



CITY OF NEW HAVEN TWO-WAY CONVERSION

Final Report

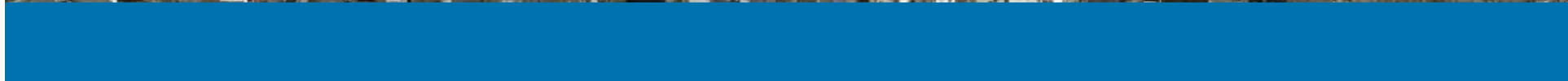
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FUSS & O'NEILL



SCRCOG



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Advisory Committee

- Ed Anderson, New Haven Resident
- Bianca Bowles, Mayor’s Office
- Laura Carpenter, Vice President, Fusco Management Company, LLC
- Dan Carron, Alexion
- Cindy Clair, New Haven Arts Council
- Kevin Coughlin, New Haven Resident
- Win Davis, Town Green Special Services District
- Steve Dudley, Southern Connecticut Regional Council of Governments
- Florita Gillepsie, Dwight Neighborhood
- Brian McGrath, Chapel West Business District
- Steve Merz, Yale-New Haven Hospital
- Elain Quinn, Dwight Neighborhood
- Linda Townsend-Maier, Greater Dwight Development Corporation
- Lauren Zucker, Associate Vice President, Director of New Haven Affairs, Yale University

City of New Haven

- Toni Harp, Mayor, City of New Haven
- Matthew Nemerson, Economic Development Director, City of New Haven
- Michael Piscitelli, Deputy Economic Development Administrator, City of New Haven
- Doug Hausladen, Director, Department of Transportation, Traffic and Parking, City of New Haven
- Jim Travers, Director, Department of Transportation, Traffic and Parking, City of New Haven
- Neetu Singh, Traffic Engineer, City of New Haven
- Bijan Notgh, Traffic Engineer, City of New Haven

Design Team

- Jon Allard, Fuss & O’Neill
- Ted DeSantos, Fuss & O’Neill
- Chris Ferrero, Fuss & O’Neill
- Sarah Lewis, Fuss & O’Neill
- Pat Lozinski, Fuss & O’Neill
- Tess Milkove, Fuss & O’Neill
- Mark Vertucci, Fuss & O’Neill
- Wade Walker, Alta Planning
- Stephanie White, Fuss & O’Neill
- Matt Skelly, Fuss & O’Neill

The City of New Haven, in partnership with the South Central Regional Council of Governments (SCRCOG), facilitated a week-long design charrette to explore converting many of the City's one-way streets to two-way streets. The project is a two-phase effort, with the first phase focusing on the streets that may be converted easily and cost-effectively in the short term with pavement striping and minor traffic signal changes. The second phase of the project will focus on streets that will require more of a capital investment to convert, with physical changes to infrastructure or major upgrades to traffic signals.

The Design Team collected data, mapping, and information on other projects within New Haven's downtown and prepared extensive existing conditions maps. The process was guided by an Advisory Committee made up of downtown residents, business and community leaders, and city staff. The Advisory Committee met with the Design Team at multiple times over the course of the project to identify challenges, opportunities, and streets to be included in a short-term street conversion scenario for the public's consideration.

The existing condition maps were shared with the Advisory Committee and transportation modeling was prepared to verify the validity of the short-term conversion scenario.

Residents and business owners of New Haven were then welcomed to the New Haven Free Public Library during the four day charrette to view the existing conditions information, participate in hands-on sessions, and view the Design Team's work-in-progress.



The Design Team also met individually with specific stakeholder groups during the charrette including representatives from each of the following:

- CT Transit
- Emergency Services (fire and police)
- Department of Public Works
- Dwight Neighborhood Management Team
- Hill Neighborhood Management Team
- Economic Development and City Plan Departments
- Aldermen from four of the surrounding Wards
- Elm City Bicycles and the Urban Design League
- Housing Authority

These small group meetings were held in order to gather input specific to these stakeholder groups. There were many opportunities for public input during the four day charrette, including formal information sessions, presentations, workshops, hands on drawing by the public, and time for any member of the public to have one on one discussion with the Design Team members.

Ideas were generated by many different people and the community input helped form a plan for converting one-way streets to two-way that accommodates drivers, pedestrians, bicyclists, business deliveries, and transit and emergency vehicles.

The public sentiment was largely supportive of two-way streets in Downtown. There were many vocal advocates for converting streets in order to accomplish slower speeds, reduce navigation confusion, and make the Downtown more favorable to bikes and pedestrians. Listed below is the most common feedback:

Two-way street versus one-way street issues:

- Lots of public support in favor of two-way streets
- One-way streets cause faster vehicular travel speeds which impacts the quality of life
- New Haven one-way streets are confusing to navigate and add commute time

Bike Issues:

- Cyclists choose to ride the wrong way down one-way streets for convenience and safety
- Education is needed for drivers, pedestrians and bicyclists on how to interact with other modes
- Lack of connectivity of bike facilities between train station, medical district, Wooster Square, and Downtown make it difficult to choose the bike as a mode of travel
- Court Street and Hillhouse Avenue are key opportunities for two-way bicycle travel.

Pedestrian Issues:

- Pedestrians are crossing Elm Street mid-block between High Street and College Streets
- Pedestrians are crossing Church Street mid-block between George & Elm
- Pedestrians are crossing Grove Street mid-block between College and Temple
- Pedestrian accidents at MLK Boulevard and South Frontage Road
- Lack of connectivity between Medical District and Downtown



A survey among the Stakeholder Groups was conducted in order to establish personal preference on a number of mobility and parking options. The following are the ranked preferences from top priority to lowest priority:

Ability to easily access my business or location from a car	1
Ability to access my business or location by foot, bicycle, or bus	2
Ability to park close to my location	3
Visibility of my business/location from car traffic	4
Ability to travel through downtown as quickly as possible	5

The history of New Haven shows that downtown streets were designed and constructed for two-way traffic. This allowed two-way carriage traffic for several hundred years, and automobiles for approximately 40 years. During the 1950's, many streets were changed to one-way traffic flow in order to speed up the commuter traffic inbound and outbound to peripheral residential areas. More recently, the City has had one of the most progressive and sustainable transportation programs in the State and beyond. The City Aldermen adopted a Complete Streets Manual, and the Department of Traffic, Transportation and Parking has constructed bike lane facilities, sharrows, and raised crosswalks to improve safety. These efforts are ongoing with more locations in design and construction. Construction in the study area includes the following: bike lanes on MLK Boulevard and South Frontage Road, raised intersections on MLK Boulevard at the intersections with Church Street, and on South Frontage Road at intersections with Church Street and College Street.



Stars indicate high priority pedestrian crossings

Our recommendations were organized into five broad categories:

1. Short Term Conversion Recommendations

- Nine streets were designated for short term conversion to two-way traffic operations:
 - North-South: Dwight Street, Howe Street, York Street, Park Street, College Street, Hillhouse Avenue
 - East-West: Grove Street, Crown Street, George Street
- Four streets were designated for further review and analysis under Phase 2 of this study: Church Street, Elm Street, Temple Street, and Chapel Street.

2. Long Term Conversion Recommendations

- Convert Elm Street to two-way traffic between Broadway and State Street:
- Convert Temple Street to two-way traffic between Elm Street and Trumbull Street, and a transit/emergency vehicle only roadway between Elm Street and Chapel Street.
- Reconfigure the intersections of Trumbull Street at Temple Street and Whitney Avenue to improve traffic operations and accommodate two-way flow.
- Reconfigure the intersections of Broadway at Tower Parkway Dixwell Avenue, Goffe Street, and Whalley Avenue to simplify traffic flow and

improve operations.

3. Simplify Bus Routes

- CT Transit identified a number of advantages to their bus service based on the conversion of streets to two way traffic operations.

4. Expand Bike Network

- Install sharrow lanes (bike and vehicle sharing the lane): on all converted city streets
- Install contra-flow bike lane on Court Street (two-way bike traffic on one-way street)
- Install dedicated bike lanes on Church Street between Chapel Street and Elm Street.
- Install two-way traffic and bicycle ROW on Hillhouse Avenue to improve bicycle connectivity to the Farmington Canal Greenway.

5. Improve Pedestrian Safety

- Traffic speeds produce safer pedestrian crossings at many locations, including:
 - George Street at Church Street
 - Crown Street at Church Street
 - Chapel Street at Church Street
 - Temple Street at Grove Street
 - College Street at Grove Street
 - High Street at Church Street
 - Areas around The Green

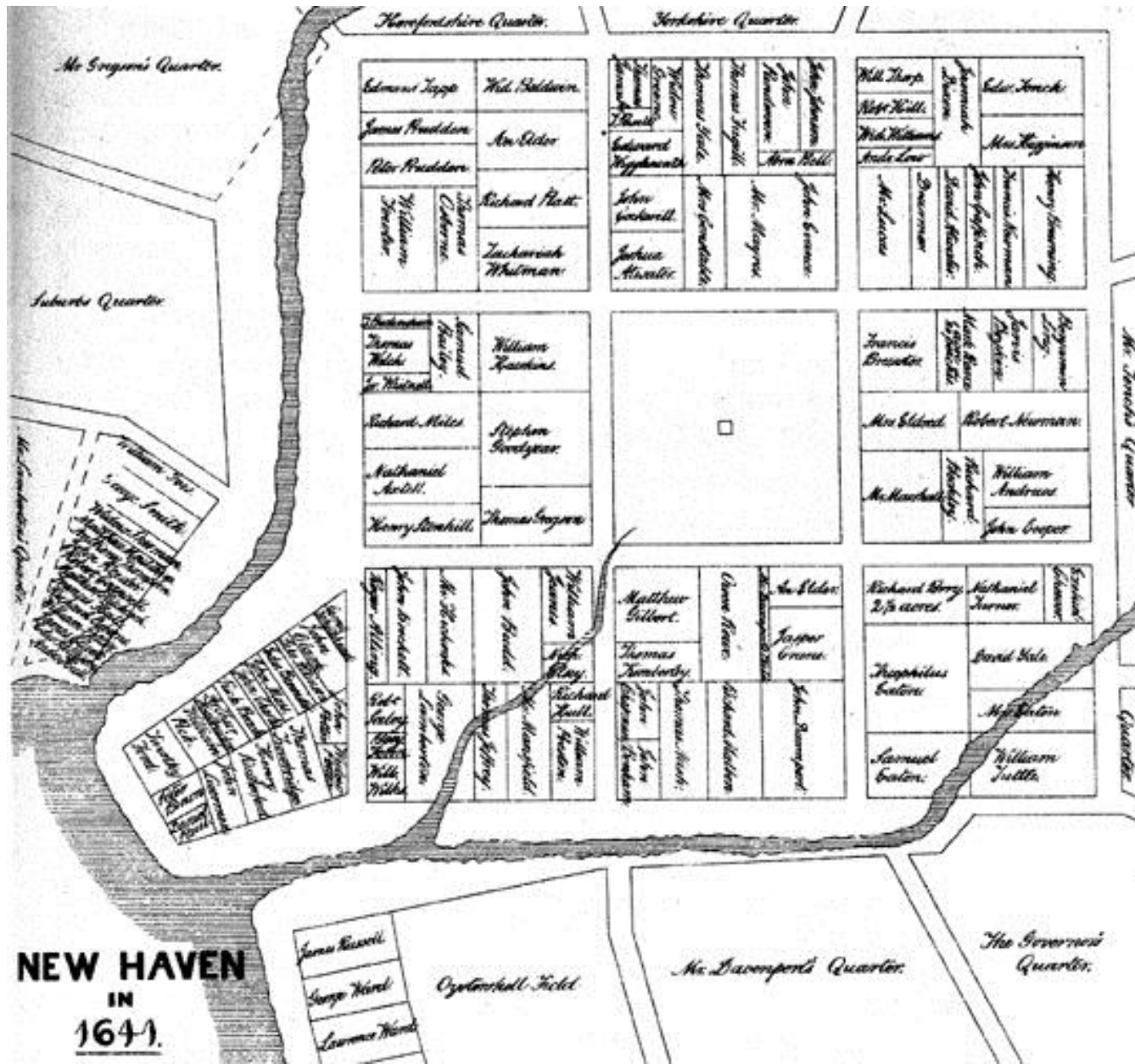
Ongoing design work for 15 of the downtown traffic signals (under a separate state project) will include two-way traffic operations for the short term conversion. This will allow use of the available design and construction funding for completion of these downtown signals with two way traffic operation.

The City will move forward with the short term conversions based on available funding and construction scheduling logistics. The construction of the short term conversions is anticipated to begin in three to five years, and the streets will be grouped for scale of construction packages based on funding. Phase 2 of the project will address the longer term conversions and intersection reconstructions with design and construction expected in the five to ten year horizon, depending on available funding.



1 HISTORY





New Haven's Nine Square Plan, circa 1641

The layout of New Haven's nine-square grid, though not the plan itself, is attributed to the original settlers' surveyor, John Brockett. Evidence of this can be found in the Records of the Colony and Plantation of New Haven, from 1638 to 1649:

Brockett laid out a street a half a mile long running parallel to West Creek, the original landing point for the colonists arriving in Quinnipiac Harbour from Massachusetts aboard the Hector in 1638. Using the street as a baseline, Brockett mapped out a town plat (or area of land) a half-mile square, which was then divided by two parallel streets running east and west and two running north and south. Forming nine equal squares, the plan left the center square as common space with the meetinghouse in the middle. The common space, called the market-place, is today New Haven's Town Green.

The other eight squares or quarters were fenced and assigned for house lots in relation to the amount invested in the common stock of the company. The quarters were commonly known by their principal occupants: Governor Eaton, Robert Newman, John Davenport, Edward Tench, and George Lambertson. New Haven's Nine Squares are bounded by the streets known today as George, York, Grove, and State.

(source: www.connecticuthistory.org)

History of One-Way Streets

New Haven was founded in 1638 by English Puritans, and a year later, eight streets were laid out in a four-by-four grid of two-way streets, creating what is now commonly known as the “Nine Square Plan”, as seen on the facing page. Recognized by the American Institute of Certified Planners (AICP) as a National Planning Landmark, the central 16-acre square, now referred to as the Green, was named a National Historic Landmark and is the heart of Downtown New Haven.

The streets provided for two-way traffic flow for more than 300 years serving horse/carriage and automobiles. The city reached its peak population with the post-World War II baby boom in the 1940’s. As in many major cities across the United States, city-dwellers began retreating from crowded apartment and tenement buildings to the newly-created suburbs, driving into the city on an ever-expanding network of roads. The effect was a series of poor planning decisions creating widespread urban decay and a clogged traffic network.

In an attempt to revitalize the city, New Haven embarked on a series of urban renewal projects beginning in 1954. In 1959, many of the city’s streets were converted from two-way to one-way to reduce congestion and smooth the late afternoon travel rush exiting the city. A practice popular among urban planners in the late 1950’s and 1960’s allowing for a higher capacity of traffic flow through the existing infrastructure, in an attempt to increase the viability of the city.



Sources: New Haven Historical Society





New Haven Today: Public and Private Momentum

The challenges New Haven’s infrastructure now faces hardly resemble those of the 1950’s. As the country experiences an unprecedented rise in urbanization, many of the families who relocated to suburbia during the baby boom have children or grandchildren returning to cities. In New Haven, the social and economic center of south central Connecticut, the rise in population must be met with an equal growth in the infrastructure and support systems.

Planning, design, and construction of enabling projects by the City of New Haven has promoted private

investment in the institutional, biotechnology, and housing markets in recent years. The City has been dedicated to sustainable transportation planning, complete streets policies, and creation of designs integrating land use with a world class transportation network. The goal has been to create a walkable, liveable downtown where business and residents can thrive and enjoy the urban lifestyle, have easy access to jobs and amenities, and an improved quality of life. Several noteworthy planning and design projects are ongoing, and have tremendous influence on the consideration of converting streets to two way traffic operations in the downtown. These projects are transformative in setting the course for downtown New Haven in the years to come.



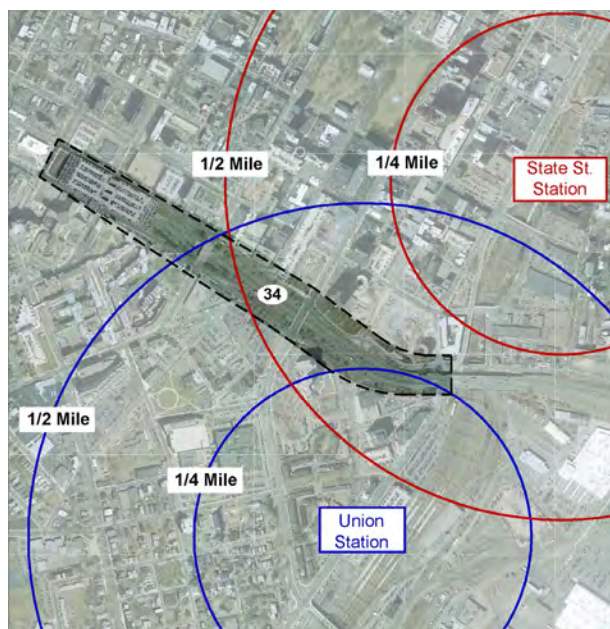
Concept: Restore Cross Streets

Downtown Crossing

The Downtown Crossing/Route 34 East project, which extends from Union Avenue to Park Street, will reconnect the downtown and the Medical District/Hill neighborhood. Replacement of the highway section of Route 34 with new city streets will help re-knit the neighborhoods severed by the highway. This project will also free up about 10 acres between downtown and the Yale medical district for development. The first site at 100 College Street is under construction with the project opening in Summer 2015, providing 500,000 square feet of biotechnology research, laboratory and office space. The City has also signed a Development Agreement comprising a \$400 million mixed use development on the former Coliseum site between Orange and State Wtreets. A primary goal of the Downtown Crossing/Route 34 East project is to develop a livable, walkable community while providing local and regional connectivity. Teh following four interrelated themes have been identified for achieving this overall goal.

1) Complete Streets/Connectivity

The Downtown Crossing/Route 34 East project will reconnect the street grid that was bisected by the original highway construction in the 1950s at Orange Street and Temple Street. The design of all streets and intersections within the Downtown Crossing/Route 34 East project area will be based on design standards in the City's newly adopted Complete Streets Manual, such as traffic calming, pedestrian safety, bicycle safety, and improved traffic control. Design features under consideration include bicycle lanes, pedestrian zones at intersections, and a wayfinding system. Complete Streets support alternative modes of transportation to the automobile, increase safety, and are designed for all users, including children, the elderly, and people with disabilities.



2) Placemaking/Transit Oriented Development (TOD)

The four parcels of land that would be created by the conversion of Route 34 East to city streets are all located within ½ mile of Union Station and State Street Station. This land is ideally suited for transit-oriented development. TOD includes a relatively dense mix of commercial, retail, and housing located within an easy walk of public transit. Creating a compact, walkable community supported by high quality rail and bus transit systems may also enhance the quality of life in downtown.

3) Economy

The new parcels of land created by the new Route 34 design are located within 1/4 mile of the Yale-New Haven Hospital, Smilow Cancer Center, Yale Medical School and City Hall and also within ½ mile of Union Station and State Street Station. The land is ideally situated for expansion of existing institutions and the development of related businesses.



4) Environment/Sustainability

Health and environmental benefits such as increased physical activity along with reduced air and noise pollution are associated with an increase in walking and cycling. By providing new and enhanced bicycle and pedestrian accessibility as well as opportunities for mixed use development within the corridor, Downtown Crossing/Route 34 East will support the city's sustainable growth objectives which include a reduced reliance on automobile travel.

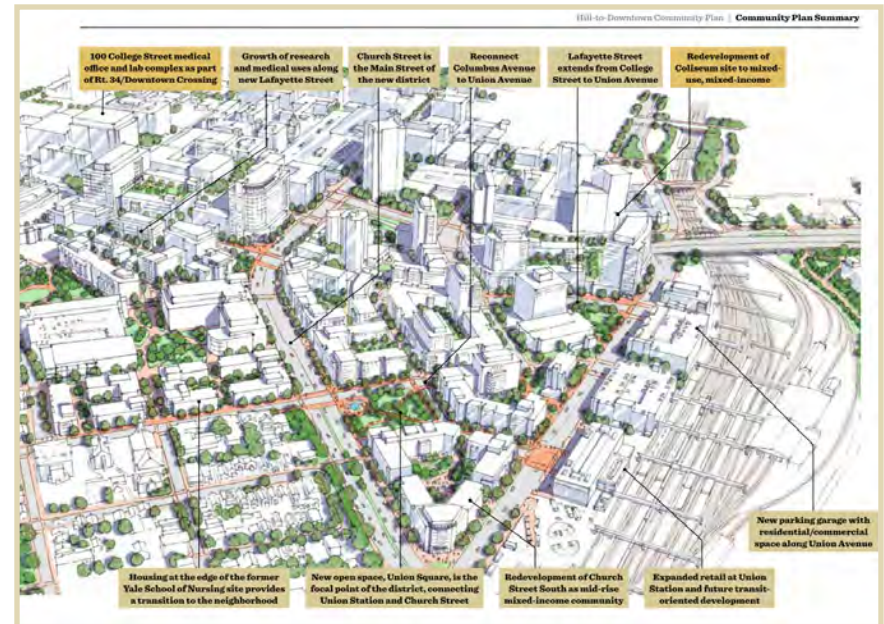
(Image Source: <http://www.downtowncrossingnewhaven.com/overview/reconnecting.aspx>)

Hill to Downtown

“The plan builds on a strong foundation of market research and community input, which recognizes downtown New Haven’s growing appeal as a location for new homes, workplaces, research and medical facilities, shopping and entertainment. The district is well placed to benefit from national demographic trends and changes that are drawing more people to diverse urban centers to live, work and play. Few places in the Northeast have the assets that are such a prominent part of the district: walkable and diverse urban neighborhoods; proximity to the heart of historic New Haven with its rich amenities; a strong institutional employment base represented by Yale-New Haven Hospital, Yale School of Medicine, and Gateway Community College; a growing research presence; and the region’s most important transportation center, Union Station.” - Hill to Downtown Community Plan, December 2013; Utile Group on behalf of the City of New Haven Economic Development Corporation.

These projects all share a common goal: transforming New Haven from a city suited to serve a mid 20th century automobile centric populace into a 21st century city, capable of providing a safe network of roadways for all users, while also promoting a healthy and sustainable economy.

(Image Source: Hill to Downtown New Haven Community Plan Summary - December 2013)



Key Initiatives

- 1 Establish Church Street as the Center of a Walkable, Mixed-Use District**
The Community Plan establishes Church Street as an active, pedestrian-oriented roadway defined by new housing, open space, retail, research and institutional uses.
- 2 Invest in Existing Neighborhoods**
(Columbus, Howard, Trowbridge)
The Community Plan promotes strengthened connections between Hill-to-Downtown and Trowbridge Square. A significant reuse opportunity exists at the Sacred Heart Church campus on Columbus Avenue, with several infill opportunities on Cedar Street and Howard Avenue. Funding should be established for these targeted investments that will strengthen the existing neighborhood.
- 3 Connect Union Station to Church Street**
The Community Plan seeks to reestablish a historic connection between Union Station and Downtown by creating a new pedestrian/vehicular corridor extending from the front doors of Union Station directly to Church Street.
- 4 Redevelop the Church Street South Residential Complex**
The Community Plan shows a potential scenario for how this critical area of the district could be redeveloped as a new mixed-income residential community including retail, restaurants and a new destination open space at the doorstep of downtown.
- 5 Build a New Lafayette Street**
The Community Plan establishes a New Lafayette Street, enhancing access, assisting with traffic demand management, and opening up significant development opportunities on key parcels of land along Route 34. The new street builds on the plan for New Orange and Temple Streets that is part of the Downtown Crossing initiative.
- 6 Strengthen Union Avenue**
The Community Plan proposes roadway improvements for Union Avenue, making it a “complete street”—one that balances the needs of autos, pedestrians, and cyclists and anticipates future development next to and across from Union Station.

ILLUSTRATIVE PLAN

The map shows the layout of downtown New Haven with numbered callouts (1-6) corresponding to the key initiatives. Key locations labeled include New Haven Green, Downtown New Haven, Trowbridge Square, Union Station, and Long Wharf.



2 WHY TWO-WAY STREETS?



**Why Convert Downtown Streets?
The Answer is Livability**

Transportation systems must serve the entire community and improve the quality of life for people who live and work in and around the area. Limited access highways such as move large volumes of vehicles at high speeds but provide few points of access. They favor vehicle capacity over non-motorized modes of transportation.

Local streets in urban centers, however, provide access to shopping, entertainment and housing so should be more balanced to also include pedestrians and bicyclists. They move fewer vehicles at lower speeds, which is safer for the non-motorized modes. Two-way streets in an urban environment favor mobility and livability over high speeds. In a downtown, the mantra of “move people, not just cars” should be the guiding principle of enhancing the mobility system. While the land use context and mixture of uses in Downtown suggests that walkability is balanced with vehicular movement. However, the number of one-way streets in New Haven tips the balance more toward vehicular use at the expense of walkability.

One-way streets do have an advantage of being able to move significant amounts of traffic through a system. Manhattan is a good example of a place that has been able to balance one-way streets with walkability in an urban context. However, unlike New Haven, the streets are logically alternating directions. The sheer volume of cars on the roads of Manhattan result in an operating condition that is close to capacity for much of the day, which results in much slower vehicle speeds. Additionally, the density of land use results in a huge

volume of pedestrian users, which is expected and anticipated by drivers.

Downtown New Haven, while a dense urban environment by most standards, does not have the traffic or pedestrian volumes to keep vehicle speeds in check due to the presence of a significant amount of excess capacity in the one-way system throughout most of the day. These higher speeds result in an environment that is hostile to non-motorized traffic, with vehicles overtaking even each other on these downtown streets

being a prevalent practice.

While it is true that one-way streets can have a traffic capacity of 10-20% higher than similar two-way streets, they also incur additional vehicle miles traveled and additional turning movements due to the recirculation required to reach destinations. This is especially true in New Haven as the one-way streets do not operate logically as pairs in opposite travel directions. In New Haven, the analysis of the conversions that were proposed, shows the street network operates effectively.

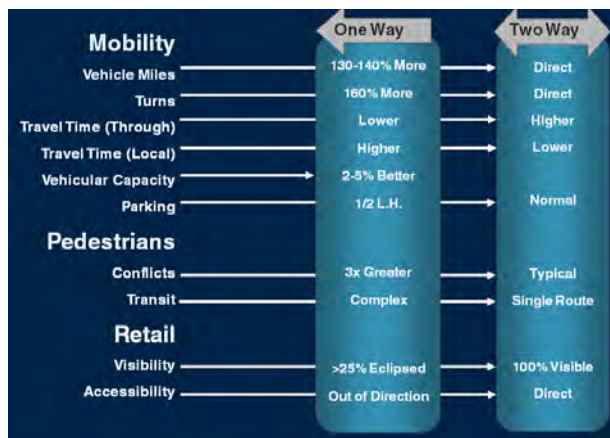


The circuitous route the design team had to take from the library to get to one of the public hands-on workshops at Chapel West

One-way streets often owe their existence to a time when it was important to move significant amounts of car traffic into and out of a downtown in a very short period of time. Downtowns were merely employment centers that moved commuters inbound in the morning and outbound in the afternoon. As New Haven has matured, people have placed an emphasis on spending more time in downtown, living, shopping, and dining. The increased population makes it more of a 24/7 environment where walkability is more important than the speed at which traffic can be moved in and out.

Wayfinding

A common problem for visitors to New Haven is the inability to find their destination due to the unfamiliar layout of the street network and the necessity to loop around one or more blocks to get to their destination. Traveling in a one-way street network requires approximately 160% more turns than traveling to the same destinations on a two-way network, as illustrated



The benefits of two-way streets over one-way

by the example on the left. One-way streets do not pose a major inconvenience for commuters and regular visitors to the downtown; these motorists have learned the downtown network and know the “best route” to their destination. Rather, it is the visitors to downtown who are often confused and disoriented when they encounter a one-way street network. Often, these motorists are able to see their destination but are directed away from it by the one-way streets. Unfortunately, these occasional users are in fact the customers that revitalized downtowns are trying to attract. If circulation in the downtown can be made easier by converting one-way streets, people in this target market segment would be more pleased with their overall experience and become regular downtown patrons. Conversely, if their first experience is one of frustration and angst in not being able to reach their destination easily or directly, they may not give downtown a second chance.

A vivid example of this was experienced by the study team during the charrette: to get to the evening hands-on session in the Chapel West neighborhood, the project team followed GPS directions which took a circuitous route. Immense frustration caused by lost time and confusion is common in cities with one-way networks, and the team consisting of non-residents certainly experienced this. Anecdotally, the team also heard this same frustration from charrette participants; that it’s difficult to navigate the one-way system and if you miss a turn you may end up recirculating through the system, adding time to the trip. A change from one-way to two-way circulation certainly goes a long way toward remedying this issue.

Pedestrian Safety

Due to the excess capacity on many one-way streets, vehicular speeds are often higher than on a similar two-way street. In addition to vehicle speeds causing discomfort for pedestrians walking along or crossing one-way streets, higher speeds result in a much higher fatality rate should a pedestrian be struck while crossing the street. Research has shown that 95% of pedestrians survive being struck by a vehicle at a speed of 20 miles per hour; in contrast, 85% die when struck by a vehicle traveling at 40 miles per hour. Given the amount of excess capacity and observations during the charrette, speeds in this deadly range happen on New Haven’s one-way streets every day.



Pedestrian survival rates when struck by a car driving at higher rates of speed



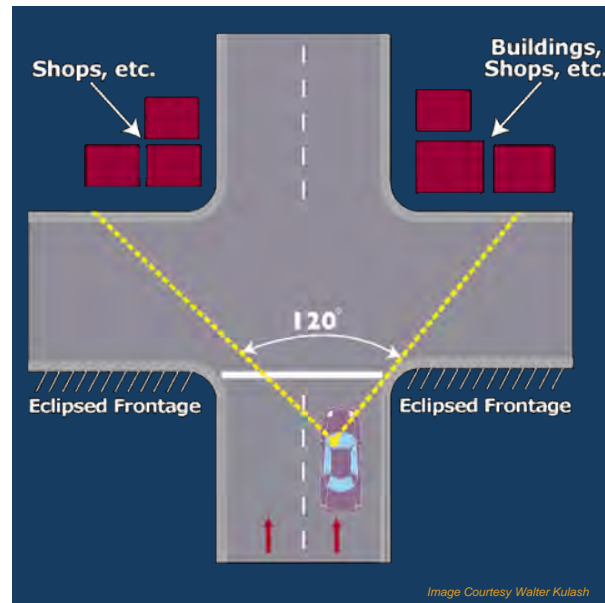
Multiple threat pedestrian conflict

An additional drawback for pedestrians walking in a one-way street network is the “multiple threat” pedestrian conflict illustrated above. A pedestrian starts crossing the street when one vehicle stops to allow him to cross, but he cannot see or be seen by the driver of the vehicle in the second lane. If the vehicle is moving fast enough, the result can be deadly as previously discussed. Converting streets to two-way removes this potential conflict at the majority of locations studied in this effort by eliminating the ability for motorists to overtake vehicles that are stopped waiting for a pedestrian to cross the street.

One advantage of one-way streets for pedestrian safety is only needing to check for on-coming vehicles in one direction rather than two. Gaps in traffic must occur in both directions for a safe crossing with two-way flow.

Economic Impact

One-way streets have a negative impact on storefront exposure for those businesses highly dependent on pass-by traffic. As a vehicle stops at or enters an intersection the driver has excellent visibility of the storefronts on the far side of the cross street. On one-way street networks, storefront exposure is lost when one direction of travel is removed, causing one side of every cross street to be partially “eclipsed” from view. Approximately 25% of businesses are “eclipsed” in a one-way network, meaning they are not visible to vehicles travelling on the one-way street.



Eclipsed Frontage

Image Courtesy Walter Kulash

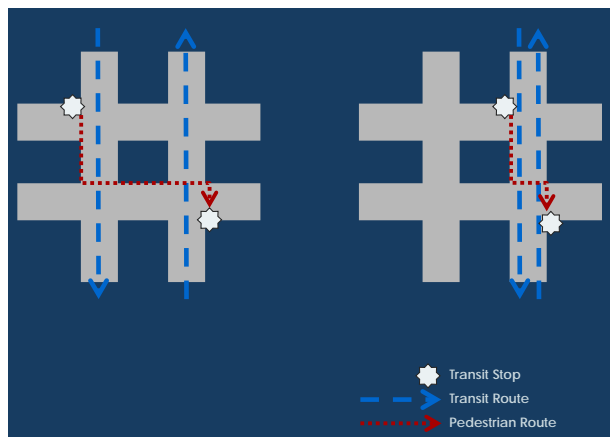
The economic development implications have been documented for both conversions to and from one-way streets. Both Chattanooga and Cincinnati saw retail vacancies climb dramatically on the heels of their mid-20th century conversions of downtown streets from two-way to one-way. Conversely, in the City of West Palm Beach, Florida, property values along Clematis Street increased from \$10-40 per square foot to \$50-100 per square foot after converting from one-way to two-way. Commercial rents increased from \$6 per square foot to \$30 per square foot, and retail vacancies went from 50% to 0%. Private investors injected \$350 million into the local economy and Clematis Street is now the premier address for retail and office uses in West Palm Beach.



Clematis Street, West Palm Beach, Florida

Public Transit

One-way streets require transit stops to be located on two different streets for the same route, causing confusion. Pedestrians have to walk around the block or sometimes two, to locate the appropriate stop for a transfer. On a two-way street, the stops may be located across the street from each other, making the system more intuitive for users. This characteristic is particularly important for visitors and infrequent transit users who may not know where to catch their “outbound” bus in the afternoon. It may be one street over from where they were dropped off in the morning. Not only are buses subject to the same impacts on personal motor vehicles such as additional turning movements, recirculation, and increased vehicle miles traveled, but they also have an additional operating cost due to high fuel consumption from circulating within the network. The required recirculation can additionally have a negative impact on timetables and schedules for transit providers and riders.



Pedestrian Distance Walked to Transit

Parking, Deliveries, Loading

A common concern in cities considering one-way to two-way street conversions is providing space for businesses to load and receive deliveries without obstructing the flow of traffic. In New Haven’s one-way network, delivery trucks commonly park in one travel lane, leaving one free lane of travel; the ability to do this underscores the fact that excess capacity exists in the system. With two-way traffic, care must be taken to provide appropriate parking and loading zones to keep delivery trucks out of the travel way. In most instances, the dedication of two on-street parking spaces on one to two block street segments for a loading zone can adequately serve businesses without detrimental impact on the parking supply.

With respect to on-street parking, in a one-way network half of the on street parking is on the left hand side of the roadway, which can be an unfamiliar maneuver for motorists. The two-way scenario does not have this characteristic.



Grove Street at Church Street



Granby Street, Norfolk, Virginia

Peer Cities Converted

Many cities have undertaken conversions of downtown one-way streets, realizing gains in overall livability, walkability, and economic vitality. A list of cities that have undertaken conversions successfully includes:

- | | |
|----------------|-----------------|
| Berkeley, CA | Albuquerque, NM |
| Denver, CO | Chattanooga, TN |
| Lakeland, FL | Norfolk, VA |
| Pensacola, FL | Waukesha, WI |
| Cincinnati, OH | |
| Toledo, OH | |

Case Study: West Palm Beach, Florida

Improvements:

- Convert a one-way, four lane street to two-way
- On-street parking
- Bulb-outs
- Street trees

Effects:

- Property values up \$40-\$60 per square foot
- Commercial rents up \$24 per square foot in downtown areas
- Commercial buildings at 0% vacancy vs. 50% vacancy prior to the improvements
- \$350 million in private investment attracted to the area.



City of West Palm Beach (1998). "Traffic Calming Reference Materials." Ian Lockwood and Timothy Stillings. October.



3 PUBLIC DESIGN PROCESS

Public Design Process

In advance of the charrette, the design team met with an advisory committee made up of business leaders, residents, members of community organizations, and representatives from the city. The committee met in April 2013 and again in July 2013 and provided the design team with valuable input on opportunities, challenges, and issues to be addressed. Out of these meetings came a potential street conversion scenario for the public to consider, made up of streets which could be easily converted in the short-term. Longer term street conversions and intersection reconstruction alternatives were vetted in a subsequent advisory committee meeting in April 2014 and presented for comment at a Public Information Meeting in May 2014.

Data Collection

A massive data collection effort produced vehicle and pedestrian counts, traffic signal timings, an inventory of existing arrangements of vehicle lanes and sidewalks, on- and off-street parking locations and usage, and other data. Traffic volumes were counted at a total of 64 intersections, in some cases using video cameras to capture data at many locations in a short period of time.

Prior Studies and Mapping

Plans and prior studies carried out by the city informed and inspired the design team throughout the process. Parking location and utilization information was pulled from the New Haven Point-in-Time Survey and Parking Plan Update published by the New Haven Parking Authority. CT Transit bus route maps provided the existing transit routes serving Downtown New Haven. Existing bicycle routes were reviewed using the city bicycle map created by Elm City Cycling. Other studies referenced include the Union Station Transit-Oriented Development & District Plan, the New Haven Street Car Preliminary Alignment and Implementation Plan, and the Route 34 Downtown Crossing study.

Stakeholder Interviews

Four days of in-depth interviews with stakeholders were held to understand issues and opportunities related to the potential conversions. The stakeholders included members of the business, residential, and institutional communities along with representatives of city agencies, transit providers, and elected officials. While a few specific locations were mentioned as areas of concern, the general consensus about converting the downtown streets to two-way was very positive.



What is a Charrette?

The National Charrette Institute (<http://charretteinstitute.com/>) defines a charrette as a multi-day, collaborative planning event that harnesses the talents and energies of all affected parties to create and support a feasible plan that represents transformative community change.

The communication loops foster a holistic understanding of complex problems by all participants and form the basis of a plan that reflects all vital viewpoints. They result in true buy-in by everyone involved, who are thereby inspired to support the plan, allowing it to overcome the inevitable challenges on its path to implementation. The need for three feedback loops spread at least day apart is a prime reason that charrettes last at least four days.

Key Principles:

Compress Work Sessions

Time compression facilitates creative problem-solving by accelerating decision-making and reducing unconstructive negotiation tactics. It also encourages people to abandon their usual working patterns and “think outside of the box.”

Study the Details and the Whole

Lasting agreement is based on a fully informed dialogue, which can only be accomplished by looking at the details and the big picture concurrently.

Communicate in Short Feedback Loops

Regular stakeholder input and reviews quickly build trust in the process and foster true understanding and support of the product.

Work collaboratively

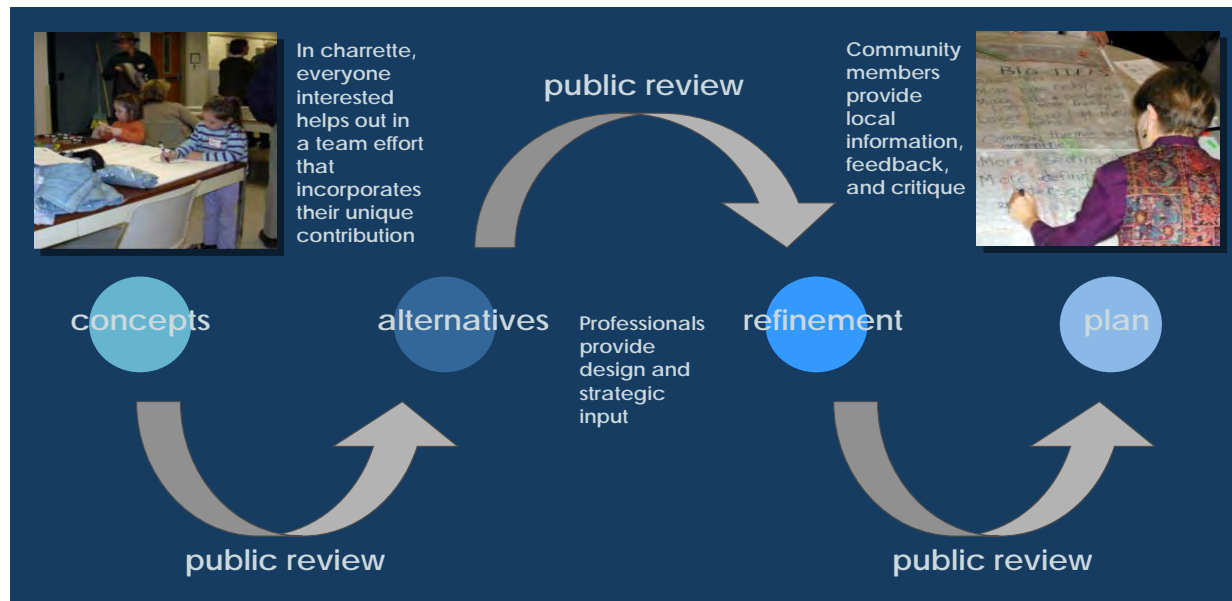
All interested parties must be involved from the beginning. Having contributed to the planning, participants are in a position both to understand and support a project’s rationale.

Produce a Feasible Plan

To create a feasible plan, every decision point must be fully informed, especially by legal, financial, and engineering disciplines.

The French word “charrette” means “cart” and is often used to describe the final, intense work effort expended by art and architecture students to meet a project deadline.

At the École des Beaux Arts in Paris during the 19th century, proctors circulated with carts to collect final drawings while the students frantically put finishing touches on their work.



City of New Haven Downtown One-Way to Two-Way Conversion Study Design Charrette

Time	Monday Oct. 21st	Tuesday Oct. 22nd	Wednesday Oct. 23rd	Thursday Oct. 24th
10:00am		Hands-On Session New Haven Free Public Library Design Studio	Open Design Studio	Open Design Studio
11:00am				
12noon				
1:00pm		Open Design Studio	Open Design Studio	Design Consultant Presentation preparation
2:00pm				
3:00pm				
4:00pm				
5:00pm				
6:00pm				
7:00pm	6:30 pm Project Overview/ Educational Session	Hands-On Session Chapel West Special Services District 1205 Chapel Street	Open Design Studio	Work-in-Progress Presentation
8:00pm			Work Pin-up Session	

The public is welcome to stop by the design studio at any time. The design studio is located in the New Haven Free Public Library, lower level, in the performance arts space.

Key public meetings
open studio

The 4-Day Charrette

Day 1: Tours & Education

The first day of the charrette is all about sharing information. The charrette begins with a team tour of the site and surrounding areas and then an evening kick-off presentation. This presentation provided an education about existing conditions, the process, and establishing a common language of urban design terminology.

Day 2: Public Vision

The next day a public “hands-on” workshop is held where everyone works in small groups to describe and draw their vision of the project. There were two of these sessions conducted, one in the morning in the public library and one in the evening in a Chapel West neighborhood storefront, to enable as many citizens as possible to participate. At each session, a citizen representative from each working table presents their top ideas to the whole assembly. Everyone learns from each other’s work and several alternative themes begin to emerge.

Day 3: Design and More Public Input

Over the subsequent days, the design team takes the community vision along with the project constraints and creates a series of alternative plans. The team meets with key stakeholders and develops concepts. The alternatives are debated at a public open house by representatives of all major viewpoints. It is often during these sessions that solutions to previously “unsolvable” problems are created. People are often overheard saying things such as, “Now I understand why two-way streets are important,” or “I understand how parallel parking contributes to walkability.”

Day 4: Refining Plans and Summary

On the final day, the design team synthesizes the input and narrows the number of alternatives, working toward the goal of a preferred plan. Equipped with the information and input from the public open house, the design team investigates the preferred alternative in detail and performs feasibility tests before presenting the plan and set of recommendations for public confirmation on the final evening of the charrette.

Work-in-Progress

The presentation on the final evening of the charrette is called a “work-in-progress” rather than a “final” presentation due to the fact the input can still be provided as the recommendations are finalized and documented. The design team consolidates all elements of the project including master plans, economic and transportation impacts and strategy, and any program or policy recommendations into a summary report - everything needed to move the project forward into implementation.

After the charrette the team continues refining the concepts to ensure the recommendations can be implemented.

Phase 2

The charrette produced a bounty of ideas with great potential to improve the safety and efficiency of the roadway network in downtown New Haven. The nature of the existing system dictates whether these ideas could be undertaken immediately, or if perhaps further design work may be required to bring the change to life. One of the objects of the refinement process following the charrette is to identify the “low-hanging fruit” ideas that could potentially be accomplished simply and economically by restriping lanes and changes to the signals and signing. The other ideas, which would likely involve more substantial changes to layout of intersections are addressed in Phase 2.

After the charrette, the design team set out to produce some viable options for these longer-range projects. The Study Advisory Committee, comprised of community leaders and neighborhood representatives, had the opportunity to provide feedback on these ideas to the team on which ideas might work best.

With this input, the design team was able to further refine these concepts, model the traffic impacts, and produce visual representations of the options that would help explain the schemes to residents and city staff.

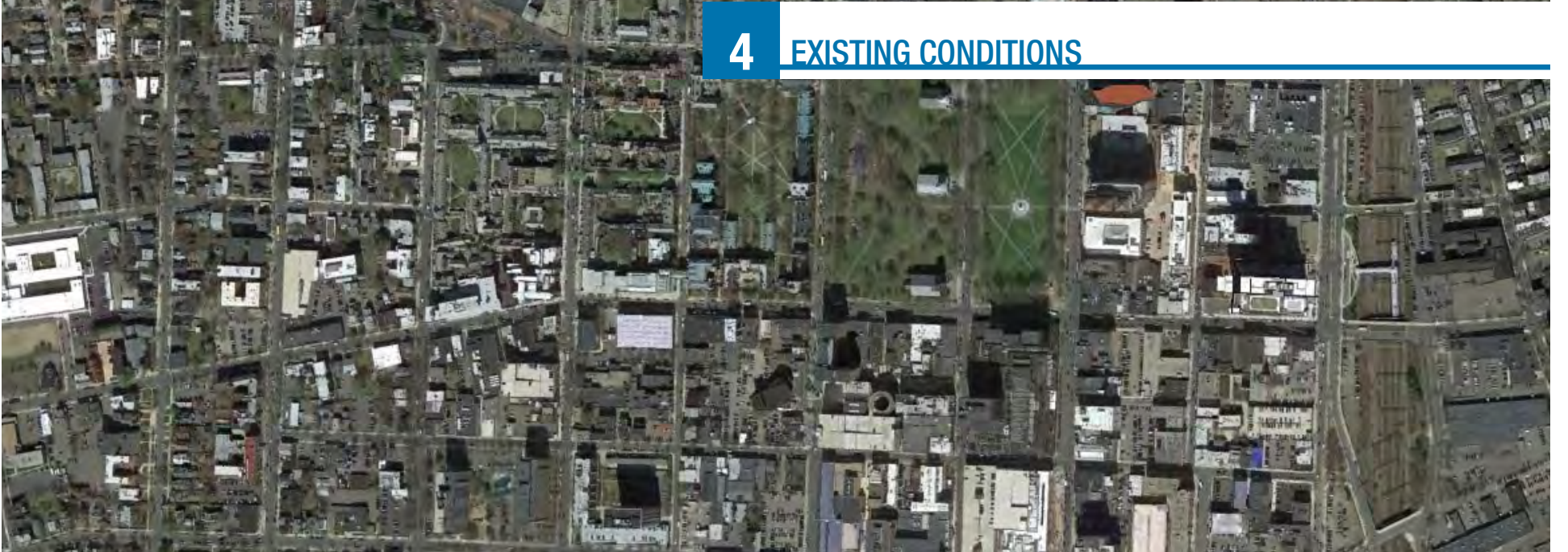
Public Information Session

After producing several options for the long-term solutions, the design team held an open house in the New Haven Free Public Library to receive feedback from the community at large. Thanks to some strategic advertising and assistance from the Department of Transportation, Traffic and Parking, the open house information session was well attended by both impacted residents as well as the local media.

The questions raised by the attendees were all documented and reviewed to be sure that every angle was considered. Several of the concept plans were altered and bettered as a result of the open house.







4 EXISTING CONDITIONS

Existing Conditions Analysis

A traffic model was created to examine how vehicular traffic in the downtown street grid functions with the existing one-way street restrictions. The project team counted vehicular and pedestrian traffic volumes at 64 intersections for use in modeling the existing downtown street grid. The city provided information about the operations and timings for all of the intersections controlled by traffic lights. Widths and configurations of lanes, bike lanes, sidewalks and other street characteristics were observed and measured.

The traffic model allowed the design team to understand in more detail where sensitivities and vulnerable spots are in the network and where there is excess vehicular capacity. The model was later compared to a model of how vehicular traffic would operate if streets were converted to two-way.

Traffic models cannot perfectly predict future traffic operations, and they do not adequately take non-vehicular factors into account; they are simply one tool used to inform the stakeholders and design team in the process of deciding which streets are appropriate for conversion. These models were considered along with other factors such as on-street parking, loading, available right of way, transit routes, bicycle and pedestrian facilities, and general public support of the stakeholders.

Synchro 8 Software

Capacity analyses for both signalized and unsignalized intersections were conducted using Synchro Professional Software, version 8.0. Synchro is a tool used to determine many attributes of a roadway network. In this study, delay is a quantity of interest.

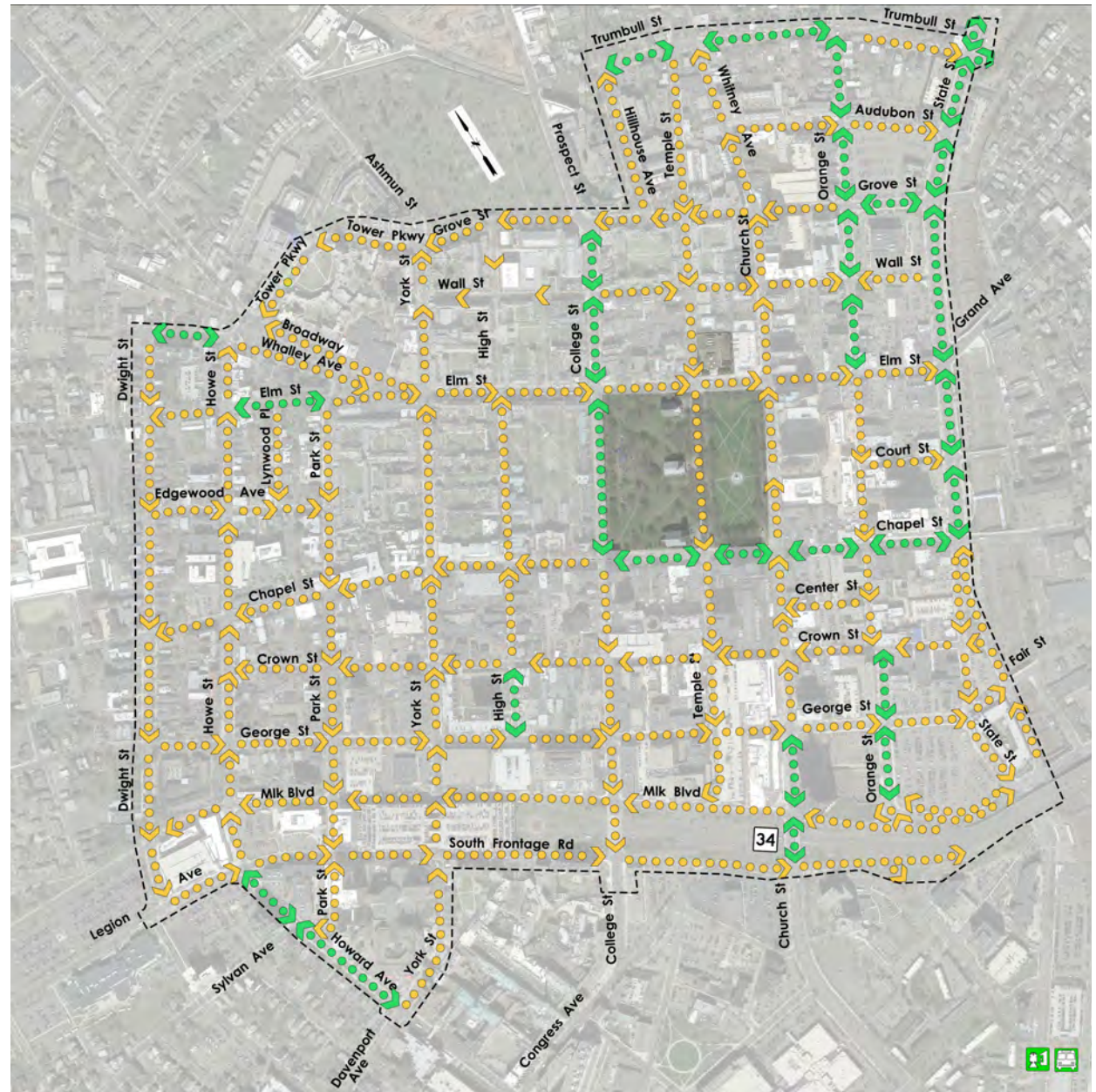
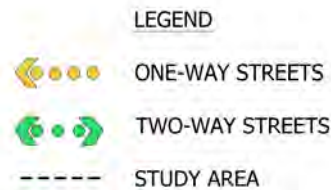
Level of Service (LOS) is a measure of the delay experienced by stopped vehicles at an intersection. LOS is rated on a scale from A to F, with A describing a condition of very low delay (less than 10 seconds per vehicle), and F describing a condition where delays will exceed 50 seconds per vehicle for unsignalized intersections and 80 seconds per vehicle for signalized intersections. Therefore, intersections with longer delay times are less acceptable to most drivers.

LOS is generally used to describe the operation (based on delay time) of both signalized and unsignalized intersections. The definition for LOS, as well as the methodology for conducting signalized and unsignalized intersection capacity analyses, are taken from the “2000 Highway Capacity Manual” published by the Transportation Research Board.

It is an important goal of this study to minimize delay as much as possible. This analysis is a factor in any recommendation made.

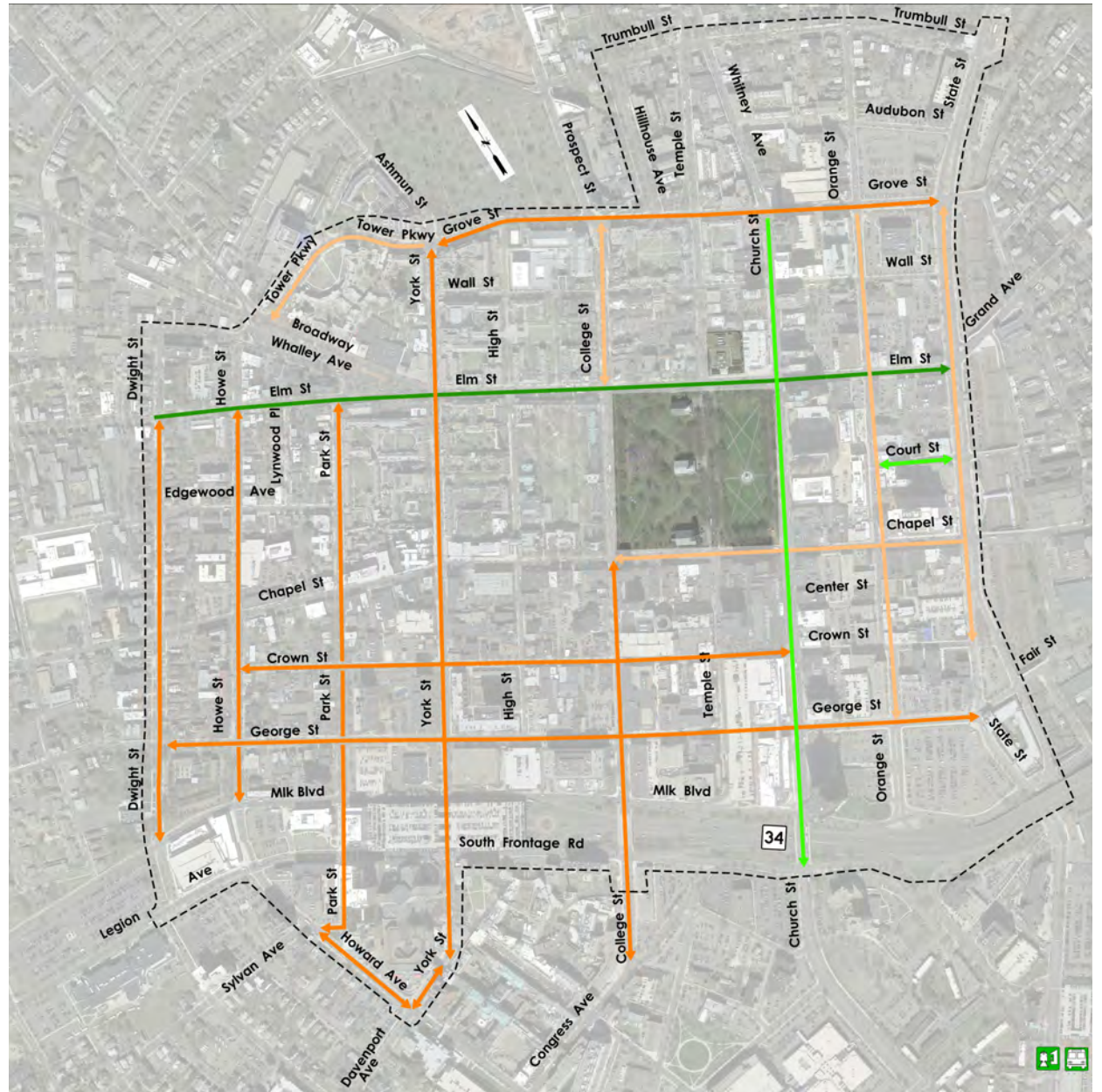
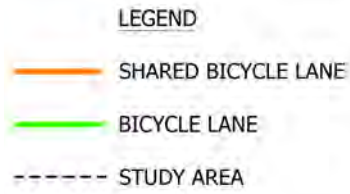
Existing Conditions Street Network

The project study area is bounded by Trumbull Street and Tower Parkway to the north, State Street to the east, South Frontage Road and the Yale-New Haven Hospital area to the south, and Dwight Street to the west. The existing street configurations and direction of travel are shown on the map. Much of New Haven's downtown is made up of one way streets. However, the travel directions do not follow a predictable alternating pattern making circulation difficult and navigation confusing.



Existing Bicycle Facilities

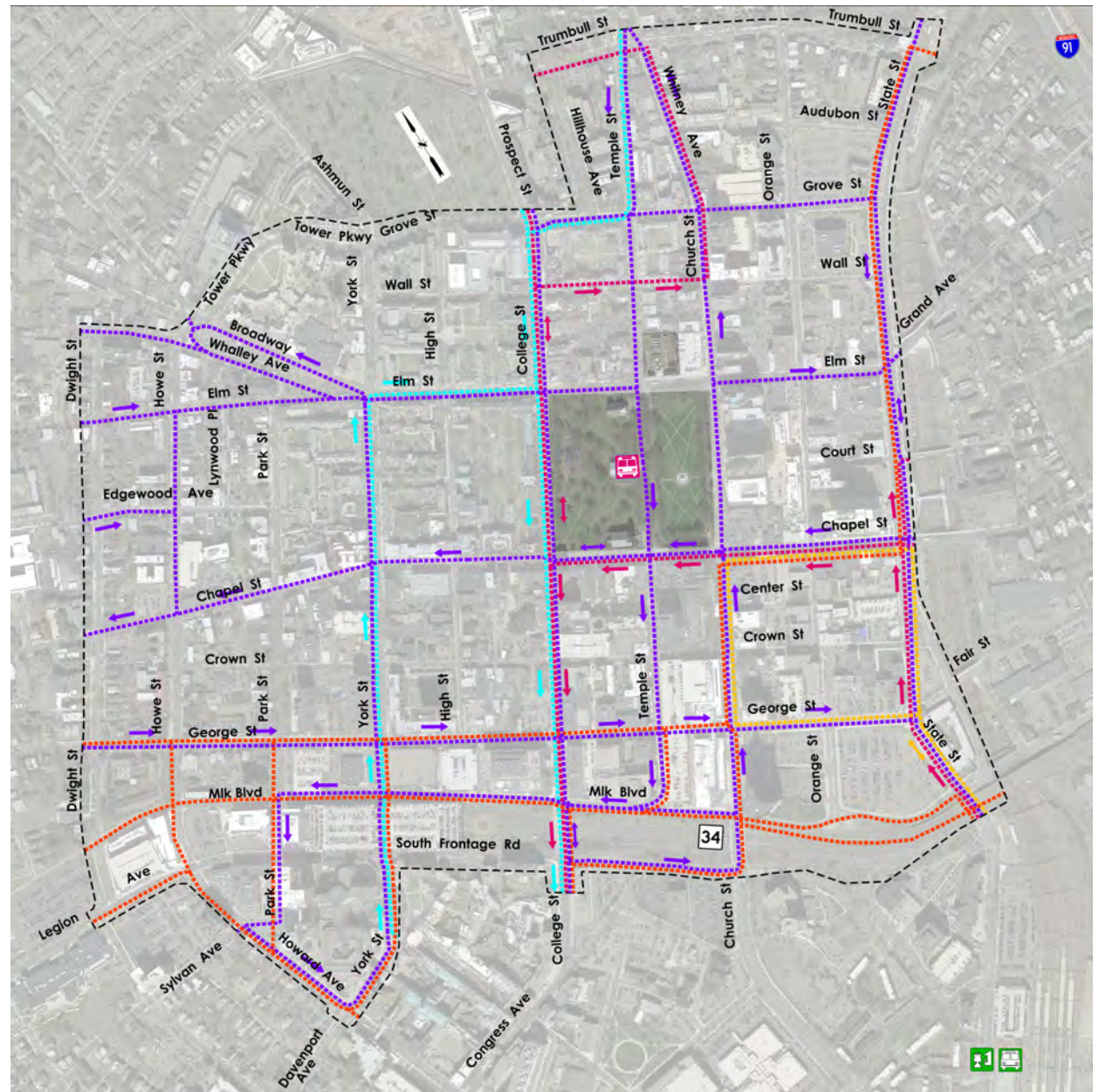
Sharrows (vehicle lanes shared with bicycles) are provided on Grove Street/Tower Parkway, portions of College Street, Chapel Street, George Street, Park Street, Orange Street and State Street. A dedicated bicycle lane, installed in 2013, runs along Elm Street from York to Orange.



Existing Area Transit

Local and regional bus service is provided by CT Transit, with the hub for making transfers located on Temple Street in the block between Elm Street and Chapel Street at New Haven Green. Shuttles operated by Yale New Haven Hospital, Yale University and the Long Wharf Maritime Center also have routes throughout the downtown area.

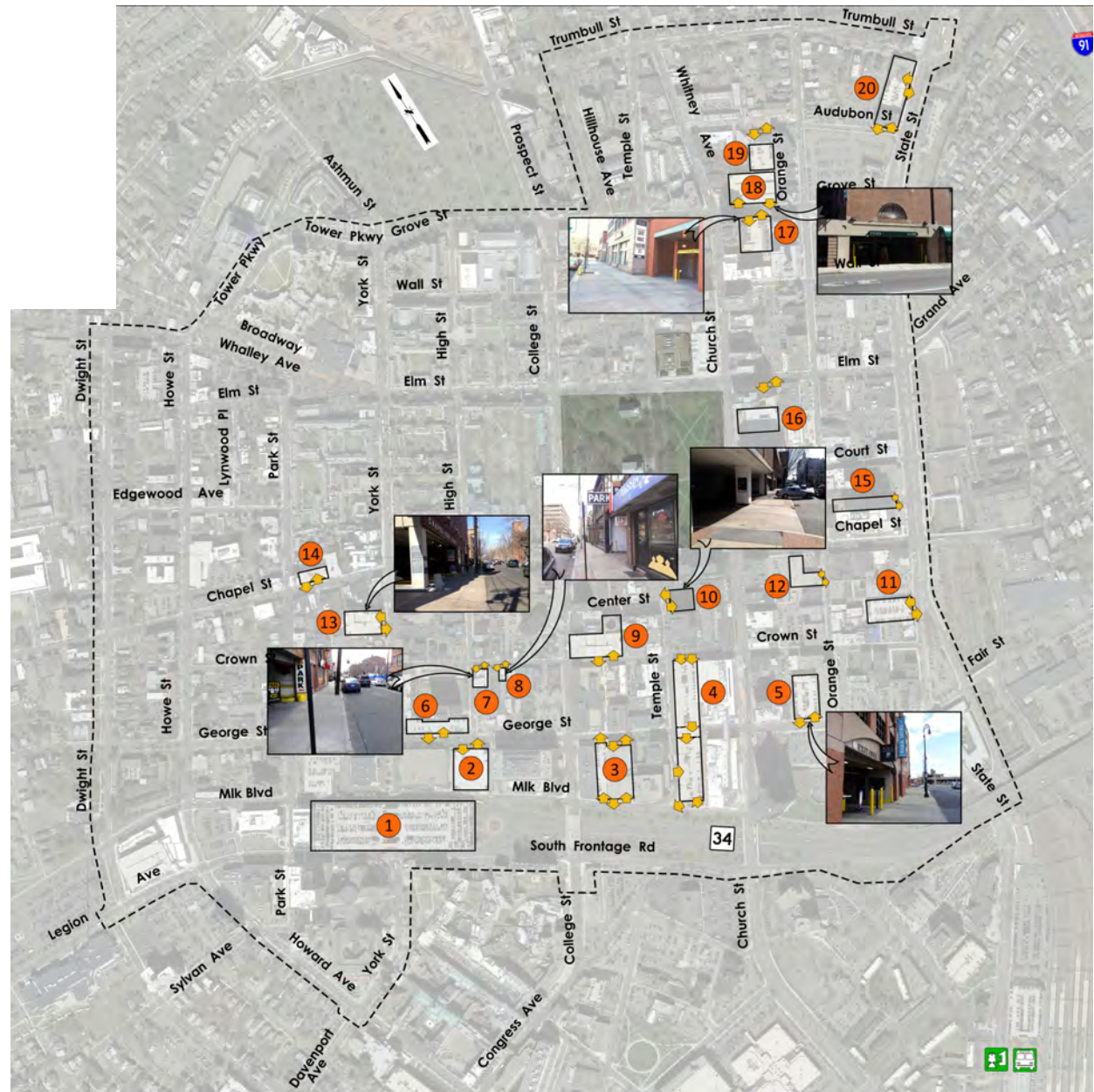
- LEGEND**
-  YALE NEW HAVEN HOSPITAL SHUTTLES
 -  YALE SHUTTLE BLUE LINE AND ORANGE LINE
 -  YALE SHUTTLE RED LINE
 -  CT TRANSIT BUS
 -  LONG WHARF MARITIME CENTER SHUTTLE BUS
 -  TRANSIT HUB
 -  STUDY AREA



Existing Garage Parking

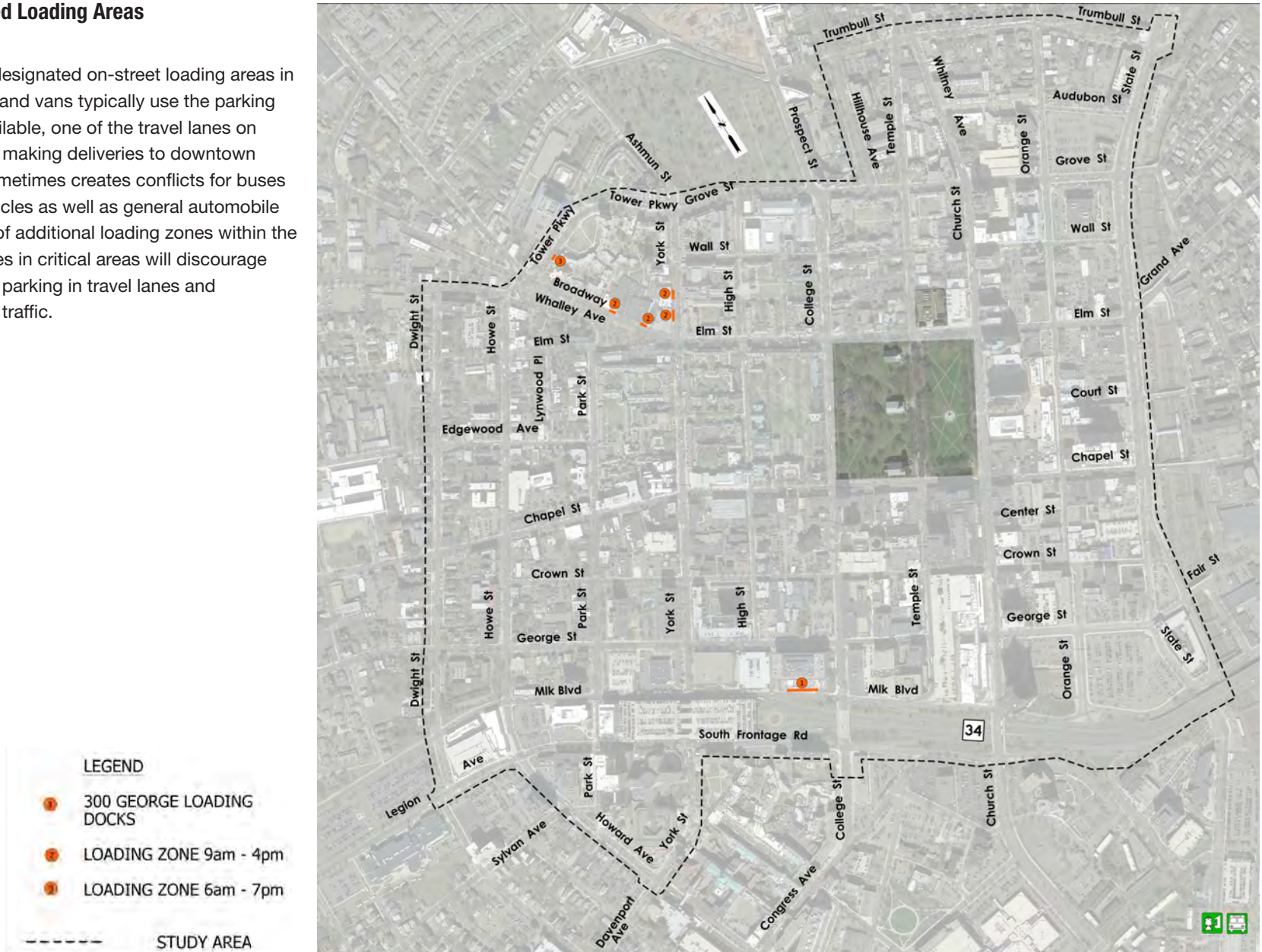
This map shows the existing parking garage locations, as well as the locations of the entrance and exit drives. Photos of the driveway locations have been provided for reference. On one-way streets to be converted to two-way, care must be taken to ensure adequate sight lines and turning radii for vehicles entering and exiting garages from both directions. In other cases, new queues formed at traffic signals must be managed to minimize obstructions at garage driveways for entering and exiting vehicles.

- LEGEND**
- 1 AIR RIGHT GARAGE
 - 2 AT&T GARAGE
 - 3 TEMPLE GEORGE GARAGE
 - 4 TEMPLE STREET GARAGE
 - 5 9th SQUARE GEORGE ST GARAGE
 - 6 NEW HAVE TOWERS GARAGE
 - 7 CENTRAL GARAGE
 - 8 NEON GARAGE
 - 9 CROWN ST GARAGE
 - 10 CHAPEL SQUARE GARAGE
 - 11 9th SQUARE STATE ST GARAGE
 - 12 ICRESEGE'S GARAGE
 - 13 CHAPEL MORE GARAGE
 - 14 THE STUDY HOTEL GARARE
 - 15 300 STATE ST GARAGE
 - 16 FINANCIAL CENTER GARAGE
 - 17 CENTURY GARAGE
 - 18 GROVE ST GARAGE
 - 19 AUDUBON ST GARAGE
 - 20 GRANITE SQUARE GARAGE
- STUDY AREA
- PARKING GARAGE ACCESS LOCATION AND DIRECTION



Existing Designated Loading Areas

There are very few designated on-street loading areas in New Haven. Trucks and vans typically use the parking lane or, when unavailable, one of the travel lanes on a one way street for making deliveries to downtown businesses. This sometimes creates conflicts for buses and emergency vehicles as well as general automobile traffic. Designation of additional loading zones within the existing parking lanes in critical areas will discourage delivery trucks from parking in travel lanes and obstructing through traffic.

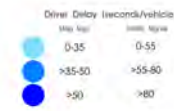


Existing Vehicle Delays

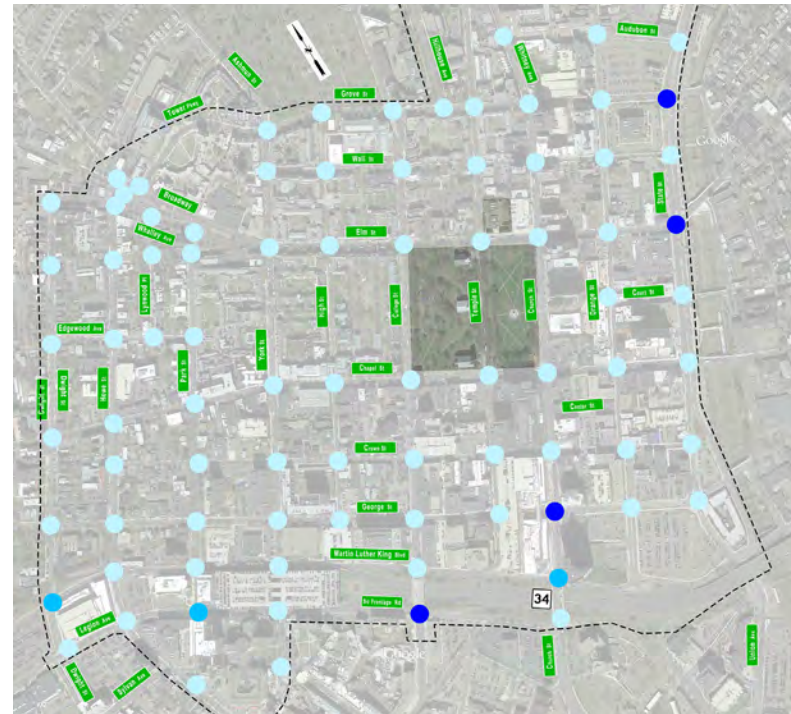
Delay is used as a measure of driver discomfort, frustration, fuel consumption, and lost travel time. High levels of delay are considered unacceptable at intersections that are designed solely to carry high levels of traffic through them. In city centers where there is a balance between vehicular traffic, pedestrians, bicyclists, and those making on-street parking maneuvers, higher levels of delay are accepted as part of this balance. A red signal light alone is not considered a delay in this analysis as the network requires controls to function correctly.

The light blue dots represent intersections with delay of 55 seconds or less during the peak hour of traffic for signalized intersections and 35 seconds or less for unsignalized intersections (without traffic lights). The medium blue dots show intersections with 55 to 80 seconds of delay for signalized intersections and 35 to 50 seconds of delay for the unsignalized intersections. The dark blue dots represent delay exceeding 80 seconds for signalized intersections and 50 seconds for unsignalized intersections.

As indicated on the maps below, the majority of the intersections in Downtown New Haven operate acceptably during existing condition peak hours. Levels of intersection delay are not abnormal for an urban area and most intersections operate with some reserve capacity.



Existing morning peak conditions



Existing afternoon peak conditions

Design Considerations

During the analysis of any potential change to a roadway, many factors were accounted for. These factors varied from intersection to intersection, but some remained constant throughout. A few primary design considerations are as follows:

- Turning Radii -- When altering the geometry of an intersection, a factor that must always be taken into account is the ability of larger vehicles to successfully navigate the new turning movements without encroachment on the opposing double yellow centerline. This can be especially challenging in smaller intersections where stop bars may need to be set back further, parking may need to be eliminated near corners, or minor curb radius revisions may be required to accommodate two-way traffic flow.
- Parking Regulations -- In the City of New Haven, motor vehicles must be parked a minimum of 25 feet away from any intersection of two roads. This regulation improves sight lines on street corners, facilitates vehicle turns between streets, and provides a small area for right turning vehicles to queue. These factors are important to the success of any two-way street conversions.
- Loading Zones -- Throughout the City, certain sections of streets have parking restricted in order to allow local businesses relatively easy access to the goods brought in on a daily basis. In some areas these restrictions are held on a permanent basis, in others they are dependent on the time of day. These loading zones will be maintained and additional loading zones should be considered post conversion to discourage delivery vehicles from parking in the travel lane and obstructing through vehicle flow. Replacement of two on-street parking spaces every one to two City blocks is typically sufficient to serve businesses and has minimal impact to on-street parking supply.
- Emergency Vehicles -- New Haven Fire Department and New Haven Police Department officials were involved in the planning process for the proposed street conversions and have endorsed the two-way street conversion plan. Two-way streets with on street parking will function no differently than existing streets with this cross section in other areas of New Haven, as well as many other urban areas throughout the country. Provision of adequate turning space at study intersections and appropriate designated loading zones will facilitate emergency vehicle circulation.



5

SHORT TERM RECOMMENDATIONS



Short-Term Conversion Scenario

The advisory committee, the community, and the design team collaborated on a short-term conversion scenario which includes streets that could be converted relatively easily and cost-effectively in the 3 to 5+ year time period, depending on funding availability for the signal modifications. These streets include:

- Dwight Street
- Howe Street
- Park Street
- York Street
- College Street
- Church Street
- Hillhouse Avenue
- Wall Street
- Grove Street
- Crown Street
- George Street

The majority of these recommendations were identified through preliminary analysis and modeling efforts and study advisory committee input received in advance of the design charrette. As a result of public input received during the charrette, Hillside Avenue was added as a short term street conversion to improve vehicular circulation and bicycle circulation in the vicinity of the Farmington Canal Greenway. A second opportunity was identified on Court Street to provide a contraflow bike lane to allow bicyclists safe travel westbound, against the flow of vehicular travel, to access the downtown area and improve connectivity.



Two-Way Loop

A central theme presenting itself in the community hands-on sessions and meetings with key stakeholders was the idea of a “two-way loop” honoring the original nine squares of New Haven’s downtown. Grove Street, State Street, George Street and York Street would facilitate vehicular travel around the downtown center and New Haven Green, with additional north/south connectivity provided by Church and College Streets. The two-way loop will reduce driver confusion, improve connectivity and circulation within the Downtown for both drivers and transit vehicles, and eliminate long, circuitous travel for the general public driving between locations within the Downtown.



Dwight and Howe Streets

Dwight and Howe Streets are residential streets in the Dwight Neighborhood on the western edge of downtown. Both streets currently serve as a one-way couple and provide two one-way travel lanes (Dwight Street southbound and Howe Street northbound) with the exception of Dwight Street between Elm Street and Whalley Avenue, and Dwight Street between Edgewood Avenue and Chapel Street which provides only one southbound travel lane. Parking and sidewalks are provided on both sides of each street with the exception of Dwight Street between Elm Street and Edgewood Avenue where two southbound lanes are provided with parking only on the east side.

section will result in a loss of parking from the existing condition. It should be noted that there was a lack of neighborhood support for the removal of this parking during the public involvement process. Therefore, conversion of these segments of road should be completed only if alternative parking solutions can be achieved, such as physical alternation of the curbline to retain on street parking or provision of off-street parking accommodations.

When converted to two-way operation, Howe Street will provide a single travel lane with sharrow and a parking lane in each direction while retaining the existing street trees and sidewalks. The same cross section will be provided on Dwight Street south of Chapel Street. North of Chapel Street, Dwight Street is wide enough only for two travel lanes and parking on one side of the roadway. For the segments of Dwight Street between Elm Street and Whalley Avenue, and between Edgewood Avenue and Chapel Street, this cross



Dwight Street existing conditions



Dwight Street proposed travel lanes with sharrow and parking lanes



Howe Street diagram

York and Park Streets

York Street and Park Street currently serve as a one-way couple and generally provide two wide one-way travel lanes (Park Street southbound and York Street

northbound) as well as on street parking along the majority of their length, and wide sidewalks on both sides of the streets north of George Street. Between George Street and MLK Boulevard, three travel lanes are provided on both roadways and parking is prohibited.



York Street existing conditions

Converted to two-way traffic, York and Park Streets will generally provide one 11-foot travel lane and one 7-foot parking lane in each direction while retaining sidewalks on both sides of the street. The travel lanes will be shared bicycle lanes.



York Street proposed two-way traffic with shared bicycle lanes



York Street diagram

College Street

College Street already provides two-way operation north of Chapel Street, while one-way southbound operation is in place south of Chapel Street. College Street provides two southbound travel lanes south of Chapel Street widening to three lanes south of Crown Street and eventually four south of George Street, making the roadway sufficiently wide for an extension of the two-way operation south to the MLK Boulevard/South Frontage Road corridor. On street parking is supplied on both sides of College Street north of Chapel Street and portions of College Street south of Chapel Street.

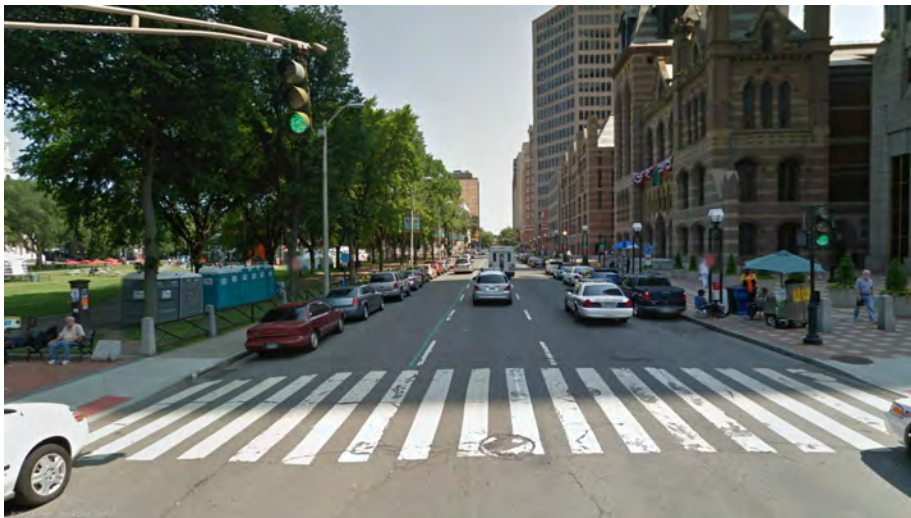
Upon conversion of the remainder of College Street to two-way traffic, a minimum of one travel lane in each direction can be maintained with additional turn lanes recommended for capacity at the approaches to George Street, Crown Street, and MLK Boulevard.

Church Street

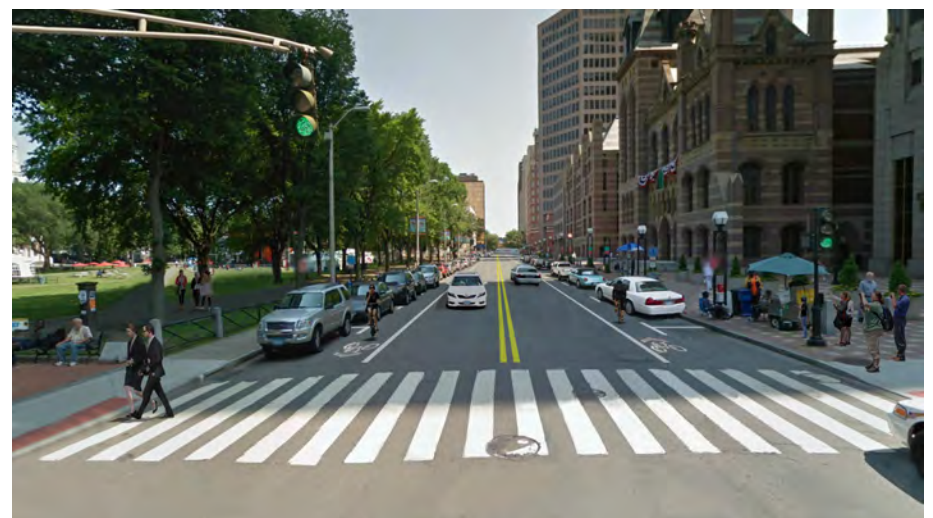
Church Street is a prominent street in Downtown New Haven, located adjacent to the Green and City Hall, and providing multiple northbound travel lanes between its intersection with Route 34 to the south and Whitney Avenue to the north. It currently provides two-way traffic flow between MLK Boulevard and George Street before becoming one-way northbound north of George Street. Three wide northbound travel lanes are provided along the majority of its length north of George Street, with on street parking and wide sidewalks on both sides of the street.

Church Street is proposed to be converted to two-way traffic north of George Street. North of Chapel Street adjacent to the Green, the typical roadway section will provide one 12-foot through travel lane, one 5-foot exclusive bike lane and one 8-foot parking lane in each

direction while retaining sidewalks on both sides of the street. Additional exclusive turn lanes on the Church Street northbound approaches to Chapel Street and Elm Street will be required for intersection capacity. This roadway would serve as the first major north-south bicycle corridor in the City and would connect to major east/west bike lanes along Elm Street and MLK Boulevard.



Church Street existing conditions



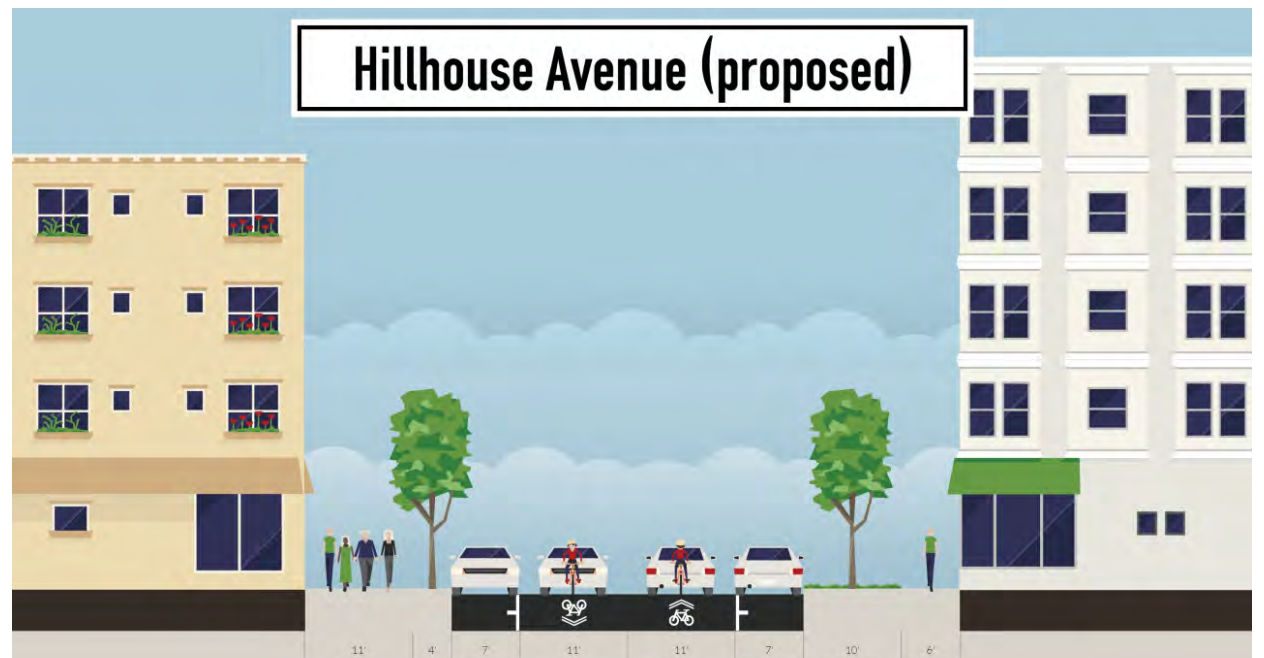
Church Street proposed travel lanes with bike and parking lanes

Hillhouse Avenue

Hillhouse Avenue is a short street, two blocks in length, at the northern edge of downtown. This street was identified by bicyclists taking part in the hands-on public sessions as a key bicycle route connector between Downtown and the Farmington Canal Greenway. By converting this roadway to two-way traffic, cyclists will have an alternate north-south connection to the Greenway on a lesser travelled roadway parallel to Prospect Street.



Existing conditions



Proposed two-way travel lanes

Grove Street

Grove Street currently provides two wide westbound travel lanes with on street parking and 10-foot sidewalks on both sides of the street along the majority of its length.



Proposed Grove Street median

The proposed section provides for a “green” boulevard along the northern edge of the two-way loop incorporating street trees and a possible bio-swale.

Converted to two-way traffic, Grove Street would provide one 11-foot travel lane and one 8-foot parking lane in each direction along with a 12-foot wide planted island between Temple and York Streets, while retaining sidewalks on both sides of the street. Left turn lanes would be provided in lieu of the median at key intersections with additional median breaks provided at intersections and major driveway locations.



Existing conditions



Proposed two-way traffic with planted bio-swale median

Wall Street

Wall Street currently flows westbound between College Street and York Street, eastbound between Orange Street and College Street, and westbound again between Orange Street and State Street. This inconsistent direction of flow is confusing to most drivers and results in circuitous travel. As a result, this study recommends reversing the one-way direction of Wall Street between Orange and College Streets to create a consistent one-way westbound flow. This will allow for better connectivity within the study area and reduce the number of circulating vehicles on parallel and intersecting roadways.

Crown Street and George Street

Crown Street and George Street currently serve as a one-way couple (Crown Street westbound and George Street eastbound). George Street provides two lanes of travel and some on street parking west of College Street while east of College Street, the roadway widens from three to four travel lanes with limited on-street parking. Crown Street generally provides two travel lanes and parking on one side of the road throughout the majority of its length.

In the proposed condition, George Street is proposed to be converted to two-way operation along its entire length within the study area, and Crown Street is proposed to be converted west of Church Street. At least one through lane of travel with bike sharrow markings will be provided throughout with George Street striped to provide additional travel and turn lanes east of

College Street. Some minor losses in on street parking will occur on portions of both roadways as described later in this Section, however ample off-street parking is available in these areas.

Court Street

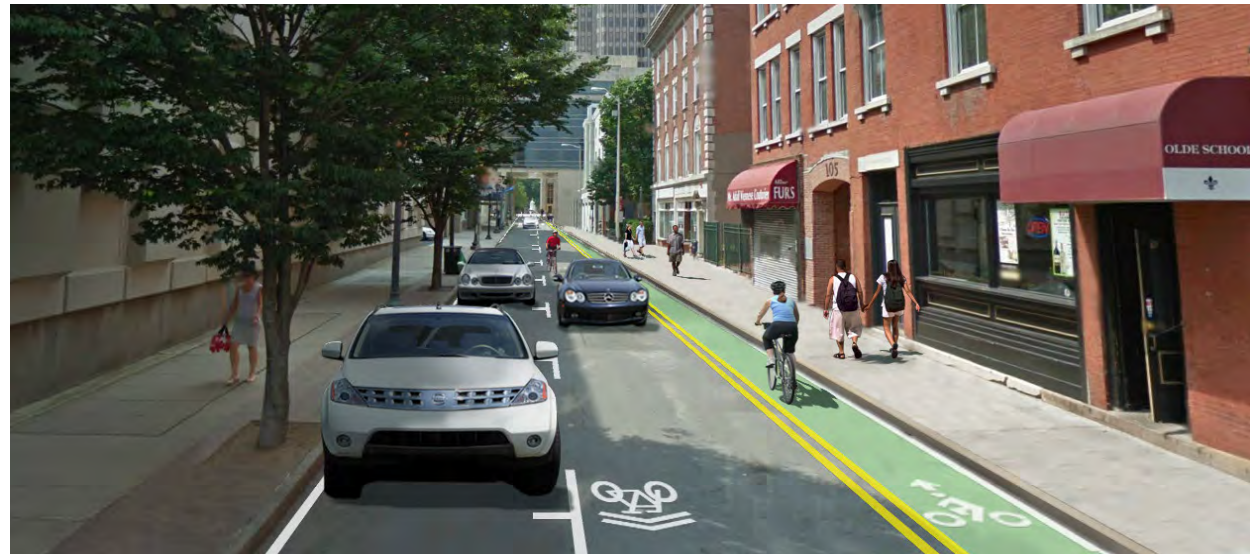
From the stakeholder interviews and hands-on public workshops, the project team learned that bicyclists often ride the wrong way (westbound) down Court Street to travel downtown from the train station area and points east. With simple lane re-striping, Court Street can be reconfigured to provide a 10-foot eastbound travel lane with sharrow markings and a 5-foot bicycle lane in the westbound direction. The existing 7-foot parking lane will be retained and shifted to the south side of the roadway.

Center Street

Center Street between Church Street and Orange Street currently flows one-way westbound which results in safety concerns near its intersection with Church Street due to bus activity and limited sight lines. As a result of input received, this roadway is recommended for conversion to one-way eastbound flow. This simple conversion will require minor signage and striping modifications and can be easily implemented in the short term.



Court Street existing conditions



Court Street proposed travel lane with sharrow markings and new bike lane

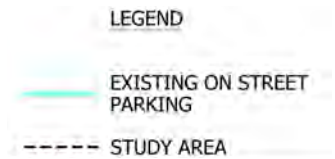
On-Street Parking and Truck Loading

When assessing the feasibility of converting each Downtown City street, potential impacts to on street parking and surrounding land uses were closely examined. Net parking gains and losses were quantified for each street proposed to be converted to two-way. The majority of the streets proposed for conversion currently contain two or more lanes of travel in the one way direction. Therefore, conversion of these streets to two-way operation is possible without impacting on street parking lanes. The conversion of parallel city streets in a one way pair allows for the existing north/south or east/west lane capacity to be maintained. Thereby allowing the streets to operate efficiently once converted, without the need to eliminate parking lanes. In some instances, where a single lane of one-way traffic exists, two-way traffic is not possible without elimination of on street parking. In other cases, opportunities were identified where the existing road width could accommodate on street parking even though it is not provided today.

As the graphic shows, net gains in on-street parking are possible in the vicinity of the busy College Street at George Street intersection. Some losses of parking are expected on segments of Crown Street and George Street however ample off-street garage parking is available in these areas. Some loss of on street parking would also occur on York Street at the Yale campus and Dwight Street north of Chapel Street as previously discussed. Overall, the net number of on-street parking spaces is not anticipated to substantially change as a result of this project.

In other considerations, restriping of on street parking lanes to provide exclusive left or right turn lanes on approaches to key intersections may be considered during design.

With respect to truck deliveries, there are currently few loading zones designated throughout the Downtown and where loading does occur on a one way street, the delivery vehicle often stops in one of the travel lanes, leaving the other lane open for through travel. In the proposed two-way street condition, striped loading zones (typically replacing two parking spaces) should be considered in appropriate locations to allow for loading and unloading without blocking the travel lane.





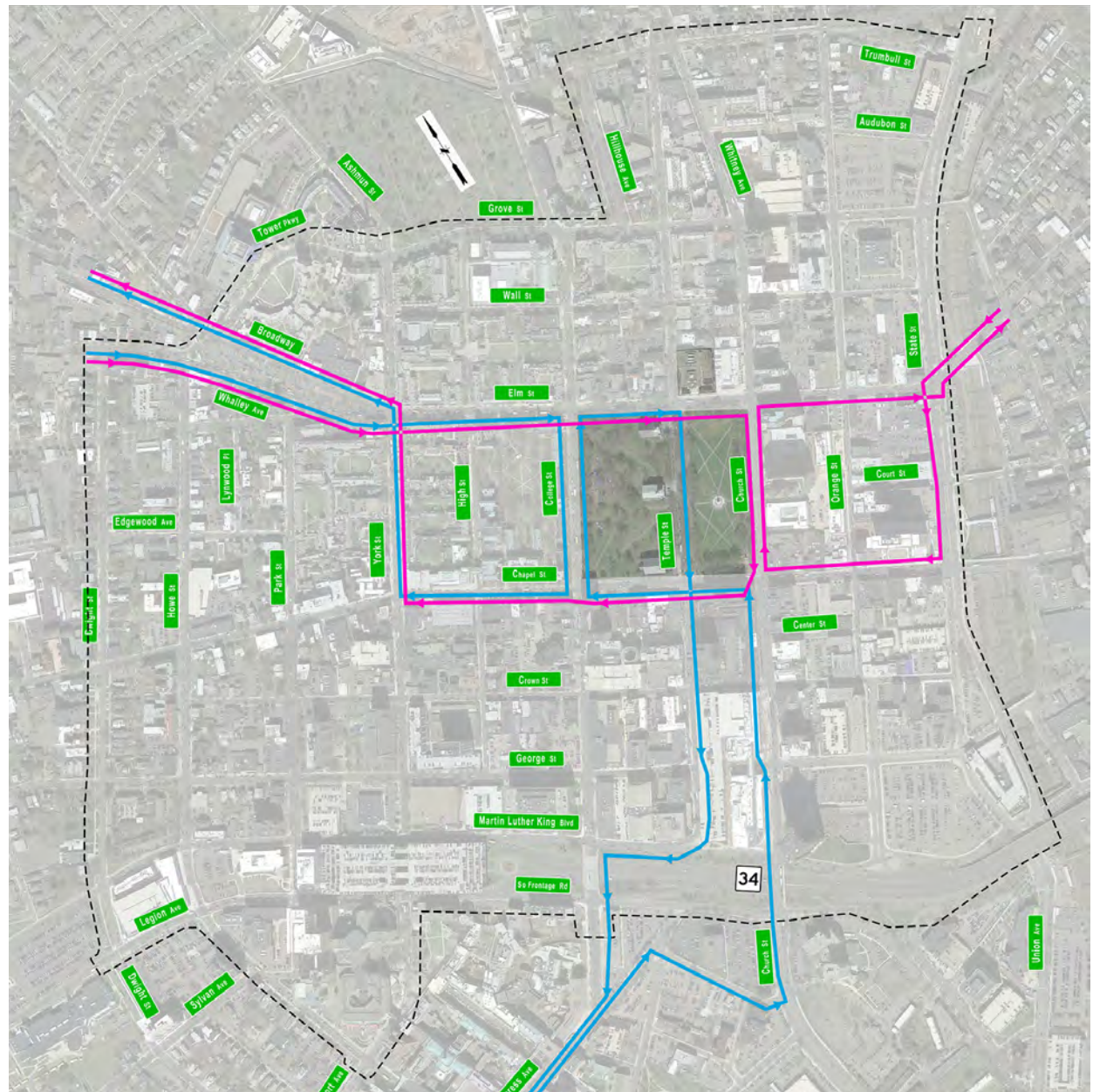
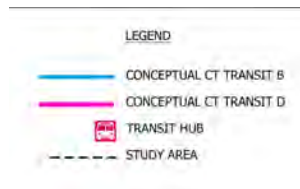
Pedestrian Safety

Traffic on the existing one-way City streets generally travels faster than the posted speed limit. The multiple travel lanes in the same direction increases the effective road width for drivers and gives them a greater level of comfort. As a result, pedestrians often feel uncomfortable and unsafe crossing City streets. Two-way vehicular traffic, especially on streets with parallel parking, travels significantly slower given the reduction in travelway width and visual tightening that on-street parked cars introduces. This will be especially true along the “two-way loop” of Grove, York, George, and Church Streets where higher volumes of vehicular traffic conflict with high volume pedestrian crossings.

Simplify Bus Routes

CT Transit has indicated that conversion of downtown streets from one-way to two-way would allow for simpler bus routing in Downtown New Haven. The buses currently travel longer, more circuitous routes than necessary due to the one-way street network and therefore experience greater fuel consumption. Converting York Street and Church Street in particular to two-way operation allows for more flexibility in efficient routing, thereby reducing vehicle miles traveled, reducing fuel consumption, and providing more logical routes for passengers.

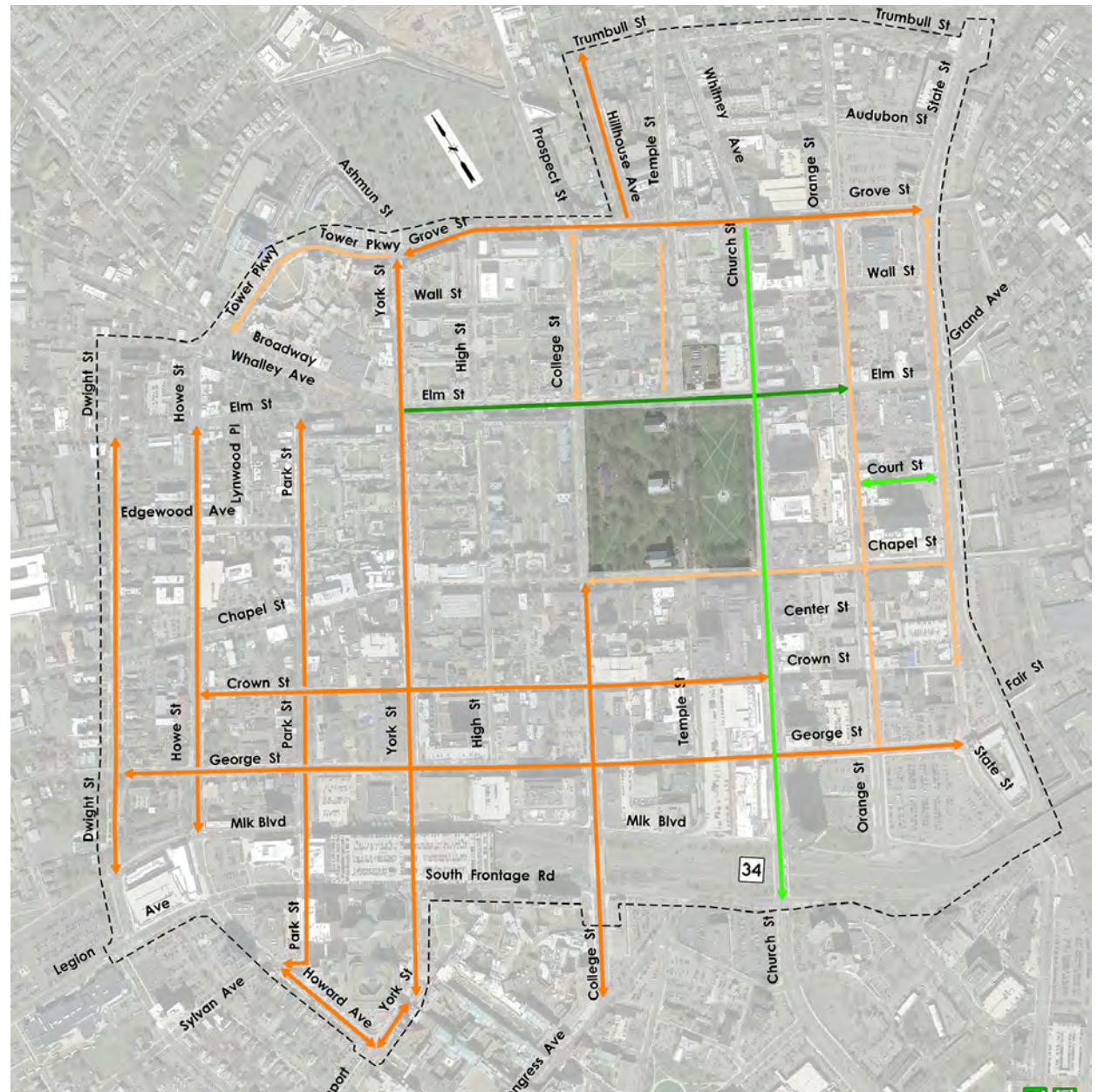
The diagram to the right, prepared in collaboration with CT Transit, illustrates how Routes B and D could be split to provide an inbound bus and an outbound bus, meaning that if one bus is delayed, the other can still operate on time.



Expand Bike Network

The city has been actively expanding bicycle facilities in recent years, installing a dedicated bike lane on Elm Street and shared lane markings (sharrows) on portions of College Street, Orange Street, State Street, Grove Street and Chapel Street as well as many other areas of the City. Converting streets from one-way to two-way provides opportunities for restriping the roadways to provide sharrow markings and in some instances, reallocation of existing pavement width to install dedicated bike lanes.

As indicated in the bike route map, recommendations include a dedicated bike lane on Church Street, a contraflow bike lane on Court Street, and sharrow markings on all of the other streets proposed for conversions. Conversion of many roadways in the downtown network will make streets safer and easier to navigate for bicyclists, with lower vehicular travel speeds, greater connectivity, and a reduction in wrong way bicycle riders.



Cost-Effective Implementation

The replacement and/or upgrade of traffic control signals represent the vast majority of the costs that are associated with the conversion of one-way streets to two-way. Many of the City’s traffic signals are aging and will require complete replacement when modified. Even in locations where signals have been recently replaced, additional mast arms, signal heads, and detectors will be needed to accommodate the new vehicle approaches that will be introduced at many of the Downtown intersections.

The City of New Haven is currently in the process of upgrading and replacing traffic signals throughout the Downtown as part of a multi-phased project. Each time funding becomes available for additional traffic signals to be replaced, this represents a significant opportunity for the signals to be designed to accommodate future two-way operation. The City has recently received grant funding for installation of new traffic signals at 15 locations in the Downtown as indicated in the figure to the right. The designs of these signals are underway and will incorporate the necessary equipment to accommodate approach lanes on all four legs of each intersection. As indicated in the map, a significant number of signals on Grove and Church Streets are being upgraded as part of this project, making these streets ideal locations for some of the first street conversions.

By having a one-way to two-way street conversion plan in place before applying for funding, determining which

signals need upgrades, and initiating design, the City can minimize the amount of additional funds needed to convert the streets. The striping necessary at each

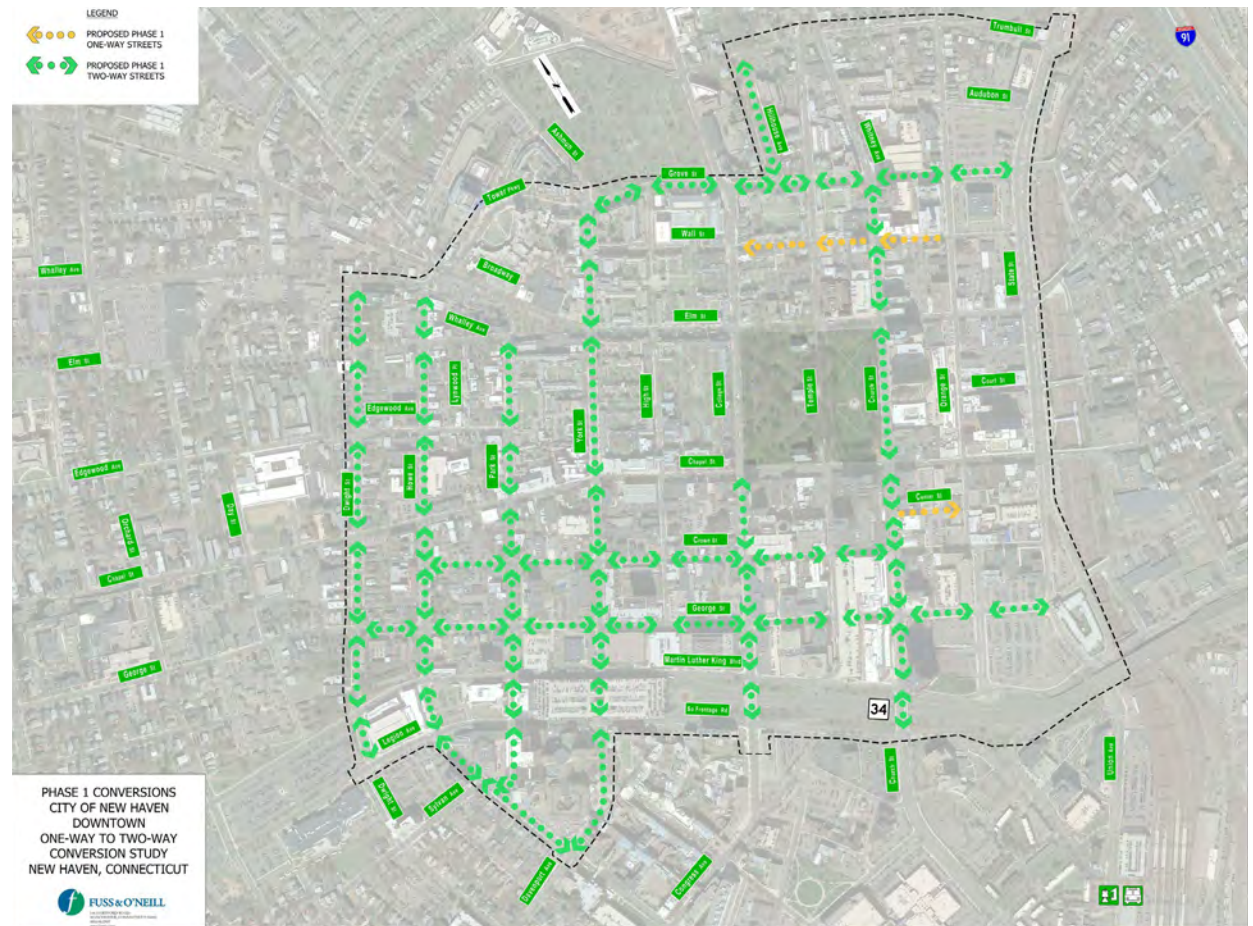
intersection can be included as part of the traffic signal work, with only the striping and signage modifications between the intersections paid for with other City transportation funds.



Project Phasing

This map at the right summarizes the proposed short term street conversions that are recommended as part of Phase 1. The proposed two-way street conversions described previously are shown in green. Wall Street will remain one-way, but the section between Orange Street and College Street will change directions so that it will run westbound in its entirety. Center Street will also remain one-way, but will reverse direction to improve traffic circulation and safety.

These proposed short term street conversions are recommended to be prioritized below. This list considers both the ease of the conversion and cost of the conversions, factoring in the ongoing City signal project. In addition, as some of the Downtown streets operate in pairs, these conversions should happen simultaneously to minimize disruption to traffic flow, circulation, and intersection delays on parallel streets. The City had also previously indicated a preference to initiate conversions of the north/south streets in the western portion of the study area early on as these streets are somewhat lower volume roadways and operate in logical one way pairs.



- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Center Street and Court Street (simple, low cost conversions) 2. Grove Street and Hillhouse Avenue (ongoing signal design project) 3. Church Street (ongoing signal design project) | <ol style="list-style-type: none"> 4. College Street (ongoing signal design project) 5. Wall Street (few signal modifications required) 6. Dwight Street and Howe Street (one-way pair) 7. York Street and Park Street (one-way pair) 8. Crown Street and George Street (one-way pair) |
|--|---|

Streets Not Recommended For Conversion

Some one way streets in the Downtown were found to have physical constraints (either lack of right of way or limited curb to curb width) that would prohibit conversion of the streets to two-way without either substantial loss of parking, sidewalk impacts, or property takes. These streets (or segments of streets) that were deemed infeasible for conversion included:

- Chapel Street west of College Street
- Crown Street east of Church Street
- Edgewood Avenue
- High Street
- Orange Street south of Elm Street
- Audubon Street

While also too narrow to convert to two-way, Wall Street and Center Street were proposed for a directional change to improve safety and circulation as previously described.

In addition, Tower Parkway, Elm Street, Temple Street and Whitney Avenue were not proposed for short term conversions due to more significant operational constraints, however these streets were reviewed in more detail as part of the second phase of this project and are proposed for long term conversions as discussed in Section 6.



6

LONG TERM RECOMMENDATIONS

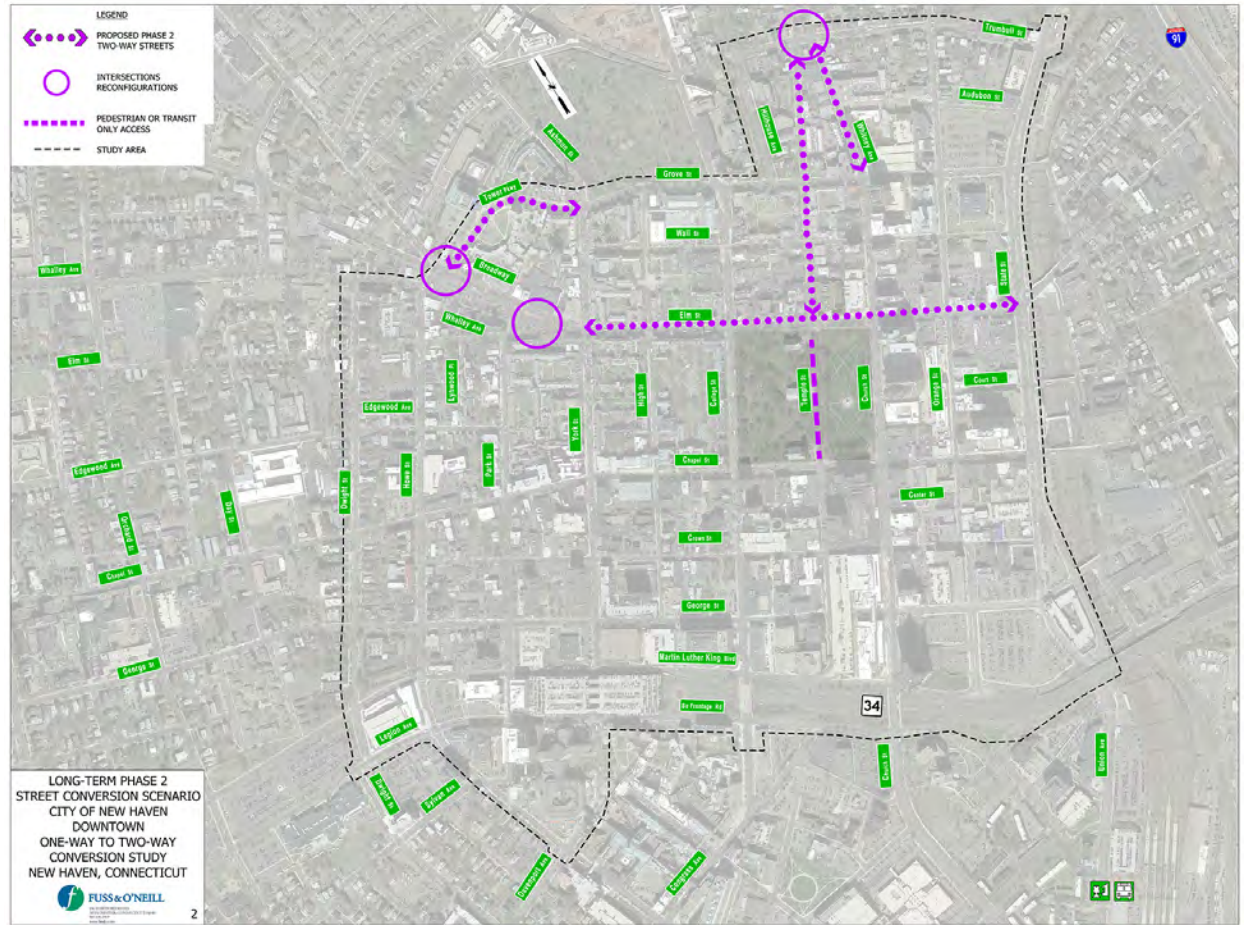


Long Term Conversion Scenario

Following completion of Phase 1 of the Study, the Advisory Committee and design team reviewed the Downtown streets that were identified for possible conversion in the longer term (5 or more years). The streets were generally identified for longer term conversions due to anticipated traffic operational concerns that would need to be reviewed in more detail and addressed as part of this second phase of the project. In addition to the street conversions, the scope for Phase 2 of the study included review of two challenging intersections where traffic operations are deficient and circulation patterns are confusing. These streets and intersections reviewed for long term reconfiguration are as follows:

- Elm Street
- Temple Street
- Tower Parkway
- Broadway/Whalley/Goffe/Dixwell/Tower Parkway Intersection
- Temple/Trumbull/Whitney Intersection Cluster

The one way portion of Chapel Street west of College Street was also reviewed as a potential long term conversion but quickly discounted during the public input process as the roadway would require significant physical alterations to curbing and sidewalks as well as potential loss of parking in a dense retail area.



Most of the long-term solutions described in this Section require physical alterations to the roadways and in some cases, major intersection realignment, in addition to the typical lane striping revisions and traffic signal upgrades. Therefore, it is anticipated that these improvements would be pursued five or more years in the future, or as funding becomes available.

The preferred consensus alternatives for each focus area are described on the following pages. Several additional alternatives were also developed as part of the public information process and are included in the Appendix. These alternatives were not endorsed due to lack of consensus achieved during the process.

Broadway/Whalley/Goffe/Dixwell/Tower Parkway

Perhaps the most complex and confusing intersection in Downtown New Haven is the point where the north and south legs of Broadway intersect with Tower Parkway, Dixwell Avenue, Goffe Street, and Whalley Avenue. This intersection carries both historical and modern day significance, bearing the names of three of New Haven's most prominent early citizens, as well as serving as a retail center and traffic hub for motorists traveling between Yale University, Downtown, and northwestern portions of the City. It also includes a large parking facility in the center (between the north and south legs of Broadway) that is owned by Yale University.

The current intersection configuration is awkward and at times dangerous to navigate for both pedestrians and drivers alike. The criss-crossing of lanes and presence of several mini-islands creates a large amount of unusable space in the intersection and can be difficult to traverse, especially for out of town drivers. This layout also makes converting the flow of traffic from one-way to two-way on approaching streets difficult.

Following the public input process and significant stakeholder coordination with Yale University, a proposed configuration was chosen that realigns Goffe Street and provides for two distinct intersections with two-way flow between the intersections as indicated in the concept plan to the right. This alignment allows for Tower Parkway and Howe Street to operate as two-way streets, making the entire intersection more logical to navigate and safer for pedestrians to cross. The conversion of Tower Parkway to two-way operation is



critical in that it enables a seamless transition to the converted portion of Grove Street and also enables the conversion of Elm Street by providing a continuous alternative eastbound corridor from Broadway to State Street.

The existing Yale-owned parking facility in the center of Broadway is not impacted by this improvement recommendation. The realignment of Goffe Street will require one property take but also free up space in the parcel created between Goffe Street and Dixwell Avenue for future development. Two new interconnected traffic control signals will be required to accommodate the proposed reconfiguration.

Several additional alternatives for reconfiguration of this intersection were developed and reviewed during the public information process but not endorsed. These alternatives are provided in the Appendix for reference.

Elm Street

Elm Street currently provides three lanes of one-way eastbound traffic throughout its length, with four lanes provided in the segment between Temple Street and Church Street. On street parking is provided along at least one side of the roadway throughout the majority of its length and the City recently installed a dedicated bike lane along the south side of the roadway between Broadway and Temple Street.

This street was deemed a longer term conversion candidate not because of lack of available road width but because of the significant eastbound traffic volumes that exist on the roadway throughout the day. Elm Street serves as a primary thoroughfare to Interstates 91 and 95 from the Downtown and area Yale University with few alternative eastbound routes in close vicinity. However, following the Phase 1 conversion of Grove Street which will provide additional eastbound lane capacity, the conversion of Elm Street to two-way flow becomes feasible. In fact, actual implementation of the street conversion could be accomplished in relatively short order following the conversion of Grove Street,

given the available roadway width and given that the majority of the signals along the Elm Street corridor will have been redesigned and constructed to accommodate two-way flow as part of the current ongoing City signal system upgrade project.

Shown at left are two renderings of potential cross sections of Elm Street looking to the east. Between College and Temple streets (along The Green) Elm Street is wide enough to accommodate bike lanes in both directions, while maintaining three travel lanes and parking on both sides of the street.



Between High and College Streets, the new westbound lane will be a shared lane for bicycles and automobiles, leaving room for two travel lanes, on street parking, and a dedicated bike lane eastbound.



Temple / Trumbull / Whitney

This pair of closely spaced intersections on Trumbull Street at Temple Street and Whitney Avenue causes substantial vehicle delays and congestion on a daily basis. In order to accommodate two-way traffic flow on Temple Street and Whitney Avenue (which becomes Church Street, a Phase 1 conversion street, to the south), these intersections will require modification.

Several alternatives were reviewed at these intersections, including a modified roundabout (included in the Appendix), however the preferred consensus alternative shown to the right provides the most simplistic traffic operation and will permit additional turning options at the intersection, afforded by the new two-way street operations on Whitney Avenue and Temple Street. While additional turn movements will be introduced at the intersection, the two-way street operation will better distribute traffic volumes through the intersections. With traffic control signal upgrades, these intersections can operate acceptably in the proposed condition.



Temple Street

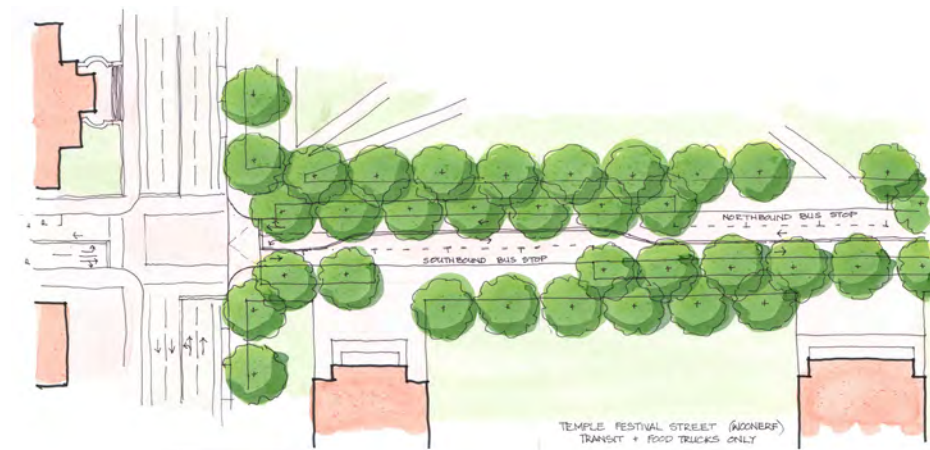
Temple Street was identified as a more challenging corridor to convert given the presence of a transit hub located along the portion of Temple Street between Elm Street and Chapel Street, and the narrow width of the street south of Chapel Street. In addition, several garage driveways are located along this segment of roadway, including ramps to the Temple Street garage at the intersection with MLK Boulevard that would require major reconfiguration to accomplish two-way flow. As a result, Temple Street is not proposed for two-way conversion south of Chapel Street.

Between Elm Street and Chapel Street (along the Green), significant opportunities exist to provide a friendlier environment for pedestrians and bus traffic. A number of design alternatives (included in the Appendix) were reviewed for this segment of roadway and included conversion of the street to two-way traffic, conversion of the street to pedestrian and transit traffic only, and complete closure of the street to provide a pedestrian esplanade.

Following input received during the public involvement process, the provision of a dedicated transit/pedestrian/emergency vehicle only corridor was advanced as shown in the image to the right. The concept proposed would provide a textured or stamped brick roadway pattern with one travel lane in each direction designated for transit and emergency vehicle use only by High Occupancy Vehicle (HOV) only diamond legends. Alternating pull offs with bus shelters would be provided for bus loading and unloading in both

directions. Sidewalks along the street would be flush with the travelway, effectively converting the street to a “woonerf”. A woonerf is a Dutch term for a special kind of street or group of streets that functions as shared public space — for pedestrians, cyclists, children and, in

many cases, for slow-moving vehicles as well. Roughly translated as “living streets,” the woonerf encourages human interaction; those who use the space are forced to be aware of others around them, make eye contact and engage in person-to-person interactions.





Temple Street - Before

In the spirit of the woonerf and adjacent New Haven Green, this roadway space could also potentially accommodate food trucks or other vendors to allow for the street to be used for festivals and other community gatherings. An additional benefit to this alternative is the increased safety afforded to transit riders needing to change bus lines in this location.

North of Elm Street, Temple Street provides two southbound travel lanes and on street parking lanes on both sides of the roadway. This portion of the roadway (between Elm Street and Trumbull Street) is proposed for two-way street conversion with one travel lane and sharrows provided in each direction and on street parking maintained on both sides of the roadway. Turn lanes in lieu of on street parking will need to be considered on critical intersection approaches.



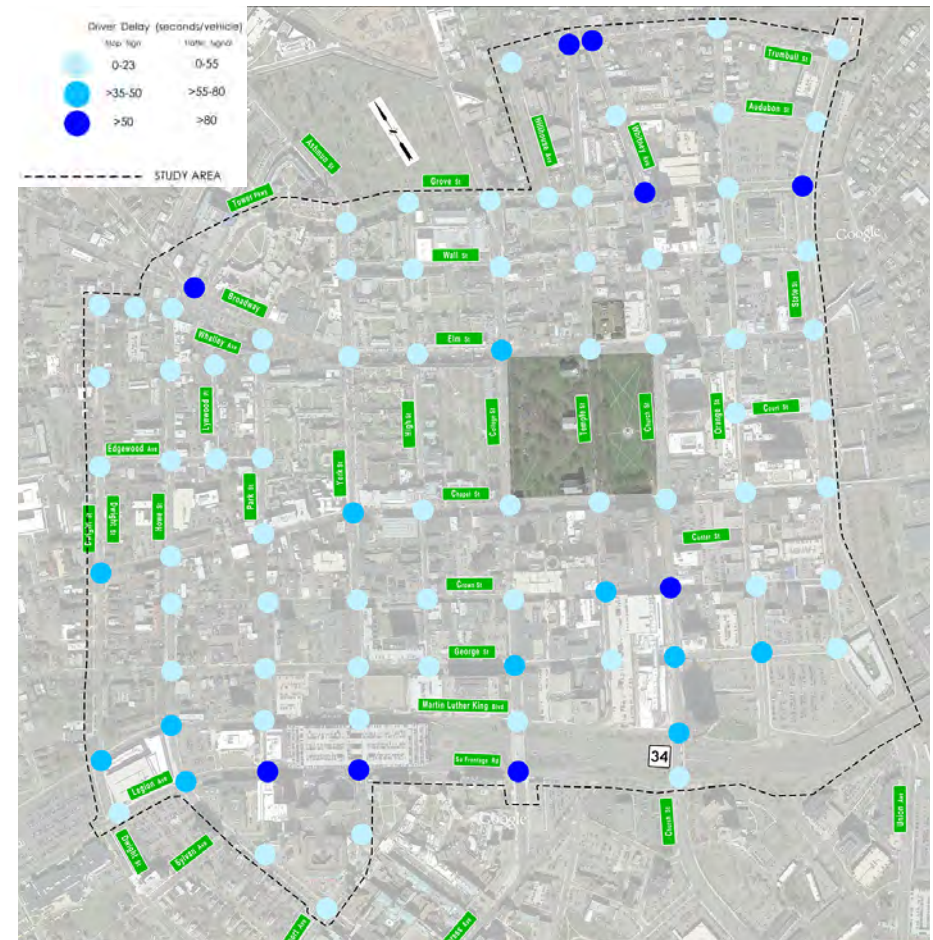
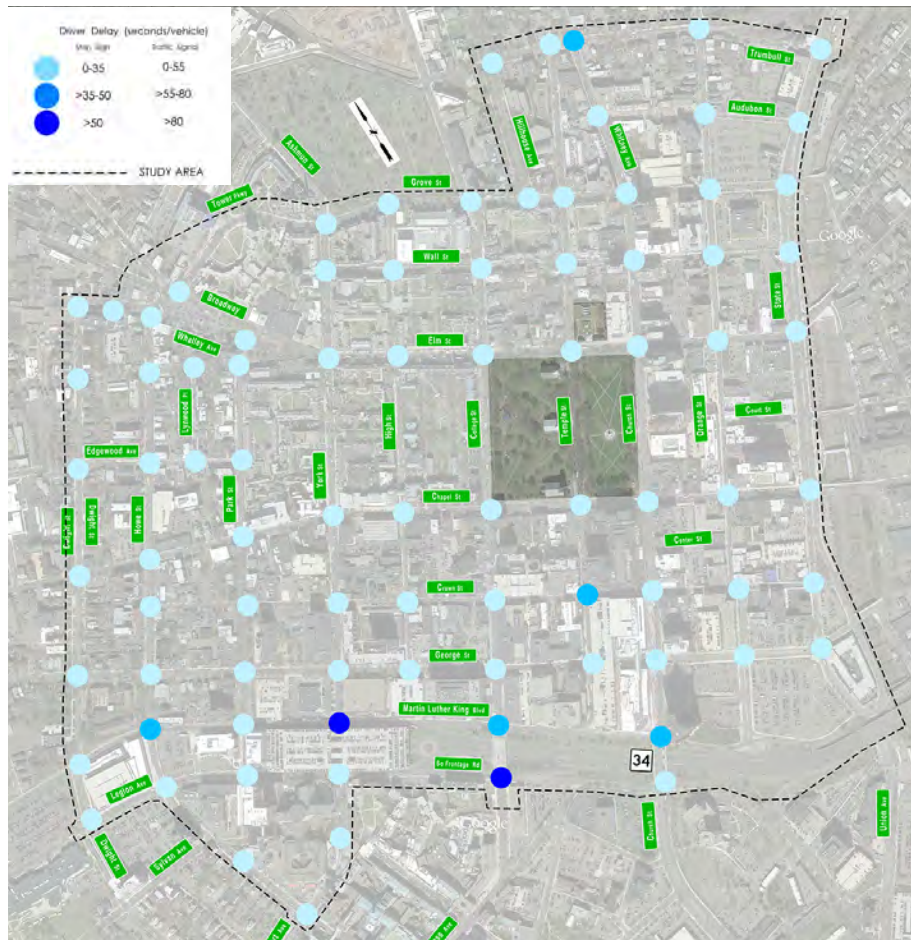
Temple Street - After

Future Vehicle Delays

Upon implementation of the proposed street conversions and intersection reconfigurations proposed throughout the Downtown Street network, peak hour delays experienced by drivers will remain in the same range as in the existing condition at the majority of the

intersections. A number of intersections will actually experience a decrease in delay as drivers distribute more evenly throughout the two-way street grid, making fewer turns. Some higher volume intersections where turning movements are introduced will experience an increase in delay, but these delay levels are not considered abnormal for a dense urban area. As a whole, the two-way street conversions will significantly

improve vehicle circulation and connectivity within the Downtown area for all modes of travel without compromising vehicle delay.



Funding Opportunities

It is anticipated that a mixture of Federal, State, local, and private funding sources will be used to achieve the two-way street conversions and intersection reconfigurations recommended by this study. The vast majority of the costs involved in this project will be upgrade of the traffic control signals in the study area to provide mast arms, signal heads, detectors, and other equipment that will accommodate the additional intersection approach movements. The City is in the process of upgrading traffic control signals throughout the Downtown area and will be incorporating the two-way street operation into the ongoing traffic signal designs and future signal upgrade projects where appropriate. This represents the most cost effective method for funding this project in phases. Potential funding sources for pavement marking, signing, and traffic signal upgrade costs as well as the costs to implement the longer term intersection reconfigurations are as follows:

- Congestion Mitigation and Air Quality (CMAQ) Enhancement (Federal and State)
- Surface Transportation Program Urban (STP-U) (Federal and State)
- Local Transportation Capital Improvement Program (LOTICIP) (State and local)
- Public Private Partnerships

Utilization of this document in the grant application process can help demonstrate the holistic, community-led vision that drives the overall slate of improvements contained herein.

Conclusion

An older city, especially one like New Haven with a complex history, always presents a challenge when confronted with changing infrastructure needs – whether transportation, land use, or technology. It is also critical that all the elements interact in a seamless and balanced way so that one piece does not adversely control the system. For example, the understanding of how travel direction can affect the success of retail space and, therefore, influence economic development must be considered.

As the national economy has shown us in recent years, the resources and funding provided by the Federal government is likely to continue reducing. This means that states, and especially local jurisdictions and municipalities, will need to become more co-operative and efficient – and even creative – to continue providing required planning and implementation with fewer resources. New Haven has been working collaboratively for a number of years. The inter-agency partnerships over the timeline of this study demonstrate that the city is well positioned for the future.

This project shows that it is physically possible to relatively easily convert the recommended short-term scenario streets to a two-way movement and the majority of stakeholders in downtown are in support of such a conversion. It also demonstrates how an open process and communication can coordinate resources between city-led projects, such as grant-funded traffic signals work, and foster further interaction between agencies.



146 Hartford Road Manchester, CT 06040
www.fando.com