roads and sidewalks) that allow people to move around the area. For Northborough Downtown, this includes a variety of transportation options including automobiles, pedestrians, bicyclists, trucks, buses, emergency vehicles, and freight trains. These different transportation modes use the circulation system, consisting of roadways, intersections, sidewalks, trails, driveways, parking areas, and railroad tracks. All of these areas, when combined, contribute to the circulation in and around Northborough Downtown. Circulation is important because it affects how people access, travel through, and use the area.

### ROADWAYS

**MAIN STREET (ROUTE 20)** is an east-west urban principal arterial that links Boston to the state of New York. The roadway segment through Northborough is under the jurisdiction of the Massachusetts Department of Transportation (MassDOT). Within the study area, the roadway generally consists of two travel lanes in each direction with exclusive turn lanes at some intersections, with the exception of the segment east of Hudson Street and west of Monroe Street which each have one travel lane in each direction. The posted speed along the roadway is 30 mph. There are variable width sidewalks along both sides of the roadway and shoulders are designated as bicycle lanes.

**HUDSON STREET** is a north-south urban minor arterial roadway that connects Main Street to Interstate 290. This roadway is under the jurisdiction of the Town of Northborough. Within the study area, the roadway consists of one travel lane in each direction with exclusive turn lanes at its intersection with Main Street. The posted speed along the roadway is 25 mph. There is a short sidewalk (approx. 200 ft long) along the east side and along the west side (approximately 50 ft. long) near the intersection of Main Street. There are no bicycle accommodations.

**PATTY LANE** is a north-south local roadway which is a dead-end that connects to several businesses, the

public library and the Housing Authority's apartment complex. This roadway is under the jurisdiction of the Town of Northborough. Within the study area, the roadway consists of one travel lane in each direction with exclusive turn lanes at its intersection with Main Street. The posted speed along the roadway is 25 mph. There is a continuous sidewalk along the east side and a short section (approx. 50 ft) along the west side of the roadway near the intersection of Main Street. There are no bicycle accommodations.

**BLAKE STREET** is a north-south local roadway that connects Main Street to Pierce Street. This roadway is under the jurisdiction of the Town of Northborough. Within the study area the roadway consists of one travel lane in each direction with exclusive turn lanes at its intersection with Main Street. A portion of the street is one-way for vehicular travel. The posted speed along the roadway is 25 mph. There is a continuous sidewalk along the west side of the roadway. There are no bicycle accommodations.

**SOUTH STREET (ROUTE 135)** is a north-south urban minor arterial roadway that connects Main Street to the Town of Westborough. This roadway is under the jurisdiction of the Town of Northborough. Within the study area, the roadway consists of one travel lane in each direction with exclusive turn lanes at its intersection with Main Street. The posted speed limit along the roadway is 30 mph. There are variable width sidewalks along both sides of the roadway. There are no bicycle accommodations.

**CHURCH STREET** is an east-west urban minor arterial roadway that connects Main Street to Interstate 290. This roadway is under the jurisdiction of the Town of Northborough. Within the study area, the roadway consists of one travel lane in each direction with exclusive turn lanes at its intersection with Main Street. The posted speed along the roadway is 30 mph. There is a variable width sidewalk along the north side of the roadway. There are no bicycle accommodations.

**MONROE/GALE STREET** is a north-south local roadway network that connects Main Street to South Street and Assabet Park. These roadways are under

the jurisdiction of the Town of Northborough. Within the study area, the roadways consist of one travel lane in each direction. The posted speed along the roadways is 25 mph. There is variable width sidewalk along a portion of Monroe Street along east side. Gale Street has no sidewalks. There are no bicycle accommodations along either roadway.

## INTERSECTIONS

**Main Street (Route 20) at Hudson Street and Patty Lane:** Main Street, Hudson Street, and Patty Lane meet to form a four-legged intersection under traffic signal control. The traffic signal at this intersection is interconnected with the traffic signal that operates the South Street and Church Street intersections. The Patty Lane northbound approach consists of one 11-foot-wide travel lane. The Hudson Street southbound approach consists of one 10.5-foot-wide exclusive right-turn lane and one 10.5-foot-wide share thru/left-turn lane. The Main Street eastbound approach consists of two 10.5-foot-wide general use travel lanes and one 10.5-foot-wide exclusive left-turn lane. The Main Street westbound approach consists of two 10.5-foot-wide general use travel lanes and one 10.5-foot-wide exclusive left-turn lane. Traffic along Main Street is separated by a double yellow line on both approaches to the intersection. The intersection has crosswalks across the Hudson Street southbound approach, the Main Street westbound approach and the Patty Lane northbound approach which are all under traffic signal control using exclusive pedestrian phasing.

**Main Street (Route 20) at South Street (Route 135):** Main Street and South Street meet to form a three-legged “T” type intersection under traffic signal control. The traffic signal at this intersection is operated by the same traffic signal controller as the Church Street intersection which is coordinated with the Hudson Street traffic signal. The South Street northbound approach consists of one 10.5-foot-wide exclusive left-turn lane and one 10.5-foot-wide share left/right turn lane. The Main Street eastbound approach consists of two 10.5-foot-wide general use travel lanes and one 10.5-foot-wide exclusive left-turn lane. The Main Street westbound approach consists of two 10.5-foot-wide general use travel lanes and one 11-foot-wide exclusive right-turn lane. Traffic along Main Street is separated by a double yellow line on both approaches to the intersection. The intersection has crosswalks across the South Street southbound approach, the Main Street westbound approach and the Main Street eastbound approach which are all under traffic signal

control using exclusive pedestrian phasing.

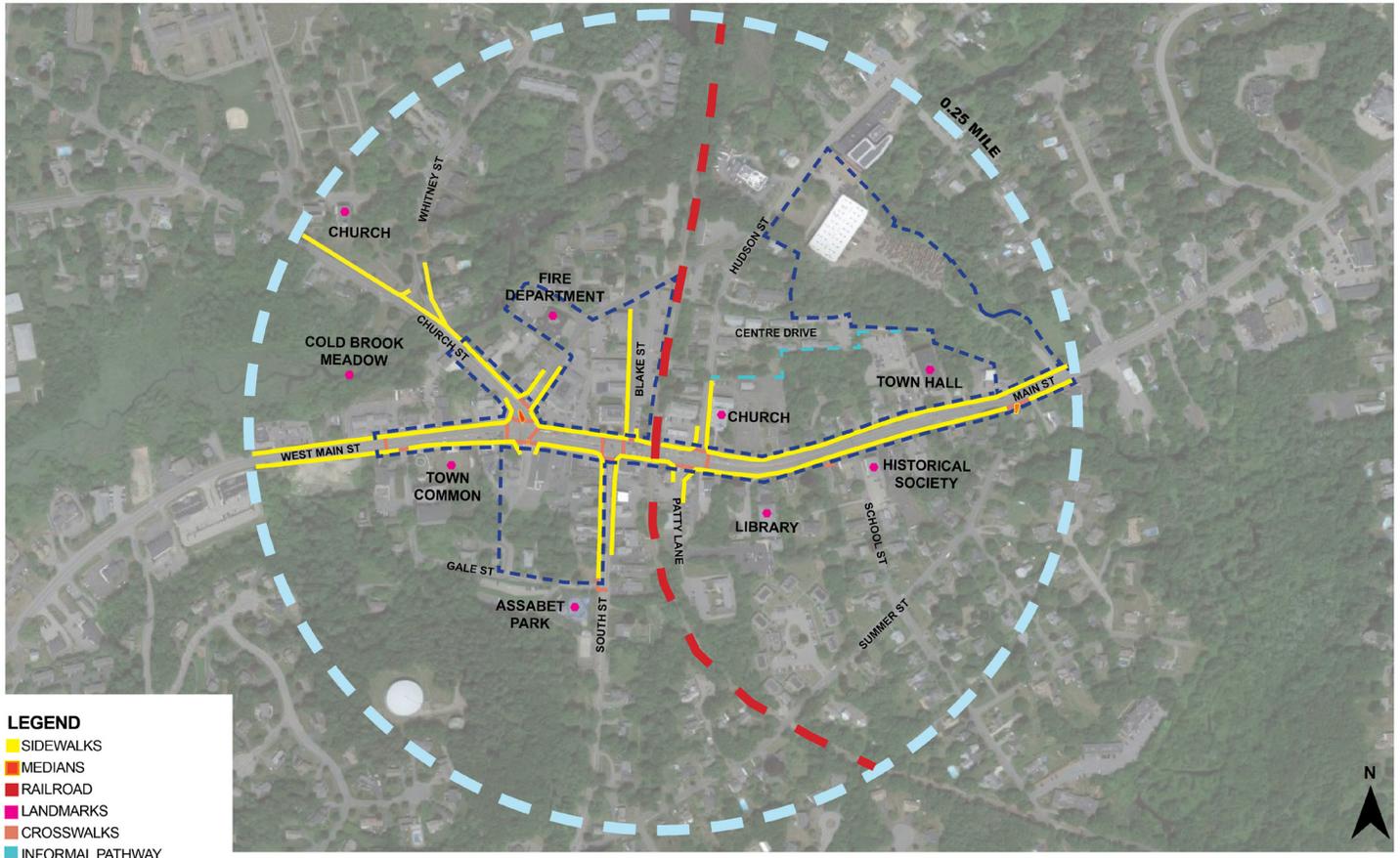
**Main Street (Route 20) at Church Street:** Main Street, Church Street, and private driveway meet to form a four-legged intersection under traffic signal control. The traffic signal at this intersection is operated by the same traffic signal controller as the South Street intersection which is coordinated with the Hudson Street traffic signal. The private driveway northbound approach consists of one 15-foot-wide right-turn only lane under “Stop” sign control. The Main Street eastbound approach consists of two 10.5-foot-wide general use travel lanes and one 10.5-foot-wide exclusive left-turn lane. The Main Street westbound approach consists of two 10.5-foot-wide general use travel lanes. Traffic along Main Street is separated by a double yellow line on both approaches to the intersection. The intersection has crosswalks across all four roadways at the intersection of which the Main Street and Church Street crossing are under traffic signal control using exclusive pedestrian phasing.

## PARKING

The design of parking areas within the Downtown area differs from location to location, though all parking occurs off the roadway on either municipal or private property (Figure 3-2). There is no on-street parking along Route 20, Church Street, Pierce Street, South Street, Gale Street, Blake Street, or Hudson Street. Occasionally users of the Town Common park on Monroe Street, but it is not clear whether on-street parking is allowed in this location due to the lack of signage or striping. Many of the parking lots in the study area are privately owned and are associated with businesses.

Parking lots occupy a significant portion of many of the developed lots. Most of the parking lots are not connected due to raised berms, forcing vehicles out onto the roadway to go from location to location. This design increases the volume of traffic entering and exiting the roadway and makes pedestrian travel in the area more difficult as crossing parking lots and driveway entrances can be challenging without proper pedestrian amenities. Moreover, a pedestrian may be concerned about leaving their car in a business’ private lot to patronize another business not associated with that lot due to the risk that their vehicle will be towed. The private parking lots often contain unnecessary hardscape that requires maintenance and supporting infrastructure (e.g., stormwater management systems). There are several municipal parking lots located Downtown, though few visitors

**Figure 3-1: Pedestrian accessibility.**



know about them because there is no recognizable wayfinding signage. The municipal lots are located at Assabet Park (approximately 50 parking spaces), the Northborough Free Library (approximately 47 parking spaces), the Town Offices (approximately 66 spaces), the Fire Department Headquarters (12 spaces), various parking spaces (both public and private) along Blake Street (105 parking spaces), on the south side of Pierce Street at the Mill Street intersection (approximately 23 parking spaces), and on the south side of Pierce Street to the east of the railroad tracks (approximately 21 parking spaces).

The public survey results identified strong opinions regarding parking in the Downtown. Approximately 40% of survey participants were interested in making parking more convenient and 32% thought there is not enough parking. When asked about locating and navigating parking, 36% of participants thought that existing parking lots are not easy to navigate and cause confusion. Approximately 32% of participants thought that parking lots are not appropriately sized for the businesses they serve and 47% of survey respondents think that there is not enough municipal parking lot space or on-street parking Downtown.

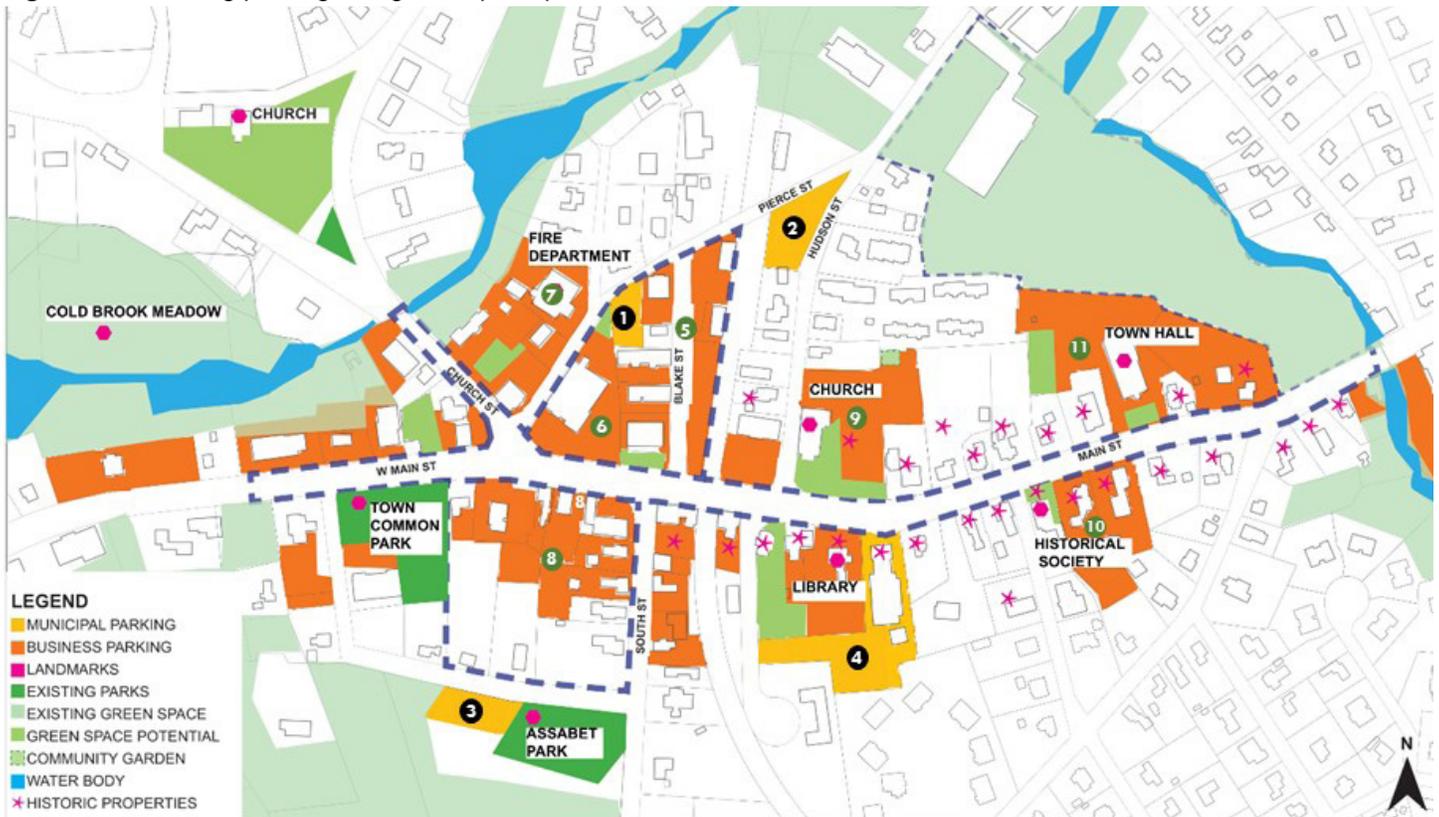
During the public engagement sessions, attendees

provided input regarding access to parking. One resident pointed out that when visiting Downtown, there are no central municipal parking lots that can be used for visits to multiple businesses. When visiting Downtown, she must drive to different parking areas for each business she patronizes. Another resident mentioned that during AppleFest, her family must park very far away from the festivities and walk. If there were centralized municipal lots, residents would be able to park and visit multiple establishments and venues Downtown with ease. The anecdotal feedback and survey responses show that residents are dissatisfied with the availability of parking Downtown and this impedes their ability to visit and frequent the businesses there.

## RAILROAD

A railroad track runs north-south through the center of Northborough Downtown intersecting with Route 20. It is part of the New Haven Railroad system. Commercial trains transporting freight to Leominster run along the tracks through CSX, a rail-based freight transportation service in the United States. The railroad system has terminals locally in Westborough and Framingham and runs through town anecdotally about two times a day.

**Figure 3-2: Existing parking and green open space.**



## WAYFINDING AND SIGNAGE

Business signage in the Downtown is inconsistent in its age, quality, design, location, and size. The Town does have a sign bylaw that limits the type, location, and size of signs permitted in all the business districts, although, there are no provisions that require the replacement of signs that are nonconforming or deteriorated. Wayfinding signage is lacking. During the public engagement events, participants indicated that municipal parking lots are not properly marked and difficult to locate. Signs that direct residents and visitors to key locations, such as parks or public facilities, are also lacking.

## PEDESTRIAN ENVIRONMENT

### SIDEWALKS

Pedestrian access throughout the Downtown is variable (Figure 3-1). This is due to intermittent sidewalks, which are inconsistent in width, quality, accessibility, and location. There are pedestrian traffic signals located on Route 20 to allow crossing at the West Main Street and Church Street intersection, at the Main Street and South Street intersection, and at the Main Street and Hudson Street intersection. These pedestrian signals take a long time to cycle through.

This frustrates some users, encouraging them to ignore the signals or avoid crossing altogether. Along Route 20, there are continuous sidewalks along both sides of the roadway, however, sidewalks along the side streets usually exist along one side of the street only, dead-end along Hudson, Pierce and Monroe Streets, or of poor quality (South Street). Gale Street does not have a sidewalk at all, which is particularly problematic since the Town Common has no dedicated parking. Users of the Common often park in the municipal parking lot associated with Assabet Park on Gale Street and walk west to Monroe Street and then on to the Common from there. Because of the lack of sidewalk, they walk within the roadway or along the grassy shoulder.

Walking along the sidewalks and crossing Route 20 can feel unsafe and is an unpleasant experience for pedestrians. Vehicles travel at a high rate of speed which, when compounded by the significant roadway width and long queues at the traffic signals during rush hour, makes walking along and crossing Route 20 an intimidating experience. There is no separation between pedestrians and vehicles and few street trees, causing vehicle noise to be overwhelming and pedestrians to feel unsheltered from the fast-moving traffic. Overall, the intermittent and disconnected pattern of sidewalks makes pedestrian access throughout the Downtown area challenging, especially for individuals with disabilities.

## BICYCLE ACCESS

Downtown lacks defined bicycle accommodations such as bike lanes, shared use paths, on-street shared use signs or pavement markings, and bike racks. Route 20 is a dangerous route to navigate on a bicycle due to vehicle speeds, narrow travel lanes, vehicles crossing multiple lanes of traffic to turn onto side streets and in and out of parking lots and, beyond the study area, the lack of wide shoulders in many areas. The main streets off of Route 20, including Church Street, South Street and Hudson Street also lack bicycle accommodations making Downtown travel via bicycle unsafe. Visually, these side streets seem narrower resulting in cyclists feeling threatened by vehicular traffic sharing the road with them.

There is also a distinct lack of bicycle parking accommodations within Downtown. Cyclists have to resort to using utility poles, trees, and other vertical elements to secure their bikes.

## TRAILS

There are no formalized paths or trails in the area and the Downtown has few off-street pedestrian amenities. There is an informal pathway that runs behind the Trinity Church parking lot, through the community garden, and down Centre Drive connecting the back of the Town Hall parking lot. The path is not marked

and is not well-known as an off-street cut through, although it provides a safe, pedestrian friendly pathway off of Route 20. The wonderful natural resources that the town currently has in the Assabet River and Cold Harbor Brook are not fully utilized or appreciated because of their lack of connectivity to Downtown.

## UTILITIES

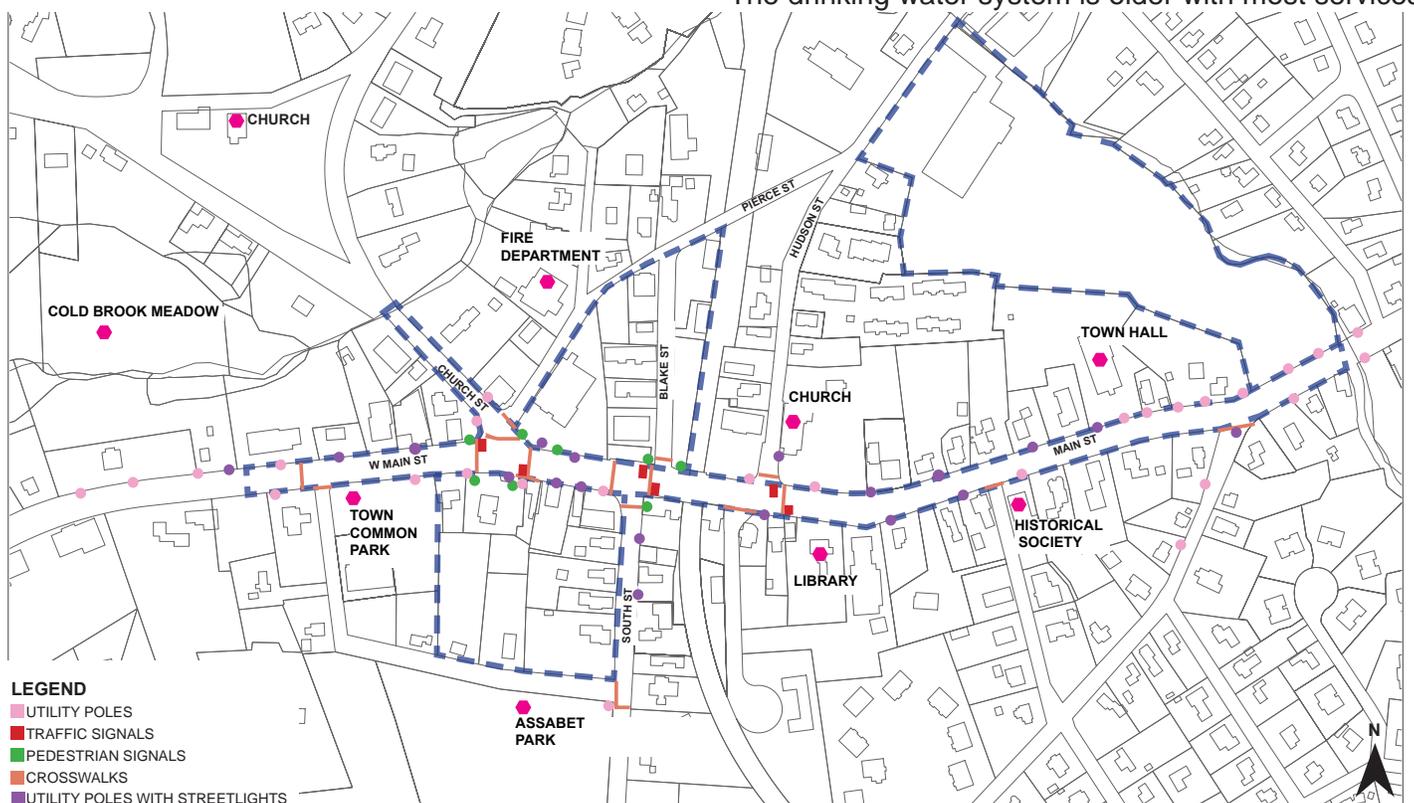
### ELECTRICAL AND CABLE INFRASTRUCTURE

Electrical and cable infrastructure in the Downtown consists of overhead lines on utility poles (Figure 3-3). Utility poles are frequently located in the sidewalk, impeding pedestrian access, and rendering portions of the sidewalk inaccessible for disabled individuals.

### PUBLIC WATER AND SEWER INFRASTRUCTURE

Public water and sewer infrastructure in the Downtown consists of drinking water distribution lines and sewer lines. These lines are managed by the town's Water Department through the Water and Sewer Commission of Northborough. Municipal and sanitary sewer services are available throughout the focus area. The sewer system is relatively new, dating back only to the 1960's, therefore is in good condition with adequate capacity to support future development.

Figure 3-3: Utilities.



likely warranting replacement as part of any property redevelopment. There is adequate water supply for both domestic and fire service. It should be noted that Route 20 pavement is underlaid by a reinforced concrete slab which adds a level of cost and difficulty to any proposed utility work within the roadway.

Drainage facilities function well throughout the focus area, with the exception of the westerly limit at the intersection of West Main Street and Monument Drive where MassDOT drain is damaged and has no discharge. The often results in localized ponding and seasonal freezing.

## 3.2 NATURAL, CULTURAL, AND HISTORICAL FEATURES

### PARKS AND OPEN SPACE

Within the Downtown study area, there are two large municipal parks (Figure 3-2). The 10-acre Assabet Park, featuring a playground, splash pad, benches, parking lot, and large forested area, is located on the corner of Gale Street and South Street. Established in 2019, the 1.35-acre Town Common accommodates the Civil War and Gulf War/Global War on Terrorism memorial and a beautiful community green space with seating, a sculpture, gardens, and a pergola. The Town Common hosts seasonal events like AppleFest, cultural activities and fitness programs. It serves as an inspiring example of how derelict, underutilized private properties can be transformed into a community amenity.

Three small pocket parks also exist within the study area. A small playground with a picnic table and benches is located on the grounds of the Town Offices at 63 Main Street. A second pocket park is located at the corner of Blake Street and Route 20, containing landscaping, a small seating wall, a flagpole, and the Lions Club electronic message center advertising public events, meetings and programs. The Annual Christmas Tree lighting, held in honor of Neil Ellsworth, a Northborough native who died in the Vietnam conflict, is celebrated at this location. A third pocket park of approximately ½ acre in size is located at the intersection of Hudson and Pierce Streets. This pocket park features a green space, War Memorial dedicated to those lost during World War II, the Korean War and the Vietnam War, and a parking lot.

### RIVER ACCESS

There are two water-based natural resources that

run through the Downtown. The first is the Assabet River which is the most significant water resource in Northborough. The Assabet River originates from the George H. Nichols Reservoir in Westborough, MA and merges with the Sudbury River and Concord River in Concord, MA. The Assabet River meanders through the study area, crossing underneath Route 20 to the west of River Street, then flowing in a northeasterly direction before crossing beneath River Street near its intersection with Hudson Street. Within the study area, the Assabet River is mostly concealed behind private property except at the two roadway crossings. A beautiful waterfall is visible at the Route 20 crossing when looking south.

The second water-based resource in Downtown is Cold Harbor Brook. The Cold Harbor Brook originates at Carney Park in Northborough and travels northeast toward Downtown before crossing beneath Church Street east of its intersection with Whitney Street, under the railroad tracks behind Fire Department Headquarters and merging with the Assabet River near its River Street crossing. There is a second picturesque waterfall that can be seen from Hudson Street looking north to Cold Harbor Brook. Within the Downtown, both natural resources are primarily hidden and inaccessible. These are valuable resources, both environmentally and economically that should be celebrated and integrated into the Downtown Vision.

### CULTURAL AND HISTORICAL

Downtown has a variety of cultural and historic resources that contribute to the character of the area. The Northborough Free Library is a public institution located off Route 20 on Patty Lane. It was originally built in 1895 and had major renovations and expansions in 1975 and 2007. The library provides a resource for events and services in the community. Located along Route 20 within the study area, the Northborough Historical Society building, a former church that was built in 1860, and the Northborough Trinity Church, founded in 1832, are important cultural institutions that play important roles in the celebration of Northborough's history, faith and community. In addition to these institutions, the majority of the properties located on Route 20 between Blake Street and River Street and those located along School Street, are considered historic properties (by the Northborough Historic District Commission) in that they were built prior to 1910. These properties make up about one half of the properties considered historic throughout the town. These cultural assets help to establish the character of the area and a sense of place and should be preserved to the extent possible.

Figure 3-4: Northborough Trinity Church



### 3.3 DOWNTOWN CHARACTER

The Downtown is generally defined by commercial buildings that are one to two stories tall and residential buildings that are two to three stories tall. The five-story replica of the historic Town Hall, located at 4 West Main Street, and the spire of the nearby Trinity Church of Northborough are the most noteworthy buildings Downtown due to their massing and significant height relative to the rest of the buildings.

Buildings throughout Downtown vary in terms of type, age and style. Structures run the spectrum from historic single-family, two-family and multi-family homes, modern garden-style apartment buildings, large homes that were converted into businesses municipal and institutional structures, and isolated 1950s, 1960s, and 1970s style commercial developments.

Buildings have inconsistent yard setbacks which leads to varied building orientations and an undefined building edge. Parking lots are also inconsistently situated, often located along the front or side of buildings and occasionally located behind the

buildings they serve. These features combined with inconsistent landscaping and signage, contribute to the Downtown's impaired aesthetic and issues with circulation and pedestrian safety.

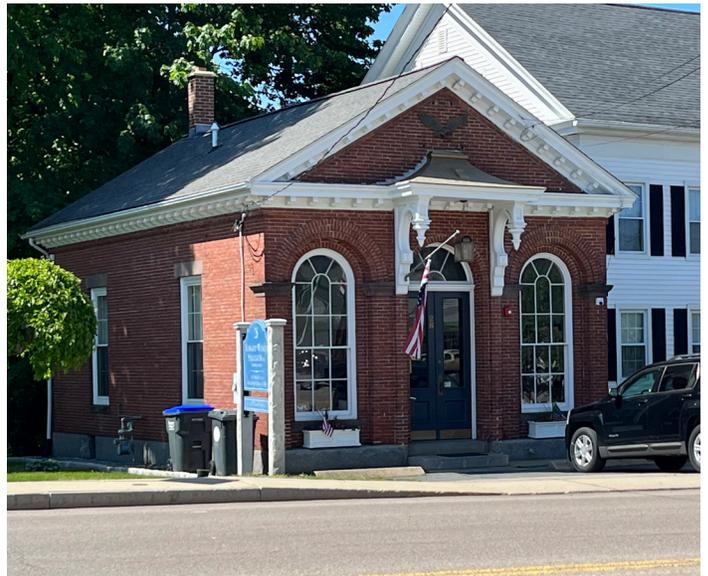
Downtown has experienced a decline in the number of businesses over several decades. Many businesses have closed over time, leaving vacant storefronts in their place. The establishments that remain, many of which are fast food establishments, convenience stores and automobile service stations, do not create a destination that attracts residents and visitors from further afield.

Downtown has an eclectic mix of architectural styles ranging from Colonial, Romanesque, Victorian, Gothic, Craftsman, and Modern. The historic buildings, in particular, provide charm downtown and should be celebrated and considered as future development comes in. (Figure 3-5).

***The existing make-up of commercial, cultural, institutional, and entertainment uses in the Downtown lacks a combination of everyday destinations and the drawing power to attract residents and visitors and keep them lingering for prolonged periods of time.***

Town of Northborough 2020 Master Plan

Figure 3-5: Images of historic buildings in Downtown.



## 3.4 REGULATORY FRAMEWORK

### ZONING

The study area includes several zoning districts including Downtown Business, Downtown Neighborhood, and Main Street Residential. Table 3-1 provides a summary of the zoning districts within the study area and the approximate amount of land within each district.

### LAND USE CHARACTERISTICS

Downtown consists of a variety of commercial establishments including restaurants, retail and personal services, banks, professional offices, and service stations. Route 20 runs east/west through the

center of Downtown bisecting the area and making pedestrian and vehicular travel from business to business difficult. The Northborough Free Library, Trinity Church of Northborough, the Town Offices, Assabet Park, and the Town Common serve as the area's primary community gathering spaces. Single-family and multi-family housing is interspersed among businesses, however most housing in the downtown area is located along side streets and on Route 20 beyond the commercial core. There are a few examples of mixed-use buildings with first floor retail and apartments above that exist downtown. Those living in the neighborhoods beyond Downtown are inhibited by an inconsistent and fragmented sidewalk network.<sup>1</sup>

**Table 3-1**

Zoning Designation	Zoning Description	Approximate Acres within the Town
<b>Residential Districts</b>		
Main Street Residential (MSR)	Single-family detached dwelling units are the only residential use allowed by right in this district; two-family dwelling units are allowed by special permit from the Planning Board. Institutional, business, and mixed uses are not allowed without a special permit from the Zoning Board of Appeals. Agricultural activities on less than 5 acres of land; nonexempt farm stands; and passive recreation, open space or conservation are allowed. The minimum lot area in MSR is 15,000 sq. ft., while maximum lot coverage is set at 30 percent. The district has minimum yard setbacks of 30 ft. (front), 15 ft. (side), and 25 ft. (rear). Building heights are capped at 35 ft.	20.3 acres
Downtown Neighborhood (DN)	This district allows for single family attached and detached dwelling units by right. Multi-family dwellings containing 4 units are allowed by-right and 5-8 units are allowed by special permit; two-family dwelling units are allowed by special permit from the Planning Board. Further cultural uses, adult daycare facilities and various limited mixed uses, including artists live/work units are allowed by-right. A variety of business uses, including stores, restaurants, personal service establishments, and offices are allowed by-right and by special permit. The DN district is the second highest density zoning district; its minimum lot area is 10,000 sq. ft. The maximum lot coverage in the DN district is 30 percent and the minimum open space required is 20 percent. The district has minimum yard setbacks of 15 ft. (front), 20 ft. (side), and 30 ft. (rear). Building heights are capped at 35 ft.	36.1 acres
<b>Non Residential Districts</b>		
Downtown Business (DB)	All residential uses, including single-family attached and multi-family dwellings require a special permit from the Zoning Board of Appeals. Allowed institutional uses include cultural uses and non-profit club or membership organizations. Allowed mixed uses include limited mixed-use buildings, artist live/work units, custom workshops, and vertical mixed-use developments. Business uses are allowed with a few exceptions. Industrial uses are not allowed. Very few dimensional controls exist within the DB District, which makes sense when trying to create a high density, pedestrian-friendly downtown. The minimum lot size is 4,000 sq. ft. and the front yard setback requirement is 6 ft. There is no maximum lot coverage requirement, although 15% of a parcel must be landscaped. The maximum building height requirement is 45 ft.	70.3 acres

## PARKING REQUIREMENTS

The Town of Northborough has parking requirements that vary based upon the type of land use, from retail/shopping, business/personal services, to multi-family, bars/restaurants, and other uses (Table 3-2). Parking requirements for non-residential uses are typically based on the gross floor area of the building and address parking needs for both employees and patrons. Parking requirements for residential uses are based on number of units or bedrooms. The Town's Site Plan Approval authority does have the authority to reduce or increase the required number of parking spaces on a case-by-case basis, or provide credit for mixed use developments with uses that have different hours of operation.

As future redevelopment is planned, suitable parking should be included to serve these new uses and replace some of the existing parking that may be lost to redevelopment.

There is a provision in the bylaw that the special permit granting authority may grant a special permit to locate up to 100% of the off-street parking spaces required on a different lot than the lot with the building or use served by the parking.<sup>2</sup>

The bylaw requires that off-street parking is located behind or beside the correlated building on the lot and that the parking may not be closer to the front lot line than the building the parking is serving.

## DOWNTOWN PUBLIC / PRIVATE PARKING SUPPLY

The project team analyzed the supply of public and private parking currently serving the core downtown area, specifically the three redevelopment catalyst areas described later in this section (Table 3-3/ Figure 3-1). In the future, if these catalyst areas are redeveloped, the current parking supply will be reconfigured or replaced with new buildings and parking spaces.

Based on parking counts observed on Google Earth, it is estimated that there are 141 public parking spaces serving the Downtown core, located within 700 feet of the intersection of Main and South Street. A five-minute walk, or ¼ mile, is generally considered a walkable distance for most people. All the parking areas in Table 3-3 are within a two-to-three-minute walking distance. Of the 555 existing parking spaces that could be located in or near future downtown

redevelopment areas, the public lots only account for 25% of this supply.

Beyond those public parking lots, there are 226 (40.7%) spaces located within the future downtown redevelopment areas. The Blake Street parking spaces constitute the largest supply with 105 spaces located along streets and in private parking lots. If this area is redeveloped in the future, much of this parking will have to be reconfigured and moved to other locations. The same is true for the existing Northborough Fire Station, which currently has only 12 spaces to meet the needs of fire department staff, but if the station is adaptively reused for a private business, the on-site parking will likely increase to meet different needs.

Finally, there is another 188 (36.6%) public and privately-owned spaces at the Trinity Church, Northborough Historical Society, and the Northborough Town Hall, which could be used for special events, but are not conveniently located to meet everyday shopping needs. If the Town Hall is redeveloped into affordable housing then the existing parking lot will be impacted significantly and the need for more spaces most likely. Trinity Church's leadership is currently exploring the potential to make their parking lot available for public use, either for special Downtown events/festivals, or under a future lease agreement with the Town. The church does not fully utilize their parking, except on Sundays and during special church events.

Regarding whether the existing parking supply is sufficient to meet future downtown parking needs, an analysis of future needs is necessary as is a conceptual design of where new buildings would be located and how they might impact the existing parking supplies. A comparison of future parking supplies and needs is contained in Chapter 6 – Revitalization Analysis.

- 1 The Town of Northborough 2020 Master Plan.
- 2 Northborough Municipal Code. Chapter 7-09-030 Off-Street parking and Loading. April 25,2022: <https://www.codepublishing.com/MA/Northborough/#!/Northborough07/Northborough0709.html#7-09-030>

**Table 3-2**

<b>Commercial Use Parking Requirements</b>	
<b>Type of Establishment</b>	<b>Number of Spaces Required</b>
Restaurant/ Bar	1 space per 4 seats and 1 space for every 2 employees
Retail	3 spaces per 1,000 sq. ft. for 1,000-10,000 sq. ft.
	2.5 spaces per 1,000 sq. ft. for 10,001-12,500 sq. ft.
	2 spaces per 1,000 sq. ft. for >12,500 sq. ft.
Office Space	1 space per 400 sq. ft.
Personal or Service Business	1 space per 250 sq. ft.
Medical Office	
Bank or Financial Institution	
Hotel or Motel	1 space per sleeping room and 1 space for every 3 employees
Place of Assembly with Seating	1 space for every 4 seats or 8' of bench
Library or Museum	1 space per 250 sq. ft.
Public Assembly	1 space for every 5 occupants
Theater or Cinema	1 space for every 3 seats
Hospital	1 space for every 2 beds and 1 space for every 2 employees
Funeral Home	1 space for every 60 sq. ft.
Bowling Alley	3 spaces per each alley
Other Commercial Uses	1 space per 3 employees or 1 space per 300 sq. ft.
Day Care Centers	1 space per employee and 1 space per 5 children
Brewery	1 space per 3 seats and 1 space per 2 employees
*See Zoning By Law 7-09-030, Section B(2)(b) Off-street parking and loading.	

**Table 3-3**

**Table 3-3  
Downtown Existing Parking Supply  
2023**

<b>Existing Public Parking Lots</b>	<b>Est. Spaces</b>
1 - Pierce Street Lot No. 1	23
2 - Pierce Street Lot 2	21
3 - Assabet Park	50
4 - Northborough Library	47
Total Public Parking	141
<b>Existing Parking on Redevelopment Lots</b>	
5 - Blake Street Parking Spaces	105
6 - CVS Drug Parking	43
7 - Northborough Fire Station	12
8 - West Main Street (Southside)	66
Total on Redevelopment Lots	226
<b>Other Downtown Parking</b>	
9 - Trinity Church	102
10 - Northborough Historical Society	20
11 - Northborough Town Hall	66
Total Other Downtown Parking	188
<b>Grand Total - Parking</b>	<b>555</b>

Source: Google Earth & RKG Associates, Inc, 2023



# 4. TRAFFIC VOLUMES AND MOVEMENTS

## 4.1 TRANSPORTATION MODELING

In order to accurately model existing and future conditions along this corridor it was necessary to collect traffic volume data. Once collected this data is then adjusted to peak month conditions in order to develop a traffic volume network that approximates the worst case (most conservative) conditions that the corridor will experience through a given year. Once the base traffic volumes have been developed, these traffic volumes are projected out to a future year condition using a historical background growth rate for analysis purposes. The process below outlines how the traffic volume data was collected and adjusted in order to develop our future 2030 traffic volume network for analysis.

## 4.2 TRAFFIC VOLUMES

Turning Movement Counts (TMC) (Table 4-1) were performed by the Central Massachusetts Regional Planning Agency at three intersections within the study area during the weekday AM peak hours (6:00AM-9:00AM), weekday PM peak hours (3:00PM-6:00PM) on and the Saturday midday peak hour (11:00AM-2:00PM) during the months of January and February 2023 including:

- Main Street and Church Street
- Main Street and South Street
- Main Street and Hudson Street

Additional pedestrian and bicycle counts were collected by the town during the AM and PM peak hours on March 20, 2023. The traffic count and pedestrian count volumes are provided in the Appendix.

## 4.3 SEASONAL TRAFFIC ADJUSTMENT

Traffic on a given roadway typically fluctuates throughout the year depending on the area and the type of roadway. Based on the type of roadway (U3) the data provided in the 2019 MassDOT Weekday Seasonal and Axle Correction Factor publication, was reviewed to determine if any adjustments for seasonal variations were required. It was determined that traffic volumes in the month of February are 3 percent lower

(Factor of 1.03 in 2019 of the average month) than average-month conditions. Therefore, the February traffic volumes were adjusted to reflect the average-month conditions. The seasonal adjustment data is provided in the Appendix.

## 4.4 TRAFFIC GROWTH

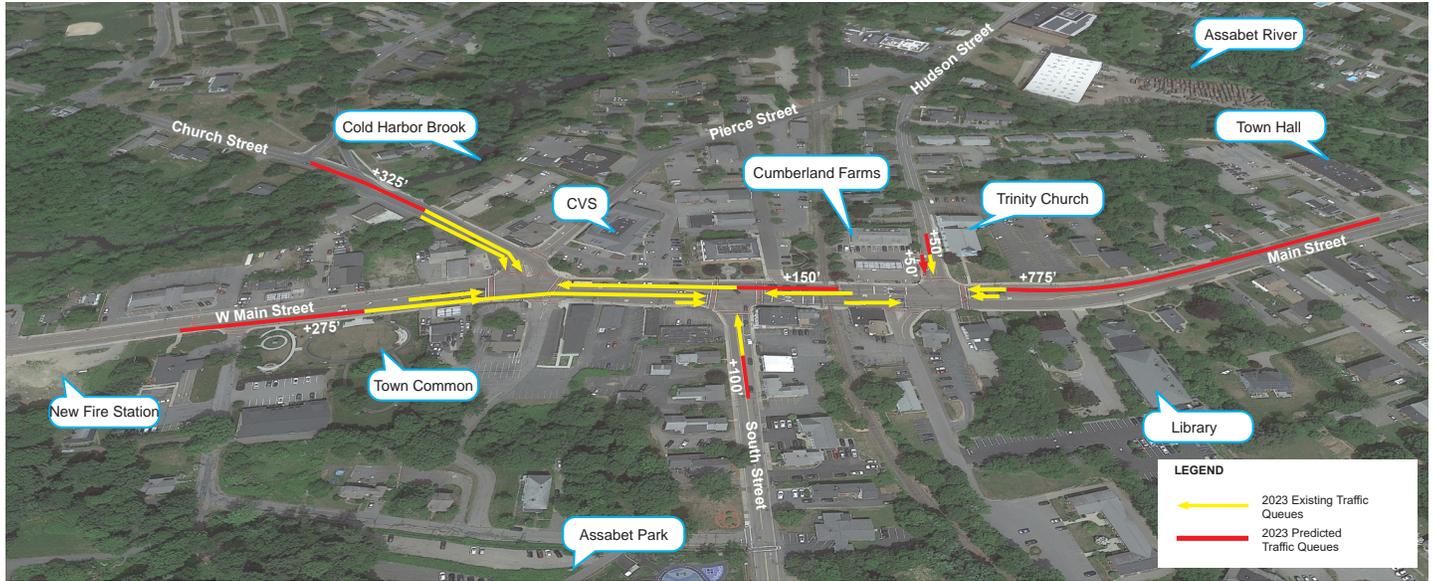
For analysis purposes, the year 2023 was considered the existing year and the year 2030 (a seven-year planning horizon) was chosen as the future Design Year and was used to analyze future traffic conditions within the study area as a result of roadway geometric changes only. The 2030 future year only includes traffic increases as a result of background traffic growth and does not take into account any additional traffic that may be generated by the redevelopment scenarios. The impacts of the project may then be determined by making a comparison between the No-Build and Build conditions. Under all alternatives, traffic increases consist of a combination of general background annual growth or specific developments within the study area applied to existing traffic volumes.

Based on the MassDOT transportation data management system, the average growth rate of 0.5 percent can be used. This background growth rate was used in generating the future No-Build peak hour traffic-flow networks for 2030 conditions. These volumes are then placed into a transportation modeling program as outlined below to determine the existing and future operating conditions along the corridor.

## 4.5 INTERSECTION CAPACITY ANALYSIS METHODOLOGY

Capacity analysis is used to assign levels of service to traffic facilities under various traffic conditions. Operational analyses of the study intersections were completed using procedures in the Transportation Research Board's Highway Capacity Manual, 2016 (HCM 6). This is the nationally accepted methodology for the analysis of traffic conditions. The software program Synchro 11 by TrafficWare (a nationally recognized computer software package for analyzing capacities, Levels of Service, and queuing in intersections) was used to perform the actual capacity and queue analyses.

**Below: Route 20 traffic backup during AM Peak Hours**



**Table 4-1 Traffic Volumes**

Intersection	Scenario	Traffic Volumes											
		From North			From East			From South			From West		
		SBLT	SBT	SBRT	WBLT	WBT	WBRT	NBLT	NBT	NBRT	EBLT	EBT	EBRT
Main St & Church St.	Traffic Count	514		125	0	374	273				127	557	0
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	<b>2023 Peak Season Traffic</b>	<b>529</b>	<b>0</b>	<b>129</b>	<b>0</b>	<b>385</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>131</b>	<b>574</b>	<b>0</b>
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Existing plus Background Growth	548	0	133	0	399	291	0	0	0	135	594	0
	<b>0 Background Traffic</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>
	Committed Development Trips												
	<b>2030 Background Traffic</b>	<b>548</b>	<b>0</b>	<b>133</b>	<b>0</b>	<b>399</b>	<b>291</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>135</b>	<b>594</b>	<b>0</b>
	In/Out												
	Project Assignment												
	Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0
	<b>0 Total Traffic</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>2030 Total Traffic</b>	<b>548</b>	<b>0</b>	<b>133</b>	<b>0</b>	<b>399</b>	<b>291</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>135</b>	<b>594</b>	<b>0</b>	
Main Street & South Street	Traffic Count	0	0	0	61	522	0	167	0	72	0	817	224
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	<b>2023 Peak Season Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>63</b>	<b>538</b>	<b>0</b>	<b>172</b>	<b>0</b>	<b>74</b>	<b>0</b>	<b>842</b>	<b>231</b>
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Existing plus Background Growth	0	0	0	65	557	0	178	0	77	0	871	239
	<b>0 Background Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>
	Committed Development Trips												
	<b>2030 Background Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>65</b>	<b>557</b>	<b>0</b>	<b>178</b>	<b>0</b>	<b>77</b>	<b>0</b>	<b>871</b>	<b>239</b>
	In/Out												
	Project Assignment												
	Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0
	<b>0 Total Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>
<b>2030 Total Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>65</b>	<b>557</b>	<b>0</b>	<b>178</b>	<b>0</b>	<b>77</b>	<b>0</b>	<b>871</b>	<b>239</b>	
Main Street & Hudson Street	Traffic Count	43	0	102	0	470	20				107	753	0
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	<b>2023 Peak Season Traffic</b>	<b>44</b>	<b>0</b>	<b>105</b>	<b>0</b>	<b>484</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>110</b>	<b>776</b>	<b>0</b>
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Existing plus Background Growth	46	0	109	0	501	21	0	0	0	114	803	0
	<b>0 Background Traffic</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>
	Committed Development Trips												
	<b>2030 Background Traffic</b>	<b>46</b>	<b>0</b>	<b>109</b>	<b>0</b>	<b>501</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>114</b>	<b>803</b>	<b>0</b>
	In/Out												
	Project Assignment												
	Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0
	<b>0 Total Traffic</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>
<b>2030 Total Traffic</b>	<b>46</b>	<b>0</b>	<b>109</b>	<b>0</b>	<b>501</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>114</b>	<b>803</b>	<b>0</b>	

## SIGNALIZED INTERSECTIONS

The operating LOS of a signalized intersection is based on the average control delay per vehicle. The control delay per vehicle is estimated for each lane group and combined for each approach and the intersection as a whole. The LOS associated with different control delay times for signalized intersections, as defined by the HCM, is shown in Table 4-2.

## NO-BUILD CONDITION

This scenario is based off the corridor as it exists today. The existing conditions section outlines the geometric conditions of the corridor. However, we also need to further define the traffic signal operations. Along this corridor there are three signalized intersections including the following:

1. Main Street at Church Street and Private Drive
2. Main Street at South Street
3. Main Street at Hudson Street

Under current conditions, the intersection of Main Street and Church Street and the intersection of Main Street at South Street operate under one fully actuated traffic controller. This means that the two intersections are tied together and that the traffic movements at both intersections are controlled by one traffic controller, thus they cannot operate independently to address changing traffic conditions at either intersection directly. While the intersection of Main Street and Hudson Street operates under its own fully actuated traffic controller which means it can operate independently under certain conditions.

Since these three intersections are so close together, they are also tied together in a coordinated system. This means that they share certain timing and phasing parameters across the entire network. The goal of a coordinated system is to try to improve traffic flow through the entire network.

## BUILD CONDITION

For the Build Condition the goal was to reduce the number of travel lanes through the corridor to allow for more sidewalk space, potential for on street parking and improved bicycle accommodations. Given the existing traffic volumes along the corridor and the current intersection spacing, it was necessary to review several different traffic signal adjustments that could be made to try to improve traffic operations if possible

or, at a minimum, to try to minimize the impacts of the reduced number of lanes.

For this corridor several changes to traffic signal operations were considered including:

1. Adjust the existing timing and phasing of the intersections using the current system configuration.
2. Remove the existing coordination and allow the traffic signal to operate independently.
3. Add an additional traffic controller at Church Street so that all three intersections run on their own traffic signal controllers which allows more flexibility in the operations.
4. Change the pedestrian operation parameters from exclusive crossing mode to concurrent crossing mode.

These changes were placed into the transportation modeling software and manipulated to come up with the preferred combination of improvements that would optimize operations along the corridor. Overall, there was no combination of changes to the traffic signals that would improve the existing conditions or maintain the status quo. Under all the scenarios reviewed, there was some impact to the overall operations of the corridor. The scenarios were adjusted until a least impactful Build condition was developed.

**Table 4-2 Signalized Intersection Level of Service Criteria**

<b>Level of Service</b>	<b>Control Delay Times (sec/veh)</b>
A	<10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

## 4.6 CONCLUSIONS

The preferred scenario included a combination of using an individual traffic signal controller at each of the intersections and placing them in a coordinated system. The traffic signal timing and phasing was adjusted to balance the operations of each movement along the corridor and attempt to minimize vehicle queue lengths, especially between the intersections.

Overall, the preferred scenario resulted in an increase in the Level of Service (LOS) for several critical movements along the corridor. This included several movements dropping to a LOS E or F under the Build condition from a LOS C in the No-Build condition. A change in LOS results when traffic traveling through the intersection experiences an increase in vehicle delay. When comparing Level of Service it is important to note that a LOS A is good (i.e. small delay) and LOS F is bad (i.e., large delay). In addition, several of the vehicle queue lengths increase dramatically and were shown not to clear during each traffic signal

cycle. Ultimately this results in cars getting stuck at one or more red lights along the corridor after sitting through more than one phase at the traffic signal. A table showing the results of the existing, No-Build and Build Condition is included in the Appendix.

Since Main Street (Route 20) is under the jurisdiction of MassDOT, the MassDOT District 3 Representative was consulted regarding the operational results noted above. He noted that if there were some minor changes to the LOS and queue lengths along the corridor MassDOT would have considered providing a further review and evaluation of the operations. However, given the extreme changes that were observed in the preferred scenario, he did not believe that MassDOT could support the proposed changes because of the negative impacts to the LOS and very long queues.



**Above:** Route 20 at intersection of Route 135 (South Street)



# 5. MARKET ANALYSIS

## 5.1 DEMOGRAPHIC TRENDS

### DATA SOURCE AND STUDY AREAS

In this section, data from the American Community Survey (ACS) 5-Year Estimates produced by the U.S. Census Bureau were utilized to analyze the demographic trends for Northborough and its surrounding region for the decade between 2011 and 2021. Note that 2021 is the latest year available in the current ACS dataset. Data for the town of Northborough were compared to Worcester County, the Commonwealth of Massachusetts, and a regional market area, which was defined by the consultants as those communities within close proximity to Northborough and served by U.S. Route 20 and the Interstate 495 corridor. The regional market area is much smaller than Worcester County and consists of nine towns and cities in Worcester County and Middlesex County, including Northborough Town, Berlin Town, Hudson Town, Marlborough City, Southborough Town, Westborough Town, Boylston Town, Shrewsbury Town, and Worcester City. These are the county subdivisions that surround Northborough (Map 5-1).

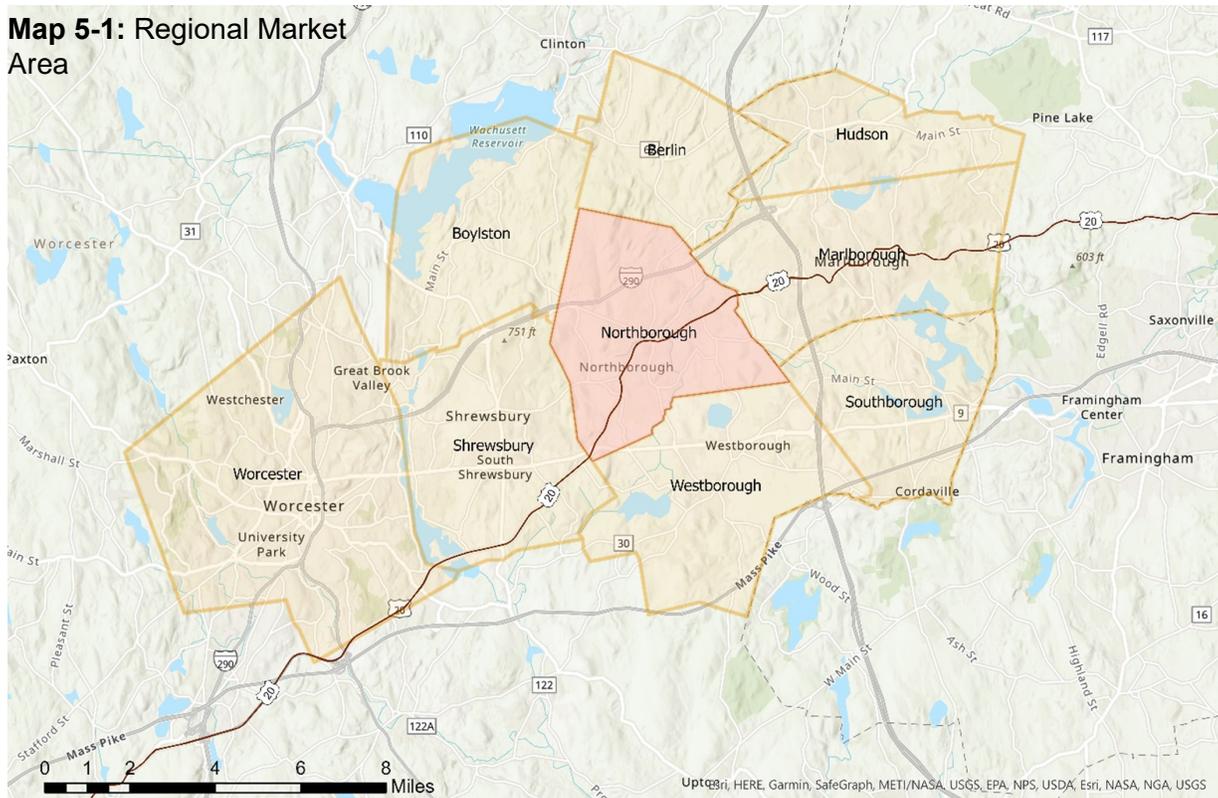
### POPULATION

The population in the town of Northborough has been steadily increasing between 2011 and 2021 by 10.0% during this decade. Northborough’s population grew faster than Worcester County and the state during this decade while trailing slightly behind the Study Region. This suggests that Northborough’s population and therefore demand are likely to continue to grow in the near future, a positive sign for future housing and retail development (Table 5-1).

### AGE DISTRIBUTION

Northborough’s median age in 2021 was 44.1, older than the County (40.2) and Massachusetts (39.6). However, 27.6% of its population were 55 and above in 2021, lower than the county (30.1%) and the state (30.3%) figures. In addition, the town has seen the fastest increase in young adults aged 25 to 34, people aged 45 to 54, and the second fastest growth of seniors aged 65 and above. This suggests a positive sign for new multi-family apartment developments, as

**Map 5-1: Regional Market Area**



young adults tend to choose to rent, and seniors are more likely to downsize their homes or prefer to live closer to their children and grandchildren who usually prefer to call Downtown home (Figure 5-1).

### HOUSEHOLD TYPE

Similar to the population trend, Northborough's number of households grew faster than the county and state between 2011 and 2021, a positive sign for future

housing and commercial development. In addition, the Town has seen the fastest growth occurring in non-family households with householders not living alone among all household types, a similar trend seen in the county, state, and the study region. This type of household usually consists of young adults or students living with roommates in rental units, suggesting promising future demand for multi-family apartment developments (Figure 5-2).

**Table 5-1  
Population Trends  
Northborough, Worcester County, Massachusetts & Study Region (2011-2021)**

Jurisdiction	2011	2016	2021	2011-2021 Change	
	Count	Count	Count	Actual Chg.	% Chg.
<b>Northborough town</b>	14,180	14,846	15,605	1,425	10.0%
<b>Worcester County</b>	794,981	813,589	856,858	61,877	7.8%
<b>Massachusetts</b>	6,512,227	6,742,143	6,991,852	479,625	7.4%
<b>Study Region</b>	321,995	330,457	359,029	37,034	11.5%

Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

**Figure 5-1**

### Population Age Trends (2011-2021)

Northborough, Worcester County, Massachusetts, and Study Region, MA

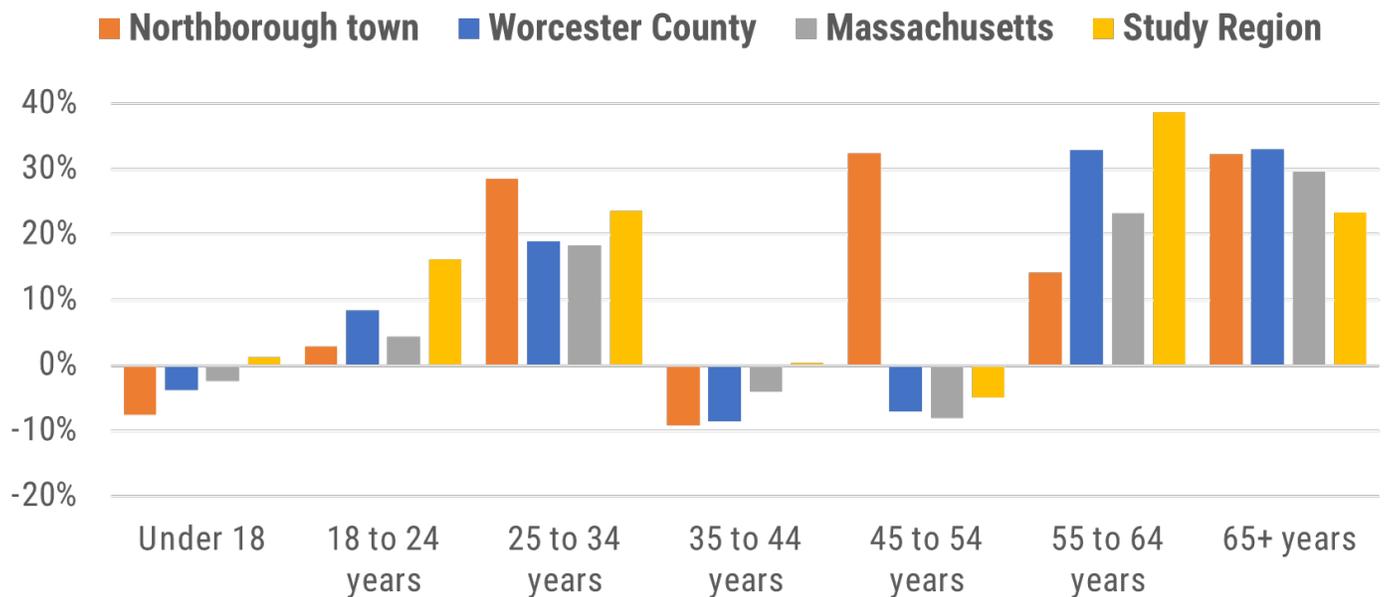
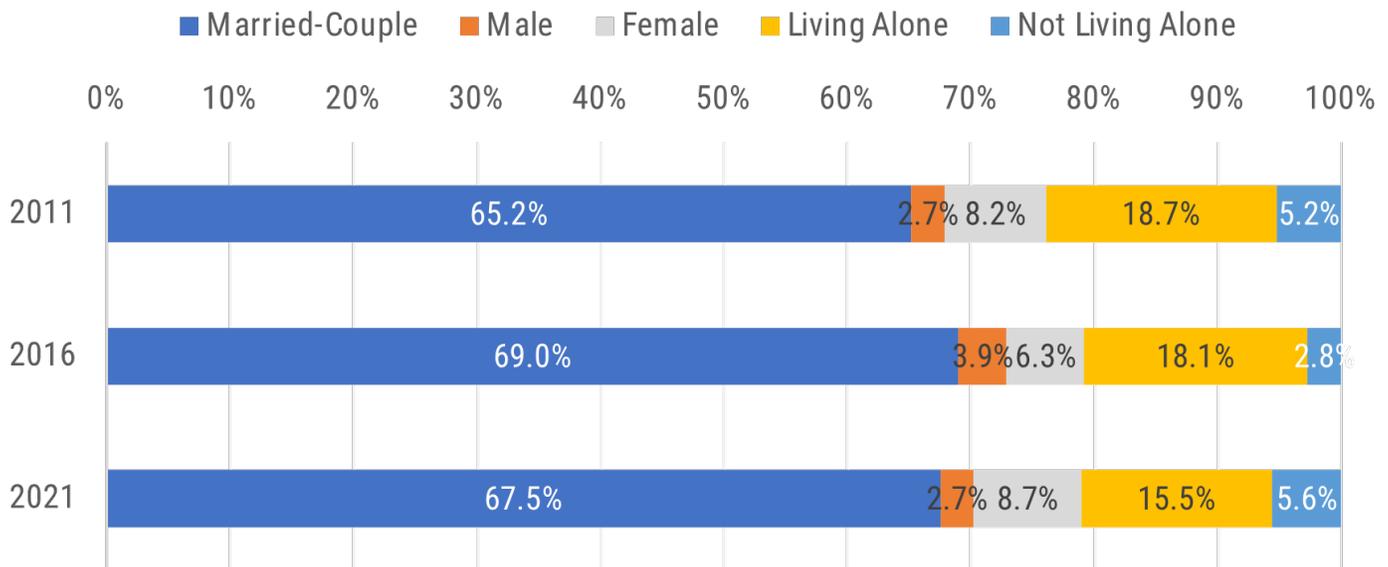


Figure 5-2

## Household Type Composition Trend (2011-2021) Northborough, MA



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

### HOUSEHOLD TENURE

Northborough's housing stock is predominately owner-occupied with 83.0% of homes occupied by owners in 2021. In 2021, Northborough's share of renters was the lowest compared to the county, state, and study region. However, following a similar trend in the other three geographies, Northborough's renter households grew faster than its owner households, although only marginally more than renter households in both Worcester County and Massachusetts. In addition, Northborough has seen the fastest renter household increase of 23.1% between 2011 and 2021 compared to the county, state, and study area. This resonates with the previous findings that people living in non-family households with roommates who are usually renters saw rapid growth during the same period in the town. This suggests there is most likely a market for new multi-family rental apartment developments (Figure 5-3).

### TENURE BY AGE OF HOUSEHOLDER

Northborough's increase in the percentage of renter households between 2011 and 2021 was largely contributed by renter households with householders aged between 45 to 54, with a 128.2% increase during this decade, the fastest among all age groups and all four geographies (town, county, state, study region). This is followed by renter households headed

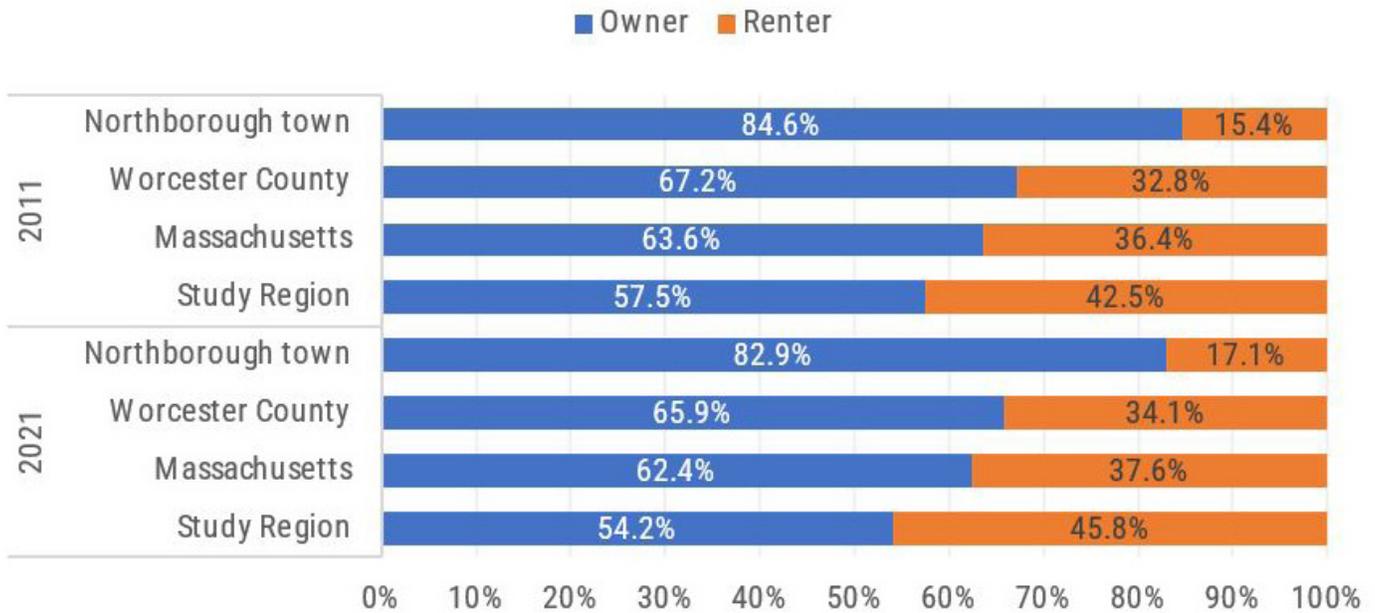
by householders aged 55 to 64. 66.7% of renter households in the town were headed by householders aged 45 and above in 2021 (Figure 5-4).

### INCOME DISTRIBUTION

Approximately, 65.3% of Northborough's households earned at or above \$100,000 annually in 2021, the highest share compared to the county, the state, and the study region. Similar to the other three geographies, Northborough's highest-income households earning above \$200,000 annually increased the fastest between 2011 and 2021 by 138.3%, followed by households earning \$100,000 to 149,999 and \$150,000 to \$199,999 per year. This suggests that new households moving into Northborough have higher incomes, or that the town's existing households' incomes have increased during this decade, a positive sign because households have a greater ability to afford housing costs (Figure 5-5).

**Figure 5-3**

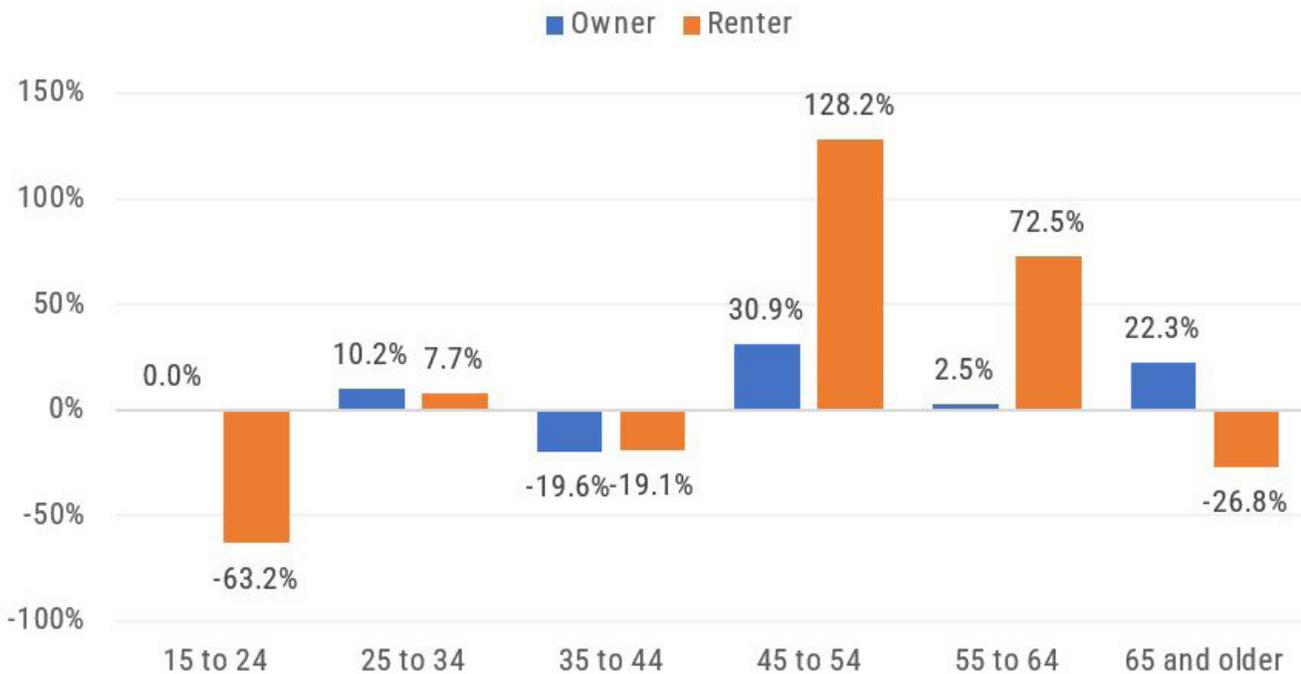
### Household Tenure (2011-2021) Northborough, Worcester County, Massachusetts, and Study Region, MA



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

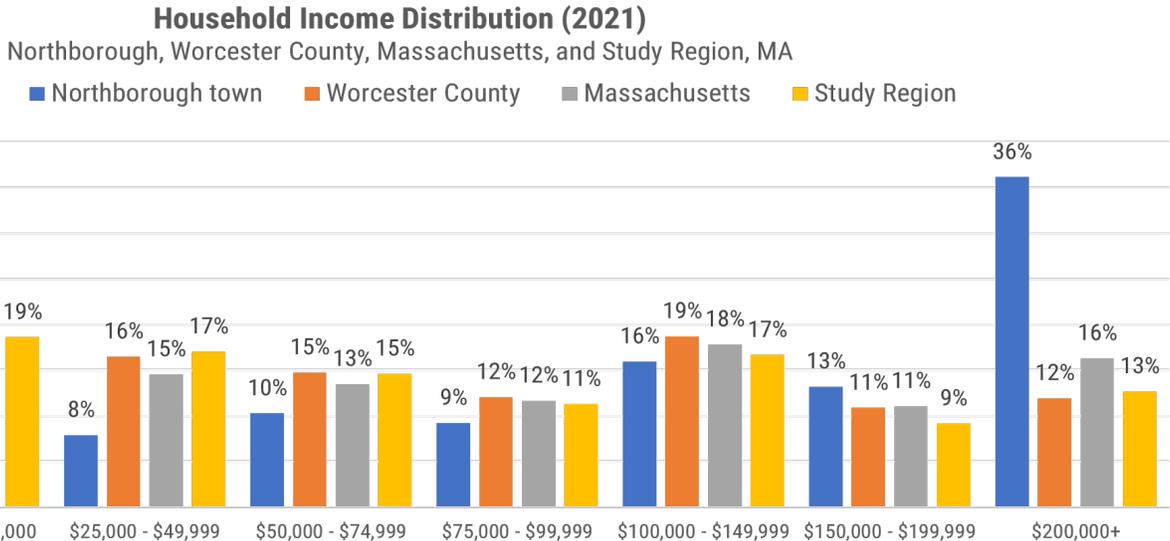
**Figure 5-4**

### Tenure by Householder Age Percent Change (2011-2021) Northborough, MA



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

**Figure 5-5**



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

**INCOME BY HOUSEHOLDER AGE**

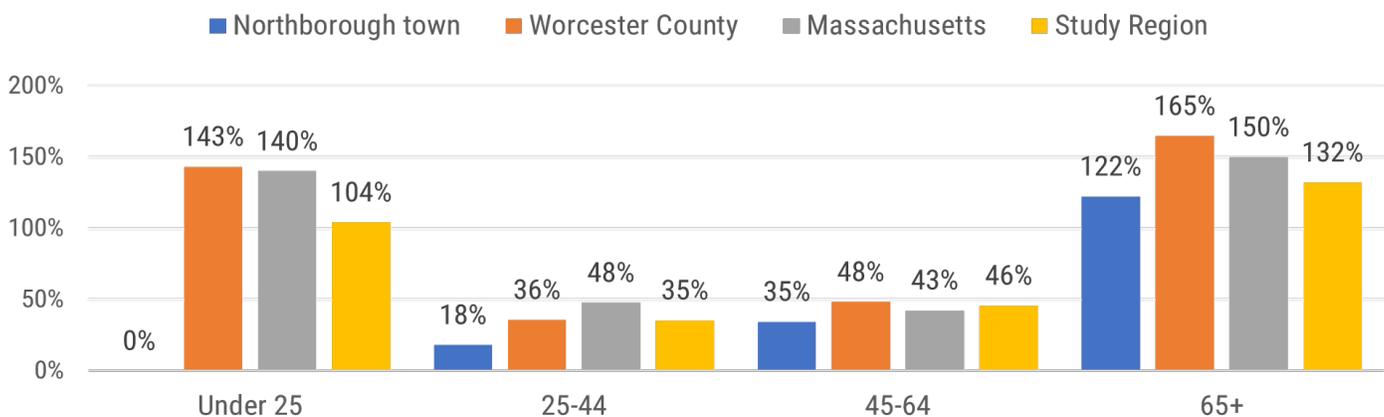
The highest-income households earning at or above \$100,000 per year grew by 35.8% in Northborough between 2011 and 2021, a slower rate than the county, state, and study region. Similar to the other three geographies, among households earning at or above \$100,000 annually, those headed by senior householders aged 65 and above increased the fastest among all age groups in Northborough (Figure 5-6).

**UNIT IN STRUCTURE BY TENURE**

Similar to the county, state, and study region, Northborough’s owner-occupied housing stock is comprised mostly of single-family homes (97.0% in 2021). Its renter-occupied housing stock is more

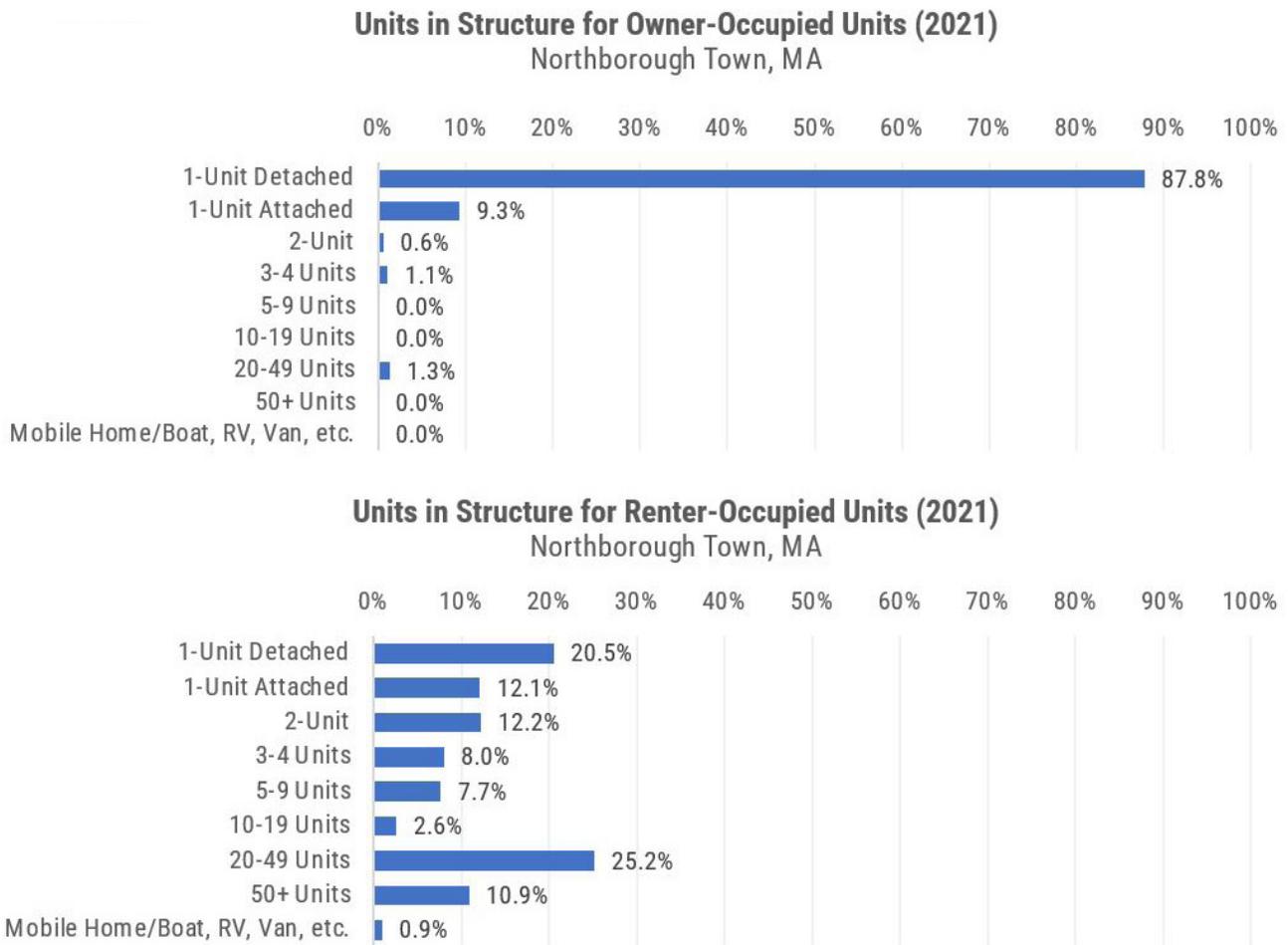
diverse with higher densities, with 54.2% of rental units in structures with 3 or more units. Compared to the county, state, and the study region, Northborough has a lower-density housing stock, with a higher share of single-family homes for both owner-occupied and renter-occupied housing. However, the town’s rental housing stock has seen faster growth in density than the other three geographies, with the fastest increase in multi-family buildings with 20 to 49 units (800.0%) between 2011 and 2021. This resonates with the growing demand for multi-family apartment units and suggests that the rental market has started to respond to this under served demand, but there is still room for growth. It indicates positive market potential for future multi-family apartment development in Northborough (Figure 5-7).

**Figure 5-6**



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

Figure 5-7



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

## YEAR BUILT BY TENURE

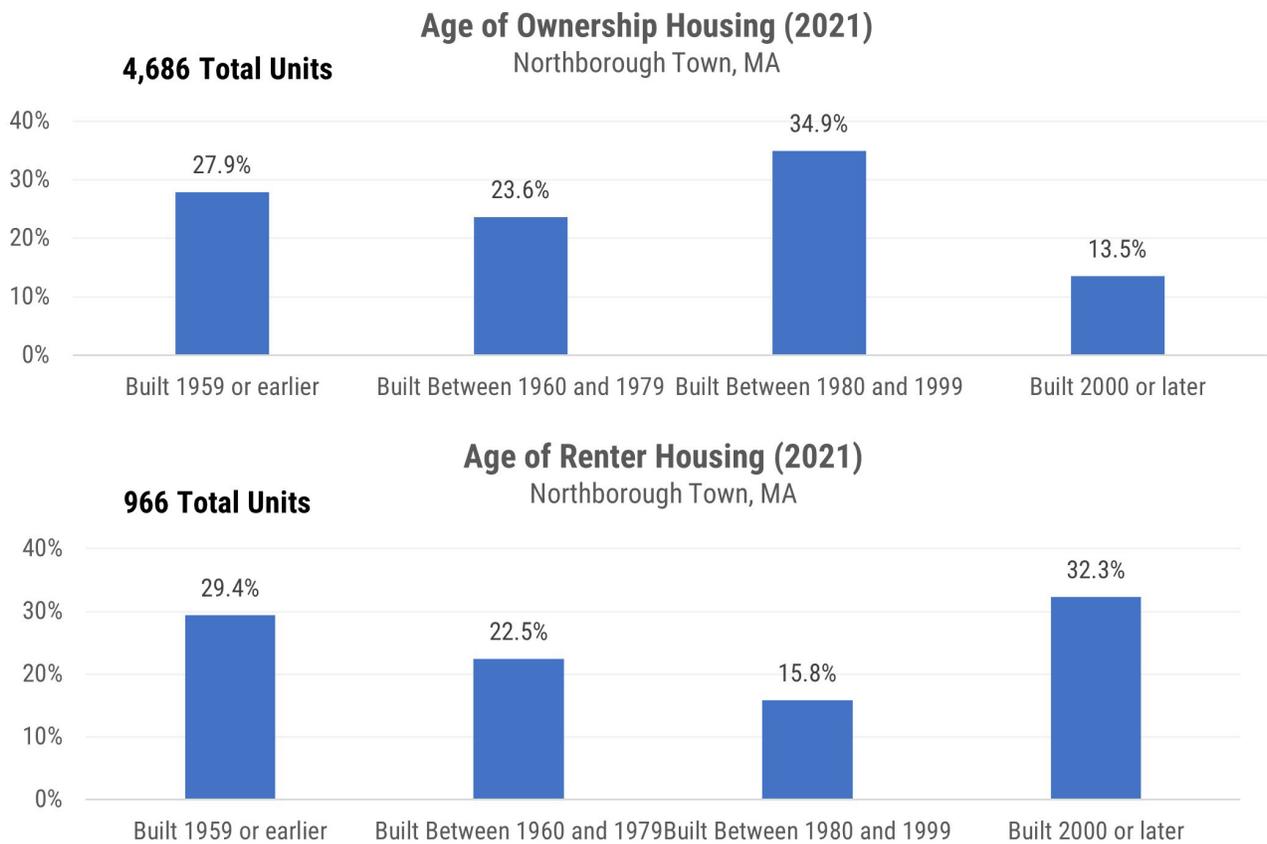
Northborough's owner-occupied housing stock is older than its rental housing stock, with 86.5% of owner-occupied housing units built before 2000 as of 2021. In comparison, 32.3% of the town's rental units have been built since 2000, largely within the Northborough Avalon development, and this share is higher than in the county, state, and study region. This suggests more active market activities and demand in the town's rental housing market since 2000, which is a positive trend for new apartment development in Northborough (Figure 5-8).

## HOUSING VACANCY

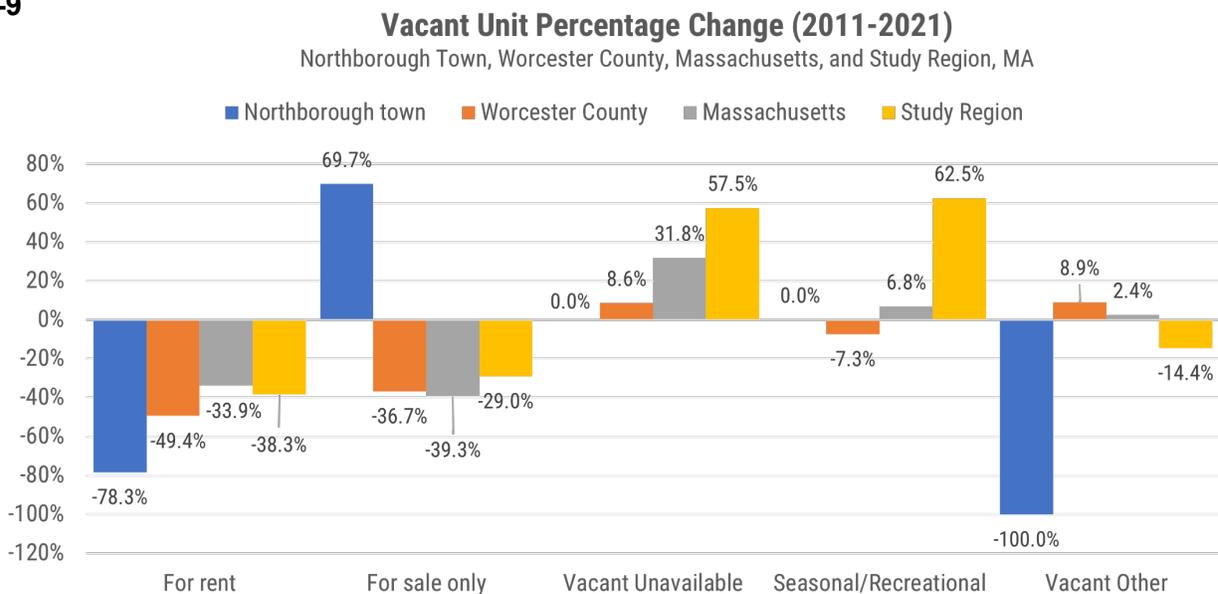
Northborough's total vacant housing units increased by 27.8% between 2011 and 2021, a trend opposite to the county, state, and study region, which have all seen a drop in their housing vacancy rates during this decade.

The growth of vacant housing units in Northborough is largely contributed by the 69.7% increase in units for sale. In contrast, vacant units for sale have declined during this decade in the county, state, and the study region. Meanwhile, the town's vacant units for rent dropped by 78.3%, a faster decrease compared to the other three geographies. This suggests a weakening demand for for-sale homes while a stronger demand for rental units in Northborough compared to the county, state, and the study region between 2011 and 2021, a positive trend for new rental housing developments in Northborough (Figure 5-9). Other vacant units as defined by the Census Bureau include those year-round units which are vacant for other reasons. For example, other vacant units can be held for settlement of an estate, held for personal reasons, or held for repairs, among other reasons.

**Figure 5-8**



**Figure 5-9**



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

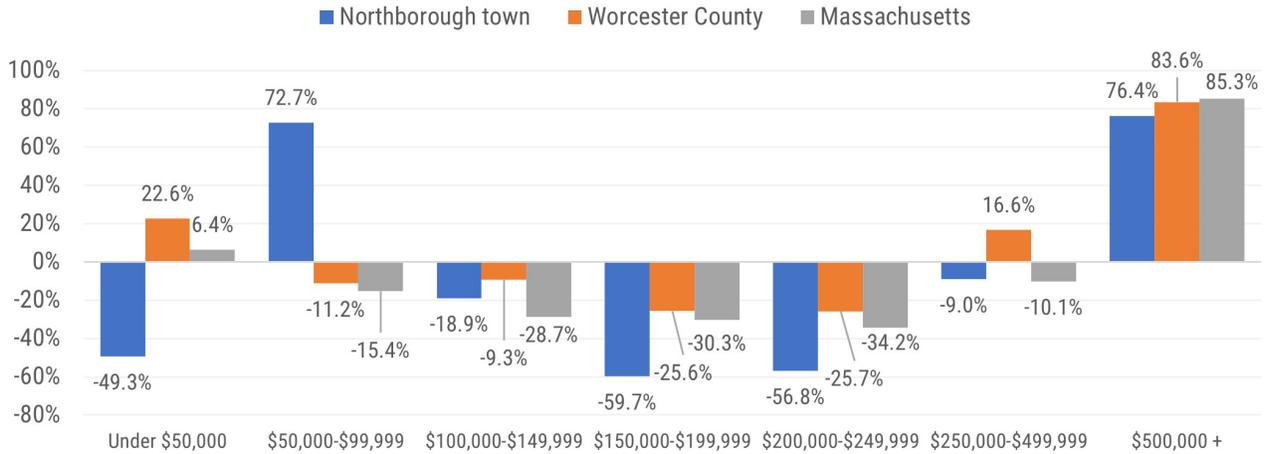
## HOME VALUES

In 2021, 43.4% of Northborough's homes were valued at \$500,000 or more, a higher share than the county (15.8%), state (38.1%), and study region (23.6%), suggesting that Northborough has a more expensive ownership home market. In addition, similar to the

county, state, and study region, the Town has seen the fastest growth occurring at the highest end of the market for homes valued at half a million and more between 2011 and 2021. However, such growth in Northborough is not as fast as in the other three geographies during the same decade (Figure 5-10).

**Figure 5-10**

**Home Percentage Change by Home Value (2011-2021)**  
Northborough Town, Worcester County, Massachusetts, and Study Region, MA



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

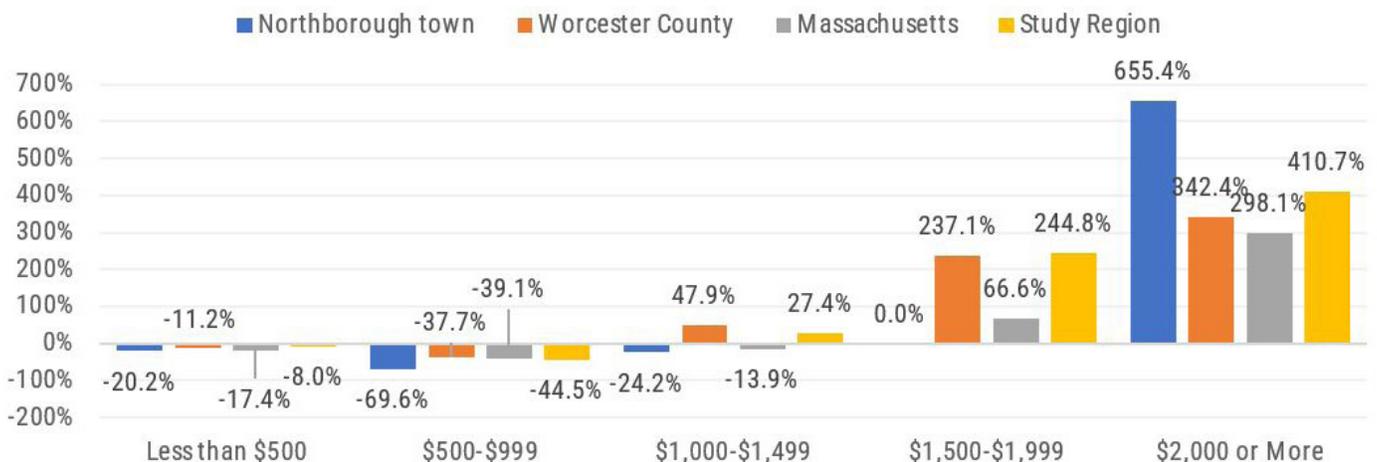
**GROSS RENT**

Northborough’s rental market is more expensive, with nearly half of its rental units (49.8%) priced at \$2,000 or more per month in 2021, a higher share than the county (7.4%), state (25.4%), and study region (10.5%). In comparison, only 7.8% of rental units in the town were priced at or above \$2,000 per month in 2011. This means that Northborough’s highest-end rental units priced at \$2,000 or more monthly saw the fastest growth among the four geographies, soaring by 655.4% between 2011 and 2021. Its median

monthly gross rent stood at \$1,992, 74% higher than the county level (\$1,142) and 39% higher than the state level (\$1,429). As market supply usually is a response to demand, this most likely suggests that the Northborough market has started to respond to the growing demand for higher-end rental products. This is a positive trend for new rental apartment developments because it suggests that more renters in Northborough can pay for higher-priced rental units, which are usually new apartment projects that usually can charge a premium due to their better amenities and newer units (Figure 5-11).

**Figure 5-11**

**Percent Change of Rental Units with Cash Rent by Gross Rent (2011-2021)**  
Northborough Town, Worcester County, Massachusetts, and Study Region, MA



Source: American Community Survey (ACS) and RKG Associates, Inc., 2023

## 5.2 ECONOMIC TRENDS

### EMPLOYMENT TRENDS

The consultants analyzed job trends for all industries in the Town of Northborough and the broader study region (Map 5-1) projected through 2033. It is important to note that the beginning of the period followed the Great Recession of 2009-2010, which was a deep financial crisis that created a deep recession and took several years for the economy to recover. Then in 2020, the Covid-19 global pandemic emerged which precipitated a national economic shut down which resulted in the loss of over 10 million jobs in the matter several months. These major economic events and their recoveries have created shifts in the U.S. economy which has reshaped many of the industries included in this analysis. In many respects, it will take years to sort out the impacts and downturns will evolve with these structural changes.

The consultants specifically focused their analysis on retail, services (personal and professional), and food/drink industries that are typically located in most downtown settings. Changes in employment are one indicator of demand for specific goods and services. For example, if coffee shops/cafes are experiencing rapid employment growth in a given area, one can conclude that the demand for coffee shops and cafes are increasing and the need for additional shops is necessary to meet this demand.

The employment data was obtained from EMSI/Lightcast, a third-party industry and employment data analytics firm in the U.S. The retail, service, and food/drink industries analyzed in this section include:

- Retail industries with NAICS (North American Industry Classification System) codes starting with

- 44 and 45;
- Financial, bank, insurance, and real estate related industries with NAICS codes starting with 52 and 531;
- Professional, technical, and related support businesses with NAICS codes starting with 54, 55, and 561;
- Office of physicians, dentists, and other health practitioners with NAICS codes 6211, 6212, and 6213;
- Child day care services with NAICS code 6244;
- Food/drink industries with NAICS codes starting with 722, and;
- Personal service industries with NAICS codes starting with 812.

Job growth across all industries in Northborough was faster (2.5% annually) than in the study region (0.9% per year) over the past decade, although job growth is projected to slow and will be surpassed by the study region between 2023 and 2033. Retail, services, and food/drink industries also show a similar trend for the two geographies in the same period. However, Northborough's retail, services, and food/drink industries have grown faster than all industries combined between 2013 and 2023, and it is projected to remain so through 2033. This is a positive trend for the retail, services, and food/drink businesses in Northborough, though it should be noted that there is projected to be more competition from the study region in the future 10 years. Therefore, diversification is essential for future businesses in downtown Northborough. Retail, services, and food/drink industries account for 48.4% of jobs among all industries in Northborough in 2023 (Table 5-2).

The biggest employer in the retail, services, and food/drink industries in 2023 is Restaurants and Other Eating Places in both Northborough and the study region, followed by other types of general retail

**Table 5-2**

**Employment Growth Trends, 2013-2033  
Northborough Study Area Region, MA**

	2013	2023	2033	Change 13'-23'		Change 23'-33'	
				Actual Chg.	Ann. % Chg.	Actual Chg.	Ann. % Chg.
<b>All Industries</b>							
Northborough	7,042	8,783	9,839	1,741	2.5%	1,056	1.2%
Study Region	180,001	196,105	226,099	16,104	0.9%	29,994	1.5%
<b>Retail, Service, Food/Drink Industries</b>							
Northborough	3,090	4,251	4,818	1,161	3.8%	567	1.3%
Study Region	76,685	83,642	95,329	6,958	0.9%	11,686	1.4%

Source: EMSI and RKG Associates, Inc., 2023

businesses and professional/technical services (Table 5-3).

Similar types of businesses have contributed to the largest number of job growth in the past decade in both geographies, though the study region has seen proportionally more job gains contributed by professional, technical, and healthcare services, with 86.6% of the top ten job gains contributed by these industries between 2013 and 2023, compared to 39.9% in Northborough during the same decade. This means that the job gain for the retail, services, and food/drink industries in Northborough during the past decade was contributed more by traditional retail and food/drink businesses other than technical/professional services, which are usually higher-paying jobs (Table 5-4).

Significant employment growth in the retail and food/drink industries is largely owing to the 2011 completion

of Northborough Crossing, a 600,000 square foot open-air shopping destination located at the intersection Route 9 and Route 20 that is anchored by Wegmans Food Markets and includes a mix of restaurants and “big box” stores such as BJ’s Wholesale Club, Dick’s Sporting Goods, TJ Maxx, Marshalls, and Homesense.

It is projected that a similar trend will continue through 2033 (See Table 5-5), in that 55.2% of the top ten job gains between 2023 and 2033 in Northborough will be contributed by general merchandise retailers, restaurants/other eating places, and department stores. In comparison, only 34.8% of projected job growth in the future ten years in the study region will be contributed by restaurants/other eating places and general merchandise stores.

**Table 5-3**

**Top 10 Employment Industries for Retail, Services, Food/Drink, 2023  
Northborough, MA**

<b>NAICS</b>	<b>Description</b>	<b>2023 Jobs</b>
7225	Restaurants and Other Eating Places	536
4551	Department Stores	532
	Warehouse Clubs, Supercenters, and Other General	
4552	Merchandise Retailers	399
5415	Computer Systems Design and Related Services	313
5617	Services to Buildings and Dwellings	299
5413	Architectural, Engineering, and Related Services	229
4561	Health and Personal Care Retailers	225
	Management, Scientific, and Technical Consulting	
5416	Services	135
5419	Other Professional, Scientific, and Technical Services	120
4571	Gasoline Stations	105

Source: EMSI and RKG Associates, Inc., 2023

**Top 10 Employment Industries for Retail, Services, Food/Drink, 2023  
Northborough Study Area Region, MA**

<b>NAICS</b>	<b>Description</b>	<b>2023 Jobs</b>
7225	Restaurants and Other Eating Places	11,401
5613	Employment Services	8,321
5415	Computer Systems Design and Related Services	5,256
5511	Management of Companies and Enterprises	5,178
4451	Grocery Stores	4,954
5417	Scientific Research and Development Services	3,332
5241	Insurance Carriers	3,331
5617	Services to Buildings and Dwellings	2,904
5221	Depository Credit Intermediation	2,747
5413	Architectural, Engineering, and Related Services	2,731

Source: EMSI and RKG Associates, Inc., 2023

**Table 5-4**

**Top 10 Employment Growth by Industry for Retail, Services, Food/Drink, 2013-2023  
Northborough, MA**

NAICS	Description	2013 Jobs	2023 Jobs	13'-23' Chg.
	Warehouse Clubs, Supercenters, and Other General			
4552	Merchandise Retailers	182	399	217
7225	Restaurants and Other Eating Places	344	536	192
5413	Architectural, Engineering, and Related Services	105	229	124
5617	Services to Buildings and Dwellings	181	299	118
4551	Department Stores	432	532	100
4561	Health and Personal Care Retailers	139	225	85
5419	Other Professional, Scientific, and Technical Services	49	120	70
5415	Computer Systems Design and Related Services Management, Scientific, and Technical Consulting	252	313	61
5416	Services	88	135	46
4571	Gasoline Stations	68	105	37

Source: EMSI and RKG Associates, Inc., 2023

**Top 10 Employment Growth by Industry for Retail, Services, Food/Drink, 2013-2023  
Northborough Study Area Region, MA**

NAICS	Description	2013 Jobs	2023 Jobs	13'-23' Chg.
5613	Employment Services	6,440	8,321	1,881
5417	Scientific Research and Development Services	1,860	3,332	1,471
5413	Architectural, Engineering, and Related Services	1,990	2,731	741
6213	Offices of Other Health Practitioners	843	1,546	702
7225	Restaurants and Other Eating Places	10,761	11,401	639
5617	Services to Buildings and Dwellings Management, Scientific, and Technical Consulting	2,283	2,904	621
5416	Services	1,598	2,148	549
5511	Management of Companies and Enterprises General Merchandise Stores, including Warehouse	4,749	5,178	428
4523	Clubs and Supercenters	1,308	1,713	404
5242	Agencies, Brokerages, and Other Insurance Related Activities	921	1,280	359

Source: EMSI and RKG Associates, Inc., 2023

**Table 5-5**

**Top 10 Projected Employment Growth by Industry for Retail, Services, Food/Drink, 2023-2033  
Northborough, MA**

NAICS	Description	2023 Jobs	2033 Jobs	23'-33' Chg.
	Warehouse Clubs, Supercenters, and Other General			
4552	Merchandise Retailers	399	542	143
7225	Restaurants and Other Eating Places	536	650	114
5617	Services to Buildings and Dwellings	299	383	84
4551	Department Stores	532	603	72
5413	Architectural, Engineering, and Related Services	229	280	51
5419	Other Professional, Scientific, and Technical Services Management, Scientific, and Technical Consulting	120	165	46
5416	Services	135	162	28
6244	Child Day Care Services	61	82	21
6213	Offices of Other Health Practitioners	33	52	19
6212	Offices of Dentists	75	94	19

Source: EMSI and RKG Associates, Inc., 2023

**Table 5-5  
Continued**

**Top 10 Projected Employment Growth by Industry for Retail, Services, Food/Drink, 2023-2033  
Northborough Study Area Region, MA**

NAICS	Description	2023 Jobs	2033 Jobs	23'-33' Chg.
7225	Restaurants and Other Eating Places	11,401	13,838	2,438
5613	Employment Services	8,321	9,872	1,551
5417	Scientific Research and Development Services	3,332	4,338	1,006
5415	Computer Systems Design and Related Services	5,256	5,931	676
6213	Offices of Other Health Practitioners	1,546	2,158	612
	General Merchandise Stores, including Warehouse			
4523	Clubs and Supercenters	1,713	2,244	531
5617	Services to Buildings and Dwellings	2,904	3,395	491
6244	Child Day Care Services	1,427	1,841	414
6212	Offices of Dentists	1,846	2,255	409
5413	Architectural, Engineering, and Related Services	2,731	3,138	406

Source: EMSI and RKG Associates, Inc., 2023

It should be noted that healthcare and childcare services are projected to be emerging job contributors in the next decade, with these categories estimated to account for 9.8% and 16.8% of future job gains in Northborough and the study region, respectively (Table 5-5).

The data also suggests that a high portion of Northborough’s job gains has and will come from general and most likely chained retailers, such as department stores, warehouse clubs, supercenters, and other general merchandise retailers. However, they are not the most suitable business type for the Northborough downtown area, and it will be hard to compete with Northborough Crossing and the study region with generic and chained businesses. Therefore, downtown Northborough needs to diversify its future business types and encourage local and small businesses to create a competitive advantage and distinguish itself from Northborough Crossing and the study region in terms of the types of business it offers. Examples include local boutique stores and mom-and-pop restaurants. It should also include service businesses such as daycares, dentists’ offices, and professional/technical services as these categories are projected to continue to grow.

### 5.3 DOWNTOWN BUSINESS MIX

The Town of Northborough property assessment data for 2022 was utilized to analyze the downtown study area. The year 2021 was the latest year built

recorded in the 2022 property assessment data so that is the most current information available. Within the study area, there are 43.8 acres of various commercial land uses, totaling 337,202 square feet of commercial building space. Roughly 27.6% of the total commercial building area is comprised of offices, followed by apartments (14.0%), retail (13.7%), and Industrial/Warehouse (11.6%). In terms of land acreage, Industrial/Warehouse properties account for the highest share of commercial land areas in the downtown study area at 22.8%, followed by offices (22.0%), and service businesses (such as banks, dry cleaners, barber shops, etc.) (11.8%) (see Table 5-6).

## 5.4 NORTHBOROUGH DEVELOPMENT TREND ANALYSIS

### LAND DEVELOPMENT ACTIVITY (1990-2021)

Town of Northborough property assessment data for 2022 was utilized to analyze town-wide commercial development trends in terms of new building square footage and apartment units constructed. For apartments, the data represents the number of units, and for all other commercial properties, the figures represent building square footage. The analysis includes all commercial developments since 1990. The result indicates that shopping centers contribute the largest share (47.5%) of new commercial square footage since 1990 in the town, followed by offices (17.8%), retail (11.9%), and auto-related properties (10.7%) (Table 5-7).

**Table 5-6**

**Downtown Study Area Land Uses by Acres and Building SF (2022)  
Northborough, MA**

Land Use Types	Total Lot Acres	Total Building SF	% of Total Acres	% of Total Bldg. SF
Apartment	3.1	47,084	7.0%	14.0%
Auto	0.5	5,632	1.2%	1.7%
Gas Station	1.5	8,786	3.4%	2.6%
Food/Drink	2.5	16,404	5.8%	4.9%
Retail	4.7	46,234	10.6%	13.7%
Shopping Center	4.4	23,465	9.9%	7.0%
Service	5.2	29,789	11.8%	8.8%
Office	9.6	93,102	22.0%	27.6%
Commercial-Vacant	0.7	8,154	1.6%	2.4%
Mixed Use	1.7	19,517	3.9%	5.8%
Industrial/Warehouse	10.0	39,035	22.8%	11.6%
<b>Grand Total</b>	<b>43.8</b>	<b>337,202</b>	<b>100.0%</b>	<b>100.0%</b>

Source: Northborough Property Assessor's Office and RKG Associates, Inc.

**Table 5-7**

**Commercial Property Development Trends by Building Square Footage/Units (1990-2021)  
Northborough, MA**

	Before 1990	1990-1999	2000-2009	2010-2021	Total Since 1990	Percent	Total All Years	Percent
Apartment (Units)	125	0	12	733	745	N/A	870	N/A
Auto	29,092	0	143,468	44,010	187,478	10.7%	216,570	7.7%
Gas Station	4,810	0	0	3,976	3,976	0.2%	8,786	0.3%
Food/Drink	35,573	2,210	0	0	2,210	0.1%	37,783	1.3%
Hospitality	75,200	0	0	0	0	0.0%	75,200	2.7%
Retail	93,701	193,233	15,638	0	208,871	11.9%	302,572	10.7%
Shopping Center	132,881	21,147	59,420	751,431	831,998	47.5%	964,879	34.2%
Service	26,496	5,445	17,460	24,208	47,113	2.7%	73,609	2.6%
Office	408,674	53,668	250,113	7,437	311,218	17.8%	719,892	25.5%
Medical	31,568	0	32,265	31,372	63,637	3.6%	95,205	3.4%
Mixed Use	218,596	25,917	0	39,407	65,324	3.7%	283,920	10.1%
Agriculture	12,742	0	0	0	0	0.0%	12,742	0.5%
Commercial Condo	0	1,667	26,320	0	27,987	1.6%	27,987	1.0%
Total - Commercial SF	1,069,333	303,287	544,684	901,841	1,749,812	100.0%	2,819,145	100.0%
Percent of Total SF	37.9%	10.8%	19.3%	32.0%	62.1%		100.0%	

Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

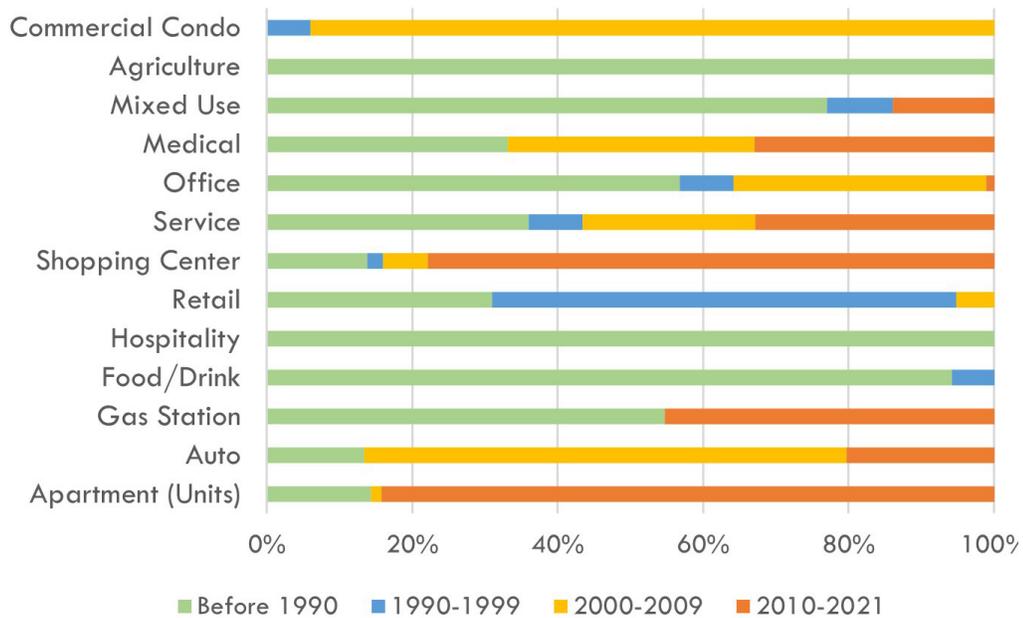
Regarding recent commercial development trends, the Town witnessed significant growth in new commercial space since 2010 largely owing to Northborough Crossing. 32% of the total current commercial building supply has been constructed since 2010 or 901,841 building square feet. This accounts for roughly 51.5% of all commercial building areas built since 1990. At the same time, the number of apartment units constructed in Northborough has increased from 125 units in 1990 to 870 in 2021, for an increase of 745 units reflecting an increase of 596% over 31 years. Over 84% of all apartment units have come on the market since 2010, which indicates that the Town's housing supply is starting to diversify and cater to more renter-occupied households than in the past.

According to the property assessment data, nearly half of the Town's 870 new apartment units built since

2010 are in the Avalon Northborough development, which accounts for 382 units. In addition, 77.9% of the shopping center building space has been constructed since 2010, followed by 45.3% of gas station square footage, 33.0% of medical building areas, and 32.9% of service business square footage built between 2010 and 2021. In comparison, food/drink establishments, hospitality, retail, offices, and mixed-use properties in Northborough are older, with all or most of their building areas built before 2000 with few new developments. This suggests that there is potential for new development of food/drink establishments in Northborough to tap into unmet demand. It should be noted that though restaurants associated with Northborough Crossing were built in 2011, their building areas are included in the Shopping Center category versus the food/drink establishments category by the assessment data (Figure 5-12).

Figure 5-12

**Commercial Development Trend by Year Built**  
 (Percentage of New Space Added to the Downtown Supply  
 by Period)  
 Town of Northborough, MA



Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

**DOWNTOWN STUDY AREA LAND DEVELOPMENT ACTIVITY (1990-2021)**

The same property assessment data was analyzed for the downtown study area. Shopping centers contributed the most commercial building square footage built since 1990, accounting for 29.2%, followed by retail (27.7%), offices (17.3%), and service businesses (14.8%) (Table 5-8).

In terms of the commercial development trend in the downtown, 62.1% of all commercial spaces in Northborough were built since 1990 and 32.0% built since 2010, only 20% of commercial spaces within the downtown study area were built since 1990, and only 8.9% were built since 2010. In other words, most (80.0%) of the commercial spaces within the downtown study area are older, built before 1990. This suggests there have not been as many new

Table 5-8

**Commercial Property Development Trends by Building Square Footage/Units (1990-2021)  
 Downtown Study Area, Northborough, MA**

	Before 1990	1990-1999	2000-2009	2010-2021	Total Since		Total All	
					1990	Percent	Years	Percent
Apartment (Units)	32	0	12	10	22	N/A	54	N/A
Auto	5,632	0	0	0	0	0.0%	5,632	2.0%
Gas Station	4,810	0	0	3,976	3,976	7.0%	8,786	3.1%
Food/Drink	14,194	2,210	0	0	2,210	3.9%	16,404	5.8%
Retail	30,596	0	15,638	0	15,638	27.7%	46,234	16.4%
Shopping Center	6,963	0	0	16,502	16,502	29.2%	23,465	8.3%
Service	21,424	5,445	0	2,920	8,365	14.8%	29,789	10.6%
Office	83,335	8,130	0	1,637	9,767	17.3%	93,102	33.0%
Mixed Use	19,517	0	0	0	0	0.0%	19,517	6.9%
Industrial/Warehouse	39,035	0	0	0	0	0.0%	39,035	13.8%
<b>Total - Commercial SF</b>	<b>225,506</b>	<b>15,785</b>	<b>15,638</b>	<b>25,035</b>	<b>56,458</b>	<b>100.0%</b>	<b>281,964</b>	<b>100.0%</b>
<b>Percent of Total SF</b>	<b>80.0%</b>	<b>5.6%</b>	<b>5.5%</b>	<b>8.9%</b>	<b>20.0%</b>		<b>100.0%</b>	

Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

commercial developments in the downtown study area as the town as a whole since 1990. Only 56,458 square feet were built since 1990 in the downtown study area. However, similar to the town-wide trend, among commercial spaces built since 1990, the period since 2010 has seen more commercial development activities, with 44.3% of commercial spaces built since 1990 delivered in or after 2010 (25,035 square feet) (Figure 5-13).

### COMMERCIAL COMPETITORS OUTSIDE STUDY AREA

The consultants also looked at areas within one mile west and east of the downtown study area boundary along Route 20 for clusters of commercial developments that can be potential competitors of the downtown. Four clusters of commercial properties were identified, totaling 363,721 square feet (Map 5-2).

The first cluster (West 1) is located to the southwest of the downtown study area, around the intersection

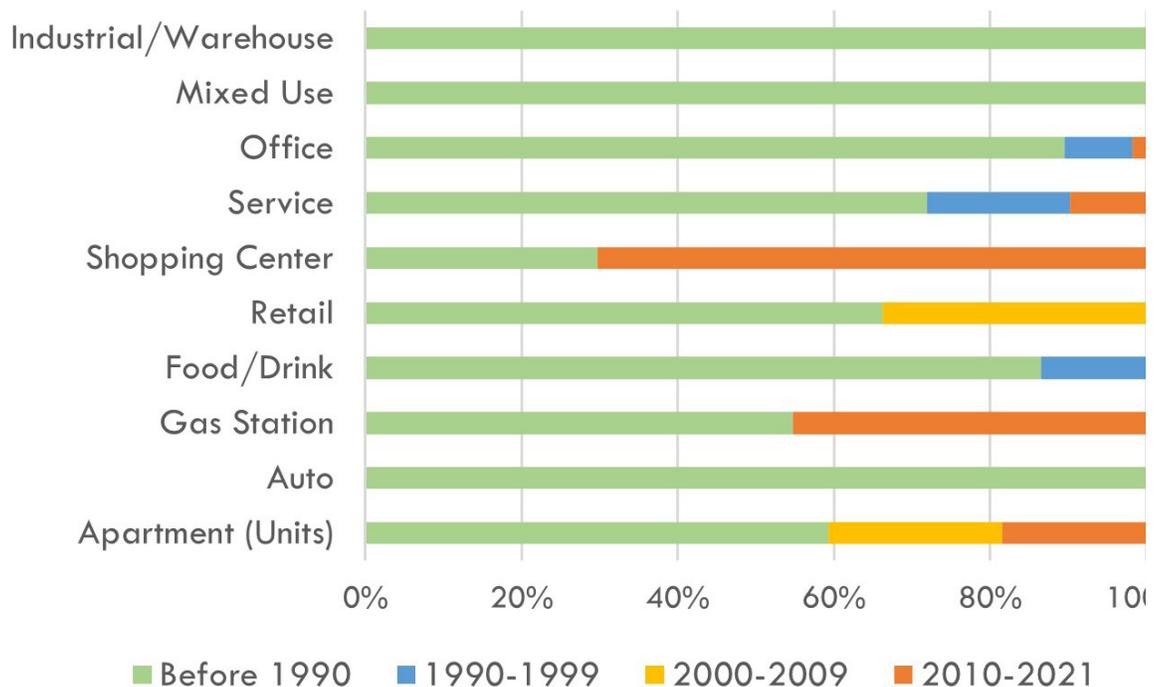
where West Main Street and Route 20 merge. It includes the Time Square shopping center (includes tenants such as Romaine's Kitchen and Bar), the Fox Meadow Crossing business center, the 290 West Main Street shopping center (where Rancho Corona Authentic Restaurant and Cantina is located), the 276 West Main Street shopping center (where Pickle Haus Deli is located), and Northborough Shopping Center (where Jolly Roger's Diner and Town Center Pizza are located).

The second cluster (West 2) is right outside the southwest edge of the downtown study area, north of and west of Crestwood Drive, and east of Lincoln St. Elementary School. It includes Mayo's Pets and More, Children's Dentistry of Northborough, the accountant's office McCarthy, Hargrave and Co., Sogno The Salon Company, Choice Cleaners, and The Pigment Parlour.

The third cluster (East 1) is outside of the east end of the downtown study area near White Cliffs, along the section of Route 20 where Brigham Street, Maple

Figure 5-13

**Commercial Development Trend by Year Built**  
(Percentage of New Space Added to the Downtown Supply by Period)  
Downtown Study Area, Northborough, MA



Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

## Map 5-2



Source: RKG Associates, Inc., 2023

Street, and East Main Street merge into Route 20. This cluster roughly starts with Luxe Electrology and Aesthetic Studio, includes tenants such as Northborough Dental Associates and Metrowest Oral Surgical Associates, and ends with Chet's Diner.

The fourth cluster (East 2) is northeast of the downtown study area around the intersection of Route 20 and Bartlett Street. It roughly starts with Julia's Alterations Bridal Seamstress, includes tenants such as La Miette La Mai Thai Bistro, Vina's Pizza, and ends with Post Road Marketplace, where The Neighborhood Tavern is located.

Approximately, 57% of these commercial spaces were built before 1990. Only 10.6% or 38,521 square feet were developed since 2010, including 5,800 square feet of offices in the West 2 cluster, 1,948 square feet of medical use and 27,173 square feet of mixed-use office space in the East 1 cluster, and 3,600 square feet of an auto repair shop in the East 2 cluster. The latest retail developments are 25,560 square feet of the 290 West Main Street shopping center in the West 1 cluster and 33,860 square feet of the Post Road

Marketplace in the East 2 cluster, both of which were developed in 2006. Food/drink establishments located at 290 West Main Street shopping center and the Post Road Marketplace are the latest developed, and the remaining ones were developed before 1990 in these four clusters. This suggests that there is a potential for the downtown area to fill in the gap with new retail and eating/drinking establishments.

## 5.5 REAL ESTATE MARKET PERFORMANCE TRENDS

The consultants obtained real estate market data for the retail, office, and apartment sectors from Moody's Analytics, a national real estate market analytics firm. As Marlborough is the primary competitor with Northborough, data for both communities were analyzed to understand real estate market performance between 2012 and 2022. Northborough is within the Worcester market (defined by Moody's), and Marlborough is within the Boston West submarket as defined by Moody's.

## OFFICE MARKET PERFORMANCE

Data for the Worcester Non-CBD (Central Business District) office submarket was examined for Northborough (Figure 5-14). The Worcester Non-CBD submarket has been stagnant during the past decade. It has seen no new inventory between 2012 and 2022, a notably high vacancy rate averaging 26.8% during the ten-year period, and modest asking rent between \$21 and \$23 per square foot.

However, there was some improvement between 2021 and 2022, as the negative impacts of the COVID-19 pandemic started to ease. Office vacancy rates have dropped from 30.8% in 2021 to 26.3% in 2022, as 185,000 square feet of office space were absorbed in 2022, though the net absorption has been mixed in the past decade. Net absorption represents the net change in occupied building space in a given 12-month period. The asking rent has also been steadily increasing by 7.4% during the past decade. Though the demand for office space has started to recover in this submarket, its current vacancy rate is still high, indicating a surplus

of office space supply (Figure 5-15).

The Boston West Suburban office submarket, which includes Marlborough (Figure 5-16), performed better than the Worcester Non-CBD submarket. The Boston West Suburban submarket saw the new completion of 75,000 square feet of office space in 2019, lower vacancy rates averaging 19.9% between 2012 and 2022, and higher asking rents averaging \$25.3 per square foot during this decade (Figure 5-17).

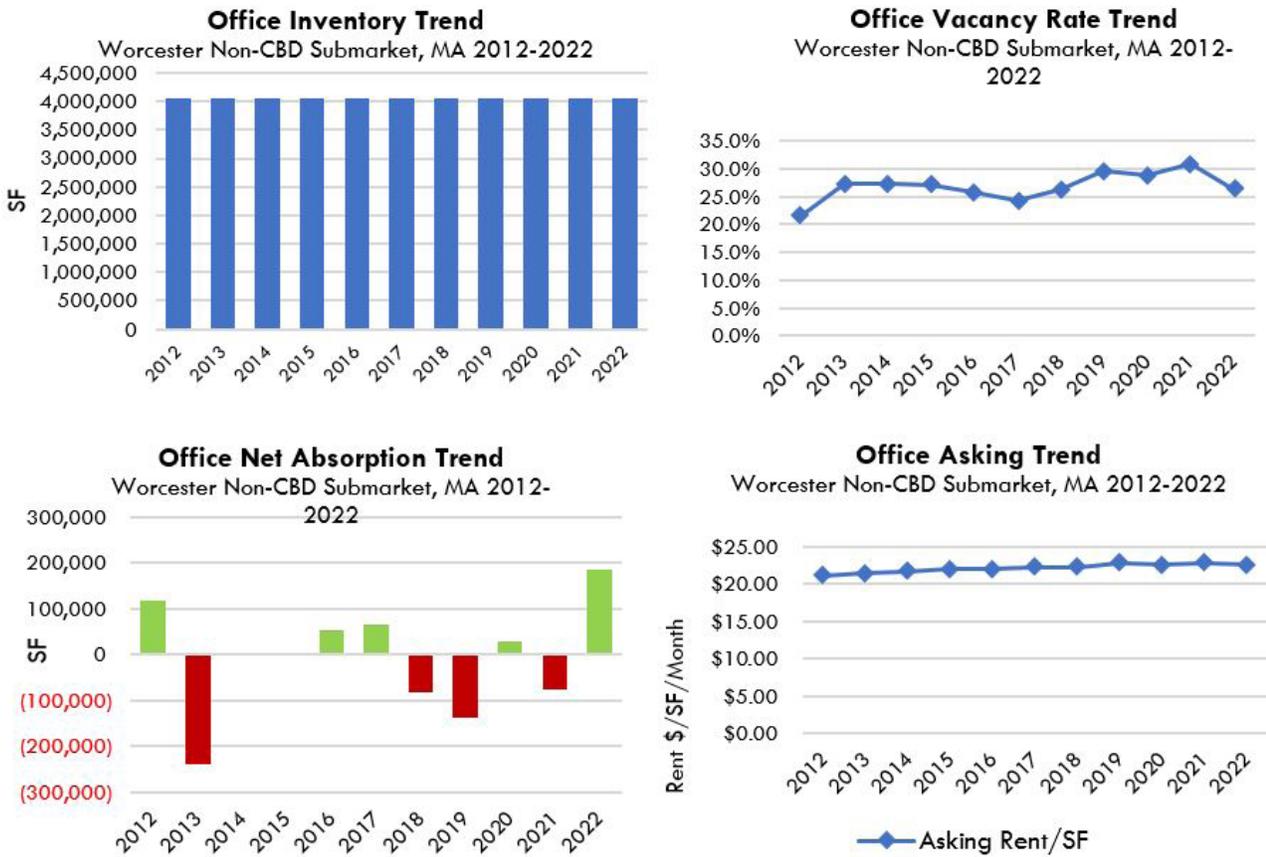
However, in general, this office submarket is still challenged with a stagnant inventory and rising vacancy rates since 2020, as well as negative net absorptions in 2021 and 2022. It also has lower effective rents than asking rents, with an effective rent of \$21.40 per square foot in 2022, which is 20.3% lower than the asking rent of \$26.84 in the same year. The asking rent is the rental price listed by the landlord, while the effective rent is the actual average amount that a renter pays on a monthly basis for the lease of a rental property. Simply put, the Boston West Suburban office submarket still seemed to be under

**Figure 5-14: Worcester Non-CBD Office Submarket**



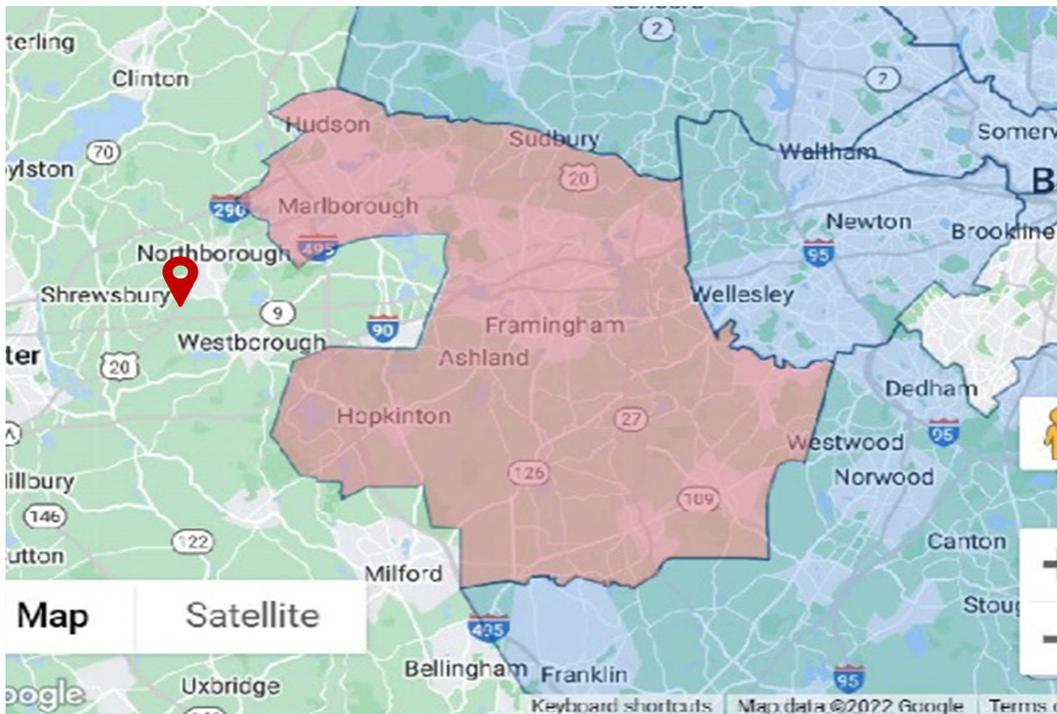
Source: Moody's Analytics, 2023

Figure 5-15



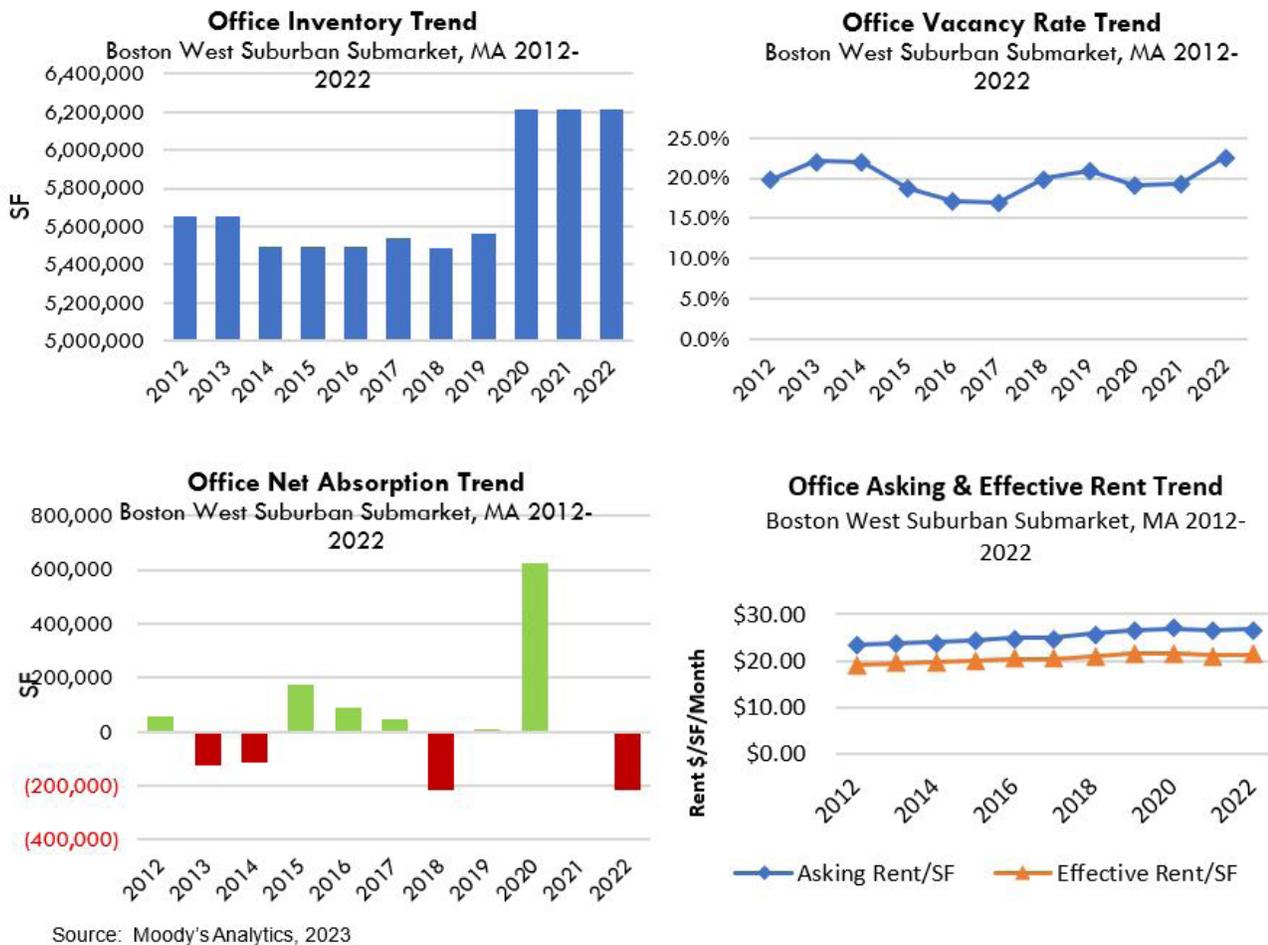
Source: Moody's Analytics, 2023

Figure 5-16: Boston West Suburban Office Market



Source: Moody's Analytics, 2023

**Figure 5-17**



the impact of the COVID-19 pandemic as of 2022, while the Worcester Non-CBD office submarket had shown signs of recovery between 2021 and 2022.

### APARTMENT MARKET PERFORMANCE

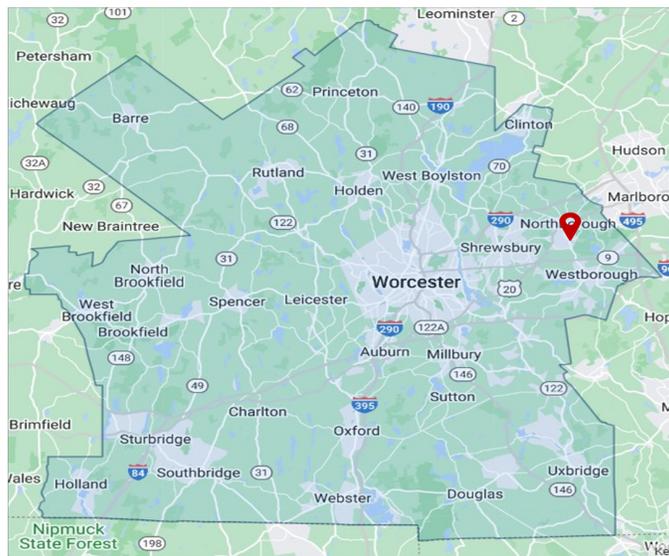
The performance of the Worcester apartment market (Figure 5-18) between 2012 and 2022 seems promising considering all building classes, with steadily growing inventory, exceptionally low vacancy rates, almost all positive net absorptions, and rising asking rents during this decade. This market has last seen 72 units delivered in 2020, with an inventory of 12,762 units in 2022. It has remarkably low vacancy rates, with a 2.2% vacancy rate in 2022, and the vacancy rates have been on a downward trend as well during the past decade. The Worcester market has also seen all positive net absorptions since 2013, and a 36.6% increase in the asking rent between 2012 and 2022, with the asking rent standing at \$1,572 per unit in 2022 (Figure 5-19).

All these suggest that the apartment market in the

Worcester market area is extremely tight, with the majority of the apartment inventory occupied, which creates a very competitive market for those looking for an apartment. The market trend data indicates the Worcester market area is likely to remain strong, and there is the potential for new apartment development to meet robust demand in the future.

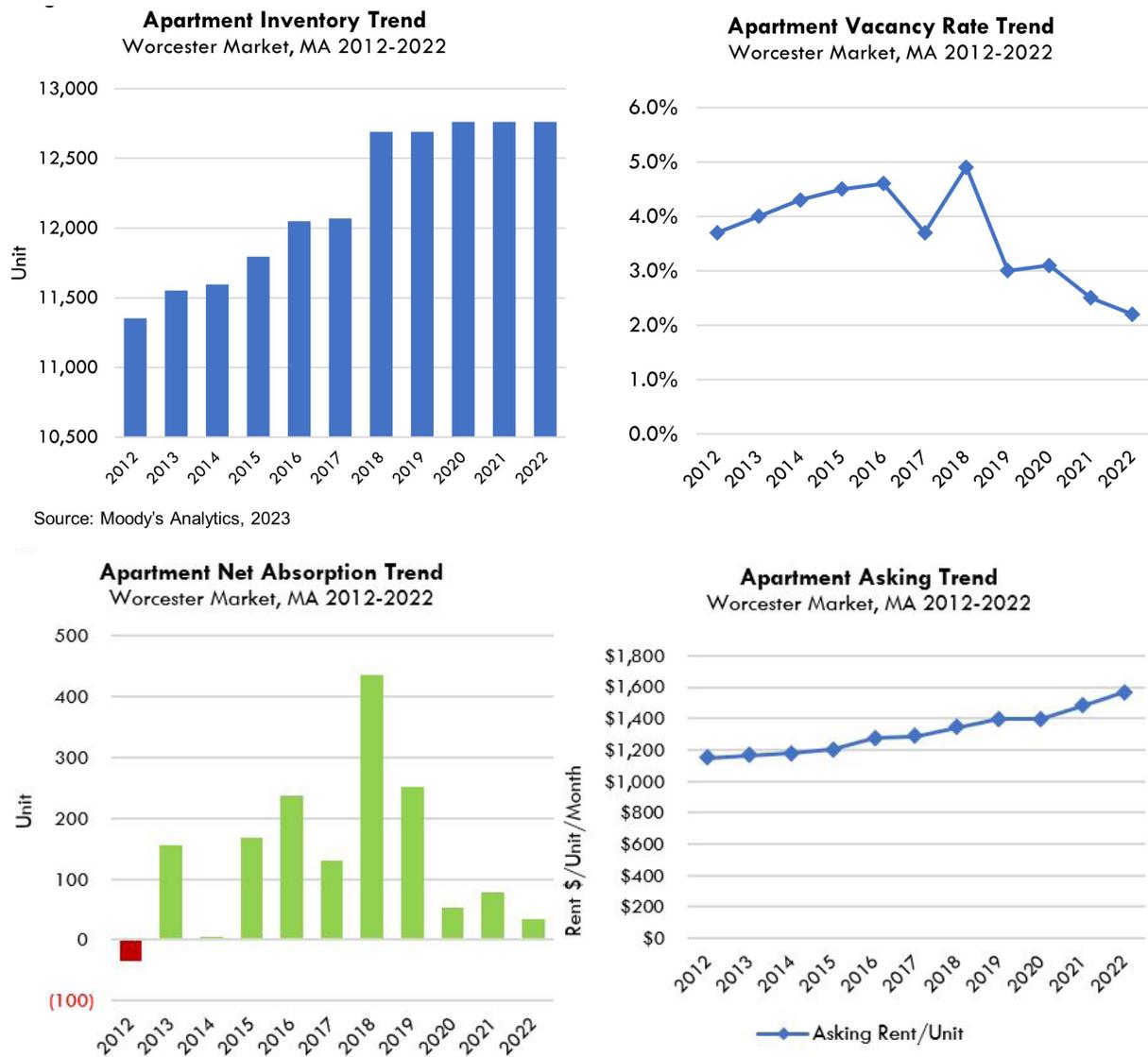
The apartment market performance between 2012 and 2022 in the Boston West/Northwest Suburban submarket (Figure 5-20) was also positive, with rising inventory, low vacancy rates, positive net absorptions, and soaring rents. It last saw the delivery of 965 new units in 2020, and its 2022 inventory stood at 23,851 units. This submarket is a higher-priced apartment market than the one in the Worcester area, as the asking rent in 2022 was \$2,569 per unit, which is 1.6 times that of the Worcester market during the same year. The asking rents in the Boston West/Northwest Suburban submarket have also climbed faster than the Worcester market, with asking rents jumping by 60.2% and effective rents soaring by 64.5% between 2012 and 2022.

**Figure 5-18: Worcester Apartment Market**



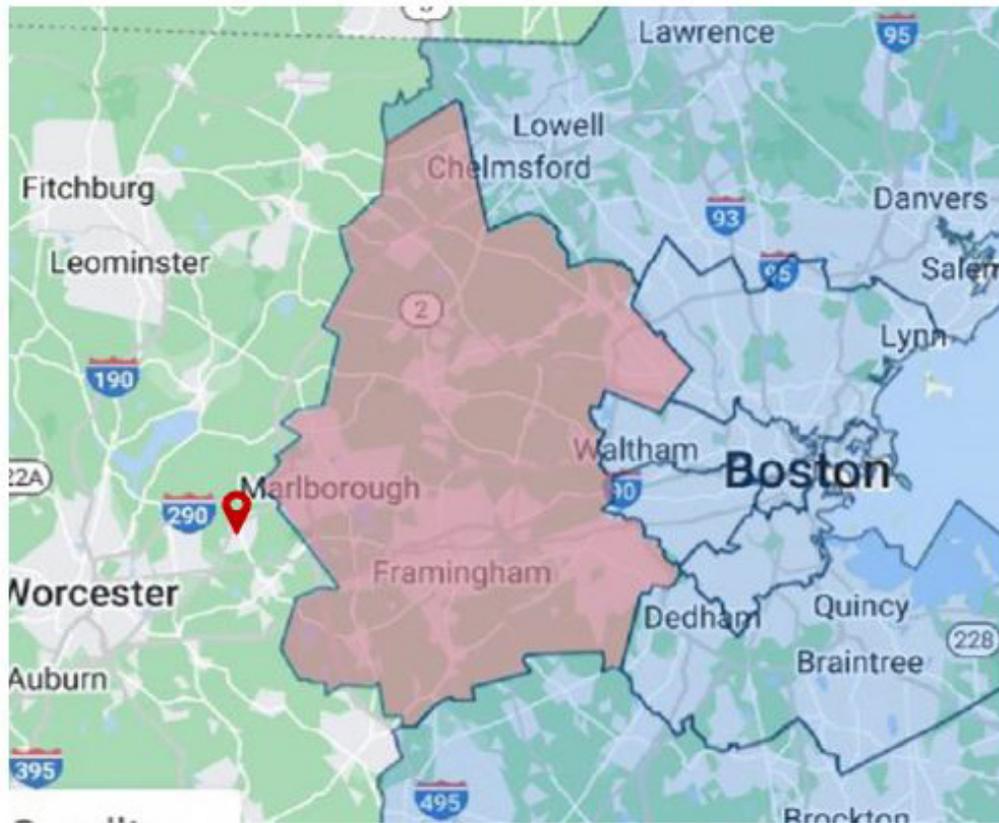
Source: Moody's Analytics,

**Figure 5-19**



Source: Moody's Analytics, 2023

**Figure 5-20: Boston West/Northwest Suburban Apartment Submarket**



Source: Moody's Analytics, 2023

Its vacancy rates are also low, fluctuating around the average of 5.4% during the past decade, but it was not as low as the Worcester figure in 2022. This likely suggests that the apartment market in the Boston West/Northwest Suburban submarket is more established than the Worcester market, with the apartment supply

catching up well with the rising strong demand (Figure 5-21).

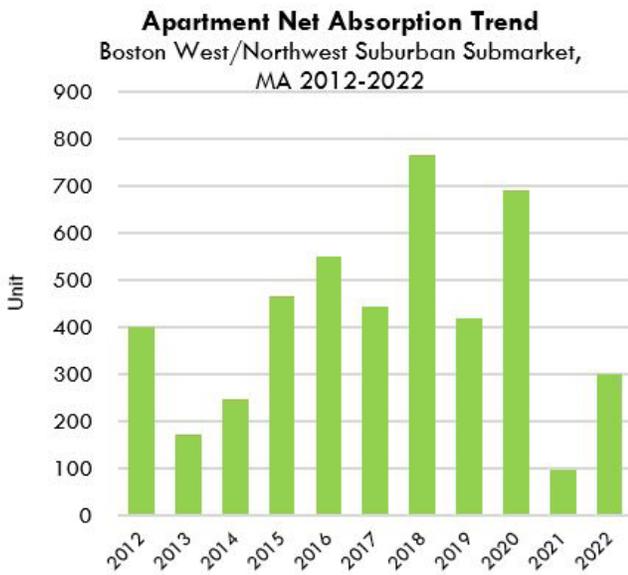
### APARTMENT PRICING ANALYSIS

The consultants also conducted internet research on Apartments.com and apartment property websites to

**Figure 5-21**



**Figure 5-21 Continued**

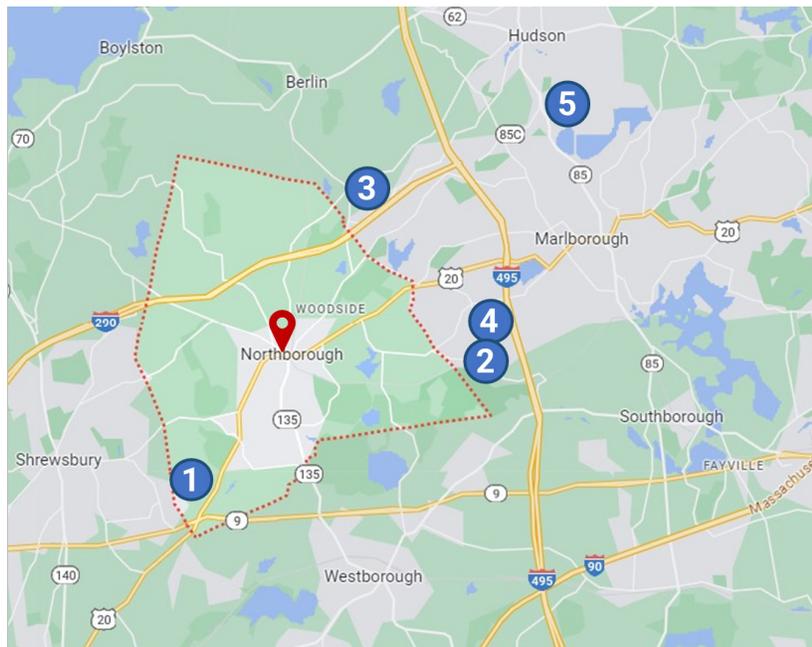


Source: Moody's Analytics, 2023

document and analyze existing apartment competitors' pricing situation in the study region. For the purpose of this study, new market-rate multi-family apartments of higher quality with at least 50 units built since 2015 were considered potential competitors, as they are more comparable to new apartment developments that could be potentially developed in downtown Northborough.

A total of five apartment complexes in Northborough, MA, Marlborough, MA, and Hudson, MA, were identified as potential competitors, totaling 1,470 units (Map 5-3, Table 5-9). The approximate location of the midpoint of downtown Northborough is illustrated with a red pin on the map. Note that though Avalon Northborough was built in 2010, it is the only multi-family apartment of comparable scale with at least 50 units built since 2000 in Northborough. Therefore, it is

**Map 5-3: Apartment Competitors in the Greater Northborough Area**



Source: Google Maps and RKG Associates, Inc., 2023

included in this study for analysis.

The result of the consultants' pricing research (Table 5-10) shows that the asking rent per square foot is around \$3 per square foot across unit types among these five competitors and can even go above \$4.6 per square foot for studios (in the Burrow apartment in Marlborough, MA). The most common unit types are one-bedroom units with one bathroom, and two-bedroom units with two bathrooms.

The consultants also calculated the total median

values for unit size, monthly asking rent, and asking rent per square foot across the five competitors and across all unit types available in these five projects. The result shows that the median monthly rent ranges between \$2,600 and \$4,000, and the median rent per square foot ranges between \$2.21 per square foot to \$4.41 per square foot depending on the unit type (Table 5-11).

## RETAIL MARKET PERFORMANCE

The retail market in the Worcester market (Figure 5-22), which includes Northborough, is stabilizing, with

**Table 5-9**

<b>Apartment Competitors</b>		
<b>No.</b>	<b>Name</b>	<b>Units</b>
1	Avalon Northborough (2010) (Northborough)	382
2	The Burrow (2022) (Marlborough)	235
3	The Rockwell (2020) (Marlborough)	204
4	Avalon Marlborough (2015) (Marlborough)	473
5	Matrix Hudson (2016) (Hudson)	176
<b>Total</b>		<b>1,470</b>

Source: Property Websites, Apartments.com, and RKG Associates, Inc., 2023

**Table 5-10**

**Median Square Footage and Median Asking Rents of Existing Competitors  
Northborough, Marlborough, and Hudson, MA**

<b>Name</b>	<b>Bedroom</b>	<b>Bathroom</b>	<b>Med. SQFT</b>	<b>Med. Monthly Rent</b>	<b>Med. Rent PSF</b>
<b>Northborough, MA</b>					
<b>Avalon Northborough (2010) (382 Units)</b>					
1B1B	1	1	800	\$2,445	\$3.06
2B2B	2	2	1,273	\$2,925	\$2.30
2B2.5B	2	2.5	1,702	\$3,804	\$2.24
3B2B	3	2	1,313	\$3,338	\$2.54
<b>Marlborough, MA</b>					
<b>The Burrow (2022) (235 Units)</b>					
Studio	Studio	1	600	\$2,715	\$4.53
1B1B	1	1	740	\$2,785	\$3.76
2B2B	2	2	1,130	\$3,603	\$3.19
3B2B	3	2	1,380	\$4,270	\$3.09
<b>The Rockwell (2020) (204 Units)</b>					
Studio	Studio	1	725	\$1,984	\$2.74
1B1B	1	1	949	\$2,712	\$2.86
1B1.5B	1	1.5	1,010	\$2,887	\$2.86
2B2B	2	2	1,201	\$3,121	\$2.60
<b>Avalon Marlborough (2015) (473 Units)</b>					
1B1B	1	1	845	\$2,596	\$3.07
2B2B	2	2	1,297	\$2,933	\$2.26
2B2.5B	2	2.5	1,641	\$3,311	\$2.02
<b>Hudson, MA</b>					
<b>Matrix Hudson (2016) (176 Units)</b>					
1B1B	1	1	886	\$2,595	\$2.93
2B2B	2	2	1,100	\$3,095	\$2.81

Source: Property Websites, Apartments.com, and RKG Associates, Inc., 2023

**Table 5-11**

Commercial Property Development Trends by Building Square Footage/Units (1990-2021)  
Northborough, MA

	Before 1990	1990-1999	2000-2009	2010-2021	Total Since 1990	Percent	Total All Years	Percent
Apartment (Units)	125	0	12	733	745	N/A	870	N/A
Auto	29,092	0	143,468	44,010	187,478	10.7%	216,570	7.7%
Gas Station	4,810	0	0	3,976	3,976	0.2%	8,786	0.3%
Food/Drink	35,573	2,210	0	0	2,210	0.1%	37,783	1.3%
Hospitality	75,200	0	0	0	0	0.0%	75,200	2.7%
Retail	93,701	193,233	15,638	0	208,871	11.9%	302,572	10.7%
Shopping Center	132,881	21,147	59,420	751,431	831,998	47.5%	964,879	34.2%
Service	26,496	5,445	17,460	24,208	47,113	2.7%	73,609	2.6%
Office	408,674	53,868	250,113	7,437	311,218	17.8%	719,892	25.5%
Medical	31,568	0	32,265	31,372	63,637	3.6%	95,205	3.4%
Mixed Use	218,596	25,917	0	39,407	65,324	3.7%	283,920	10.1%
Agriculture	12,742	0	0	0	0	0.0%	12,742	0.5%
Commercial Condo	0	1,667	26,320	0	27,987	1.6%	27,987	1.0%
Total - Commercial SF	1,069,333	303,287	544,684	901,841	1,749,812	100.0%	2,819,145	100.0%
Percent of Total SF	37.9%	10.8%	19.3%	32.0%	62.1%		100.0%	

Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

stagnant inventory growth since 2019, rising vacancy rates, mixed building absorption, and stagnant asking rents between 2012 and 2022.

After the completion of 18,000 square feet of new retail space in 2019, the sub-market's retail inventory has remained steady at 7.6 million square feet. This is largely attributable to the Covid-19 pandemic, which stalled the construction of many commercial projects over the last few years.

The retail vacancy rate has been rising steadily from 8.0% in 2012 to 13.0% in 2022, increasing between 2021 and 2022 despite a slight decline in the prior year. Though this market absorbed 41,000 square feet of retail space between 2020 and 2021, its net absorption was negative in 2022, indicating weakening demand even though the negative economic impacts of the COVID-19 pandemic shutdown have largely subsided. The asking rent trend has also been almost flat, hovering around \$20 per square foot during the past decade (Figure 5-23).

In comparison, the Boston West submarket has also experienced stagnant inventory growth since 2018 and rising vacancy rates (Figure 5-24). However, it showed

more resilience and better market performance between 2012 and 2022 than the Worcester market. Boston West sub-market's retail vacancy rate was 6.9% in 2022, much lower than the Worcester market, and it also dropped between 2021 and 2022 with positive absorption in 2022. After 35,000 square feet were last released in 2018, this sub-market's retail inventory has remained at 4,298,000 square feet. The Boston West submarket has also seen negative net absorptions and rising vacancy rates between 2020 and 2021, most likely impacted by the COVID-19 pandemic shutdown.

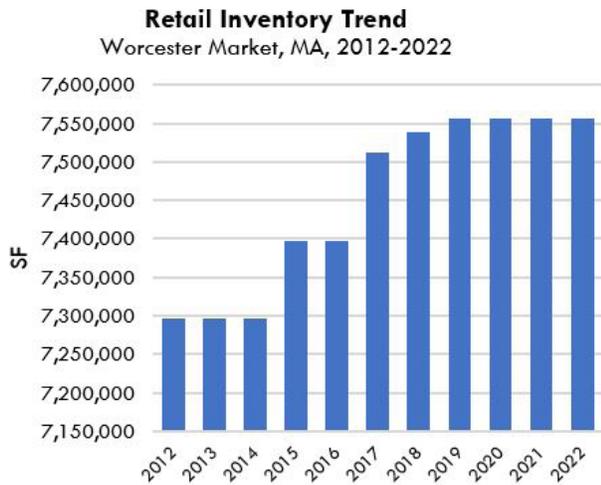
However, both net absorption and the vacancy rate have shown signs of recovery in 2022 along with both asking rent and effective rent increasing. Boston West sub-market's asking rent is also higher than that of the Worcester market, standing at \$25.67 per square foot in 2022. This is likely because of the subsiding negative impacts of the COVID-19 pandemic and the improving economy in 2022, indicating resilience in the retail market (Figure 5-25).

**Figure 5-22: Worcester Retail Market**

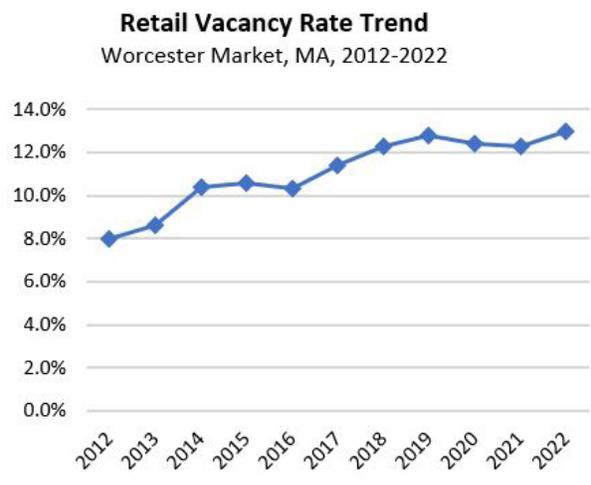


Source: Moody's Analytics, 2023

**Figure 5-23**



Source: Moody's Analytics, 2023



Source: Moody's Analytics, 2023

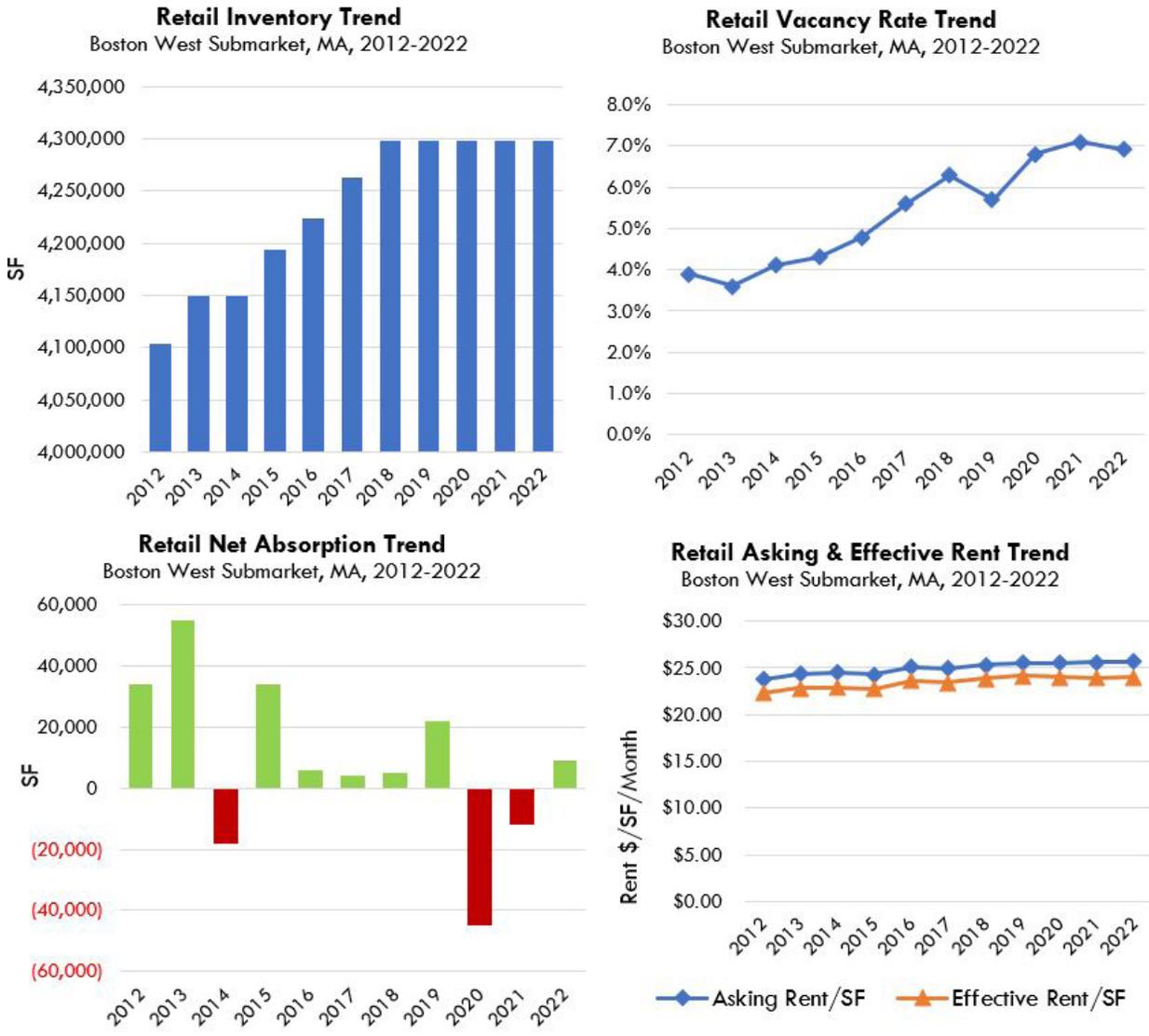


**Figure 5-24: Boston West Retail Submarket**



Source: Moody's Analytics, 2023

**Figure 5-25**



Source: Moody's Analytics, 2023

## 5.6 RETAIL SUPPLY/DEMAND GAP ANALYSIS

### METHODOLOGY

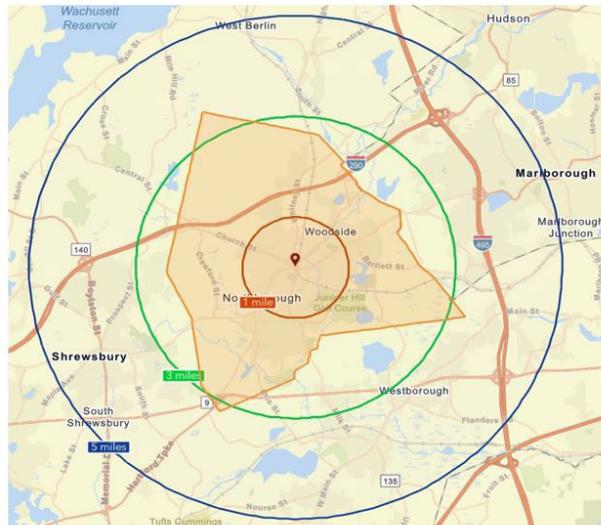
The consultants obtained the 2023 retail demand and supply data, as well as the projected 2028 retail demand data by the North American Industry Classification System (NAICS) category from Environics, a third-party data provider based in the U.S. The study area was set as the zero-to-one-mile, one-to-three-mile, and three-to-five-mile radius from the 4 W Main Street site at the center of Downtown Northborough (Map 5-4). The retail demand and supply data are represented by retail sales numbers in U.S. dollars. The consultants then projected the 2028 retail supply

numbers by extrapolating the 2023 supply figures based on the projected retail demand growth between 2023 and 2028 for each NAICS category. One mile is around a 20-minute walk, three miles are around five minutes' drive, and five miles are around 10 minutes' drive (assuming 30 miles/hour). The retail gap/surplus was then calculated by subtracting the supply numbers from the demand figures by the NAICS category.

### What is a Retail Supply/Demand Gap?

If the retail demand for this NAICS category exceeds the retail supply, then it results in a retail demand gap that could potentially be captured and served by new businesses in downtown Northborough. If the supply exceeds demand, then it leads to a retail demand surplus for this NAICS category. Simply put, if there

## Map 5-4



is a retail demand gap for a retail category, then there are not enough retail supply/businesses to serve the consumers. For example, if local consumers have a demand for \$1 million in grocery store items and there is only one small market capturing sales of \$150,000/year, then it is assumed that local consumers are traveling outside their immediate market to do their grocery shopping. In this example, \$850,000 in consumer spending is said to have “leaked” outside the local market and is being captured by grocery stores in other nearby areas. In addition, people typically make shopping purchases outside their immediate market out of convenience. Many people shop on their way to and from work or online, so it is not possible to capture all demand gaps.

If there is a retail demand surplus, then it suggests an oversupply of goods and services for this retail category, and there are not many opportunities for retail newcomers in this area as the existing competition is already fierce. Calculating and understanding how much retail demand gap exists for which retail categories within five miles of downtown Northborough will help inform the discussion of what types of businesses should be introduced to the downtown, and how many square feet of retail spaces could potentially be supported by the unmet market.

### How can the data inform our study?

Industry benchmarks of national sales per square foot were then utilized to convert the retail demand gap figures into the supportable retail square footage. Capture rates were then set and applied for each retail category and for each radius area to calculate how much new retail demand downtown Northborough can potentially attract and serve in 2028. The result is

represented by the total supportable retail square feet figure, which indicates how many square feet of retail spaces can be supported by the unmet retail demand within five miles of downtown Northborough in 2028. The total supportable square feet figure is also broken down by NAICS categories.

### PROJECTED 2028 RETAIL DEMAND GAP RESULT

In summary, areas within the five-mile radius of downtown Northborough can support 121,315 square feet of new retail spaces in 2028. A breakdown by retail category is shown in Table 5-12. Out of the 121,315 square feet, Restaurants/Other Eating Places contribute the largest share of 27.1%, totaling 32,836 square feet. This is followed by Other General Merchandise Stores (15.9%, 19,235 square feet) and Grocery Stores (10.9%, 13,255 square feet). These footage values are significant enough to support new businesses in downtown Northborough. For reference, a typical mom-and-pop restaurant is usually around 2,000 to 3,000 square feet. That means the supportable square feet for Restaurants/Other Eating Places within the five-mile radius of downtown can translate into around 10 new restaurants and/or other eating places. The 13,255 square feet of supportable Grocery Store spaces can translate into a smaller grocery store common in an urban setting.

The U.S. Census defines Other General Merchandise Stores in this way: “These establishments retail a general line of new and used merchandise, such as apparel, automotive parts, dry goods, groceries, hardware, housewares or home furnishings, and other lines in limited amounts, with none of the lines predominating.” Examples of Other General

**Table 5-12**

**Commercial Property Development Trends by Building Square Footage/Units (1990-2021)  
Downtown Study Area, Northborough, MA**

	Before 1990	1990-1999	2000-2009	2010-2021	Total Since		Total All	
					1990	Percent	Years	Percent
Apartment (Units)	32	0	12	10	22	N/A	54	N/A
Auto	5,632	0	0	0	0	0.0%	5,632	2.0%
Gas Station	4,810	0	0	3,976	3,976	7.0%	8,786	3.1%
Food/Drink	14,194	2,210	0	0	2,210	3.9%	16,404	5.8%
Retail	30,596	0	15,638	0	15,638	27.7%	46,234	16.4%
Shopping Center	6,963	0	0	16,502	16,502	29.2%	23,465	8.3%
Service	21,424	5,445	0	2,920	8,365	14.8%	29,789	10.6%
Office	83,335	8,130	0	1,637	9,767	17.3%	93,102	33.0%
Mixed Use	19,517	0	0	0	0	0.0%	19,517	6.9%
Industrial/Warehouse	39,035	0	0	0	0	0.0%	39,035	13.8%
Total - Commercial SF	225,506	15,785	15,638	25,035	56,458	100.0%	281,964	100.0%
Percent of Total SF	80.0%	5.6%	5.5%	8.9%	20.0%		100.0%	

Source: Northborough Property Assessment, and RKG Associates, Inc., 2023

Merchandise Stores include dollar stores, general merchandise (new and used) auction houses, general stores, home and auto supply stores, and variety stores. Examples of Other Miscellaneous Store Retailers include stores with unique characteristics like florists, used merchandise stores, and pet supply stores as well as other store retailers.

The consultants envision potential businesses for the categories of Furniture and Home Furnishings Stores, Clothing Stores, Shoe Stores, and Jewelry, Luggage and Leather Goods Stores to be local small businesses and boutique shops that are common in a downtown setting. Note that though there are capturable spaces for Building Material/Supplies Dealers and Lawn and Garden Equipment/Supply Stores, these two retail categories are not suitable for the downtown area and instead should be located elsewhere in Northborough. For reference, a typical ACE hardware store is 8,000 to 15,000 square feet. In addition, the capturable square footage for Specialty Food Stores (174 square feet) and Sporting Goods/Hobby/Musical Instrument Stores (137 square feet) is not enough to support an individual new store, but the town can consider combining them into other types of stores. Examples include a section for specialty food in the new grocery store and a section for sporting goods/hobby/musical instruments in a general merchandise store. Though there are also capturable spaces for department stores (excluding leased departments), 692 square feet is not enough to support a whole new department store, which is not suitable for a downtown setting either. The town can consider meeting this demand in another capacity in areas outside of the downtown.

It is important to note that the retail demand gap analysis

informs future development and retailing opportunities in Downtown Northborough but is not predictive of the future. The gap analysis is a snapshot of the market potential as it exists today, but the redevelopment of the downtown could take 10 to 20 years or more. In addition, the proposed building development program described later in the master plan does not assume that all three redevelopment scenarios occur at one time, nor does it assume that all three will get implemented in the future. There are too many factors or variables (e.g., limited financial resources, unwilling property owners, changing market conditions, etc.) that could delay, or derail a given redevelopment initiative. The retail gap estimates in this section simply identifies a market opportunity that exists today but does not prescribe where those uses would be located in the future.



# 6. REVITALIZATION ANALYSIS

## 6.1 DOWNTOWN REDEVELOPMENT OPPORTUNITIES

Redevelopment is a process of remaking a property or a group of properties by replacing the existing buildings or integrating new development onto an existing site. Typically, redevelopment involves the removal of older, functionally obsolete buildings to make room for newer, more efficient, and commercially viable buildings. Often it involves replacing existing land uses or introducing mixed-uses (i.e., combining residential with commercial uses) on the same site to diversify the market and financial viability.

The Weston & Sampson team examined a number of factors to determine the best redevelopment opportunities for Downtown Northborough. To be successful, the planning elements must first respond to measurable demand indicators that prove that there is a need for the proposed project and that private developers or property owners would be interested in pursuing redevelopment and investing their money in the Town.

### LAND USE CHARACTERISTICS

The study area is roughly five blocks wide and three blocks long, stretching from River Street in the east to Monument Drive in the west, and from Gale Street in the south to the location where Cold Harbor Brook passes below Hudson Street in the north. The downtown's commercial core is located along Route 20 from Hudson Street to Monument Drive. Figure 6-1 shows the locations of various land uses, which represent the primary use for each parcel within the downtown study area.

There is roughly 525,392 SF of building space within 79.4 acres of land. The largest single land use category is single-family residential, which accounts for 20.3% of total land area. Office uses comprised the most building square footage at 93,102 SF (17.7%) (Table 6-1). In total, it is estimated that there are 269 housing units located within the study area, 43% of which are affordable rental units owned by the Northborough Housing Authority and another non-profit.

Other important land use categories include retail/shopping centers (69,699 SF), industrial/warehouse (39,035 SF), service (29,789 SF) and food & drinking places (16,404 SF).

### PROPERTY OWNERSHIP PATTERNS

Since property acquisition and land assemblage is often an important element in downtown redevelopment projects, the consultants analyzed downtown property ownership patterns to identify multiple properties owned by the same entity or person. The presumption is that acquiring properties owned by the same person is potentially easier than acquiring multiple properties from multiple owners.

While it's difficult to know in every case because people create different limited liability corporations (LLCs) as holding companies for different real estate assets, the Weston & Sampson team identified twenty-seven properties within the study area that appear to be owned by individuals and corporations with multiple property interests. These properties contain 76,509 SF of building space on over 16 acres of land and have a total assessed valuation of \$11.2 million (Figure 6-2). Also, several of these properties are considered key properties for redevelopment and are shown in Table 6-2.

As shown in Figure 6-2, the single largest landowner is the Town of Northborough which owns 12 properties within the overall study area. Some of these properties include the new Town Common, the Town Library, the former Town Hall at 4 West Main Street, the current Town Hall at 63 Main Street, the former Fire Station at 13 Church Street, the current Fire Station at 11 Pierce Street, and the new site for the Northborough Fire Station on West Main Street. While some of those properties will not be part of the redevelopment scheme, others could be part of those efforts.

### VACANT LAND AND BUILDINGS

Another factor to consider is the presence of vacant

**Table 6-1**

**Downtown Study Area Land Uses by Acres and Building SF or Units (2022)  
Northborough, MA**

<b>Land Use Types</b>	<b>Total Lot Acres</b>	<b>Total Building SF/Units</b>	<b>% of Total Acres</b>	<b>% of Total Bldg. SF/Units</b>
Single Family Resider	16.1	77,006	20.3%	16.1%
Duplex	0.0	6,302	0.0%	1.3%
Townhouse	0.0	3,591	0.0%	0.8%
3+ Unit House	2.7	18,627	3.4%	3.9%
Apartment (Units)	3.1	54	3.9%	N/A
Residential-Vacant	0.5	6,157	0.6%	1.3%
Auto	0.5	5,632	0.6%	1.2%
Gas Station	1.5	8,786	1.9%	1.8%
Food/Drink	2.5	16,404	3.2%	3.4%
Retail	4.7	46,234	5.9%	9.7%
Shopping Center	4.4	23,465	5.5%	4.9%
Service	5.2	29,789	6.5%	6.2%
Office	9.6	93,102	12.1%	19.5%
Commercial-Vacant	0.7	8,154	0.9%	1.7%
Mixed Use	1.7	19,517	2.1%	4.1%
Industrial/Warehouse	10.0	39,035	12.6%	8.2%
Church	1.9	15,890	2.4%	3.3%
Civic	6.8	16,950	8.5%	3.5%
Civic-Vacant	0.4	5,450	0.5%	1.1%
Government	1.9	33,057	2.4%	6.9%
Fire Station	1.0	5,160	1.3%	1.1%
Park	2.5	0	3.1%	0.0%
Parking	0.8	0	1.0%	0.0%
Vacant Land	1.0	0	1.3%	0.0%
<b>Grand Total</b>	<b>79.39</b>	<b>478,308</b>	<b>100.0%</b>	<b>100.0%</b>

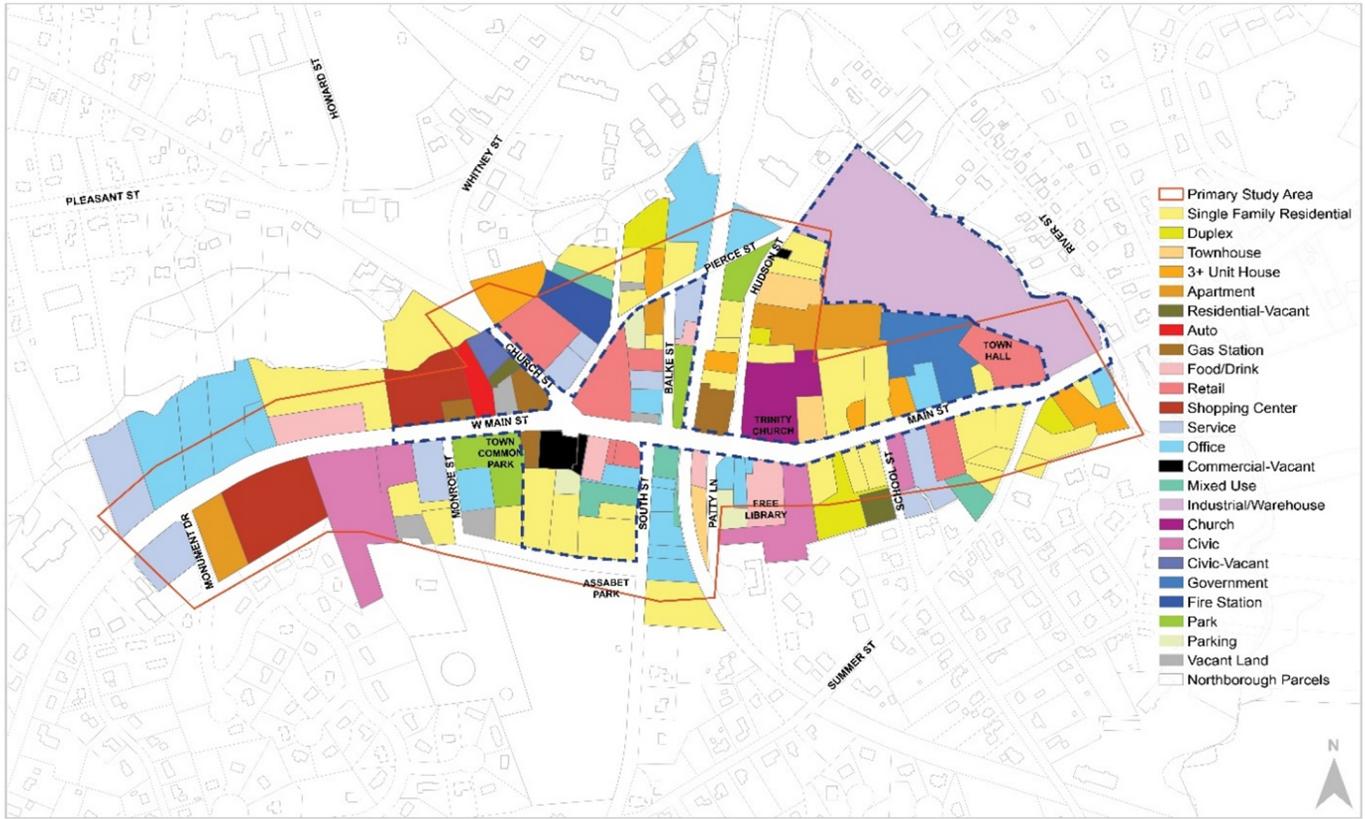
Source: Northborough Property Assessor's Office and RKG Associates, Inc.

land and buildings that can be either developed or adaptively reused in the future. Typically, this would not include parking lots, which are an important resource in every downtown, unless they are relocated or included in a new parking garage. Vacant buildings, if they're greatly deteriorated and have no historical value, may be candidates for demolition and replacement.

Based on the consultants' analysis, there are roughly eleven vacant properties located within the study area containing 19,761 SF of building space on 2.61 acres (Figure 6-3). While some of these properties are in

potential redevelopment areas, none are expected to have a major impact on future revitalization plans. Some vacant buildings are currently under renovation so they can be leased to new tenants in the near future. Two significant buildings that are not currently vacant but will become vacant in the near future are the Northborough Fire Station (5,160 SF) at 11 Pierce Street and the former Town Hall building located at 4 West Main Street (26,321 SF). Both of those buildings are in active use but will eventually become vacant and create opportunities for new and exciting adaptive reuse projects in the future.

**Figure 6-1: Downtown Study Area Land Use Characteristics**



Source: RKG Associates, Inc., 2023

**Figure 6-2: Downtown Study Area Owners with Multiple Properties**

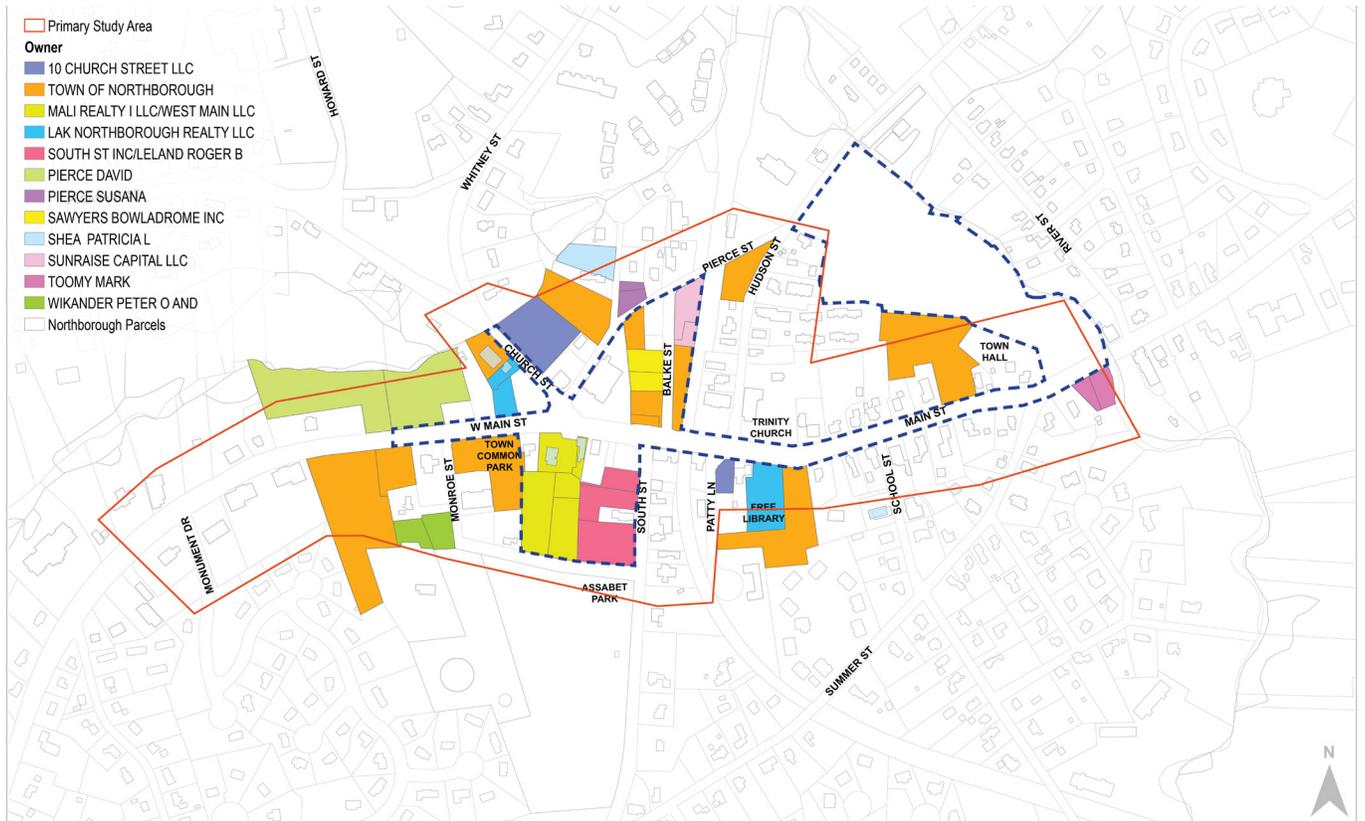


Table 6-2

**Northborough, MA Downtown Study Area - Key Properties  
2023**

No.	Owner Name	Property Type	Year Built	Building Area (SF)	Lot Size	Total Assessed Value
<b>Convenience Shopping Services Area</b>				<b>16,301</b>	<b>1.95</b>	<b>\$2,663,400</b>
A	LAK NORTHBOROUGH REALTY LLC	Residential-Vacant	1880	1,869	0.14	\$294,000
B	36 WEST MAIN STREET LLC	Gas Station	1956	2,121	0.43	\$769,600
C	LAK NORTHBOROUGH REALTY LLC	Vacant Land	0	0	0.23	\$227,300
I	WCD GARAGE INC	Auto	1916	5,632	0.51	\$536,900
P	SANDZ-E LLC	Gas Station	1965	1,229	0.22	\$480,600
Q	TOWN OF NORTHBOROUGH	Civic-Vacant	1900	5,450	0.42	\$355,000
<b>Commercial Mixed-Use Area</b>				<b>15,429</b>	<b>2.13</b>	<b>\$ 2,686,600</b>
D	NEW ENGLAND LIQUOR RETAILS LLC	Retail	1970	1,540	0.08	\$284,700
E	MALI REALTY I LLC	Commercial-Vacant	1866	4,840	0.15	\$495,300
K	WEST MAIN LLC	Commercial-Vacant	1979	2,994	0.51	\$585,300
S	CARBONNEAU LAURIE	Residential	1925	1,315	0.85	\$295,000
W	VEDC LLC	Retail	1981	3,280	0.29	\$495,400
X	HUSAM AUTO SERVICE INC	Gas Station	1940	1,460	0.25	\$530,900
<b>Entertainment/Dining/Residential Area</b>				<b>80,199</b>	<b>4.65</b>	<b>\$11,156,400</b>
G	TRSTEE	Apartment	2004	10,706	0.23	\$1,373,000
H	MAGALHAES ANNA CAROLINA R M	Residential	1829	1,656	0.10	\$365,800
J	SAWYERS BOWLADROME INC	Service	1900	5,882	0.21	\$544,400
L	SAWYERS BOWLADROME INC	Retail	1900	8,704	0.28	\$722,700
M	SUNRAISE CAPITAL LLC	Service	1900	4,032	0.43	\$445,000
N	SUNRAISE CAPITAL LLC	Food/Drink	1900	2,100	0.13	\$410,700
O	TOWN OF NORTHBOROUGH	Parking	0	0	0.26	\$228,300
R	TOWN OF NORTHBOROUGH	Fire Station	1975	5,160	1.00	\$1,449,500
T	TOWN OF NORTHBOROUGH	Vacant Land	0	0	0.10	\$221,900
U	TOWN OF NORTHBOROUGH	Park	0	0	0.44	\$197,700
V	NORTHBORO COMMONS LLC	Office	1900	26,321	0.29	\$2,222,100
Y	NORTHBORO CENTER PLAZA LLC	Retail/Gas Station	2008	15,638	1.18	\$2,975,300
<b>Riverfront Residential Mixed-Use Area</b>				<b>39,035</b>	<b>10.00</b>	<b>1,865,400</b>
F	Trustees	Industrial/Warehouse	1900	39,035	10.00	\$1,865,400
<b>Total - All Properties</b>				<b>150,964</b>	<b>18.73</b>	<b>18,371,800</b>

Source: Town of Northborough Property Assessor's data and RKG Associates, Inc., 2023

## 6.2 REDEVELOPMENT CATALYST AREAS

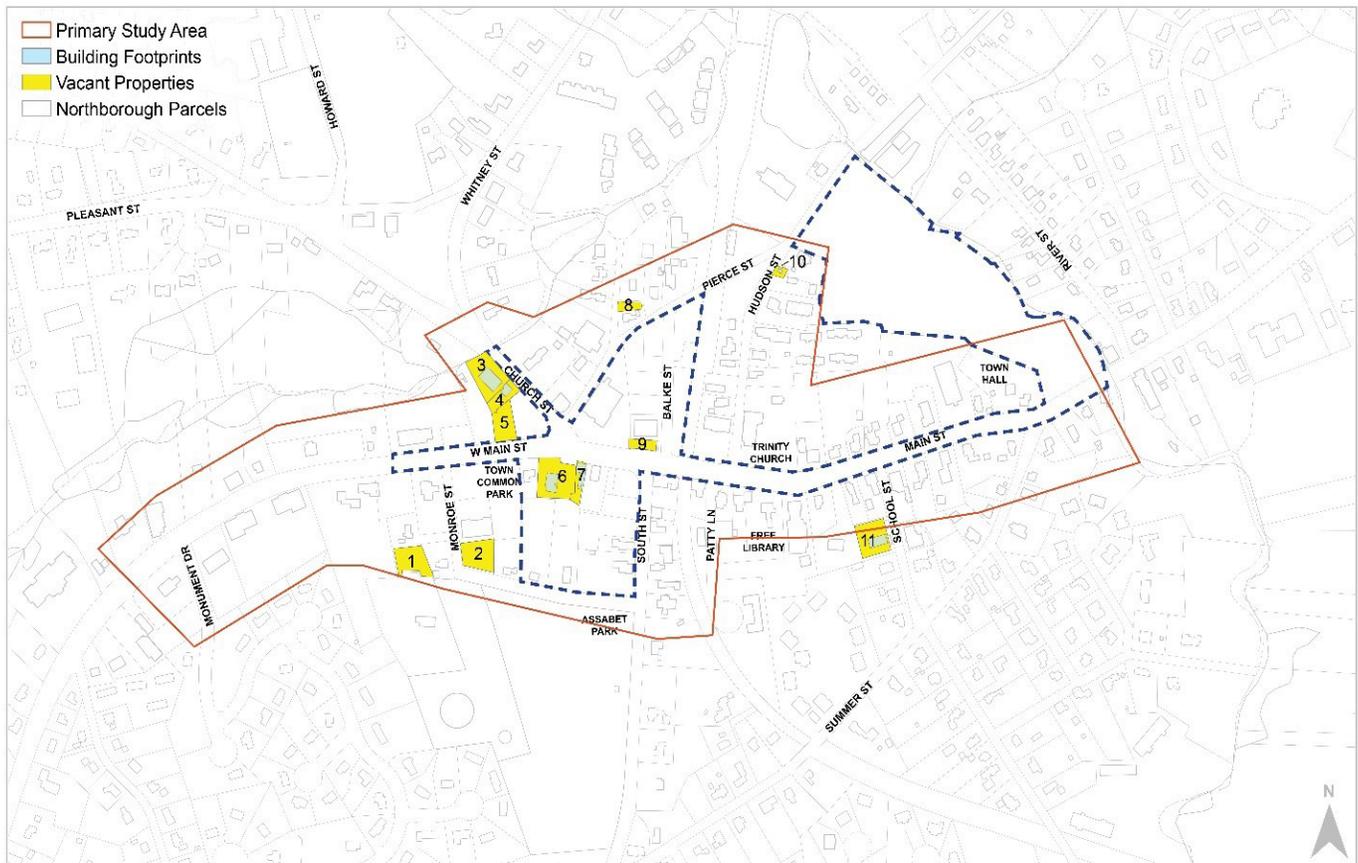
Most successful downtown revitalization efforts depend on certain catalyst investments or projects to draw attention to future opportunities. The same is true for Downtown Northborough. After considerable research, the consultants believe the following redevelopment areas create the framework for new catalyst development to occur. This is because certain important properties, either publicly- or privately-owned, have the potential to change in use over time to attract new development or businesses that will expand commercial and residential opportunities in the study area.

Each area has been programmed with a different theme or development focus that will guide future redevelopment activities. It is not the Town’s intent to be overly prescriptive in its future land use goals for these areas, but rather to offer a vision to future investors as to the future direction of Downtown Northborough. The following figure and table call out the key properties which define each one of these themed areas (Figure 6-4/Table 6-2).

In total, there are 25 properties located within the downtown study area that are considered key parcels for future redevelopment. These parcels account for 150,964 SF of building space on 18.7 acres of land and have an assessed value of \$18.4 million (Table 6-3). The Town of Northborough owns five of those properties, consisting mostly of vacant land and two buildings including the current fire station at 11 Pierce Street and an older fire station building at 13 Church Street. The former town hall building at 4 West Main Street is another property with 26,231 SF of office space that reverted back to the Town’s ownership in spring 2023 once the current long-term management lease expired.

These properties are considered key because they are in areas where redevelopment would most likely occur in the future. They are not the only properties that could be included in future redevelopment efforts, but they are the most likely candidates. This is not to suggest that the Town would acquire other privately-owned properties and in many cases the properties would

**Figure 6-3: Downtown Study Area - Vacant Land and Buildings**



not have to be acquired. However, existing or future property owners may have the opportunity to realize a higher and better use of their properties in the future if the Town moves forward with its redevelopment goals. Most projects of this type are implemented by private developers who will work in partnership with the Town and negotiate private development deals directly with downtown property owners.

### FUTURE BUSINESS PROSPECTS BY AREA

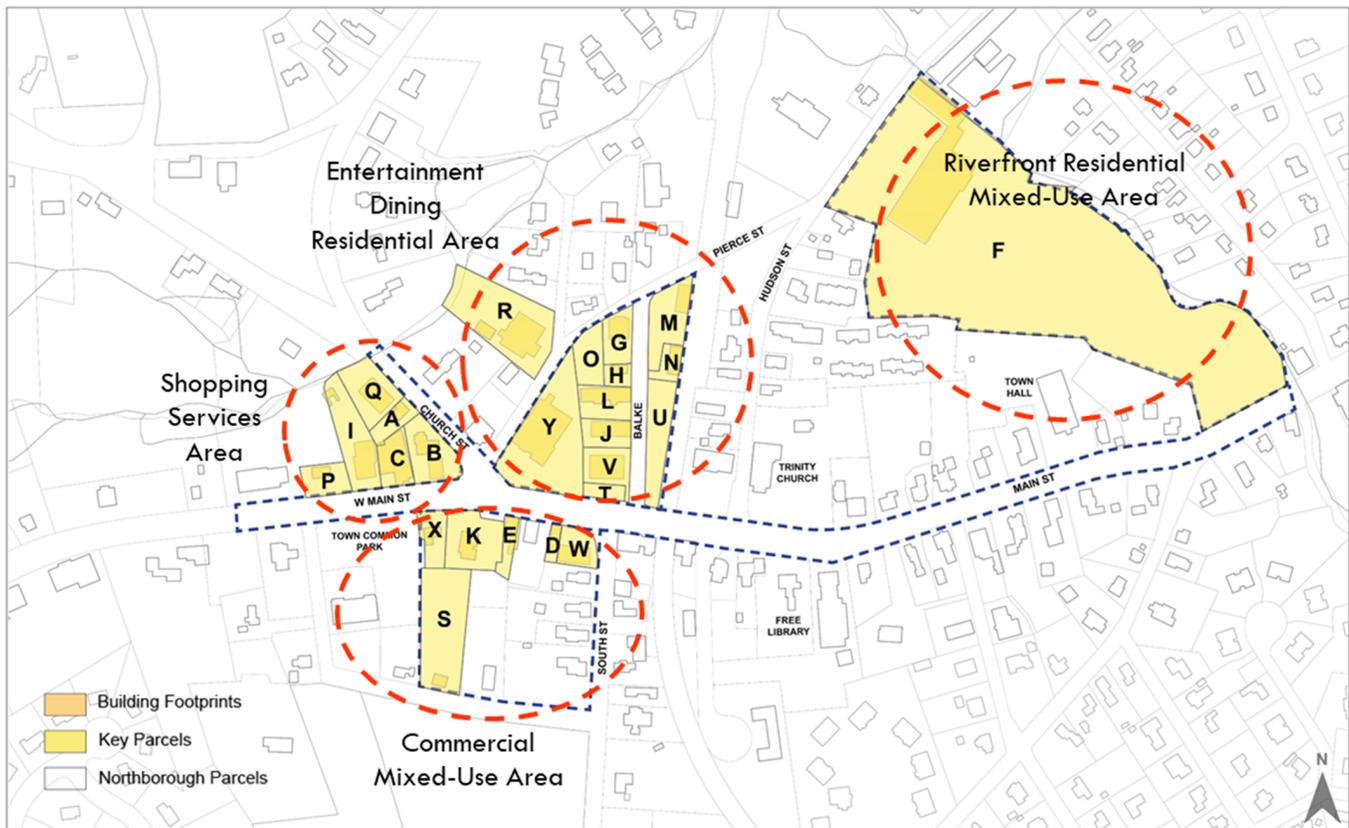
One of the intended benefits of theming redevelopment areas is to create opportunities for certain types of businesses to cluster where they will be visible and attract customers. There are also some benefits derived from having complementary business types operating near each other, which are accessible to on-street foot-traffic and people visiting downtown. In a downtown setting, it is important to have activated uses at the street level that will enhance foot-traffic and offer opportunities for dining, shopping, and browsing. Certain uses that breakup or interrupt ground level

businesses can discourage pedestrians on foot from walking and force them back into their cars, which is counter to Northborough’s revitalization objectives. While it is difficult to manage in a small downtown, promoting offices or other uses on the ground floor that do not promote customer turnover and foot traffic can reduce pedestrian activity.

An active downtown scene is reliant on customer/visitor turnover, with people making multiple stops in a single trip. For example, the number of people entering and existing a popular restaurant during a day will be much greater than a people going to and from a dentist’s office, particularly after hours and on weekends. However, there are other types of destinations that can spur downtown visitors by creating their own drawing power. That might include museums, entertainment centers, parks, specialty shops or specific tourist attractions.

In accordance with Figure 6-1, the following business uses are considered targeted uses within each area.

**Figure 6-4: Key Properties and Redevelopment Catalyst Areas**



Source: RKG Associates, Inc., 2023

**Entertainment / Dining / Residential Area** – The center of downtown should be where most people come to experience Northborough. It should appeal to residents, shoppers, people seeking entertainment, regional day-trippers, and commuters. However, since much of this area is located to the north side of Route 20, the activities and businesses should be more focused on catering to pedestrians and creating a fun area for people to relax and enjoy Downtown with friends and family. It should not be a vehicle dominated area, but suitable facilities should be provided to accommodate vehicles.

With the future relocation of the Northborough fire station from 11 Pierce Street (Figure 6-5) to a new site located on West Main Street, there is a unique opportunity to adaptively reuse the old station for a specialty restaurant, brewery or entertainment venue that would attract young people, visitors, and families to downtown. Because the station is town-owned, it can become a catalyst development site, in partnership with a private developer. The station property backs up to beautiful views of Cold Harbor Brook and would be a signature location for a live entertainment/music venue, signature restaurant/brewery or indoor/outdoor event space. The building is only 5,100 SF and sits on 1 acre of land but could be integrated into a much larger entertainment hub for the community.

Blake Street would define the central access into the entertainment district and the former town hall building, located at 4 West Main Street, can become a catalyst site in the middle of downtown. Recently, there has been some discussion about relocating the Town’s offices to 4 West Main Street (Figure 6-6), after vacating the current former high school building. While this might be an option for the town to meet its future

office space needs, it may not create the desired effect at a key location in the downtown entertainment hub. The type of visitor activity generated by a town hall would be much different than a multi-use building with restaurants and shops operating in the evenings and on weekends when visitors are in town. The town hall would operate from 8:00 am to 4:00 pm on Monday, Wednesday and Thursday, from 8:00 am to 7:00 pm on Tuesday, and would be closed after 12:00 pm on Fridays and on weekends. Ideally, one of the most significant buildings downtown should be one of the most significant destinations or activity centers. The type of businesses attracted to this area might include:

- Specialty dining and drinking establishments,
- Destination restaurant,
- Café and coffee shops,
- Local craft brewery,
- Small format live music venue,
- Outdoor dining locations,
- Food trucks for special events and festivals,
- Farmers market,
- Antique shops,
- Clothing boutiques/thrift shops and consignment stores,
- Health and beauty shop,
- Card and Gift shops,
- Day spa,
- Jewelry store,
- Party store,
- Book Store,
- Hair, nails, beauty salons,
- Wine, beer, and cheese shop,
- Bakery,
- Sandwich shops,

**Figure 6-5: 11 Pierce Street Fire Station**



**Figure 6-6: 4 West Main Street**



- Chocolatier,
- Ice cream parlor, and
- Smoke shop and cigar bar.

**Riverfront Residential Mixed-Use Area** – The Assabet River in Northborough is an attractive natural feature in the downtown that is largely hidden from public view and has few access points because it runs primarily along private property. There are two waterfalls within the study area; one at the river crossing near Main Street and one at the crossing at Hudson Street near the Harvey Property entrance. This area is largely envisioned as a residential area, with parks and open space and a trail system along the river. However, there are limited opportunities to create commercial destinations at either end. A riverfront restaurant is envisioned for the Main Street side of the development site and another restaurant/bar, shops and entertainment venue might be possible at the Hudson Street end, through an adaptive reuse of the existing buildings in that location. The redevelopment of this site would be contingent on the acquisition of the existing Harvey property, which currently is being used as their business location, and for the storage of solid waste dumpsters.

Potential business attracted to this area might include:

- Signature restaurant
- Bar and Entertainment Venue

**Commercial Mixed-Use Area** – The commercial mixed-use area fronts the south side of West Main Street and is bordered by South Street to the east and Northborough’s Town Common to the west. It is envisioned that this area will be redeveloped in the

**Figure 6-7: Existing Sunoco Station**



future with a mixture of small businesses and residential uses. The spacing of buildings and presence of surface parking lots creates a more suburban feel on this block, as compared to a continuous block of storefronts fronting West Main Street. To attract new ground floor commercial users, the entire site will have to be redeveloped to create those commercial ground floor spaces and provide additional residential development above storefronts and elsewhere on the site. This will expand downtown’s commercial offerings and enhance its Main Street appearance.

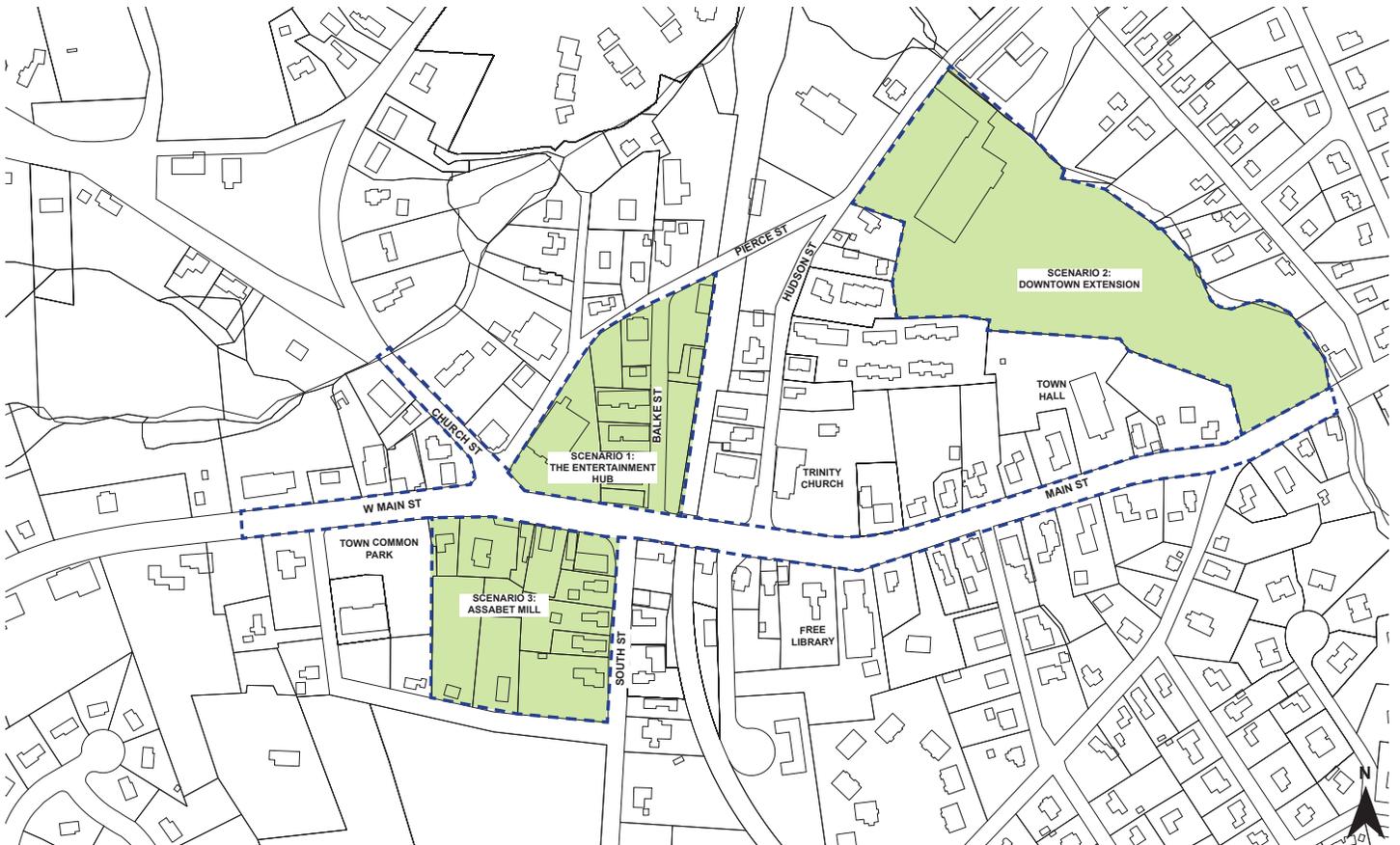
The type of business that would be attracted to this location would be:

- Small locally owned shops,
- Cafes/restaurants/bars,
- Art galleries and studios,
- Locally owned bookstore,
- Card and gift shop,
- Clothing/thrift and consignment store,
- Bridal shop,
- Specialty music, games, and comic bookstores,
- Florist,
- Integrated grocery store, butcher shop, produce stand,
- Jewelry store,
- Photographer’s studio,
- Hardware store,
- Health food store,
- Pet supply/grooming shop,
- Yoga and fitness studio,
- Personal services businesses (e.g., hair, nails, spa) and
- Office and business services should be located off Main Street at interior parts of the site.

As with any redevelopment, there is an added cost associated with acquiring the land, removing existing structures and integrating the current business into the new development. This increases the cost of the overall project so there needs to be a financial incentive for developers to take on those additional costs. Typically, redevelopment projects account for these added costs by increasing the amount of leasable building space that can be constructed on the site. This is why additional residential (e.g., townhomes and multi-family) and building heights would be envisioned for the interior and southern parts of the site heading towards Gale Street.

**Convenience Shopping Services Area** – This area fronting West Main Street and Church Street is mostly dominated by automotive services and gas stations.

## Map 6-1: Catalyst Areas



However, it has greater potential in the future as a small business area offering retail shopping and small restaurant opportunities backing up to a natural area known as Cold Harbor Brook.

The Sunoco Station (Figure 6-7) is currently listed for sale for \$849,900 and has been actively marketed since early 2023. The site is only .22 acres and has limited redevelopment potential on its own, but if combined with adjacent properties, this area has some reuse potential. With auto service uses, particularly gas stations, the subsurface conditions are often an issue. While the condition of this site is unknown, it could become an obstacle for redevelopment relative to the potential costs associated with environmental cleanup.

Another opportunity exists on three of the parcels abutting the Sunoco Station. A local developer owns two abutting parcels totaling .38 acres of land- a vacant home at 9 Church Street and a vacant parcel at 40 West Main Street. If this developer purchases the former Fire Station at 13 Church Street, they will have a total of .80 acres to construct a multi-story mixed use development with frontage on both West Main

and Church Streets. This is a likely scenario since the Town of Northborough has classified the property as surplus and issued a Request for Proposals for its redevelopment and disposition. Proposals are due on September 20, 2023.

The area is in a very busy traffic location and the existing properties are small, which will require land assemblage to create an impactful development. The site lends itself to businesses that are more convenience-oriented and cater to passing traffic along Route 20. With a different business mix, the number of vehicles coming into and out of the area could be reduced but improvements are needed to sidewalks, parking, and pedestrian amenities to encourage pedestrian activity in this area. The type of businesses attracted to this location might include:

- Small restaurants/cafes to take advantage of the site's natural views to Cold Harbor Brook,
- Carryout restaurants,
- Convenience store
- Tech/computer repair,
- Cell phone sales store, and
- Mail store and package pickup and drop-off facility for on-line shopping and returns.

## 6.3 KEY REDEVELOPMENT CATALYST AREAS

The key redevelopment catalyst areas (Map 6-1) described above are located within the study area and were assembled into three design scenarios. Scenario 1, the Entertainment Hub, incorporates the parcels between Peirce Street to the north and west, the rail tracks to the east, Route 20 to the south, and includes the fire station located at 11 Pierce Street. Scenario 2, the Downtown Extension, incorporates the entirety of the parcel located at 77 Main Street between Hudson Street to the north, the Assabet River to the east, Route 20 to the south, and residential properties to the west. Scenario 3, the Assabet Mill, incorporates the properties bound between Route 20 to the north, South Street to the east, Gale Street to the south, and the Town Common to the west.

Each of the three scenarios are described in detail below through the elements of land use and zoning, new buildings, circulation, parking, landscape elements, site furnishings, and public art.

### SCENARIO 1: THE ENTERTAINMENT HUB

#### LAND USE / ZONING / BUILDINGS

The design proposal for Scenario 1 (Figure 6-8) suggests retaining three existing buildings, 4 West Main Street (the old Town Hall (E1)), 31 Blake Street

(E3), and 11 Pierce Street (the current town fire station (E2)). The additional buildings (eight in total) are proposed new construction buildings.

The current zoning within the boundaries of Scenario 1 is Downtown Business District, which currently allows medium density housing options, mixed use buildings and a variety of commercial uses, including restaurants and retail uses, proposed by this redevelopment scheme. Consistent with the current dimensional requirements which enable buildings to be constructed close to the sidewalk edge with no side and rear setback requirements or lot coverage limitations and a maximum height of 45 feet, the proposed buildings should be a minimum of two stories and a maximum of three stories high, with retail/commercial/dining on the first floor and housing on the second and third floors.

This arrangement enhances pedestrian activity and connectivity in the streets and contributes to a vibrant downtown experience. The proposed building located opposite the intersection of Mill Street and Pierce Street (P3), is a proposed parking garage that would provide more opportunities for parking downtown to support the addition of seven new buildings in the Downtown.

Of the three existing buildings to remain in Scenario 1, two have redevelopment potential. The old Town



**Flexible open space for community events is a key component of this Scenario.**

**Figure 6-8: The Entertainment Hub**



Hall, located at 4 West Main Street (E2), is owned by the town. It is being considered for the relocation of the town offices. However, this proposal recognizes that 4 West Main Street (E2) has potential to catalyze economic development in the area. Because it is owned by the Town, the Town has a say over what type of businesses occupy it, if it is not used for town purposes. Because of its central and visible location in the downtown area, this building would receive a lot of traffic if it were occupied by restaurants, cafes, and food related businesses on the first floor. The upper floors could remain office space, as they are now, or they could be retrofitted into apartments.

The existing fire station, located at 11 Pierce Street (E2), will relocate to its new location on Route 20. This relocation will open up this property for reuse or redevelopment. Former fire stations have a unique redevelopment potential and have been retrofitted across the region into dining establishments. Two recent examples are the conversion of the old fire station in Marlborough into a café and the conversion of the old fire station in Groton into a mixed use building containing a restaurant on the first floor and an apartment above). The large garage openings for the firetrucks could be replaced with glass windows or doors that open to allow for outdoor dining or

engagement with the street. This scenario proposes that a brewery or restaurant would occupy this property and provide an outdoor experience adjacent to Cold Harbor Brook, which runs along the rear of the property. Scenario 1 contemplates an outdoor terrace and a lawn that slopes down towards the brook. This space could host outdoor lawn games, gatherings, or small music performances and shows while providing a view of the brook. This property is already owned by the Town and could act as a development catalyst in the area.

**CIRCULATION**

**ROADWAY** Scenario 1 maintains the existing road alignments of Route 20, and Pierce Street, and converts Blake Street into a one-way paved woonerf where traffic enters from Route 20 and exits onto Pierce Street. A woonerf is a Dutch term for a “living street” which originated in the Netherlands and employs strategies like traffic calming devices and low speed limits to force drivers to slow down and safely share street space with pedestrians, bicyclists, and others. Typically, the sidewalks and roads are at the same level without an elevated curb. Converting Blake Street into a woonerf will help prevent it from being used as a cut through for vehicular traffic on Route 20. It will help to provide a safe pedestrian friendly

**Figure 6-9**



**SCENARIO 1 - The Entertainment Hub: Breakdown by Numbers**



environment which will enhance the enjoyment of the redeveloped space.

**PEDESTRIAN** The potential new development identified in Scenario 1 is designed to prioritize pedestrian travel and accessibility. The new buildings proposed along Pierce Street, would be set back from the street allowing ample sidewalk space for pedestrians, street furniture, and an extension of the commercial space within the buildings. This particular stretch of new sidewalk would connect to the sidewalks on Route 20 heading north to the intersection of Pierce Street and Blake Street. Pedestrians would be able to safely walk along Blake Street where vehicles are traveling at slower speeds. All new development is proposed to include paths and walkways between the buildings and adjacent open spaces that would connect amenities and commercial spaces. Scenario 1 proposes a railroad crossing which would connect to an existing pedestrian pathway. This pathway extension would connect Trinity Church to the existing Town Hall and to a new pathway proposed to connect Town Hall to Scenario 2 creating a cohesive walking path that would connect Scenario 1 with Scenario 2.

**PARKING** Scenario 1 identifies a variety of parking opportunities. Blake Street can accommodate on-

street parking on the east side of the street. During events, these spaces can be occupied by food trucks or vendors. Similarly, Pierce Street can accommodate on-street parking on the east side of the street between the intersection with Church Street and Mill Street. A new parking garage is recommended at the corner of Pierce and Mill streets, across from the current Fire Station, that could accommodate as many as 96 new parking spaces. These spaces would provide centrally located parking for any new development and redevelopment proposals in the Downtown. The property at 11 Pierce Street (E2) can accommodate on-site parking for any redevelopment proposal.

General considerations for parking in Scenario 1 should include:

- Parking areas should provide appropriate parking capacity and safe pedestrian and vehicular circulation.
- Parking lots should be appropriately designed to maximize space for parking, internal circulation, pedestrian path of travel, and with coordinated access points.
- The Town should incentivize the development of shared parking arrangements to provide adequate parking for small businesses and better utilization of parking lots.

**LANDSCAPE ELEMENTS** The location, scale, and proportions of proposed gathering areas throughout Scenario 1 are designed to provide for a variety of experiences. The most prominent public open space proposed in Scenario 1 is located in the southeast portion of the site between Blake Street and the railroad tracks. This proposed public space includes a linear paved walkway that has a central circular space for public art and gathering. The northern portion proposes a flat paved plaza that can be used for farmers markets, craft fairs, and other events such as Applefest. This public space would be situated adjacent to the existing railroad tracks where a cargo rail passes through slowly twice a day. The space would be designed to provide a buffer of trees between the paved path and railroad tracks, however, an opportunity to celebrate the train station would remain by utilizing train themes in the plaza's furniture or including an art piece that references trains or the town's history related to the railroad.

Scenario 1 proposes a smaller pocket park north of P4 which could be used for quiet respite and contemplation, outdoor spillover seating at restaurants, or outdoor recreation space. The proposed open space to the northwest of 4 West Main Street (E1) would be designed as a shaded grove that provides relief from sun and would have paved accessible pathways that connect Peirce Street, Blake Street, and Route 20.

The 11 Pierce Street parcel (E2) is proposed to include open space behind the existing building as described above. The area could be used for an outdoor terrace for dining associated with the private entity that takes over the space. The lawn could be used for lawn games or a small outdoor concert. The pathway adjacent to Cold Harbor Brook, which would be maintained by the private entity, would connect people to the natural resource and the trail could be expanded to other properties to create a longer route along the brook.

**SITE FURNISHINGS** Scenario 1 proposes a distinct and unique style represented through street furniture and other site amenities. This would include furnishing like benches, seat walls, trash receptacles, and bike racks that are cohesive in design and representative of the existing character of the area. These site amenities would be located in higher traffic areas and would be designed to be accessible to all users. These spaces would be illuminated with LED street lights that meet the dark sky requirements for light pollution.

**PUBLIC ART** During the public engagement process there was considerable interest expressed in incorporating art into Downtown. Public art can add character and help to create a Downtown identity.

The proposed open space plaza located between Blake Street and the railroad tracks is proposed as a central location to display local artwork. The interest expressed in highlighting the train and its important role in history in the town could be celebrated in the form of art.

## **PROPOSED DEVELOPMENT PROGRAM**

Scenario 1 offers a diverse mix of uses and rethinks the entire block defined by West Main Street, the railroad tracks, and Pierce Street. As the centerpiece of Northborough's Downtown Revitalization Plan, there are a variety of uses envisioned for this area that are summarized in Figure 6-9.

The building program consists of 32,000 SF of restaurants/bars/entertainment venues, 32,000 SF of new retail shops, 10,900 SF of adaptive reuse space and 11,840 SF of office/service business space (i.e., real estate offices, dentists, insurance, beauty salons, etc.). In addition, the plan calls for apartment units above storefronts along Blake Street equaling 23 to 28 units, depending on unit size.

To serve the parking needs of this space, the plan envisions 32 parking lot spaces, 38 on-street spaces along Blake Street and 96 spaces in a small parking garage located across from the fire station on Pierce Street. Additional parking may be accessible through a lease agreement with Trinity Church, which has expressed interest in leasing some of its parking.



**New pedestrian connections to the Assabet River makes it more accessible.**



**Providing natural and man-made shaded areas for seating and respite.**



**Public art can play a key role in placemaking.**



**Pedestrian streets with limited vehicular traffic helps to create more public open space.**



**Addressing universal access for all is an important feature of this Scenario.**



**New green spaces help to reduce the affects of Urban Heat Island.**

## SCENARIO 2: THE DOWNTOWN EXTENSION

Scenario 2 (Figure 6-10), which encompasses the property located at 77 Main Street, presents a unique opportunity for a developer. Scenario 2 is comprised of a single 10-acre parcel containing two 1-story warehouse buildings with a combined footprint of 39,850 square feet that are surrounded by paved surfaces and landscaped areas. The property is situated at the convergence of Cold Harbor Brook and the Assabet River and contains frontage on both Route 20 and Hudson Street. A developer could purchase this property and would have a variety of different development options available to them under the current zoning. The entrance to the property on Route 20 is a 0.3 mile walk to Blake Street, which would serve to connect Scenario 2 to Scenarios 1 and 3. There is an opportunity to highlight and celebrate the Assabet River to the east as part of a redevelopment scheme.

### LAND USE / ZONING / BUILDINGS

The current zoning scheme applied to land within Scenario 2 consists of the Downtown Neighborhood District in the northern portion of the site and Main Street Residential District in the southern portion of the site. Scenario 2 proposes two garden-style apartment buildings in the center of the site (P3 and P2), two mixed-use buildings at the northeast and southeast ends of the site (P1 and P5), and a parking garage at the northwest end of the site (P4). Both of the zoning districts will need to be amended or the parcel will need to be rezoned to allow the density and mixture of uses proposed by this development scenario.

The Town should consider including the parcel within the new by-right multi-family zoning district that must be adopted by the Town in accordance with the amendments to M.G.L. Chapter 40A, Section 3A. This new law requires Northborough to create a district of at least 50 acres in size that allows for the by-right development of 750 units of multi-family housing at an average density of 15 units per acre. This does not necessarily mean that the Town must construct 750 new units, but the district must be created to enable the development of up to 750 units. This requirement applies to the entire community and could include non-contiguous parcels of land, but downtown, especially this parcel, could play a pivotal role in meeting those requirements.

The proposed mixed-use development at the corner of

the property and Route 20 (P1) is a keystone building that connects Scenario 2 with the rest of downtown. Situated at the gateway of the new Scenario 2 development, construction of a mixed-use building at this location with a restaurant would enable residents and patrons to enjoy picturesque views of the Assabet River, and the waterfall that lies south of Route 20. This proposed building (P1) would be 2-3 stories high where the upper floors would be multi-family units. The proposed building to the northeast of the site on Hudson Street (P5) has similar features and is also proposed as a mixed-use building, 2-3 stories high with commercial uses or dining on the first floor and housing above. This proposed building also benefits from its location on the Assabet River and features open space amenities along the river that could be used by tenants or patrons of the bottom level business.

Scenario 2 also contemplates two garden-style multi-family structures that are proposed to be four stories tall. The first floor is proposed as podium parking (ground floor parking this is enclosed by the building walls) with the upper three floors proposed for residential units. These multi-family structures would be the tallest buildings within the vicinity, however, they would be screened by the topography of the land and the existing and proposed landscaping. Scenario 2 envisions this residential option as equally appealing to a younger demographic as an aging population. As the economics and demographics of Northborough change and more people express a desire to minimize their reliance on automobiles to travel from place to place, this alternative to single-family homes in suburban neighborhoods will be celebrated. Residents of such a development at this location would have easy access to a variety of businesses and municipal uses Downtown as well as significant open spaces and recreation amenities.

### CIRCULATION

**ROADWAY** Scenario 2 introduces a new street through the property that connects Route 20 to Hudson Street, running parallel to the Assabet River. This new street is proposed with two-way traffic, on-street parking, and sidewalks on both sides of the street. Any new streets contemplated would incorporate Complete Streets design features to ensure safe and accessible options for walking, biking, and vehicles.

**Figure 6-10: The Downtown Extension**



**PEDESTRIAN** In addition to sidewalks along both sides of the new street, Scenario 2 incorporates a network of walking paths throughout the property including a river walk along the Assabet River. This pathway along the river would provide views of the river and access to one of the town’s natural resources that is currently inaccessible. Trails are proposed through the wooded area behind the proposed residential structures. These trails would connect to the existing pathway behind town hall that ultimately links to Blake Street. This linkage would create a walkable connection between Scenario 1 and Scenario 2 that serves as an alternative to the existing sidewalks providing a pedestrian connection between Hudson and Pierce Streets.

**PARKING** Scenario 2 incorporates several different parking approaches. The new street will have on-street parking on both sides of the street. Two off-street parking lots are proposed in the southern half of the site to the west of the proposed street. Each multi-family structure will have first floor parking for residents, and a proposed parking garage (P4) to the northwest of the site would serve the two mixed-use buildings and provide additional residential and commercial parking. The proposed street will be designed to incorporate Complete Streets design features and safety measures to protect pedestrians

and cyclists at parking lot access points and at on-street parking locations.

**LANDSCAPE ELEMENTS** Scenario 2 provides a unique opportunity for up to six acres of open space and recreation amenities. There are already existing natural features on the site such as the Assabet River and dense forested areas that could be enhanced and celebrated. The prominent landscape feature proposed in Scenario 2 is the development of a multi-use river walk along the Assabet River. This paved pathway would be accessible to both pedestrians and cyclists and would provide an opportunity for the public of Northborough to enjoy this natural feature, which is largely obscured today by dense vegetation and private property, as part of the Downtown. Featuring scenic overlooks along the way, the pathway could benefit Northborough by improving the scenic value of the Assabet River, attracting families and individuals to enjoy outdoor activities, and even increase property values and business opportunities.

A formal green space with a network of paved walkways is proposed for the area immediately abutting the Assabet River and the riverwalk. This park would feature an array of furnishings such as benches, picnic tables, barbecue grills, shade shelters, LED lighting, and lawn space for informal gatherings.

**Figure 6-11**



**SCENARIO 2 - Downtown Extension: Breakdown by Numbers**

To the west of the proposed street and behind the proposed residential structures would be another forested open space. As this property is already heavily forested, this area of the site could retain the existing tree cover, selectively remove some plantings, and incorporate an informal trail network through the site. The northern portion of the site, along the Hudson Street frontage, is an ideal location for a shaded gazebo that could be used for picnicking or small events. In contrast to the more manicured park area along the river, this area would have a more natural feel with significant tree cover.

To accompany the residential development, a playground is proposed as part of Scenario 2. The size, shape, and design of the playground could vary but would include accessible play options for children ranging from two to twelve years old and seating for caretakers.

**SITE FURNISHINGS** Scenario 2 is proposed to have a distinct and unique style that will be represented through street furniture and other site amenities. This family of furniture could match that in Scenario 1 and 3 to draw connection to downtown or have a different character. This would include furnishings like pedestrian-scale lighting, benches, seat walls, trash receptacles, and bike racks that are cohesive in design and representative of the existing character of the area. These site amenities would be located

in higher traffic areas and would be designed to be accessible to all users.

**PROPOSED DEVELOPMENT PROGRAM**

The proposed development program for Scenario 2 – Downtown Extension is more residential in nature than the other development scenarios. Given the riverfront location, the suitability for residential development could attract development interest in higher value condominiums and apartments in this area, with views of the river channel and wooded area. The plan envisions a public walking trail along the river’s edge leading from Main Street to Hudson Street and connecting to a larger downtown trail system leading to Cold Harbor Brook. The current plan concept assumes between 163 and 191 new residential units could be constructed in this location, with 10,300 SF of retail space and 10,300 SF of restaurants, bars and entertainment space (Figure 6-11). Residential structures would be three stories over podium, which is a high density, less land-consumptive type of development that will allow cars to be parked under a first-floor structure, with residential units constructed above the parking podium. The concept includes 40 parking lot spaces for retail and restaurant uses, 75 on-street parking spaces and 200 spaces under podium for residential owners and renters. The rest of the development will consist of walking trails and open space, a public plaza, and a playground.



**Places for children to play in this new neighborhood are important features to incorporate.**



**Offering safe, accessible crossings for pedestrians helps to connect public open spaces.**



**Gaining access adjacent to the Assabet River offers a different pedestrian experience for users.**



**Housing with access to surrounding areas helps to enliven this new system of trails.**



**Providing easy access to Main Street will make these new trails more successful.**



**The new riverfront walk will be a great place to be.**

## SCENARIO 3: ASSABET MILL

Scenario 3 (Figure 6-12) involves redeveloping the 11 parcels between Route 20, South Street, Gale Street, and the Town Common. Within the extent of Scenario 3 there are a few existing businesses, several vacant properties, and large expanses of pavement. The proposal for Scenario 3 recommends developing this area as one cohesive redevelopment project. This could be accomplished as a single development project or conducted in phases.

### LAND USE / ZONING / BUILDINGS

The current zoning of the land within Scenario 3 is Downtown Business District. Scenario 3 proposes to construct six (6) new buildings. The proposed buildings are a combination of 3 mixed use (P1, P2, P3) and 3 residential buildings (P4, P5, P6). The two proposed buildings along Route 20 (P1 and P2) are shown as two-story mixed-use buildings. The first floor could house retail or commercial uses with the second floor used for either apartments or office space. The L shaped building in the center of the parcel (P3) would also be a two-story mixed-use building with similar uses. The buildings along South Street (P4), Gale Street (P5), and opposite the existing parking lot at Assabet Park (P6) would be two-story townhouses. Because the Downtown Business District allows attached single-family dwellings, multi-family dwellings, mixed-use buildings, and a variety of business uses both by-right and by special permit, minimal changes to the existing zoning scheme are necessary. The major changes would be to increase the maximum number of attached single-family dwellings and multi-family dwellings, which are currently capped at 4 and 6, respectively. There is no cap on the number of dwelling units associated with a mixed-use development.

### CIRCULATION

**ROADWAY** Scenario 3 introduces a new street through the property that connects Route 20 to Gale Street. An additional proposed street forms a U-shape around the proposed building (P3). The new street connecting Route 20 and Gale Street would allow for two-way traffic, parking on both sides of the street, and sidewalks on both sides of the street. Proposed side streets would also permit two-way traffic and on-street parking on both sides of the street. One of the side streets would feature diagonal parking to accommodate more cars. While there is little latitude

to adjust Route 20 in its current configuration, when developing this parcel, new buildings could be set back from Route 20 to accommodate patio seating, streetscape furniture and landscaping.

**PEDESTRIAN** Scenario 3 would incorporate new concrete sidewalks and vertical granite curb along proposed streets, South Street, Gale Street and Monroe Street. A walking path connecting Route 20 to Gale Street alongside the Town Common is proposed to provide an efficient pedestrian route from the municipal parking lot on Gale Street to the Town Common and uses along Route 20. All streets within the study area will incorporate Complete Streets design features that will provide safe and accessible options for walking, biking, and vehicles. Street lighting would be updated to meet current dark sky requirements for light pollution.

**PARKING** Scenario 3 incorporates several different parking options. New streets are proposed to have on-street parking on both sides. One street will feature diagonal parking to maximize parking capacity. There is a proposed surface parking lot located just south of Route 20 behind a new proposed building (P1). If designated as public parking, this proposed lot would be a great alternative to the existing municipal parking lot on Gale Street that is associated with the Assabet Park, especially for the Town Common which has no parking associated with it.

General considerations for parking in Scenario 3 include:

- Parking areas should provide appropriate parking capacity and safe pedestrian and vehicular circulation,
- Parking lots should be well designed for parking opportunities, internal circulation, pedestrian path of travel, and with coordinated access points.
- The town can incentivize the development of shared parking arrangements to provide adequate parking for small businesses and better utilization of parking lots.

**LANDSCAPE ELEMENTS** There are opportunities within Scenario 3 to make this area of Downtown more inviting. Although the zoning allows buildings to be constructed very close to the paved roadways, the 6' minimum front setback requirement provides an opportunity to incorporate pedestrian-scale lighting,

street trees and small landscaped areas along Route 20, South Street, Gale Street, Monroe Street, and the proposed new interior streets. This will make the pedestrian experience more inviting and provide shade during hot summer days.

There are three opportunities for plaza spaces in Scenario 3. The first opportunity is at a prominent location at the corner of West Main Street and South Street. This intersection experiences a significant volume of vehicular traffic and with the development of higher density housing and commercial development and a more interconnected sidewalk network, could receive a significant amount of pedestrian activity. A small plaza at this location could attract visitors into the site. There could be a welcome sign, café seating, a shade structure, art displays, and planted landscape features that will enhance the experience of visitors and encourage them to explore the area and spend time there.

The second opportunity for plaza space is located on South Street between the townhouse buildings. This space could serve the residents of the townhouses as an outdoor seating area with the potential for shared grills and picnic tables.

In the central portion of the site at the mixed-use building, there is an opportunity to develop a third plaza. This area offers adjacent space for a café or

restaurant and food truck parking. This space is proposed to contain shaded outdoor seating and a small lawn space that could be used for lawn games or other small-scale recreational activities.

In addition to opportunities for plaza space, Scenario 3 proposes to incorporate a pedestrian path connecting Route 20 and the Town Common to Gale Street. This path could be planted with large shade trees and smaller flowering trees for seasonal interest.

**SITE FURNISHINGS** Scenario 3 is proposed to have a distinct and unique style that will be represented through street furniture and other site amenities. This would include furnishing like benches, seat walls, trash receptacles, and bike racks that are cohesive in design and representative of the existing character of the area. These site amenities would be located in higher traffic areas and would be designed to be accessible to all users. These spaces will be illuminated with LED street lights that meet dark sky requirements for light pollution.

**PUBLIC ART** Like in Scenario 1, there was also interest in incorporating art into this area of Downtown. Public art adds character and helps to create a Downtown identity. The plaza located at the corner of West Main Street and Gale Street is a prominent location for a sculpture or mural, as it is at a central

**Figure 6-12: Assabet Mill**



intersection in the Downtown and would draw attention into the site.

### PROPOSED DEVELOPMENT PROGRAM

The development program for Scenario 3 – Assabet Mill is mixed-use: a combination of ground floor retail and service space, with apartments or offices above. This configuration is reminiscent of a classic New England downtown and compliments the scale, character and massing of historic mixed-use buildings located on the east side of South Street and some of the older buildings along Route 20.

This would increase the amount of square footage for new shops and service businesses, with residential units located above the ground floor. A small street

network will be created in this area to serve other interior uses and shops, including a row of townhouses along South Street (Figure 6-13). A total of between 73 and 85 new residential units (both ownership and rentals) are proposed at this location.

Incorporating high density residential development in the downtown mix is key to increasing the amount of activity downtown, which, in turn, will create a more vibrant, desirable downtown economy. The amount of commercial space will be split between retail shops and service businesses (15,000 SF) and restaurants, cafes, and other uses (15,000 SF). There will also be a public plaza, a pocket park, and trails that connect to other parts of Downtown. Finally, approximately 109 on-street parking spaces and 20 parking lot spaces will be created to support the shops and residential units.

Figure 6-13



### SUMMARY OF DOWNTOWN REDEVELOPMENT PROGRAM

Based on the above-described redevelopment program, the Town of Northborough has the potential to remake the downtown for generations to come. While the three scenarios offer different but complementary uses, they could potentially take decades to implement, given the level of private and public investment required. Table 6-3 provides a summary of the combined building program for all three catalyst redevelopment areas. Based on the proposed redevelopment plan, approximately 57,319 SF of retail, 33,059 SF of business/personal service, and 57,319 SF of bars, restaurants, and entertainment venues will be constructed.

In addition, approximately 264,000 SF of new residential space is being proposed, which will consist of 264 new townhouses and multi-family apartments. The majority of the new housing units are proposed for the Scenario 2 catalyst area called Downtown Extension located along the Assabet River. Finally, new green space, plaza space, parks and playgrounds, and downtown trails will be included in the revitalization plan and will cover nearly 290,000 SF (6.79 acres) of improvements.

Another important element will be the public and private parking resources in these core areas. Table 6-3 shows the number of proposed parking spaces compared to what might be required by the Town based on its current parking requirements and the

proposed building program described above. While this information is preliminary, it suggests that the Town's parking requirements may exceed what can be reasonably achieved given the confined land area in some of the scenarios (Table 6-3).

Regarding the future supply and demand for parking spaces, RKG Associates estimates that the demand for spaces (1,073 spaces) could exceed the proposed supply (610 spaces) by 463 spaces. This shortage is most acute in Scenario 1 – Entertainment Hub, which may have a deficit of 293 spaces. This is largely due to the concentration of 32,000 SF of restaurants and bars, which typically attract a higher number of customers and require a larger workforce than other business types. However, it should be noted that the “proposed parking” numbers shown in Table 6-3 only reflect the parking within the scenario boundaries. It does not take into account other nearby parking lots or spaces located within a short walk of the redevelopment areas. For example, nearly 200 spaces are located within a 5 minute walk of Scenario 1 at Assabet Park (50 spaces), Trinity Church (102 spaces) and Northborough Public Library (47 spaces) if they were in demand.

In addition, while Scenario 1 is currently showing a deficit of 293 parking spaces at peak demand, that would only be true under certain operating

assumptions. That means every restaurant table, retail store, office and apartment are full at the same time and are demanding parking spaces. In reality, this is not likely to occur and those “required parking” estimates should be viewed in that light. In addition, different businesses have varying peak customer hours during different times of the day and week.

Restaurants and apartments might have the greatest demand during the evening hours, while retail shops and offices might expect more activity during the daytime hours. If one assumes that typical operating levels might be two-thirds of the peak demand, the parking deficit might be reduced substantially to a deficit of 141 in Scenario 1.

Perhaps a combination of reduced parking requirements and adjustments in the building program will be required to align these two elements in the future. Weston & Sampson has planned a new parking garage at the location of an existing parking lot off Pierce Street to provide additional parking for 96 vehicles to serve the Blake Street redevelopment area (Scenario 1). At an average cost of \$25,000 to \$35,000 per structured parking space, a 96-space parking garage could cost between \$2.4 and \$3.4 million to construct.

**Table 6-3**

**Table 6-3  
Downtown Northborough  
Redevelopment Scenarios - Total New Building Development Program and Parking Demand**

Scenario Concept	Retail Shopping	Business Services	Bars/ Restaurants	Multi-family Res. Units	Park/Trails/ Open Space	Proposed Parking	Peak Parking Demand	2/3 Parking Demand	Peak Parking Suplus/(Deficit)	Parking Suplus/(Deficit)
Scenario 1 Entertainment Hub	32,000	22,740	32,000	28	47,755	166	459	307	(293)	(141)
<b>Total</b>	<b>32,000</b>	<b>22,740</b>	<b>32,000</b>	<b>28</b>	<b>47,755</b>	<b>166</b>	<b>459</b>	<b>307</b>	<b>(293)</b>	<b>(141)</b>
Scenario 2 Downtown Extended	10,319	-	10,319	163	234,900	315	326	218	(11)	97
<b>Total</b>	<b>10,319</b>	<b>-</b>	<b>10,319</b>	<b>163</b>	<b>234,900</b>	<b>315</b>	<b>326</b>	<b>218</b>	<b>(11)</b>	<b>97</b>
Scenario 3 Assabet Mill	15,000	-	15,000	73	6,430	129	288	193	(159)	(64)
<b>Total</b>	<b>15,000</b>	<b>-</b>	<b>15,000</b>	<b>73</b>	<b>6,430</b>	<b>129</b>	<b>288</b>	<b>193</b>	<b>(159)</b>	<b>(64)</b>
<b>Grand Total</b>	<b>57,319</b>	<b>22,740</b>	<b>57,319</b>	<b>264</b>	<b>289,085</b>	<b>610</b>	<b>1073</b>	<b>719</b>	<b>(463)</b>	<b>(109)</b>

Source: Weston & Sampson and RKG Associates, Inc., 2023



**Centrally located public gathering areas will enhance the sense of community for this Scenario.**



**Open and channeled views from Main Street enhances visual connections.**



**Public art provides a sense of arrival.**



**Safe pedestrian connections on tree-lined streets help to reduce traffic speeds.**



**Enlivening the street with food trucks and active gathering spaces.**



**Public open spaces with shade and communal gathering opportunities.**

## 6.4 DOWNTOWN DESIGN CHARACTERISTICS

### BUILDING MASSING AND DESIGN

The major impediment to achieving a more cohesive and aesthetically pleasing Downtown is that most of the parcels are already developed. The best opportunity to implement a new Downtown scheme is through redevelopment, as represented in Scenarios 1, 2, and 3. During the public engagement sessions, residents expressed an interest in 2-3 story building heights, which is slightly taller than the 1 to 2-story buildings that occupy most of the Downtown today. The old Town Hall at 4 West Main Street is five stories high and the maximum height allowed in the Downtown Business District is 45 feet. Therefore, the existing dimensional requirements of the Downtown Business District are largely consistent with the proposed redevelopment scheme.

The existing historic buildings in Downtown range in style from Colonials, Romanesque, Victorian, Gothic, to Craftsman. Aesthetically, all new developments should take inspiration and consideration from the existing historic structures to create a cohesive look and feel within the Downtown.

To improve the aesthetic of existing buildings Downtown, the Town could incentivize facade and landscaping improvements by funding a grant program or providing tax incentives to commercial property and business owners to voluntarily upgrade their properties.

There are several historic buildings located along Main Street and the adjacent streets that are significant contributors to the character of Downtown Northborough. These buildings should be preserved and their architectural features uncovered or enhanced when renovated. The Town adopted a Demolition Delay Bylaw that is enforced by the Building Inspector and the Historic District Commission and provides a window of opportunity to protect significant historic buildings when proposed for demolition. However, this Bylaw merely delays demolition, it does not ensure the permanent protection of the Town's most vulnerable and significant historic properties. To that end, the Northborough Historic District Commission is encouraged to recognize and protect the historic properties along Main Street and on adjacent streets by creating a local Historic District, which would preserve and protect the distinctive architectural

characteristics of buildings that can be viewed from a public way, maintain and improve the settings of those buildings and places, and encourage new designs compatible with existing buildings in the District. The Design Review Committee also has an important role to play to protect historic commercial and multi-family buildings when significant additions are proposed. Through the site plan approval process, the Design Review Committee and the appropriate permitting authority can ensure that additions, facade changes, and new signage is in keeping with the character, architectural style and materials of the building as well as with other buildings on the street that have a visual relationship to it.

### SIGNAGE

Signage overall in Downtown Northborough is inconsistent – with some establishments having newer and more modern signs and others having outdated, faded, and poorly located signs. This inconsistent pattern of signage does not support the Town's vision for the area expressed in the Master Plan and through this project. The haphazard signage style and placement negatively impacts the overall aesthetic of the Downtown.

The Town should consider creating a sign incentive program for the replacement of existing signs within the Downtown. It could be designed as a voluntary program to improve the streetscape through signs and landscaping. The Town could consider funding a grant program or providing tax incentives to business owners to assist with implementation.

### UNDERGROUND CABLING AND ELECTRICAL INFRASTRUCTURE

During the public engagement process there was strong support for burying communications and electric lines underground in the Downtown. Currently, the utility infrastructure is above ground on utility poles, which compromises the use of sidewalks, especially for the wheelchair-bound, and negatively impacts the appearance of the Downtown. Placing communications and electrical lines underground would improve the overall aesthetic and would reduce or remove the sidewalk obstructions related to utility pole placement.

The key benefits of under-grounding include:

- Reduced visual clutter, which may increase the value of nearby properties.

- Reduced frequency of outages, particularly those caused by storms.
- Reduced cost of post-storm restoration of the electric system and reduced revenue losses for electric utilities resulting from these outages.
- Reduced cost of tree trimming and other vegetation management and damages to electric facilities caused by vehicle crashes.
- Reduced risk of the public encountering live wires.

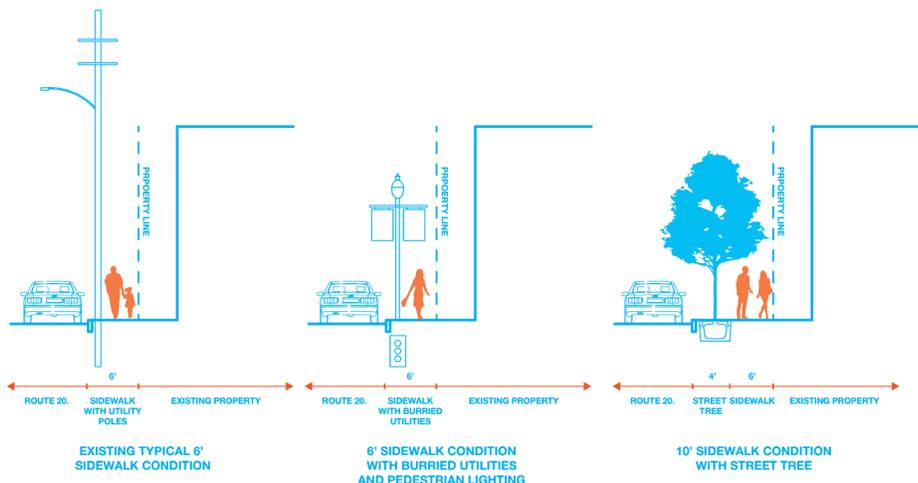
Moving existing communications and electrical lines underground is a significant undertaking and would require coordination with MassDOT, the Town’s Department of Public Works and the associated electric company and communications service providers. This is a long-term strategy that would require significant study and collaboration amongst several parties.

The pursuit of under-grounding electrical and communications infrastructure as a municipal project would require the Town to take on a significant financial burden. The cost of under-grounding utilities is approximately \$800 to \$1,000 per linear foot, making under-grounding of electrical and telecommunication lines Downtown on the order of a \$3 million project. Given the cost, a requirement for developers to underground electric and telecommunication lines might discourage development. This plan proposes an approach of incentivizing under-grounding the infrastructure, as doing nothing leaves the problem unaddressed.

Before any system, overhead or underground, is installed, a certain amount of planning is necessary, and more emphasis is required in this respect for the underground system. This is because the overhead system, being readily accessible, is much more flexible and can be added to or modified to suit changing loads or other requirements without too much difficulty.

- In planning, a utility usually is looking for a system that, consistent with economy, will give a high degree of service continuity, is accessible for maintenance purposes, is safe both to public and to utility employees, and can supply present and future loads without expensive modification or additional construction.
- The location of the system is important. Unless cables can be laid underneath a sidewalk, they are probably subject to more damage in the street location from the operation and maintenance of other utilities such as water, sewer, gas, than in a rear lot location. This must be balanced against more difficult accessibility of equipment, should maintenance be required when in the rear lot location.
- Knowledge of present and future loads is important in the planning of any system and probably more so for underground systems. With an overhead system, these additions usually are no problem but with underground they could be difficult and expensive unless carefully planned for in advance.
- Continuity of service is of ever-increasing importance. Interruptions on an underground system are usually considerably longer than those on overhead systems and therefore it is necessary in the planning of an underground system to build in adequate facilities to avoid lengthy interruptions should a fault occur.
- Operations and maintenance on an underground system are usually carried out in a much more confined space than on overhead systems and, therefore, to ensure safety to linemen, special facilities and work methods are usually required.

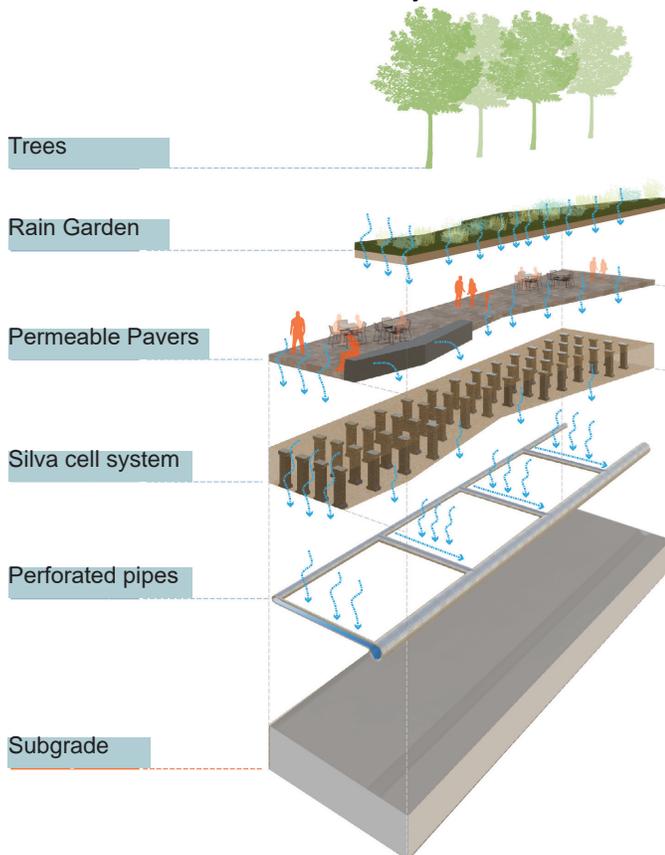
Implementing this plan would be a long-term goal and because it involved coordination with MassDOT and utility companies, it would most like happen the next time Route 20 is renovated.



**Sections to indicate the visual impacts of burying utilities on Route 20.**

## CLIMATE RESILIENCY

Urban heat islands occur when municipalities replace vegetation and natural landcover with pavement, buildings, and other surfaces that absorb and retain heat. The effects of this type of development raise the temperature of the micro-climates and can lead to increases in heat related illness, energy costs, and air pollution levels. Trees and vegetation will help combat urban heat island effects by shading paved surfaces, buildings, deflecting radiation from the sun, absorbing moisture into the ground and vegetation, and also releasing moisture into the atmosphere<sup>1</sup>. Downtown Northborough is densely developed with buildings, roadways, and large swaths of paved surfaces like parking lots. There is little tree cover along the sidewalks and streets, making pedestrians susceptible to excessive heat exposure. Each of the three design scenarios propose significant increases to the number of street trees and designed open spaces, many of which include vegetative cover and shade structures. These areas will reduce the urban heat island effect in Downtown while also improving the overall aesthetic of the area and providing public spaces for active and passive recreation and community events.



### Streetscape design elements to help combat Climate Change

1 US EPA. 2019. "Reduce Urban Heat Island Effect." US EPA. May 22, 2019. <https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect>.

## 6.5 KEY PRINCIPLES FOR DRIVING REDEVELOPMENT OPPORTUNITIES

For the Town of Northborough to successfully revitalize its downtown and meet its goals, there are a number of factors to consider that will drive interest and attract private investment.

**Strategic Public/Private Partnerships are Required** - Very few cities and towns are successful at implementing downtown revitalization initiatives on their own. While there is an important role for local government to play, the Town will need private partners to accomplish most of the redevelopment envisioned in this plan. The Town must prepare to create public/private partnerships with interested private developers and property owners. Typical roles for local government include: (1) providing infrastructure investments (e.g., parking/parking garages, utility infrastructure, streetscape/landscaping improvements), (2) assisting with land acquisition and assemblage, (3) accessing state and federal funding sources and (4) amending local development regulations (e.g., zoning) where necessary to accommodate the new development.

**Downtown Management and Leadership is Needed to Achieve Higher Level Revitalization Goals** - Aside from real estate development activities, there are a myriad of activities that must be initiated and coordinated by some local entity as it relates to downtown revitalization. Often, those responsibilities fall under the purview of the local government. However, currently the Town lacks dedicated staff, and in some instances, the technical expertise to provide that level of oversight, coordination, and management. The Town may have to be involved in a variety of different activities relative to how downtown functions in the future or will have to coordinate with other organizations.

- Planning for future downtown beautification improvements to buildings and streetscape,
- Engaging with downtown merchants on cooperative special promotions and marketing campaigns to promote Downtown Northborough,
- The future recruitment of targeted businesses that diversify the downtown business mix,
- Planning and coordinating existing and future special events or festivals hosted downtown,
- Researching and submitting grant applications for

- state and federal funding requests,
- Working with downtown property owners to improve the appearance of storefronts, building facades and signage,
- Create a Business Improvement District (BID) to fund activities that directly benefit downtown businesses and property owners
- Seeking annual general fund or municipal bonding commitments to support new investments in conjunction with private development proposals, and
- Enhance communication of downtown activities, project updates and keeping the community informed of progress.

To be successful in Downtown Revitalization efforts, the Town may need to increase the level of effort provided by the staff. It may be necessary to hire a downtown manager or economic development manager.

**Increased Development Density is Needed** – There is little incentive for private investors to redevelop individual properties without additional development density allowances. It is difficult to financially justify acquiring property, demolishing buildings, remediating subsurface environmental contamination, and then to construct a similar-size structure on the site. The economics of that does not work and developers will need to increase the amount of development on a given site to offset those additional costs.

The Town of Northborough has 45-foot maximum allowable building heights downtown, which would accommodate a four-story building. Whether that is sufficient to support redevelopment activity is dependent on the individual project and the full cost of site acquisition, building demolition, infrastructure, building construction, permitting and other development costs.

**Downtown Residential will be a Key Driver for Redevelopment** - High density residential uses, including townhouses, garden-style apartment buildings and mixed-use buildings, will be a key driver for larger-scale redevelopment. There is a strong demand for new residential uses in the Greater Boston market, which is highly constrained. The addition of residential uses Downtown will be viewed as desirable, particularly during the early stages of redevelopment before new commercial storefronts and businesses are attracted to Northborough.

Residential interest Downtown will be driven first by the

Town's locational advantages in the Greater Boston Region, because it has excellent highway access to Boston and surrounding employment centers, as well as regional shopping and services.

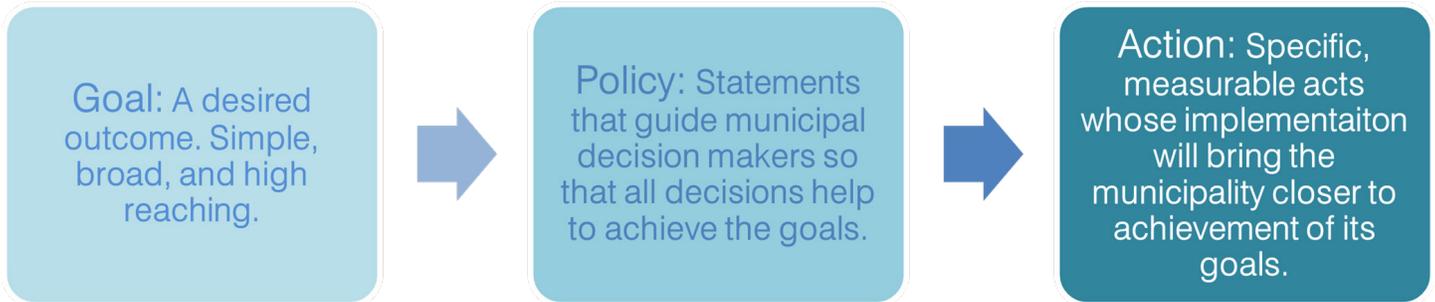
However, new residents Downtown will need high quality amenities such as restaurants, bars, entertainment, parks/trails, and shopping nearby to support their Downtown living decision. They should come together as a package.

**Space for New Downtown Businesses Must be Created** – The lack of usable, leasable building space and storefronts will constrain future business growth Downtown. New space must be created through redevelopment to attract new businesses and diversify the business offerings.



# 7. IMPLEMENTATION

Drafting and adopting this Master Plan has been a year-long collaborative effort by many dedicated staff, volunteers, and residents of the Town of Northborough. That hard work was just the beginning of the process, as much work remains for the plan to be successfully implemented. This implementation involves adopting new policies, revising regulations and ordinances, drafting new regulations and ordinances, conducting studies, and adjusting and adapting current practices to implement the goals, policies, and actions contained in this element. In this element three types of initiatives are identified:



These stated goals, policies, and actions provide a road map for the Town to move the plan forward. Goals provide overarching desired outcomes, while policies guide municipal decision making and actions provide measurable acts that achieve implementation. When all three initiatives work together the Town can make considerable strides towards achieving the stated goals. The matrix provided in this element has several important functions. First it states each particular element's goals and policies. This is followed by actions. For each action a time frame and responsible parties are identified. This is done to provide guidance to those involved in implementation in what time frame the action is anticipated to take place and who will be responsible for initiating and supporting each action item. These considerations will vary based on circumstances at the time and this information is provided as a guide. The following key should be used when reviewing the matrix:

## 7.1 TIME FRAME

Factors used to determine the time frame for specific actions include priority level, cost/budget, staff time, and overall length of time for a particular action item to be initiated and completed. Time frames are categorized as follows:

- Short-term (S): 0 to 3 years
- Medium-term (M): 4-7 years
- Long-term (L): 8 to 10 years

Several action items are identified with an initial time

frame (S, M, or L). This means that the initial action will take place in either a short, medium, or long-time frame and the action item will require ongoing maintenance or monitoring.

## 7.2 IMPLEMENTATION LEADERS

Each action has at least one responsible party identified. In many cases there are two or more responsible parties identified. Those listed in bold in the matrix are the lead responsible party, with those listed beneath it identified as support parties. The lead responsible party should be those directly involved in conducting a study or implementing an action or policy. Those identified as support parties should be those that will play a role in the implementation or action, but are not leading the charge, only providing support to those that do. The following are a list of acronyms used to identify responsible parties.

### Private

- A Architect
- AP Appraiser
- B/D Builders/Developers
- BO Business Owners
- E Engineer & Designer
- LU Land Use Attorney
- PO Property Owner
- UC Utility Companies

### Public

- ARC Architectural Review Committee
- PD Planning Department

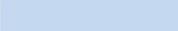
TA Town Administrator  
SB Select Board  
DPW Department of Public Works

DMA Downtown Merchants Assoc.  
DM Downtown Manager  
MDI Massachusetts Downtown Initiative  
MDOT Massachusetts Department of Transportation  
NGC Northborough Garden Club

#### Cost Estimate Legend

a/a administrative action  
A \$0 - \$25,000  
B \$25,000 - \$50,000  
C \$50,000 - \$100,000  
D \$100,000 - \$250,000  
E \$250,000 - \$500,000  
F \$500,000 - \$1,000,000  
G \$1,000,000 - \$5,000,000  
H \$5,000,000+

#### Implementation Timing Legend

	Short-Term
	Medium-Term
	Long-Term

10-Year Downtown Revitalization Implementation Strategy (2023-2032)												Estimated Cost	Cost Frequency		
Town of Northborough, MA		Implementation Lead		Implementation Timing (Year)											
		Public/Partners	Private	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Cost	Frequency
SHORT-TERM STRATEGIES (0-3 YEARS)				Short-Term				Medium-Term				Long-Term			
<b>Objective #1</b>	<b>Hire an Experienced Downtown Manager to Lead Northborough's Revitalization Effort and Coordinate Activities with Other Community Organizations and Town Government</b>														
Action 1:	Hire an experienced downtown manager to kick-start implementation of the downtown master plan.														
Action 2:	Create a strategic action plan to drive the Downtown Merchants Association's annual action plan and provide leadership to committee groups.														
Action 3:	Explore the budgetary needs of the Downtown Merchants Association over the next five years.														
Action 4:	Undertake annual fundraising activities, including grant writing opportunities, to support Northborough's downtown revitalization efforts.														
Action 5:	Outreach to property owners to gauge their interest in pursuing the Town's catalyst redevelopment initiatives.														
Action 6:	Seek a 5-Year annual funding commitment from the Town to support the operations of the Downtown Merchants Association, in addition to contributions made by local businesses and property owners.														
Action 7:	Meet with real estate developers to explore their interests in making redevelopment investments in Northborough.														
Action 8:	Meet with Town leadership regarding the need for land acquisition and assemblage in catalyst redevelopment areas.														
<b>Objective #2</b>	<b>Create a Downtown Management Organization to Plan, Organize and Coordinate Downtown Revitalization Activities and Create Key Partnerships.</b>														
Action 1:	Organize downtown merchants, property owners and local leaders to identify and prioritize on-going needs for downtown revitalization.														
Action 2:	Establish a Northborough Downtown Merchants Association board of directors and create a volunteer committee structure to undertake important downtown initiatives and to partner with community organizations.														
Action 3:	Organize an annual Downtown Merchants Association dues structure to undertake new projects and initiatives that benefit downtown.														
Action 4:	Seek annual support from the Town of Northborough to provide seed funding for the merchants association activities that benefit downtown and the community.														
Action 5:	Establish volunteer committees focused on: (1) special events/festival planning, (2) district advertising and promotion, (3) beautification, and (4) governmental affairs.														
<b>Objective #3</b>	<b>Create a Downtown Campaign to Promote Local Businesses and Special Events.</b>														
Action 1:	Create a campaign to promote Downtown Northborough through a series of seasonal special events including: (1) cultural events, (2) musical/art festival, (3) a food festival and (4) holiday event.														
Action 2:	Promote these events through the use of media and promotional signage and advertising inside and outside the community to attract people to downtown.														
Action 3:	Seek volunteers from the community, business sponsorships and the support of community organizations to coordinate and staff these events annually.														
<b>Objective #4</b>	<b>Create a Downtown Building Façade and Signage Improvement Program for Local Businesses and Property Owners.</b>														
Action 1:	Establish a local signage and façade improvement program through a 5-year funding commitment of \$30,000/yr. to support downtown low interest loan program.														
Action 2:	Seek assistance from the Massachusetts Downtown Initiative (MDI) to create program guidelines and design standards and solicit proposals from downtown businesses and property owners.														

<b>Objective #5</b>	<p><b>Improve the aesthetics of Downtown Northborough through public and private actions.</b></p> <p>Action 1: Award \$1,500 seed grants to businesses and property owners willing to match those funds to make improvements to the front of their properties in accordance with program requirements.</p> <p>Action 2: Draft program guidelines identifying the types of improvements eligible for seed funding including: new signage, planting boxes, window displays, awnings, etc.</p> <p>Action 3: Develop a program to promote the planting and sustained growth of street trees, landscaping, and other green infrastructure in Downtown in coordination with the Northborough Garden Club.</p> <p>Action 4: Engender local buy-in through establishment of an Adopt-A-Tree and Adopt-A-Planter Program focused on Downtown Northborough.</p> <p>Action 5: Add benches, tables, trash receptacles, and pedestrian-scale LED lighting, and attractive banners at key locations.</p> <p>Action 6: Commission local artists to paint murals on key sites in the district.</p> <p>Action 7: Consider adorning utility boxes with historic photos of downtown or custom artwork using vinyl wraps.</p>	<p>SB,TA,DMA BO,PO</p> <p>DM,MDI BO,PO</p> <p>DMA,NGC BO,PO</p> <p>DM,PD,DPW BO,PO</p> <p>DM,PD,DPW BO,PO</p> <p>DM,DMA BO,PO</p> <p>DM,DPW BO,PO</p>	<p>A</p> <p>A</p> <p>a/a</p> <p>A</p> <p>B</p> <p>A</p> <p>A</p>	<p>Annual</p> <p>One-Time</p> <p>---</p> <p>Annual</p> <p>One-Time</p> <p>One-Time</p> <p>One-Time</p>
<b>Objective #6</b>	<p><b>Review the Town's Zoning Regulations to Allow for Higher Density Mixed-Use Development in the Greater Downtown Area.</b></p> <p>Action 1: Investigate the need for changes in the Town's zoning to allow for increased density bonuses/density transfer credits and changes to parking requirements within the downtown's catalyst redevelopment areas.</p> <p>Action 2: Consider adopting a minimum of 10% of units in residential/mixed use developments with 10 units or more should be permanently deed restricted for affordable housing to maintain the Town's Chapter 40B compliance.</p> <p>Action 3: Work with the appropriate boards and town residents to adopt necessary changes to downtown parking regulations (number of spaces per use), business signage bylaw and downtown design standards.</p> <p>Action 4: To ensure downtown revitalization success, work closely with the Town's land use boards to develop a collaborative process that is responsive and transparent to both the development community and the public.</p>	<p>PD,PB PO</p> <p>PD,PB,TA,SB PO,B/D</p> <p>PD,DM BO,PO,B/D</p> <p>PD,TA,DM,PB B/D</p>	<p>a/a</p> <p>a/a</p> <p>a/a</p> <p>a/a</p>	<p>---</p> <p>---</p> <p>---</p> <p>---</p>
<b>Objective #7</b>	<p><b>Refine Planning for Future Catalyst Redevelopment Areas (Scenario 1 and 2) and Establish New Development Partnerships.</b></p> <p>Action 1: Retain a consultant to conduct an analysis of financial feasibility for the first and second catalyst redevelopment areas, including adjustments to the proposed building development program and to advise the Town.</p> <p>Action 2: Conduct more detailed engineering for key infrastructure planning and cost estimates in support of the first catalyst redevelopment project.</p> <p>Action 3: Coordinate with property owners to conduct real estate appraisals and/or environmental assessment on key properties that require land acquisition in the first catalyst redevelopment area.</p>	<p>DM,TA C,A,E</p> <p>DM,TA E</p> <p>TA PO,AP</p>	<p>B</p> <p>D</p> <p>B</p>	<p>One-Time</p> <p>One-Time</p> <p>One-Time</p>
<b>Objective #8</b>	<p><b>Develop and Implement a multi-year, multi-phase effort to improve public infrastructure Downtown, including the streetscape.</b></p> <p>Action 1: Work with the MPIC to identify a Phase I streetscape and infrastructure improvement project.</p> <p>Action 2: Pursue ARPA funds to hire a consulting engineer to design a Phase I streetscape and infrastructure improvement project.</p> <p>Action 3: Form a focus group consisting of key stakeholders and Town staff to provide oversight and direction to the engineering consultant.</p> <p>Action 4: Pursue grants and municipal sources of money to finance construction of the Phase I streetscape and infrastructure improvement project.</p>	<p>PD,MPIC</p> <p>PD E</p> <p>PD E,BO,PO</p> <p>PD,TA,SB</p>	<p>Underway</p> <p>a/a</p> <p>a/a</p> <p>a/a</p>	<p>One time</p> <p>---</p> <p>---</p> <p>---</p>



MEDIUM-TERM STRATEGIES (4-7 YEARS)													
<b>Objective #1</b> Consider Expanding the Downtown Merchants Association Staff Expertise as Property Redevelopment Starts.	Action 1:	Expand the DMA staff to include redevelopment planning and implementation expertise.	DM,DMA,TA,SB									C	On-Time
	Action 2:	Retain the services of a land use attorney to draft and negotiate future development agreements.	DM,TA	LU								C	On-Going
	Action 3:	Target key properties for acquisition in partnership with real estate development partners and negotiate repayment of public funds as possible.	TA,TS,DMA	PO,B/D								a/a	---
	<b>Objective #2</b> Work with Developers and Investors on the Redevelopment of Catalyst Area Scenario 2 (Downtown Extended).												
Action 1:	Retain consulting services to conduct an analysis of financial feasibility for the first catalyst redevelopment area, including adjustments to the proposed building development program.	DM,DMA,TA	C,PO									A	One-Time
	Conduct more detail engineering for key infrastructure planning and cost estimates in support of catalyst Scenario 2.	DM,DMA,TA	E									D	One-Time
	Coordinate with property owners and real estate developers interested in pursuing this project.	DM,TA	B/D,PO									a/a	---
	Investigate the need for changes in the Town's zoning to allow for increased density bonuses and changes to parking requirements within the downtown's catalyst redevelopment areas.	PD,PB	B/D									a/a	---
	Work with developers and property owners to plan for redevelopment and approve entitlements that meet the town's revitalization goals.	TA,SB,PD,PB,AR C	C,B/D									B	On-Going
<b>Objective #3</b> Plan for Major Infrastructure Improvements Needed to Support the Catalyst Redevelopment Projects.													
Action 1:	Work closely with public utility companies to explore the potential to underground utilities along Main Street.	TA,PD,DM	UC									a/a	---
	Retain an engineering firm to plan for a new downtown parking structure in catalyst Scenario 1.	PD,DM	E									D	One-Time
	Retain a design firm to plan for public realm improvements in the catalyst Scenario areas, including traffic, streetscape, walking trails, on and off street parking, pedestrian plaza, green spaces, and public water, sewer and drainage upgrades.	PD,DM,MDOT	E									E	One-Time
<b>Objective #4</b> Prepare a Business Recruitment Strategy to Attract New Businesses to Downtown Northborough.													
Action 1:	Retain consultant to prepare a retail recruitment strategy for downtown.	DM	C,BO/PO									A	One-time
	Target specific businesses within the region that would complement Northborough's downtown business mix.	DM,DMA	C									A	One-time
	Provide a business recruitment incentive package to attract target companies to Northborough downtown.	DM,TA,SB										A	One-time
	Hire a business recruitment consultant to implement the business recruitment program.	DM	C									A	On-Going
<b>Objective #5</b> Explore the Potential to Create a Downtown Business Improvement District (BID) to Provide Improvements to Downtown.													
Action 1:	Educate downtown businesses and property owners on the benefits of a downtown improvement district (BID).	DM,MDI	BO,PO									a/a	---
	Seek assistance from the Massachusetts Downtown Initiative (MDI) to explain how a downtown BID works and share experiences from other communities.	DM,MDI	BO,PO									a/a	---
	Prepare a BID plan to identify the improvements and services to be provided and how to finance them through the BID property assessment.	DM,DMA,TA	C									A	One-Time
<b>LONG-TERM STRATEGIES (8-10 YEARS)</b>													
<b>Objective #1</b> Work with Developers and Investors on the Redevelopment of Catalyst Scenario 3 (Assabet Mill).													
Action 1:	Retain consulting services to conduct an analysis of financial feasibility for the third catalyst redevelopment area, including adjustments to the proposed building development program.	DM,DMA,TA	C,PO									B	One-Time
	Conduct more detailed engineering for key infrastructure planning and cost estimates in support of catalyst Scenario 3 area.	DM,DMA,TA	E									C	One-Time
	Coordinate with property owners and real estate developers interested in pursuing this project.	DM,TA	B/D,PO									a/a	---
	Investigate the need for changes in the Town's zoning to allow for increased density bonuses and changes to parking requirements within the downtown's catalyst redevelopment areas.	PD,PB	B/D									a/a	---
	Work with developers and property owners to plan for redevelopment and approve entitlements that meet the town's revitalization goals.	TA,SB,PD,PB,AR C	C,B/D									B	On-Going

# 8. APPENDICES

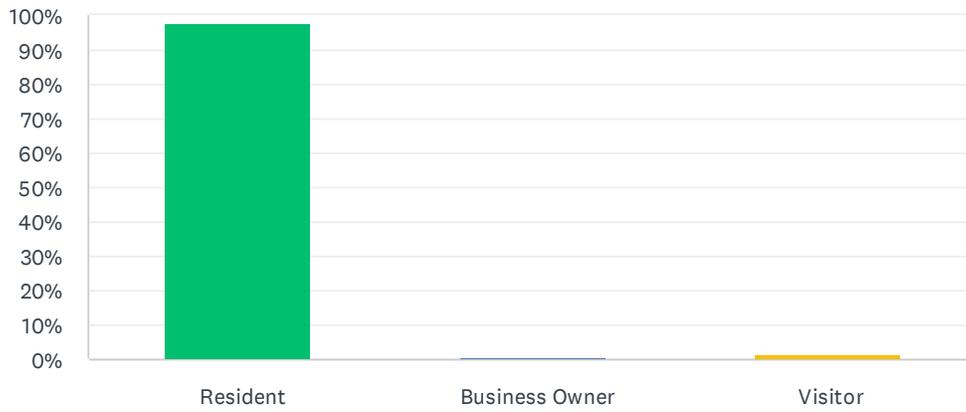
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**Appendix A - Online Survey Results**

**Appendix B - Traffic Study Analysis**

# Q1 Are you a resident, business owner, or visitor of Northborough?

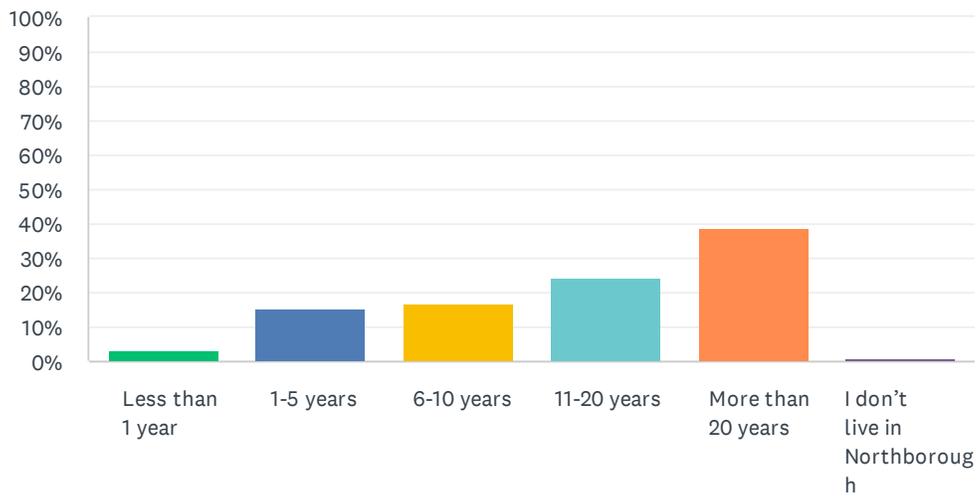
Answered: 635 Skipped: 2



ANSWER CHOICES	RESPONSES	
Resident	97.95%	622
Business Owner	0.47%	3
Visitor	1.57%	10
<b>TOTAL</b>		<b>635</b>

## Q2 If you are a resident, how long have you lived in Northborough?

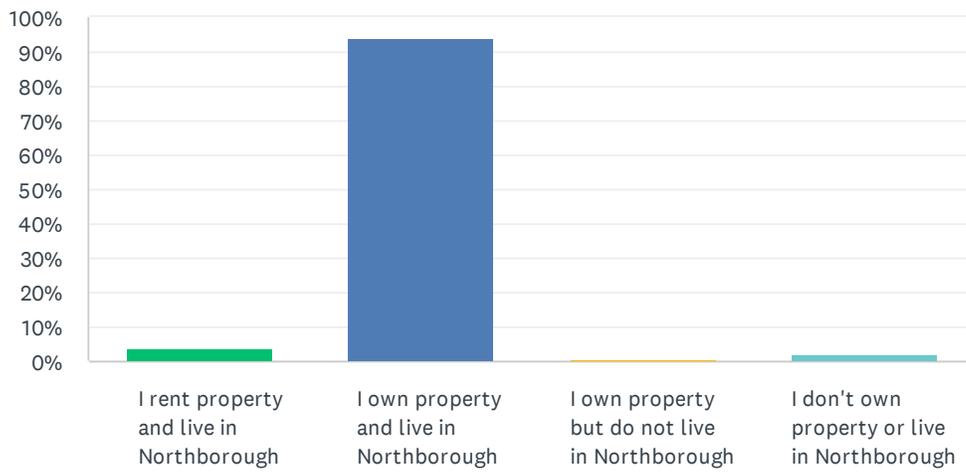
Answered: 633 Skipped: 4



ANSWER CHOICES	RESPONSES	
Less than 1 year	3.16%	20
1-5 years	15.48%	98
6-10 years	16.90%	107
11-20 years	24.17%	153
More than 20 years	39.02%	247
I don't live in Northborough	1.26%	8
<b>TOTAL</b>		<b>633</b>

### Q3 What is your resident status?

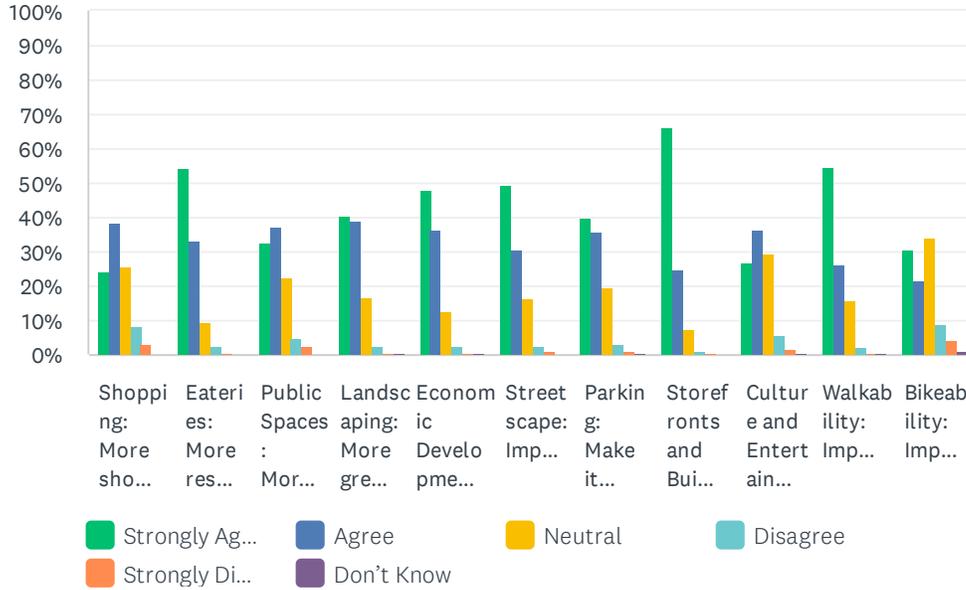
Answered: 635 Skipped: 2



ANSWER CHOICES	RESPONSES	
I rent property and live in Northborough	3.46%	22
I own property and live in Northborough	94.33%	599
I own property but do not live in Northborough	0.31%	2
I don't own property or live in Northborough	1.89%	12
<b>TOTAL</b>		<b>635</b>

### Q4 When focusing on revitalization of the Northborough Downtown area, what are your top priorities? (please choose one for each row)

Answered: 636 Skipped: 1



## Northborough Downtown Revitalization Survey

	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	DON'T KNOW	TOTAL	WEIGHTED AVERAGE
Shopping: More shopping options	24.00% 150	38.56% 241	25.92% 162	8.16% 51	3.20% 20	0.16% 1	625	2.28
Eateries: More restaurants, cafes and bakeries	54.27% 343	33.07% 209	9.49% 60	2.53% 16	0.47% 3	0.16% 1	632	1.62
Public Spaces: More places to gather, sit, and socialize	32.64% 204	37.28% 233	22.56% 141	4.96% 31	2.40% 15	0.16% 1	625	2.08
Landscaping: More greenery, planters, trees	40.44% 256	39.02% 247	16.90% 107	2.69% 17	0.63% 4	0.32% 2	633	1.85
Economic Development: Attract and retain downtown businesses	48.10% 303	36.19% 228	12.38% 78	2.70% 17	0.32% 2	0.32% 2	630	1.72
Streetscape: Improve Downtown's streetscape (benches, lighting, signage)	49.45% 313	30.65% 194	16.27% 103	2.53% 16	1.11% 7	0.00% 0	633	1.75
Parking: Make it more convenient	40.22% 253	35.93% 226	19.55% 123	3.02% 19	0.95% 6	0.32% 2	629	1.90
Storefronts and Buildings: Improve facades, fill empty storefronts and revitalize older buildings	66.51% 423	24.69% 157	7.23% 46	1.26% 8	0.31% 2	0.00% 0	636	1.44
Culture and Entertainment: Expand culture, public art and entertainment	26.86% 170	36.18% 229	29.70% 188	5.53% 35	1.42% 9	0.32% 2	633	2.19
Walkability: Improve walkability to and within the downtown	54.89% 348	26.18% 166	15.62% 99	2.21% 14	0.63% 4	0.47% 3	634	1.69
Bikeability: Improve bikeability to and within the downtown	30.33% 192	21.64% 137	33.97% 215	9.00% 57	4.27% 27	0.79% 5	633	2.38

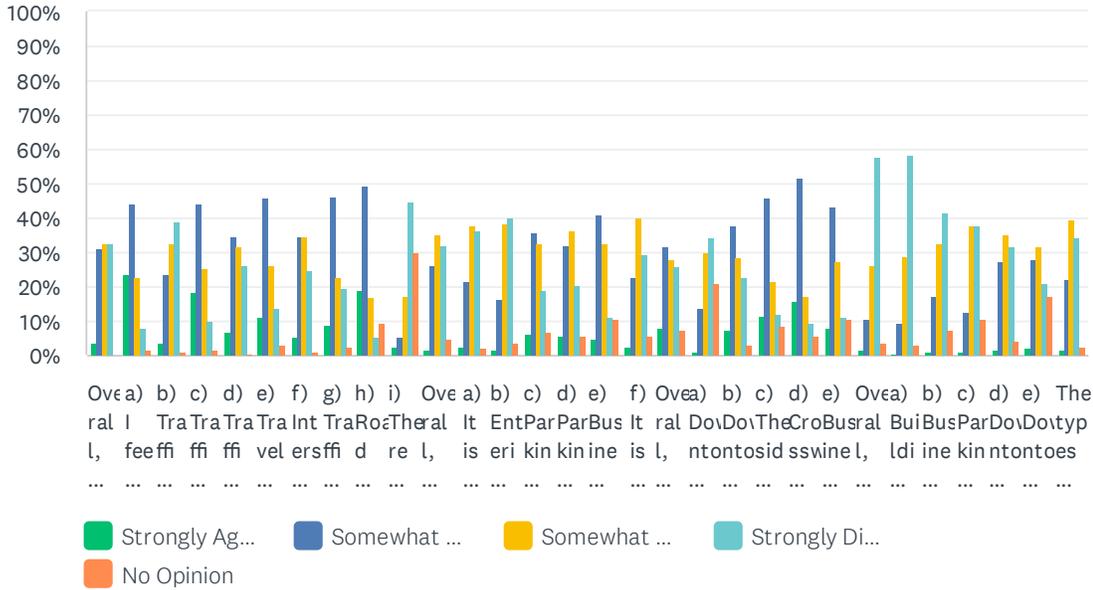
Q5 Please provide a word or phrase (no more than 5 words) that you feel best describes Downtown Northborough today. Please keep your three entries to no more than 50 characters each.

Answered: 575 Skipped: 62

ANSWER CHOICES	RESPONSES	
Word or phrase 1	100.00%	575
Word or phrase 2	90.78%	522
Word or phrase 3	79.48%	457

Q6 Regarding the current transportation conditions of the Downtown area, to what extent do you agree with the following statements: (please check the appropriate box for each row)

Answered: 636 Skipped: 1



## Northborough Downtown Revitalization Survey

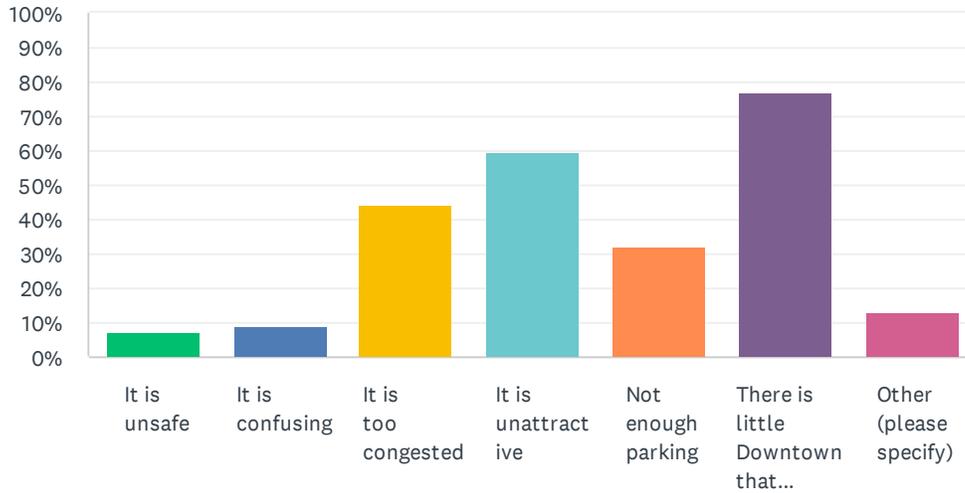
	STRONGLY AGREE	SOMEWHAT AGREE	SOMEWHAT DISAGREE	STRONGLY DISAGREE	NO OPINION	TOTAL	WEIGHTED AVERAGE
Overall, traffic flow through Downtown is efficient.	3.54% 21	30.98% 184	32.83% 195	32.49% 193	0.17% 1	594	2.95
a) I feel safe driving (little fear of an accident)	23.78% 151	44.25% 281	22.52% 143	7.87% 50	1.57% 10	635	2.21
b) Traffic flows smoothly with little congestion	3.63% 23	23.82% 151	32.49% 206	39.12% 248	0.95% 6	634	3.11
c) Traffic / directional signs are easy to interpret while driving	18.35% 116	44.46% 281	25.32% 160	10.13% 64	1.74% 11	632	2.34
d) Traffic signals effectively control the flow of traffic	6.77% 43	34.65% 220	31.65% 201	26.46% 168	0.47% 3	635	2.80
e) Travel lanes are designed well	11.22% 71	45.81% 290	26.38% 167	13.59% 86	3.00% 19	633	2.54
f) Intersections function effectively	5.37% 34	34.60% 219	34.60% 219	24.49% 155	0.95% 6	633	2.82
g) Traffic rules are obeyed	9.18% 58	46.20% 292	22.47% 142	19.62% 124	2.53% 16	632	2.63
h) Road lighting is effective at night	18.90% 120	49.45% 314	16.85% 107	5.35% 34	9.45% 60	635	2.46
i) There is adequate public transportation	2.38% 15	5.39% 34	17.43% 110	44.69% 282	30.11% 190	631	4.25
Overall, access and circulation are effective at business locations Downtown.	1.49% 9	26.32% 159	35.10% 212	32.12% 194	4.97% 30	604	3.18
a) It is easy for me to enter and exit parking lots in Downtown	2.52% 16	21.45% 136	37.70% 239	36.28% 230	2.05% 13	634	3.16
b) Entering and exiting parking lots does not disrupt the roadway traffic for others	1.73% 11	16.22% 103	38.43% 244	39.84% 253	3.78% 24	635	3.31
c) Parking lots are appropriately sized for the businesses they serve (spaces are not too full or empty)	6.18% 39	35.66% 225	32.49% 205	19.02% 120	6.66% 42	631	2.91
d) Parking lots are easy to navigate through and do not cause confusion	5.54% 35	32.12% 203	36.08% 228	20.73% 131	5.54% 35	632	2.94
e) Business signage makes it easy to navigate	4.75% 30	41.20% 260	32.49% 205	11.25% 71	10.30% 65	631	2.91
f) It is easy to navigate between businesses in Downtown	2.70% 17	22.42% 141	39.75% 250	29.57% 186	5.56% 35	629	3.18
Overall, I feel comfortable as a walking pedestrian or bicyclist Downtown.	7.75% 48	31.50% 195	27.79% 172	25.85% 160	7.11% 44	619	3.00
a) Downtown is bicycle friendly	0.95% 6	13.77% 87	30.06% 190	34.34% 217	20.89% 132	632	3.81
b) Downtown is walk friendly	7.63% 48	37.68% 237	28.62% 180	22.73% 143	3.34% 21	629	2.80
c) The sidewalks are in good condition for safety	11.73% 74	45.96% 290	21.71% 137	12.20% 77	8.40% 53	631	2.68

## Northborough Downtown Revitalization Survey

d) Crosswalks effectively facilitate walking safely	15.69% 99	51.82% 327	17.59% 111	9.35% 59	5.55% 35	631	2.43
e) Business parking lots are easy to navigate safely when walking	8.10% 51	43.02% 271	27.14% 171	11.27% 71	10.48% 66	630	2.83
Overall, the Downtown aesthetic appropriately reflects the character of Northborough.	1.80% 11	10.66% 65	26.23% 160	57.87% 353	3.44% 21	610	3.54
a) Buildings in Downtown have curb appeal	0.48% 3	9.35% 59	28.68% 181	58.48% 369	3.01% 19	631	3.57
b) Business signage is aesthetically pleasing	0.95% 6	17.59% 111	32.49% 205	41.68% 263	7.29% 46	631	3.44
c) Parking lots are aesthetically designed	0.95% 6	12.88% 81	38.00% 239	37.68% 237	10.49% 66	629	3.54
d) Downtown landscaping is aesthetically pleasing	1.59% 10	27.62% 174	35.40% 223	31.43% 198	3.97% 25	630	3.13
e) Downtown lighting is appealing	2.25% 14	27.65% 172	31.35% 195	21.22% 132	17.52% 109	622	3.42
The types of businesses in Downtown Northborough generally meet my needs.	1.61% 10	22.03% 137	39.55% 246	34.08% 212	2.73% 17	622	3.17

### Q7 If you do not like going Downtown, please tell us why. (select all that apply)

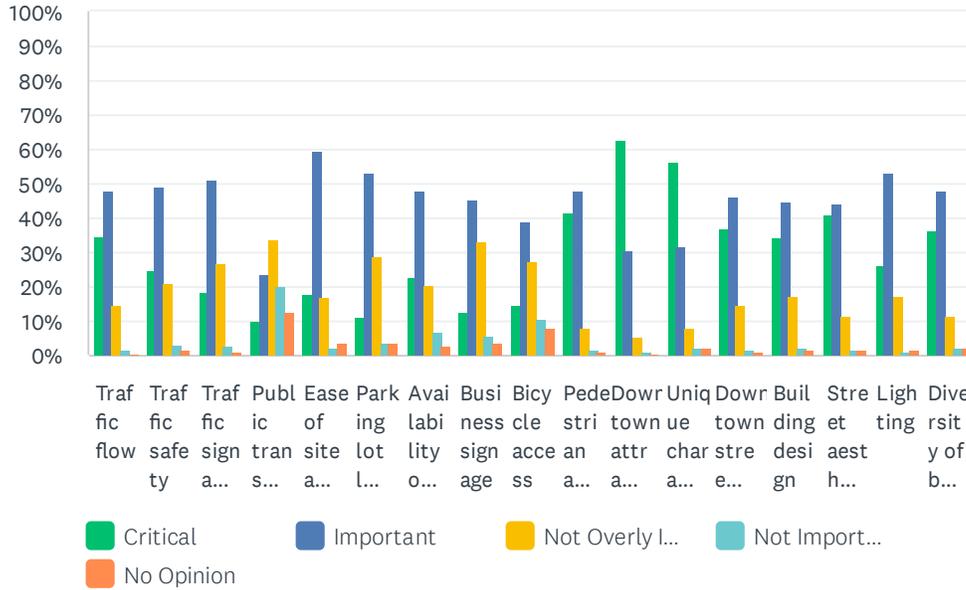
Answered: 573 Skipped: 64



ANSWER CHOICES	RESPONSES	
It is unsafe	7.16%	41
It is confusing	8.73%	50
It is too congested	44.33%	254
It is unattractive	59.34%	340
Not enough parking	32.11%	184
There is little Downtown that interests me	76.61%	439
Other (please specify)	13.09%	75
Total Respondents: 573		

## Q8 In the Downtown area, how would you rate the importance of addressing or improving the following? (please choose the appropriate box for each row)

Answered: 632 Skipped: 5

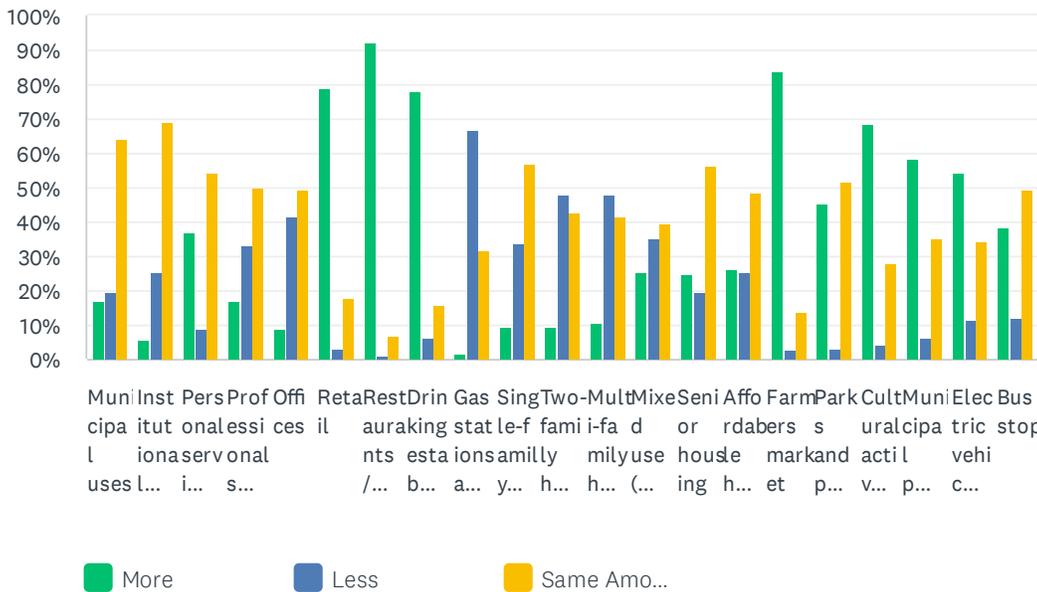


## Northborough Downtown Revitalization Survey

	CRITICAL	IMPORTANT	NOT OVERLY IMPORTANT	NOT IMPORTANT	NO OPINION	TOTAL	WEIGHTED AVERAGE
Traffic flow	34.98% 220	47.85% 301	14.79% 93	1.75% 11	0.64% 4	629	1.85
Traffic safety	24.96% 155	49.11% 305	20.93% 130	3.38% 21	1.61% 10	621	2.08
Traffic signals and signs	18.40% 115	50.88% 318	26.88% 168	2.72% 17	1.12% 7	625	2.17
Public transportation	9.94% 62	23.72% 148	33.65% 210	20.19% 126	12.50% 78	624	3.02
Ease of site access	17.90% 111	59.35% 368	17.10% 106	1.94% 12	3.71% 23	620	2.14
Parking lot layout	10.88% 68	52.96% 331	28.80% 180	3.84% 24	3.52% 22	625	2.36
Availability of municipal and on-street parking	22.65% 142	47.69% 299	20.41% 128	6.86% 43	2.39% 15	627	2.19
Business signage	12.66% 79	45.03% 281	33.01% 206	5.77% 36	3.53% 22	624	2.42
Bicycle access	14.74% 92	39.10% 244	27.40% 171	10.74% 67	8.01% 50	624	2.58
Pedestrian access	41.32% 257	47.91% 298	8.04% 50	1.45% 9	1.29% 8	622	1.73
Downtown attractiveness	62.74% 394	30.41% 191	5.41% 34	0.80% 5	0.64% 4	628	1.46
Unique character of Northborough	56.30% 353	31.42% 197	8.13% 51	2.07% 13	2.07% 13	627	1.62
Downtown street landscaping	36.66% 228	46.14% 287	14.63% 91	1.77% 11	0.80% 5	622	1.84
Building design	34.08% 213	44.64% 279	17.28% 108	2.24% 14	1.76% 11	625	1.93
Street aesthetics	40.90% 254	43.96% 273	11.59% 72	1.77% 11	1.77% 11	621	1.80
Lighting	26.40% 165	53.12% 332	17.60% 110	1.12% 7	1.76% 11	625	1.99
Diversity of businesses	36.48% 228	47.68% 298	11.68% 73	2.08% 13	2.08% 13	625	1.86

### Q9 What types of development and services do you feel Downtown needs more of, less of, or the same amount of? (please check the appropriate box for each row)

Answered: 630 Skipped: 7

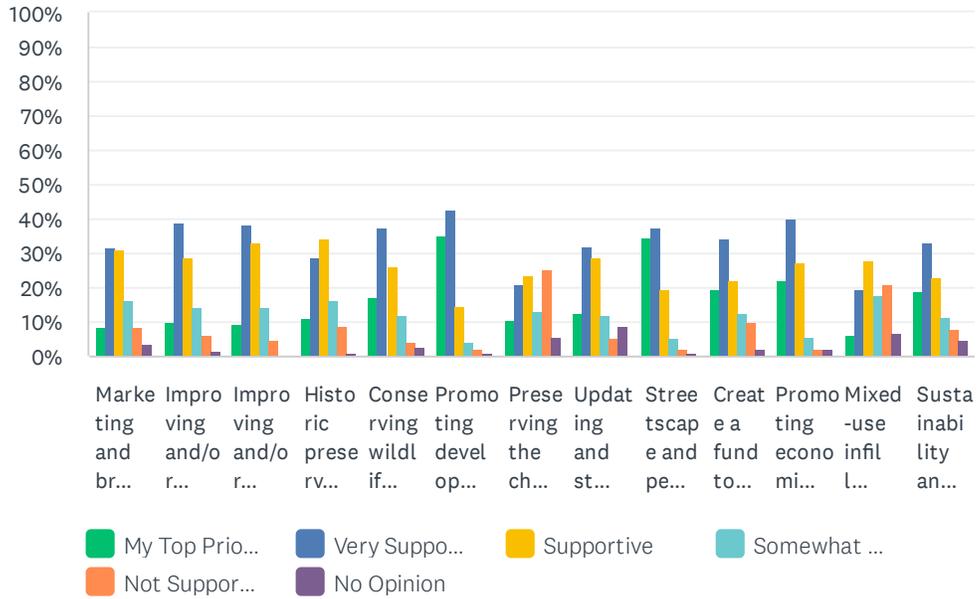


## Northborough Downtown Revitalization Survey

	MORE	LESS	SAME AMOUNT	TOTAL
Municipal uses	16.67% 99	19.36% 115	63.97% 380	594
Institutional uses (churches, daycare facilities)	5.82% 36	25.20% 156	68.98% 427	619
Personal services (barber, beauty salon, photographer)	36.89% 228	8.90% 55	54.21% 335	618
Professional services (bank, medical, realtor)	16.80% 105	33.28% 208	49.92% 312	625
Offices	8.79% 54	41.53% 255	49.67% 305	614
Retail	79.09% 488	2.92% 18	17.99% 111	617
Restaurants / eateries	92.05% 579	0.95% 6	7.00% 44	629
Drinking establishments / brew pubs	78.04% 487	6.41% 40	15.54% 97	624
Gas stations and auto repair shops	1.44% 9	66.77% 418	31.79% 199	626
Single-family homes	9.69% 60	33.60% 208	56.70% 351	619
Two-family homes (duplexes)	9.63% 60	47.67% 297	42.70% 266	623
Multi-family homes	10.42% 65	47.92% 299	41.67% 260	624
Mixed use (housing and commercial together)	25.28% 157	35.43% 220	39.29% 244	621
Senior housing	24.56% 152	19.22% 119	56.22% 348	619
Affordable housing	26.26% 161	25.29% 155	48.45% 297	613
Farmers market	83.47% 520	2.73% 17	13.80% 86	623
Parks and playgrounds	45.19% 282	3.37% 21	51.44% 321	624
Cultural activities (art festivals, concerts, parades)	68.32% 427	4.00% 25	27.68% 173	625
Municipal parking lot	58.48% 362	6.30% 39	35.22% 218	619
Electric vehicle charging stations	54.15% 333	11.38% 70	34.47% 212	615
Bus stop	38.36% 234	11.97% 73	49.67% 303	610

Q10 Below are examples of types of initiatives that towns can prioritize through new programs, investment of tax dollars, or changes in policy. This question will help us determine the types of actions that may be supported by Northborough residents and property owners. Please check a box for each row based on how important you think each action is for the revitalization of the downtown planning area.

Answered: 629 Skipped: 8



## Northborough Downtown Revitalization Survey

	MY TOP PRIORITY!	VERY SUPPORTIVE	SUPPORTIVE	SOMEWHAT SUPPORTIVE	NOT SUPPORTIVE	NO OPINION	TOTAL	WEIGHT AVERAG
Marketing and branding for the Downtown area	8.58% 53	31.39% 194	31.23% 193	16.50% 102	8.58% 53	3.72% 23	618	2
Improving and/or expanding recreation resources, parks, and playgrounds	9.79% 61	39.00% 243	28.89% 180	14.29% 89	6.42% 40	1.61% 10	623	2
Improving and/or expanding cultural and recreation activities	9.66% 60	38.16% 237	33.01% 205	14.17% 88	4.51% 28	0.48% 3	621	2
Historic preservation	10.91% 68	28.89% 180	34.03% 212	16.53% 103	8.83% 55	0.80% 5	623	2
Conserving wildlife habitat, wetlands, and/or woodlands	17.60% 110	37.28% 233	26.08% 163	12.16% 76	4.16% 26	2.72% 17	625	2
Promoting development of vacant or underutilized properties through incentives	35.36% 221	42.72% 267	14.72% 92	4.32% 27	1.92% 12	0.96% 6	625	1
Preserving the character of existing downtown	10.74% 67	21.15% 132	23.88% 149	13.30% 83	25.32% 158	5.61% 35	624	3
Updating and streamlining land development regulations and zoning ordinance	12.46% 77	31.88% 197	29.13% 180	11.97% 74	5.50% 34	9.06% 56	618	2
Streetscape and pedestrian improvements within Downtown area (more walkability)	34.77% 218	37.16% 233	19.46% 122	5.42% 34	2.07% 13	1.12% 7	627	2
Create a fund to help businesses make capital improvements (i.e., façade	19.33% 121	34.03% 213	21.88% 137	12.78% 80	9.74% 61	2.24% 14	626	2

## Northborough Downtown Revitalization Survey

improvements,  
signage and  
awning  
improvements,  
sidewalk  
accessibility,  
outdoor  
amenities)

Promoting economic development	22.35% 139	40.19% 250	27.49% 171	5.63% 35	2.25% 14	2.09% 13	622	2
Mixed-use infill development (ground-floor commercial with 2nd story residential)	6.40% 40	19.68% 123	28.00% 175	17.92% 112	20.96% 131	7.04% 44	625	3
Sustainability and climate resilience	19.00% 118	33.33% 207	23.19% 144	11.76% 73	7.73% 48	4.99% 31	621	2

## Q11 Is there anything else you would like to share about the Downtown Revitalization effort?

Answered: 258 Skipped: 379

**Q12 Please share your email to receive information about future engagement opportunities.**

Answered: 255 Skipped: 382



**TURNING MOVEMENT COUNT WORKSHEET**

**CMRPC**

MUNICIPALITY: Town of Northborough

DATE: 2/9/2023

LOCATION: West Main Street (Rt 20)/ Church Street

DAY OF WEEK: Thursday

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Church Street (SB)								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
7:00 - 7:15	30	92	0	4	0	45	47	5	75	0	25	2					314	
7:15 - 7:30	23	119	0	6	0	69	82	4	100	0	35	11					428	
7:30 - 7:45	28	157	0	4	0	89	90	10	159	0	30	5					553	
7:45 - 8:00	32	138	0	4	0	104	63	12	134	0	31	2					502	1797
8:00 - 8:15	40	127	0	6	0	97	57	13	110	0	34	2					465	1948
8:15 - 8:30	27	135	0	7	0	84	63	4	111	0	30	8					450	1970
8:30 - 8:45	37	122	0	3	0	95	66	7	96	0	29	3					445	1862
8:45 - 9:00	27	131	0	6	0	99	55	10	98	0	41	2					451	1811
<b>TOTAL</b>	<b>244</b>	<b>1021</b>	<b>0</b>	<b>40</b>	<b>0</b>	<b>682</b>	<b>523</b>	<b>65</b>	<b>883</b>	<b>0</b>	<b>255</b>	<b>35</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3608</b>	
	EBPct 34.7				WBPct 32.8				NBPct 32.4				SBPct 0.0					

Peak Sums: 127 557 0 21 0 374 273 39 514 0 125 17 0 0 0 0 0 1970  
 Total Trucks 77 TrkPct 3.91 PHF 0.89

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Church Street (SB)								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
4:00 - 4:15	48	115	0	2	0	141	105	5	64	0	32	2					505	
4:15 - 4:30	43	100	0	2	0	167	92	3	89	0	27	1					518	
4:30 - 4:45	35	100	0	0	0	152	98	1	67	0	42	2					494	
4:45 - 5:00	43	100	0	1	0	163	89	2	88	0	38	3					521	2038
5:00 - 5:15	40	122	0	1	0	189	96	5	90	0	44	1					581	2114
5:15 - 5:30	32	87	0	1	0	173	108	3	92	0	29	0					521	2117
5:30 - 5:45	27	108	0	0	0	150	98	2	83	0	26	3					492	2115
5:45 - 6:00	30	100	0	1	0	143	79	1	78	0	30	1					460	2054
6:00 - 6:15	41	113	0	0	0	132	92	1	68	0	23	1					469	1942
6:15 - 6:30	26	70	0	1	0	134	81	4	58	0	23	0					392	1813
6:30 - 6:45	31	73	0	0	0	90	81	0	50	0	29	0					354	1675
6:45 - 7:00	24	93	0	0	0	105	62	0	44	0	17	1					345	1560
<b>TOTAL</b>	<b>420</b>	<b>1181</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>1739</b>	<b>1081</b>	<b>27</b>	<b>871</b>	<b>0</b>	<b>360</b>	<b>15</b>	<b>0</b>	<b>1739</b>	<b>1081</b>	<b>0</b>	<b>5652</b>	
	EBPct 26.4				WBPct 50.4				NBPct 23.1				SBPct 0.0					

Peak Sums: 150 409 0 3 0 677 391 11 337 0 153 6 0 0 0 0 0 2117  
 Total Trucks 20 TrkPct 0.94 PHF 0.91

**TURNING MOVEMENT COUNT WORKSHEET**

**CMRPC**

MUNICIPALITY: Town of Northborough

DATE: 2/11/2023

LOCATION: West Main Street (Rt 20)/ Church Street

DAY OF WEEK: Sat

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Church Street (SB)								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
11:00 - 11:15	37	145	0	0	0	132	53	0	76	0	38						481	
11:15 - 11:30	43	127	0	0	0	142	74	0	61	0	45	2					492	
11:30 - 11:45	45	143	0	0	0	140	63	1	65	0	49						505	
11:45 - 12:00	37	141	0	1	0	139	73	1	70	0	49						509	1987
12:00 - 12:15	48	111	0	0	0	122	57	0	64	0	42						444	1950
12:15 - 12:30	41	118	0	0	0	127	82	1	67	0	40						475	1933
12:30 - 12:45	33	116	0	0	0	126	60	1	63	0	43						441	1869
12:45 - 1:00	49	136	0	0	0	138	64	2	49	0	32	1					468	1828
1:00 - 1:15	36	103	0	1	0	117	56	1	70	0	41						423	1807
1:15 - 1:30	26	127	0	0	0	123	58	0	60	0	42						436	1768
1:30 - 1:45	35	112	0	0	0	121	61	0	59	0	39						425.9	1753
1:45 - 2:00	34	110	0	0	0	119	60	0	57	0	38						418.3	1703
<b>TOTAL</b>	<b>463</b>	<b>1489</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>1545</b>	<b>761</b>	<b>7</b>	<b>761</b>	<b>0</b>	<b>498</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5518</b>	
	EBPct 36.1				WBPct 41.1				NBPct 22.8				SBPct 0.0					

Peak Sums: 162 556 0 1 0 553 263 2 272 0 181 2 0 0 0 0 0 1987  
 Total Trucks 5 TrkPct 0.25 PHF 0.98

# TURNING MOVEMENT COUNT WORKSHEET

CMRPC

MUNICIPALITY: Town of Northborough

DATE: 1/5/2023

LOCATION: West Main Street (Rt 20)/ Hudson Street

DAY OF WEEK: Thursday

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Hudson St SB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
7:00 - 7:15	25	89	0	2	0	49	9	9	8	0	15	1					195	
7:15 - 7:30	29	161	0	16	0	85	8	6	18	0	24	2					325	
7:30 - 7:45	23	200	0	5	0	108	4	10	14	0	28	1					377	
7:45 - 8:00	31	228	0	4	0	122	12	7	12	0	31	1					436	1333
8:00 - 8:15	29	160	0	2	0	129	4	10	7	0	20	2					349	1487
8:15 - 8:30	24	165	0	8	0	111	0	6	10	0	23	1					333	1495
8:30 - 8:45	25	141	0	5	0	102	3	4	8	0	28	1					307	1425
8:45 - 9:00	28	139	0	5	0	118	8	6	8	0	30	1					331	1320
<b>TOTAL</b>	<b>214</b>	<b>1283</b>	<b>0</b>	<b>47</b>	<b>0</b>	<b>824</b>	<b>48</b>	<b>58</b>	<b>85</b>	<b>0</b>	<b>199</b>	<b>10</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2653</b>	
EBPct		57.5		WBPct		32.8		NBPct		9.7		SBPct		0.0				

Peak Sums: 107 753 0 19 0 470 20 33 43 0 102 5 0 0 0 0 1495  
 Total Trucks 57 TrkPct 3.81 PHF 0.86

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Hudson St SB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
4:00 - 4:15	31	119	0	2	0	154	6	3	10	4	22	1					346	
4:15 - 4:30	40	129	0	4	0	144	5	2	10	1	13	2					342	
4:30 - 4:45	25	108	0	4	0	172	11	3	14	1	23	0					354	
4:45 - 5:00	39	141	0	3	0	153	5	2	6	1	13	0					358	1400
5:00 - 5:15	30	120	0	7	0	174	10	0	11	1	26	2					372	1426
5:15 - 5:30	27	121	0	7	0	163	6	1	9	1	18	0					345	1429
5:30 - 5:45	34	95	0	2	0	134	9	0	12	3	16	0					303	1378
5:45 - 6:00	37	140	0	0	0	180	10	1	3	0	11	0					381	1401
6:00 - 6:15	35	138	0	3	0	187	5	1	11	1	26	1					403	1432
6:15 - 6:30	33	115	0	2	0	172	11	2	9	1	18	0					359	1446
6:30 - 6:45	30	97	0	1	0	165	5	2	12	3	16	1					328	1471
6:45 - 7:00	24	124	0	0	0	166	7	2	3	0	11	0					335	1425
<b>TOTAL</b>	<b>385</b>	<b>1447</b>	<b>0</b>	<b>35</b>	<b>0</b>	<b>1964</b>	<b>90</b>	<b>19</b>	<b>110</b>	<b>17</b>	<b>213</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4226</b>	
EBPct		42.5		WBPct		50.0		NBPct		7.5		SBPct		0.0				

Peak Sums: 135 490 0 6 0 704 31 6 35 5 71 2 0 0 0 0 1471  
 Total Trucks 14 TrkPct 0.95 PHF 0.91

# TURNING MOVEMENT COUNT WORKSHEET

CMRPC

MUNICIPALITY: Town of Northborough

DATE: 2/18/2023

LOCATION: West Main Street (Rt 20)/ Hudson Street

DAY OF WEEK: Sat

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				Hudson St SB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
11:00 - 11:15	37	119	0	1	0	112	3	1	9	0	46	0					326	
11:15 - 11:30	42	107	0	0	0	120	5	0	10	0	45	0					329	
11:30 - 11:45	48	104	0	2	0	109	9	0	7	0	36	0					313	
11:45 - 12:00	32	110	0	1	0	151	6	0	14	0	56	0					369	1337
12:00 - 12:15	49	107	0	1	0	101	6	0	10	0	27	0					300	1311
12:15 - 12:30	40	115	0	1	0	124	7	0	6	0	35	0					327	1309
12:30 - 12:45	41	115	0	0	0	109	6	1	12	0	41	0					324	1320
12:45 - 1:00	38	131	0	0	0	139	2	1	10	0	56	0					376	1327
1:00 - 1:15	41	105	0	2	0	145	8	0	5	0	47	0					351	1378
1:15 - 1:30	34	89	0	0	0	121	7	0	15	0	49	0					315	1366
1:30 - 1:45	45	130	0	0	0	127	4	0	5	0	43	0					354	1396
1:45 - 2:00	46	97	0	1	0	119	8	0	7	0	42	0					319	1339
<b>TOTAL</b>	<b>493</b>	<b>1329</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>1477</b>	<b>71</b>	<b>3</b>	<b>110</b>	<b>0</b>	<b>523</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4003</b>	
EBPct		43.9		WBPct		39.6		NBPct		16.5		SBPct		0.0				

Peak Sums: 158 455 0 2 0 532 21 1 35 0 195 0 0 0 0 0 1396  
 Total Trucks 3 TrkPct 0.21 PHF 0.93

**TURNING MOVEMENT COUNT WORKSHEET**

**CMRPC**

MUNICIPALITY: Town of Northborough

DATE: 1/5/2023

LOCATION: West Main Street (Rt 20)/ South Street

DAY OF WEEK: Thursday

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				South Street NB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
7:00 - 7:15	0	108	39	3	7	54	0	4	23	0	13	0					244	
7:15 - 7:30	0	188	29	15	6	108	0	9	33	0	18	0					382	
7:30 - 7:45	0	205	45	5	18	111	0	12	51	0	15	0					445	
7:45 - 8:00	0	251	63	4	20	146	0	7	36	0	19	2					535	1606
8:00 - 8:15	0	182	54	5	12	145	0	10	44	0	22	1					459	1821
8:15 - 8:30	0	179	62	9	11	120	0	6	36	0	16	3					424	1863
8:30 - 8:45	0	169	43	4	16	114	0	6	33	0	13	4					388	1806
8:45 - 9:00	0	159	59	5	16	135	0	7	41	0	15	4					425	1696
<b>TOTAL</b>	<b>0</b>	<b>1441</b>	<b>394</b>	<b>50</b>	<b>106</b>	<b>933</b>	<b>0</b>	<b>61</b>	<b>297</b>	<b>0</b>	<b>131</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3302</b>	

EBPct 55.9      WBPct 31.3      NBPct 12.8      SBPct 0.0

Peak Sums: 0 817 224 23 61 522 0 35 167 0 72 6 0 0 0 0 0 1863  
 Total Trucks 64      TrkPct 3.44      PHF 0.87

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				South Street NB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
4:00 - 4:15	0	117	31	2	0	151	6	3	12	0	33	1					350	
4:15 - 4:30	0	126	39	4	0	142	5	2	8	0	47	2					367	
4:30 - 4:45	0	104	25	4	0	170	10	3	9	0	41	0					359	
4:45 - 5:00	0	138	39	3	0	151	5	2	12	0	38	0					383	1459
5:00 - 5:15	0	113	30	7	0	174	10	0	9	0	52	2					388	1497
5:15 - 5:30	0	114	27	7	0	162	6	1	18	0	58	0					385	1515
5:30 - 5:45	0	93	34	2	0	134	9	0	14	0	50	0					334	1490
5:45 - 6:00	0	140	37	0	0	179	10	1	9	0	54	0					429	1536
6:00 - 6:15	0	135	35	3	0	186	5	1	5	0	56	1					422	1570
6:15 - 6:30	0	114	32	2	0	170	11	2	13	0	59	0					399	1584
6:30 - 6:45	0	96	30	1	0	163	5	2	5	0	39	1					338	1588
6:45 - 7:00	0	124	24	0	0	164	7	2	15	0	40	0					374	1533
<b>TOTAL</b>	<b>0</b>	<b>1414</b>	<b>383</b>	<b>35</b>	<b>0</b>	<b>1946</b>	<b>89</b>	<b>19</b>	<b>129</b>	<b>0</b>	<b>567</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4528</b>	

EBPct 39.0      WBPct 45.9      NBPct 15.1      SBPct 0.0

Peak Sums: 0 485 134 6 0 698 31 6 32 0 208 2 0 0 0 0 0 1588  
 Total Trucks 14      TrkPct 0.88      PHF 0.93

**TURNING MOVEMENT COUNT WORKSHEET**

**CMRPC**

MUNICIPALITY: Town of Northborough

DATE: 2/18/2023

LOCATION: West Main Street (Rt 20)/ South Street

DAY OF WEEK: Sat

WEATHER: AM: Cloudy PM: Cloudy

TECHNICIAN: Camera

Time Period	West Main St (Rte 20) EB				West Main St (Rte 20) WB				South Street NB								Total	Peak
	L	S	R	HV	L	S	R	HV	L	S	R	HV	L	S	R	HV		
11:00 - 11:15	0	154	41	1	14	155	0	0	39	0	25	1					428	
11:15 - 11:30	0	130	36	1	27	147	0	1	57	0	32	0					429	
11:30 - 11:45	0	123	32	0	25	132	0	0	43	0	25	0					380	
11:45 - 12:00	0	138	46	2	27	183	0	0	33	0	18	0					445	1682
12:00 - 12:15	0	140	45	1	22	133	0	0	35	0	26	0					401	1655
12:15 - 12:30	0	154	37	2	23	144	0	0	38	0	13	0					409	1635
12:30 - 12:45	0	139	41	0	17	135	0	1	42	0	24	0					398	1653
12:45 - 1:00	0	159	51	0	21	162	0	1	45	0	23	1					461	1669
1:00 - 1:15	0	118	36	1	20	182	0	0	36	0	27	1					419	1687
1:15 - 1:30	0	136	40	0	24	145	0	0	42	0	18	1					405	1683
1:30 - 1:45	0	148	48	0	30	146	0	0	55	0	23	0					450	1735
1:45 - 2:00	0	135	47	1	28	128	0	0	41	0	16	0					395	1669
<b>TOTAL</b>	<b>0</b>	<b>1674</b>	<b>500</b>	<b>9</b>	<b>278</b>	<b>1792</b>	<b>0</b>	<b>3</b>	<b>506</b>	<b>0</b>	<b>270</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5020</b>	

EBPct 42.4      WBPct 42.1      NBPct 15.5      SBPct 0.0

Peak Sums: 0 561 175 1 95 635 0 1 178 0 91 3 0 0 0 0 0 1735  
 Total Trucks 5      TrkPct 0.29      PHF 0.94

Massachusetts Highway Department  
 Statewide Traffic Data Collection  
 2019 Weekday Seasonal Factors

Factor Group	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Axle Factor
R1	1.22	1.14	1.12	1.06	1.00	0.96	0.87	0.85	0.96	0.99	1.04	1.12	0.85
R2	0.95	0.96	0.98	0.97	0.97	0.93	0.97	0.94	0.96	0.90	0.92	0.93	0.96
R3	1.15	1.06	1.07	1.00	0.89	0.88	0.89	0.89	0.95	0.92	1.02	1.01	0.97
R4-R7	1.09	1.09	1.11	1.02	0.96	0.92	0.89	0.89	0.99	0.98	1.09	1.13	0.98
U1-Boston	1.03	1.01	0.98	0.94	0.94	0.92	0.95	0.93	0.94	0.94	0.97	1.04	0.96
U1-Essex	1.09	1.06	1.03	0.99	0.94	0.90	0.88	0.86	0.93	0.94	0.99	1.06	0.93
U1-Southeast	1.06	1.05	1.01	0.97	0.95	0.93	0.93	0.90	0.94	0.94	0.98	1.04	0.98
U1-West	1.19	1.14	1.09	0.95	0.92	0.89	0.89	0.86	0.91	0.95	0.97	1.07	0.84
U1-Worcester	1.02	1.04	0.97	0.94	0.93	0.91	0.95	0.91	0.93	0.92	0.95	1.10	0.88
U2	1.01	1.00	0.94	0.93	0.91	0.89	0.93	0.90	0.90	0.91	0.94	1.02	0.99
U3	1.06	1.03	0.98	0.94	0.93	0.91	0.95	0.91	0.92	0.93	0.97	1.00	0.98
U4-U7	1.01	1.00	0.95	0.92	0.88	0.86	0.92	0.91	0.92	0.94	0.99	1.04	0.99
Rec - East	1.04	1.16	1.12	0.98	0.92	0.88	0.77	0.81	0.94	1.02	1.08	1.12	0.99
Rec - West	1.30	1.23	1.32	1.18	0.95	0.82	0.70	0.69	0.97	0.96	1.16	1.15	0.98

Round off:

0-999 = 10

>1000 = 100

U = Urban  
 R = Rural

- 1 - Interstate
- 2 - Freeway and Expressway
- 3 - Other Principal Arterial
- 4 - Minor Arterial
- 5 - Major Collector
- 6 - Minor Collector
- 7 - Local Road and Street

<b>Recreational - East Group</b> - Cape Cod (all towns) including the town of Plymouth south of Route 3A (stations 7014,7079,7080,7090,7091,7092,7093,7094,7095,7096,7097,7108 and 7178), Martha's Vineyard and Nantucket.
<b>Recreational - West Group</b> - Continuous Stations 2 and 189 including stations 1066,1067,1083,1084,1085,1086,1087,1088,1089,1090,1091,1092,1093,1094,1095,1096,1097,1098,1099,1100,1101,1102,1103,1104,1105,1106,1107,1108,1113,1114,1116,2196,2197 and 2198.

**AM PEAK HOUR TRAFFIC VOLUME CALCULATIONS**  
Downtown Revitalization Plan

Intersection	Scenario	Traffic Volumes												
		From North			From East			From South			From West			
		SBLT	SBT	SBRT	WBLT	WBT	WBRT	NBLT	NBT	NBRT	EBLT	EBT	EBRT	
Main St & Church St.	Traffic Count	514		125	0	374	273					127	557	0
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	<b>2023 Peak Season Traffic</b>	<b>529</b>	<b>0</b>	<b>129</b>	<b>0</b>	<b>385</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>131</b>	<b>574</b>	<b>0</b>
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Existing plus Background Growth	548	0	133	0	399	291	0	0	0	0	135	594	0
	<b>0 Background Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>548</b>	<b>0</b>	<b>133</b>	<b>0</b>	<b>399</b>	<b>291</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>135</b>	<b>594</b>	<b>0</b>
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	
<b>0 Total Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	
<b>2030 Total Traffic</b>	<b>548</b>	<b>0</b>	<b>133</b>	<b>0</b>	<b>399</b>	<b>291</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>135</b>	<b>594</b>	<b>0</b>	
Main Street & South Street	Traffic Count	0	0	0	61	522	0	167	0	72	0	817	224	
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
	<b>2023 Peak Season Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>63</b>	<b>538</b>	<b>0</b>	<b>172</b>	<b>0</b>	<b>74</b>	<b>0</b>	<b>842</b>	<b>231</b>	
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	
	Existing plus Background Growth	0	0	0	65	557	0	178	0	77	0	871	239	
	<b>0 Background Traffic</b>	0	0	0	1	1	0	1	0	1	0	1	1	
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>65</b>	<b>557</b>	<b>0</b>	<b>178</b>	<b>0</b>	<b>77</b>	<b>0</b>	<b>871</b>	<b>239</b>	
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0		
<b>0 Total Traffic</b>	0	0	0	1	1	0	1	0	1	0	1	1		
<b>2030 Total Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>65</b>	<b>557</b>	<b>0</b>	<b>178</b>	<b>0</b>	<b>77</b>	<b>0</b>	<b>871</b>	<b>239</b>		
Main Street & Hudson Street	Traffic Count	43	0	102	0	470	20	107	753	0				
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03				
	<b>2023 Peak Season Traffic</b>	<b>44</b>	<b>0</b>	<b>105</b>	<b>0</b>	<b>484</b>	<b>21</b>	<b>110</b>	<b>776</b>	<b>0</b>				
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%				
	Existing plus Background Growth	46	0	109	0	501	21	114	803	0				
	<b>0 Background Traffic</b>	1	0	1	0	1	1	1	1	0				
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>46</b>	<b>0</b>	<b>109</b>	<b>0</b>	<b>501</b>	<b>21</b>	<b>114</b>	<b>803</b>	<b>0</b>				
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0					
<b>0 Total Traffic</b>	1	0	1	0	1	1	1	1	1					
<b>2030 Total Traffic</b>	<b>46</b>	<b>0</b>	<b>109</b>	<b>0</b>	<b>501</b>	<b>21</b>	<b>114</b>	<b>803</b>	<b>0</b>					

**PM PEAK HOUR TRAFFIC VOLUME CALCULATIONS**  
Downtown Revitalization Plan

Intersection	Scenario	Traffic Volumes												
		From North			From East			From South			From West			
		SBLT	SBT	SBRT	WBLT	WBT	WBRT	NBLT	NBT	NBRT	EBLT	EBT	EBRT	
Main St & Church St.	Traffic Count	337	0	153	0	677	391	0	0	0	0	150	409	0
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
	<b>2023 Peak Season Traffic</b>	<b>347</b>	<b>0</b>	<b>158</b>	<b>0</b>	<b>697</b>	<b>403</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>155</b>	<b>421</b>	<b>0</b>
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
	Existing plus Background Growth	359	0	163	0	722	417	0	0	0	0	160	436	0
	<b>0 Background Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>359</b>	<b>0</b>	<b>163</b>	<b>0</b>	<b>722</b>	<b>417</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>160</b>	<b>436</b>	<b>0</b>
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	
<b>0 Total Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	
<b>2030 Total Traffic</b>	<b>359</b>	<b>0</b>	<b>163</b>	<b>0</b>	<b>722</b>	<b>417</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>160</b>	<b>436</b>	<b>0</b>	
Main Street & South Street	Traffic Count	0	0	0	31	698	0	32	0	208	0	485	134	
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
	<b>2023 Peak Season Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>32</b>	<b>719</b>	<b>0</b>	<b>33</b>	<b>0</b>	<b>214</b>	<b>0</b>	<b>500</b>	<b>138</b>	
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	
	Existing plus Background Growth	0	0	0	33	744	0	34	0	222	0	517	143	
	<b>0 Background Traffic</b>	0	0	0	1	1	0	1	0	1	0	1	1	
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>744</b>	<b>0</b>	<b>34</b>	<b>0</b>	<b>222</b>	<b>0</b>	<b>517</b>	<b>143</b>	
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0		
<b>0 Total Traffic</b>	0	0	0	1	1	0	1	0	1	0	1	1		
<b>2030 Total Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>33</b>	<b>744</b>	<b>0</b>	<b>34</b>	<b>0</b>	<b>222</b>	<b>0</b>	<b>517</b>	<b>143</b>		
Main Street & Hudson Street	Traffic Count	35	5	71	0	704	31	0	0	0	135	490	0	
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	
	<b>2023 Peak Season Traffic</b>	<b>36</b>	<b>5</b>	<b>73</b>	<b>0</b>	<b>725</b>	<b>32</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>139</b>	<b>505</b>	<b>0</b>	
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	
	Existing plus Background Growth	37	5	76	0	751	33	0	0	0	144	523	0	
	<b>0 Background Traffic</b>	1	1	1	0	1	1	0	0	0	1	1	0	
	Committed Development Trips													
	<b>2030 Background Traffic</b>	<b>37</b>	<b>5</b>	<b>76</b>	<b>0</b>	<b>751</b>	<b>33</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>144</b>	<b>523</b>	<b>0</b>	
	In/Out													
	Project Assignment													
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0		
<b>0 Total Traffic</b>	1	1	1	0	1	1	0	0	0	1	1	0		
<b>2030 Total Traffic</b>	<b>37</b>	<b>5</b>	<b>76</b>	<b>0</b>	<b>751</b>	<b>33</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>144</b>	<b>523</b>	<b>0</b>		

**SAT PEAK HOUR TRAFFIC VOLUME CALCULATIONS**  
Downtown Revitalization Plan

Intersection	Scenario	Traffic Volumes																							
		From North						From East						From South						From West					
		SBLT	SBT	SBRT	WBLT	WBT	WBRT	NBLT	NBT	NBRT	EBLT	EBT	EBRT	NBLT	NBT	NBRT	EBLT	EBT	EBRT						
Main St & Church St.	Traffic Count	272	0	181	0	553	263	0	0	0	0	162	556	0	0	0	0	162	556	0					
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03					
	<b>2023 Peak Season Traffic</b>	<b>280</b>	<b>0</b>	<b>186</b>	<b>0</b>	<b>570</b>	<b>271</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>167</b>	<b>573</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>167</b>	<b>573</b>	<b>0</b>						
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%					
	Existing plus Background Growth	290	0	193	0	590	281	0	0	0	0	173	593	0	0	0	173	593	0						
	<b>0 Background Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0						
	Committed Development Trips																								
	<b>2030 Background Traffic</b>	<b>290</b>	<b>0</b>	<b>193</b>	<b>0</b>	<b>590</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>593</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>593</b>	<b>0</b>						
	In/Out																								
	Project Assignment																								
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
<b>0 Total Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0							
<b>2030 Total Traffic</b>	<b>290</b>	<b>0</b>	<b>193</b>	<b>0</b>	<b>590</b>	<b>281</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>593</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>593</b>	<b>0</b>							
Main Street & South Street	Traffic Count	0	0	0	95	635	0	178	0	91	0	0	561	175	0	0	0	0	561	175					
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03					
	<b>2023 Peak Season Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>98</b>	<b>654</b>	<b>0</b>	<b>183</b>	<b>0</b>	<b>94</b>	<b>0</b>	<b>0</b>	<b>578</b>	<b>180</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>578</b>	<b>180</b>						
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%					
	Existing plus Background Growth	0	0	0	101	677	0	190	0	97	0	0	598	187	0	0	0	0	598	187					
	<b>0 Background Traffic</b>	0	0	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1					
	Committed Development Trips																								
	<b>2030 Background Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>101</b>	<b>677</b>	<b>0</b>	<b>190</b>	<b>0</b>	<b>97</b>	<b>0</b>	<b>0</b>	<b>598</b>	<b>187</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>598</b>	<b>187</b>						
	In/Out																								
	Project Assignment																								
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
<b>0 Total Traffic</b>	0	0	0	1	1	0	1	0	1	0	0	1	1	0	0	0	1	1							
<b>2030 Total Traffic</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>101</b>	<b>677</b>	<b>0</b>	<b>190</b>	<b>0</b>	<b>97</b>	<b>0</b>	<b>0</b>	<b>598</b>	<b>187</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>598</b>	<b>187</b>							
Main Street & Hudson Street	Traffic Count	35	0	195	0	532	21	0	0	0	0	158	455	0	0	0	158	455	0						
	Peak Season Conversion Factor	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03						
	<b>2023 Peak Season Traffic</b>	<b>36</b>	<b>0</b>	<b>201</b>	<b>0</b>	<b>548</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>163</b>	<b>469</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>163</b>	<b>469</b>	<b>0</b>						
	Compound Growth Rate	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%					
	Existing plus Background Growth	37	0	208	0	567	22	0	0	0	0	169	485	0	0	0	169	485	0						
	<b>0 Background Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0						
	Committed Development Trips																								
	<b>2030 Background Traffic</b>	<b>37</b>	<b>0</b>	<b>208</b>	<b>0</b>	<b>567</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>169</b>	<b>485</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>169</b>	<b>485</b>	<b>0</b>						
	In/Out																								
	Project Assignment																								
Net New Project Trips	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0								
<b>0 Total Traffic</b>	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1								
<b>2030 Total Traffic</b>	<b>37</b>	<b>0</b>	<b>208</b>	<b>0</b>	<b>567</b>	<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>169</b>	<b>485</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>169</b>	<b>485</b>	<b>0</b>							

PEDESTRIAN / BICYCLIST COUNTS

TIME	Intersection of Route 20/Church St				Intersection of Route 20/South St				Intersection of Route 20/Hudson St			
	Pedestrian (P) / Bicyclist (B)				Pedestrian (P) / Bicyclist (B)				Pedestrian (P) / Bicyclist (B)			
	A	B	C	D	A	B	C	D	A	B	C	D
Morning Peak*												
7:30 - 7:35 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:35 - 7:40 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:40 - 7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:45 - 7:50 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:50 - 7:55 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:55 - 8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0

No pedestrians/no bicyclists

\*Data Collected on Friday, March 17, 2023

Weather Conditions: Clear, snow on ground

Temperature: 38 degrees

PEDESTRIAN / BICYCLIST COUNTS

TIME	Intersection of Route 20/Church St				Intersection of Route 20/South St				Intersection of Route 20/Hudson St			
	Pedestrian (P) / Bicyclist (B)				Pedestrian (P) / Bicyclist (B)				Pedestrian (P) / Bicyclist (B)			
	A	B	C	D	A	B	C	D	A	B	C	D
Evening Peak**												
4:45 - 4:50 PM	0	P (1)	0	0	0	P (1)	0	0	0	P (1)	0	0
4:50 - 4:55 PM	0	0	0	0	0	P (1)	0	0	0	P (1)	0	P (1)
4:55 - 5:00 PM	0	0	0	P (1)	0	0	0	P (2) walkers	0	0	0	0 P (2)
5:00 - 5:05 PM	0	0	0	0	0	P (2)	0	0	0	P (2)	0	0
5:05 - 5:10 PM	0	P (1)	0	0	0	0	0	0	0	0	0	0
5:10 - 5:15 PM	0	P (1)	0	0	0	0	0	0	0	0	0	0

No bicyclists

\*Data Collected on Monday, March 20, 2023

Weather Conditions: Sunny, no snow

Temperature: 48 degrees

Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	574	0	0	385	281	0	0	0	529	0	129
Future Volume (vph)	131	574	0	0	385	281	0	0	0	529	0	129
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Flt					0.937							0.939
Flt Protected	0.950									0.950	0.971	
Satd. Flow (prot)	1685	3490	0	0	3383	0	0	0	0	1658	1591	0
Flt Permitted	0.235									0.950	0.971	
Satd. Flow (perm)	417	3490	0	0	3383	0	0	0	0	1658	1591	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Adj. Flow (vph)	147	645	0	0	433	316	0	0	0	594	0	145
Shared Lane Traffic (%)										36%		
Lane Group Flow (vph)	147	645	0	0	749	0	0	0	0	380	359	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	13.0	20.0			20.0					13.0	13.0	
Total Split (%)	14.4%	22.2%			22.2%					14.4%	14.4%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	26.5	26.5			24.0					38.4	38.4	

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Grade (%)						
Storage Length (ft)						
Storage Lanes						
Taper Length (ft)						
Lane Util. Factor						
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor						
Growth Factor						
Heavy Vehicles (%)						
Bus Blockages (#/hr)						
Parking (#/hr)						
Mid-Block Traffic (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	13.0	10.0	10.0	13.0	34.0	34.0
Total Split (%)	14%	11%	11%	14%	38%	38%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effect Green (s)						

Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.29	0.29			0.27					0.43	0.43	
v/c Ratio	0.57	0.63			0.83					0.54	0.53	
Control Delay	30.8	28.7			29.1					23.5	23.4	
Queue Delay	0.0	2.3			0.0					0.0	0.0	
Total Delay	30.8	31.0			29.1					23.5	23.4	
LOS	C	C			C					C	C	
Approach Delay		31.0			29.1						23.5	
Approach LOS		C			C						C	
Queue Length 50th (ft)	62	161			165					158	150	
Queue Length 95th (ft)	101	197			#298					269	256	
Internal Link Dist (ft)		460			303			262			288	
Turn Bay Length (ft)												
Base Capacity (vph)	258	1026			902					707	678	
Starvation Cap Reductn	0	0			0					0	0	
Spillback Cap Reductn	0	248			0					0	0	
Storage Cap Reductn	0	0			0					0	0	
Reduced v/c Ratio	0.57	0.83			0.83					0.54	0.53	

Intersection Summary

Area Type:	Other
Cycle Length:	90
Actuated Cycle Length:	90
Offset:	0 (0%), Referenced to phase 6:WBT, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	27.9
Intersection LOS:	C
Intersection Capacity Utilization:	60.5%
ICU Level of Service:	B
Analysis Period (min):	15

# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

Splits and Phases: 3: Main Street

#6 Ø1	#3 #6 Ø2	#6 Ø3	Ø9	#3 Ø4
13 s	20 s	10 s	34 s	13 s
#3 Ø5	#3 #6 Ø6 (R)	#3 Ø7	Ø10	#6 Ø8
13 s	20 s	10 s	34 s	13 s

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

Lanes, Volumes, Timings  
6: Main Street and South Street

2023 EXISTING SIGNAL  
AM PEAK HOUR

							Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR						
Lane Configurations	↑↑	↑	↓	↑↑	↓↓↓							
Traffic Volume (vph)	842	231	63	538	172	74						
Future Volume (vph)	842	231	63	538	172	74						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Grade (%)	0%			0%	0%							
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Ped Bike Factor												
Frt		0.850			0.955							
Flt Protected			0.950		0.966							
Satd. Flow (prot)	3490	1507	1685	3490	3277	0						
Flt Permitted			0.167		0.966							
Satd. Flow (perm)	3490	1507	296	3490	3277	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87						
Growth Factor	100%	100%	100%	100%	100%	100%						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Bus Blockages (#/hr)	0	0	0	0	0	0						
Parking (#/hr)												
Mid-Block Traffic (%)	0%			0%	0%							
Adj. Flow (vph)	968	266	72	618	198	85						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	968	266	72	618	283	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			13.0	20.0	13.0		20.0	10.0	13.0	13.0	10.0	34.0
Total Split (%)			14.4%	22.2%	14.4%		22%	11%	14%	14%	11%	38%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	28.2	73.8	31.8	30.6	38.4							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	38%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effect Green (s)	

Lanes, Volumes, Timings  
6: Main Street and South Street

2023 EXISTING SIGNAL  
AM PEAK HOUR



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Actuated g/C Ratio	0.31	0.82	0.35	0.34	0.43							
v/c Ratio	0.88	0.22	0.32	0.52	0.20							
Control Delay	35.3	2.1	11.4	15.5	17.3							
Queue Delay	0.6	0.0	0.0	0.2	0.0							
Total Delay	35.9	2.1	11.4	15.7	17.3							
LOS	D	A	B	B	B							
Approach Delay	28.6			15.2	17.3							
Approach LOS	C			B	B							
Queue Length 50th (ft)	~321	8	25	131	48							
Queue Length 95th (ft)	#390	38	29	146	79							
Internal Link Dist (ft)	303			262	385							
Turn Bay Length (ft)		160	120		150							
Base Capacity (vph)	1095	1236	228	1185	1397							
Starvation Cap Reductn	19	0	0	95	0							
Spillback Cap Reductn	0	0	0	45	0							
Storage Cap Reductn	0	0	0	0	0							
Reduced v/c Ratio	0.90	0.22	0.32	0.57	0.20							

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:WBT, Start of Green  
 Natural Cycle: 110  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 23.0  
 Intersection LOS: C  
 Intersection Capacity Utilization 50.5%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 6:

#6 Ø1 13 s	#3 #6 Ø2 20 s	#6 Ø3 10 s	Ø9 34 s	#3 Ø4 13 s
#3 Ø5 13 s	#3 #6 Ø6 (R) 20 s	#3 Ø7 10 s	Ø10 34 s	#6 Ø8 13 s

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Lane Group	Ø10
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2023 EXISTING SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	776	0	0	484	21	0	0	0	44	0	105
Future Volume (vph)	110	776	0	0	484	21	0	0	0	44	0	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Flt					0.994							0.850
Flt Protected	0.950										0.950	
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Flt Permitted	0.431										0.950	
Satd. Flow (perm)	764	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							309
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	128	902	0	0	563	24	0	0	0	51	0	122
Shared Lane Traffic (%)												
Lane Group Flow (vph)	128	902	0	0	587	0	0	0	0	0	51	122
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	2.5	5		6.1	1		4					3
Detector Phase	2.5	2		6.1	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		25.0			25.0		15.0	15.0		12.0	12.0	12.0
Total Split (%)		27.8%			27.8%		16.7%	16.7%		13.3%	13.3%	13.3%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.5			2.5		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		6.0			6.0			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effct Green (s)	57.7	57.7			52.4						8.3	8.3

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Grade (%)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Growth Factor			
Heavy Vehicles (%)			
Bus Blockages (#/hr)			
Parking (#/hr)			
Mid-Block Traffic (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	13%	13%	29%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	Min	None	None
Act Effect Green (s)			

Lanes, Volumes, Timings  
8: Main Street and Hudson Street

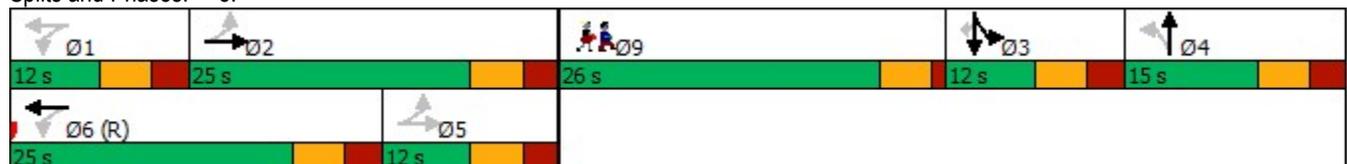
2023 EXISTING SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.64	0.64			0.58						0.09	0.09
v/c Ratio	0.26	0.40			0.29						0.33	0.29
Control Delay	2.7	2.3			9.8						43.4	1.7
Queue Delay	0.0	0.2			0.0						0.0	0.0
Total Delay	2.7	2.5			9.8						43.4	1.7
LOS	A	A			A						D	A
Approach Delay		2.5			9.8						14.0	
Approach LOS		A			A						B	
Queue Length 50th (ft)	7	27			81						28	0
Queue Length 95th (ft)	m9	m32			103						58	0
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	490	2238			2022						154	423
Starvation Cap Reductn	0	592			0						0	0
Spillback Cap Reductn	0	0			0						0	0
Storage Cap Reductn	0	0			0						0	0
Reduced v/c Ratio	0.26	0.55			0.29						0.33	0.29

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:WBTL, Start of Green  
 Natural Cycle: 70  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.40  
 Intersection Signal Delay: 6.0  
 Intersection LOS: A  
 Intersection Capacity Utilization 46.5%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8:



Lane Group	Ø1	Ø5	Ø9
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	155	421	0	0	697	403	0	0	0	347	0	158
Future Volume (vph)	155	421	0	0	697	403	0	0	0	347	0	158
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Frt					0.945							0.902
Flt Protected	0.950									0.950	0.983	
Satd. Flow (prot)	1685	3490	0	0	3411	0	0	0	0	1658	1547	0
Flt Permitted	0.126									0.950	0.983	
Satd. Flow (perm)	223	3490	0	0	3411	0	0	0	0	1658	1547	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Adj. Flow (vph)	170	463	0	0	766	443	0	0	0	381	0	174
Shared Lane Traffic (%)										24%		
Lane Group Flow (vph)	170	463	0	0	1209	0	0	0	0	290	265	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	14.0	24.0			24.0					18.0	18.0	
Total Split (%)	14.0%	24.0%			24.0%					18.0%	18.0%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	44.3	44.3			36.1					33.3	33.3	

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Grade (%)						
Storage Length (ft)						
Storage Lanes						
Taper Length (ft)						
Lane Util. Factor						
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor						
Growth Factor						
Heavy Vehicles (%)						
Bus Blockages (#/hr)						
Parking (#/hr)						
Mid-Block Traffic (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	14.0	10.0	10.0	18.0	34.0	34.0
Total Split (%)	14%	10%	10%	18%	34%	34%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effect Green (s)						



Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

Lanes, Volumes, Timings  
6: Main Street and South Street

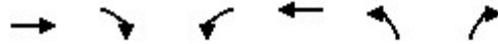
2023 EXISTING SIGNAL  
PM PEAK HOUR

							Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR						
Lane Configurations	↑↑	↑	↓	↑↑	↓↓							
Traffic Volume (vph)	500	138	32	719	33	214						
Future Volume (vph)	500	138	32	719	33	214						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Grade (%)	0%			0%	0%							
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Ped Bike Factor												
Frt		0.850			0.870							
Flt Protected			0.950		0.993							
Satd. Flow (prot)	3490	1507	1685	3490	3052	0						
Flt Permitted			0.452		0.993							
Satd. Flow (perm)	3490	1507	802	3490	3052	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93						
Growth Factor	100%	100%	100%	100%	100%	100%						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Bus Blockages (#/hr)	0	0	0	0	0	0						
Parking (#/hr)												
Mid-Block Traffic (%)	0%			0%	0%							
Adj. Flow (vph)	538	148	34	773	35	230						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	538	148	34	773	265	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			14.0	24.0	18.0		24.0	10.0	18.0	14.0	10.0	34.0
Total Split (%)			14.0%	24.0%	18.0%		24%	10%	18%	14%	10%	34%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	47.0	88.7	42.6	40.2	33.3							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	34%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effect Green (s)	

Lanes, Volumes, Timings  
6: Main Street and South Street

2023 EXISTING SIGNAL  
PM PEAK HOUR



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Actuated g/C Ratio	0.47	0.89	0.43	0.40	0.33							
v/c Ratio	0.33	0.11	0.09	0.55	0.26							
Control Delay	17.3	1.4	4.9	13.5	26.6							
Queue Delay	0.0	0.0	0.0	1.1	0.0							
Total Delay	17.3	1.4	4.9	14.6	26.6							
LOS	B	A	A	B	C							
Approach Delay	13.8			14.2	26.6							
Approach LOS	B			B	C							
Queue Length 50th (ft)	155	4	5	97	66							
Queue Length 95th (ft)	206	12	17	139	100							
Internal Link Dist (ft)	303			262	385							
Turn Bay Length (ft)		160	120		150							
Base Capacity (vph)	1640	1336	424	1404	1015							
Starvation Cap Reductn	0	0	0	198	0							
Spillback Cap Reductn	0	0	0	377	0							
Storage Cap Reductn	0	0	0	0	0							
Reduced v/c Ratio	0.33	0.11	0.08	0.75	0.26							

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	15.9
Intersection LOS:	B
Intersection Capacity Utilization:	41.6%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 6:

#6 Ø1	#3 #6 Ø2	#6 Ø3	#3 #6 Ø9	#3 Ø4
14 s	24 s	10 s	34 s	18 s
#3 Ø5	#3 #6 Ø6 (R)	#3 Ø7	#3 #6 Ø10	#6 Ø8
14 s	24 s	10 s	34 s	18 s

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Lane Group	Ø10
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2023 EXISTING SIGNAL  
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	505	0	0	725	32	0	0	0	36	5	73
Future Volume (vph)	139	505	0	0	725	32	0	0	0	36	5	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Frt					0.994							0.850
Flt Protected	0.950										0.957	
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1697	1561
Flt Permitted	0.339										0.957	
Satd. Flow (perm)	601	3490	0	1773	3469	0	0	1773	0	0	1697	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							273
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		342			536			478			539	
Travel Time (s)		7.8			12.2			10.9			12.3	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	153	555	0	0	797	35	0	0	0	40	5	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	153	555	0	0	832	0	0	0	0	0	45	80
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	2.5	5		1.6	1		4					3
Detector Phase	2.5	2		1.6	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		34.0			34.0		16.0	16.0		12.0	12.0	12.0
Total Split (%)		34.0%			34.0%		16.0%	16.0%		12.0%	12.0%	12.0%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.0			2.0		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.5			5.5			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effct Green (s)	70.7	70.7			61.1						8.2	8.2

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Grade (%)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Growth Factor			
Heavy Vehicles (%)			
Bus Blockages (#/hr)			
Parking (#/hr)			
Mid-Block Traffic (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	12%	12%	26%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	Min	None	None
Act Effect Green (s)			

Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2023 EXISTING SIGNAL  
PM PEAK HOUR

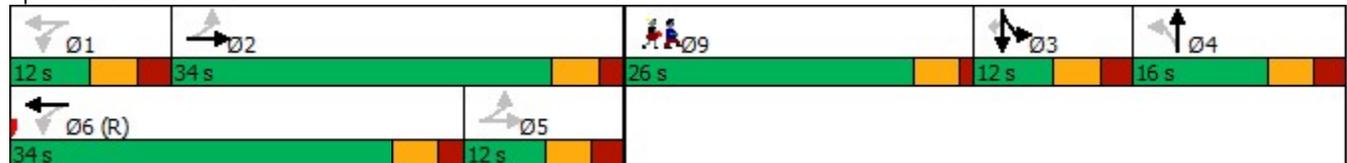


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.71	0.71			0.61						0.08	0.08
v/c Ratio	0.36	0.22			0.39						0.32	0.21
Control Delay	11.7	7.5			10.8						48.9	1.3
Queue Delay	0.0	0.1			0.0						0.0	0.0
Total Delay	11.7	7.6			10.8						48.9	1.3
LOS	B	A			B						D	A
Approach Delay		8.5			10.8						18.4	
Approach LOS		A			B						B	
Queue Length 50th (ft)	32	60			137						28	0
Queue Length 95th (ft)	52	77			172						61	0
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	424	2467			2119						139	378
Starvation Cap Reductn	0	915			0						0	0
Spillback Cap Reductn	0	0			0						0	0
Storage Cap Reductn	0	0			0						0	0
Reduced v/c Ratio	0.36	0.36			0.39						0.32	0.21

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBTL, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.39
Intersection Signal Delay:	10.4
Intersection LOS:	B
Intersection Capacity Utilization:	47.9%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 8:



Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	573	0	0	570	271	0	0	0	280	0	186
Future Volume (vph)	167	573	0	0	570	271	0	0	0	280	0	186
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Frt					0.952							0.874
Flt Protected	0.950									0.950	0.992	
Satd. Flow (prot)	1685	3490	0	0	3437	0	0	0	0	1658	1513	0
Flt Permitted	0.164									0.950	0.992	
Satd. Flow (perm)	291	3490	0	0	3437	0	0	0	0	1658	1513	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	170	585	0	0	582	277	0	0	0	286	0	190
Shared Lane Traffic (%)										13%		
Lane Group Flow (vph)	170	585	0	0	859	0	0	0	0	249	227	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	14.0	24.0			24.0					18.0	18.0	
Total Split (%)	14.0%	24.0%			24.0%					18.0%	18.0%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	49.0	49.0			42.1					27.7	27.7	
Actuated g/C Ratio	0.49	0.49			0.42					0.28	0.28	
v/c Ratio	0.54	0.34			0.59					0.54	0.54	
Control Delay	20.4	15.4			18.8					36.5	37.0	
Queue Delay	0.0	0.0			0.2					0.0	0.0	
Total Delay	20.4	15.4			19.1					36.5	37.0	
LOS	C	B			B					D	D	
Approach Delay		16.5			19.1							36.8
Approach LOS		B			B							D
Queue Length 50th (ft)	55	107			176					145	132	
Queue Length 95th (ft)	97	150			321					227	211	
Internal Link Dist (ft)		460			303			262				288

Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
SAT PEAK HOUR

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Lane Util. Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Peak Hour Factor						
Heavy Vehicles (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	14.0	10.0	10.0	18.0	34.0	34.0
Total Split (%)	14%	10%	10%	18%	34%	34%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effct Green (s)						
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						

Lanes, Volumes, Timings  
3: Main Street and Church Street

2023 EXISTING SIGNAL  
SAT PEAK HOUR



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)												
Base Capacity (vph)	312	1708			1447					458	418	
Starvation Cap Reductn	0	0			141					0	0	
Spillback Cap Reductn	0	0			0					0	0	
Storage Cap Reductn	0	0			0					0	0	
Reduced v/c Ratio	0.54	0.34			0.66					0.54	0.54	

Intersection Summary	
Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset: 0 (0%), Referenced to phase 6:WBT, Start of Green	
Natural Cycle:	90
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.59
Intersection Signal Delay:	22.2
Intersection LOS:	C
Intersection Capacity Utilization	62.1%
ICU Level of Service	B
Analysis Period (min)	15

Splits and Phases: 3: Main Street

#6 Ø1	#3 #6 Ø2	#6 Ø3	Ø9	#3 Ø4
14 s	24 s	10 s	34 s	18 s
#3 Ø5	#3 #6 Ø6 (R)	#3 Ø7	Ø10	#6 Ø8
14 s	24 s	10 s	34 s	18 s

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Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

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Lanes, Volumes, Timings  
6: Main Street and South Street

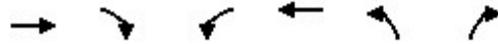
2023 EXISTING SIGNAL  
SAT PEAK HOUR

							Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR						
Lane Configurations	↑↑	↑	↓	↑↑	↓↓↓							
Traffic Volume (vph)	578	180	98	654	183	94						
Future Volume (vph)	578	180	98	654	183	94						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Frt		0.850			0.949							
Flt Protected			0.950		0.968							
Satd. Flow (prot)	3490	1507	1685	3490	3262	0						
Flt Permitted			0.418		0.968							
Satd. Flow (perm)	3490	1507	741	3490	3262	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Adj. Flow (vph)	615	191	104	696	195	100						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	615	191	104	696	295	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			14.0	24.0	18.0		24.0	10.0	18.0	14.0	10.0	34.0
Total Split (%)			14.0%	24.0%	18.0%		24%	10%	18%	14%	10%	34%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	48.7	83.6	50.2	48.9	27.7							
Actuated g/C Ratio	0.49	0.84	0.50	0.49	0.28							
v/c Ratio	0.36	0.15	0.23	0.41	0.33							
Control Delay	14.9	2.4	5.5	7.6	30.4							
Queue Delay	0.2	0.0	0.0	0.2	0.0							
Total Delay	15.1	2.4	5.5	7.8	30.4							
LOS	B	A	A	A	C							
Approach Delay	12.1			7.5	30.4							
Approach LOS	B			A	C							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Fr <sub>t</sub>	
Fl <sub>t</sub> Protected	
Satd. Flow (prot)	
Fl <sub>t</sub> Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	34%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Lanes, Volumes, Timings  
6: Main Street and South Street

2023 EXISTING SIGNAL  
SAT PEAK HOUR



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Queue Length 50th (ft)	164	4	12	47	78							
Queue Length 95th (ft)	223	50	m25	71	114							
Internal Link Dist (ft)	303			262	385							
Turn Bay Length (ft)		160	120		150							
Base Capacity (vph)	1699	1259	457	1708	902							
Starvation Cap Reductn	428	0	0	380	0							
Spillback Cap Reductn	0	0	0	110	0							
Storage Cap Reductn	0	0	0	0	0							
Reduced v/c Ratio	0.48	0.15	0.23	0.52	0.33							

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBT, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.59
Intersection Signal Delay:	13.0
Intersection LOS:	B
Intersection Capacity Utilization	44.6%
ICU Level of Service	A
Analysis Period (min)	15
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 6:

#6 Ø1	#3 #6 Ø2	#6 Ø3	Ø9	#3 Ø4
14 s	24 s	10 s	34 s	18 s
#3 Ø5	#3 #6 Ø6 (R)	#3 Ø7	Ø10	#6 Ø8
14 s	24 s	10 s	34 s	18 s

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Lane Group	Ø10
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2023 EXISTING SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	163	469	0	0	548	22	0	0	0	36	0	201
Future Volume (vph)	163	469	0	0	548	22	0	0	0	36	0	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>					0.994							0.850
Fl <sub>t</sub> Protected	0.950											0.950
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Fl <sub>t</sub> Permitted	0.402											0.950
Satd. Flow (perm)	713	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							278
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	175	504	0	0	589	24	0	0	0	39	0	216
Shared Lane Traffic (%)												
Lane Group Flow (vph)	175	504	0	0	613	0	0	0	0	0	39	216
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	5 2	5		1 6	1		4					3
Detector Phase	5 2	2		1 6	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		34.0			34.0		16.0	16.0		12.0	12.0	12.0
Total Split (%)		34.0%			34.0%		16.0%	16.0%		12.0%	12.0%	12.0%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.5			2.5		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		6.0			6.0			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effct Green (s)	80.1	80.1			57.1						7.9	7.9
Actuated g/C Ratio	0.80	0.80			0.57						0.08	0.08
v/c Ratio	0.31	0.18			0.31						0.30	0.57
Control Delay	5.0	1.9			11.8						48.5	8.1
Queue Delay	0.0	0.1			0.0						0.0	0.0
Total Delay	5.0	2.0			11.8						48.5	8.1
LOS	A	A			B						D	A
Approach Delay		2.8			11.8						14.3	
Approach LOS		A			B						B	

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	12%	12%	26%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	None	None	None
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			



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Lane Group	Ø1	Ø5	Ø9
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

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Lane Group	Ø1	Ø5	Ø9
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

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Lanes, Volumes, Timings  
3: Main Street and Church Street

2030 NO BUILD SIGNAL  
AM PEAK HOUR



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗			↖					↖	↗	
Traffic Volume (vph)	135	594	0	0	399	291	0	0	0	548	0	133
Future Volume (vph)	135	594	0	0	399	291	0	0	0	548	0	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Flt					0.937							0.940
Flt Protected	0.950									0.950	0.971	
Satd. Flow (prot)	1685	3490	0	0	3383	0	0	0	0	1658	1593	0
Flt Permitted	0.247									0.950	0.971	
Satd. Flow (perm)	438	3490	0	0	3383	0	0	0	0	1658	1593	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Adj. Flow (vph)	152	667	0	0	448	327	0	0	0	616	0	149
Shared Lane Traffic (%)										36%		
Lane Group Flow (vph)	152	667	0	0	775	0	0	0	0	394	371	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	13.0	20.0			20.0					13.0	13.0	
Total Split (%)	14.4%	22.2%			22.2%					14.4%	14.4%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	24.6	25.8			24.0					39.3	39.3	

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Grade (%)						
Storage Length (ft)						
Storage Lanes						
Taper Length (ft)						
Lane Util. Factor						
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor						
Growth Factor						
Heavy Vehicles (%)						
Bus Blockages (#/hr)						
Parking (#/hr)						
Mid-Block Traffic (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	13.0	10.0	10.0	13.0	34.0	34.0
Total Split (%)	14%	11%	11%	14%	38%	38%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effect Green (s)						

Lanes, Volumes, Timings  
3: Main Street and Church Street

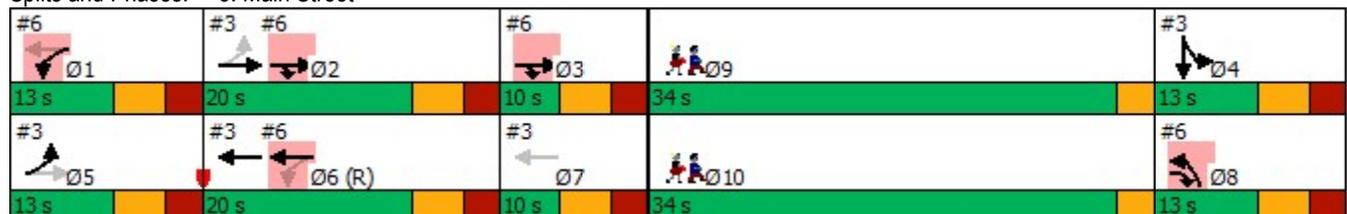
2030 NO BUILD SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.27	0.29			0.27					0.44	0.44	
v/c Ratio	0.63	0.67			0.86					0.54	0.53	
Control Delay	35.1	30.4			30.9					22.8	22.7	
Queue Delay	0.0	42.0			0.0					0.0	0.0	
Total Delay	35.1	72.4			30.9					22.8	22.7	
LOS	D	E			C					C	C	
Approach Delay		65.5			30.9							22.7
Approach LOS		E			C							C
Queue Length 50th (ft)	66	171			231					162	151	
Queue Length 95th (ft)	106	209			#316					274	258	
Internal Link Dist (ft)		460			303			262				288
Turn Bay Length (ft)												
Base Capacity (vph)	240	1002			902					724	695	
Starvation Cap Reductn	0	0			0					0	0	
Spillback Cap Reductn	0	381			0					0	0	
Storage Cap Reductn	0	0			0					0	0	
Reduced v/c Ratio	0.63	1.07			0.86					0.54	0.53	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:WBT, Start of Green  
 Natural Cycle: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.94  
 Intersection Signal Delay: 40.3  
 Intersection LOS: D  
 Intersection Capacity Utilization 62.1%  
 ICU Level of Service B  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Main Street



Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

Lanes, Volumes, Timings  
6: Main Street and South Street

2030 NO BUILD SIGNAL  
AM PEAK HOUR

							Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR						
Lane Configurations	↑↑	↑	↓	↑↑	↓↓↓							
Traffic Volume (vph)	871	239	65	557	178	77						
Future Volume (vph)	871	239	65	557	178	77						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Grade (%)	0%			0%	0%							
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Ped Bike Factor												
Frt		0.850			0.955							
Flt Protected			0.950		0.966							
Satd. Flow (prot)	3490	1507	1685	3490	3277	0						
Flt Permitted			0.167		0.966							
Satd. Flow (perm)	3490	1507	296	3490	3277	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87						
Growth Factor	100%	100%	100%	100%	100%	100%						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Bus Blockages (#/hr)	0	0	0	0	0	0						
Parking (#/hr)												
Mid-Block Traffic (%)	0%			0%	0%							
Adj. Flow (vph)	1001	275	75	640	205	89						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1001	275	75	640	294	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			13.0	20.0	13.0		20.0	10.0	13.0	13.0	10.0	34.0
Total Split (%)			14.4%	22.2%	14.4%		22%	11%	14%	14%	11%	38%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	27.4	73.9	31.7	31.7	39.3							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	38%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effct Green (s)	



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Lane Group	Ø10
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2030 NO BUILD SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	114	803	0	0	501	21	0	0	0	46	0	109
Future Volume (vph)	114	803	0	0	501	21	0	0	0	46	0	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Flt					0.994							0.850
Flt Protected	0.950										0.950	
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Flt Permitted	0.422										0.950	
Satd. Flow (perm)	748	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							309
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	133	934	0	0	583	24	0	0	0	53	0	127
Shared Lane Traffic (%)												
Lane Group Flow (vph)	133	934	0	0	607	0	0	0	0	0	53	127
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	2.5	5		6.1	1		4					3
Detector Phase	2.5	2		6.1	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		25.0			25.0		15.0	15.0		12.0	12.0	12.0
Total Split (%)		27.8%			27.8%		16.7%	16.7%		13.3%	13.3%	13.3%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.5			2.5		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		6.0			6.0			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effct Green (s)	57.7	57.7			52.8						8.3	8.3

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Grade (%)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Growth Factor			
Heavy Vehicles (%)			
Bus Blockages (#/hr)			
Parking (#/hr)			
Mid-Block Traffic (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	13%	13%	29%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	Min	None	None
Act Effect Green (s)			

Lanes, Volumes, Timings  
8: Main Street and Hudson Street

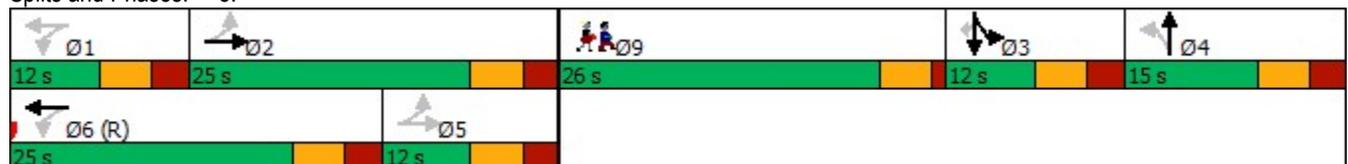
2030 NO BUILD SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.64	0.64			0.59						0.09	0.09
v/c Ratio	0.28	0.42			0.30						0.34	0.30
Control Delay	2.9	3.4			9.7						43.5	1.8
Queue Delay	0.0	0.3			0.0						0.0	0.0
Total Delay	2.9	3.7			9.7						43.5	1.8
LOS	A	A			A						D	A
Approach Delay		3.6			9.7						14.1	
Approach LOS		A			A						B	
Queue Length 50th (ft)	8	27			83						29	0
Queue Length 95th (ft)	m9	m31			105						60	0
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	479	2235			2035						156	424
Starvation Cap Reductn	0	613			0						0	0
Spillback Cap Reductn	0	0			0						0	0
Storage Cap Reductn	0	0			0						0	0
Reduced v/c Ratio	0.28	0.58			0.30						0.34	0.30

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:WBTL, Start of Green  
 Natural Cycle: 70  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.42  
 Intersection Signal Delay: 6.6  
 Intersection LOS: A  
 Intersection Capacity Utilization 47.2%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8:



Lanes, Volumes, Timings  
3: Main Street and Church Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	436	0	0	722	417	0	0	0	359	0	163
Future Volume (vph)	160	436	0	0	722	417	0	0	0	359	0	163
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Frt					0.945							0.903
Flt Protected	0.950									0.950	0.983	
Satd. Flow (prot)	1685	3490	0	0	3411	0	0	0	0	1658	1549	0
Flt Permitted	0.130									0.950	0.983	
Satd. Flow (perm)	231	3490	0	0	3411	0	0	0	0	1658	1549	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Adj. Flow (vph)	176	479	0	0	793	458	0	0	0	395	0	179
Shared Lane Traffic (%)										25%		
Lane Group Flow (vph)	176	479	0	0	1251	0	0	0	0	296	278	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	14.0	24.0			24.0					18.0	18.0	
Total Split (%)	14.0%	24.0%			24.0%					18.0%	18.0%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	43.5	43.5			35.1					34.1	34.1	

Lanes, Volumes, Timings  
3: Main Street and Church Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Grade (%)						
Storage Length (ft)						
Storage Lanes						
Taper Length (ft)						
Lane Util. Factor						
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor						
Growth Factor						
Heavy Vehicles (%)						
Bus Blockages (#/hr)						
Parking (#/hr)						
Mid-Block Traffic (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	14.0	10.0	10.0	18.0	34.0	34.0
Total Split (%)	14%	10%	10%	18%	34%	34%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effect Green (s)						



Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

Lanes, Volumes, Timings  
6: Main Street and South Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR

												
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Configurations	↑↑	↑	↓	↑↑	↓	↓						
Traffic Volume (vph)	517	143	33	744	34	222						
Future Volume (vph)	517	143	33	744	34	222						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Grade (%)	0%			0%	0%							
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Ped Bike Factor												
Frt		0.850			0.870							
Flt Protected			0.950		0.993							
Satd. Flow (prot)	3490	1507	1685	3490	3052	0						
Flt Permitted			0.444		0.993							
Satd. Flow (perm)	3490	1507	787	3490	3052	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93						
Growth Factor	100%	100%	100%	100%	100%	100%						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Bus Blockages (#/hr)	0	0	0	0	0	0						
Parking (#/hr)												
Mid-Block Traffic (%)	0%			0%	0%							
Adj. Flow (vph)	556	154	35	800	37	239						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	556	154	35	800	276	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			14.0	24.0	18.0		24.0	10.0	18.0	14.0	10.0	34.0
Total Split (%)			14.0%	24.0%	18.0%		24%	10%	18%	14%	10%	34%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	46.1	88.6	41.7	39.3	34.1							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	34%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effect Green (s)	

Lanes, Volumes, Timings  
6: Main Street and South Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Actuated g/C Ratio	0.46	0.89	0.42	0.39	0.34							
v/c Ratio	0.35	0.12	0.09	0.58	0.27							
Control Delay	17.7	1.5	5.2	14.7	26.1							
Queue Delay	0.0	0.0	0.0	2.0	0.0							
Total Delay	17.7	1.5	5.2	16.6	26.1							
LOS	B	A	A	B	C							
Approach Delay	14.2			16.2	26.1							
Approach LOS	B			B	C							
Queue Length 50th (ft)	162	4	4	106	69							
Queue Length 95th (ft)	214	14	17	152	103							
Internal Link Dist (ft)	303			262	385							
Turn Bay Length (ft)		160	120		150							
Base Capacity (vph)	1609	1335	411	1371	1041							
Starvation Cap Reductn	0	0	0	164	0							
Spillback Cap Reductn	0	0	0	400	0							
Storage Cap Reductn	0	0	0	0	0							
Reduced v/c Ratio	0.35	0.12	0.09	0.82	0.27							

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.05
Intersection Signal Delay:	16.9
Intersection LOS:	B
Intersection Capacity Utilization:	42.3%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 6:

#6 Ø1 14 s	#3 #6 Ø2 24 s	#6 Ø3 10 s	#3 #6 Ø9 34 s	#3 Ø4 18 s
#3 Ø5 14 s	#3 #6 Ø6 (R) 24 s	#3 Ø7 10 s	#3 #6 Ø10 34 s	#6 Ø8 18 s

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Lane Group	Ø10
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	523	0	0	751	33	0	0	0	37	5	76
Future Volume (vph)	144	523	0	0	751	33	0	0	0	37	5	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Flt					0.994							0.850
Flt Protected	0.950										0.957	
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1697	1561
Flt Permitted	0.329										0.957	
Satd. Flow (perm)	583	3490	0	1773	3469	0	0	1773	0	0	1697	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							273
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		342			536			478			539	
Travel Time (s)		7.8			12.2			10.9			12.3	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	158	575	0	0	825	36	0	0	0	41	5	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	575	0	0	861	0	0	0	0	0	46	84
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	2.5	5		1.6	1		4					3
Detector Phase	2.5	2		1.6	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		34.0			34.0		16.0	16.0		12.0	12.0	12.0
Total Split (%)		34.0%			34.0%		16.0%	16.0%		12.0%	12.0%	12.0%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.0			2.0		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		5.5			5.5			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effct Green (s)	70.6	70.6			61.8						8.3	8.3

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Grade (%)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Growth Factor			
Heavy Vehicles (%)			
Bus Blockages (#/hr)			
Parking (#/hr)			
Mid-Block Traffic (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	12%	12%	26%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	Min	None	None
Act Effect Green (s)			

Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2030 NO BUILD SIGNAL  
PM PEAK HOUR

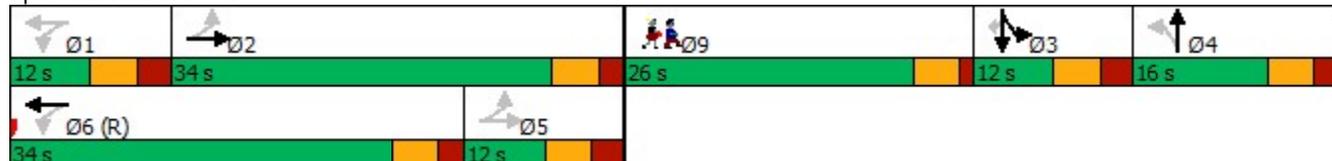


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.71	0.71			0.62						0.08	0.08
v/c Ratio	0.38	0.23			0.40						0.33	0.22
Control Delay	12.2	7.5			10.6						48.9	1.4
Queue Delay	0.0	0.1			0.0						0.0	0.0
Total Delay	12.2	7.6			10.6						48.9	1.4
LOS	B	A			B						D	A
Approach Delay		8.6			10.6						18.2	
Approach LOS		A			B						B	
Queue Length 50th (ft)	33	62			140						28	0
Queue Length 95th (ft)	53	80			176						63	0
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	411	2465			2144						140	379
Starvation Cap Reductn	0	877			0						0	0
Spillback Cap Reductn	0	0			0						0	0
Storage Cap Reductn	0	0			0						0	0
Reduced v/c Ratio	0.38	0.36			0.40						0.33	0.22

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.40
Intersection Signal Delay:	10.3
Intersection LOS:	B
Intersection Capacity Utilization:	49.0%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 8:



Lane Group	Ø1	Ø5	Ø9
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
3: Main Street and Church Street

2030 NO BUILD SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	173	593	0	0	590	281	0	0	0	290	0	193
Future Volume (vph)	173	593	0	0	590	281	0	0	0	290	0	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Frt					0.952							0.874
Flt Protected	0.950									0.950	0.992	
Satd. Flow (prot)	1685	3490	0	0	3437	0	0	0	0	1658	1513	0
Flt Permitted	0.141									0.950	0.992	
Satd. Flow (perm)	250	3490	0	0	3437	0	0	0	0	1658	1513	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Adj. Flow (vph)	177	605	0	0	602	287	0	0	0	296	0	197
Shared Lane Traffic (%)										13%		
Lane Group Flow (vph)	177	605	0	0	889	0	0	0	0	258	235	0
Turn Type	pm+pt	NA			NA					Split	NA	
Protected Phases	5	2			6					4	4	
Permitted Phases	2	5			7							
Detector Phase	5	2			6					4	4	
Switch Phase												
Minimum Initial (s)	3.0	3.0			6.0					4.0	4.0	
Minimum Split (s)	9.0	9.0			12.0					10.0	10.0	
Total Split (s)	14.0	24.0			24.0					18.0	18.0	
Total Split (%)	14.0%	24.0%			24.0%					18.0%	18.0%	
Yellow Time (s)	3.5	3.5			3.5					3.5	3.5	
All-Red Time (s)	2.5	2.5			2.5					2.5	2.5	
Lost Time Adjust (s)	0.0	0.0			0.0					0.0	0.0	
Total Lost Time (s)	6.0	6.0			6.0					6.0	6.0	
Lead/Lag	Lead	Lag			Lag					Lag	Lag	
Lead-Lag Optimize?												
Recall Mode	Min	Min			C-Min					None	None	
Act Effct Green (s)	47.8	47.8			40.3					28.9	28.9	

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Lane Configurations						
Traffic Volume (vph)						
Future Volume (vph)						
Ideal Flow (vphpl)						
Lane Width (ft)						
Grade (%)						
Storage Length (ft)						
Storage Lanes						
Taper Length (ft)						
Lane Util. Factor						
Ped Bike Factor						
Frt						
Flt Protected						
Satd. Flow (prot)						
Flt Permitted						
Satd. Flow (perm)						
Right Turn on Red						
Satd. Flow (RTOR)						
Link Speed (mph)						
Link Distance (ft)						
Travel Time (s)						
Confl. Peds. (#/hr)						
Confl. Bikes (#/hr)						
Peak Hour Factor						
Growth Factor						
Heavy Vehicles (%)						
Bus Blockages (#/hr)						
Parking (#/hr)						
Mid-Block Traffic (%)						
Adj. Flow (vph)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)						
Turn Type						
Protected Phases	1	3	7	8	9	10
Permitted Phases						
Detector Phase						
Switch Phase						
Minimum Initial (s)	6.0	3.0	4.0	6.0	5.0	5.0
Minimum Split (s)	12.0	9.0	10.0	12.0	33.5	33.5
Total Split (s)	14.0	10.0	10.0	18.0	34.0	34.0
Total Split (%)	14%	10%	10%	18%	34%	34%
Yellow Time (s)	3.5	3.5	3.5	3.5	2.5	2.5
All-Red Time (s)	2.5	2.5	2.5	2.5	0.0	0.0
Lost Time Adjust (s)						
Total Lost Time (s)						
Lead/Lag	Lead			Lag	Lead	Lead
Lead-Lag Optimize?				Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	None
Act Effect Green (s)						

Lanes, Volumes, Timings  
3: Main Street and Church Street

2030 NO BUILD SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.48	0.48			0.40					0.29	0.29	
v/c Ratio	0.58	0.36			0.64					0.54	0.54	
Control Delay	23.4	16.2			21.0					35.7	36.2	
Queue Delay	0.0	0.0			0.3					0.0	0.0	
Total Delay	23.4	16.2			21.3					35.7	36.2	
LOS	C	B			C					D	D	
Approach Delay		17.8			21.3						35.9	
Approach LOS		B			C						D	
Queue Length 50th (ft)	59	114			251					149	136	
Queue Length 95th (ft)	111	156			337					233	216	
Internal Link Dist (ft)		460			303			262			288	
Turn Bay Length (ft)												
Base Capacity (vph)	303	1666			1385					478	436	
Starvation Cap Reductn	0	0			104					0	0	
Spillback Cap Reductn	0	0			0					0	0	
Storage Cap Reductn	0	0			0					0	0	
Reduced v/c Ratio	0.58	0.36			0.69					0.54	0.54	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBT, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.64
Intersection Signal Delay:	23.3
Intersection LOS:	C
Intersection Capacity Utilization:	63.8%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 3: Main Street

#6  Ø1 14 s	#3 #6  Ø2 24 s	#6  Ø3 10 s	 Ø9 34 s	#3  Ø4 18 s
#3  Ø5 14 s	#3 #6  Ø6 (R) 24 s	#3  Ø7 10 s	 Ø10 34 s	#6  Ø8 18 s

Lane Group	Ø1	Ø3	Ø7	Ø8	Ø9	Ø10
Actuated g/C Ratio						
v/c Ratio						
Control Delay						
Queue Delay						
Total Delay						
LOS						
Approach Delay						
Approach LOS						
Queue Length 50th (ft)						
Queue Length 95th (ft)						
Internal Link Dist (ft)						
Turn Bay Length (ft)						
Base Capacity (vph)						
Starvation Cap Reductn						
Spillback Cap Reductn						
Storage Cap Reductn						
Reduced v/c Ratio						
Intersection Summary						

Lanes, Volumes, Timings  
6: Main Street and South Street

2030 NO BUILD SIGNAL  
SAT PEAK HOUR

							Ø2	Ø3	Ø4	Ø5	Ø7	Ø9
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR						
Lane Configurations	↑↑	↑	↑	↑↑	↑↑↑							
Traffic Volume (vph)	598	187	101	677	190	97						
Future Volume (vph)	598	187	101	677	190	97						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900						
Lane Width (ft)	11	10	10	11	11	11						
Grade (%)	0%			0%	0%							
Storage Length (ft)		160	120		150	0						
Storage Lanes		1	1		1	0						
Taper Length (ft)			25		25							
Lane Util. Factor	0.95	1.00	1.00	0.95	0.97	0.95						
Ped Bike Factor												
Frt		0.850			0.949							
Flt Protected			0.950		0.968							
Satd. Flow (prot)	3490	1507	1685	3490	3262	0						
Flt Permitted			0.390		0.968							
Satd. Flow (perm)	3490	1507	692	3490	3262	0						
Right Turn on Red		No				No						
Satd. Flow (RTOR)												
Link Speed (mph)	30			30	30							
Link Distance (ft)	383			342	465							
Travel Time (s)	8.7			7.8	10.6							
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94						
Growth Factor	100%	100%	100%	100%	100%	100%						
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%						
Bus Blockages (#/hr)	0	0	0	0	0	0						
Parking (#/hr)												
Mid-Block Traffic (%)	0%			0%	0%							
Adj. Flow (vph)	636	199	107	720	202	103						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	636	199	107	720	305	0						
Turn Type	NA	pt+ov	pm+pt	NA	Prot							
Protected Phases	2 3	2 3 8	1	6	8		2	3	4	5	7	9
Permitted Phases			6	1								
Detector Phase	2 3	2 3 8	1	6	8							
Switch Phase												
Minimum Initial (s)			6.0	6.0	6.0		3.0	3.0	4.0	3.0	4.0	5.0
Minimum Split (s)			12.0	12.0	12.0		9.0	9.0	10.0	9.0	10.0	33.5
Total Split (s)			14.0	24.0	18.0		24.0	10.0	18.0	14.0	10.0	34.0
Total Split (%)			14.0%	24.0%	18.0%		24%	10%	18%	14%	10%	34%
Yellow Time (s)			3.5	3.5	3.5		3.5	3.5	3.5	3.5	3.5	2.5
All-Red Time (s)			2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	0.0
Lost Time Adjust (s)			0.0	0.0	0.0							
Total Lost Time (s)			6.0	6.0	6.0							
Lead/Lag			Lead	Lag	Lag		Lag		Lag	Lead		Lead
Lead-Lag Optimize?					Yes							Yes
Recall Mode			None	C-Min	None		Min	Min	None	Min	None	None
Act Effct Green (s)	44.9	79.8	48.5	48.5	28.9							

Lane Group	Ø10
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	10
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	5.0
Minimum Split (s)	33.5
Total Split (s)	34.0
Total Split (%)	34%
Yellow Time (s)	2.5
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	Yes
Recall Mode	None
Act Effect Green (s)	



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Lane Group	Ø10
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
8: Main Street and Hudson Street

2030 NO BUILD SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	485	0	0	567	22	0	0	0	37	0	208
Future Volume (vph)	169	485	0	0	567	22	0	0	0	37	0	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	120		30	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor												
Flt					0.994							0.850
Flt Protected	0.950										0.950	
Satd. Flow (prot)	1685	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Flt Permitted	0.392										0.950	
Satd. Flow (perm)	695	3490	0	1773	3469	0	0	1773	0	0	1685	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4							278
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		342			536			478			539	
Travel Time (s)		7.8			12.2			10.9			12.3	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	182	522	0	0	610	24	0	0	0	40	0	224
Shared Lane Traffic (%)												
Lane Group Flow (vph)	182	522	0	0	634	0	0	0	0	0	40	224
Turn Type	custom	NA		custom	NA					Split	NA	Perm
Protected Phases		2			6			4		3	3	
Permitted Phases	5 2	5		1 6	1		4					3
Detector Phase	5 2	2		1 6	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)		3.0			6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)		9.0			12.0		12.0	12.0		12.0	12.0	12.0
Total Split (s)		34.0			34.0		16.0	16.0		12.0	12.0	12.0
Total Split (%)		34.0%			34.0%		16.0%	16.0%		12.0%	12.0%	12.0%
Yellow Time (s)		3.5			3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)		2.5			2.5		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	0.0
Total Lost Time (s)		6.0			6.0			6.0			6.0	6.0
Lead/Lag		Lag			Lead					Lag	Lag	Lag
Lead-Lag Optimize?												
Recall Mode		Min			C-Min		None	None		None	None	None
Act Effect Green (s)	80.0	80.0			56.8						8.0	8.0

Lane Group	Ø1	Ø5	Ø9
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Lane Width (ft)			
Grade (%)			
Storage Length (ft)			
Storage Lanes			
Taper Length (ft)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (mph)			
Link Distance (ft)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Growth Factor			
Heavy Vehicles (%)			
Bus Blockages (#/hr)			
Parking (#/hr)			
Mid-Block Traffic (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	1	5	9
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	6.0	3.0	5.0
Minimum Split (s)	12.0	9.0	9.5
Total Split (s)	12.0	12.0	26.0
Total Split (%)	12%	12%	26%
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	1.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lag	Lead
Lead-Lag Optimize?			Yes
Recall Mode	None	None	None
Act Effect Green (s)			

Lanes, Volumes, Timings  
8: Main Street and Hudson Street

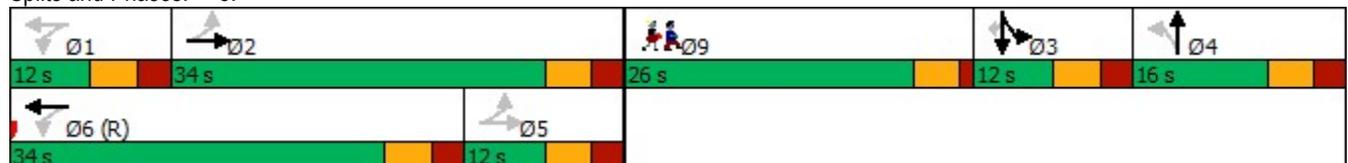
2030 NO BUILD SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Actuated g/C Ratio	0.80	0.80			0.57						0.08	0.08
v/c Ratio	0.33	0.19			0.32						0.30	0.59
Control Delay	5.5	1.9			11.9						48.5	8.9
Queue Delay	0.0	0.1			0.0						0.0	0.0
Total Delay	5.5	2.0			11.9						48.5	8.9
LOS	A	A			B						D	A
Approach Delay		2.9			11.9						14.9	
Approach LOS		A			B						B	
Queue Length 50th (ft)	16	23			106						25	0
Queue Length 95th (ft)	53	30			136						56	34
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	555	2792			1973						134	380
Starvation Cap Reductn	0	1141			0						0	0
Spillback Cap Reductn	0	0			0						0	0
Storage Cap Reductn	0	0			0						0	0
Reduced v/c Ratio	0.33	0.32			0.32						0.30	0.59

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 6:WBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.59
Intersection Signal Delay:	8.4
Intersection LOS:	A
Intersection Capacity Utilization:	45.7%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 8:



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Lane Group	Ø1	Ø5	Ø9
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

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Lane Group	Ø1	Ø5	Ø9
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (ft)			
Queue Length 95th (ft)			
Internal Link Dist (ft)			
Turn Bay Length (ft)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
3: Driveway/Church Street & W Main Street

2030 BUILD SIGNAL  
AM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	135	594	1	0	399	291	0	0	0	548	0	133
Future Volume (vph)	135	594	1	0	399	291	0	0	0	548	0	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Storage Length (ft)	260		0	0		0	0		0	0		0
Storage Lanes	1		0	0		1	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>						0.850						0.850
Fl <sub>t</sub> Protected	0.950									0.950		
Satd. Flow (prot)	1685	1837	0	0	1900	1561	0	0	0	1745	1561	0
Fl <sub>t</sub> Permitted	0.263									0.950		
Satd. Flow (perm)	466	1837	0	0	1900	1561	0	0	0	1745	1561	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	152	667	1	0	448	327	0	0	0	616	0	149
Shared Lane Traffic (%)												
Lane Group Flow (vph)	152	668	0	0	448	327	0	0	0	616	149	0
Turn Type	custom	NA			NA	pm+ov				Split	NA	
Protected Phases	5	2 5			6	4				4	4	
Permitted Phases	2					6						
Detector Phase	5	2 5			6	4				4	4	
Switch Phase												
Minimum Initial (s)	3.0				6.0	4.0				4.0	4.0	
Minimum Split (s)	24.0				26.0	41.0				41.0	41.0	
Total Split (s)	24.0				32.0	44.0				44.0	44.0	
Total Split (%)	24.0%				32.0%	44.0%				44.0%	44.0%	
Yellow Time (s)	3.5				3.5	3.5				3.5	3.5	
All-Red Time (s)	2.5				2.5	2.5				2.5	2.5	
Lost Time Adjust (s)	0.0				0.0	0.0				0.0	0.0	
Total Lost Time (s)	6.0				6.0	6.0				6.0	6.0	
Lead/Lag	Lag				Lead							
Lead-Lag Optimize?	Yes				Yes							
Recall Mode	Min				C-Min	None				None	None	
Act Effct Green (s)	47.8	47.8			30.0	76.2				40.2	40.2	
Actuated g/C Ratio	0.48	0.48			0.30	0.76				0.40	0.40	
v/c Ratio	0.42	0.76			0.79	0.28				0.88	0.24	
Control Delay	26.1	28.7			46.3	7.0				43.3	20.8	
Queue Delay	0.0	0.9			1.2	0.4				50.1	0.0	
Total Delay	26.1	29.6			47.5	7.4				93.4	20.8	
LOS	C	C			D	A				F	C	
Approach Delay		29.0			30.6						79.3	
Approach LOS		C			C						E	

Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Fr <sub>t</sub>	
Fl <sub>t</sub> Protected	
Satd. Flow (prot)	
Fl <sub>t</sub> Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	3.0
Minimum Split (s)	26.0
Total Split (s)	56.0
Total Split (%)	56%
Yellow Time (s)	3.5
All-Red Time (s)	2.5
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	C-Min
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Lanes, Volumes, Timings  
 3: Driveway/Church Street & W Main Street

2030 BUILD SIGNAL  
 AM PEAK HOUR

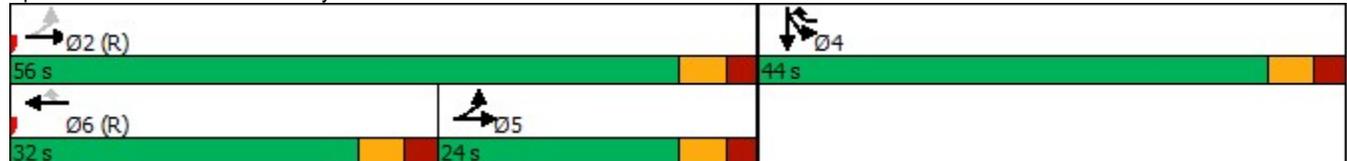


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	60	379			240	68				318	55	
Queue Length 95th (ft)	87	454			#447	170				#580	110	
Internal Link Dist (ft)		460			303			262			288	
Turn Bay Length (ft)	260											
Base Capacity (vph)	471	992			570	1181				713	638	
Starvation Cap Reductn	0	0			30	457				0	0	
Spillback Cap Reductn	0	123			0	0				204	0	
Storage Cap Reductn	0	0			0	0				0	0	
Reduced v/c Ratio	0.32	0.77			0.83	0.45				1.21	0.23	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection  
 Natural Cycle: 95  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 45.8  
 Intersection LOS: D  
 Intersection Capacity Utilization 73.8%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Driveway/Church Street & W Main Street



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Lane Group	Ø2
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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Lanes, Volumes, Timings  
6: South Street & W Main Street

2030 BUILD SIGNAL  
AM PEAK HOUR

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Traffic Volume (vph)	871	239	65	557	178	77
Future Volume (vph)	871	239	65	557	178	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	10	11	11	11
Storage Length (ft)		160	120		150	0
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected			0.950		0.950	
Satd. Flow (prot)	1837	1507	1685	1837	1745	1546
Fl <sub>t</sub> Permitted			0.114		0.950	
Satd. Flow (perm)	1837	1507	202	1837	1745	1546
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	383			342	465	
Travel Time (s)	8.7			7.8	10.6	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	1001	275	75	640	205	89
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1001	275	75	640	205	89
Turn Type	NA	pt+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	2	2 8	1	6	8	8 1
Permitted Phases			6	1		
Detector Phase	2	2 8	1	6	8	8 1
Switch Phase						
Minimum Initial (s)	3.0		5.0	6.0	6.0	
Minimum Split (s)	26.0		11.0	26.0	26.0	
Total Split (s)	63.0		11.0	74.0	26.0	
Total Split (%)	63.0%		11.0%	74.0%	26.0%	
Yellow Time (s)	3.5		3.5	3.5	3.5	
All-Red Time (s)	2.5		2.5	2.5	2.5	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0		6.0	6.0	6.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	C-Min		None	C-Min	None	
Act Effct Green (s)	62.9	86.4	72.9	71.7	16.3	25.1
Actuated g/C Ratio	0.63	0.86	0.73	0.72	0.16	0.25
v/c Ratio	0.87	0.21	0.33	0.49	0.72	0.23
Control Delay	23.3	1.2	7.7	2.9	54.0	28.9
Queue Delay	12.7	0.5	0.0	0.1	0.8	0.0
Total Delay	36.0	1.7	7.7	3.0	54.7	28.9
LOS	D	A	A	A	D	C
Approach Delay	28.6			3.5	46.9	
Approach LOS	C			A	D	



Lanes, Volumes, Timings  
8: Patty Lane/Hudson Street & W Main Street

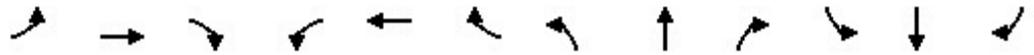
2030 BUILD SIGNAL  
AM PEAK HOUR



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	114	803	10	10	501	21	10	10	10	46	10	109
Future Volume (vph)	114	803	10	10	501	21	10	10	10	46	10	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Storage Length (ft)	120		0	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.998			0.994			0.955				0.850
Flt Protected	0.950			0.950				0.984				0.961
Satd. Flow (prot)	1685	1833	0	1685	1826	0	0	1666	0	0	1704	1561
Flt Permitted	0.324			0.105				0.984				0.961
Satd. Flow (perm)	575	1833	0	186	1826	0	0	1666	0	0	1704	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			2			12				127
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	133	934	12	12	583	24	12	12	12	53	12	127
Shared Lane Traffic (%)												
Lane Group Flow (vph)	133	946	0	12	607	0	0	36	0	0	65	127
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6		4	4		3	3	5
Permitted Phases	2			6								3
Detector Phase	5	2		1	6		4	4		3	3	5
Switch Phase												
Minimum Initial (s)	5.0	3.0		4.0	4.0		4.0	4.0		6.0	6.0	5.0
Minimum Split (s)	9.5	26.0		10.0	26.0		26.0	26.0		26.0	26.0	9.5
Total Split (s)	10.4	38.0		10.0	37.6		26.0	26.0		26.0	26.0	10.4
Total Split (%)	10.4%	38.0%		10.0%	37.6%		26.0%	26.0%		26.0%	26.0%	10.4%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	1.0	2.5		2.5	2.5		2.5	2.5		2.5	2.5	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Lost Time (s)	4.5	6.0		6.0	6.0			6.0			6.0	4.5
Lead/Lag	Lag	Lead		Lag	Lead		Lead	Lead		Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	C-Min		Min	C-Min		None	None		None	None	None
Act Effct Green (s)	70.1	62.7		66.3	62.3			7.1			9.2	16.0
Actuated g/C Ratio	0.70	0.63		0.66	0.62			0.07			0.09	0.16
v/c Ratio	0.28	0.82		0.07	0.53			0.28			0.41	0.36
Control Delay	3.1	14.2		9.6	16.0			37.5			50.0	6.9
Queue Delay	0.0	1.5		0.0	0.0			0.0			0.0	0.0
Total Delay	3.1	15.7		9.6	16.0			37.5			50.0	6.9
LOS	A	B		A	B			D			D	A
Approach Delay		14.2			15.9			37.5			21.5	
Approach LOS		B			B			D			C	

Lanes, Volumes, Timings  
 8: Patty Lane/Hudson Street & W Main Street

2030 BUILD SIGNAL  
 AM PEAK HOUR

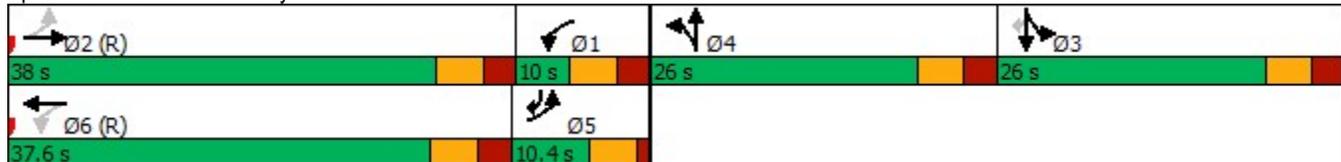


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	7	68		2	242			15			40	0
Queue Length 95th (ft)	m8	#813		10	377			43			76	31
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120			150								150
Base Capacity (vph)	468	1148		183	1137			342			340	357
Starvation Cap Reductn	0	81		0	0			0			0	0
Spillback Cap Reductn	0	0		0	0			0			0	0
Storage Cap Reductn	0	0		0	0			0			0	0
Reduced v/c Ratio	0.28	0.89		0.07	0.53			0.11			0.19	0.36

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 22 (22%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Natural Cycle: 130  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.82  
 Intersection Signal Delay: 15.9 Intersection LOS: B  
 Intersection Capacity Utilization 69.6% ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Patty Lane/Hudson Street & W Main Street



Lanes, Volumes, Timings  
3: Driveway/Church Street & W Main Street

2030 BUILD SIGNAL  
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	436	1	0	722	417	0	0	0	359	0	163
Future Volume (vph)	160	436	1	0	722	417	0	0	0	359	0	163
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Storage Length (ft)	260		0	0		0	0		0	0		0
Storage Lanes	1		0	0		1	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>						0.850						0.850
Fl <sub>t</sub> Protected	0.950									0.950		
Satd. Flow (prot)	1685	1837	0	0	1900	1561	0	0	0	1745	1561	0
Fl <sub>t</sub> Permitted	0.108									0.950		
Satd. Flow (perm)	192	1837	0	0	1900	1561	0	0	0	1745	1561	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		540			383			342			368	
Travel Time (s)		12.3			8.7			7.8			8.4	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	176	479	1	0	793	458	0	0	0	395	0	179
Shared Lane Traffic (%)												
Lane Group Flow (vph)	176	480	0	0	793	458	0	0	0	395	179	0
Turn Type	pm+pt	NA			NA	pm+ov				Split	NA	
Protected Phases	5	2 5			6	4				4	4	
Permitted Phases	2 5					6						
Detector Phase	5	2 5			6	4				4	4	
Switch Phase												
Minimum Initial (s)	3.0				6.0	4.0				4.0	4.0	
Minimum Split (s)	9.0				24.0	41.0				41.0	41.0	
Total Split (s)	16.0				72.0	42.0				42.0	42.0	
Total Split (%)	12.3%				55.4%	32.3%				32.3%	32.3%	
Yellow Time (s)	3.5				3.5	3.5				3.5	3.5	
All-Red Time (s)	2.5				2.5	2.5				2.5	2.5	
Lost Time Adjust (s)	0.0				0.0	0.0				0.0	0.0	
Total Lost Time (s)	6.0				6.0	6.0				6.0	6.0	
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?												
Recall Mode	Min				C-Min	None				None	None	
Act Effct Green (s)	83.7	85.2			65.0	105.3				34.3	34.3	
Actuated g/C Ratio	0.64	0.66			0.50	0.81				0.26	0.26	
v/c Ratio	0.66	0.40			0.83	0.36				0.86	0.43	
Control Delay	27.1	12.1			27.6	2.4				63.9	42.9	
Queue Delay	0.0	0.1			6.6	0.8				1.9	0.0	
Total Delay	27.1	12.2			34.3	3.1				65.8	42.9	
LOS	C	B			C	A				E	D	
Approach Delay		16.2			22.9						58.7	
Approach LOS		B			C						E	

Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Fr <sub>t</sub>	
Fl <sub>t</sub> Protected	
Satd. Flow (prot)	
Fl <sub>t</sub> Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	3.0
Minimum Split (s)	26.5
Total Split (s)	88.0
Total Split (%)	68%
Yellow Time (s)	3.5
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	C-Min
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	



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Lane Group	Ø2
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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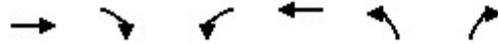
Lanes, Volumes, Timings  
6: South Street & W Main Street

2030 BUILD SIGNAL  
PM PEAK HOUR

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↘	↑	↖	↗
Traffic Volume (vph)	517	143	33	744	34	222
Future Volume (vph)	517	143	33	744	34	222
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	10	11	11	11
Storage Length (ft)		160	120		150	0
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Fr <sub>t</sub>		0.850				0.850
Fl <sub>t</sub> Protected			0.950		0.950	
Satd. Flow (prot)	1837	1507	1685	1837	1745	1546
Fl <sub>t</sub> Permitted			0.368		0.950	
Satd. Flow (perm)	1837	1507	653	1837	1745	1546
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	383			342	465	
Travel Time (s)	8.7			7.8	10.6	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	556	154	35	800	37	239
Shared Lane Traffic (%)						
Lane Group Flow (vph)	556	154	35	800	37	239
Turn Type	NA	pt+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	2	2 8	1	6	8	8 1
Permitted Phases			6	1		
Detector Phase	2	2 8	1	6	8	8 1
Switch Phase						
Minimum Initial (s)	3.0		6.0	6.0	6.0	
Minimum Split (s)	26.0		12.0	26.0	26.0	
Total Split (s)	85.0		12.0	97.0	33.0	
Total Split (%)	65.4%		9.2%	74.6%	25.4%	
Yellow Time (s)	3.5		3.5	3.5	3.5	
All-Red Time (s)	2.5		2.5	2.5	2.5	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0		6.0	6.0	6.0	
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	C-Min		None	C-Min	None	
Act Effct Green (s)	79.7	96.7	107.0	107.0	11.0	38.3
Actuated g/C Ratio	0.61	0.74	0.82	0.82	0.08	0.29
v/c Ratio	0.49	0.14	0.05	0.53	0.25	0.53
Control Delay	14.2	3.3	0.9	2.2	57.6	41.2
Queue Delay	1.1	0.0	0.0	0.8	0.0	0.0
Total Delay	15.2	3.3	0.9	3.0	57.6	41.2
LOS	B	A	A	A	E	D
Approach Delay	12.6			2.9	43.4	
Approach LOS	B			A	D	

Lanes, Volumes, Timings  
6: South Street & W Main Street

2030 BUILD SIGNAL  
PM PEAK HOUR

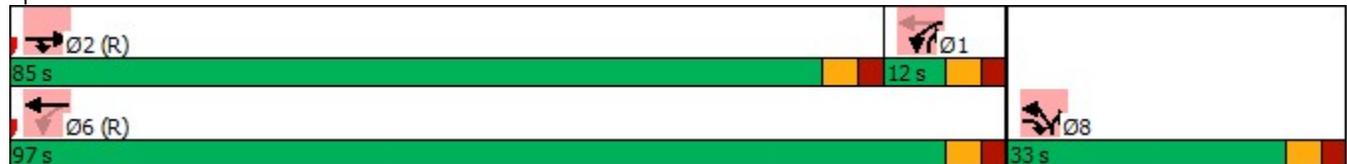


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Queue Length 50th (ft)	109	17	3	63	30	171
Queue Length 95th (ft)	541	m43	m1	27	61	214
Internal Link Dist (ft)	303			262	385	
Turn Bay Length (ft)		160	120		150	
Base Capacity (vph)	1170	1156	706	1512	362	645
Starvation Cap Reductn	369	0	0	394	0	0
Spillback Cap Reductn	94	0	0	97	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.13	0.05	0.72	0.10	0.37

Intersection Summary

Area Type: Other  
 Cycle Length: 130  
 Actuated Cycle Length: 130  
 Offset: 126 (97%), Referenced to phase 2:EBT and 6:WBTL, Start of Green  
 Natural Cycle: 65  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.53  
 Intersection Signal Delay: 12.9 Intersection LOS: B  
 Intersection Capacity Utilization 54.2% ICU Level of Service A  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: South Street & W Main Street



Lanes, Volumes, Timings  
8: Patty Lane/Hudson Street & W Main Street

2030 BUILD SIGNAL  
PM PEAK HOUR



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	523	10	10	751	33	10	10	10	37	5	76
Future Volume (vph)	144	523	10	10	751	33	10	10	10	37	5	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Storage Length (ft)	120		0	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.994			0.955				0.850
Flt Protected	0.950			0.950				0.984			0.957	
Satd. Flow (prot)	1685	1831	0	1685	1826	0	0	1666	0	0	1697	1561
Flt Permitted	0.150			0.411				0.984			0.957	
Satd. Flow (perm)	266	1831	0	729	1826	0	0	1666	0	0	1697	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			2			11				84
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	158	575	11	11	825	36	11	11	11	41	5	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	158	586	0	11	861	0	0	33	0	0	46	84
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6		4	4		3	3	5
Permitted Phases	2			6								3
Detector Phase	5	2		1	6		4	4		3	3	5
Switch Phase												
Minimum Initial (s)	3.0	3.0		4.0	6.0		4.0	4.0		6.0	6.0	3.0
Minimum Split (s)	9.0	25.5		10.0	25.5		26.0	26.0		26.0	26.0	9.0
Total Split (s)	14.0	68.0		10.0	64.0		26.0	26.0		26.0	26.0	14.0
Total Split (%)	10.8%	52.3%		7.7%	49.2%		20.0%	20.0%		20.0%	20.0%	10.8%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.5	2.0		2.5	2.0		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	0.0
Total Lost Time (s)	6.0	5.5		6.0	5.5			6.0			6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	C-Min		Min	C-Min		None	None		None	None	None
Act Effct Green (s)	102.7	91.4		87.4	82.1			7.4			9.0	24.1
Actuated g/C Ratio	0.79	0.70		0.67	0.63			0.06			0.07	0.19
v/c Ratio	0.42	0.46		0.02	0.75			0.31			0.39	0.24
Control Delay	13.0	10.9		6.8	25.7			50.8			66.7	7.0
Queue Delay	0.0	0.4		0.0	0.0			0.0			0.0	0.0
Total Delay	13.0	11.4		6.8	25.7			50.8			66.7	7.0
LOS	B	B		A	C			D			E	A
Approach Delay		11.7			25.5			50.8			28.2	
Approach LOS		B			C			D			C	



Lanes, Volumes, Timings  
3: Driveway/Church Street & W Main Street

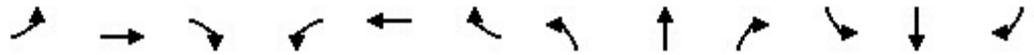
2030 BUILD SIGNAL  
SAT PEAK HOUR

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	173	593	0	0	590	281	0	0	0	290	0	193
Future Volume (vph)	173	593	0	0	590	281	0	0	0	290	0	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	8	12	11	11	11	11	11	11	11
Storage Length (ft)	260		0	0		0	0		0	0		0
Storage Lanes	1		0	0		1	0		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1685	1837	0	0	1900	1561	0	0	0	1745	1561	0
Flt Permitted	0.192									0.950		
Satd. Flow (perm)	340	1837	0	0	1900	1561	0	0	0	1745	1561	0
Right Turn on Red			No			No			Yes			No
Satd. Flow (RTOR)												
Link Speed (mph)		30			30			30				30
Link Distance (ft)		540			383			342				368
Travel Time (s)		12.3			8.7			7.8				8.4
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	177	605	0	0	602	287	0	0	0	296	0	197
Shared Lane Traffic (%)												
Lane Group Flow (vph)	177	605	0	0	602	287	0	0	0	296	197	0
Turn Type	pm+pt	NA			NA	pm+ov				Split	NA	
Protected Phases	5	2 5			6	4				4	4	
Permitted Phases	2 5					6						
Detector Phase	5	2 5			6	4				4	4	
Switch Phase												
Minimum Initial (s)	3.0				6.0	4.0				4.0	4.0	
Minimum Split (s)	24.0				26.0	41.0				41.0	41.0	
Total Split (s)	24.0				55.0	41.0				41.0	41.0	
Total Split (%)	20.0%				45.8%	34.2%				34.2%	34.2%	
Yellow Time (s)	3.5				3.5	3.5				3.5	3.5	
All-Red Time (s)	2.5				2.5	2.5				2.5	2.5	
Lost Time Adjust (s)	0.0				0.0	0.0				0.0	0.0	
Total Lost Time (s)	6.0				6.0	6.0				6.0	6.0	
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?												
Recall Mode	Min				C-Min	None				None	None	
Act Effct Green (s)	80.7	80.7			53.6	86.9				27.3	27.3	
Actuated g/C Ratio	0.67	0.67			0.45	0.72				0.23	0.23	
v/c Ratio	0.38	0.49			0.71	0.25				0.75	0.55	
Control Delay	10.7	12.4			31.0	6.0				54.3	46.0	
Queue Delay	0.0	0.2			2.2	0.4				0.0	0.0	
Total Delay	10.7	12.5			33.2	6.3				54.3	46.0	
LOS	B	B			C	A				D	D	
Approach Delay		12.1			24.5						51.0	
Approach LOS		B			C						D	

Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Fr <sub>t</sub>	
Fl <sub>t</sub> Protected	
Satd. Flow (prot)	
Fl <sub>t</sub> Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Heavy Vehicles (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	3.0
Minimum Split (s)	26.0
Total Split (s)	79.0
Total Split (%)	66%
Yellow Time (s)	3.5
All-Red Time (s)	2.5
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	C-Min
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	

Lanes, Volumes, Timings  
 3: Driveway/Church Street & W Main Street

2030 BUILD SIGNAL  
 SAT PEAK HOUR



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	47	214			444	94				213	135	
Queue Length 95th (ft)	90	356			445	49				290	196	
Internal Link Dist (ft)		460			303			262			288	
Turn Bay Length (ft)	260											
Base Capacity (vph)	470	1235			860	1230				508	455	
Starvation Cap Reductn	0	0			139	506				0	0	
Spillback Cap Reductn	0	128			0	0				0	0	
Storage Cap Reductn	0	0			0	0				0	0	
Reduced v/c Ratio	0.38	0.55			0.83	0.40				0.58	0.43	

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle:	95
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	26.0
Intersection LOS:	C
Intersection Capacity Utilization	71.7%
ICU Level of Service	C
Analysis Period (min)	15

Splits and Phases: 3: Driveway/Church Street & W Main Street



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Lane Group	Ø2
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

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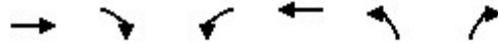
Lanes, Volumes, Timings  
6: South Street & W Main Street

2030 BUILD SIGNAL  
SAT PEAK HOUR

	→	↘	↙	←	↖	↗
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗	↙	↑	↖	↗
Traffic Volume (vph)	598	187	101	677	190	97
Future Volume (vph)	598	187	101	677	190	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	10	11	11	11
Storage Length (ft)		160	120		150	0
Storage Lanes		1	1		1	1
Taper Length (ft)			25		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1837	1507	1685	1837	1745	1546
Flt Permitted			0.295		0.950	
Satd. Flow (perm)	1837	1507	523	1837	1745	1546
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Link Speed (mph)	30			30	30	
Link Distance (ft)	383			342	465	
Travel Time (s)	8.7			7.8	10.6	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	0%	0%	1%
Adj. Flow (vph)	636	199	107	720	202	103
Shared Lane Traffic (%)						
Lane Group Flow (vph)	636	199	107	720	202	103
Turn Type	NA	pt+ov	pm+pt	NA	Prot	pt+ov
Protected Phases	2	2 8	1	6	8	8 1
Permitted Phases			6	1		
Detector Phase	2	2 8	1	6	8	8 1
Switch Phase						
Minimum Initial (s)	3.0		6.0	6.0	6.0	
Minimum Split (s)	26.0		12.0	26.0	26.0	
Total Split (s)	74.0		14.0	88.0	32.0	
Total Split (%)	61.7%		11.7%	73.3%	26.7%	
Yellow Time (s)	3.5		3.5	3.5	3.5	
All-Red Time (s)	2.5		2.5	2.5	2.5	
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	
Total Lost Time (s)	6.0		6.0	6.0	6.0	
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	C-Min		None	C-Min	None	
Act Effct Green (s)	75.0	100.2	88.8	88.8	19.2	33.0
Actuated g/C Ratio	0.62	0.84	0.74	0.74	0.16	0.28
v/c Ratio	0.55	0.16	0.23	0.53	0.72	0.24
Control Delay	16.0	3.4	2.2	2.6	62.1	33.4
Queue Delay	0.7	0.0	0.0	0.3	0.0	0.0
Total Delay	16.6	3.4	2.2	2.9	62.1	33.4
LOS	B	A	A	A	E	C
Approach Delay	13.5			2.8	52.4	
Approach LOS	B			A	D	

Lanes, Volumes, Timings  
6: South Street & W Main Street

2030 BUILD SIGNAL  
SAT PEAK HOUR

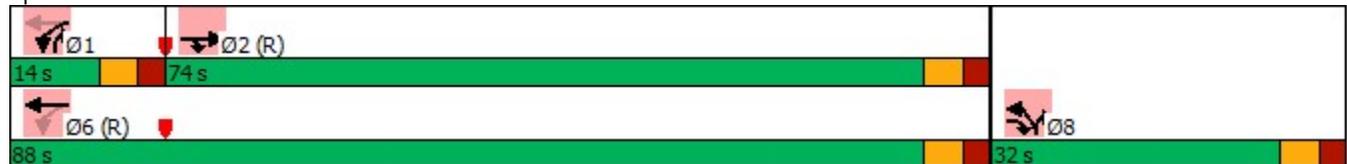


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Queue Length 50th (ft)	223	44	5	44	151	62
Queue Length 95th (ft)	544	23	m9	51	218	98
Internal Link Dist (ft)	303			262	385	
Turn Bay Length (ft)		160	120		150	
Base Capacity (vph)	1155	1336	469	1360	379	429
Starvation Cap Reductn	223	0	0	185	0	0
Spillback Cap Reductn	0	0	0	156	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.15	0.23	0.61	0.53	0.24

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 116 (97%), Referenced to phase 2:EBT and 6:WBTL, Start of Green  
 Natural Cycle: 70  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.72  
 Intersection Signal Delay: 15.0 Intersection LOS: B  
 Intersection Capacity Utilization 62.6% ICU Level of Service B  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: South Street & W Main Street



Lanes, Volumes, Timings  
8: Patty Lane/Hudson Street & W Main Street

2030 BUILD SIGNAL  
SAT PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	485	10	0	567	22	10	10	10	37	10	208
Future Volume (vph)	169	485	10	0	567	22	10	10	10	37	10	208
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	10	10	10	11	10	11
Storage Length (ft)	120		0	150		0	0		0	0		150
Storage Lanes	1		0	1		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.997			0.994			0.955				0.850
Flt Protected	0.950							0.984			0.962	
Satd. Flow (prot)	1685	1831	0	1773	1826	0	0	1666	0	0	1706	1561
Flt Permitted	0.289							0.984			0.962	
Satd. Flow (perm)	512	1831	0	1773	1826	0	0	1666	0	0	1706	1561
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			2			11				224
Link Speed (mph)		30			30			30				30
Link Distance (ft)		342			536			478				539
Travel Time (s)		7.8			12.2			10.9				12.3
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	182	522	11	0	610	24	11	11	11	40	11	224
Shared Lane Traffic (%)												
Lane Group Flow (vph)	182	533	0	0	634	0	0	33	0	0	51	224
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	Perm
Protected Phases	5	2		1	6		4	4		3	3	
Permitted Phases	2			6								3
Detector Phase	5	2		1	6		4	4		3	3	3
Switch Phase												
Minimum Initial (s)	3.0	3.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Minimum Split (s)	9.0	26.0		12.0	26.0		26.0	26.0		26.0	26.0	26.0
Total Split (s)	15.0	56.0		12.0	53.0		26.0	26.0		26.0	26.0	26.0
Total Split (%)	12.5%	46.7%		10.0%	44.2%		21.7%	21.7%		21.7%	21.7%	21.7%
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.5	2.5		2.5	2.5		2.5	2.5		2.5	2.5	2.5
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0		6.0	6.0		6.0	6.0	6.0
Lead/Lag	Lag	Lag		Lead	Lead		Lead	Lead		Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	C-Min		None	C-Min		None	None		None	None	None
Act Effct Green (s)	86.8	86.8			68.8			9.4			10.6	10.6
Actuated g/C Ratio	0.72	0.72			0.57			0.08			0.09	0.09
v/c Ratio	0.37	0.40			0.60			0.23			0.34	0.66
Control Delay	7.8	5.0			23.5			40.0			55.5	15.7
Queue Delay	0.7	0.3			0.0			0.0			0.0	0.0
Total Delay	8.5	5.2			23.5			40.0			55.5	15.7
LOS	A	A			C			D			E	B
Approach Delay		6.1			23.5			40.0			23.1	
Approach LOS		A			C			D			C	

Lanes, Volumes, Timings  
 8: Patty Lane/Hudson Street & W Main Street

2030 BUILD SIGNAL  
 SAT PEAK HOUR

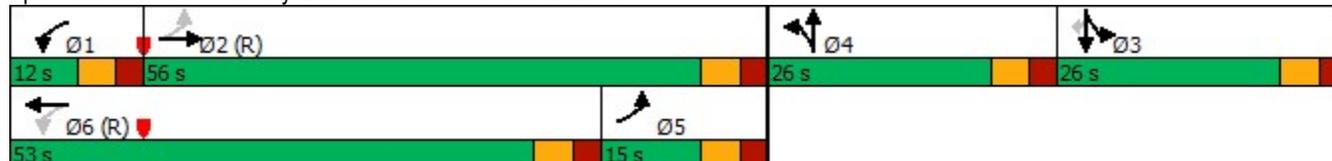


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	21	62			328			17			38	0
Queue Length 95th (ft)	43	108			#672			45			72	70
Internal Link Dist (ft)		262			456			398			459	
Turn Bay Length (ft)	120											150
Base Capacity (vph)	487	1324			1048			286			284	446
Starvation Cap Reductn	114	281			0			0			0	0
Spillback Cap Reductn	0	0			0			0			0	0
Storage Cap Reductn	0	0			0			0			0	0
Reduced v/c Ratio	0.49	0.51			0.60			0.12			0.18	0.50

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 118 (98%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green  
 Natural Cycle: 100  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.66  
 Intersection Signal Delay: 16.3  
 Intersection LOS: B  
 Intersection Capacity Utilization 64.1%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 8: Patty Lane/Hudson Street & W Main Street



Intersection/Lane Group	2023 Existing				2030 No Build				2030 Build			
	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>
<b>AM Peak</b>												
<b>Main Street and Church Street</b>												
Eastbound Left	0.57	30.8	C	125	0.63	35.1	D	125	0.42	26.1	C	100
Eastbound Thru	0.63	28.7	C	200	0.67	30.4	E	225	0.76	29.6	C	475
Westbound Thru/ Right	0.83	29.1	C	#300	0.86	30.9	C	#325	0.79	47.5	D	450
Westbound Right	-	-	-	-	-	-	-	-	0.28	7.4	A	175
Southbound Left	0.54	23.5	C	275	0.54	22.8	C	275	0.88	93.4	F	600
Southbound Thru/Right	0.53	23.4	C	275	0.53	22.7	C	275	0.24	20.8	C	125
<b>Main Street and South Street</b>												
Eastbound Thru	0.88	35.3	D	#400	0.94	42.5	D	#450	0.87	36	D	#825
Eastbound Right	0.22	2.1	A	50	0.22	2.1	A	50	0.21	1.7	A	*25
Westbound Left	0.32	11.4	B	50	0.34	12.2	B	50	0.33	7.7	A	25
Westbound Thru	0.52	15.7	B	150	0.52	16.2	B	175	0.49	2.9	A	75
Northbound Right/ Left	0.20	17.3	B	100	0.21	16.6	B	100	0.72	54.0	D	200
Northbound Right	-	-	-	-	-	-	-	-	0.23	28.9	C	100
<b>Main Street and Hudson Street</b>												
Eastbound Left	0.60	2.5	A	25	0.28	2.9	A	*25	0.28	3.1	A	*25
Eastbound Thru	0.30	2.0	A	50	0.42	3.4	A	*50	0.82	14.2	B	*825
Westbound Left/ Right/ Thru	0.98	12.2	B	100	0.30	9.7	A	125	0.07	9.6	A	25
Westbound Left	-	-	-	-	-	-	-	-	0.53	16.0	B	400
Northbound Thru	-	-	-	-	-	-	-	-	0.28	37.5	D	50
Southbound Thru/Left	0.53	49.2	D	50	0.34	43.5	D	75	0.41	50.0	D	100
Southbound Right	0.51	2.1	A	0	0.3	1.8	A	0	0.36	6.9	A	50

Intersection/Lane Group	2023 Existing				2030 No Build				2030 Build			
	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>
<b>PM Peak</b>												
<b>Main Street and Church Street</b>												
Eastbound Left	0.60	26.9	C	125	0.62	27.8	C	125	0.66	27.1	C	#175
Eastbound Thru	0.30	17.8	B	150	0.32	18.4	B	150	0.40	12.1	B	275
Westbound Thru/ Right	0.98	40.3	D	#550	1.05	57.9	E	#585	0.83	27.6	C	550
Westbound Right	-	-	-	-	-	-	-	-	0.36	2.4	A	50
Southbound Left	0.53	32.7	C	275	0.52	32.1	C	275	0.86	63.9	E	#475
Southbound Thru/Right	0.51	32.7	C	250	0.53	32.5	C	250	0.43	42.9	D	200
<b>Main Street and South Street</b>												
Eastbound Thru	0.33	17.3	B	225	0.35	17.7	B	225	0.49	15.2	B	#550
Eastbound Right	0.11	1.4	A	25	0.12	1.5	A	25	0.14	3.3	A	*50
Westbound Left	0.09	4.9	A	25	0.09	5.2	A	25	0.05	0.9	A	*25
Westbound Thru	0.55	14.6	B	150	0.58	16.6	B	175	0.53	3.0	A	#50
Northbound Right/ Left	0.26	26.6	C	100	0.27	26.1	C	125	0.25	57.6	E	75
Northbound Right	-	-	-	-	-	-	-	-	0.53	41.2	D	225
<b>Main Street and Hudson Street</b>												
Eastbound Left	0.36	11.7	B	75	0.38	12.2	B	75	0.42	13.0	B	100
Eastbound Thru	0.22	7.5	A	100	0.23	7.5	A	100	0.46	10.9	B	275
Westbound Left/ Right/ Thru	0.39	10.8	B	175	0.40	10.6	B	200	0.75	25.5	C	#975
Westbound Left	-	-	-	-	-	-	-	-	0.02	6.8	A	550
Northbound Thru	-	-	-	-	-	-	-	-	0.31	50.8	D	25
Southbound Thru/Left	0.32	48.9	D	75	0.33	48.9	D	75	0.39	66.7	E	50
Southbound Right	0.21	1.3	A	0	0.22	1.4	A	0	0.24	7.0	A	0

Intersection/Lane Group	2023 Existing				2030 No Build				2030 Build			
	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>	v/c <sup>a</sup>	Delay <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>
<b>SAT Peak</b>												
<b>Main Street and Church Street</b>												
Eastbound Left	0.54	20.4	C	100	0.58	23.4	C	125	0.38	10.7	B	100
Eastbound Thru	0.34	15.4	B	150	0.36	16.2	B	175	0.49	12.4	B	375
Westbound Right/ Thru	0.59	18.8	B	325	0.64	21.0	C	350	0.71	31.0	C	450
Westbound Right	-	-	-	-	-	-	-	-	0.25	6.0	A	50
Southbound Left	0.54	36.5	D	250	0.54	35.7	D	250	0.75	54.3	D	300
Southbound Thru/Right/Left	0.54	37	D	225	0.54	36.2	D	225	0.55	46.0	D	200
<b>Main Street and South Street</b>												
Eastbound Thru	0.36	14.9	B	225	0.41	16.5	B	250	0.55	16.6	B	550
Eastbound Right	0.15	2.4	A	50	0.17	2.6	A	75	0.16	3.4	A	*25
Westbound Left	0.23	5.5	A	*25	0.26	5.9	A	*25	0.23	2.2	A	#25
Westbound Thru	0.41	7.6	A	75	0.43	7.0	A	75	0.53	2.9	A	#75
Northbound Right/ Left	0.33	30.4	C	100	0.32	29.7	C	125	0.72	62.1	E	225
Northbound Right	-	-	-	-	-	-	-	-	0.24	33.4	C	100
<b>Main Street and Hudson Street</b>												
Eastbound Left	0.31	5.0	A	50	0.33	5.5	A	75	0.37	8.5	A	50
Eastbound Thru	0.18	1.9	A	50	0.19	1.9	A	50	0.40	5.2	A	125
Westbound Right/ Thru	0.31	11.8	B	150	0.32	11.9	B	150	0.60	23.5	C	#675
Northbound Thru	-	-	-	-	-	-	-	-	0.23	40.0	D	50
Southbound Thru/Left	0.30	48.5	D	75	0.30	48.5	D	75	0.34	55.5	E	75
Southbound Right	0.57	8.1	A	50	0.59	8.9	A	50	0.66	15.7	B	75

