BRIDGEPORT, CONNECTICUT

BARNUM STATION

FEASIBILITY STUDY

JUNE 2013

PREPARED FOR | Greater Bridgeport Regional Council
City of Bridgeport

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BILL FINCH
Mayor

Dear Bridgeport residents,

With this document in your hands, we are one step closer to realizing our dream for a second train station in our city, designed to improve mobility and spur economic development in the East Side and the East End. The following pages and diagrams detail the findings of a year-long study to determine the feasibility of this station. The answer to our questions of whether or not this station can be built and effectively operated is a resounding yes!

A new "P.T. Barnum Train Station" on the site of the former Remington Arms factory has the potential to be the driving force for redeveloping and revitalizing hundreds of acres of former industrial land that has blighted these neighborhoods for far too long. It will help to create new jobs, retain existing jobs, provide diverse housing options for all the members of our community, and improve access to employment in other towns and cities. The new station will allow residents to rely less on their cars, pay less in gas, and shorten their commutes.

The study was guided by the goals of our BGreen 2020 Plan and was completed in partnership with the New York-Connecticut Sustainable Communities Program. For the past two years, we have been working alongside our sister cities from New Haven to New York to develop economic development and infrastructure strategies that will benefit us all. The new P.T. Barnum rail station may be one of the most important and far reaching projects ever contemplated by the City of Bridgeport and its benefits will be felt far beyond our borders. I am confident that it has the potential of reshaping the entire East Bridgeport Development Corridor along Seaview Avenue and spark job creation in eastern Fairfield County while meeting our goals of sustainable development, reduced carbon emissions, and a path to prosperity for all.

I would like to voice the city's thanks to both the Greater Bridgeport Regional Council and the New York-Connecticut Sustainable Communities Consortium in serving as our partners in this effort. I would also like to thank the organizations, businesses and individuals that served on the two advisory committees who guided the study. The opinions of local property owners, civic groups, and constituents are of the utmost importance to ensure that this process and project achieves all that we know that it can.

As you review this document, you will see that a new P.T. Barnum station will play a key role in making Bridgeport the cleanest and greenest city. I look forward to working with you all to make this vision a reality.

Sincerely,

Bill Finch
Mayor

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The Partnership for Sustainable Communities in Bridgeport is an example of collaborative problem-solving and unified government at its best. This Federal collaboration has encouraged HUD, DOT, and EPA to work together to focus resources not just on transportation, housing, or the environment, but on how to coordinate all three.

—Bridgeport Mayor Bill Finch

INTRODUCTION

Based on recent planning and development initiatives undertaken by the City of Bridgeport, as well as input received from area stakeholders, there is a strong desire for a new commuter rail station ("Barnum Station") to be located along Barnum Avenue in East Bridgeport on the site of the former Remington factory. The new P. T. Barnum Station would improve transit and serve as a catalyst for redevelopment in the East Side, East End, and adjacent neighborhoods. In order to respond to this challenge, the City of Bridgeport, in conjunction with the Greater Bridgeport Regional Council (GBRC) became a partner in the New York-Connecticut Sustainable Communities Consortium with a goal of developing livable communities with mixed-income housing and employment at key transit nodes.

The purpose of the Bridgeport Barnum Station Feasibility Study is to determine whether the construction and operation of a second train station is physically and operationally possible and compatible with the existing Metro-North Railroad (MNR) and Amtrak service and assess the redevelopment opportunities on adjacent parcels.

Results of the analysis indicate it is feasible to construct and operate a new Barnum Station on the site of the former Remington factory. Further, the Study shows that the station has the potential to be a catalyst for redevelopment and revitalization in East Bridgeport, including creating jobs and providing additional housing options close to transit.

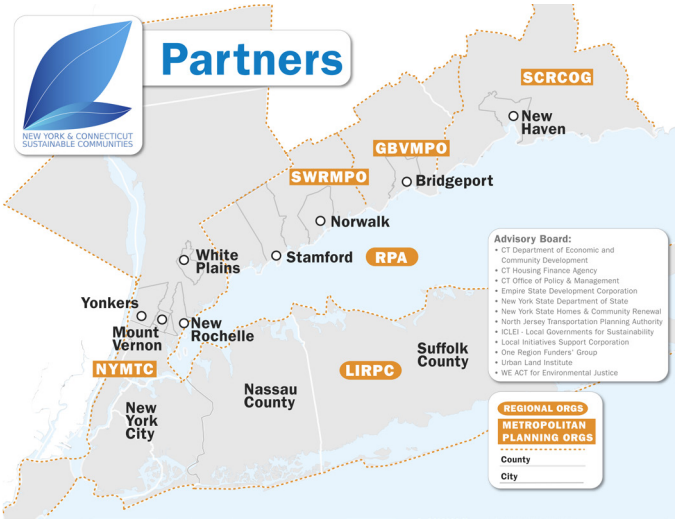
The full version of the Study is available on GBRC's website at: ***http://www.gbrct.org/projects/environment-sustainability-2/ny-ct-sustainable-communities/bridgeport-barnum-station-feasibility-study/***

Sustainable Communities

Partnership for Sustainable Communities

On June 16, 2009, United States Secretary of Housing and Urban Development (HUD) Shaun Donovan, United States Secretary of Transportation (DOT) Ray LaHood, and United States Environmental Protection Agency (EPA) Administrator Lisa P. Jackson announced the formation of the interagency Partnership for Sustainable Communities. The mission of the Office of Sustainable Housing and Communities is to create strong, sustainable communities by connecting housing to jobs, fostering local innovation, and helping to build a clean energy economy ***(http://www.sustainablecommunities.gov/).***

New York-Connecticut Sustainable Communities Consortium



The New York-Connecticut Sustainable Communities Consortium contains 17 members comprised of city, county, and regional representatives, as well as an advisory board of 15 members that received a 2010 HUD Regional Planning Grant through the Regional Plan Association (RPA). The initiative integrates housing, economic development, transportation and environmental planning. The goal of the Consortium is to reposition the New York-Connecticut region to fully harness its innovation capabilities in a competitive global environment, build on its strong foundation of energy efficiency, and become as equitable as it is efficient. Its primary focus is to leverage the most extensive and robust transit system in the nation by developing livable communities with mixed-income housing and employment at key transit nodes ***(http://www.sustainablenyct.org/).***

Livability Principles

The Sustainable Communities Program, the New York-Connecticut Sustainable Communities Consortium, and the Barnum Station Feasibility Study were guided by HUD's Six Livability Principles:

- Provide More Transportation Choices
- Promote Equitable, Affordable Housing
- Enhance Economic Competitiveness
- Support Existing Communities
- Coordinate Policies and Leverage Investment
- Value Communities and Neighborhoods

Project Overview

The Barnum Station Feasibility Study was funded under the New York-Connecticut Sustainable Communities Program, which is one of 16 major activities being conducted by consortium members. The study seeks to determine the feasibility of constructing a second rail station in Bridgeport as a catalyst for revitalizing the East Side and East End neighborhoods. Barnum Station is envisioned as an anchor for mixed-use development on adjacent parcels and is a key element of the City of Bridgeport's sustainability plan: ***BGreen 2020 (http://www.bgreenbridgeport.org/).***

SCOPE OF WORK

The Barnum Station Feasibility Study was conducted over an approximate one-year period and consisted of six main tasks.

- Public Participation and Outreach
- Existing Conditions/Data Collection
- Station Location/Fatal Flaw Analysis
- Build-Out/Ridership and Operational Analysis
- Alternatives Evaluation
- Final Documentation

In conjunction with the work, a number of technical reports/memoranda were produced:

- Technical Memorandum #1: Existing Conditions Analysis
- Technical Memorandum #2a: Site Station Locations/Fatal Flaw Analysis
- Technical Memorandum #2b: Station Area Concept Plans
- Market Overview
- Technical Memorandum #3a: Station Operational Feasibility Analysis
- Technical Memorandum #3b: Ridership Analysis
- Cost Estimate

The information, recommendations, and conclusions contained in these reports are summarized in this Executive Summary.

PROJECT CONTEXT AND GOALS

Local Context

Figure 1: Barnum Station

The proposed Barnum Station is to be located on the site of the former Remington factory, on Barnum Avenue. Helen Street borders the west side of the parcel and Seaview Avenue the east side. The site comprises approximately 16.7 acres of land and includes over 340,000 square feet of industrial floor space that is currently vacant. The elevated railroad right-of-way for the New Haven Main Line runs along the south side of the site. The site is located between the west end of the East Bridgeport Rail Yard (EBRY) and the long curve that starts at Hallett Street, crosses the PECK drawbridge and sweeps into the existing Bridgeport Intermodal Center on Water Street in the downtown. The existing downtown Bridgeport Station is approximately one mile from the planned Barnum Station site. **Figure 2, City Context**, illustrates the relationship of Barnum Station to Bridgeport Station and the EBRY, as well as the City of Bridgeport as a whole.

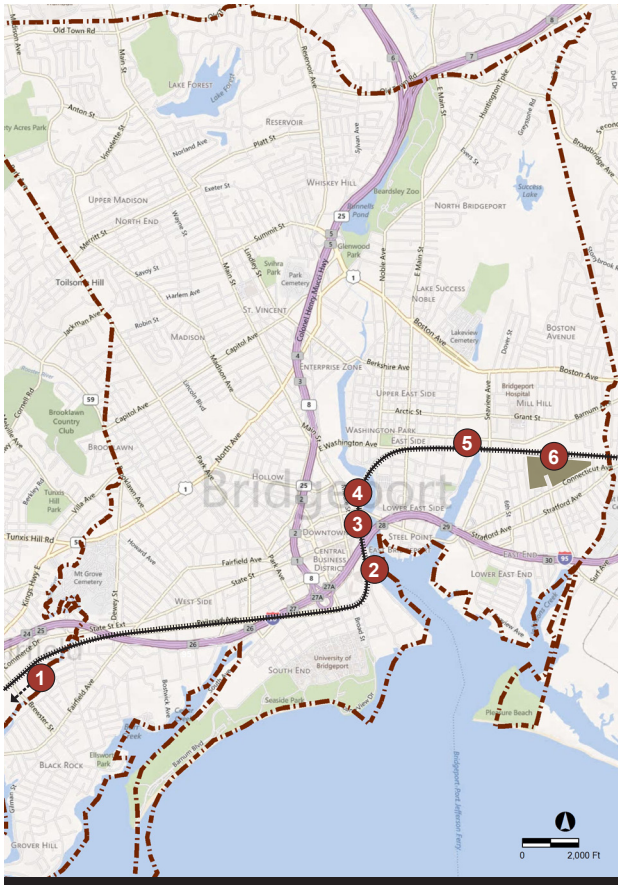


Figure 2: City Context

1 Fairfield Metro Station
2 Ferry Terminal
3 Bridgeport Station
4 Bus Station
5 Proposed Barnum Station
6 East Bridgeport Rail Yard
City of Bridgeport boundary

Figure 3: Neighborhood Context

Hydrology
River
Pond
Wetlands
Rail

The Barnum Station study area is defined as a ½-mile radius around the site of Barnum Station, as depicted in **Figure 3, Neighborhood Context**. This area includes portions of seven census tracts (734, 736, 737, 738, 739, 740, and 743) and four neighborhoods: 1) Boston Avenue/Mill Hill, 2) East Side, 3) East End, and 4) North Bridgeport. The East Side neighborhood makes up the greatest portion of the study area. The area within a ¼-mile radius around the site is the core study area, where the focus of transit-oriented development would be expected to take place.

Fewer than 10 percent of the City of Bridgeport's residents live in the study area. The study area is more diverse, younger, and has lower incomes than the City or Fairfield County

Project Goals and Objectives

In considering the feasibility of a commuter rail station in East Bridgeport, three goals were established:

- Determine whether a new station can be **physically** constructed.
- Determine whether a new station is **operationally** compatible with existing MNR and Amtrak service.
- Assess the **redevelopment potential** on adjacent properties.

The study was guided by the following objectives:

- Increase the availability of housing options in a transit-supportive location.
- Improve transit and promote transit-oriented development (TOD) in East Bridgeport.
- Improve access to jobs, education, and services.

» Decrease per-capita vehicle-miles-travelled (VMT) and transportation-related emissions for the corridor.

» Increase participation and decision-making in developing a long-range vision for the area around Barnum Station.

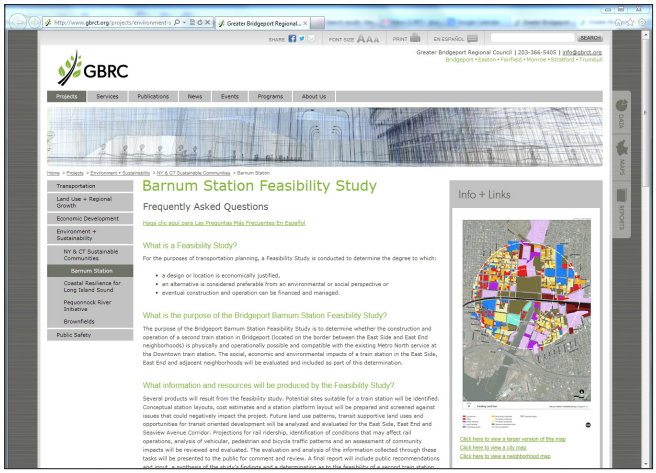
The Barnum Station Feasability Study continues the on-going long-term planning in the city, including furthering initiatives such as BGreen. In addition, it is consistent with other TOD initiatives in Connecticut and along the New Haven Line. A second station in Bridgeport would help residents and businesses of the city, specifically within the study area and surrounding neighborhoods, by providing better access to transit.

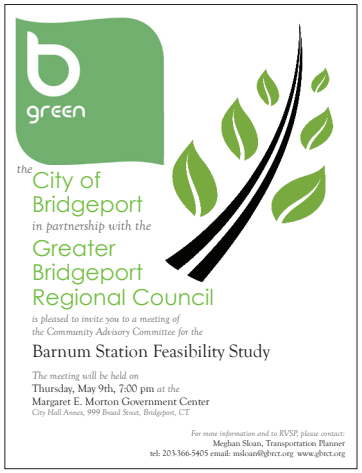
Public Outreach

One of the most important objectives of the feasibility study was increasing public participation and decision-making in the development of a long-range vision for the area around Barnum Station. With this objective in mind, public outreach was a focal element of the feasibility process. Outreach included the creation of a project website in English and Spanish ***(http://www.gbrct.org/projects/environment-sustainability-2/ny-ct-sustainable-communities/bridgeport-barnum-station-feasibility-study),*** which included background information on the project, notice of meetings and postings of interim project deliverables. Two advisory committees were established that were instrumental in soliciting feedback on the project:

» **Technical Advisory Committee (TAC)** – The TAC was comprised of key representatives from the City of Bridgeport, Greater Bridgeport Transit (GBT), the Connecticut Department of Transportation (ConnDOT), MNR, Metro-North Commuter Rail Council, RPA, Bridgeport Hospital, Housing Authority of the City of Bridgeport (Bridgeport Housing Authority), General Electric, and DuPont, among others.

» **Community Advisory Committee (CAC)** – The CAC was comprised of representatives from the East Side Neighborhood Revitalization Zone (NRZ), East End NRZ, local community organizations, business representatives, and property owners. These leaders represented their communities and acted as the conduit to share ideas and receive feedback with the general public.





The committees met during the study process to review work and provide feedback. In addition to the TAC/CAC meetings, a number of one-on-one meetings with key stakeholders occurred. These included meetings with the Bridgeport Housing Authority and Bridgeport Hospital to discuss the project and their development plans, as well as with ConnDOT to discuss the rail ridership and operations analysis. A public meeting was held at the conclusion

of the project, as well. Finally, as part of its extensive public outreach strategy for implementing the HUD planning grant, the New York-Connecticut Sustainable Communities Consortium has held numerous forums and "town halls," where an estimated 420 residents and stakeholders heard about the progress of the planning work and provided input.

The benefit of this outreach effort is that it has provided an opportunity for citizen input into the planning process. The process has allowed GBRC, the City of Bridgeport, and its consultants to solicit input from a broad range of perspectives.

HISTORY OF THE STUDY AREA AND SUMMARY OF EXISTING CONDITIONS

History of the Study Area

The study area's rich industrial heritage helped shape development and the economy within the City of Bridgeport. The site and its factory buildings were formerly operated by the Remington Arms Corporation. The plant was established in 1867 and originally incorporated as the Union Metallic Cartridge Company. The plant was noted for its development of metallic cartridges. The company merged with Remington Arms and, in 1888, Bridgeport became home of its ammunitions plant. The Remington munitions factory developed the first paper shot shells successfully manufactured in the United States and was the first company to produce and make several other ammunition advancements. A unique component of the plant was the approximately 130-foot tall shot tower. The Remington Shot Tower is one of only a relatively few surviving shot towers in the United States.

One of the more prominent buildings in Bridgeport is Bridgeport Hospital. Situated on the top of Mill Hill, within a 10-15 minute walk of the proposed new station, the ten-story hospital dominates the skyline of East Bridgeport. The hospital was founded in 1878 and ground was broken in 1883. The hospital was created to provide health care to a growing immigrant population. In November 1884, the hospital began treating its first patients, primarily providing medical services to the poorest residents of the city. When it was established, Bridgeport Hospital became the first hospital in Fairfield County and only the third in the state. The Bridgeport School of Nursing was established at the same time and has been providing extraordinary programs ever since. Its first president of the board of trustees was P. T. Barnum, the noted philanthropist, entertainer, showman, State Legislator, and Mayor of the City of Bridgeport. The hospital is part of the Yale New Haven Health System and is the City's largest employer with approximately 2,500 employees.

Summary of Existing Conditions

An integral part of conducting the feasibility study was undertaking a comprehensive review and analysis of existing site conditions including:

- Demographics
- Land use and zoning
- Traffic and parking
- Transit
- Pedestrian and bicycle facilities
- Vacant and/or underutilized land
- Environmental conditions
- Office and commercial market

Based upon the existing conditions analysis, a number of key issues and opportunities were identified in the study area, including:

- **Strong anchors** – The study area includes a number of strong anchors including Bridgeport Hospital, the newly constructed Waltersville and Barnum Elementary School, existing industrial uses (such as Lacey Manufacturing), and significant open space resources along the Yellow Mill Channel.
- **Available land** – Approximately 2/3 of the land within a 1/4-mile radius of Barnum Station is either vacant or underutilized.
- **Environmental conditions** – There are a number environmental conditions in the study area that will affect redevelopment. These include floodplains and coastal conditions, especially given recent storms that have impacted Bridgeport. In addition, other environmental conditions in the study area include brownfields sites and contaminated buildings that will need to be remediated in order to facilitate redevelopment. **(See Figures 4 and 5)**
- **Relationship to Yellow Mill Channel** – There is the potential for water and recreation opportunities along the Yellow Mill Channel, including creation of a greenway, consistent with ongoing City planning efforts.
- **Proximity to downtown Station** – Due to Barnum Station's proximity to the downtown Bridgeport Station, there are potential impacts on ridership and rail operations, as well as competition for real estate uses, that will need to be carefully considered.
- **Transit ridership** – The study area is currently well served by local GBT bus routes. There is the potential for additional local- and hospital-related demand, as well as more efficient north-south connections as area redevelopment takes place.
- **Roadways** – Analysis indicates that there is available capacity on study area roadways. There are opportunities for improving these roadways, particularly in taking a "complete streets" approach to accommodate not only vehicles, but pedestrians and bicyclists as well, particularly along Seaview Avenue.
- **Neighborhood stabilization** – Barnum Station has the potential to stabilize and encourage reinvestment in the East End and East Side neighborhoods.
- **Market opportunities** – In spite of the current state of the economy, analysis indicates that there is a potential market for new residential, retail, and flex/office spaces in the study area. There is an opportunity to complement, but not compete with various other development efforts within the City of Bridgeport, including Steel Point, Bridgeport Housing Authority redevelopment plans, and expansion of Bridgeport Hospital.

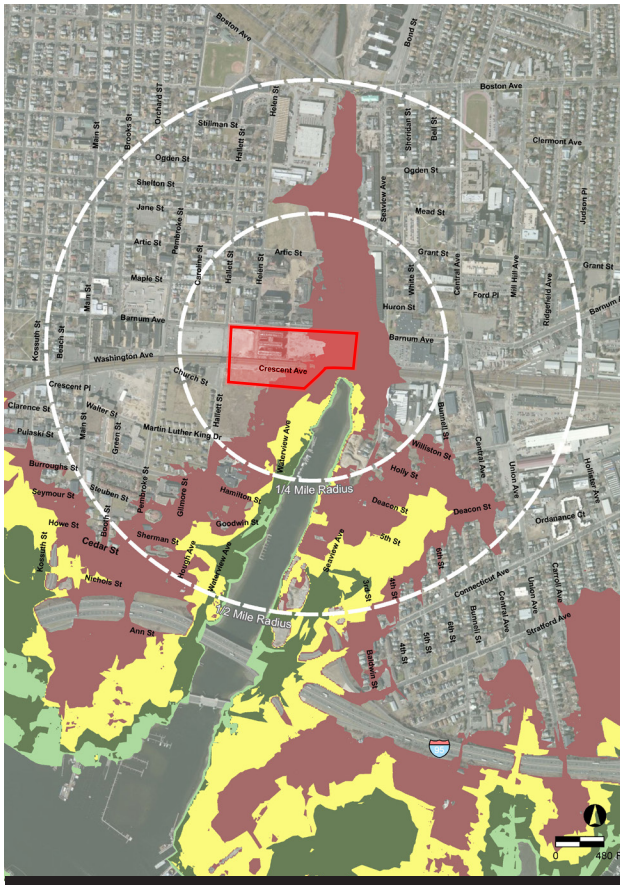


Figure 4: Potential Extent of Storm Surge

Category 1 Storm
Category 2 Storm
Category 3 Storm
Category 4 Storm
Proposed Station Area

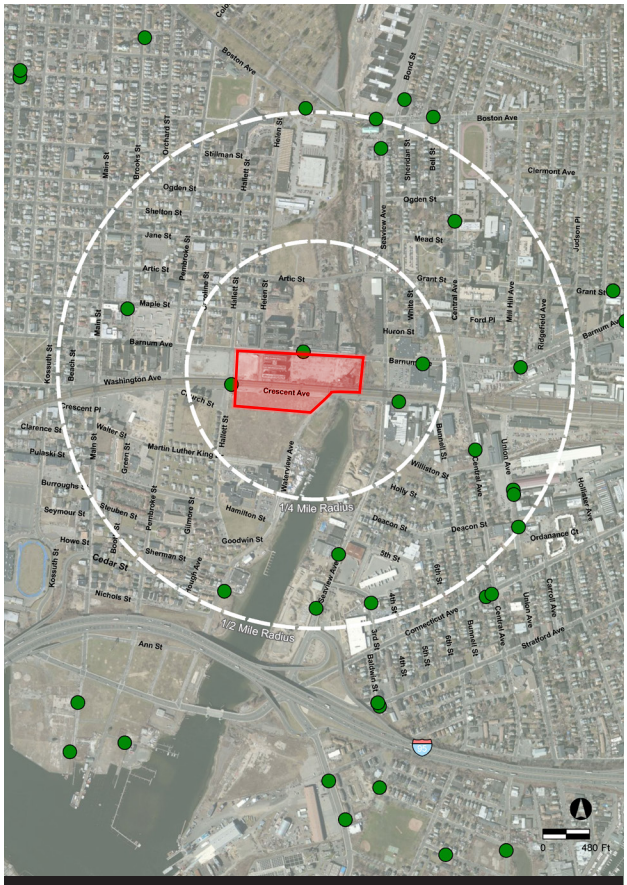


Figure 5: Brownfields Sites

Brownfields Sites
Proposed Station Area

THREE UNDERLYING QUESTIONS

The feasibility study set out to answer three fundamental questions:

1. Is a new rail station operationally feasible?
2. Which station configuration provides the best multi-modal operations and development opportunities?
3. With a strong rail station hub, what are the opportunities for redevelopment of the neighborhood?

Analysis indicates that, from a rail ridership and infrastructure perspective, constructing a second station is operationally feasible. Furthermore, initial planning and design demonstrates that Barnum Station and its associated improvements can be accommodated on the site and that if constructed, it has the potential to stimulate significant redevelopment in the adjacent area.

IS BARNUM STATION OPERATIONALLY FEASIBLE?

In order to determine if placing a station in East Bridgeport was operationally feasible, two components were evaluated:

- Potential rail ridership; and
- Impacts on rail operations and infrastructure

Rail Ridership Analysis

An integral part of conducting the feasibility study was achieving an understanding of the ridership potential at Barnum Station. Four scenarios were evaluated by ConnDOT using the Connecticut Statewide Travel Demand Model:

- Existing Conditions
- 2040 No-Build
- 2040 Partial Build
- 2040 Full Build

The 2040 No-Build assumed ConnDOT's baseline 2040 land use forecasts. The 2040 Partial Build included the addition of Barnum Station and also assumed ConnDOT's baseline 2040 land use forecasts. The 2040 Full Build included the addition of Barnum Station, but assumed a mixed-use, transit-oriented development land use build-out around the proposed station.

Analysis indicates that daily ridership along the New Haven Main Line in the 2040 Partial Build would increase with the addition of Barnum Station. In the peak-period, the anticipated ridership at Barnum Station would be primarily comprised of current ridership shifting from the Stratford and Bridgeport Stations rather than new riders, due to the convenience of the station location within the region. The ridership in the off-peak period would be a combination of existing riders shifting from the Stratford and Bridgeport Stations, as well as new riders. The new rail riders would be primarily short trips traveling between the Stratford, Barnum, and Bridgeport Stations. The addition of Barnum Station would improve regional mobility by bringing residents closer to their origin or destination (i.e., provide better access to employment). In addition, there would be a shift from bus to rail and walking. Under the 2040 Partial Build, daily ridership at Barnum Station would be equivalent to the current ridership at the Fairfield Town Center Station, almost twice the current ridership at the Stratford Station.

The 2040 Full Build alternative was also tested. However, due to limitations of the State model, it was not possible to extract meaningful results. The Barnum Station ridership for the 2040 Full Build will be revisited as part of the Bridgeport Regional TOD Pilot Study, which will be studying further how land use development, particularly TOD, affects rail ridership around regional rail stations along the greater Bridgeport regional New Haven rail line corridor.

It is important to note that there are strong ridership synergies between hospital employees shuttling between Bridgeport Hospital and Yale-New Haven Hospital. In addition, the Hospital's expansion plans, including potential housing for nursing students, would further provide potential riders at Barnum Station not currently captured in the Statewide Model.

Rail Operations Analysis

Existing rail infrastructure constraints associated with providing a new station and its implications on operations along the New Haven Main Line were evaluated. The operations analysis took a conservative approach and was based on the capacity of the existing MNR system and it's current schedule.

The operations analysis concluded that the addition of the new station would not negatively or adversely impact rail operations—if peak-period trains serving Barnum are limited to local trains only. Express and partial express trains would operate on their current schedules and would still access Bridgeport Station, but not Barnum Station. This, conservatively, would provide ten trains stopping at Barnum Station in the morning and evening peak-periods.

Subsequent conversations with ConnDOT have indicated that Barnum Station could have the potential to also serve express and partial express trains. It is recommended that a full simulation of rail operations be undertaken in order to better delineate these findings and refine the recommendations.

WHAT IS THE BEST CONFIGURATION OF THE STATION?

In order to determine the best location of Barnum Station, a platform configuration analysis was undertaken, followed by the development of station concept plans, which included alternative configurations for the location of Barnum Station itself and associated site improvements including parking and access.

Platform Configurations

There is currently 1,050 feet of tangent track between the yard switches to the north and the curve to the south of the proposed Barnum Station. This is the length required for a new station platform.

There are three basic station platform configurations that can be considered for Barnum: 1) side platform, 2) center platform, and 3) some combination of a side and center platform. Each configuration has its advantages and disadvantages which can vary with the specifics of the site.

- **Side platform stations** typically require no modification of the tracks. Side platform stations usually require more vertical circulation provisions than center platform stations.
- **Island/center platform stations** entail widening of the track centers within the station and for a distance on either end of the station. Center platform stations offer riders the ability to transfer between trains without the need to change platforms, something side platform stations usually require.
- **Stations with center and side platforms** have the greatest requirement for vertical circulation provisions and require widened track centers for the center platform.

Three platform/station scenarios were considered for Barnum Station. Note that these options represent side platform and center and side platform stations, but do not include an island/center only station:

Scenario 1: Route Express Amtrak Trains to Barnum Station Side Platforms

This scenario involves routing express Amtrak trains that operate on the inside tracks to a side platform configuration at Barnum Station.

Scenario 2: Provide Center and Side Platforms at Barnum Station

This scenario would involve routing express Amtrak trains to an island/center platform configuration at Barnum Station, as well as including side platforms for local MNR service.

Scenario 3: Extend Existing MNR Express Service from Downtown Bridgeport Station to Barnum Station Side Platforms

This scenario proposes revising some or all of the existing MNR express service trains to serve Barnum Station side platforms, instead of Bridgeport Station. Alternatively, these trains could stop at Barnum Station as well as Bridgeport Station, which would render them less “express” for Barnum and other northern/eastern riders, but unchanged for those commuting from Bridgeport to the south.

Assessment

The overall objective for Barnum Station is to provide the best possible access for patrons with the fewest possible impacts on rail operations for the lowest possible capital and operating cost. To that end, the following station design screening criteria were established:

- Guideway modifications
- Right-of-way (ROW) requirements
- Track and signal modifications
- Access to the East Bridgeport Rail Yard (EBRY)
- MNR and Amtrak approvals

Each of the platform/station scenarios was evaluated based on these criteria, as summarized:

Barnum Station Platform Fatal Flaws Analysis

Scenario	Screening Criteria				
	Guideway Modifications	ROW Requirements	Track and Signal Modifications	Access to EBRY	Approvals
1. Side Platforms (Amtrak/Local)	None	No additional ROW needed	Substantial track and signal modifications	Southern access to and from EBRY would be eliminated from Tracks 2 and 4, the tracks on the north side of the guideway.	Amtrak approval for additional station stop. MNR approval for additional station stop and elimination of EBRY access.
2. Amtrak Island Platform/Local Side Platforms	New guideway required both north and south of Barnum Station for several hundred feet. New guideway 25 feet wider at Barnum Station, slowly tapering back to current width. New bridges over local roadways from Pulaski Street to Seaview Avenue. Seaview Avenue overpass replacement.	Addition of 25 feet of ROW at Barnum Station slowly tapering to current ROW on either side of Barnum Station.	Substantial track and signal modifications.	Southern access to and from EBRY potentially eliminated.	Amtrak approval of additional station stop. MNR approval for additional station stop and elimination of EBRY access.
3. Extend MNR Service	None	No additional ROW needed	No additional signal modifications	Not impacted	MNR approval for additional station stop.

As demonstrated above, the creation of a station with an island platform would require the greatest impact. Providing side platforms would involve less impact, while extending existing MNR express service from Downtown to Barnum Station side platforms would require the least. To that end, the third scenario was identified as the preferred and most optimum platform configuration.

Station Area Concept Plans

Based upon existing rail constraints, the optimal platform configuration, and available land, four station concept alternatives were prepared. The alternatives were based upon the following assumptions:

- Station platform length is set at 1,050 feet.
- There will be no development within the 100- and 500-year floodplains.
- Bus access in both inbound (to downtown) and outbound directions would initially be only on the north side of the tracks with south access a future option.
- There would be a passage beneath the viaduct for pedestrians to cross between the north and south sides of the track.

The station design options are differentiated with respect to the following:

- In each scheme, existing and new roads are aligned in a way that best serves that particular design alternative.
- While there will be one cut and pedestrian passage under the viaduct, its location varies with each option.
- The location of the station changes within the set 1,050-foot platform length.

Station Design Program

The proposed program for Barnum Station would consist of a two-level station, as follows:

- **Street level**—5,400 square feet, includes a ticket office, enclosed waiting room, restrooms, and limited retail. This level would include the pedestrian passage.
- **Platform level**—1,680 square feet, with access and circulation outside of the platforms. The platform length would be 1,050 feet and would be 12 feet wide. Canopies would cover nine feet of the platform.

For all station concept options, vehicular drop-offs are located on both sides of the tracks, as well as bicycle racks and pedestrian sidewalks. Initially, bus pick-ups and drop-offs are only located on the north side of the tracks. Pedestrian access from the park and ride is marked with raised crosswalks. Bicycle access is encouraged with a canopy covered storage area. Information about bicycle routes in the area would be posted on wayfinding signs.

For all station concept options, future bus access to both the north and south sides and in both directions would be ensured. Turn radii at intersections would be sufficient to accommodate existing local buses, as well as the possibility of articulated buses.

The Father Panik Village site will play an integral role over the coming years in the City and Housing Authority's combined efforts to replace the aging public housing units at Marina Village and create mixed-income, transit-oriented, walkable neighborhoods. While construction of Barnum Station will require the utilization of approximately 3 acres of land on the Father Panik Village site currently owned by the Bridgeport Housing Authority, the transit service and accessibility created by the station will ensure that the lower income residents of this redevelopment will have the highest quality access to regional employment opportunities and amenities and that there will be transit-driven demand for the market-rate component of the mixed-income redevelopment, providing necessary revenue to offset the subsidy required to support the affordable units.

Forty dwelling units-per-acre has been identified as a preliminary density goal based on the Bridgeport Housing Authority's overall development strategy for its parcels in this area.

Concept Options

» **Option 1: Church Street Realignment (Figure 6)**—Option 1 locates the station to its western most extreme, near Hallett Street. Vehicular access to the southern site is provided by an expansion of Church Street, which would be widened to 30 feet, and offsetting Crescent Avenue. Taxi and kiss and ride accommodations alternate with five sawtooth bays of bus parking on the north side. Long-term parking is located to the north and east of the Station Access North Road, which reconnects with Barnum Avenue. This option has the potential for up to 965 parking spaces and up to 350 housing units.

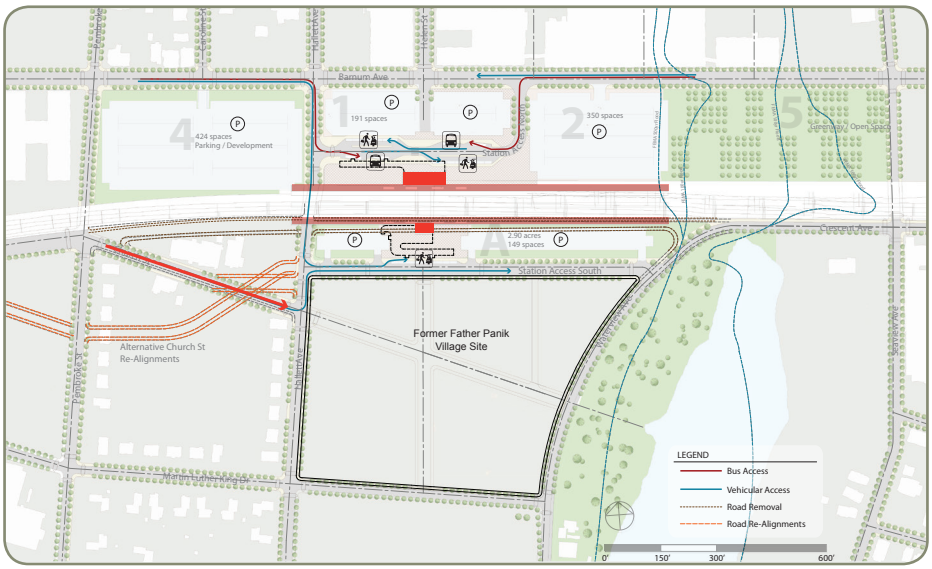


Figure 6, Option 1: Church Street Realignment

» **Option 2: East Washington Avenue Extension (Figure 7)**—Option 2 locates the station at its furthest point east, closest to Bridgeport Hospital. Vehicular access to the northern site is supported by an extension of East Washington Avenue, which would continue into downtown. Taxi and kiss and ride accommodations are located on the side of the road closest to the parking lot while the bus drop-offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. Long-term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Avenue. This option has the potential for up to 1,015 parking spaces and up to 350 housing units.

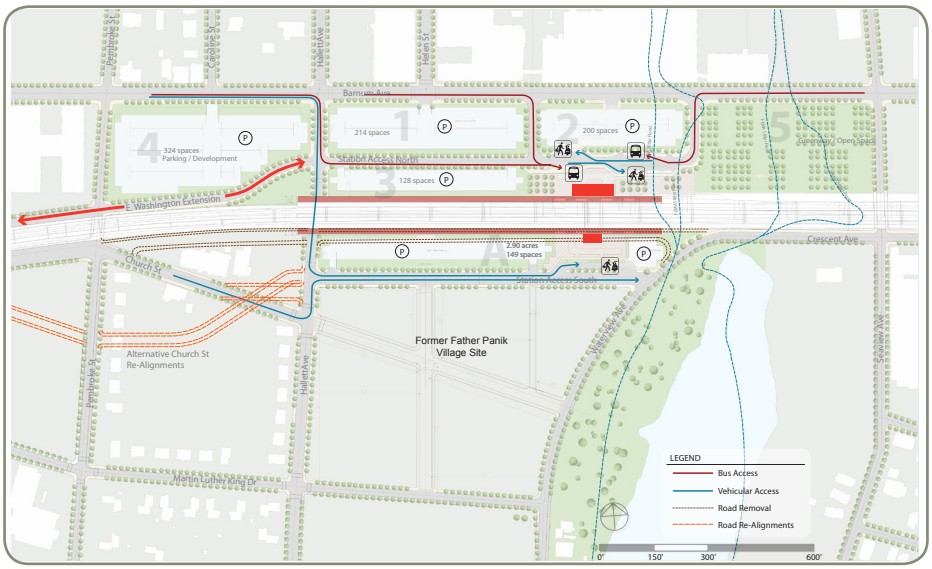


Figure 7, Option 2: East Washington Avenue Extension

» **Option 3: Waterview Avenue Connection (Figure 8)**—Option 3 supports an eastern station location by constructing a new road under the viaduct connecting Barnum Avenue to Waterview Avenue, just offset from the eastern edge of the station platform. Taxi and kiss and ride accommodations are located on the side of the road closest to the parking lot while the bus drop offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. Long-term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Avenue. This option has the potential for up to 965 parking spaces and up to 350 housing units.

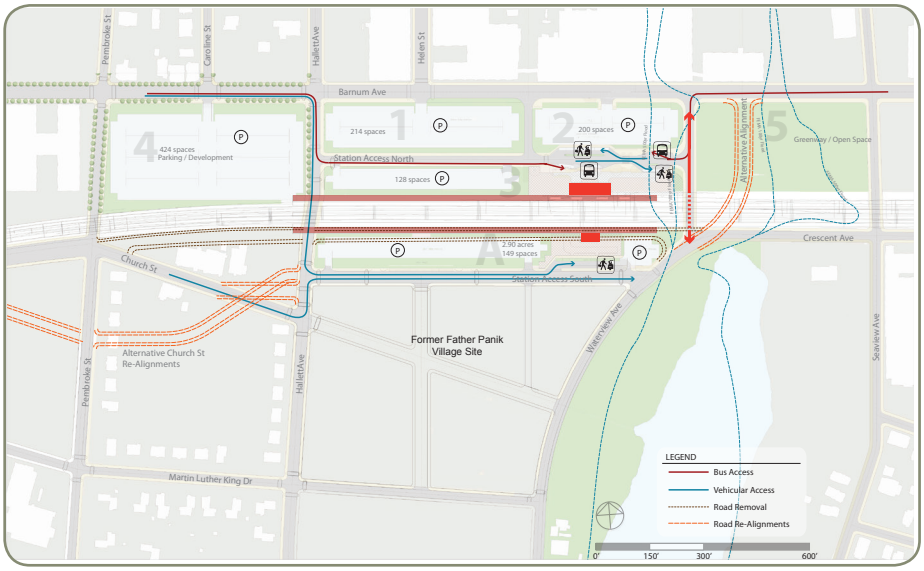


Figure 8, Option 3: Waterview Avenue Connection

» **Option 4: Helen Street Extension (Figure 9)**—Option 4 moves the station to a relatively centered portion of the platform by extending Helen Street through the site. Taxi and kiss and ride accommodations are located off the North Station Access Road, on the side of the road closest to the parking lot while the bus drop-offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. Long-term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Avenue. This option has the potential for up to 1,120 parking spaces and up to 345 units.

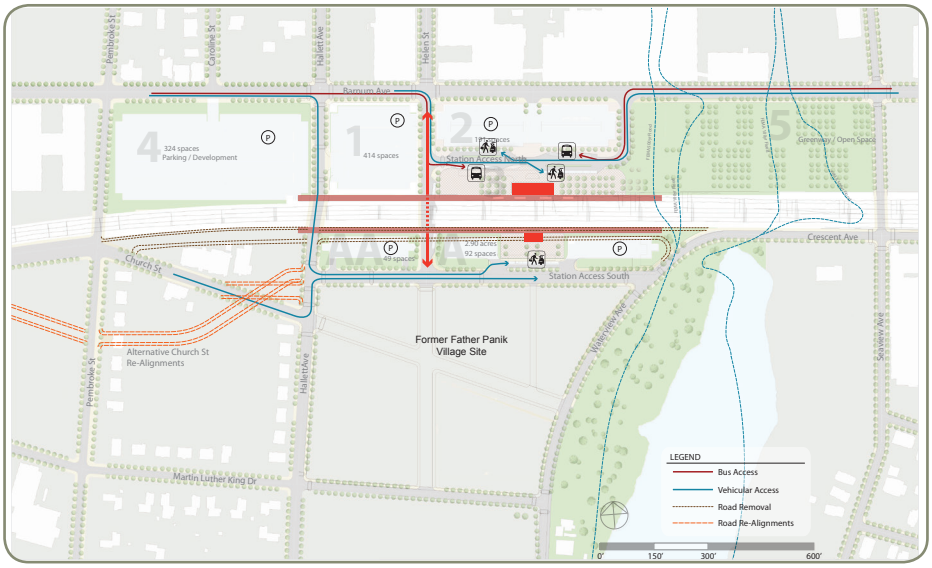


Figure 9, Option 4: Helen Street Extension

Impact Evaluation of Options

Each of the options was qualitatively evaluated based on the following impact categories:

- Rail and transit impacts
- Traffic impacts
- Land use impacts
- Environmental impacts

Barnum Station Concept Plan Evaluation Matrix		
Option	**Pros**	**Cons**
1. Church Street Realignment	» Limited flood zone encroachment » Least amount of new road construction » Full block TOD potential » Large dwell space for buses	» Least integration with existing and planned road network » No new vehicular/bus access through viaduct
2. East Washington Avenue Extension	» Closer station location to Bridgeport Hospital » East Washington Avenue extended for improved connection to downtown » Opportunity for additional east/west bus route service » Noise/open space buffer between potential development tracks	» Extensive floodplain encroachment for new Station Access North Road » High infrastructure costs: new road construction full length of site » No new vehicular/bus access through viaduct
3. Waterview Avenue Connection	» Closer station location to Bridgeport Hospital » Station Access North Road extended fully through site » Better vehicular connections through viaduct » Opportunity for north/south bus route service through new viaduct	» Extensive floodplain encroachment for vehicular connections under viaduct » High infrastructure costs: new road construction full length of site » Two tunnels, higher infrastructure development costs
4. Helen Street Extension	» Primary thru-way to US 1/Boston Avenue reconnected to southside of tracks, Steel Point, and Housing Authority sites » Full blocks available for future TOD » Largest greenway/open space allowances » No encroachment on floodplain zone » Station location near midpoint of platform » Potential for improved pedestrian safety and visibility under viaduct via combined vehicular and pedestrian connection	» Higher infrastructure costs due to second vehicular tunnel

GBT has highlighted, among other things, the need for north/south bus service connecting the Steel Point and Harbor area with the East Bridgeport Development Corridor more directly (through Barnum Station), since the closest north/south service is (to the west) on East Main Street and (to the east) on Central Avenue. It was suggested that a new north/south connection be provided up Hallett Street, through the south side of the proposed station, and along Waterview Avenue to Seaview Avenue. In addition, in order for any station plan to advance, the Seaview Avenue underpass would need to be widened and improved, including being able to provide requisite turning radii to safely accommodate buses. To that end, any future preferred station alternative should include a new north/south access connection and the appropriate improvements at the Seaview Avenue underpass.

As the project moves forward, a preferred alternative, which may include components of one or more of the above options, will be identified and will undergo a more extensive, impact analysis.

Cost Estimate

An order-of-magnitude capital cost estimate was developed for the project, based upon Option 2, East Washington Avenue Extension. The estimated cost of $48 million in present day dollars (2013) is comprised of the following elements:

Station Infrastructure ..... **$7.9 million**
Includes two station buildings, elevators, stairways, a pedestrian tunnel and exit stairways and ramps.

Parking and Roadways ..... **$11 million**
Includes 0.75 miles of roadways and 1,016 surface parking spaces.

Platforms ..... **$7.4 million**
Includes two 1,050 feet long platforms with a 150-foot canopy each and retaining wall repairs (the platform extensions across Hallett Street are included in this item as bridges since they would have to be suspended over the roadway).

Catenary ..... **$1.2 million**
Includes new overhead catenary structures (five total).

Engineering Services ..... **$6.7 million**
Based on Federal Transit Administration (FTA) allowances, providing for Preliminary Engineering, Final Design, Project Management, Construction Administration and Management, Insurance, Legal Permits, Agency Review Fees, Surveys, Testing, Investigation and Inspection and Agency Force Account Work.

Construction Contingency ..... **$13.8 million**
An allowance of 50 percent to cover unknowns and additional design detail.

GRAND TOTAL ..... **$48 million**

This compares to the actual $37.4 million cost for the recently constructed West Haven Station.

WHAT ARE THE DEVELOPMENT OPPORTUNITIES?

In addition to the benefits associated with commuter rail accessibility, a new Barnum Station would serve as a catalyst for redevelopment in East Bridgeport. The last question looked at the potential development opportunities that would arise with the construction of a station.

Vacant and Underutilized Parcels

The study area was once home to an expansive and world-known manufacturing base that included General Electric, Remington Arms, and Singer Sewing Company. As the manufacturing base left the area, old factory buildings were left vacant and underutilized.

As depicted in **Figure 10, Vacant and/or Underutilized Parcels,** approximately 2/3 of the core station area is either vacant or underutilized, including a number of larger parcels immediately adjacent to the proposed station and along major corridors in the study area including Barnum Avenue, Crescent Avenue, and Seaview Avenue. In contrast, there are fewer parcels beyond ¼-mile but within the ½-mile radius, with most of these being smaller parcels.

Market Overview

A preliminary market overview was conducted in order to assess the market potential for development in the study area. The assessment reviewed current market conditions in 5- and 15-minute drive sheds around the station for residential and the Bridgeport-Stamford-Norwalk CT MSA for office, flex, and retail, and the likely impact current conditions will have over the near- and mid-term (through 2020) with respect to development within the study area. The overview identified initial residential, office, flex, and retail development opportunities over the next seven years (through 2020) based on trends in household growth, employment, retail expenditures, and current market conditions.

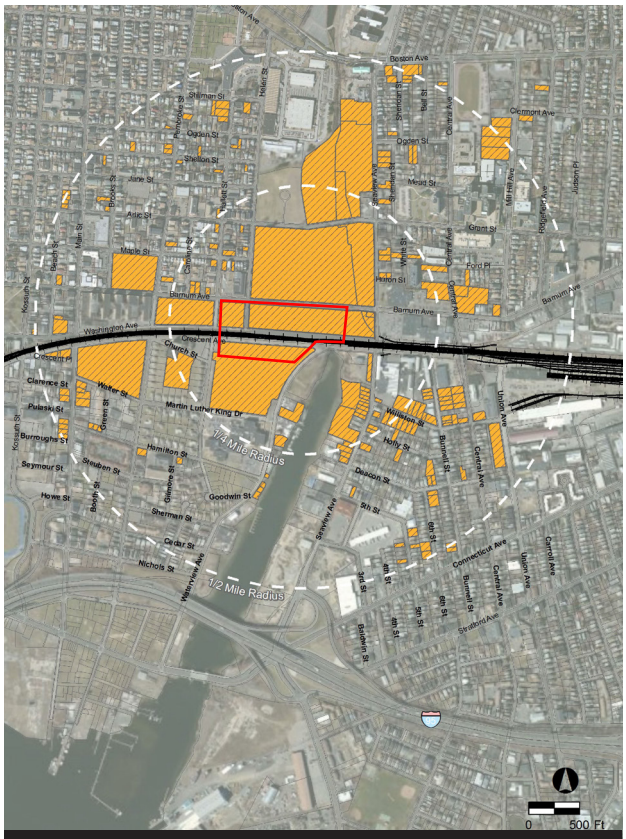


Figure 10: Vacant and/or Underutilized Parcels

Vacant and/or Underutilized Parcel

Proposed Station Area

The *Market Overview* also considered other proposed and planned developments in the vicinity of Barnum Station including Steel Point, Seaview Plaza, General Electric, Lake Success Eco Business Park, and infill development in the East Side, East End and Mill Hill neighborhoods and any impacts these regional projects could have on the Barnum Station market and vice-versa. The analysis reflected discussions with the Bridgeport Housing Authority and Bridgeport Hospital regarding future plans. Current development incentive programs offered by the City of Bridgeport such as the Enterprise Zone Program, Brownfields Program, and Tax Credits were also taken into account. In order to provide a broader development perspective, the assessment examined case studies of similar projects nationwide (Hudson River waterfront in New Jersey; Charlotte, North Carolina; and Cleveland, Ohio) to evaluate the longer-term vision for East Bridgeport and the likely impact on the real estate market. The longer-term implications were examined with respect to the catalytic nature of this development and the addition of Barnum Station to the East Bridgeport market and a 30-minute drive shed around the station.

Based on current economic and market conditions, the analysis indicated that there is an initial, short- and medium-term market for residential, as well as some limited office/flex and retail. In addition, there is a longer-term expanded market for additional mixed-use development, as summarized below:

Near-, Medium-, and Long-Term Market Demand

Market	Near-/Medium-Term (Through 2020)	Long-Term (Beyond 2020)
Residential	950 units	Additional 2,000 units
Office/Flex	100,000-175,000 sf	Additional 340,000-580,000 sf
Retail	40,000 sf	Additional 80,000 sf

The projected demand over the period through 2020 considers the competitive nature of the marketplace and the intrinsic implications associated with expansion within the study area. The supportable units and square footage presented are reasonable projections for the Barnum Station study area, and will be defined by the accessibility provided by the location of a new station, and realizing other planned projects within the study area.

The long-term vision for Barnum Station and portions of East Bridgeport are aggressive, considering current market conditions. However, as development and redevelopment initiatives continue to increase in the area, the comparative appeal of East Bridgeport and Barnum Station will enhance the development opportunities in the area. Further, with impactful interest in East Bridgeport coming from the City, the Bridgeport Housing Authority, and the Bridgeport Hospital, the resources are in place to transform the study area. Initial development around the station that is currently planned by these parties and private investors will induce further development. The introduction of Barnum Station to the market and the accessibility provided by transit will serve as a catalyst for future development and the success of the vision for the area.

Future Land Use Build Out and TOD Plan

Drawing upon results from the *Market Overview,* a future land use build-out and TOD Plan was developed for selected parcels within the study area.

Sites Subject to Change

The first step in this build out/TOD plan was to identify those sites that were "subject to change"—those sites that exhibit the characteristics that could result in change of use. These characteristics include:

- Existing vacant land
- Existing development that is below current development potential
- Current developer interest and/or specific development proposals

In addition, parcels that were identified through coordination with the City of Bridgeport, the TAC, and CAC were also included. These "Sites Subject to Change" were then analyzed within the context of local and regional factors to determine the likelihood of change occurring over the next 20 to 25 years.

Figure 11, Potential Development shows the following 11 sites within the study area that were determined to have the potential of changing in the near future with or without the introduction of Barnum Station:

- Steel Point
- Seaview Plaza
- Seaview Industrial Park
- Bridgeport Housing Authority
- Housing Authority Infill
- Bridgeport Health/Department of Public Works
- Barnum Station TOD
- 547 Barnum Avenue
- General Electric Redevelopment
- Bridgeport Hospital Expansion
- Lake Success Eco Business Park

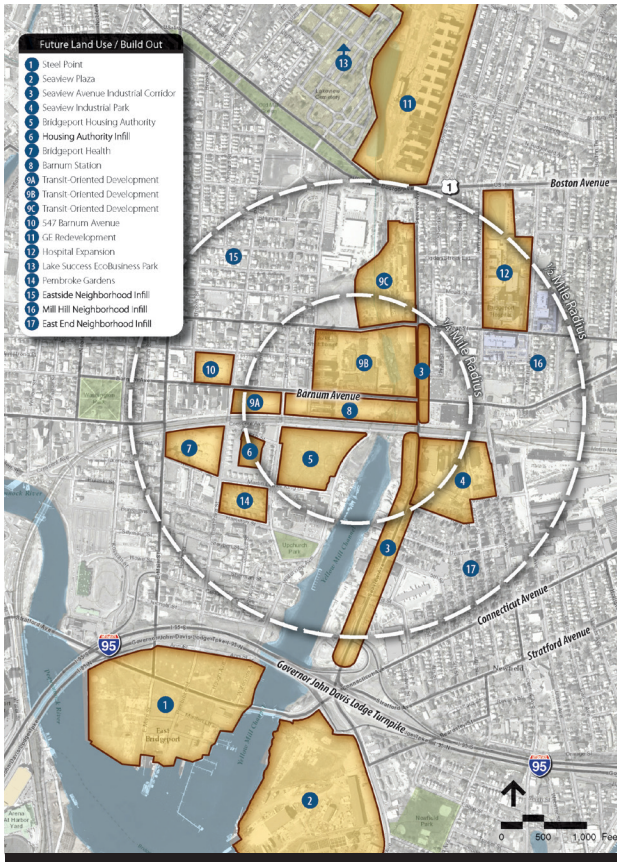


Figure 11: Potential Development

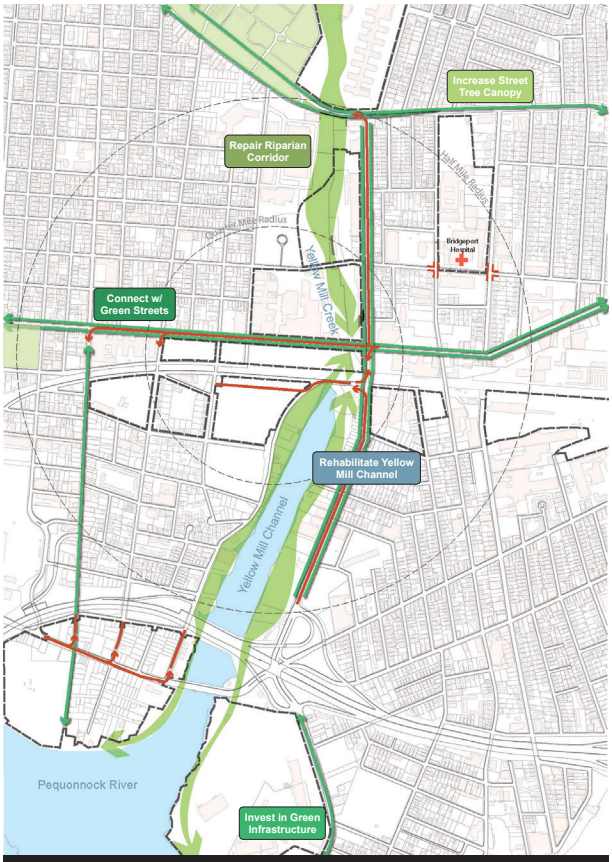


Figure 12: Green Infrastructure Plan

Green Street
Road Improvements
Current Projects
Riparian Rehabilitation

In addition, various sites along the Seaview Avenue Industrial Corridor and in the East Side, East End, and Mill Hill neighborhoods were determined to have the potential to change. A build-out of these sites was conducted in conjunction with market inputs to determine potential units and square footages that might occur in the near-, medium-, and long-term.

Infrastructure Improvements

Several infrastructure improvements are proposed by the City of Bridgeport to enhance the study area and to implement the recommendations of *BGreen 2020*. These are noted in **Figure 12, Green Infrastructure Plan** and include:

- **Greenway**—A business incubator, community center, and new residential and retail development connecting the existing marina on Yellow Mill Channel to Barnum Station and, ultimately as a greenbelt to Beardsley Zoo and Lakeview Cemetery. The intent is to endow future generations with healthier ecological, social, and economic environments.
- **Roadway improvements**—Route 130 and short sections of Route 127, Pembroke Street, and Waterview Avenue will be widened to four lanes, with some addition of left turn lanes as appropriate as part of the Steel Point redevelopment project. Federal aid through the TIGER II program has been allocated to the City for these improvements. Grant Street, in front of the Bridgeport Hospital has been recently closed to promote pedestrian connections and safety.

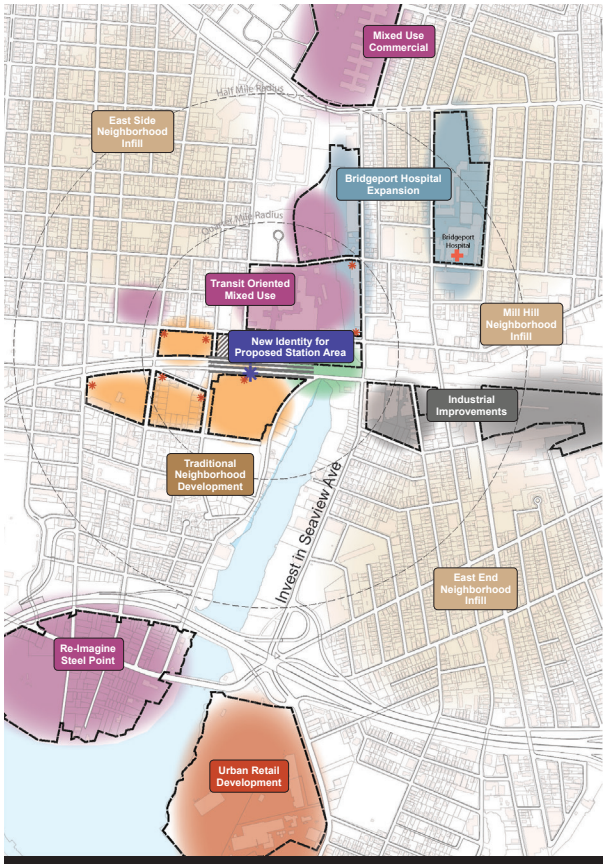


Figure 13: TOD Land Uses

TOD Plan

Figure 13, TOD Land Uses identifies the major land use goals for the immediate station area and the larger East Side/East End neighborhoods. These goals are consistent with the existing land use pattern, the above-noted infrastructure improvements currently planned by the City of Bridgeport, and major institutional and commercial projects already in the development pipeline, as noted above under *Sites Subject to Change.*

The new station would anchor mixed-use, transit-oriented development on several adjacent vacant parcels located within walking distance of the station and Bridgeport Hospital. Large parcels available for redevelopment exist along Seaview Avenue. The ultimate uses in this area would include affordable, workforce housing critical to the East End and East Side neighborhoods. The new, high-quality transit access would also support commercial and institutional investment that would create jobs and greater prosperity for residents in these neighborhoods. The creation of Barnum Station would encourage re-investment throughout the area.

As noted, construction of Barnum Station would require use of approximately three acres of land currently owned by the Bridgeport Housing Authority. Locating a new station across from this site would ensure that residents of this redevelopment would have the highest quality access to regional employment opportunities and amenities and that there would be transit-driven demand for the market-rate component of the mixed-income redevelopment, providing necessary revenue to offset the subsidy required to support the affordable units.

CONCLUSIONS AND NEXT STEPS

The analysis conducted as part of the Barnum Station Feasibility Study demonstrated that it is feasible and desirable to construct a second commuter rail station in the City of Bridgeport, which will serve as a catalyst for economic development and revitalization in the East Side and East End neighborhoods in East Bridgeport.

In order to move forward, the feasibility study identifies a number of additional studies that would be necessary to advance the project. These include:

- A full rail operations simulation
- A refined rail ridership model to further delineate anticipated ridership generated by the station and adjacent redevelopment
- More detailed programming and design of the station itself
- Additional environmental impact analysis

The Barnum Station Feasibility Study can be incorporated into the Greater Bridgeport Regional Transit Oriented Development (TOD) Pilot Project; a planning assessment of alternative public transportation modes, development strategies of properties located in close proximity to public transportation centers, and potential linkages of neighborhoods and districts for pedestrians along the region's commuter rail line in the City of Bridgeport, the Town of Stratford, and the Town of Fairfield. Specifically, the Regional TOD study aims to increase and enhance public transit services and associated development of properties of Downtown Stratford, including the existing MNR train station, commercial, retail and mixed use properties located in the downtown area, the Seaview Avenue corridor in Bridgeport, which includes the Port of Bridgeport, Steel Point Harbor, and the Lake Success Eco-Business Park, and the Commerce Drive area of Fairfield, which includes the Fairfield Metro Center MNR train station. The ultimate goal is to develop a model TOD ordinance for the Greater Bridgeport region. While Barnum Station is site-specific to Bridgeport's East Side and East End neighborhoods, it is best to viewed from a regional context as the Barnum Station project offers increased opportunity for development along the rail corridor in the Greater Bridgeport region and providing increased access to public transportation for residents who live near transit centers.

BRIDGEPORT, CONNECTICUT

TECHNICAL MEMORANDA

BARNUM STATION

FEASIBILITY STUDY

BARNUM STATION FEASIBILITY STUDY

Technical Memorandum #1: Existing Conditions

Submitted to:
Greater Bridgeport Regional Council (GBRC)
City of Bridgeport

Submitted by:
Vanasse Hangen Brustlin, Inc.

In association with:
ICON architecture, Inc.
Vantage Point Development Advisors, LLC

August 2012
Revised March 2013

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Technical Memorandum #1: Existing Conditions

Introduction

Based on recent City of Bridgeport initiatives and planning, as well as input received from outreach to the public, there is a strong desire and need for a new commuter rail station ("Barnum Station") in East Bridgeport to, among other things, serve as a catalyst for redevelopment.

The objectives of the feasibility study are to:

- Determine feasibility of a commuter rail and intercity rail station in East Bridgeport
- Improve transit and promote transit-oriented development in East Bridgeport
- Develop alternative build-out scenarios to be considered and the related ridership forecasts
- Provide a range of housing types and options
- Improve access to jobs, education, and services
- Enhance climate resilience and environmental conditions

These objectives are tied to the answers to three primary questions:

1. Is a new rail station in the East Side neighborhood operationally feasible?
2. Which station configuration provides the best multi-modal operations and development opportunities?
3. With a strong rail station hub, what are the opportunities for redevelopment of the neighborhood and how might they impact the community?

An integral part of any comprehensive study is achieving an understanding of the existing conditions and any issues that may result from those conditions. The design of a new commuter rail station and its potential impact on the community is strongly influenced by a number of important factors including: the existing vehicular transportation network, the existing public transportation systems, demographics, land use, and available land.

This technical memorandum describes the existing transportation, transit, demographics, and land use conditions of the Barnum Station study area and highlights some of the resultant issues and opportunities of the study area. These issues and opportunities include the presence of a large number and sizes of vacant and/or underutilized parcels, which present potential opportunities for transit-oriented development (TOD) in the future, should a station be constructed. These opportunities and others will be explored further as the project progresses.

This evaluation includes a review of plans and other documents relevant to the Barnum Station area (listed in **Appendix A**) and characterizes the demographics and land use, transportation and parking, and transit in the study area provided by the Greater Bridgeport Regional Council (GBRC). VHB provided a preliminary evaluation of areas that can be considered future opportunity areas (i.e., vacant and/or underutilized parcels).

General Description of the Study Area

The proposed Barnum Station is to be located on the site of the former RemGrit factory, on Barnum Avenue. Helen Street borders the west side of the parcel and Seaview Avenue the east side. The site is 16.7 acres and includes over 340,000 sq. ft. of industrial floor space, currently vacant. The railroad right-of-way for the New Haven Metro-North Branch runs elevated along the south side of the site. This location is between the west end of the East Bridgeport Rail Yard and the long curve that starts at Hallett Street and sweeps into the existing Bridgeport Intermodal Center on Water Street in the downtown, which is approximately one mile away. ***Figure 1, City Context***, provides the relationship of the proposed station to the downtown Bridgeport station and East Bridgeport Rail Yard, as well as the City of Bridgeport as a whole.

The Barnum Station study area is defined as a ½-mile radius around the site of the proposed rail station, as depicted in ***Figure 2, Neighborhood Context***. This area includes portions of seven census tracts (734, 736, 737, 738, 739, 740, and 743) and four neighborhoods: 1) Boston Avenue/Mill Hill, 2) East Side, 3) East End, and 4) North Bridgeport (including the Lake Success EcoBusiness Park). The East Side neighborhood makes up the greatest portion of the study area. The area within a ¼-mile radius around the site is the core study area, where the focus of station activities would be expected to take place.

South of the study area is the proposed mixed use Steel Point development, which is planned to include retail (613,400 sq. ft.), restaurant and entertainment (64,800 sq. ft.), residential (22 condominium units; 1,328 apartment flats), office (404,000 sq. ft.), hotel (200 rooms), a public marina (260 berths), and other water-related and water-dependent uses on

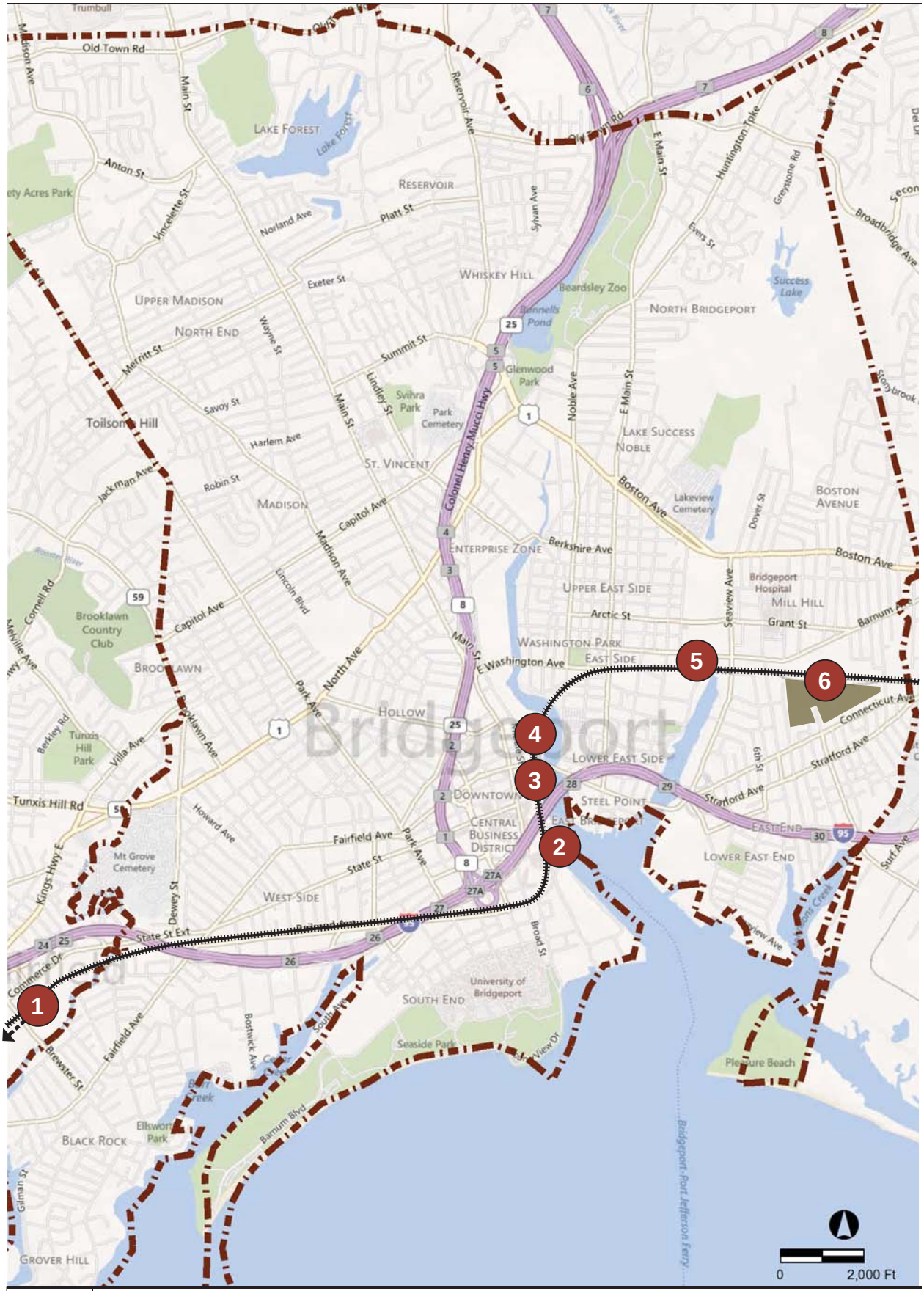


FIGURE **1**

City Context

Barnum Station Feasibility Study | Bridgeport, CT

1. Fairfield Metro Station
2. Ferry Terminal
3. Bridgeport Station
4. Bus Station
5. Proposed Barnum Station
6. East Bridgeport Rail Yard

City of Bridgeport boundary

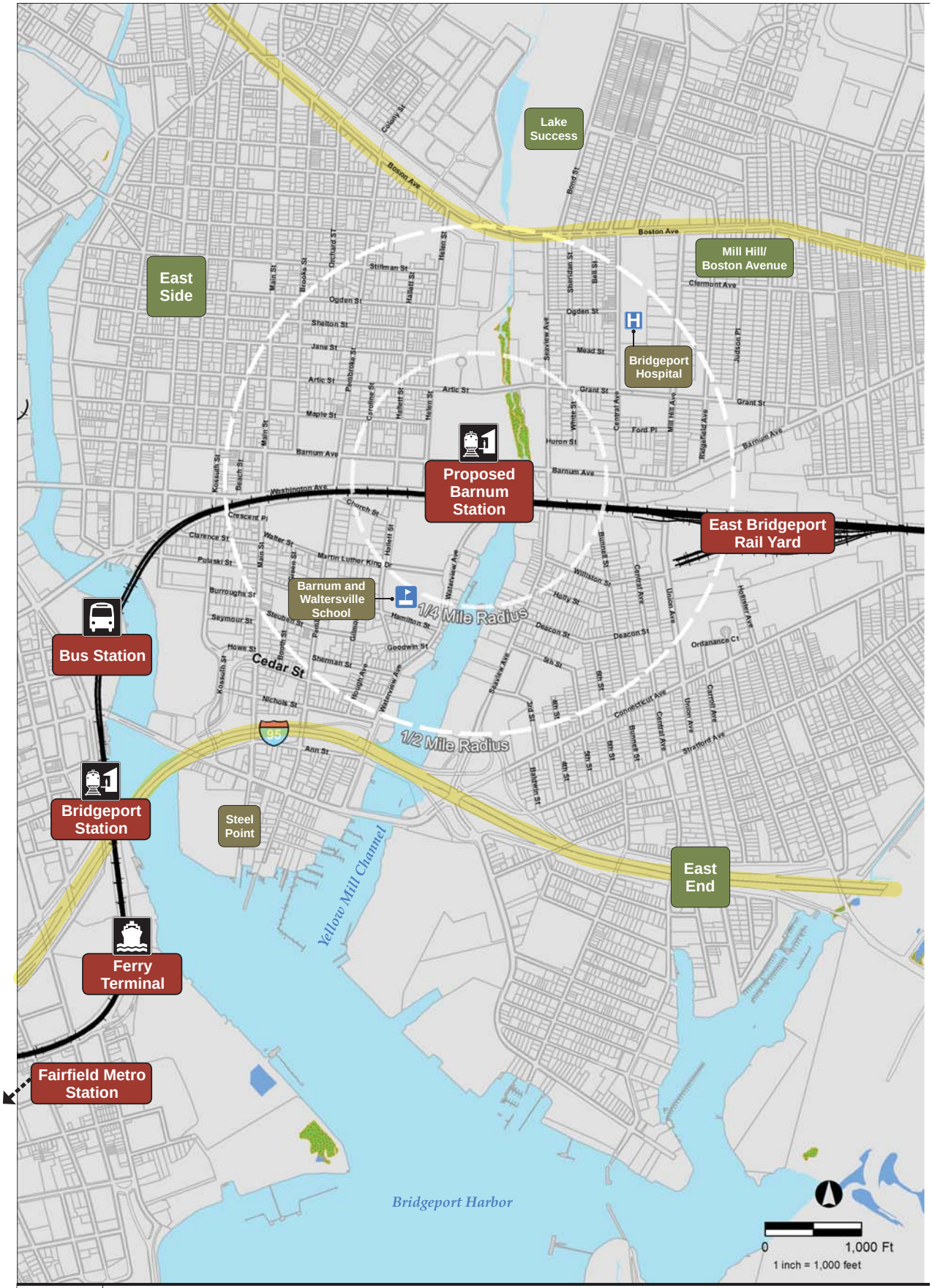


FIGURE 2

Neighborhood Context

Barnum Station Feasibility Study | Bridgeport, CT

Hydrology
- River
- Pond
- Wetlands

Rail

approximately 55 acres. Recently, a Bass Pro Shop was announced for this site. The Lake Success EcoBusiness Park (formerly Remington Woods) in North Bridgeport is a portion of the 335-acre property within the study area. Currently vacant, remediation of the site and plans for new industrial and business uses are being developed. South of the Lake Success Business Park in the study area is the 78-acre GE site, which is also planned to be remediated and redeveloped, likely with a combination of low-to-moderate density residential, commercial, and some institutional uses. Additional development potential remains for a 10-acre tract of the former Father Panik Village site as a planned locus for affordable workforce housing.

Cutting through the middle of the southern half of the study area and across from the proposed station, the Yellow Mill Channel flows into Bridgeport Harbor. The railroad right-of-way and Yellow Mill Channel divide the study area into: East Side (north of the railroad); Lower East Side (south of the railroad and west of Yellow Mill Channel); and East End (south of the railroad and east of Yellow Mill Channel). Interstate 95 (I-95) borders the study area's southern tip.

History of the Study Area

The City of Bridgeport was originally a part of the towns of Fairfield and Stratford. The City was incorporated in 1821, combining the Newfield village east of the Pequonnock River and Stratfield. The Black Rock village was annexed in 1870, enlarging the City to its present day boundaries. Because of access to Long Island Sound, shipbuilding and whaling were important early industries. However, with the construction of railroad lines and good harbor access, the City experienced rapid industrialization. The railroad lines connected Bridgeport to New York to the west, New Haven to the east and Pittsfield, Massachusetts to the north. Various goods were produced in Bridgeport and shipped to around the word. Products included brass fittings, sewing machines, carriages, and ammunition.

Bridgeport has a rich history as a manufacturing center and a diversity of housing styles were built to support the industries that located and grew in the City. Much of the housing is typical of the mid-to-late Victorian era, including the Italianate Villa and Queen Anne styles. Colonial Revival and neo-classic styles are also well represented. Work force housing was provided in "workers" cottages, brick "Philadelphia style" row houses, and triple deckers.

The East Side and East End are prime examples of the diversity and development patterns found in Bridgeport. In the mid-1800s, the areas were primarily rural, with farming and fishing the prevailing activities. They became important sites for manufacturing plants to be built. Tight residential housing was built in proximity to the factories to attract and retain the

workers needed by the industries. Several mixed residential, commercial, and industrial areas were developed on the East Side and East End. Several have been recognized for their social history, architectural styles, community planning, and development patterns. Established historic districts include:

- **Remington City**—an enclave of 166 closely spaced structures consisting of single family, duplex, and quadraplex residential units. The neighborhood was built along a four-block area adjacent to the Remington Arms factory, which, subsequently, became a small appliance manufacturing plant for the General Electric Company (GE) at the corner of Boston Avenue and Bond Street.
- **Deacon's Point**—a planned housing development located along the Yellow Mill Channel and roughly bounded by Seaview Avenue, Williston Street, Bunnell Street, and Deacon Street. The neighborhood was built in the last third of the 19th century and consisted of 79 residential structures with characteristics common of suburban developments built outside urban centers of the time, including deep lots, 20-foot setbacks and shaded lawns.
- **East Bridgeport/Pembroke City**—a planned residential and industrial community comprised of 25 city blocks and 260 buildings. It is bounded by the New Haven rail line to the south, the Pequonnock River to the west, Arctic Street to the north, and East Main Street to the east, centered on Washington Park. A range of housing styles and categories are represented in the district. Homes for the wealthy industrialists encircled Washington Park with major church structures also fronting the park. These houses were larger single-family homes in the Italian Villa or Queen Anne style. Housing for the tradesmen and supervisors were located along the streets a block from the park. Laborer housing, consisting of row houses, four family tenements and smaller single and two-family houses, was scattered farther away from the center of the area.
- **East Main Street**—was developed as Bridgeport's second commercial area and consists of two-to-four story structures that were originally built for retail stores with apartments on the upper floors. The corridor extends from Crescent Avenue and the New Haven rail line embankment to Nichols Street.
- **Lakeville Village**—a planned residential development located along Boston Avenue (US Route 1) and in proximity to the Remington Arms factory (subsequently GE). The area encompasses twelve residential streets lined with single-family, duplex and row house dwellings. The dwellings are unified by a common Colonial Revival style and architectural detail. The development was built to provide housing for workers employed at the nearby war-related factories. It is a good example of early government supported housing built in Bridgeport.

The planned residential developments built in the East Side and East End areas reflected the need to provide workforce houses to support the factories located in this part of the City. The dominant factory was operated by the

Remington Arms Corporation. The plant, located along Helen Street between East Washington Avenue and Arctic Street, was established in 1867 and originally incorporated as the Union Metallic Cartridge Company. It was noted for its development of metallic cartridges. The company merged with Remington Arms and, in 1888, Bridgeport became home of its ammunitions plant.

The Remington munitions factory developed the first paper shot shells successfully manufactured in the United States and it was the first company to produce and make several other ammunition advancements. The factory consisted of five interconnected building and totaled about 340,000 square feet of space. A unique component of the plant was the 130+ foot tall shot tower. A shot tower is used for the production of shot balls by freefall of molten lead. The Remington Shot Tower is one of only a relatively few surviving shot towers. In recent years, the complex has been the site of several suspicious fires and the City has started demolition of the remaining buildings.

Remington Shot Tower, corner of Helen Street and Arctic Street

In response to the need to supply Russia, England and France rifles and ammunition while engaged in World War I, the Remington Arms Corporation constructed the massive factory located at the corner of Boston Avenue and Bond Street. The plant consisted of the thirteen interconnected, five story building and totaled over 1.4 million square feet. At the time, it was among the largest munitions factories in the world. After the war and in face of reduced demand, Remington sold the building to GE in 1920. GE used it to manufacture various products, including small kitchen appliances, irons, table radios, electric motors, outlet boxes, and cable. The last products were manufactured in 2007. The complex has been demolished by the property owner and the site has been leveled for redevelopment.

The manufacture of sewing machines was another important industry in Bridgeport. The Wheeler and Wilson Sewing Machine Company, one of the early manufacturers and at one time the seller of the most popular sewing machine, moved to Bridgeport in 1856. Sewing machines were produced in a large factory located along Barnum Avenue between East Main Street, Hallett Street, and the New Haven rail line. About 1,000 workers were employed at the plant. Elias Howe moved his sewing machine production to Bridgeport in 1862, also employing around 1,000 workers. The factory building was located south of the railroad line along the east banks of the Pequonnock River. In 1907, the Wheeler and Wilson Company was bought by the Singer

Manufacturing Company and sewing machines and parts were manufactured at the location into the 1960s.

The original Wheeler and Willow plant was demolished over time with the last remnants torn down in the 1970s to provide parking for the Housatonic Community College. The remaining portions of the factory, built by Singer, were converted to house the HCC. The former Singer Sewing Company factory is now the Bridgeport Trade and Technology Center. It provides multi-tenant, flexible space for start-up companies, offices, and industrial uses. Classrooms are also provided. The BTTC is the home for The Park City Prep Charter School.

One of the more prominent buildings in Bridgeport is Bridgeport Hospital. Situated on the top of Mill Hill and at ten stories, it dominates the skyline of East Bridgeport. The hospital was founded in 1878 and ground was broken in 1883. It was created in response to a growing immigrant population. In November 1884, the hospital began treating its first patients, primarily providing medical services to the poorest residents of the city. When it was established, Bridgeport Hospital became the first hospital in Fairfield County and only the third in the state. The Bridgeport School of Nursing was established at the same time and has been providing extraordinary programs ever since. Its first president of the board of trustees was P.T. Barnum. It has undergone several expansions and modernizations over the years and, today, the hospital has 425 beds, employs over 2,600 people, and has nearly 600 attending physicians. Specialties include the only burn center in Connecticut and cardiology and cardiac surgery.

Demographics, Land Use, Environment, and Businesses

The study area's social and economic profile helps provide the background context for the community. Available data were examined primarily at two levels: 1) the study area – those census block groups that are within a ½ mile of the proposed Barnum Station; and 2) the City of Bridgeport. For certain indicators, data reflecting trends in the Greater Bridgeport Region, Fairfield County, and Connecticut overall are also provided for comparative purposes. Data were compiled primarily from the United States Census Bureau, 2000 and 2010 United States Census and 2006-2010 American Community Survey 5-Year Estimates, as well as the Connecticut Department of Labor Office of Research, 2012, 2011 & 2010, Connecticut Labor Force Data by Place of Residence.

■

Population Growth

Fewer than ten percent of the City of Bridgeport's residents live in the study area. Between 2000 and 2010 the population of the study area grew by five percent, from 8,778 people to 9,223 (***Table 1***). This represented a slightly higher growth rate than the City of Bridgeport's and Fairfield County's three percent population increase (U.S. Census 2000 & 2010).

Table 1
Population

	2000	2010	% Change
Study Area	8,778	9,223	5.07%
Bridgeport	139,529	144,229	3.37%
Greater Bridgeport Region	307,607	318,004	3.38%
Fairfield County	882,567	916,829	3.88%
Connecticut	3,405,565	3,574,097	4.95%

SOURCE: U.S. Census 2000 & 2010, SF1.

■

Ethnicity and Age

As indicated in ***Table 2***, a majority of residents in the study area are Hispanic (59 percent). Non-Hispanic, African-American residents make up close to a third of the population. About five percent of study area residents are white. This ethnic diversity has not changed dramatically since 2000, indicating that the study area has remained relatively stable.

Table 2
Ethnicity

	White[1]	African-American[1]	Hispanic	Asian/Other
Study Area	514	2,927	5,451	331
Bridgeport	32,794	46,472	55,100	9,863
Percentage				
Study Area	5.57%	31.74%	59.10%	3.59%
Bridgeport	22.74%	32.22%	38.20%	6.84%

SOURCE: U.S. Census 2000 & 2010, SF1.
NOTE: [1] Non-Hispanic

Almost 30 percent of residents are between the ages of 25 and 44. The next highest age cohort are those from 45 to 64 years old (20 percent). Those between 15 and 24 make up 17 percent of residents (***Table 3***), and those between five and 14 constitute 15 percent of the population. Nine percent of residents are under the age of five and only eight percent of residents are over 65 (U.S. Census 2010).

Table 3
Age

	Under 5	5-14	15-24	25-44	45-64	Over 65
Study Area	837	1,436	1,596	2,692	1,868	794
Bridgeport	10,731	19,246	24,011	43,177	32,576	14,488
Percentage						
Study Area	9.08%	15.57%	17.30%	29.19%	20.25%	8.61%
Bridgeport	7.44%	13.34%	16.65%	29.94%	22.59%	10.05%

SOURCE: U.S. Census 2000 & 2010, SF1.

■

Unemployment and Income

Like the State of Connecticut and Fairfield County, unemployment levels in the City of Bridgeport have decreased slightly since their peak in 2010 (***Table 4***). Currently, Bridgeport's unemployment rate for 2012 is 12.31 percent (for the first four months of 2012) – significantly higher than the single digit unemployment percentages in the State of Connecticut overall and especially, Fairfield County (State of Connecticut Department of Labor).

Table 4
Unemployment Rate

	2008	2009	2010	2011	Jan-Apr 2012
Bridgeport	8.70%	12.30%	13.60%	13.30%	12.31%
Fairfield County	5.10%	7.80%	8.40%	8.00%	7.43%
Connecticut	5.60%	8.30%	9.30%	8.80%	8.08%

SOURCE: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence

A comparison of household income underscores the economic impact of unemployment in the City of Bridgeport (***Table 5***). The American Community Survey estimates that median household income in Bridgeport is slightly more than half that of Fairfield County – $41,047 to $81,268. It is likely that income is much lower in the study area – roughly estimated at $23,956[1]. Median household income in Connecticut is $67,740 (ACS 2010).

Table 5
Unemployment and Income

	# Unemployed	Unemployment %	Median Household Income
Study Area	1,715	7.92%	$23,956.19
Bridgeport	9,018	8.22%	$41,047.00
Fairfield County	36,207	5.14%	$81,268.00
Connecticut	145,356	5.15%	$67,740.00

SOURCE: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence.
NOTE: [1] Estimated Population – People (over 16) & Households.

[1] A weighted mean of household median income (weighted by the population of each census tract) was used to calculate median household income for the study area.

As can be seen by these data, the study area contains some of the poorest and most economically distressed areas in the region. Further, when compared to the median household income from the 2000 Census (based on 1999 income), the median household income has gone down slightly, indicating deteriorating economic conditions within the study area. Taken together with population growth and ethnicity, the study area appears to be stable, with increasing economic distress.

■

Place of Work and Commuting

A third of the study area's employed population works within the City of Bridgeport and 80 percent within Fairfield County (***Table 6***). Six percent of these residents work outside of Connecticut. The study area's employment location patterns are similar to those of Bridgeport overall (ACS 2010).

Table 6
Place of Work

	Work in Bridgeport	Work in Fairfield County	Work in Connecticut	Work Outside of Connecticut
Study Area	2,845	6,824	7,853	525
Bridgeport	19,323	52,043	58,548	3,581
Fairfield County		335,872	366,058	62,512
Connecticut			1,618,120	107,976
Percentage				
Study Area	33.96%	81.45%	93.73%	6.27%
Bridgeport	31.10%	83.77%	94.24%	5.76%
Fairfield County		78.37%	85.41%	14.59%
Connecticut			93.74%	6.26%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Workers.

Automobile access in the study area and the City of Bridgeport underscore the link between transit and employment opportunities (***Table 7***). A third of households in the study area do not have access to an automobile. In Bridgeport, 22 percent of households do not have automobile access. In contrast, fewer than nine percent of households in both Fairfield County and Connecticut are without access to a vehicle (ACS 2010).

Table 7
Household Vehicles

	No Vehicles	1 Vehicle	2 Vehicles	3 Vehicles	4+ Vehicles
Study Area	2,745	2,834	1,799	632	122
Bridgeport	11,590	21,207	13,214	4,452	1,818
Fairfield County	28,074	101,740	130,610	51,218	20,140
Connecticut	116,802	433,536	528,116	197,972	82,792
Percentage					
Study Area	33.76%	34.85%	22.12%	7.77%	1.50%
Bridgeport	22.17%	40.56%	25.27%	8.52%	3.48%
Fairfield County	8.46%	30.66%	39.37%	15.44%	6.07%
Connecticut	8.59%	31.90%	38.85%	14.57%	6.09%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Households.

Reliance on the automobile in the study area is less than is typical of Bridgeport, as reflected in the commuting patterns of the study area. Although the majority of employed residents (59 percent) drive alone to their job, 16 percent of the employed population use public transit, 13 percent carpool, and eight percent walk. In Bridgeport, 66 percent of employed residents drive alone to work; while in Fairfield County, 73 percent of employed residents drive alone to their job (ACS 2010). ***Table 8*** summarizes the commuting patterns relative to the study area.

Table 8
Commute

	Car, truck, or van - drove alone	Car, truck, or van - carpool	Public trans	Walked	Taxicab, motorcycle, bicycle, or other means
Study Area	4,953	1,128	1,377	679	154
Bridgeport	41,591	7,906	7,749	2,670	1,305
Fairfield County	314,376	33,728	39,612	14,043	5,169
Connecticut	1,364,621	143,679	76,305	51,957	21,463
Percentage					
Study Area	59.12%	13.46%	16.44%	8.10%	1.84%
Bridgeport	66.94%	12.73%	12.47%	4.30%	2.10%
Fairfield County	73.35%	7.87%	9.24%	3.28%	1.21%
Connecticut	79.06%	8.32%	4.42%	3.01%	1.24%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Workers.

■

Housing

The bulk of housing stock (80 percent) in the study area is made up of multi-family units (***Table 9***). 39 percent of residential structures are made of three to nine housing units, with denser structures of 10 units or more constituting 18 percent of the study area's housing stock. Fifteen percent of housing units are single-family detached dwellings. The density of housing in the study area is greater than Bridgeport overall, as less than 70 percent of the city's housing stock is made up of multi-family housing. However, housing density and the availability of multi-family housing units is much greater in Bridgeport than Fairfield County (and Connecticut overall), as 58 percent of the County's housing stock is made up of single-family detached dwellings (ACS 2010).

Table 9
Housing Type

	Single Family Detached	Single Family Attached	2 units	3 or 4 units	5 to 9 units	10 to 19 units	20 to 49 units	50+ units	Housing: Other
Study Area	1,408	584	2,171	2,752	969	619	510	531	0
Bridgeport	15,706	3,078	9,394	13,928	4,478	3,784	3,909	5,517	125
Fairfield County	207,747	21,817	30,573	32,095	17,449	12,912	12,917	21,283	1,339
Connecticut	874,259	76,187	119,757	132,977	78,850	55,069	52,693	72,668	13,197
Percentage									
Study Area	14.75%	6.12%	22.75%	28.83%	10.15%	6.49%	5.34%	5.56%	0.00%
Bridgeport	26.21%	5.14%	15.68%	23.24%	7.47%	6.32%	6.52%	9.21%	0.21%
Fairfield County	58.01%	6.09%	8.54%	8.96%	4.87%	3.61%	3.61%	5.94%	0.37%
Connecticut	59.25%	5.16%	8.12%	9.01%	5.34%	3.73%	3.57%	4.92%	0.89%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Houses.

As indicated in ***Table 10***, only 30 percent of the study area's housing units are owner occupied – a lower percentage than Bridgeport overall (39 percent), Fairfield County (65 percent), and Connecticut (63 percent). While the majority of housing in the study area is occupied by renters (55 percent), 14 percent of all housing units are vacant, twice the state and county averages of seven percent (ACS 2010).

Table 10
Housing Occupancy

	Housing Units	Vacant Housing Units	Owner	Renter
Study Area	9,544	1,412	2,792	5,340
Bridgeport	59,919	7,638	23,654	28,627
Fairfield County	358,132	26,350	234,419	97,363
Connecticut	1,475,657	116,439	939,984	419,234
Percentage				
Study Area		14.79%	29.25%	55.95%
Bridgeport		12.75%	39.48%	47.78%
Fairfield County		7.36%	65.46%	27.19%
Connecticut		7.89%	63.70%	28.41%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Houses.

Table 11 shows that a majority (54 percent) of the housing stock in the study area was built before 1940**.** Less than a quarter of housing in the study area was built after 1969 (ACS 2010). In contrast, there is a much greater age distribution of housing in Fairfield County and Connecticut, with less than a quarter of housing stock built before 1940 and well over a third of stock made up of structures built after 1969.

Table 11
Age of Housing Stock

	2005 or later	2004 to 2005	1990 to 1999	1980 to 1989	1970 to 1979	1960 to 1969	1950 to 1959	1940 to 1949	Before 1939
Study Area	183	116	406	417	660	512	718	1,322	5,210
Bridgeport	699	635	1,560	5,096	5,977	6,058	9,371	7,834	22,689
Fairfield County	6,703	14,206	22,958	41,006	49,780	51,631	60,736	30,136	80,976
Connecticut	28,434	61,101	108,780	189,562	202,661	198,079	225,730	109,487	351,823
Percentage									
Study Area	1.92%	1.22%	4.25%	4.37%	6.92%	5.36%	7.52%	13.85%	54.59%
Bridgeport	1.17%	1.06%	2.60%	8.50%	9.98%	10.11%	15.64%	13.07%	37.87%
Fairfield County	1.87%	3.97%	6.41%	11.45%	13.90%	14.42%	16.96%	8.41%	22.61%
Connecticut	1.93%	4.14%	7.37%	12.85%	13.73%	13.42%	15.30%	7.42%	23.84%

SOURCES: Connecticut Department of Labor Office of Research, 2012, 2011, & 2010, Connecticut Labor Force Data by Place of Residence; U.S. Census, ACS 5-Year 2006-2010, by Census Tract.
NOTE: Estimated Population – Houses.

■

Land Use and Zoning

Land Use

As depicted in ***Figure 3, Existing Land Use***, former industrial sites predominate on Seaview Avenue, Barnum Avenue, and along the rail tracks. Much of the industrial space predates 1930 and is associated with difficult to use multi-storied facilities. Environmental issues linked with many of these structures further complicate their continued reuse. The most prominent

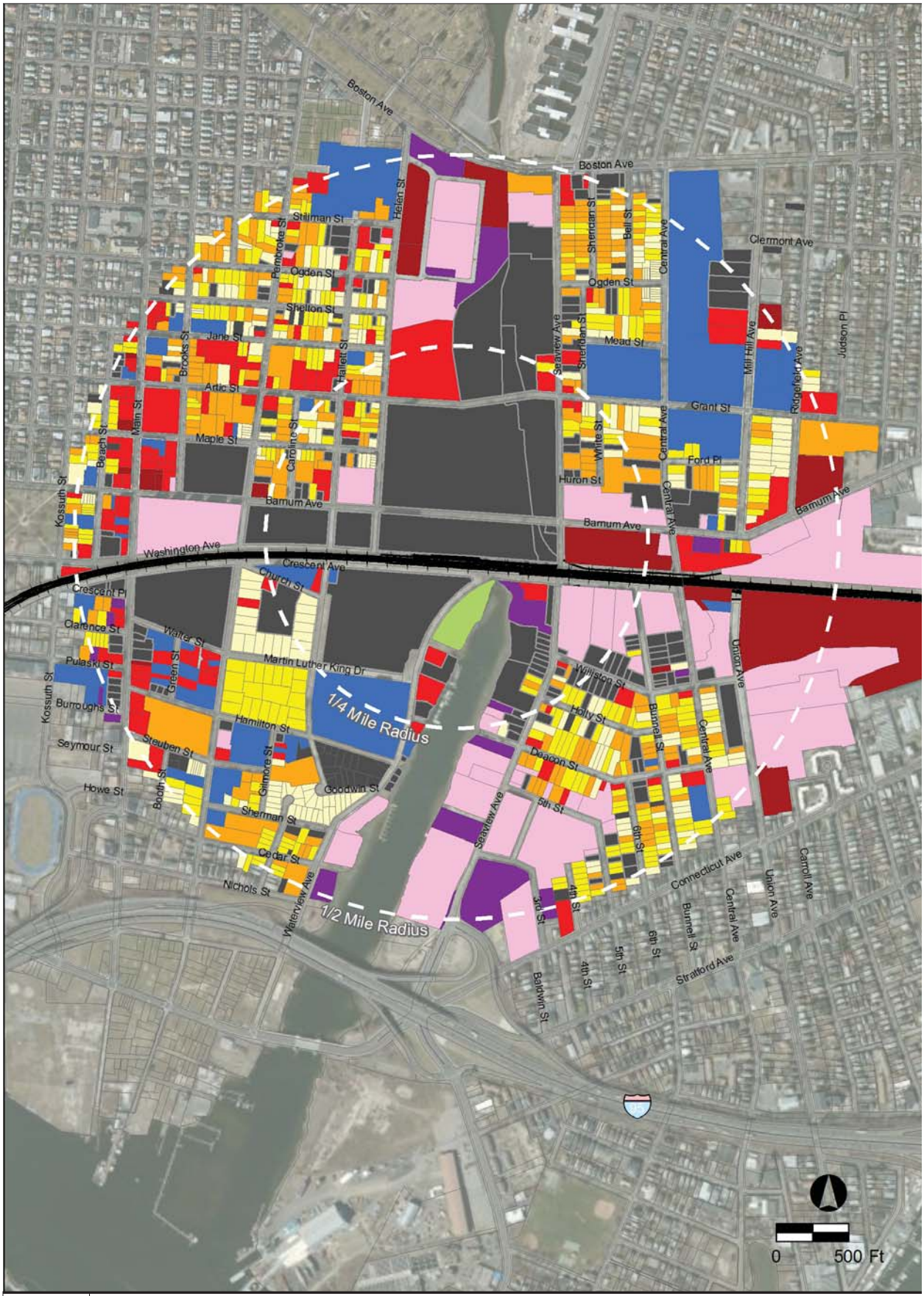


FIGURE **3**

Existing Land Use

Barnum Station Feasibility Study | Bridgeport, CT

- Commercial
- Office
- Heavy industrial
- Light industrial
- Public/quasi-public
- Multi-family residential
- One-family residential
- Two-family residential
- Vacancy underutilized land
- Not yet classified
- Proposed station

example of such facilities is the former RemGrit property, the site of the proposed Barnum Station.

Concentrations of industrial uses are found along Seaview Avenue with Lacey Manufacturing (maker of surgical supplies) and the Seaview Avenue Industrial Park figuring most prominently. Lacey completed a major expansion of its plant on Boston Avenue that included the construction of a 38,000 sq. ft. facility.

Also located within the study area is the 28-acre Boston Avenue Industrial Park (BAIP) representing a combination of reused older buildings and new industrial space. BAIP is situated immediately north of the Remington Arms plant on 25 acres and consists of five buildings totaling 225,000 sq. ft. Another significant multi-tenanted commercial/industrial land user is the 550,000 sq. ft. Bridgeport Trade & Technology Park (formerly the Singer Sewing Machine Complex located on Barnum Avenue and East Main Street).

Other significant industrial plants in the area include: All-Phase Construction Company, Rotair Industries; Valley Container; and Moore Tool. More recent industrial construction has occurred on lower Seaview Avenue, where vacant and underutilized parcels have been redeveloped with construction company facilities, warehousing and distribution buildings, and trucking terminals.

Outside of industrial uses, the area is characterized by institutional uses, notably Bridgeport Hospital. Bridgeport Hospital is located in the study area's northwest side on Grant Street in the Mill Hill neighborhood of Bridgeport, approximately ½ mile from the proposed station. The 425-bed private, not-for-profit hospital was founded in 1878 and opened in 1884, becoming the first hospital in Fairfield County and the third in the state. The hospital is part of the Yale New Haven Health System, together with Yale-New Haven Hospital, Yale-New Haven Children's Hospital, and Greenwich Hospital. The hospital, part of Bridgeport Hospital & Healthcare Services Inc., is the City's major employer with 2,567 employees. Burn patients are seen in the Connecticut Burn Center—the only burn center in Connecticut—from throughout the state and neighboring states. The hospital's other specialized services include obstetrics, pediatrics, wound care, surgery, oncology, medicine, cardiovascular care, psychiatry, breast care, rehabilitation, critical care, sleep disorders and community care. The Bridgeport Hospital School of Nursing, the oldest nursing school in Connecticut, is also located in the study area and offers an intensive two-year hospital-based nursing program. In addition to the main hospital facility, satellite facilities affiliated with Bridgeport Hospital include radiology sites in Shelton, Fairfield, Stratford, and Trumbull. The hospital is a strong and stable asset within the study area and should be capitalized upon in any redevelopment that results from the proposed Barnum Station.

Other institutional/community-related uses include a police substation at 135 Clarence Street, the City Department of Health and Social Services building at 752 East Main Street (in the former Bridgeport Brass complex), the City Water Pollution Control Authority at 695 Seaview Avenue, and the Hall Neighborhood House at 52 George E. Pipkin's Way. There are a number of community-related uses that, although they are just outside of the study area, serve its residents. These include Optimus Health Care, McGivney Community Center, the Police Academy on Newfield Avenue, Bridgeport Fire Department Engine Companies #6 and #10, and Habitat for Humanity of Coastal Fairfield County.

A mix of housing, retail, services, churches, and schools make up the rest of the study area, including the new Barnum and Waltersville Elementary School and the Saints Cyril and Methodius Church. One of the biggest challenges in the study area is the adjacency of churches, schools, and residential uses to industrial uses and the lack of any significant buffer between such uses. A number of churches and schools exist just outside of the study area, including Harding High School and the Luis Munoz Marin School. Open space and recreational uses within the study area include James Brown (Waterview) and Upchurch (Eastside) Parks. There are a number of open spaces/recreational uses outside, but in close proximity to the study area as well.

Finally, there are only a few water-access dependent uses and a few opportunities for recreation along the Yellow Mill Channel. Most of the waterfront in the study area is industrial.

The uses indicate that, although the neighborhoods within the study area have challenges, there are a number of important uses extant to build upon. **Appendix B** provides a detailed listing of land use, by street.

Zoning

The Planning and Zoning Commission adopted updated zoning and subdivision regulations in 2009. Existing zoning within the study area is generally consistent with existing land use. The central spine of the study area is zoned light industrial (I-L), with an area of heavy industrial (I-H) in the eastern portion of the study area and areas of Mixed Use-Light Industrial (MU-LI) adjacent to Yellow Mill Channel. The I-L zoning extends off Seaview Avenue along the north side of Williston Street and north to include Lacey Manufacturing, and west along Washington and Barnum Avenues to include the Bridgeport Trade and Technology Center (BTTC) area. Residential zoning is also found in the study area, with the Residential High Density (R-C) district found adjacent to the industrial zones, including the former Father Panik Village property. There are also pockets of lower-density residential (R-A, R-B) on the extents of the study area and along the west bank of Yellow Mill Channel. The areas around the institutional uses (i.e., Bridgeport Hospital) is zoned Mixed Use-Educational/Medical (MU-EM). Finally, there

are a few instances of Office Retail (OR) zoning within the study area, including along East Main Street, Boston Avenue, Connecticut Avenue, and the eastern portions of Barnum Avenue. Much of the vacant and/or underutilized land within the study area is currently zoned industrial.

■

Environmental Conditions

The proposed site of the new Barnum Station is located within the Yellow Mill Channel Sub-Regional Drainage Basin. This basin consists of three segments:

- Yellow Mill Stream
- Several impoundments associated with Yellow Mill Stream
- Yellow Mill Channel

Yellow Mill Stream is a freshwater stream that flows from Lake Success south to Crescent Avenue. It passes under the New Haven rail line through a culvert before entering the Yellow Mill Channel. The stream is constricted at four locations: 1) just north of Boston Avenue (US Route 1) that forms Stillman Pond; 2) Grant Street; 3) Barnum Avenue; and, 4) Crescent Avenue. Collectively these latter three impoundments are referred to as "Pembroke Lakes." Yellow Mill Channel is a saltwater channel that extends from Crescent Avenue and drains to Bridgeport Harbor.

Yellow Mill Channel and its watershed have been significantly impaired by heavy manufacturing uses over the past century. The industrial uses that have impaired Yellow Mill Watershed have also impacted Bridgeport Harbor, as well as the quality of Long Island Sound. The water quality of the Yellow Mill Channel is classified as SC/SB, indicating certain water quality criteria are not being met because of point and non-point sources of pollution. Similarly, Yellow Mill Stream and its associated impoundments are also degraded and classified as C/B. These designations indicate that the water quality of these water bodies is inadequate to accommodate one or more uses assigned to Class SB and B waters.

To address the quality of the Yellow Mill drainage basin, the City of Bridgeport anticipates the development of a watershed plan in 2013. A watershed plan for this impaired waterway is another component in the overall redevelopment of the study area. Large property owners, including the City, GE, and DuPont have made commitments to clean significant acreage of land bordering or straddling this waterway. The potential exists to restore the river so that it can simultaneously eliminate pollutants entering Bridgeport Harbor and Long Island Sound, and form the public realm and ecological foundation to the redevelopment of this former industrial district.

Wetland resources are located within and adjacent to the Barnum Station site and associated mainly with Pembroke Lakes and the Yellow Mill Stream water bodies. Both State- and Federally-designated wetlands are present. The wetlands along the banks of the Yellow Mill Channel are classified as "estuarine" wetlands and are tidally influenced. The wetlands along Yellow Mill Stream and Pembroke Lakes are well vegetated but are not affected by tides. The areas that once formed Pembroke Lakes have been substantially filled by sediment and are now heavily vegetated, with little surface water remaining.

Although these wetlands have been impacted by filling and pollution over the years, they still provide value and important functions. The principal functions include bank stabilization, wildlife habitat, sediment retention, and nutrient removal, retention, and transformation.

Soils within the study area and on the station site are primarily composed of Urban Land and Udorthents-Urban Land complex. These soil types consist of areas where urban structures cover more than 85 percent of the soil surface and areas that have been altered by cutting or filling, such as removal of top soil, mining, mixing of native soil layers, and deposition of non-native fill materials.

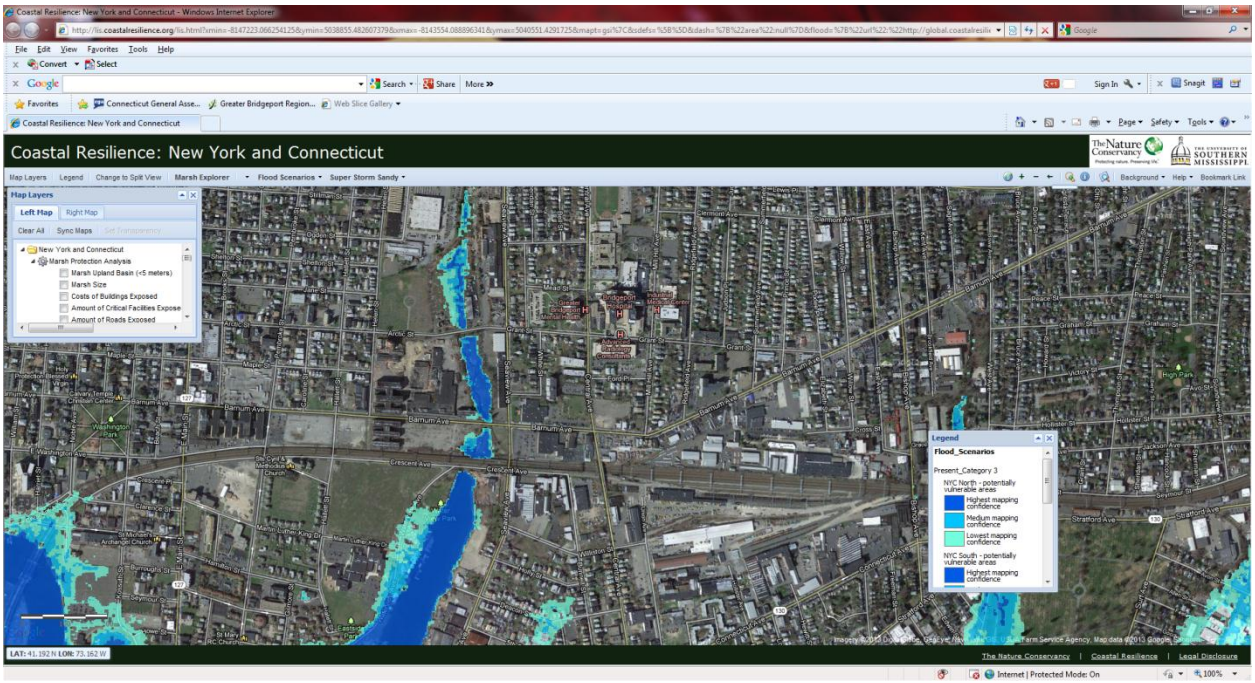
The proposed Barnum Station site is located just north of the farthest reach of Yellow Mill Channel. The Yellow Mill Stream channel and Pembroke Lake area cut through the eastern side of the site. Based on the draft 2013 Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the station site is not located within a FEMA-designated Special Flood Hazard Area (SFHA). However, the eastern half of the station site lies within the hurricane surge inundation area for a Category 4 hurricane. According to the Sea, Lake and Overland Surges from Hurricanes (SLOSH) layers in the Nature Conservancy's Coastal Resilience tool, the site is likely to experience flooding with a Category 2 hurricane. This scenario was co-developed by National Oceanic and Atmospheric Administration (NOAA) and the Nature Conservancy.

The aim of the Nature Conservancy's Coastal Resilience interactive mapping tool is to provide communities with access to information for planning, zoning, acquisition, and permitting decisions. Floods associated with Category 2 or 3 hurricanes, with or without sea level rise, scenarios for the years 2020s, 2050s, and 2080s can be visualized through this tool. In the future, potential flooding from Category 2 and 3 hurricane storm surges is projected at the eastern edge of the station site, in the area intersected by Yellow Mill Stream.

The Barnum Station study area is defined as a ½-mile radius centered on the station site. Land parcels adjacent to the Yellow Mill Channel and stream channel are located in the SFHA. These parcels are also susceptible to

inundation during Category 2 or 3 hurricanes. The critical areas are to the south and east of the station site, as depicted in the screenshot below.

Screenshot of Present Conditions for a Category 3 Hurricane



SOURCE: Nature Conservancy's Coastal Resilience interactive mapping tool – http://lis.coastalresilience.org/.
NOTE: The colors reflect mapping confidence. Dark blue is where there is the highest mapping confidence (those areas that will most likely flood); light green/blue is where there is the lowest mapping confidence.

Waterview Avenue and Crescent Avenue were identified in the 2006 *Natural Hazard Mitigation Plan* as vulnerable to flooding from a hurricane storm surge. The intersection of these two roads located at the head of Yellow Mill Channel is especially at risk because the elevated New Haven rail line acts as an impediment to the flow of floodwaters. However, the solid barrier to water provided by the rail line also helps protect the station site from advancing floodwaters. The *Natural Hazard Mitigation Plan* suggested elevating Waterview Avenue.

In recent years, the effects of sea level rise have become an increasing concern to the City of Bridgeport. The City has taken several proactive steps to address sea level rise and strengthen climate resiliency. These include preparing and implementing the *BGreen 2020 Plan* and updating the City's *Stormwater Management Manual*. In 2012 the City, in partnership with GBRC, the Nature Conservancy, Clean Air Cool Planet, and the Regional Plan Association organized and hosted two workshops on climate preparedness.

The goals of the workshop were four-fold:
1. Define extreme weather and local natural and climate-related hazards.
2. Identify existing and future vulnerabilities and strengths.

3. Develop and prioritize actions for the City and stakeholders.
4. Identify opportunities for the community to advance adaptive actions.

The top two natural hazards that workshop participants identified were the "frequency and severity of coastal and inland flooding" and "storm surge from tropical storms and hurricanes."

Workshop participants found that the City's rich natural resources, recreational areas and green infrastructure provide buffering, water storage and protective capacity, thus strengthening the resilience of the City to climate change and future hazards. Participants recommended that the overall resilience of existing and future development and infrastructure could be increased by encouraging greater infiltration of storm water runoff and the incorporation of green infrastructure.

■

Office and Commercial Market Environment

Employment

Despite the prominence of industry in the study area, institutional land users constitute the largest employers, with Bridgeport Hospital ranking highest with 2,500 employees. The most significant industrial employer in the area is Lacey Manufacturing with almost 300 employees (full- and part-time).
Table 12 presents the largest employers in and near the study area:

Table 12
Study Area Top Employers

Employer	Employees	Sector
Bridgeport Hospital	2,567	Health Care
Prime Line Resources*	310 FT/150 PT	Specialty Items
Moore Tool Company	280	Precision Tools
Lacey Manufacturing	258 FT/46 PT	Medical Products
Harding High School	123	High School
Bridgeport Health Care Center*	49	Health Care
Rotair Industries	46	Helicopter Parts
Valley Container	45	Packaging Material
Munoz Elementary School	40	Elementary School
Optimus Health Care, Inc.	35	Mental Health

SOURCE: City of Bridgeport 2011 Comprehensive Annual Financial Report. Updated via http://www.manta.com, accessed July 2012.
*NOTE: * Business that is outside, but adjacent to the study area.*

Office Market

Table 13 presents the status of the office market in Bridgeport and compares it to Central Fairfield County and Fairfield County overall.

Table 13
Office Market

	Inventory (sq. ft. of gross rentable area)	Vacancy Rate	Rental Rate
Bridgeport	1,759,711	9.40%	$23.49
Central Fairfield County (Bridgeport, Shelton, Stratford, Trumbull)	2,958,886	10.80%	$32.61
Fairfield County	41,886,986	21.40%	$33.72

SOURCE: Cushman & Wakefield of Connecticut, Q1 2012. Marketbeat: Office Snapshot, Fairfield County CT.

As ***Table 13*** indicates, Bridgeport fills an important niche in the Fairfield County office marketplace due to its affordability, as evidenced by a lower vacancy rate compared to Central Fairfield County and Fairfield County as a whole. The study area, with convenient access from local and regional roadways, may have the potential to help central Bridgeport dominate the office marketplace.

Business Incentives

Although, as stated in the January 2010 East Side Neighborhood Revitalization Zone Strategic Plan, there are few significant economic generators or uses in the study area (specifically the East Side), a number of incentives are available to businesses, as indicated in ***Table 14***.

Table 14
Business Incentives

	Program	Benefits	Eligibility
City of Bridgeport[1]	*Tax Incentive Development Program*	Tax abatements, assessment deferrals, or payments in lieu of taxes are negotiated with the Office of Planning & Economic Development.	• Real property improvements over $3 million. • Subject to City Council approval.
State of Connecticut	As the entire city of Bridgeport is a Targeted Investment Community, projects in the study area may be eligible for the following programs. Eligibility requirements vary by program and project.		
	Qualified Manufacturing Plant	• 5 year, 80% abatement of local property taxes on qualifying real and personal property, subject to the property being *new to the grand list* of the municipality as a direct result of a business expansion or renovation project, or in the case of an existing building, having met the vacancy requirement. • 10 year, 25% credit on that portion of the state's corporation business tax that is directly attributable to a business expansion or renovation project as determined by the Connecticut Department of Revenue Services.	• A manufacturing plant having an area of at least 500,000 square feet. • Department of Economic & Community Development Commissioner approval.

	Urban Jobs Program	• 5 year, 80% property tax abatement. • 10 year, 25% corporation business tax credit to qualified manufacturing businesses.	• Manufacturers, research associated with manufacturing, and distribution warehousing (new construction/ expansion only). • Eligible projects list. • Department of Economic & Community Development Commissioner approval.
		• Property tax benefits for real estate and/or equipment are provided for qualifying *service facilities*, on a sliding scale basis. The minimum investment is $20 million to qualify for a five-year, forty percent tax abatement. This benefit increases to an eighty percent, five-year tax abatement for projects with an investment greater than $90 million. The equipment qualifies only if it is installed in a facility that has been newly constructed, substantially renovated or expanded.	
		• Corporate business tax credits are provided for qualifying *service facilities*, on a sliding scale basis based on new full-time jobs created. The minimum tax credit of 15% is allowed for service companies creating 300 or more but less than 599 new jobs. The benefit increases to 50% for such companies creating 2,000 or more new jobs at the eligible facility. The eligibility period for this tax credit is ten years.	
Federal Government	*Federal HUBZone*	• Competitive and sole source contracting • 10% price evaluation preference in full and open contract competitions, as well as subcontracting opportunities.	• Census tracts 736, 737, 738, 739, 740, & 743. • Must be a small business by SBA standards • Must be owned and controlled at least 51% by U.S. citizens, or a Community Development Corporation, an agricultural cooperative, or an Indian tribe • Principal office must be located within a "Historically Underutilized Business Zone," which includes lands considered "Indian Country" and military facilities closed by the Base Realignment and Closure Act • At least 35% of its employees must reside in a HUBZone.

NOTE: [1] Additional incentives offered by the City of Bridgeport are the Urban Enterprise Zone, Arts and Entertainment District, and Foreign Trade Zone, see below.

Properties within the study area have been identified as eligible for the City's Urban Enterprise Zone. In addition, currently, a few industrial sites in the study area are approved as part of a Foreign Trade Zone.

Traffic

The historic land use patterns in the study area resulted in a grid network of streets consisting of higher functional arterials on the periphery and collector and local streets serving the internal neighborhoods. An extensive traffic count program was completed during the environmental assessment for the Seaview Avenue Corridor Project in 2001. Traffic count data for study area roads were also collected for a traffic signal inventory and evaluation program in 2000. These counts were extracted from the in-house database and used for the traffic operations assessments for this study. Current volumes along the state routes in the study area provided an indication of growth in traffic since the previous data collection efforts.

Inventory of the Road Network

The proposed Barnum rail station would be primarily located on a rectangular parcel along Barnum Avenue between Helen Street and Seaview Avenue. Outbound platforms and a waiting area would be installed on the south side of the main line between Hallett Street and Waterview Avenue along the current location of Crescent Avenue. The core study area encompasses the parcels within one-quarter mile of the proposed station site, with the surrounding context area extending out to one-half mile from the site. Because of the potential of the station project to act as a catalyst for economic development in East Side-East End neighborhoods, the East Bridgeport Development corridor was included in the broader study area. This corridor extends from the Port of Bridgeport in the south to the Lake Success EcoBusiness Park in the north.

The core and surrounding study areas are crossed by a well-established road network configured in an irregular grid pattern (***Figure 4, Principal Road Network***). The grid pattern is more pronounced in the East Side and less so in the East End.

The key roads providing access to the Barnum Station site include:

- **US Route 1—**Boston Avenue: Forms the northern border of the expanded study area and is a major east-west artery through the city. The road is functionally classified as a "principal arterial." Through the study area, it consists of four travel lanes, two in each direction. Between East Main Street (Route 127) and the vicinity of Seaview Avenue US Route 1 is separated into east- and westbound sections by Old Mill Green. The prevailing land use along this corridor is commercial/retail, especially along the south side of US Route 1. US Route 1 provides access to the Boston Avenue Industrial Park, Bridgeport Hospital, and Lake Success EcoBusiness Park.


Figure 4
Principal Road Network

- **Route 130**—Stratford Avenue and Connecticut Avenue: Forms the southern border of the expanded study area. It provides a connection between Interstate 95 (I-95) and Downtown Bridgeport and provides access to the Bridgeport train station. Route 130 is functionally classified as a "minor arterial" and consists of three-to-four travel lanes. Between the Downtown and Seaview Avenue, bi-directional travel is provided with two travel lanes eastbound and one travel lane westbound. However, westbound traffic tends to maintain two lanes even though the road is marked only for one lane. At Seaview Avenue, Route 130 splits into separate eastbound and westbound segments. The westbound section is known as Connecticut Avenue. The one-way couplet continues to the Stratford town line. The western section of this corridor is primarily vacant, as this section traverses the Steel Point redevelopment project area. The City has received a Tiger II grant totaling about $13.9 million to widen and improve the two-way section of Route 130 to serve as the gateway and main access to the Steel Point redevelopment project. The eastern section of the Route 130 corridor is a mix of multi-family residential and small commercial/retail uses. Route 130 through the area crosses two bridges; one over the Pequonnock River near the Downtown and the other over the Yellow Mill Channel near Seaview Avenue. Both bridges are moveable to accommodate waterborne transportation. Both the Pequonnock River and the Yellow Mill Channel are navigable.
- **Route 127**—East Main Street: Forms the western border of the expanded study area and is oriented in a north-south direction. It begins at Route 130 and extends through Bridgeport and into Trumbull to the north. Route 127 is functionally classified as a "minor arterial" and consists of two travel lanes, one in each direction. A partial interchange with I-95 is located on Route 127, providing a southbound on-ramp and a northbound off-ramp. The land use of this corridor is mostly small retail stores, interspersed with two-and-three family residential unit buildings. On-street parking is allowed along both sides of Route 127. The East Main Street Historic District is aligned along Route 127 from Crescent Avenue to Nichols Street.
- **Barnum Avenue**—Extends through the project core area in an east-west orientation and forms the north edge of the proposed station site. It is functionally classified as a "minor arterial." Two travel lanes are provided, one in each direction. A number of industrial properties are located along Barnum Avenue, including the Bridgeport Trade and Technology Center, Lacey Manufacturing, and the Brilco Business Park. Residential properties are located primarily along the north side of the road and at the eastern end of the study area.
- **Arctic Street and Grant Street**—Runs parallel to and two blocks north of Barnum Avenue, extending from Knowlton Street to the west to Barnum Avenue to the east. In the vicinity of Seaview Avenue, the road changes its name from Arctic Street to Grant Street. It is functionally classified as a "minor arterial." Two travel lanes are provided, one in each direction.

On-street parking is allowed along both sides. Residential uses are located along both streets, but several industrial properties have access from Arctic Street and Grant Street, including the currently vacant RemGrit parcel. Bridgeport Hospital, the city's largest employer, is located on Grant Street at the eastern end of the corridor.

- **Seaview Avenue**—Extends from the Port of Bridgeport in the south to US Route 1 in the north. It passes through the expanded study area in a north-south direction. Seaview Avenue is under local jurisdiction. Its functional classification is "minor arterial" from the I-95 northbound ramps to US Route 1 and "collector" south from the I-95 ramps to its terminus at Central Avenue. A full direction interchange with I-95 is located on Seaview Avenue. Two travel lanes are provided, one in each direction, and on-street parking is generally allowed along both sides of the road. The exception is the section north of Barnum Avenue to US Route 1. On-street parking is prohibited on the west side of Seaview Avenue from Barnum Avenue to Boston Avenue (US Route 1). Multi-family residential, consisting of two-to-three unit buildings, is the prevailing land use along the east side of Seaview Avenue, while industrial parcels are scattered along the west side. South of I-95, Seaview Avenue provides access to the Bridgeport Regional Maritime Center and the Cilco Terminal. Small retail stores are located on many of the main intersections along the corridor. Seaview Avenue passes through the Deacon's Point Historic District, which extends between Deacon Street and Williston Avenue.
- **Central Avenue**—Extends from the Port of Bridgeport to the south to US Route 1 in the north, passing through the expanded study area in a north-south orientation. Central Avenue is a locally-maintained "collector." Two travel lanes are provided, one in each direction, and on-street parking is generally present along both sides. Multi-family residential, consisting of two-to-three unit buildings, is the prevailing land use along Central Avenue north of I-95. The southern end of Central Avenue is sparsely developed, with uses related to waterborne activities.
- **Waterview Avenue**—Extends from Route 130 to Crescent Avenue and is aligned along the west side of the Yellow Mill Channel. It provides bi-directional travel along two lanes and is functionally classified as a "collector." Most of the land along Waterview Avenue is vacant, undeveloped, or underdeveloped. The northeast corner of the Steel Point development project is along Waterview Avenue and the northern end borders the former site of Father Panik Village housing complex. The housing project was demolished in the 1980s and remains vacant. The Bridgeport Housing Authority retains control of the site The recently opened Barnum Elementary School is located on Waterview Avenue and a small park is located at the north end of this corridor along the Yellow Mill Channel.
- **Crescent Avenue**—Begins at Knowlton Street, just east of the recently removed Congress Street Bridge, and ends at Bunnell Street. It provides access into the Seaview Avenue Industrial Park. Functionally classified as

a collector, Crescent Avenue is aligned parallel to the south side of the elevated New Haven main line. The westbound travel lane is directly adjacent to the rail viaduct and only a limited shoulder area is available. At about Hallett Street, a narrow strip of land separates the travel from the elevated structure, Bi-directional traffic is carried with one travel lane in each direction. Although on-street parking is not prohibited, the narrow width of Crescent Avenue, as well as the closeness of the elevated rail structure, makes parking along the road impractical.

- **Pembroke Street—** Is a north-south "collector" extending from Route 130 to US Route 1. One-way travel is designated from Route 130 to Barnum Avenue; two-way traffic is provided north of Barnum Avenue to US Route 1. Pembroke Street is primarily an older residential street, with a few small neighborhood retail stores. On-street parking is allowed on both sides. Travel along Pembroke Street is controlled by frequent all-way stop control.
- **Helen Street—** Is a short local "collector" from US Route 1 to Barnum Avenue. It provides access to several industrial parcels located in the Boston Avenue Industrial Park and the vacant RemGrit property. On the west side of Helen Street, the land use is residential. The Luis Munoz Martin Elementary School is located at the north end of Helen Street at Hallett Street. The lower block between Barnum Avenue and East Washington Avenue was abandoned by the City many years ago.

The existing conditions and characteristics of the principal roads are presented in ***Table 15***.

Table 15
Summary of Key Roadway Characteristics in the Study Area

No.	Roadway	Terminus A	Terminus B	Functional Classification	Primary Land Use in Area	On-Street Parking
1	Interstate 95	Exit 28 at Route 127	Exit 30 at Route 113	Interstate	NA	NA
2	US Route 1-Boston Ave	Route 127-East Main Street	Central Avenue	Principal Arterial	Commercial	Along the south side
3	Route 127-East Main St	US Route 1-Boston Avenue	Route 130-Stratford Ave	Minor Arterial	Commercial-Residential	Along both sides
4	Route 130-Stratford Ave	Route 127-East Main Street	Central Avenue	Minor Arterial	Industrial-Vacant	No parking west of Seaview Avenue; along both sides east of Seaview Avenue
5	Route 130-Connecticut Ave	Seaview Avenue	Central Avenue	Minor Arterial	Industrial-Vacant	Along both sides
6	Arctic Street	Route 127-East Main Street	Seaview Avenue	Minor Arterial	Residential-Industrial	Along both sides
7	Barnum Avenue	Route 127-East Main Street	Grant Street	Minor Arterial	Industrial	Along both sides
8	Central Avenue	US Route 1-Boston Avenue	Seaview Avenue	Collector	Residential-Industrial	Along both sides
9	Crescent Avenue	Route 127-East Main Street	Seaview Avenue	Collector	Residential-Industrial	Along both sides
10	Grant Street		Barnum Avenue	Minor Arterial	Residential-Industrial	Along both sides
11	Helen Street	US Route 1-Boston Avenue	Barnum Avenue	Collector	Residential-Industrial	Along both sides
12	Pembroke Street	US Route 1-Boston Avenue	Route 130-Stratford Ave	Collector	Residential	Along both sides
13	Seaview Avenue	US Route 1-Boston Avenue	I-95 NB Ramps	Minor Arterial	Industrial-Residential	Along east side; prohibited on west side
14	Seaview Avenue	I-95 NB Ramps	Central Avenue	Collector	Industrial-Residential	Along both sides
15	Waterview Avenue	Crescent Avenue	Route 130-Stratford Ave	Collector	Residential-Vacant	Along both sides

■

Traffic Control

There are 206 signal-controlled intersections in the City of Bridgeport. Over half of these (111) are on a state road or are owned and maintained by the state. The remainder is under the jurisdiction of the city. Over the last fifteen years, an extensive traffic signal modernization program has been underway to replace, modernize, interconnect, and place under computer control traffic signals throughout the Bridgeport. These upgraded systems are linked to a central computer at the city's traffic operations control center and allow remote control of operations and adjustment of timing and phasing plans to better respond to time-of-day conditions. Many locations include video monitoring.

Within the study area, 38 intersections are controlled by a traffic signal. Most are located on a state route, including eight intersections on US Route 1, eight along Route 127, and eleven along Route 130. These state routes form three-fourths of the perimeter of the study area. Within the study area, and especially the core area, only three intersections are controlled by a traffic signal. These are:

- Barnum Avenue and Seaview Avenue
- Barnum Avenue and Central Avenue
- Grant Street and Central Avenue

Within the core study area, main intersections are primarily controlled by all-way stop control. Minor intersections between a primary road and a minor street typically allow free flow on the main road and stop control on the intersecting street. Pembroke Street is an exception to this pattern in that almost all intersections along the corridor provide all-way stop control.

The location of traffic signals within the core and surrounding study areas are depicted in the following map (***Figure 5, Traffic Signal Locations***).

■

Existing Traffic Volumes

An extensive traffic count program was conducted in the area for the Seaview Avenue Corridor Project Environmental Assessment (EA) completed in 2000. In addition, the Barnum Avenue and Arctic Street/Grant Street corridors were surveyed in 1999 for an inventory of traffic signals in the City. Average daily traffic (ADTs) volumes were extracted from these studies for the principal road network for the Barnum Station feasibility study. While the previous data were collected in 2000, a comparison of these counts to more recent data from the Connecticut Department of Transportation's traffic count database suggest little or no change traffic volumes in the area and, in several cases, a decrease in ADTs. Because of the stable traffic conditions, the older data, projected to 2012, were used in this

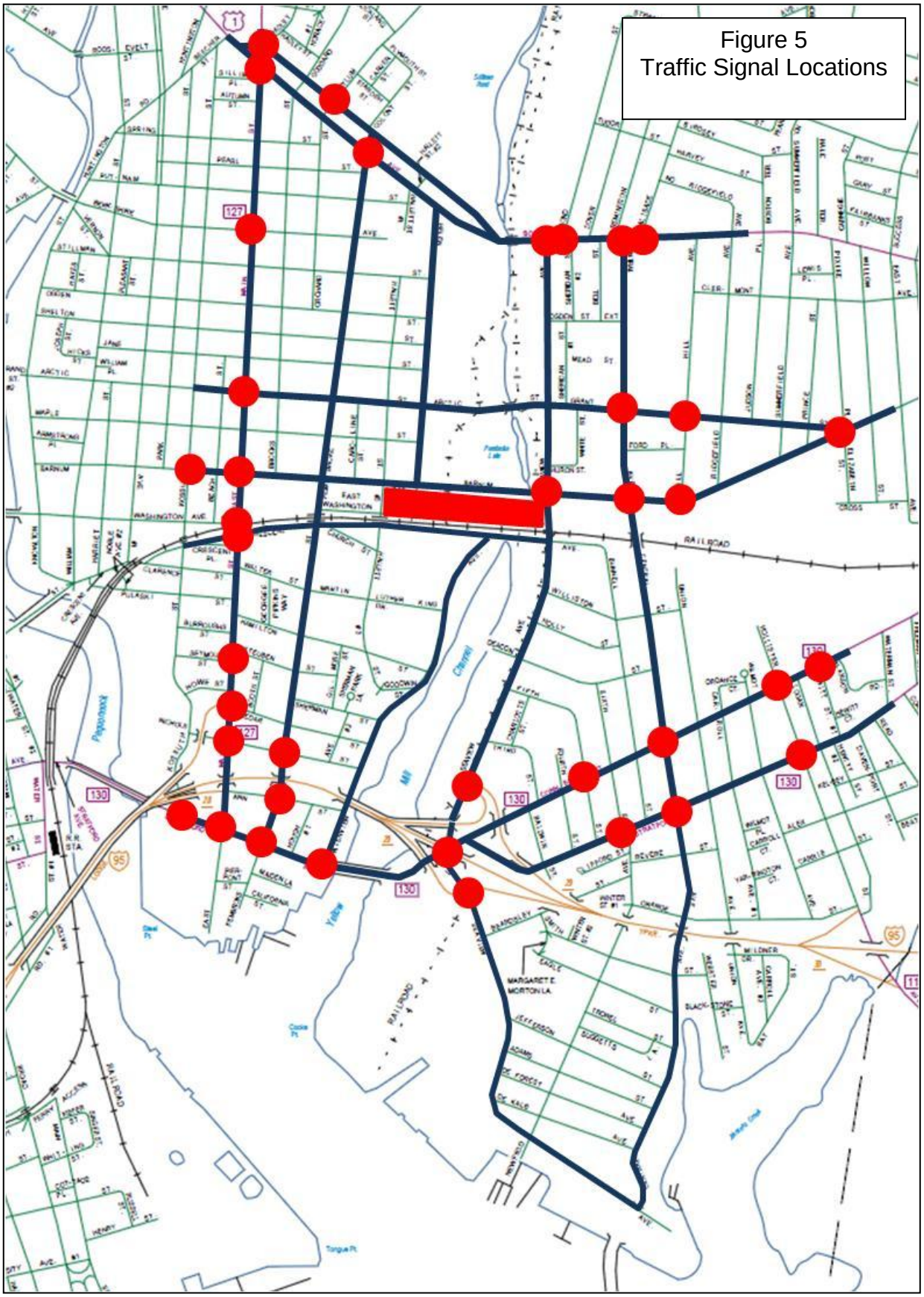


Figure 5
Traffic Signal Locations
RAILROAD
130
127
95

assessment. The traffic volumes on the principal roads within the study area are summarized in ***Table 16***.

Table 16
Study Area Average Daily Traffic (ADT) Volumes

	2000	2010	Percent Change
US Route 1	25,800	24,400	-5.4%
Route 127	8,300	8,500	2.4%
Route 130	12,000	13,300	10.8%
Arctic Street	3,500	3,300	-5.7%
Barnum Avenue	8,500	9,100	7.1%
Central Avenue	6,000	5,800	-3.3%
Crescent Avenue	3,400	2,800	-17.6%
Grant Street	5,300	5,600	5.7%
Helen Street	2,800	3,200	14.3%
Seaview Avenue	8,800	11,200	27.3%

SOURCE: GBRC traffic count database and ConnDOT traffic log.

The principal road network in the study area is comprised of one principal arterial, seven minor arterials, and six collector streets. As would be expected, the higher class roads carried the higher traffic volumes. US Route 1 along the northern edge of the study area has an average daily volume of about 24,400 vehicles per day (vpd). Between East Main Street and Central Avenue, volumes are in the 27,700-to-29,100 vpd range. Despite these high traffic volumes, the data indicate a 5.4% decrease in ADTs from 2000 to 2010.

Route 130, comprised of Stratford Avenue west of Seaview Avenue and the one-way couplet of Stratford Avenue and Connecticut Avenue, forms the southern border of the study area. While the road serves as a primary access corridor into the Downtown area and has one full and one partial interchange with I-95, the ADTs average only about 13,300 vpd. Higher traffic volumes are recorded in the vicinity of East Main Street with an ADT of 14,000 vpd east of the road.

East Main Street (Route 127) is a retail corridor on the East Side and connects Route 130 in the south and US Route 1 at the north end of the study area. The current traffic volume along East Main Street averages about 8,500 vpd, a slight increase over 2000 data. Traffic flow is somewhat impeded by the adjacent land uses, narrower road width, on-street parking, and signalized intersections.

Seaview Avenue is a key north-south road through the study area, connecting Route 130 and US Route 1. It also provides access to the port area and several industrial sites. North of Route 130, the daily traffic volume averages about 12,500 vpd, with volumes reaching 14,700 vehicles per day between the I-95 southbound ramps. North of the New Haven rail line, traffic flow decreases to about 8,700 vpd. Parallel to Seaview Avenue, Central

Avenue handles less than half of the traffic with an average flow of about 5,800 vpd.

Barnum Avenue and the combined Arctic Street/Grant Street provide east-west movement through the area. Daily volumes range between 5,100 vpd and 12,700 vpd along Barnum Avenue and 4,600 vpd and 5,600 vpd along Arctic and Grant Streets. The lower volumes are recorded at the west ends of the roads, with the higher volumes occurring in the area of Seaview Avenue and Central Avenue.

South of the New Haven rail line, Crescent Avenue is the only other east-west roadway but it extends essentially only to Seaview Avenue. It continues for short distance to Bunnell Street. Volumes range between 1,200 vpd and 4,400 vpd, with the higher traffic recorded at Seaview Avenue.

■

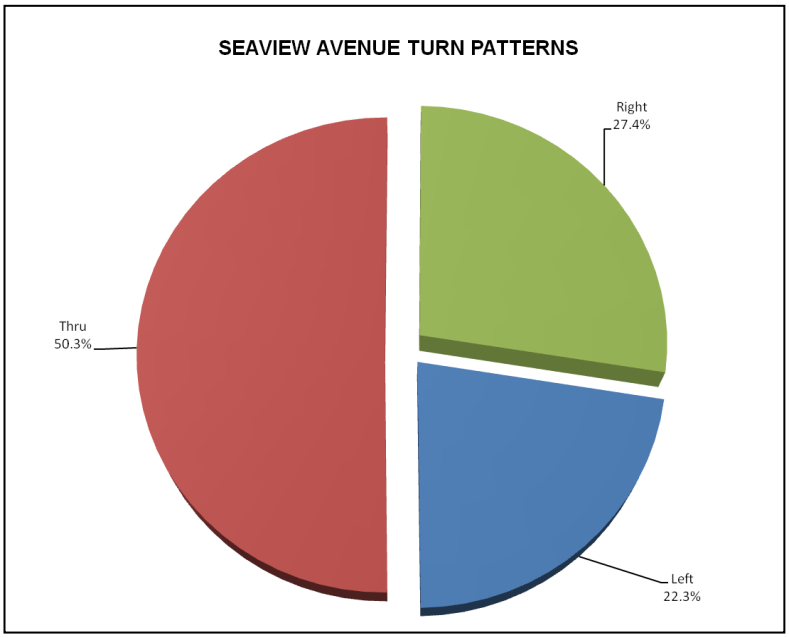
Turning Movement Data

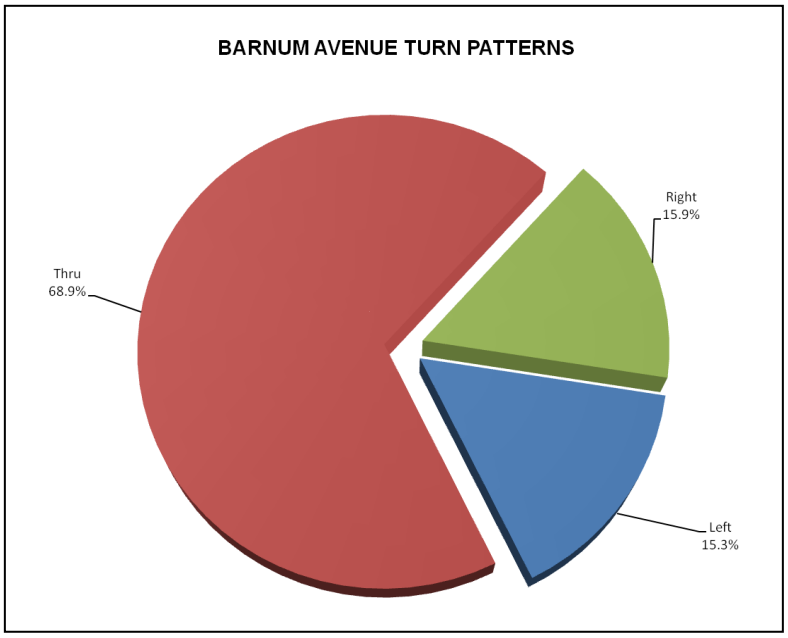
The primary access corridors to the Barnum Station site include Barnum Avenue, Arctic Street/Grant Street, and Seaview Avenue. Turning patterns at intersections in vicinity of the station site were extracted from past Seaview Avenue Environmental Assessment and the Traffic Signal Evaluation Study.

Turning movements are available for the following intersections:

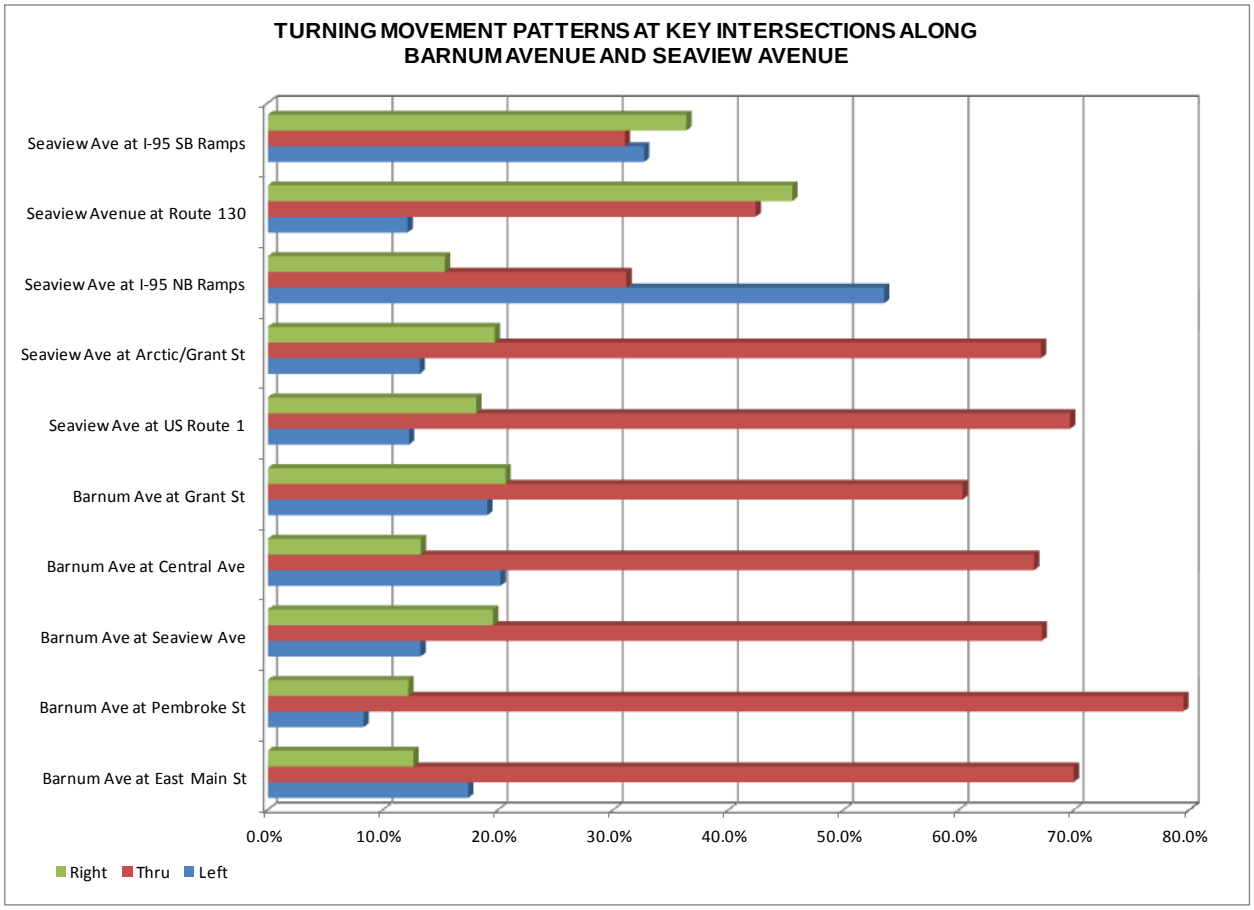
- Barnum Avenue at East Main Street
- Barnum Avenue at Pembroke Street
- Barnum Avenue at Seaview Avenue
- Barnum Avenue at Central Avenue
- Barnum Avenue at Grant Street
- Seaview Avenue at US Route 1
- Seaview Avenue at Arctic Street & Grant Street
- Seaview Avenue at I-95 southbound ramps
- Seaview Avenue at Route 130
- Seaview Avenue at I-95 northbound ramps

The prevailing movement at the key intersections is to continue straight through the intersection. Based on the survey data, about 68.9% of the vehicles traveling along Barnum Avenue went straight. However, for Seaview Avenue, only about half of the vehicles continued through the intersection. This pattern is affected by location and layout of the on- and off-ramps for I-95 that limit through movements. Turns are essentially split evenly between left and right turns as for both roads, about 19.7% of the vehicles turned left and 23.7% turned right.





The turning patterns are depicted in the following chart.



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Accident Data

Accident data were extracted from the Connecticut Department of Transportation's (ConnDOT's) accident record database for US Route 1, Route 127, and Route 130 corridors through the study area. This database includes a listing of reportable accidents by location for all state highways. The accident records provide good preliminary assessment of accident experience. However, the data are somewhat incomplete because it is limited to reportable accidents, defined as an accident that caused at least $1,000 in property damage or resulted in an injury, and does not include accidents that occurred on local roads. The data represent the most recent three period for which are available: January 2006 to December 2008.

As indicated in ***Table 17***, over the three-year period, 1,227 accidents occurred on the three state routes within the study area, about 409 per year. The highest number was recorded along US Route 1 with 173 accidents per year. Accidents along Route 127 averaged slightly less, with 160 accidents per year.

Table 17
Summary of Accident Data in the Study Area

Corridor	2006	2007	2008	Average
US Route 1-Boston Avenue	164	171	184	173
Route 127-East Main Street	165	175	140	160
Route 130-Stratford/Connecticut Ave	78	84	66	76
TOTAL	**407**	**430**	**390**	**409**

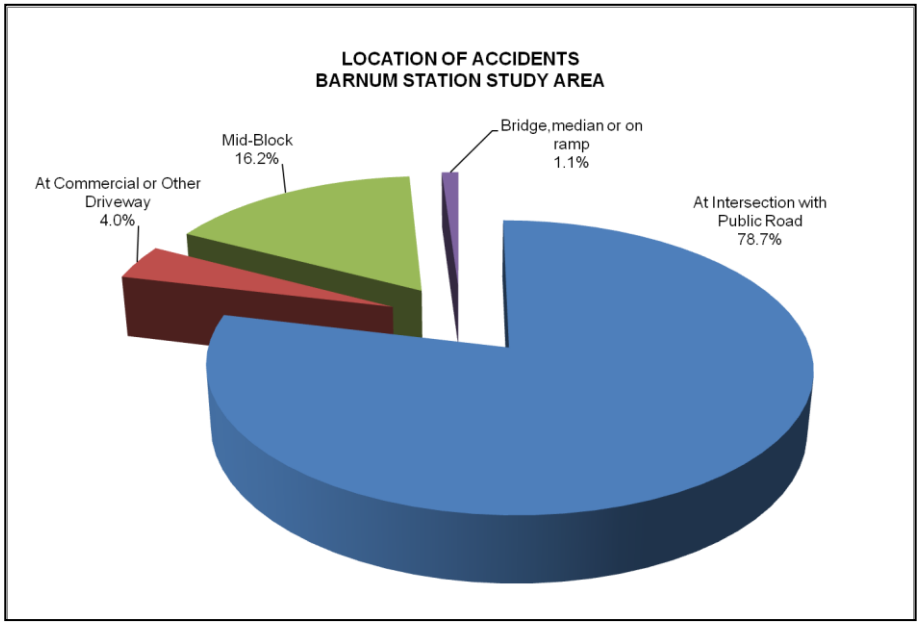
However, given the higher traffic volumes along US Route 1, the accident rate was less than along Route 127. Based on estimated annual traffic volumes, the accident rate along US Route 1 was about 19.4 accidents per million vehicles, whereas, on Route 127 it was 51.6 accidents per million vehicles. This indicates a much greater accident exposure for those traveling along Route 127 than on US Route 1. This result is not unexpected given the land use and layout of Route 127: small retail stores, narrow road width, numerous cross streets, and on-street parking. Accident rates are presented in ***Table 18***.

Table 18
Accident Rates per Million Vehicles in the Study Area

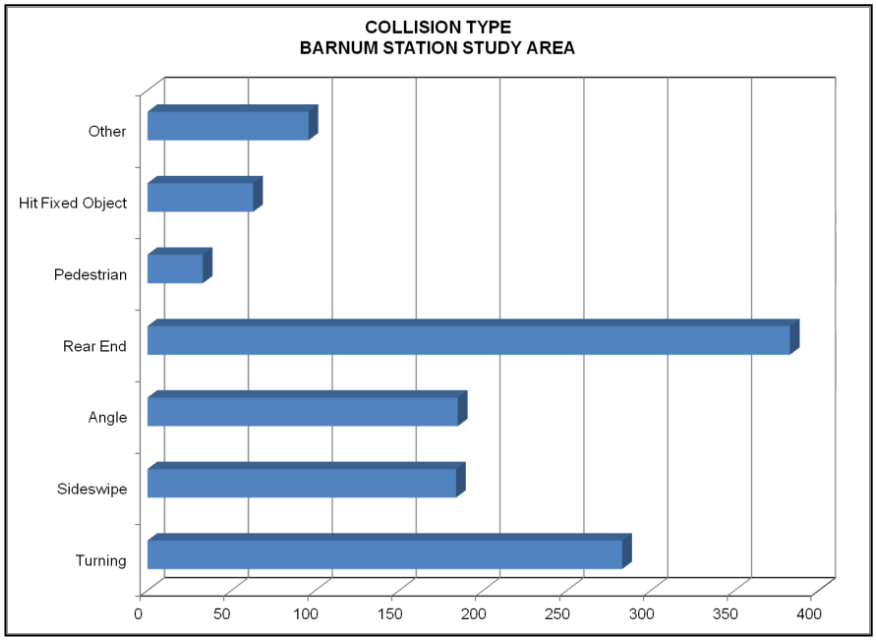
Corridor	Annual Average	ADT	Rate[1]
US Route 1-Boston Avenue	173	24,400	19.4
Route 127-East Main Street	160	8,500	51.6
Route 130-Stratford/Connecticut Ave	76	13,300	15.7
TOTAL	**409**	**15,400**	**72.8**

*NOTE: [1]Accidents rate per million vehicles = ADT * 365 / 1,000,000.*

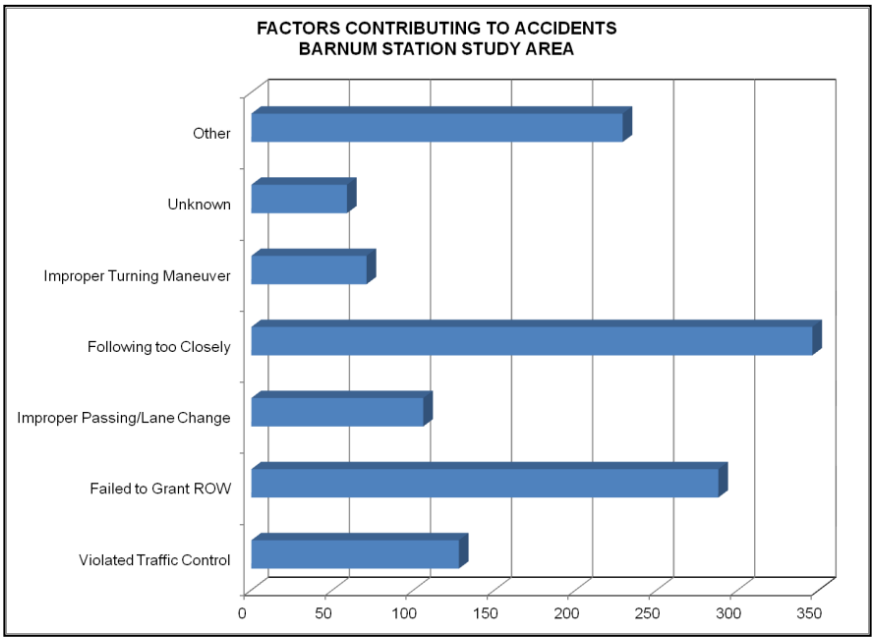
The majority of the accidents, about 78.7%, occurred at an intersection with a public road and another 4.0% happened at a commercial or residential driveway. Few accidents were recorded at a mid-block location.



Because the vast majority of accidents occurred at an intersection, the predominant collision type, about one-third, was rear end accidents. Turning and angle accidents were also over-represented in the type of collision, accounting for 23.1% and 15.1% of the total, respectively. Thirty-three accidents, 2.7% of all accidents, involved a pedestrian. While not a significant percentage of all accidents, the number is a cause for concern and indicative of need to enhance pedestrian safety along these roads.

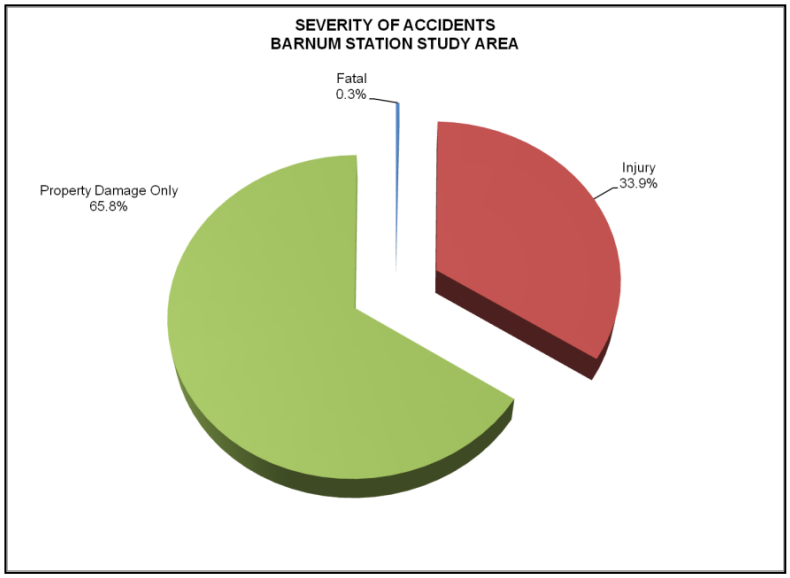


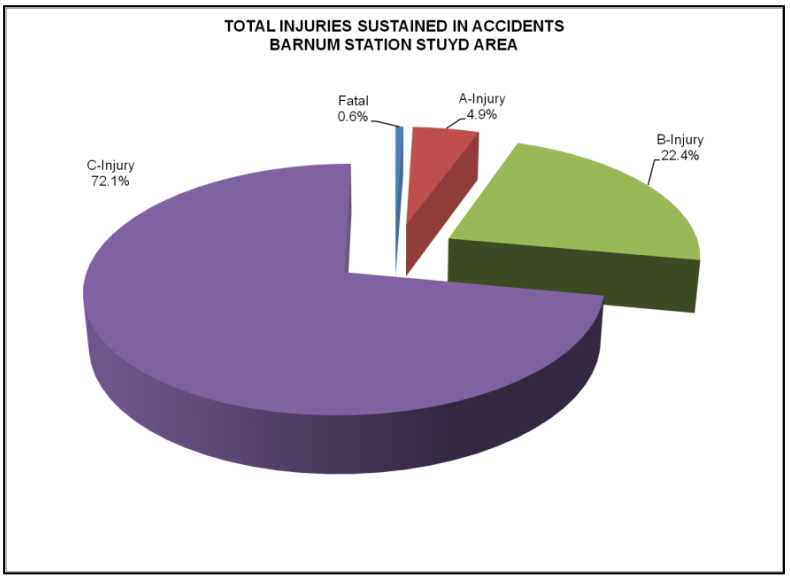
Most accidents are due to driver error and inattentiveness. Factors that contributed to an accident are related to the collision type. Most rear end accidents are caused by a driver following too close to the vehicle in front and turning accidents are due to a driver violating a traffic control or not granting the right of way. These were the three most cited factors for an accident occurring along US Route 1, Route 127, or Route 130.



The majority of the accidents resulted in only property damage to one or more of the involved vehicles. However, about 33.9% (416 accidents) caused 687 people being injured and four accidents resulted in a fatality.

Injuries are further categorized by the severity of the injury. A-injury accidents involve a debilitating injury that requires transport to a hospital for treatment. This category was recorded for 4.9% of all reported injuries. The second level of injury is classified as a B-injury. This is reported when there is a visible injury but the person is not transported to a hospital for treatment. About 22.4% of all injuries were classified as B-injuries. The remaining injuries (72.1%) were non-visible but the injured person complained of pain (C-injury).





For selected intersections for which traffic and accident data were available, the average number of accidents per year was tabulated and accident rates were calculated, see ***Table 19***. While the number of accidents provides an initial indication of safety, it is not the best measure of a hazardous location. It is better to relate accident incidence to exposure in terms of traffic. The amount of traffic passing through an intersection was calculated and converted to million entering vehicles (MEVs).

Table 19
Accident Rates for Selected Intersections within the Study Area

Intersection	Annual Accidents	MEV	Accident Rate[1]
US Route 1			
At Rte 127-East Main St	29	12.01	2.41
At Helen St	2	10.07	0.20
At Seaview Ave / Bond St	34	12.99	2.59
At Central Ave	6	11.02	0.54
Route 127			
At Rte 130-Stratford Ave	6	7.96	0.75
At Crescent Ave	6	4.12	1.37
At Barnum Ave	17	6.42	2.59
At Arctic Street	7	4.31	1.63
Route 130			
At Seaview Ave	19	8.94	2.12
At Central Ave	12	6.97	1.72

NOTE: [1]Per MEV.

Traffic volume and accident data were available for ten locations. The number of accidents ranged from a low of two per year at US Route 1 and Helen Street to a high of 34 accidents per year at US Route 1 and Seaview Avenue. Seventeen accidents each year are recorded at the Route 127 and

Barnum Avenue intersection, and 19 per year occur at the Route 130 and Seaview Avenue location.

Based on the accident rate, four intersections had an accident rate greater than two accidents per MEVs:

- US Route 1 at Route 127;
- US Route 1 at Seaview Avenue;
- Route 127 at Barnum Avenue; and
- Route 130 at Seaview Avenue.

The accident rates for these locations range between 2.12 per MEVs for the Route 130 and Seaview Avenue intersection and 2.59 per MEVs for the US Route 1 and Seaview Avenue intersection and the Route 127 and Barnum Avenue intersection. Because of these results, the accident analysis will be useful in the next phase of the project when off-site improvements are being considered. Once a preferred station site has been identified, the intersections with high accident rates will be reviewed and considered for off-site improvement.

■

Capacity Analyses

The level of service (LOS) concept indicates how well a particular road or intersection performs. It is dependent upon the type of road, the volume-to-capacity ratio, and the frequency and type of control. The calculation of level of service provides a basis for determining the adequacy or sufficiency of a road and the need for improvement to increase capacity and/or reduce congestion. The level of service of an intersection is rated alphabetically ranging from "A" to "F" with "A" representing ideal traffic conditions "F" indicating forced flow. LOS D is considered acceptable for peak hour conditions, while levels of service in the LOS E-to-F range are considered unacceptable and indicative of severe operating problems, even during peak hours. ***Table 20*** presents the LOS classifications for signalized intersections.

Table 20
Level of Service Classification—Signalized Intersections

LOS Classification	Average Delay (seconds/vehicle)	Description of Level of Service
A	Less than 5 sec.	Very good operations, free flow
B	5-to-15 seconds	Good operations, little delay
C	15-to-25 seconds	Acceptable operations, some delay
D	25-to-40 seconds	Congestion noticeable, moderate delay
E	40-to-60 seconds	Significant congestion, excessive delay
F	More than 60 seconds	Unacceptable congestion, extreme delay, breakdown conditions

The level of service at a signalized intersection is based on the amount of delay encountered by the average vehicle defined in terms of vehicle stop delay. The amount of delay is dependent on the cycle length of the signal, the amount of green time relative to the cycle length, the quality of the progression of traffic flow, and the capacity of the intersection in relationship to the volume of traffic. The quality of progression of traffic is important because the intersection will operate more efficiently if vehicles tend to arrive at the start of the green time as opposed to at the end.

The key corridor for this analysis is Barnum Avenue. The planned station will be located along Barnum Avenue, approximately between Helen Street and Seaview Avenue and will act as the main access corridor to and from the station. As described above, Barnum Avenue is a two-way, two-lane facility, with a mix of residential and industrial land uses. Traffic signals control traffic flow at Noble Avenue, Kossuth Street, Route 127 (East Main Street), Seaview Avenue, Central Avenue, and Grant Street. Generally, operations and flow are good, but movement is impeded by on-street parking, land use patterns, and cross street volumes.

The operations and levels of service at the traffic signals along Barnum Avenue were assessed using the Highway Capacity Software (HCS), a program developed to determine levels of service based on the procedures contained in the Highway Capacity Manual, developed by the Transportation Research Board (TRB).

The Barnum Avenue corridor is operated by the city as an interconnected and coordinated system. As a result, operations along Barnum Avenue are good with ample reserve capacity. The only exception is the intersection at Central Avenue. Mid-day and afternoon peak volumes create poor operations with LOS D conditions. Average vehicle delay is 36.7 seconds during the mid-day period and exceeds 45 seconds in the PM peak hour. Despite constrained operations, operations are acceptable, but reserve capacity on Barnum Avenue at this intersection is minimal and increases in traffic will likely cause the intersection to fall into an unacceptable level of service. The current level of service results are shown in ***Table 21***. Detailed reports from HCS are included as an attachment in **Appendix D**.

Table 21
Operating Levels of Service – Barnum Avenue Corridor

Intersection	AM Peak		Mid-Day Peak		PM Peak	
	Delay (Sec)	LOS	Delay (Sec)	LOS	Delay (Sec)	LOS
At Noble Avenue	19.0	B	23.2	C	33.5	C
At Kossuth Street	11.1	B	15.3	B	14.3	B
At Seaview Avenue	18.0	B	20.4	C	29.7	C
At Central Avenue	23.9	C	36.7	D	45.5	D
At Grant Street[1]	17.8	B	19.5	B	21.7	C

NOTE: [1]Intersection includes Elizabeth Street as the south leg and Pixlee Place as a fifth leg to the north.

■

Travel Time Survey

The level of service calculations provide an indication of how well traffic is moving through an intersection, but not necessarily how well it moves along a corridor. To better determine operations through the study, a travel time survey was conducted along Barnum Avenue from Knowlton Street to Bruce Avenue. The survey was conducted using a probe vehicle equipped with a distance measuring unit (DMI) attached to the vehicle's transmission. This allows a very precise measurement of distance and calculation of travel speed. The average travel speed over a section of road includes any variation in speed due to slow-downs, stops, and impedance caused by traffic. Travel time survey runs were conducted during the morning peak period starting at 7:00 AM and ending at 9:00 AM, the mid-day period from 11:00 AM to 1:00 PM, and the evening peak period between 4:00 PM and 6:00 PM.

For this survey, Barnum Avenue was divided into nine sections, each defined by a traffic signal location. The data were summed for each of these sections and averaged by direction and time of day.

Average travel speeds derived from the travel time survey runs varied only slightly by direction and time of day, ranging between a low of 17.7 miles per hour to a high of 19.1 mph. The slower speeds were attained in the westbound direction but the results are not significantly different. The average speeds included the time spent stopped at a red indication at a traffic signal. Stop delay, therefore, influenced the average speed of traffic.

Table 22
Average Travel Speeds—Barnum Avenue Corridor

	Average Speed
AM Eastbound	18.0
AM Westbound	18.7
Mid-Day Eastbound	18.8
Mid-Day Westbound	17.7
PM Eastbound	19.1
PM Westbound	17.5

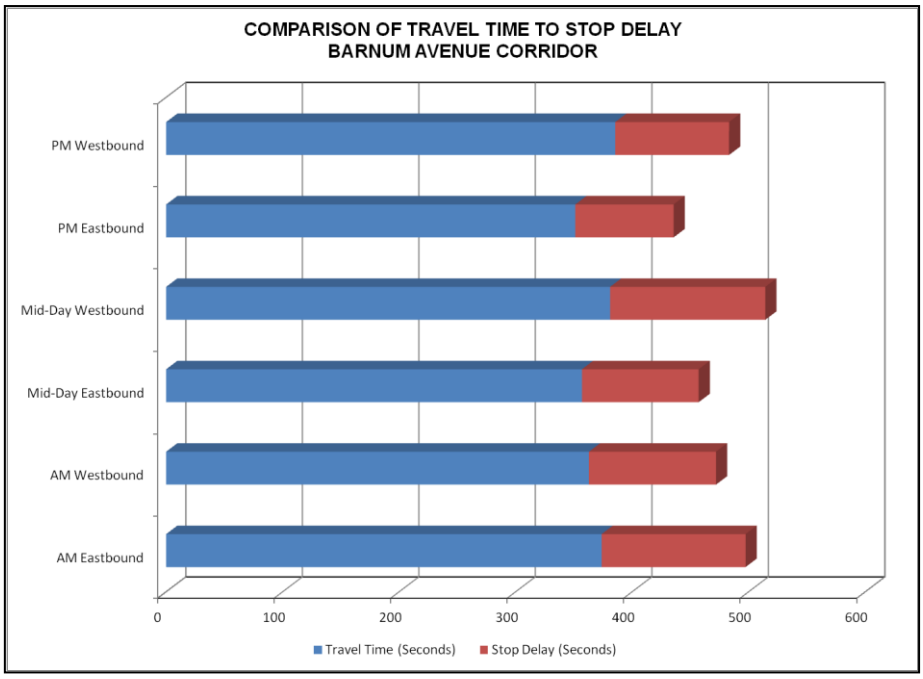
Total stop delay ranged from 84.4 seconds during PM peak hour in the eastbound direction to about 133.2 seconds in the westbound direction during the mid-day period. When stop delay is extracted from the calculations, travel speeds increase to between 23.5-and-27.2 mph. These speeds represent a free flow condition. However, they are still relatively slow and indicative of traffic and land use factors impeding flow.

Table 23
Average Free Flow Speeds—Barnum Avenue Corridor

	Stop Delay (Seconds)	Average Free Flow Speed[1]
AM Eastbound	123.6	26.9
AM Westbound	109.1	26.8
Mid-Day Eastbound	100.2	26.2
Mid-Day Westbound	133.2	27.2
PM Eastbound	84.4	25.2
PM Westbound	97.7	23.5

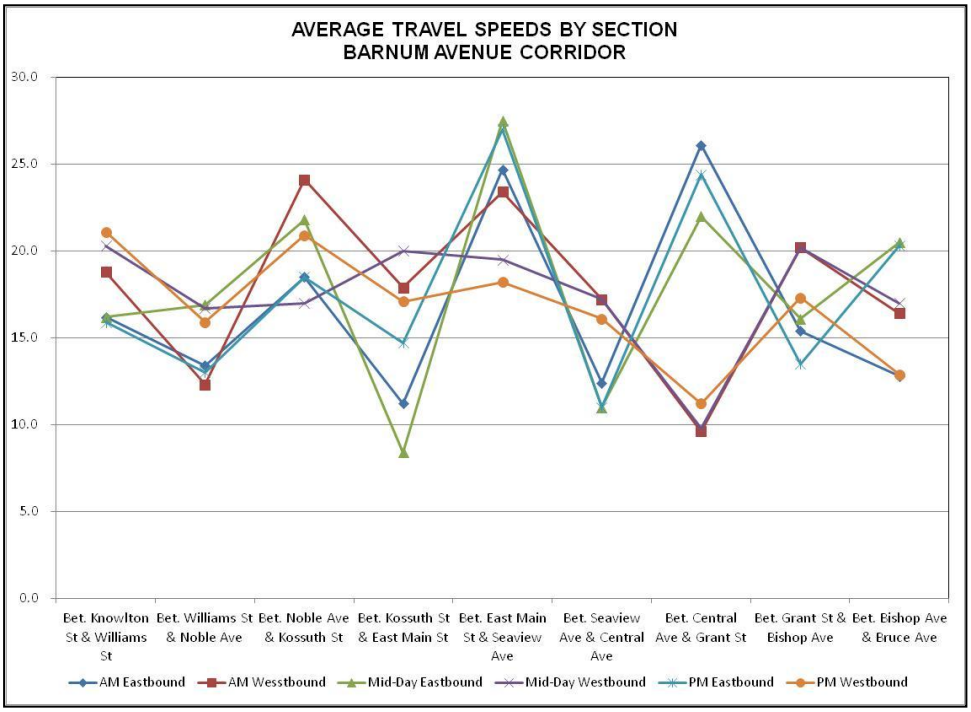
NOTE: Adjusted speed estimated by extracting stop delay.

The total time required to travel the Barnum Avenue corridor averaged slightly more than six minutes. As shown above, stop delay amounted to almost two minutes. It accounted for between 25% and 33% of the time it took to travel the 1.8 miles from Knowlton Street to Bruce Avenue.



When the data were broken-down by section, a pattern emerged that indicated that travel speeds were better along the section between East Main Street and Seaview Avenue. This is the longest section of Barnum Avenue uninterrupted by a traffic signal; therefore, stop delay was lowest. The Central Avenue to Grant Street section also experienced better travel speeds, but slow travel speeds were exhibited for several time periods. The longest travel times and slowest speeds were recorded along the sections between Williams Street and Noble Avenue and from Seaview Avenue and Central Avenue.

Average travel speeds by section are depicted in the following chart.



Parking

East Bridgeport is an old, mixed-use area that grew from a rural, farming existence to a high density residential, commercial and industrial land use pattern at a time when the private automobile had not yet been invented and people relied on foot and horse transportation. As a consequence, few houses had driveways, roads were narrow and buildings were located close to the street line. Today, travel patterns are much different. Almost all own a private vehicle and there is substantial need to accommodate automobile travel and for parking of cars.

On-street parking is prevalent through the East Side and East End neighborhoods. It is allowed on all streets and few restrictions apply. Currently, on-street parking is only prohibited on the south side of Stratford Avenue (Route 130) from East Main Street (Route 127) to Seaview Avenue and along the west side of Seaview Avenue from Barnum Avenue to Boston Avenue (US Route 1). Other no parking locations include designated commercial loading zones and short sections in advance of an intersecting street. Grant Street has a parking prohibition in front of Bridgeport Hospital between Central Avenue and Mill Hill Avenue.

Off street parking lots are scattered through the area. All are associated with an on-site use or development. There are no general public parking lots in the

study area. Several large vacant parcels are located along the New Haven rail line. Two are next to the Bridgeport Trade and Technology Center. Both are identified as potential development sites.

Transit

Local bus service operated by the Greater Bridgeport Transit covers the Barnum Station study area extensively and almost the entire area is within a short walk distance to a bus route. Commuter and intercity rail service is available at the Bridgeport rail station located in the Downtown area.

Local Bus Service

The Greater Bridgeport Transit (GBT) provides fixed-route and demand responsive public bus service in the Greater Bridgeport planning region, serving Bridgeport, Fairfield, Stratford and Trumbull with additional local and express services extending into Monroe, Shelton and Derby. Inter-district services (the Coastal Link) extend into Norwalk, Westport, Milford, and accommodate transfers with other transit systems, including Connecticut Transit (CT Transit New Haven and Stamford Divisions), Norwalk Transit District (NTD), Milford Transit District (MTD), Housatonic Area Regional Transit (HART), and Valley Transit District (VTD).

The local, fixed-route bus system consists of 19 routes, with various route extensions and branches to extend coverage. Two routes (19X and 22X) provide limited stop and express service during the morning and evening peak hours. The GBT fixed route system is radial in that most routes begin, end, or pass-through Downtown Bridgeport. The downtown terminal acts as a pulse point for the system to facilitate transfers between routes and better coordinate operations.

The study area is well served by fixed route operations. Eight GBT bus routes currently pass through and serve the core and surrounding study area, providing typically 30-minute headways. Reduced service is offered on the weekend and holidays, with headways increasing to 60 minutes on most routes.

The routes are described in ***Table 24*** and illustrated in ***Figure 6, Local Bus Routes***. The designated bus stop locations are shown in ***Figure 7, Local Bus Stops*** and summarized in ***Table 25***.

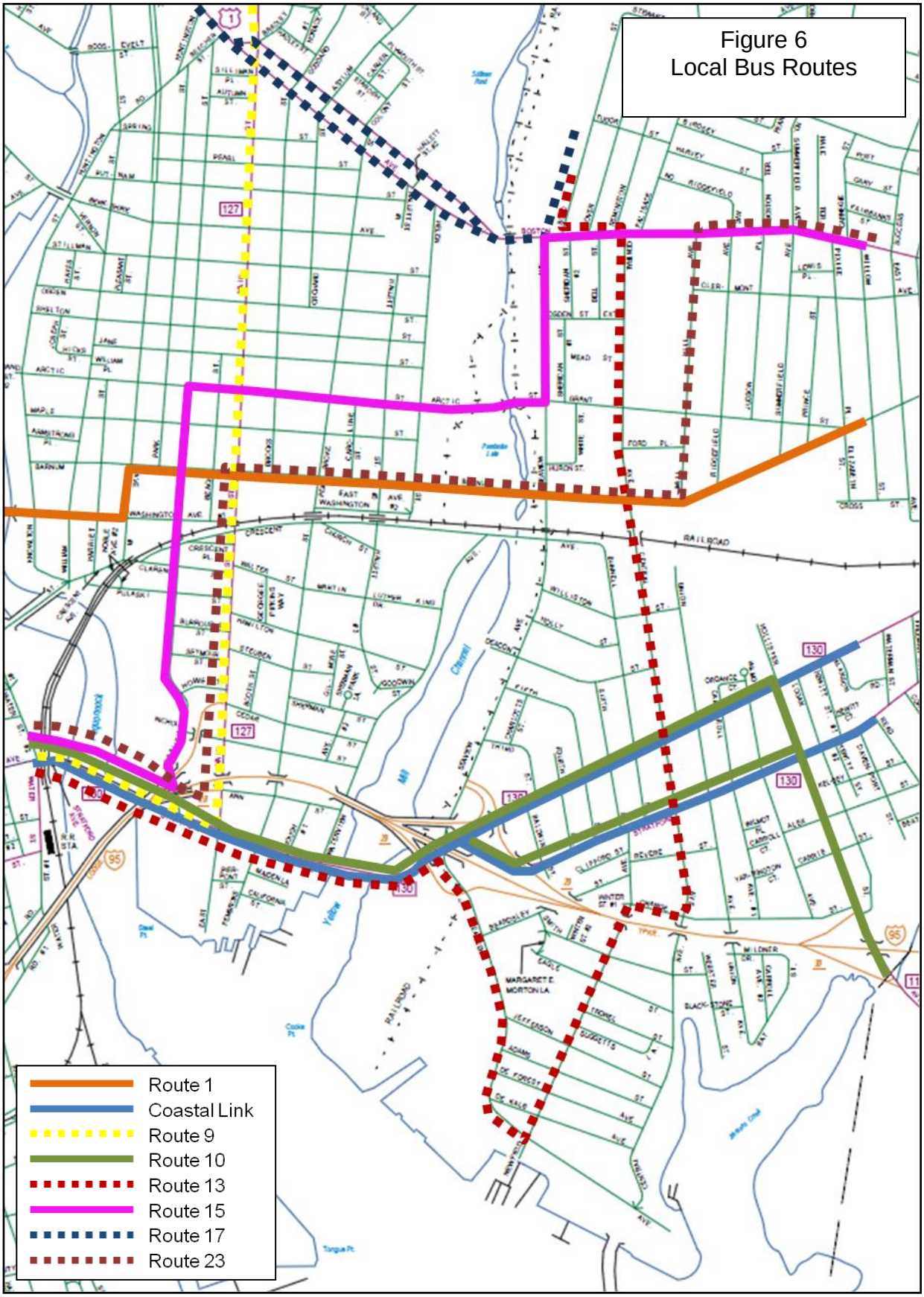


Figure 6
Local Bus Routes
Route 1
Coastal Link
Route 9
Route 10
Route 13
Route 15
Route 17
Route 23

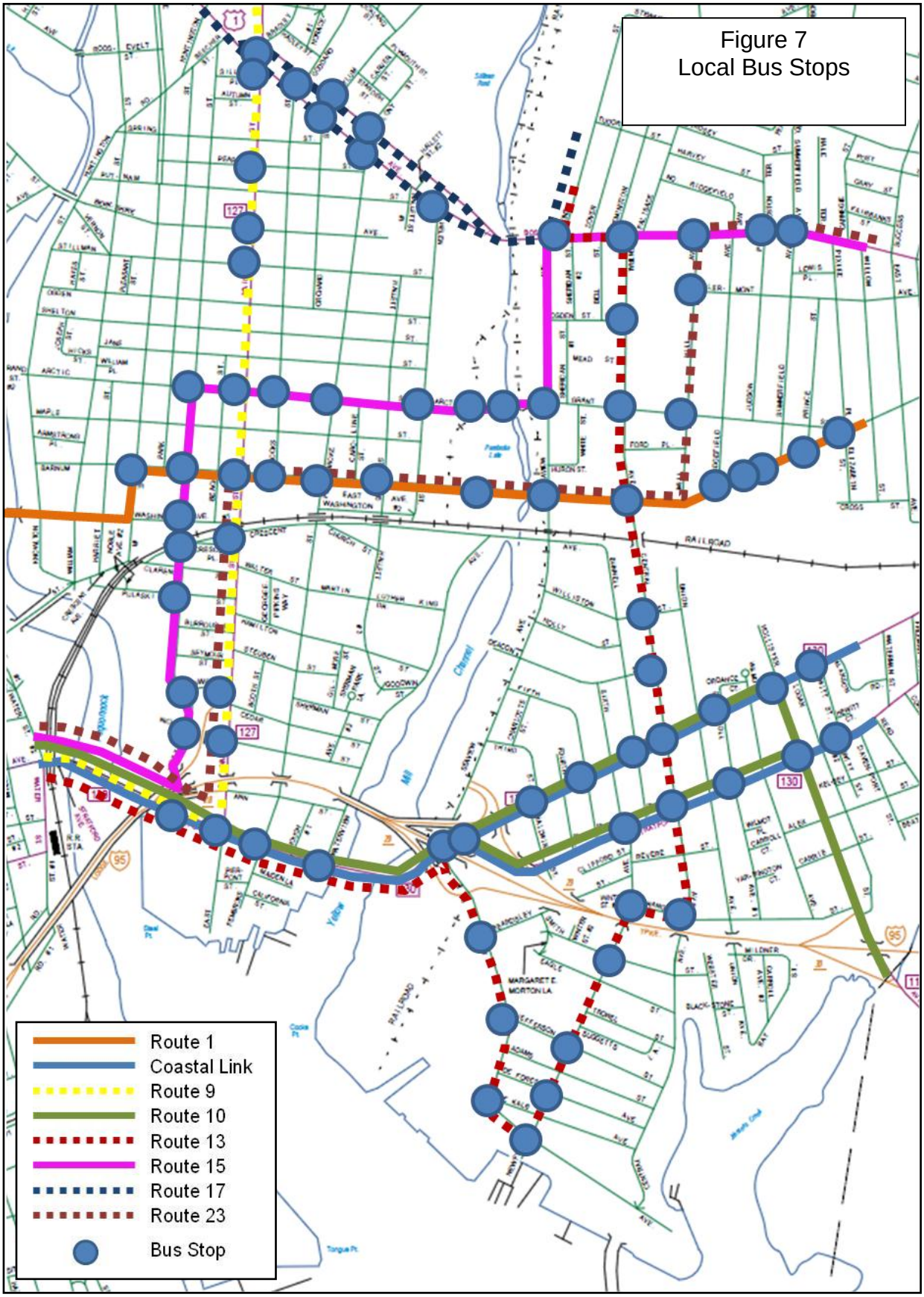


Figure 7
Local Bus Stops
Route 1
Coastal Link
Route 9
Route 10
Route 13
Route 15
Route 17
Route 23
Bus Stop

Table 24
Summary of Local Bus Routes—Barnum Station Surrounding Study Area

Bus Route	Origin	Destination	Number of Stops[1]		Down-town Bus Station	Route through Study Area	Frequency (minutes)		
			In	Out			Week-day	Satur-day	Sun-day
1	University of Bridgeport	Dock Shopping Center	11	12	Yes	Barnum Avenue	30	30	60
CL	Norwalk Wheels Hub	CT Post Mall	12	10	Yes	Stratford Ave-CT Ave	20	30	60
9	Seaside Park	Hawley Lane Mall, Trumbull Corp. Park	10	8	Yes	East Main Street	30	30	60
10	Black Rock Turnpike	Main St & Barnum Ave	11	8	Yes	Stratford Avenue-CT Ave	30	30	60
13	Bus Terminal	Success Park	22	22	Yes	Central Avenue	30	60	60
15	Bus Terminal	Derby Rail Station	14	15	Yes	Grant St-Arctic St	30	60	60
17	Bus Terminal	Success Park	6	6	Yes	US Rte 1-North Ave	30	30	NA
23	Bus Terminal	Derby Rail Station	11	10	Yes	Grant St-Arctic St	60	NA	NA

NOTE: [1]Number of stops within the study area. Inbound is service towards downtown Bridgeport; outbound is service away from the downtown.

Table 25
Summary of Bus Ridership by Route—Barnum Station Study Area

GBT Bus Route	Barnum Station Area		GBT System Total
	Boardings	Alightings	
Coastal Link	88	92	2,311
Route 1	185	178	2,116
Route 9	140	124	1,475
Route 10	62	44	1,377
Route 13	172	155	775
Route 15	107	108	779
Route 17	38	45	1,000
Route 23	43	32	260
Total	**836**	**778**	**10,094**

Annually, the GBT system carries about 5.2 million passengers. Service is operated over 187,000 hours and revenues exceed $3.9 million.

Within and through the Barnum Station study area, designated bus stops are located at most principal intersections. The frequency and coverage of the bus stops provide many opportunities for accessing a bus and reasonable walking distances. Based on ridership data, about 10,100 passengers use one of the GBT bus routes that pass through the study area each day, with about 1,600 riders getting on or getting off within the study area.

GBT Route 1, aligned along Barnum Avenue, handles the highest number of passengers daily with 185 people boarding and 178 exiting a bus. About 327 passenger movements are made on and off GBT Route 13 buses (Central Avenue) and another 264 movements are made at stops served by GBT Route 9 (East Main Street).

The most heavily used bus stop within the study area is located at the intersection of Grant Street and Mill Hill Avenue. On average, 113 bus riders board and alight at this intersection. An additional 100 riders use the bus stop at Grant Street and Central Avenue. These two bus stops directly serve Bridgeport Hospital. GBT Routes 13, 15 and 23 make stops at the locations. Other high activity locations include Barnum Avenue at East Main Street with 103 boardings and alightings each day, East Main Street at Arctic Street with 93 movements, Connecticut Avenue at Central Avenue with 88 ons and offs, and Barnum Avenue at Central Avenue with 76 passenger exchanges.

■

Commuter Rail Service

Commuter rail service offers a vital alternative for travel within and beyond Connecticut, especially lower Fairfield County and New York City. The Metro-North Railroad, a subsidiary of the New York Metropolitan

Transportation Authority, operates commuter trains through Bridgeport on the electrified New Haven main line (NHL-ML). The NHL-ML is one of five commuter rail lines operated by Metro-North Railroad in the New York Metropolitan area.

The NHL-ML runs east-west along the southwestern shoreline of the state between New Haven and New York City. Commuter rail service is oriented towards travel to and from New York City. Peak service consists of trains headed in-bound toward New York City (Grand Central Terminal) in the morning and out-bound from New York City during the evening. The State of Connecticut owns and maintains the portion of the NHL-ML between the state line and New Haven. The right-of-way is comprised of four main tracks (three in one section), constructed with continuous welded rail. The NHL-ML is electrified using overhead catenary wires. It is maintained at Federal Railroad Administration (FRA) Class 4 track standards.

In addition to main line service, three branch lines connect to the main line. The Bridgeport station is a terminus of the Waterbury Branch Line (NHL-WTY) extending from Waterbury to the interlocking on NHL-ML at Devon. Waterbury branch line trains continue on the main line making stops at Stratford and Bridgeport. The NHL-WTY is non-electrified and single-track. These line features limit and constrain the amount and level of service that can be effectively provided regardless of demand.

Several Shore Line East trains, operated by the Connecticut Department of Transportation (ConnDOT) east of New Haven, continue past New Haven and make stops at Bridgeport and Stamford. Amtrak operates inter-city and inter-state service over the NHL-ML under an agreement with ConnDOT, making stops at Bridgeport.

There are 20 stations along the NHL-ML within Connecticut, five in the Greater Bridgeport Region: Stratford, Bridgeport, Fairfield (Town Center), Southport and the recently opened Fairfield Metro Center. As depicted in ***Table 26***, the stations are relatively close together with an average of only about 2.5 miles separating the stations. High level platforms are provided at all stations and in-door waiting areas are available at Bridgeport, Fairfield and Fairfield Metro Center stations.

Table 26
Distance Between Rail Stations—New Haven Main Line

Station	Distance to Next Station (Miles)	
	To East	To West
Stratford	4.3	3.6
Bridgeport	3.6	1.5
Fairfield Metro Center	1.5	3.3
Fairfield (Town Center)	3.3	1.7
Southport	1.7	1.7

Data on passenger boardings are available from ConnDOT and is presented in ***Table 27***. Over the past several years, ridership on the NHL has increased significantly, partly in response to rising gasoline prices. Total annual ridership is currently about 37.7 million passengers. Boardings from the region's rail stations total about 7,900 persons per day. (Note: No ridership data are available for the Fairfield Metro Center station as of this writing.) The busiest stations are Fairfield (Town Center) and Bridgeport, with 3,110 and 3,009 passenger boardings per day, respectively. The majority of the riders board during the morning peak period, defined as trains arriving at Grand Central Terminal between 5:44 am and 10:00 am. Of the daily total, about 71.4% of the passengers board a peak period train. The Bridgeport station has the lowest percentage of riders boarding during the morning peak period at 63.5%.

Table 27
Weekday Passenger Boardings—Metro-North Railroad and Shoreline East

Station	Boardings	AM Peak	Off Peak
Stratford	1,427	80.7%	19.%
Bridgeport	3,110	63.5%	36.5%
Fairfield Metro Center	NA	NA	NA
Fairfield (Town Center)	3,009	74.9%	25.1%
Southport	375	74.4%	25.6%
TOTAL	**7,921**	**71.4%**	**28.6%**

Dedicated commuter rail parking is provided and the host communities operate parking permit programs. Fairfield and Stratford over-subscribe parking permits and maintain wait lists. About 1,000 permits are issued monthly for the Bridgeport Transit Garage and surface lot and excess capacity is available for new subscribers. While ridership counts have not been completed at the new Fairfield Metro Center station, parking permit data reveal how popular it has become in the short time since its opening. For the July through December time period, 1,219 permits have been issued for the station. ***Table 28*** presents the commuter rail parking capacities along the New Haven Main Line.

Table 28
Dedicated Rail Parking Capacity—New Haven Main Line

Station	Permit Parking	Daily Parking
Stratford	205	80
Bridgeport (Garage)	1,000	400
Bridgeport (Lot)	181	7
Fairfield Metro Center	1,000	369
Fairfield (Town Center)	861	355
Southport	146	32
TOTAL	**3,393**	**1,243**

The five rail stations in the Greater Bridgeport Region provide over 4,600 spaces, most are reserved for commuters with a valid permit. These facilities are well used and occupancy rates approach 100% on a daily basis. Limited commuter parking has become an issue at NHL-ML stations and the lack of sufficient capacity is considered a constraint to increased ridership.

In an attempt to satisfy demand, satellite lots have been designated for rail parking.

The need for parking space is essential because of the high percentage of commuters that drive to the stations and park. About 87.9% of rail commuters arrive at the station via a private automobile, most driving alone and parking at the station. Publically provided parking spaces are generally not sufficient to meet the demand and commuters are forced to find alternate parking in nearby private lots, on street, or in commercial lots reserved for customers. While local bus service is available to the Stratford, Bridgeport, and Fairfield stations, few rail passengers take advantage of the public transit connection. Even at Bridgeport, only 9.3% of the riders arrive at the station via a local bus.

Several rail projects have been completed or are in the planning stages to address parking shortages and meet ridership demands in the region. In Bridgeport, a 950-space parking garage was built as part of the Intermodal Transportation Center project. An expansion project was completed in 2011 that added two floors and 450 spaces to the garage. In addition, the area under the I-95 viaduct adjacent to the transit garage was converted into a rail parking lot and increased the parking supply by 186 spaces.

A new parking garage had been planned for the Stratford train station that would have constructed a 600+ parking garage. Because of fiscal constraints, these plans have been scaled back to include expansion of the existing surface lots. Lot expansions will occur on both sides and add about 700 spaces to the overall parking supply at Stratford.

The Town of Fairfield for many years has oversubscribed its rail parking permits and maintained a waiting list that exceeded 2,000 names. Opportunities to expand the Fairfield rail station were limited and expansion plans deemed unacceptable due to the potential impacts to the Town Center area. As an alternative, the Town advanced a public-private partnership to redevelop a former industrial site into an office park complex and the new Fairfield Metro Center trail station. The project included a 1,500-space surface parking lot.

Rail service on the NH-ML is oriented towards New York City. Over half (54.4%) of all daily passengers boarding from a station in the region are destined to Grand Central Terminal in Manhattan. Despite this, intrastate travel has become increasingly important. Better and more frequent service

has been instituted to meet intrastate trip purposes, especially those oriented to Stamford.

Table 29
Destination of Rail Commuters—New Haven Main Line

Station	Stamford	Grand Central Terminal
Stratford	37.4%	41.7%
Bridgeport (Garage)	40.5%	37.4%
Fairfield Metro Center	NA	NA
Fairfield (Town Center)	19.3%	74.3%
Southport	7.6%	84.9%
TOTAL	**30.3%**	**54.4%**

Pedestrian and Bicycle Facilities

The current urban form of the City of Bridgeport exhibits a challenging land use pattern for the integration of bicycle and pedestrian oriented infrastructure improvements. Historically, Bridgeport developed with a strong reliance on the accommodation of industrial uses. While this development pattern fostered factory housing in proximity to industrial plants and walking as a primary means of getting to work, roads were laid-out in a tight grid pattern and tended to be narrow. Moreover, with walking and transit as the primary means of transportation and car ownership not an option for many industrial era workers, housing lacked driveways and off-street parking. Today, as most households have at least one vehicle available, on-street parking has become more prevalent. This creates an environment that is not conducive to safe bicycling and has little room in which to place bicycle facilities. ***Figure 8, Pedestrian and Bicycle Facilities*** presents the pedestrian and bicycle facilities within the study area.

Pedestrian Features

Within the East Side and East End, sidewalks are located almost universally along the road network. Of the principal roads in the study area, sidewalks are missing only along the north side of Crescent Avenue and parts of the west side of Waterview Avenue. Despite the presence of sidewalks, many have been identified as unkempt and overflowing with overgrown trees, low hanging limbs and invasive grass and weeds. Litter has also been identified as a problem. There is also an inconsistency of width and material, and many do not meet minimum design standards. Buffers between the edge of pavement and the sidewalk are non-existent along many sections and proper curb ramps have not been installed at many intersections. While improvements have been made along sections of the main roadways, many sidewalks are in need of repair and rehabilitation.

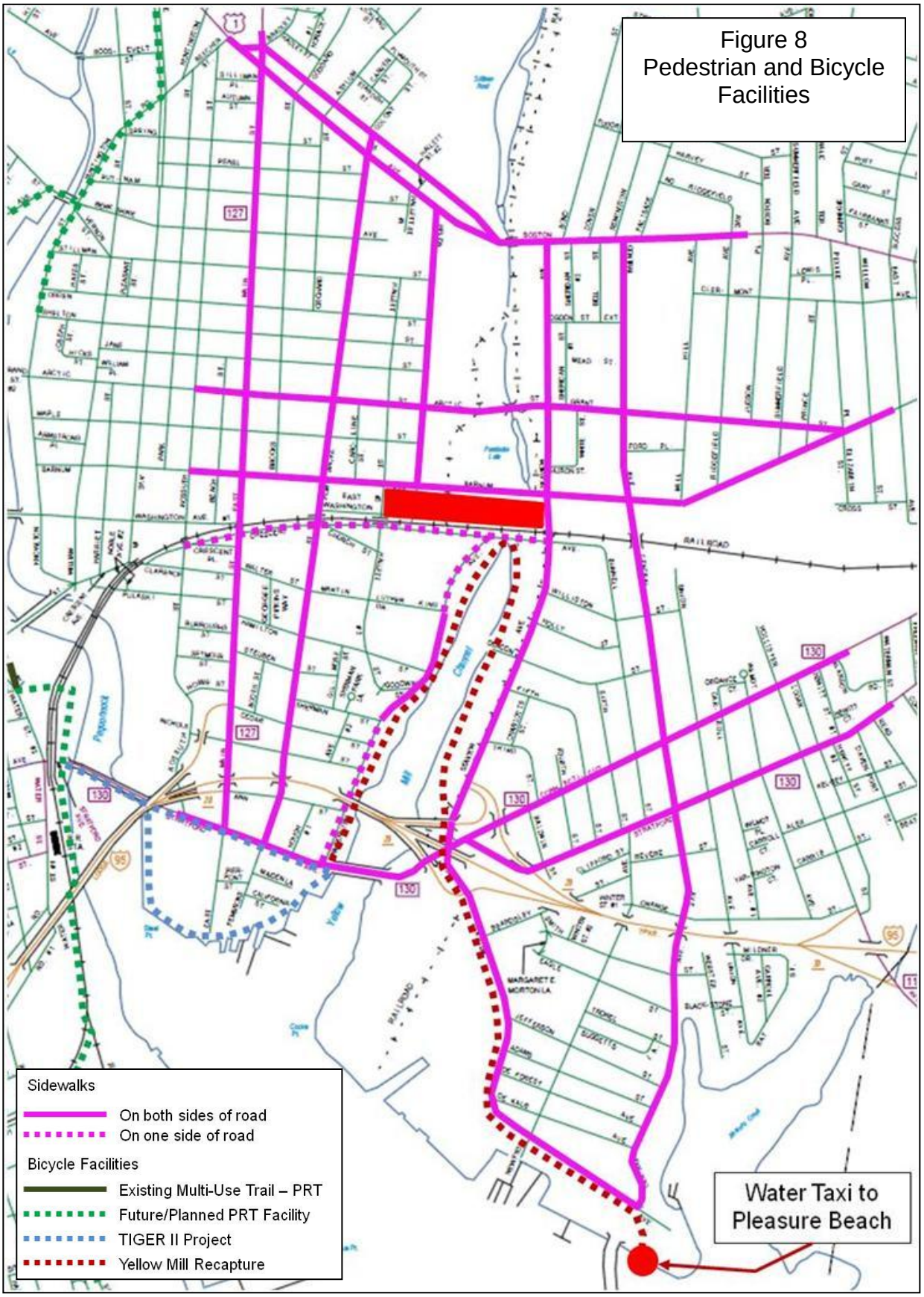


Figure 8
Pedestrian and Bicycle Facilities
Sidewalks
On both sides of road
On one side of road
Bicycle Facilities
Existing Multi-Use Trail – PRT
Future/Planned PRT Facility
TIGER II Project
Yellow Mill Recapture
Water Taxi to Pleasure Beach

Recent improvements and enhancements have been made along Barnum Avenue, East Main Street and Seaview Avenue. Streetscape improvement projects were completed along the length of East Main Street, through the Deacons Point historic district on Seaview Avenue and a short section of Barnum Avenue between Seaview Avenue and Mill Hill Avenue. Improvements included sidewalk rehabilitation, installation of concrete pavers as a buffer and new decorative lights with LED lamps. Street trees have also been planted.

Crosswalks are present at most intersections and especially at signalized locations. However, the pavement markings are worn and need repainting. Pedestrian actuated signals have been installed at signalized locations along East Main Street and Barnum Avenue.

■

Bicycle Actions

The City is actively promoting the development of a citywide bicycle route system. Its *BGreen 2020* plan promotes bicycling and development of bicycle infrastructure to allow more people to bike to work and other destinations. Infrastructure enhancements include striping bike lanes in key locations, establishing a citywide bicycle route network, installing bicycle racks near employment and striping routes to school. Bicycle needs will also be included as part of the city's *Complete Streets* policies and efforts.

Currently, there are no designated bicycle facilities or infrastructure located in or through the East Side or East End. However, the City has submitted an application under the FHWA Transportation Enhancement program to extend the regional Pequonnock River Trail (PRT) beyond Beardsley Park and connecting it with the northern terminus of the Berkshire Spur trail at US Route 1.

The GBRC, as part of its long-range transportation plan, developed a regional shared-use trail concept that envisions a continuous trail from Long Island Sound and Downtown Bridgeport to the Monroe-Newtown town line, a distance of about 16 miles. The Pequonnock River Trail was started in 1992 and various federal aid grants, state funding, and local contributions have been obtained and used to construct ten miles of the trail with another four miles expected to be constructed over the next three years. The alignment of the trail generally follows the path of the abandoned Housatonic Railroad corridor and parallel to the Pequonnock River.

An active construction project will extend the PRT through Beardsley Park. After completion of this project, an approximate one-mile gap will remain between the existing section along Housatonic Avenue and Beardsley Park. A practical and feasible off-road route is not available for this connection.

Instead, the connection will be made by installing and designating bicycle lanes and routes along local roads. The proposed alignment will pass along the west edge of the East Side and includes the following actions:

- Install bicycle lanes along Noble Avenue from Crown Street to Huntington Road.
- Designate Huntington Road as a bicycle route between Noble Avenue and Berkshire Avenue.
- The trail would cross the Berkshire Avenue Bridge over the Pequonnock River.
- Designate North Washington Avenue as a bicycle route between Berkshire Avenue and Housatonic Avenue.

A spur section would be extended along Knowlton Street south from Huntington Road and Berkshire Avenue as an on-road bicycle route to the new Knowlton Park.

The intent of the regional trail concept includes extending the PRT south of Downtown to access Seaside Park. The proposed concept would align the trail along the west side of Pequonnock River, pass through the Water Street Dock and ferry terminal and follow Main Street as a bicycle route to Seaside Park. Although this extension would not pass through the East Side, connections are envisioned that would link the area to the Downtown and South End.

The connection between the Downtown and East Side will be implemented as part of the proposed redevelopment of Steel Point and the East Bridgeport Development (Seaview Avenue) Corridor Project. These projects present opportunities for extending the PRT across the Pequonnock River to the East Side and East End. The current plan for the redevelopment of Steel Point, referred to as Bridgeport Landing, envisions a pedestrian promenade along the shoreline. Connections would be made to the Downtown along Stratford Avenue. A funded TIGER II project, in design, will rehabilitate and reconstruct Stratford Avenue and includes various "complete streets" elements and designation of bicycle lanes.

Future plans envision extending the bicycle and pedestrian infrastructure related to the Bridgeport Landing and East Bridgeport Development Corridor projects around the Yellow Mill Channel along Waterview Avenue (west side) and Seaview Avenue (east side). The project would enhance the banks of the Yellow Mill Channel and create a linear park on both sides. The trail would be extended southward along Seaview Avenue to Pleasure Beach Bridge (closed), with a connection to the planned water taxi service to the park from the mainland.

Vacant and/or Underutilized Parcels

The study area was once home to an expansive and world-known manufacturing base that included GE, Remington Arms, and Singer Sewing Company. As the manufacturing base left the area, old factory buildings were left vacant and underutilized.

Vacant and/or underutilized parcels were identified through review of Geographic Information System (GIS) information provided by the City of Bridgeport, review of relevant plans and documents, and field survey and are those parcels or areas that are:

- Vacant;
- Underutilized based on zoning potential; and,
- Located at key points or locations in the study area.

The vacant and/or underutilized parcels within the study area are presented in ***Figure 9, Vacant and/or Underutilized Parcels***. **Appendix C** provides the details of each of the vacant and/or underutilized parcels in the study area.

Figure 9 indicates that approximately 2/3 of the core station area is either vacant or underutilized, including a number of larger parcels immediately adjacent to the proposed station area and along the major corridors in the study area (e.g., Barnum Avenue, Seaview Avenue, Crescent Avenue, Arctic/Grant Street). In contrast, there are fewer parcels beyond ¼ mile but within the ½-mile radius, with most of these being smaller parcels. The general lack of in-fill development in the study area indicates that there is potentially an opportunity to redevelop both the larger and smaller parcels given the right conditions and incentives.

This discussion is included not only to aid in visioning and designing a new station and potential TOD opportunities, but also to indicate that there are issues and opportunities in the study area regardless of the implementation of a new station. Further, these parcels and their potential should be considered in the context of other related redevelopment planning elsewhere in the city, such as the proposed replacement of the Bridgeport Housing Authority's Marina Village family housing development in the South End. To that end, during the project process other sites may be identified, notably, those sites that are characterized by uses that have the potential for redevelopment due to market conditions.

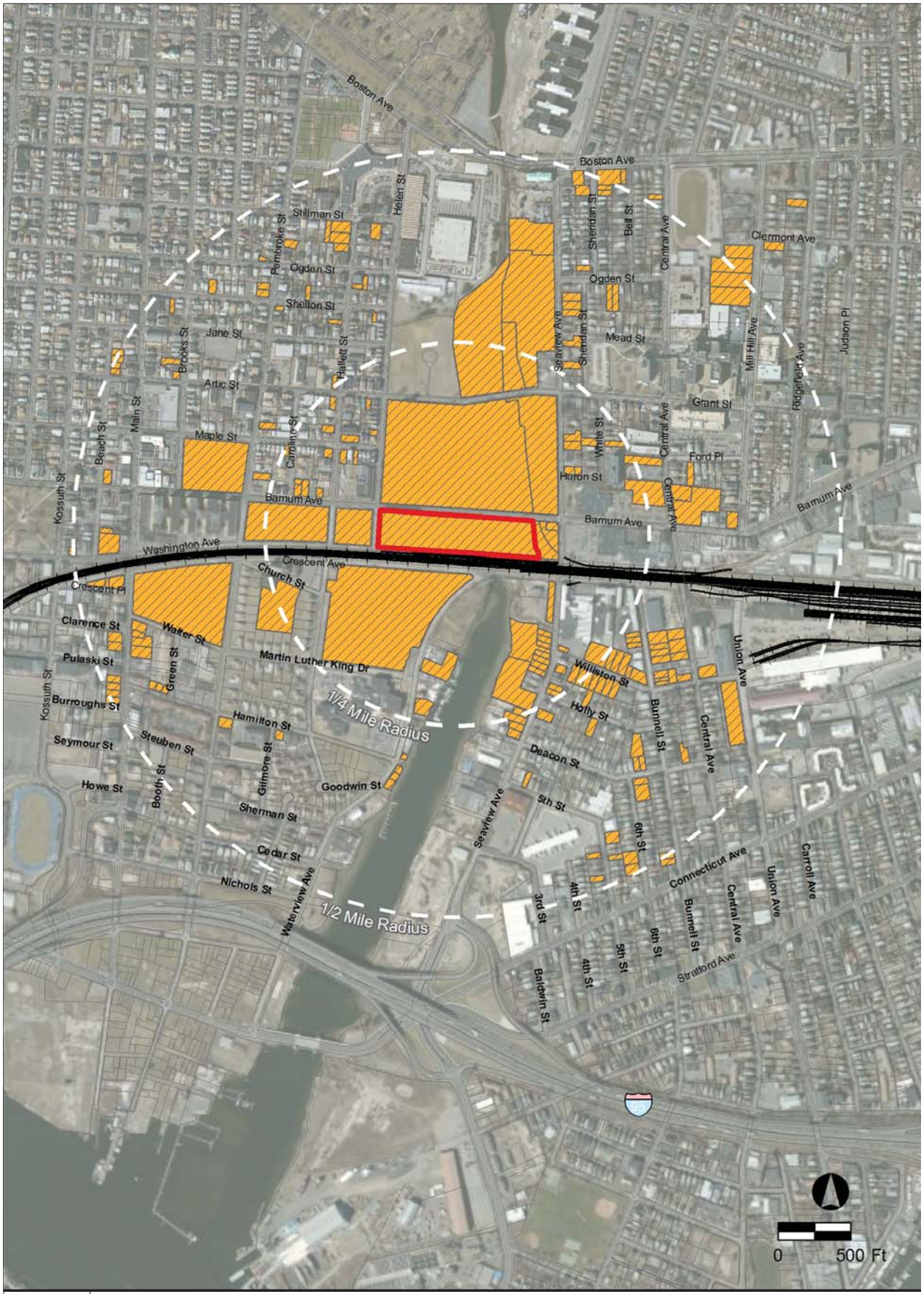


FIGURE **9**

Vacant and Underutilized Parcels

Barnum Station Feasibility Study | Bridgeport, CT

Vacant and/or underutilized parcel

Proposed station

VHB

Appendix A – List of Plans and Documents Reviewed

The following plans, ordinances, and documents were provided by the GBRC and reviewed as part of the preparation of this technical memorandum:

- Bridgeport 2020
- Re-imagining Downtown Bridgeport
- BGreen 2020
- Regional Transportation Plan
- GBRC SCI Plan Evaluation Matrix
- Parks Master Plan
- Seaview Ave Environmental Assessment
- Zoning Regulations
- Waterfront Plan/Regulations
- Bridgeport Complete Streets Plan (draft)
- Regional Bicycle Plan
- Regional Pedestrian Safety Plan
- Barnum Transit Center Master Plan
- East Side/East End Corridor Map
- RemGrit Building Info
- Remington Property Map
- Seaview Ave EA Map
- East End NRZ Strategic Plan & Presentation
- East Side NRZ Strategic Plan, Recommendations, Appendices & Presentation
- Harbor Management Plan
- Connecticut State Rail Plan—draft 2012
- CEDS One Coast Report & Appendices
- Seaview Ave. Corridor Study, 1993
- East Side/East End Municipal Development Plan, 1999
- GBRC Natural Hazard Mitigation Plan
- Pequonnock Riverfront Recapture
- Stormwater Management Manual
- Steel Pointe GDP Resolution
- List of projects under construction, planned & proposed within study area
- Steel Point Planned Development District
- Steel Point PDD/GDP Plan
- Tiger II Project for Seaview Ave
- Executive Summary & Fact Sheet of EA for NH/Hartford/Springfield Rail
- Natural Hazard Mitigation Plan, 2006.
- City of Bridgeport Climate Preparedness Workshops Summary of Findings. The Nature Conservancy and Clean Air Cool Planet. August 2012.
- The Nature Conservancy. Future Scenarios Map. Retrieved February 13, 2013 from http://coastalresilience.org/geographies/long-island-sound/future-scenarios-map
- Seaview Avenue Corridor, Draft Federal Environmental Assessment. 2003.

Appendix B – Land Use, by Street

Street and Cross Streets	Land Use					
	Residential	Sales/Service	Institutional	Manufacturing & Wholesale	Arts, Entertainment & Recreation	Parking Lot
N-S						
Kossuth Street						
Maple - Barnum	Y					
Barnum - Washington	Y		Y: Church			
Beach Street						
Jane - Arctic		Y				Y
Arctic - Maple	Y	Y				
Maple - Barnum	Y					
Barnum - Washington	Y	Y	Y: Church			Y
East Main Street						
Shelton-Arctic	Y	Y				
Arctic - Maple	Y	Y				Y
Maple - Barnum	Y	Y	Y			
Barnum - Washington/Rail tracks	Y	Y		Y		
Rail tracks /Crescent Ave - Walter	Y			Y		Y
Walter - Hamilton	Y	Y				Y
Hamilton - Seymour	Y					Y
Brooks Street						
Stillman - Shelton	Y					
Shelton - Jane			Y: Church			
Jane - Arctic	Y					
Arctic - Maple		Y				
Maple - Barnum						Y
Green Street/George E Pipkin's Way	Y		Y			Y
Booth Street	Y	Y				Y
Orchard Street	Y					
Pembroke Street						
Berkshire - Stillman	Y				Y	
Stillman - Ogden	Y	Y		Y		
Ogden - Shelton	Y					
Shelton - Jane	Y	Y				
Jane - Maple	Y	Y				Y
Maple - Barnum	Y		Y: Church			Y
Barnum - Washington/Rail tracks				Y		Y
Rail tracks/Crescent Ave - Walter/MLK	Y			Y		
Walter/MLK - Hamilton	Y			Y		Y
Hamilton - Steuben	Y	Y				

Street and Cross Streets	Land Use					
	Residential	**Sales/Service**	**Institutional**	**Manufacturing & Wholesale**	**Arts, Entertainment & Recreation**	**Parking Lot**
Steuben - Cedar	Y		Y: Church			Y
Caroline Street	Y					
Gilmore Street	Y		Y: School			
Hough/Sherman Park Lane	Y					
Hallett Street						
Helen - Stillman	Y		Y			
Stillman - Ogden	Y				Y	
Ogden - Jane	Y	Y				
Jane - Arctic	Y		Y: Church			Y
Arctic - Maple	Y					Y
Maple - Barnum	Y		Y: Church			Y
Barnum - Washington/Rail tracks	Y			Y		Y
Rail tracks/Crescent Ave - Martin Luther King	Y					
Martin Luther King Dr. - Hamilton	Y					Y
Hamilton - Goodwin	Y				Y	Y
Helen Street						
Boston - Stillman			Y: School			
Stillman - Shelton	Y			Y		
Shelton - Arctic	Y		Y			Y
Arctic - Barnum	Y			Y		
Barnum - Washington/Rail tracks						Y
Waterview Avenue						
Rail tracks/Crescent Ave - Martin Luther King		Y			Y	
Martin Luther King - Hamilton		Y	Y: School	Y		Y
Hamilton - Goodwin					Y	
Goodwin - Nichols	Y			Y		
Seaview Avenue						
Boston - Huron	Y	Y		Y		
Huron - Barnum				Y		
Barnum - Rail tracks				Y		
Rail tracks/Crescent Ave – Williston				Y		
Williston - Deacon	Y			Y		
Deacon - 5th	Y	Y		Y		
5th - Connecticut				Y		
Bond Street				Y: GE Site		
Charlotte Street				Y		

Street and Cross Streets	Land Use					
	Residential	Sales/Service	Institutional	Manufacturing & Wholesale	Arts, Entertainment & Recreation	Parking Lot
Sheridan Street						
Boston - Ogden Ext.	Y	Y				
Ogden Ext. - Grant	Y					
White Street	Y					
Bell	Y					
3rd Street		Y		Y		
4th Street	Y	Y		Y		
5th Street	Y	Y		Y		
6th Street	Y					
Bunnell Street						
Crescent Ave - Williston				Y		
Williston - Holly	Y					
Holly - Deacon	Y		Y: Church			
Deacon - Connecticut	Y					
Central Avenue						
Boston - Mead	Y		Y: School			
Mead - Grant			Y: Hospital			
Grant - Ford	Y		Y: Hospital			
Ford - Barnum	Y		Y: Hospital	Y		
Barnum - Rail tracks/Crescent Ave		Y		Y		
Rail tracks/Crescent Ave - Williston			Y			
Williston - Deacon	Y					
Deacon - Connecticut	Y		Y			
Mill Hill Avenue						
Clemont - Grant	Y		Y: Hospital			Y
Grant - Barnum	Y	Y				Y
Union Avenue						
to Williston		Y		Y		Y
Williston - Connecticut	Y	Y		Y		Y
Ridgefield Avenue						
Clemont - Grant	Y		Y			
Grant - Barnum	Y	Y				Y
W-E						
Boston Avenue						
Pembroke - Helen					Y	
Helen - Seaview	Y			Y		
Seaview - Bell		Y				

Street and Cross Streets	Land Use					
	Residential	Sales/Service	Institutional	Manufacturing & Wholesale	Arts, Entertainment & Recreation	Parking Lot
Bell - Central	Y					
Central - Mill Hill			Y: Hospital			
Berkshire Avenue			Y		Y	
Stillman Street						
Brooks - Pembroke	Y					
Pembroke - Hallett	Y		Y		Y	
Pembroke - Helen	Y			Y		
Ogden Street	Y					
Ogden Street Ext.	Y					
Shelton Street						
East Main - Brooks	Y	Y				
Brooks - Helen	Y					
Mead Street	Y		Y: Hospital			Y
Jane Street						
Beach - East Main		Y				
East Main - Brooks	Y		Y: Church			
Brooks - Pembroke	Y		Y: Church			Y
Pembroke - Helen	Y					
Arctic Street						
Kossuth - Beach	Y					
Beach - East Main	Y	Y				Y
East Main - Brooks	Y	Y				
Brooks - Caroline	Y					
Caroline - Hallett	Y	Y				
Hallett - Helen	Y					
Helen - Seaview		Y	Y : Cemetery	Y		
Grant Street						
Seaview - White	Y	Y				
White - Central	Y		Y: Hospital			
Central - Mill Hill			Y: Hospital			
Mill Hill - Ridgefield						Y
Ridgefield - Summerfield	Y					Y
Maple Street						
Kossuth - Beach	Y					
Beach - East Main						Y
East Main - Brooks			Y			Y
Brooks - Helen	Y					Y
Ford Place	Y					Y
Huron Street	Y					

Street and Cross Streets	Land Use					
	Residential	Sales/Service	Institutional	Manufacturing & Wholesale	Arts, Entertainment & Recreation	Parking Lot
Barnum Avenue						
Kossuth - East Main	Y					
East Main - Pembroke	Y	Y		Y		Y
Pembroke - Helen	Y	Y				Y
Helen - Seaview				Y: Station Area		
Seaview - Central				Y		Y
Central - Summerfield	Y	Y			Y	Y
Washington Avenue (along rail tracks)						
Kossuth - East Main		Y				Y
East Main - Pembroke				Y		
Pembroke - Helen						Y
Crescent Avenue (along rail tracks)						
Kossuth - East Main						Y
East Main - Pembroke				Y		Y
Pembroke - Hallett			Y			Y
Hallett - Seaview	Y			Y: Station Area	Y	Y
Seaview - Central				Y		Y
Crescent Place	Y	Y	Y			Y
Church Street			Y: Church			Y
Williston Street	Y			Y		Y
Walter Street	Y	Y	Y	Y		Y
Martin Luther King Drive						
Pembroke - Hallett	Y					
Hallett - Waterview			Y			Y
Clarence Street	Y					
Holly Street	Y					
Pulaski Street	Y		Y: Church, School, Funeral Home			
Deacon Street						
Dead End - 6th	Y	Y		Y		Y
6th - Central	Y		Y			Y
Hamilton Street						
East Main - Pembroke	Y	Y				Y
Pembroke - Hallett	Y		Y			
Hallett - Waterview			Y		Y	
Steuben Street						
East Main - Pembroke	Y	Y				
Pembroke - Gillmore	Y	Y	Y			
Goodwin Street	Y				Y	

Street and Cross Streets	Land Use					
	Residential	Sales/Service	Institutional	Manufacturing & Wholesale	Arts, Entertainment & Recreation	Parking Lot
Sherman Street	Y		Y			Y
Cedar Street	Y					Y

Appendix C – Vacant and/or Underutilized Parcels

Parcel ID	Address	Owner	Size (Sq. Ft.)
848-18	284 Hamilton St #290	City Of Bridgeport Redevelopment	2,528
843-1	282 Hough Av #284	Park City Hous & Dev Corp	5,845
823-1	90 Booth St #96	St Mary's Roman Catholic Church	3,918
848-14	326 Hamilton St	City of Bridgeport	6,035
748-26	62 Williston St #64	Bridgeport Economic Dev Corp	5,784
848-4	22 Hallett St #30	City of Bridgeport	6,046
857-99	252 Hallett St	Bridgeport Housing Authority	495,775
748-5	1506 Seaview Av #1508	Bridgeport Renewal LLC	4,064
1743-26	674 Shelton St #676	City of Bridgeport	3,411
1759-10	221 Beach St	Rio Chiquito LLC	2,935
1742-16	788 Shelton St	Rodriguez Ernesto	1,998
1809-5	76 White St	City of Bridgeport	5,051
848-17	294 Hamilton St	City of Bridgeport Redevelopment	2,894
848-2	54 Hallett St #56	City of Bridgeport Redevelopment	2,187
2047-1	Old Mill Green Na	City Of Bridgeport Park Dept	72,787
1736-5	491 Shelton St #493	491 Shelton Street Assoc LLC	4,856
1736-6	495 Shelton St	Pizarro Serapia	3,048
1812-3	266 Sheridan St #268	Family Properties LLC	3,697
1765-6	671 Barnum Av	Thai Motors Inc	4,224
1811-34	1106 Ogden St Ex #1108	Waikele Properties Corp	7,654
1739-12	698 Hallett St #700	New York Realty 01 LLC	2,354
1738-9	695 Shelton St	City Of Bridgeport	3,359
840-7	445 Nichols St	Bennett Gladys, J B Gomez, & GE Bennett	4,096
1806-5	2010 Seaview Av	Rivera Enrique	3,734
1812-20	19 Bell St	Bridgeport Hospital Foundation Inc	3,801
1743-24	686 Shelton St #688	Ebron Rebia	3,326
1816-22	1266 Barnum Av	Homer G Godfrey Company The	3,930
848-7	103 Goodwin St	City of Bridgeport Redevelopment	4,452
859-2	408 Waterview Av	City of Bridgeport	2,718
848-5	14 Hallett St	City of Bridgeport	2,286
848-11	141 Goodwin St	City of Bridgeport	5,475
1815-24	30 Ford Pl #32	Bridgeport Hospital	7,704
1807-5B	1860 Seaview Av	Cobblestone LLC	6,859
1739-13	760 Ogden St	NY Realty 01 LLC	3,221
1739-10	770 Ogden St	Teso Rita B & Lasy Teso & David Teso	4,765
1754-9	517 Hallett St #519	Rivera Miguel	4,322
1755-2	1058 Pembroke St #1064	Olde School Commons Limited Partnership	6,027
1806-9	1972 Seaview Av	Seaview-Sheridan, LLC	7,210
1807-10B	15 Huron St #17	Hawthorne Properties LLC	2,578
1766-7	756 Maple St	Blackwell Bonnie	2,987
748-9	149 Holly St	Bridgeport Economic Dev Corp	5,825

Parcel ID	Address	Owner	Size (Sq. Ft.)
1743-17	657 Hallett St #659	City of Bridgeport	2,136
848-1	68 Hallett St	City of Bridgeport Redevelopment	2,376
1743-15	645 Hallett St #647	City of Bridgeport Housing Authority	3,179
848-10	125 Goodwin St #127	City of Bridgeport Redevelopment	8,809
749-15	469 Bunnell St #471	Queen Grant Limited Partnership	3,698
1807-15	85 White St	City of Bridgeport	5,626
749-13	455 Bunnell St #457	Bridgeport Economic Dev Corp	3,582
733-3A	448 Bunnell St #450	Bridgeport Economic Dev Corp	5,542
749-2	1554 Seaview Av #1558	Classic Crescent LLC	2,482
1754-12	728 Arctic St #730	Gordils Melvin	3,878
1753-17	776 Arctic St	Souza Ademir	2,489
1765-7	673 Barnum Av #675	City of Bridgeport	5,788
749-14	461 Bunnell St #463	Bridgeport Economic Dev Corp	3,614
1809-34	1507 Central Av	Fairfield Ventures Of Bpt LLC	15,490
736-31	235 Bunnell St #237	Hall John D	3,482
859-3	398 Waterview Av	City of Bridgeport Redevelopment	3,951
733-12	1239 Central Av	Bedco	6,416
863-1A	576 Waterview Av	Bridgeport Redevelopment Agency	28,078
748-27	54 Williston St	Bridgeport Economic Dev Corp	6,336
1737-6	563 Shelton St #565	Martins Armando	5,094
847-14	57 Hallett St	Iglesia De Cristo Inc	8,149
738-19	169 Fifth St #171	Capital Restoration Inc	3,948
750-22	1569 Seaview Av #1571	Bridgeport Renewal LLC	3,786
1812-2	274 Sheridan St	Family Properties LLC	3,557
1730-19	668 Stillman St	Bridgeport Redevelopment Agency	5,529
1729-1A	728 Stillman St	New England Investment LLC	7,815
1738-19	722 Ogden St	Api Properties 468 LLC	3,517
750-17	1523 Seaview Av #1525	Black Thomas	5,794
855-14	70 Church St	Bridgeport Housing Authority	79,687
1744-9	1175 Pembroke St #1179	City of Bridgeport	2,772
848-16	306 Hamilton St	City of Bridgeport	6,117
848-15	318 Hamilton St	City of Bridgeport	6,050
749-9	105 Williston St	Queens Grant Limited Partnership	3,076
747-36	158 Holly St	Bridgeport Economic Dev Corp	6,997
823-20	86 Steuben St #88	St Mary's Roman Catholic Church	6,016
737-36Y	243 Sixth St	Park City Housing & Devel	4,080
1745-9	510 Shelton St	Galloza Thomas	3,152
1744-6	415 Jane St	Keovilay Vanxay & Rattanaphone	6,752
1759-11	223 Beach St	Rio Chiquito LLC	2,936
1761-2	156 Beach St #158	Afanador Noel & Gricelida Afandor	4,221
733-9	1209 Central Av	Bridgeport Economic Dev Corp	4,822

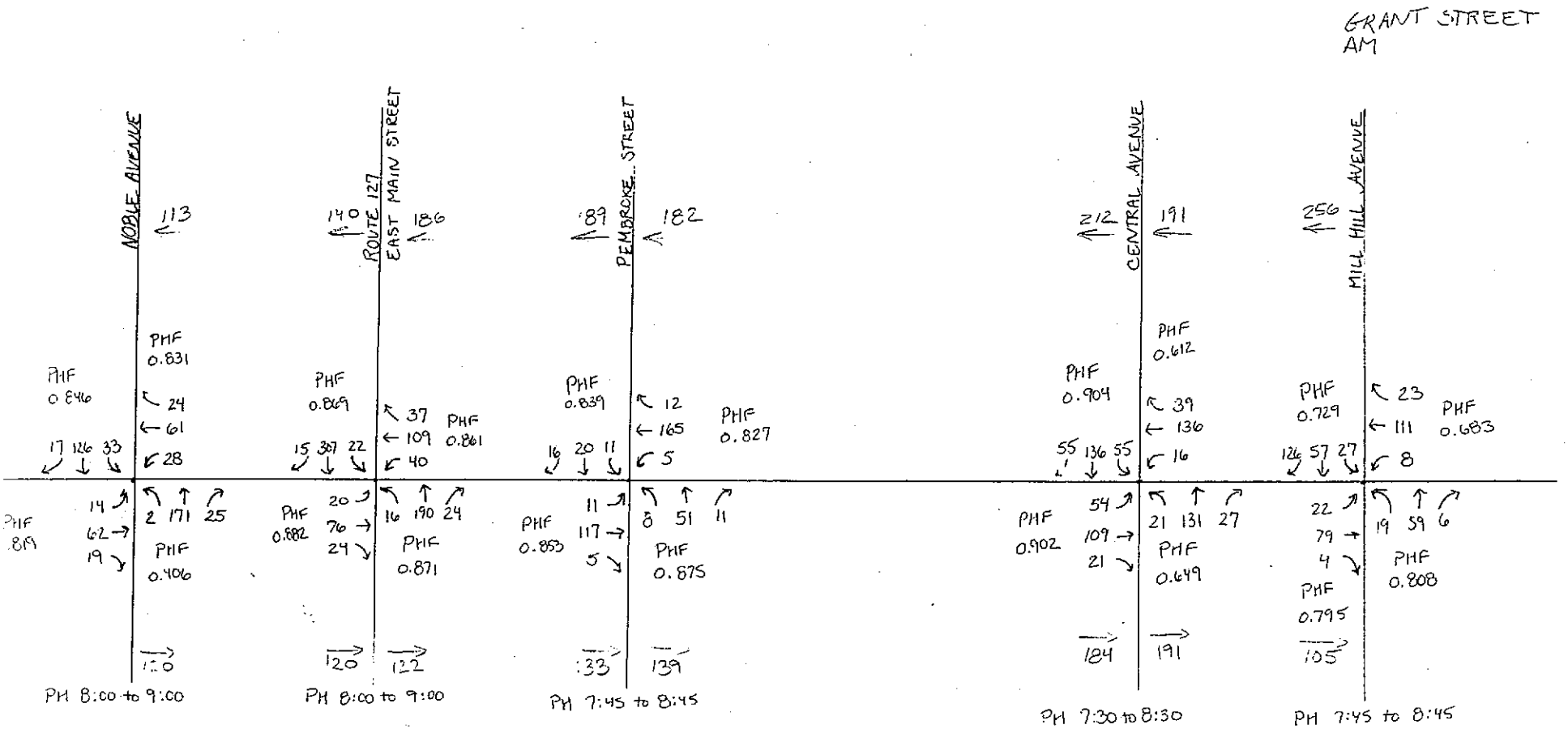
Parcel ID	Address	Owner	Size (Sq. Ft.)
748-25	72 Williston St	Bedco	6,322
733-7A	400 Bunnell St	Bridgeport Economic Dev Corp	2,414
1776-11B	579 East Washington Av #581	Washington Park Revitalization Project LP	2,789
1766-1	732 Maple St	Martinez Frank	4,604
848-3	38 Hallett St #46	City of Bridgeport	9,910
848-12	401 Waterview Av	City of Bridgeport	21,131
861-2	438 Waterview Av	Charity Christian Temple	1,628
737-22	172 Fifth St	Faison Martha	4,241
862-2	512 Waterview Av	Ryan's Realty LLC	12,069
750-8	1431 Seaview Av #1435	Bridgeport Renewal LLC	5,023
749-6	73 Williston St	Queens Grant Limited Partnership	6,382
749-8	91 Williston St #93	Queens Grant Limited Partnership	8,501
750-18	1529 Seaview Av #1533	Black Thomas	4,707
733-4	430 Bunnell St #432	City of Bridgeport	6,603
843-11	289 Waterview Av #295	Nenez Yuverka	5,403
738-23	199 Fifth St	Capital Restoration Inc	3,974
739-20	155 Fourth St	United Properties	8,289
748-24	82 Williston St	Bridgeport Economic Dev Corp	6,246
733-7	398 Bunnell St	City of Bridgeport	2,366
748-23	94 Williston St #96	Secretary Of HUD	6,095
750-9A	1441 Seaview Av #1443	Bridgeport Renewal LLC	8,363
747-39	128 Holly St	City of Bridgeport	6,071
848-13	362 Hamilton St #368	City of Bridgeport	3,017
823-2	82 Booth St #86	St Mary's Roman Catholic Church	3,729
734-10	324 Deacon St #326	296-308 Bunnell Street LLC	6,947
843-5A	239 Cedar St	Saddler Regina	993
848-8	109 Goodwin St	City of Bridgeport Redevelopment	4,657
859-1	420 Waterview Av	City of Bridgeport	2,498
848-9	115 Goodwin St #117	City of Bridgeport	5,823
848-6	4 Hallett St	City of Bridgeport	4,861
737-52	196 Fifth St #198	Framularo Charles V & Nicholas Framularo	3,822
1748-15	NA	NA	3,781
1812-34	NA	NA	3,995
1813-37	NA	NA	3,484
1819-12	NA	NA	7,232
1818-1	NA	NA	7,870
1814-9	NA	NA	17,917
1737-12	NA	NA	4,386
1748-16	NA	NA	3,937
1748-4	NA	NA	3,033
1748-5	NA	NA	2,965

Parcel ID	Address	Owner	Size (Sq. Ft.)
1753-10	NA	NA	2,307
732-2	NA	NA	9,982
736-21	NA	NA	4,512
1737-13	NA	NA	4,178

Appendix D – Transportation Attachments

Turning Movement Data

GRANT STREET
AM



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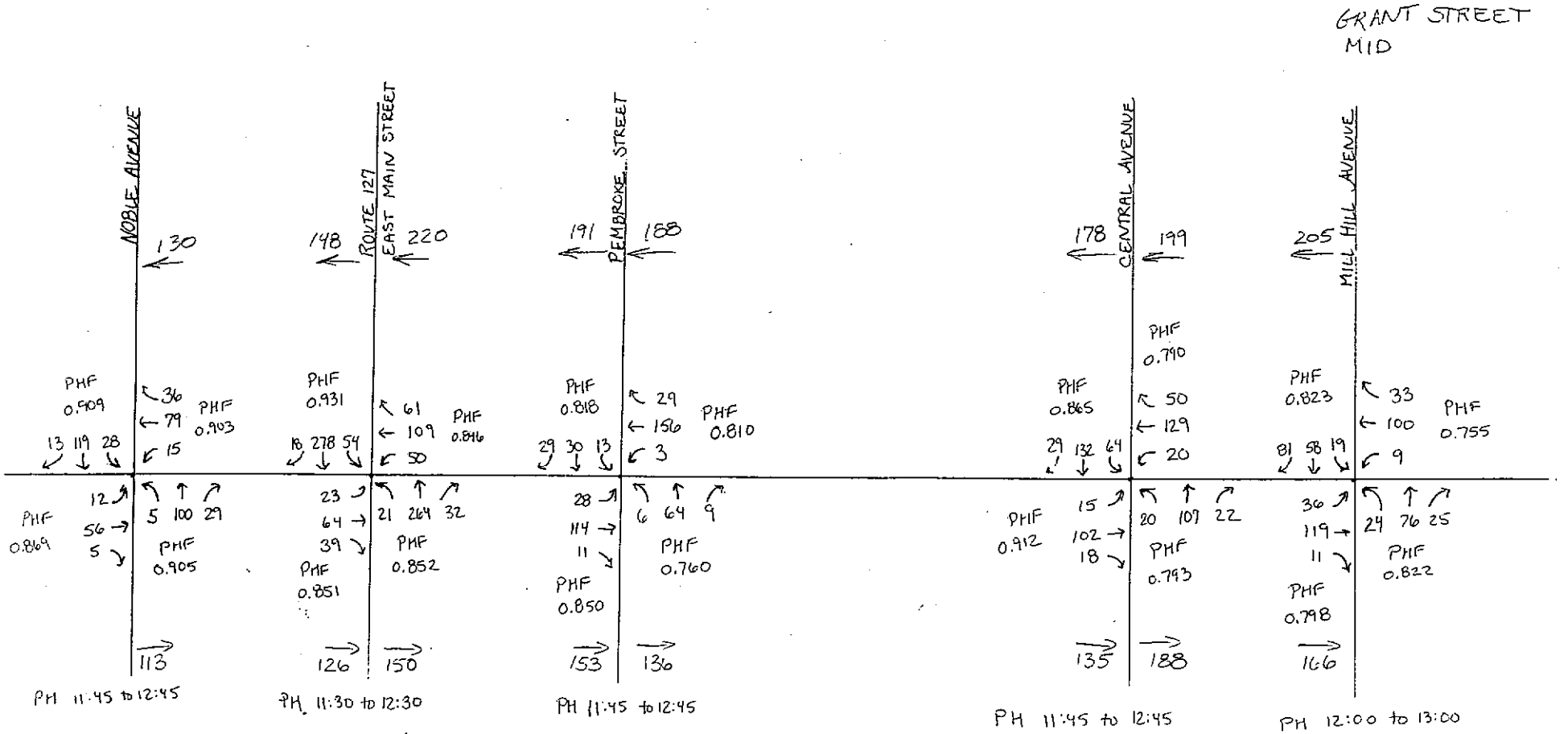
GRANT STREET
MID



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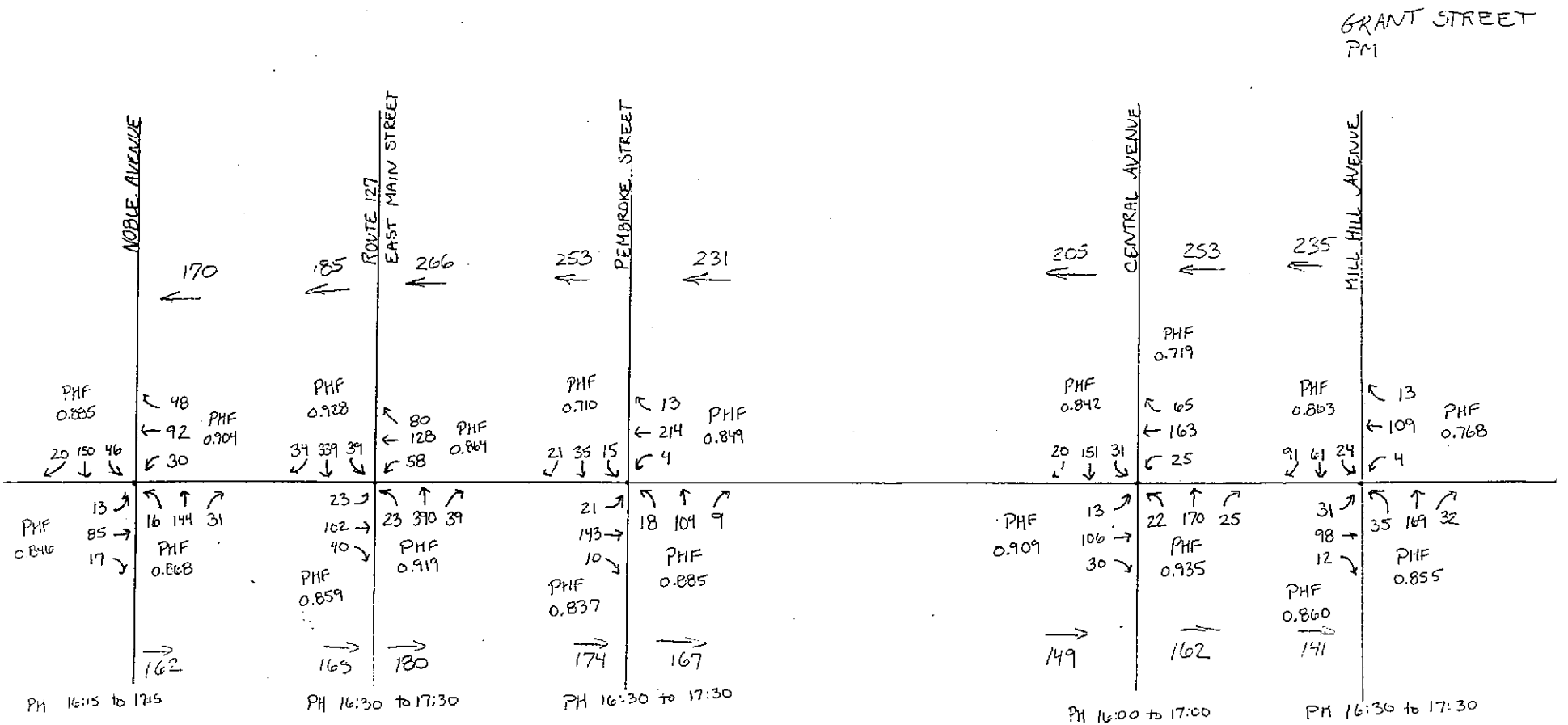


PM 16:15 to 17:15

PM 16:30 to 17:30

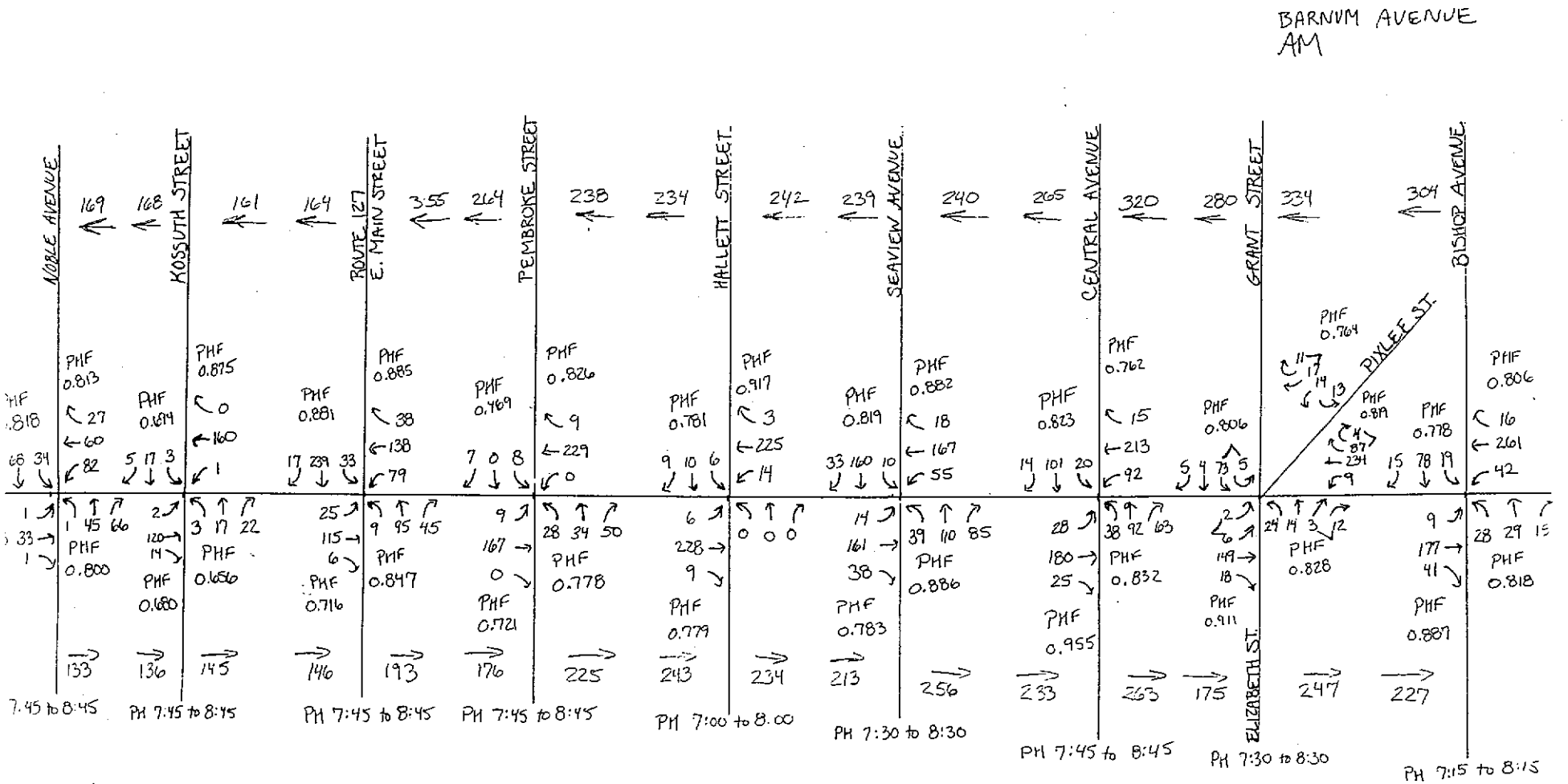
PM 16:30 to 17:30

PM 16:00 to 17:00

PM 16:30 to 17:30

N

BARNUM AVENUE
AM



BARNUM AVENUE
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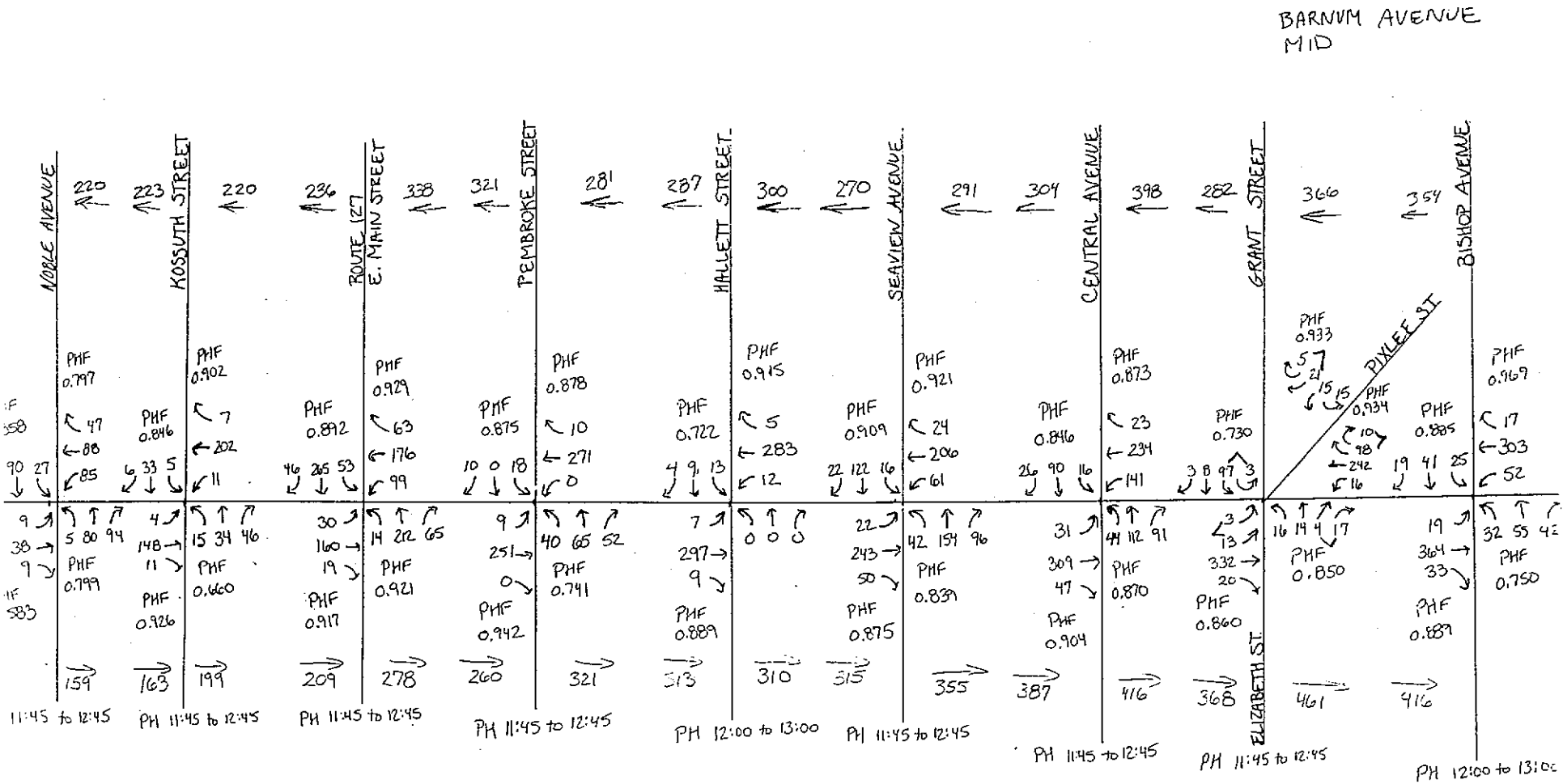
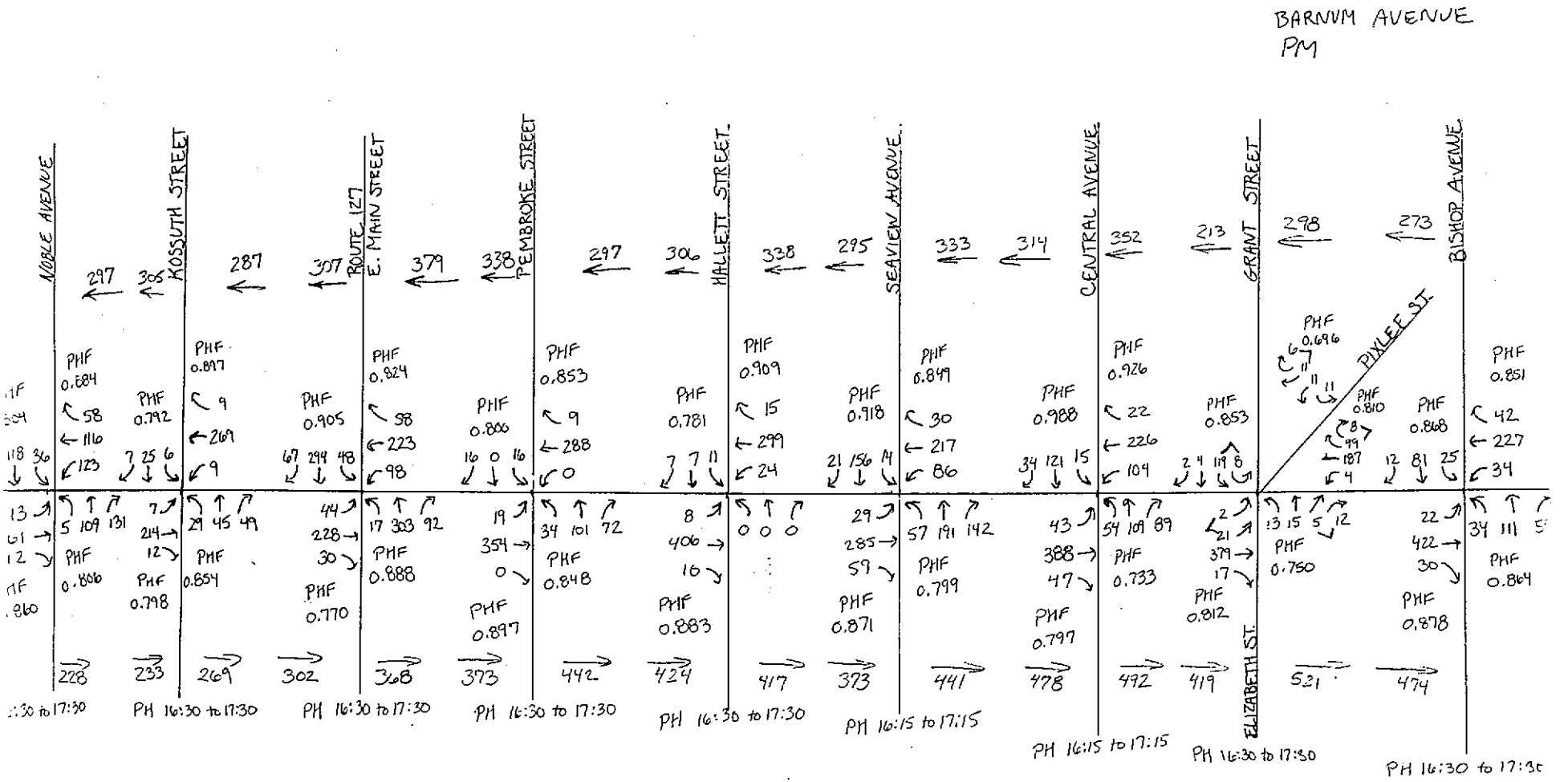


BARNUM AVENUE
PM



Traffic Accident Tables

TAVS
Version 2.1

Traffic Accident Tables

for

ROUTE: 1 FROM: 31.30 TO 32.33

TIME PERIOD: BETWEEN 01-01-2006 AND 12-31-2008

TOTAL ACCIDENTS: 519

Time: 1:38:13 PM Date: 6/11/2012

TRAFFIC ACCIDENT TABLES FOR ROUTE 1

519 accidents occurred on ROUTE 1 from mileage 31.30 to 32.33

between 1/1/2006 and 12/31/2008

TRAFFIC ACCIDENT TOTALS BY COLLISION TYPE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Turning-Same Direction				10	11	7		28	5.39%
Turning-Opp. Direction				8	8	21		37	7.13%
Turning-Intersecting Paths				16	23	19		58	11.18%
Sideswipe-Same Direction				26	32	31		89	17.15%
Sideswipe-Opp. Direction				1	1			2	0.39%
Overturn				1				1	0.19%
Angle				19	8	15		42	8.09%
Rear-end				64	70	78		212	40.85%
Head-on				1				1	0.19%
Backing				6	2	5		13	2.50%
Parking						1		1	0.19%
Pedestrian				4	2	2		8	1.54%
Fixed Object				8	10	2		20	3.85%
Moving Object					2	1		3	0.58%
Unknown					2	2		4	0.77%
TOTAL				164	171	184		519	100.00%

TRAFFIC ACCIDENT TOTALS BY ACCIDENT SEVERITY AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Fatal				2	1	1		4	0.77%
Injury				53	51	57		161	31.02%
Property Damage Only				109	119	126		354	68.21%
TOTAL				164	171	184		519	100.00%

TRAFFIC ACCIDENT TOTALS BY CONTRIBUTING FACTOR AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Driving on Wrong Side of Rd				1	1			2	0.39%
Speed Too Fast for Conditions				7	3			10	1.93%
Violated Traffic Control				8	9	15		32	6.17%
Under the Influence				2				2	0.39%
Failed to Grant ROW				35	29	35		99	19.08%
Improper Passing Maneuver				8	18	8		34	6.55%
Improper Lane Change				10	9	15		34	6.55%
Following Too Closely				57	66	77		200	38.54%
Slippery Surface				4	2	1		7	1.35%
Driver Lost Control				8	7	8		23	4.43%
Animal/Foreign Object in Rd					1	1		2	0.39%
Fell Asleep					1			1	0.19%
Defective Equipment				1				1	0.19%
Driver Illness				1				1	0.19%
Unsafe Use of Highway by Ped				1	2			3	0.58%
Unsafe Right Turn on Red						1		1	0.19%
Abnormal Road Condition					1			1	0.19%
Roadway Width Restricted					1			1	0.19%
Unknown				7	10	8		25	4.82%
Unsafe Backing				5	2	5		12	2.31%
Improper Turning Maneuver				9	9	10		28	5.39%
TOTAL				164	171	184		519	100.00%

TRAFFIC ACCIDENT TABLES FOR ROUTE 1

519 accidents occurred on ROUTE 1 from mileage 31.30 to 32.33

between 1/1/2006 and 12/31/2008

TRAFFIC ACCIDENT TOTALS BY OTHER ROADWAY FEATURE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Intersec. Public Road				136	132	150		418	80.54%
Intersec Private Road						1		1	0.19%
Intersec. Residential Dr				1	1	1		3	0.58%
Intersec. Commercial Dr				5	3	6		14	2.70%
On Bridge					1			1	0.19%
At Median X Over					1	5		6	1.16%
None				22	33	21		76	14.64%
TOTAL				164	171	184		519	100.00%

TRAFFIC ACCIDENT TABLES FOR ROUTE 1

519 accidents occurred on ROUTE 1 from mileage 31.30 to 32.33

between 1/1/2006 and 12/31/2008

OCCUPANT INJURIES BY YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Fatalities				2	1	1		4	1.52%
A-Injury				2	5	6		13	4.94%
B-Injury				14	12	18		44	16.73%
C-Injury				71	55	76		202	76.81%
TOTAL				87	72	100		263	100.00%

TAVS
Version 2.1

Traffic Accident Tables

for

ROUTE: 127 FROM: 0.00 TO 1.41

TIME PERIOD: BETWEEN 01-01-2006 AND 12-31-2008

TOTAL ACCIDENTS: 480

Time: 2:26:36 PM Date: 6/11/2012

TRAFFIC ACCIDENT TABLES FOR ROUTE 127

480 accidents occurred on ROUTE 127 from mileage 0.00 to 1.41

between 1/1/2006 and 12/31/2008

TRAFFIC ACCIDENT TOTALS BY COLLISION TYPE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Turning-Same Direction				7	5	6		18	3.75%
Turning-Opp. Direction				15	11	8		34	7.08%
Turning-Intersecting Paths				16	17	12		45	9.38%
Sideswipe-Same Direction				14	23	17		54	11.25%
Sideswipe-Opp. Direction				5	1	3		9	1.88%
Misc-Non-Collision					1	1		2	0.42%
Overturn					1			1	0.21%
Angle				47	34	34		115	23.96%
Rear-end				34	46	26		106	22.08%
Head-on					1	2		3	0.63%
Backing				4	6	6		16	3.33%
Parking				13	9	10		32	6.67%
Pedestrian				4	9	5		18	3.75%
Fixed Object				5	8	9		22	4.58%
Moving Object						1		1	0.21%
Unknown				1	3			4	0.83%
TOTAL				165	175	140		480	100.00%

TRAFFIC ACCIDENT TOTALS BY ACCIDENT SEVERITY AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Injury				63	56	50		169	35.21%
Property Damage Only				102	119	90		311	64.79%
TOTAL				165	175	140		480	100.00%

TRAFFIC ACCIDENT TOTALS BY CONTRIBUTING FACTOR AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Driving on Wrong Side of Rd						2		2	0.42%
Speed Too Fast for Conditions				3	3	1		7	1.46%
Violated Traffic Control				30	20	18		68	14.17%
Under the Influence				1		1		2	0.42%
Failed to Grant ROW				56	53	44		153	31.88%
Improper Passing Maneuver				4	5	7		16	3.33%
Improper Lane Change					1			1	0.21%
Following Too Closely				28	39	25		92	19.17%
Slippery Surface				1	3			4	0.83%
Driver Lost Control				19	20	11		50	10.42%
Animal/Foreign Object in Rd					1	1		2	0.42%
Fell Asleep					1			1	0.21%
Defective Equipment					1			1	0.21%
Driver Illness				1				1	0.21%
Driver's View Obstructed				1	2	1		4	0.83%
Unsafe Tires					1			1	0.21%
Unsafe Use of Highway by Ped				1	5	2		8	1.67%
Unsafe Right Turn on Red						1		1	0.21%
Insufficient Vert Clearance						1		1	0.21%
Proper Turn Sig Not Displayed				1				1	0.21%
Disabled/Illegally Parked Veh				1				1	0.21%
Abnormal Road Condition					1	1		2	0.42%
Vehicle Involved in Emergency					1			1	0.21%
Unknown				8	5	11		24	5.00%
Unsafe Backing				4	6	8		18	3.75%
Improper Turning Maneuver				6	7	5		18	3.75%
TOTAL				165	175	140		480	100.00%

TRAFFIC ACCIDENT TABLES FOR ROUTE 127

480 accidents occurred on ROUTE 127 from mileage 0.00 to 1.41
between 1/1/2006 and 12/31/2008

TRAFFIC ACCIDENT TOTALS BY OTHER ROADWAY FEATURE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Intersec. Public Road				122	131	103		356	74.17%
Intersec. Residential Dr				2	4			6	1.25%
Intersec. Commercial Dr				5	9	5		19	3.96%
At On Ramp				2	1	2		5	1.04%
None				34	30	30		94	19.58%
TOTAL				165	175	140		480	100.00%

TRAFFIC ACCIDENT TABLES FOR ROUTE 127

480 accidents occurred on ROUTE 127 from mileage 0.00 to 1.41

between 1/1/2006 and 12/31/2008

OCCUPANT INJURIES BY YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
A-Injury				4	6	4		14	5.60%
B-Injury				31	20	14		65	26.00%
C-Injury				68	48	55		171	68.40%
TOTAL				103	74	73		250	100.00%

TAVS
Version 2.1

Traffic Accident Tables

for

ROUTE: 130 FROM: 4.18 TO 5.05

TIME PERIOD: BETWEEN 01-01-2006 AND 12-31-2008

TOTAL ACCIDENTS: 228

Time: 2:43:23 PM Date: 6/11/2012

TRAFFIC ACCIDENT TABLES FOR ROUTE 130

228 accidents occurred on ROUTE 130 from mileage 4.18 to 5.05

between 1/1/2006 and 12/31/2008

TRAFFIC ACCIDENT TOTALS BY COLLISION TYPE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Turning-Same Direction				12	8	5		25	10.96%
Turning-Opp. Direction				5	6	12		23	10.09%
Turning-Intersecting Paths				3	8	4		15	6.58%
Sideswipe-Same Direction				11	9	7		27	11.84%
Sideswipe-Opp. Direction				1	1	1		3	1.32%
Overturn						1		1	0.44%
Angle				10	8	10		28	12.28%
Rear-end				24	22	19		65	28.51%
Backing				3	3	1		7	3.07%
Parking				2	3	1		6	2.63%
Pedestrian				1	5	1		7	3.07%
Fixed Object				6	11	4		21	9.21%
TOTAL				78	84	66		228	100.00%

TRAFFIC ACCIDENT TOTALS BY ACCIDENT SEVERITY AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Injury				32	27	27		86	37.72%
Property Damage Only				46	57	39		142	62.28%
TOTAL				78	84	66		228	100.00%

TRAFFIC ACCIDENT TOTALS BY CONTRIBUTING FACTOR AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Driving on Wrong Side of Rd						1		1	0.44%
Speed Too Fast for Conditions				3	4	3		10	4.39%
Violated Traffic Control				7	12	9		28	12.28%
Failed to Grant ROW				10	8	18		36	15.79%
Improper Passing Maneuver				3	4	3		10	4.39%
Improper Lane Change				4	4	3		11	4.82%
Following Too Closely				20	18	16		54	23.68%
Slippery Surface					2			2	0.88%
Driver Lost Control				11	8	6		25	10.96%
Driver's View Obstructed				1				1	0.44%
Unsafe Use of Highway by Ped				1	2			3	1.32%
Unsafe Right Turn on Red					1			1	0.44%
Driverless Vehicle				1				1	0.44%
Insufficient Vert Clearance						1		1	0.44%
Vehicle Involved in Emergency					1			1	0.44%
Entered Rdwy in Wrong Dir					2			2	0.88%
Unknown				2	7	1		10	4.39%
Unsafe Backing				2	3	1		6	2.63%
Improper Turning Maneuver				13	8	4		25	10.96%
TOTAL				78	84	66		228	100.00%

TRAFFIC ACCIDENT TOTALS BY OTHER ROADWAY FEATURE AND YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
Intersec. Public Road				63	69	60		192	84.21%
Intersec. Residential Dr				2				2	0.88%
Intersec. Commercial Dr				3		1		4	1.75%
On Bridge				1				1	0.44%
None				9	15	5		29	12.72%
TOTAL				78	84	66		228	100.00%

TRAFFIC ACCIDENT TABLES FOR ROUTE 130

228 accidents occurred on ROUTE 130 from mileage 4.18 to 5.05
between 1/1/2006 and 12/31/2008

OCCUPANT INJURIES BY YEAR

	2003	2004	2005	2006	2007	2008	2009	TOTAL	PERCENTAGE
A-Injury				2		5		7	5.74%
B-Injury				13	17	15		45	36.89%
C-Injury				28	24	18		70	57.38%
TOTAL				43	41	38		122	100.00%

Travel Time Survey

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 7 AM TO 9 AM, EASTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Knowlton Street & Williams Street	0.074	16.5	16.2	0.0	16.2	0.0
Between Williams Street & Noble Avenue	0.099	26.8	13.4	9.8	21.0	34.3
Between Noble Avenue & Kossuth Street	0.097	18.9	18.5	4.5	24.4	26.4
Between Kossuth Street & East Main Street	0.093	29.8	11.2	15.3	23.0	25.1
Between East Main Street & Seaview Avenue	0.560	81.6	24.7	18.0	31.7	61.6
Between Seaview Avenue & Central Avenue	0.146	42.3	12.4	23.3	27.6	65.5
Between Central Avenue & Grant Street	0.422	58.3	26.1	7.3	29.8	38.7
Between Grant Street & Bishop Avenue	0.152	35.6	15.4	13.5	24.7	59.8
Between Bishop Avenue & Bruce Avenue	0.229	64.1	12.8	32.1	25.7	77.9
Barnum Avenue Corridor	1.872	373.8	18.0	123.6	26.9	

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 7 AM TO 9 AM, WESTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Bruce Avenue & Bishop Avenue	0.224	42.9	18.8	14.0	28.0	274.6
Between Bishop Avenue & Grant Street	0.153	44.8	12.3	22.9	25.2	69.5
Between Grant Street & Central Avenue	0.419	62.5	24.1	11.0	29.3	121.4
Between Central Avenue & Seaview Avenue	0.148	29.8	17.9	9.5	26.3	105.6
Between Seaview Avenue & East Main Street	0.558	85.9	23.4	20.8	30.9	117.2
Between East Main Street & Kossuth Street	0.095	19.8	17.2	5.0	23.1	37.0
Between Kossuth Street & Noble Avenue	0.113	42.3	9.6	26.0	25.0	52.0
Between Noble Avenue & Williams Street	0.100	17.9	20.2	0.0	20.2	0.0
Between Williams Street & Knowlton Street	0.079	17.3	16.4	0.0	16.4	0.0
Barnum Avenue Corridor	1.889	362.9	18.7	109.1	26.8	

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 11 AM TO 1 PM, EASTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Knowlton Street & Williams Street	0.073	16.2	16.2	0.0	16.2	0.0
Between Williams Street & Noble Avenue	0.098	21.0	16.9	4.6	21.5	34.3
Between Noble Avenue & Kossuth Street	0.096	15.9	21.8	2.2	25.4	84.5
Between Kossuth Street & East Main Street	0.094	40.1	8.4	25.6	23.2	118.3
Between East Main Street & Seaview Avenue	0.560	73.2	27.5	10.1	31.9	115.3
Between Seaview Avenue & Central Avenue	0.147	48.0	11.0	26.4	24.6	108.9
Between Central Avenue & Grant Street	0.419	68.6	22.0	13.0	27.1	63.4
Between Grant Street & Bishop Avenue	0.153	34.3	16.1	10.8	23.5	241.1
Between Bishop Avenue & Bruce Avenue	0.226	39.6	20.5	7.6	25.4	72.2
Barnum Avenue Corridor	1.866	356.9	18.8	100.2	26.2	

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 11 AM TO 1 PM, WESTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Bruce Avenue & Bishop Avenue	0.225	39.8	20.3	9.0	26.3	81.3
Between Bishop Avenue & Grant Street	0.150	32.3	16.7	10.3	24.5	103.0
Between Grant Street & Central Avenue	0.421	89.0	17.0	41.9	32.2	160.2
Between Central Avenue & Seaview Avenue	0.146	26.3	20.0	7.2	27.5	47.5
Between Seaview Avenue & East Main Street	0.560	103.6	19.5	39.7	31.6	160.7
Between East Main Street & Kossuth Street	0.094	19.7	17.2	3.8	21.3	47.5
Between Kossuth Street & Noble Avenue	0.097	35.9	9.8	21.3	24.1	80.7
Between Noble Avenue & Williams Street	0.100	17.8	20.2	0.0	20.2	0.0
Between Williams Street & Knowlton Street	0.079	16.8	17.0	0.0	17.0	0.0
Barnum Avenue Corridor	1.872	381.1	17.7	133.2	27.2	

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 4 PM TO 6 PM, EASTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Knowlton Street & Williams Street	0.075	16.889	15.9	0.0	15.9	0.0
Between Williams Street & Noble Avenue	0.099	27.333	13.0	10.8	21.5	33.4
Between Noble Avenue & Kossuth Street	0.096	18.667	18.5	1.3	19.9	26.4
Between Kossuth Street & East Main Street	0.095	23.222	14.7	7.4	21.7	100.3
Between East Main Street & Seaview Avenue	0.559	74.667	27.0	6.3	29.5	107.4
Between Seaview Avenue & Central Avenue	0.146	47.889	11.0	26.0	24.1	87.1
Between Central Avenue & Grant Street	0.421	62.000	24.4	6.2	27.2	105.6
Between Grant Street & Bishop Avenue	0.152	40.778	13.5	17.0	23.1	128.8
Between Bishop Avenue & Bruce Avenue	0.224	39.778	20.3	9.3	26.5	146.1
Barnum Avenue Corridor	1.868	351.2	19.1	84.4	25.2	[illegible]

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

TRAVEL TIME SURVEY SUMMARY
BARNUM AVENUE CORRIDOR -- 4 PM TO 6 PM, WESTBOUND

Date = April 21, 1999 Section	Average Distance (Miles)	Average Travel Time (Seconds)	Average Speed (MPH)	Average Stop Delay (Seconds	Average Speed without Stop Delay (MPH)	Average Queue Length (Feet)
Between Bruce Avenue & Bishop Avenue	0.225	38.4	21.1	5.3	24.5	88.0
Between Bishop Avenue & Grant Street	0.212	48.1	15.9	11.2	20.7	92.9
Between Grant Street & Central Avenue	0.386	66.4	20.9	14.6	26.8	111.9
Between Central Avenue & Seaview Avenue	0.199	41.9	17.1	14.9	26.5	367.0
Between Seaview Avenue & East Main Street	0.501	99.0	18.2	35.9	28.5	151.6
Between East Main Street & Kossuth Street	0.094	21.1	16.1	5.2	21.4	59.8
Between Kossuth Street & Noble Avenue	0.092	29.5	11.2	10.6	17.5	73.9
Between Noble Avenue & Williams Street	0.092	19.3	17.3	0.0	17.3	0.0
Between Williams Street & Knowlton Street	0.079	21.9	12.9	0.0	12.9	0.0
Barnum Avenue Corridor	1.879	385.5	17.5	97.7	23.5	

Note: "Average Stop Delay" is total delay divided by number of runs; "Average Queue Length" is based on only those runs that a quue occurred.

HCS Reports

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Grant St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*AM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*8*	*149*	*18*	*9*	*234*	*91*	*24*	*14*	*15*	*78*	*5*	*4*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.91*	*0.91*	*0.91*	*0.82*	*0.82*	*0.82*	*0.83*	*0.83*	*0.83*	*0.81*	*0.81*	*0.81*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *33.0*	G =	G =	G =	G = *26.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *69.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*193*			*407*			*64*			*107*	
Lane Group Capacity		*679*			*672*			*437*			*373*	
v/c Ratio		*0.28*			*0.61*			*0.15*			*0.29*	
Green Ratio		*0.42*			*0.42*			*0.32*			*0.32*	
Uniform Delay d_1		*13.2*			*15.6*			*16.8*			*17.6*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*1.0*			*4.0*			*0.7*			*0.4*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*14.2*			*19.6*			*17.5*			*18.0*	
Lane Group LOS		*B*			*B*			*B*			*B*	
Approach Delay	*14.2*			*19.6*			*17.5*			*18.0*		
Approach LOS	*B*			*B*			*B*			*B*		
Intersection Delay	*17.8*			Intersection LOS						*B*		

HCS+™ Version 5.4

Generated: 6/19/2012 9:44 AM

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Grant St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*Mid-Day Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*16*	*332*	*20*	*16*	*242*	*108*	*16*	*14*	*21*	*100*	*8*	*3*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.86*	*0.86*	*0.86*	*0.93*	*0.93*	*0.93*	*0.85*	*0.85*	*0.85*	*0.73*	*0.73*	*0.73*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *33.0*	G =	G =	G =	G = *26.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =

Duration of Analysis (hrs) = *0.25* | Cycle Length C = *69.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*428*			*393*			*60*			*152*	
Lane Group Capacity		*681*			*659*			*450*			*375*	
v/c Ratio		*0.63*			*0.60*			*0.13*			*0.41*	
Green Ratio		*0.42*			*0.42*			*0.32*			*0.32*	
Uniform Delay d_1		*15.8*			*15.5*			*16.7*			*18.4*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*4.4*			*3.9*			*0.6*			*0.7*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*20.1*			*19.4*			*17.3*			*19.1*	
Lane Group LOS		*C*			*B*			*B*			*B*	
Approach Delay	*20.1*			*19.4*			*17.3*			*19.1*		
Approach LOS	*C*			*B*			*B*			*B*		
Intersection Delay	*19.5*			Intersection LOS						*B*		

HCS+™ Version 5.4

Generated: 6/19/2012 9:44 AM

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Grant St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*PM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*23*	*379*	*17*	*4*	*187*	*107*	*13*	*15*	*17*	*127*	*4*	*25*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.81*	*0.81*	*0.81*	*0.81*	*0.81*	*0.81*	*0.75*	*0.75*	*0.75*	*0.85*	*0.85*	*0.85*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *33.0*	G =	G =	G =	G = *26.0*	G =	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*					Cycle Length C = *69.0*			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*517*			*368*			*60*			*183*	
Lane Group Capacity		*676*			*666*			*456*			*379*	
v/c Ratio		*0.76*			*0.55*			*0.13*			*0.48*	
Green Ratio		*0.42*			*0.42*			*0.32*			*0.32*	
Uniform Delay d_1		*17.1*			*15.1*			*16.7*			*18.9*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*8.0*			*3.3*			*0.6*			*1.0*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*25.1*			*18.4*			*17.3*			*19.9*	
Lane Group LOS		*C*			*B*			*B*			*B*	
Approach Delay		*25.1*			*18.4*			*17.3*			*19.9*	
Approach LOS		*C*			*B*			*B*			*B*	
Intersection Delay		*21.7*			Intersection LOS						*C*	

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Noble Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*AM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*1*	*33*	*1*	*82*	*60*	*27*	*1*	*45*	*66*	*34*	*68*	*6*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.58*	*0.58*	*0.58*	*0.81*	*0.81*	*0.81*	*0.80*	*0.80*	*0.80*	*0.82*	*0.82*	*0.82*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *20.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *6*	Y =	Y =	Y =	Y = *6*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *62.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*61*			*208*			*139*			*131*	
Lane Group Capacity		*426*			*345*			*646*			*610*	
v/c Ratio		*0.14*			*0.60*			*0.22*			*0.21*	
Green Ratio		*0.26*			*0.26*			*0.42*			*0.42*	
Uniform Delay d_1		*17.7*			*20.2*			*11.5*			*11.5*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.50*	
Incremental Delay d_2		*0.7*			*7.6*			*0.8*			*0.8*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*18.4*			*27.8*			*12.3*			*12.3*	
Lane Group LOS		*B*			*C*			*B*			*B*	
Approach Delay	*18.4*			*27.8*			*12.3*			*12.3*		
Approach LOS	*B*			*C*			*B*			*B*		
Intersection Delay	*19.0*			Intersection LOS						*B*		

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Noble Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*Mid-Day Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*9*	*38*	*9*	*85*	*88*	*47*	*5*	*80*	*94*	*27*	*90*	*10*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.58*	*0.58*	*0.58*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.80*	*0.86*	*0.86*	*0.86*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *20.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *6*	Y =	Y =	Y =	Y = *6*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *62.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*98*			*275*			*223*			*148*	
Lane Group Capacity		*384*			*349*			*649*			*627*	
v/c Ratio		*0.26*			*0.79*			*0.34*			*0.24*	
Green Ratio		*0.26*			*0.26*			*0.42*			*0.42*	
Uniform Delay d_1		*18.3*			*21.4*			*12.2*			*11.6*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.50*	
Incremental Delay d_2		*1.6*			*16.4*			*1.4*			*0.9*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*19.9*			*37.8*			*13.7*			*12.5*	
Lane Group LOS		*B*			*D*			*B*			*B*	
Approach Delay	*19.9*			*37.8*			*13.7*			*12.5*		
Approach LOS	*B*			*D*			*B*			*B*		
Intersection Delay	*23.2*			Intersection LOS						*C*		

SHORT REPORT

General Information		Site Information	
Analyst	MCN	Intersection	Barnum Ave & Noble Ave
Agency or Co.	GBRC	Area Type	CBD or Similar
Date Performed	6/18/2012	Jurisdiction	Bridgeport
Time Period	PM-Day Peak Hour	Analysis Year	2010

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Lane Group		LTR			LTR			LTR			LTR	
Volume (vph)	13	61	12	123	116	58	5	109	131	36	118	10
% Heavy Vehicles	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.86	0.86	0.86	0.88	0.88	0.88	0.81	0.81	0.81	0.80	0.80	0.80
Pretimed/Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup Lost Time		6.0			6.0			6.0			6.0	
Extension of Effective Green		2.0			2.0			2.0			2.0	
Arrival Type		3			3			3			3	
Unit Extension		3.0			3.0			3.0			3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0			12.0			12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour		0			0			0			0	
Minimum Pedestrian Time		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 20.0	G =	G =	G =	G = 30.0	G =	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 62.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		100			338			303			204	
Lane Group Capacity		384			346			648			603	
v/c Ratio		0.26			0.98			0.47			0.34	
Green Ratio		0.26			0.26			0.42			0.42	
Uniform Delay d_1		18.3			22.8			13.0			12.2	
Delay Factor k		0.50			0.50			0.50			0.50	
Incremental Delay d_2		1.6			42.9			2.4			1.5	
PF Factor		1.000			1.000			1.000			1.000	
Control Delay		19.9			65.7			15.4			13.7	
Lane Group LOS		B			E			B			B	
Approach Delay		19.9			65.7			15.4			13.7	
Approach LOS		B			E			B			B	
Intersection Delay		33.5			Intersection LOS						C	

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Kossuth St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*AM-Day Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*2*	*120*	*14*	*1*	*160*	*1*	*3*	*17*	*22*	*3*	*17*	*5*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.68*	*0.68*	*0.68*	*0.88*	*0.88*	*0.88*	*0.66*	*0.66*	*0.66*	*0.69*	*0.69*	*0.69*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *40.0*	G =	G =	G =	G = *15.0*	G =	G =	G =
	Y = *4.5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *64.5*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*200*			*184*			*64*			*36*	
Lane Group Capacity		*920*			*934*			*260*			*269*	
v/c Ratio		*0.22*			*0.20*			*0.25*			*0.13*	
Green Ratio		*0.56*			*0.56*			*0.17*			*0.17*	
Uniform Delay d_1		*7.2*			*7.1*			*23.2*			*22.7*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*0.5*			*0.5*			*2.2*			*0.2*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*7.7*			*7.5*			*25.4*			*22.9*	
Lane Group LOS		*A*			*A*			*C*			*C*	
Approach Delay	*7.7*			*7.5*			*25.4*			*22.9*		
Approach LOS	*A*			*A*			*C*			*C*		
Intersection Delay	*11.1*			Intersection LOS			*B*					

HCS+™ Version 5.4

Generated: 6/19/2012 9:41 AM

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Kossuth St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*Mid-Day-Day Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*4*	*148*	*11*	*11*	*202*	*11*	*15*	*34*	*46*	*5*	*33*	*6*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.93*	*0.93*	*0.93*	*0.90*	*0.90*	*0.90*	*0.66*	*0.66*	*0.66*	*0.85*	*0.85*	*0.85*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *40.0*	G =	G =	G =	G = *15.0*	G =	G =	G =
	Y = *4.5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *64.5*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*175*			*248*			*145*			*52*	
Lane Group Capacity		*922*			*917*			*250*			*268*	
v/c Ratio		*0.19*			*0.27*			*0.58*			*0.19*	
Green Ratio		*0.56*			*0.56*			*0.17*			*0.17*	
Uniform Delay d_1		*7.0*			*7.4*			*24.6*			*22.9*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*0.5*			*0.7*			*9.5*			*0.4*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*7.5*			*8.1*			*34.1*			*23.3*	
Lane Group LOS		*A*			*A*			*C*			*C*	
Approach Delay		*7.5*			*8.1*			*34.1*			*23.3*	
Approach LOS		*A*			*A*			*C*			*C*	
Intersection Delay		*15.3*			Intersection LOS			*B*				

HCS+™ Version 5.4

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SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Kossuth St*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*PM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*7*	*214*	*12*	*9*	*269*	*9*	*29*	*45*	*49*	*6*	*25*	*7*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.80*	*0.80*	*0.80*	*0.90*	*0.90*	*0.90*	*0.85*	*0.85*	*0.85*	*0.79*	*0.79*	*0.79*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *40.0*	G =	G =	G =	G = *15.0*	G =	G =	G =
	Y = *4.5*	Y =	Y =	Y =	Y = *5*	Y =	Y =	Y =

Duration of Analysis (hrs) = *0.25* | Cycle Length C = *64.5*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*291*			*319*			*145*			*49*	
Lane Group Capacity		*919*			*921*			*245*			*260*	
v/c Ratio		*0.32*			*0.35*			*0.59*			*0.19*	
Green Ratio		*0.56*			*0.56*			*0.17*			*0.17*	
Uniform Delay d_1		*7.6*			*7.8*			*24.7*			*22.9*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*0.9*			*1.0*			*10.1*			*0.4*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*8.6*			*8.8*			*34.8*			*23.3*	
Lane Group LOS		*A*			*A*			*C*			*C*	
Approach Delay		*8.6*			*8.8*			*34.8*			*23.3*	
Approach LOS		*A*			*A*			*C*			*C*	
Intersection Delay		*14.3*			Intersection LOS			*B*				

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SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Seaview Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*AM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*14*	*161*	*38*	*55*	*167*	*18*	*39*	*110*	*85*	*10*	*160*	*33*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.78*	*0.78*	*0.78*	*0.88*	*0.88*	*0.88*	*0.89*	*0.89*	*0.89*	*0.82*	*0.82*	*0.82*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *4*	Y =	Y =	Y =	Y = *4*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*					Cycle Length C = *68.0*			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*273*			*273*			*264*			*247*	
Lane Group Capacity		*607*			*546*			*555*			*616*	
v/c Ratio		*0.45*			*0.50*			*0.48*			*0.40*	
Green Ratio		*0.38*			*0.38*			*0.38*			*0.38*	
Uniform Delay d_1		*15.7*			*16.0*			*15.9*			*15.3*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*2.4*			*3.2*			*2.9*			*0.4*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*18.1*			*19.3*			*18.8*			*15.7*	
Lane Group LOS		*B*			*B*			*B*			*B*	
Approach Delay	*18.1*			*19.3*			*18.8*			*15.7*		
Approach LOS	*B*			*B*			*B*			*B*		
Intersection Delay	*18.0*			Intersection LOS						*B*		

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SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Seaview Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*Mid-Day Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*22*	*243*	*50*	*61*	*206*	*24*	*42*	*154*	*96*	*16*	*122*	*22*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.88*	*0.88*	*0.88*	*0.92*	*0.92*	*0.92*	*0.84*	*0.84*	*0.84*	*0.91*	*0.91*	*0.91*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *4*	Y =	Y =	Y =	Y = *4*	Y =	Y =	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *68.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*358*			*316*			*347*			*176*	
Lane Group Capacity		*603*			*544*			*570*			*597*	
v/c Ratio		*0.59*			*0.58*			*0.61*			*0.29*	
Green Ratio		*0.38*			*0.38*			*0.38*			*0.38*	
Uniform Delay d_1		*16.8*			*16.7*			*16.9*			*14.6*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*4.3*			*4.5*			*4.8*			*0.3*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*21.0*			*21.2*			*21.7*			*14.9*	
Lane Group LOS		*C*			*C*			*C*			*B*	
Approach Delay	*21.0*			*21.2*			*21.7*			*14.9*		
Approach LOS	*C*			*C*			*C*			*B*		
Intersection Delay	*20.4*			Intersection LOS						*C*		

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Seaview Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*PM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*29*	*285*	*59*	*86*	*217*	*30*	*57*	*191*	*142*	*14*	*156*	*21*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.87*	*0.87*	*0.87*	*0.85*	*0.85*	*0.85*	*0.80*	*0.80*	*0.80*	*0.92*	*0.92*	*0.92*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*A*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *30.0*	G =	G =	G =
	Y = *4*	Y =	Y =	Y =	Y = *4*	Y =	Y =	Y =

Duration of Analysis (hrs) = *0.25* Cycle Length C = *68.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*429*			*391*			*487*			*208*	
Lane Group Capacity		*594*			*475*			*558*			*604*	
v/c Ratio		*0.72*			*0.82*			*0.87*			*0.34*	
Green Ratio		*0.38*			*0.38*			*0.38*			*0.38*	
Uniform Delay d_1		*17.9*			*18.9*			*19.5*			*14.9*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.11*	
Incremental Delay d_2		*7.4*			*14.9*			*17.0*			*0.3*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*25.4*			*33.8*			*36.5*			*15.3*	
Lane Group LOS		*C*			*C*			*D*			*B*	
Approach Delay	*25.4*			*33.8*			*36.5*			*15.3*		
Approach LOS	*C*			*C*			*D*			*B*		
Intersection Delay	*29.7*			Intersection LOS						*C*		

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Central Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*AM Peak Hour*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*28*	*180*	*25*	*92*	*213*	*15*	*38*	*92*	*63*	*20*	*101*	*14*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.96*	*0.96*	*0.96*	*0.76*	*0.76*	*0.76*	*0.83*	*0.83*	*0.83*	*0.82*	*0.82*	*0.82*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *25.0*	G =	G =	G =
	Y = *6*	Y =	Y =	Y =	Y = *6*	Y =	Y =	Y =

Duration of Analysis (hrs) = *0.25* Cycle Length C = *67.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*243*			*421*			*233*			*164*	
Lane Group Capacity		*585*			*529*			*450*			*479*	
v/c Ratio		*0.42*			*0.80*			*0.52*			*0.34*	
Green Ratio		*0.39*			*0.39*			*0.31*			*0.31*	
Uniform Delay d_1		*15.0*			*18.2*			*18.9*			*17.7*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.50*	
Incremental Delay d_2		*2.2*			*11.8*			*4.2*			*1.9*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*17.1*			*29.9*			*23.1*			*19.6*	
Lane Group LOS		*B*			*C*			*C*			*B*	
Approach Delay		*17.1*			*29.9*			*23.1*			*19.6*	
Approach LOS		*B*			*C*			*C*			*B*	
Intersection Delay		*23.9*			Intersection LOS						*C*	

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SHORT REPORT

General Information		Site Information	
Analyst	MCN	Intersection	Barnum Ave & Central Ave
Agency or Co.	GBRC	Area Type	CBD or Similar
Date Performed	6/18/2012	Jurisdiction	Bridgeport
Time Period	PM Peak Hour	Analysis Year	2010

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Lane Group		LTR			LTR			LTR			LTR	
Volume (vph)	43	388	47	104	226	22	54	109	89	15	121	34
% Heavy Vehicles	2	2	2	2	2	2	2	2	2	2	2	2
PHF	0.80	0.80	0.80	0.93	0.93	0.93	0.73	0.73	0.73	0.99	0.99	0.99
Pretimed/Actuated (P/A)	P	P	P	P	P	P	P	P	P	P	P	P
Startup Lost Time		6.0			6.0			6.0			6.0	
Extension of Effective Green		2.0			2.0			2.0			2.0	
Arrival Type		3			3			3			3	
Unit Extension		3.0			3.0			3.0			3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0			12.0			12.0			12.0	
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking/Hour												
Bus Stops/Hour		0			0			0			0	
Minimum Pedestrian Time		3.2			3.2			3.2			3.2	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 30.0	G =	G =	G =	G = 25.0	G =	G =	G =
	Y = 6	Y =	Y =	Y =	Y = 6	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 67.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		598			379			345			171	
Lane Group Capacity		593			418			439			485	
v/c Ratio		1.01			0.91			0.79			0.35	
Green Ratio		0.39			0.39			0.31			0.31	
Uniform Delay d_1		20.5			19.4			21.0			17.8	
Delay Factor k		0.50			0.50			0.50			0.50	
Incremental Delay d_2		39.1			25.9			13.2			2.0	
PF Factor		1.000			1.000			1.000			1.000	
Control Delay		59.6			45.2			34.2			19.8	
Lane Group LOS		E			D			C			B	
Approach Delay		59.6			45.2			34.2			19.8	
Approach LOS		E			D			C			B	
Intersection Delay		45.5			Intersection LOS						D	

SHORT REPORT

General Information		Site Information	
Analyst	*MCN*	Intersection	*Barnum Ave & Central Ave*
Agency or Co.	*GBRC*	Area Type	*CBD or Similar*
Date Performed	*6/18/2012*	Jurisdiction	*Bridgeport*
Time Period	*Mid-Day*	Analysis Year	*2010*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*	*0*	*1*	*0*
Lane Group		*LTR*			*LTR*			*LTR*			*LTR*	
Volume (vph)	*31*	*309*	*47*	*141*	*234*	*23*	*44*	*112*	*91*	*16*	*90*	*26*
% Heavy Vehicles	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
PHF	*0.90*	*0.90*	*0.90*	*0.87*	*0.87*	*0.87*	*0.87*	*0.87*	*0.87*	*0.85*	*0.85*	*0.85*
Pretimed/Actuated (P/A)	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*	*P*
Startup Lost Time		*6.0*			*6.0*			*6.0*			*6.0*	
Extension of Effective Green		*2.0*			*2.0*			*2.0*			*2.0*	
Arrival Type		*3*			*3*			*3*			*3*	
Unit Extension		*3.0*			*3.0*			*3.0*			*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*			*12.0*			*12.0*			*12.0*	
Parking/Grade/Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking/Hour												
Bus Stops/Hour		*0*			*0*			*0*			*0*	
Minimum Pedestrian Time		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = *30.0*	G =	G =	G =	G = *25.0*	G =	G =	G =
	Y = *6*	Y =	Y =	Y =	Y = *6*	Y =	Y =	Y =

Duration of Analysis (hrs) = *0.25* | Cycle Length C = *67.0*

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adjusted Flow Rate		*429*			*457*			*285*			*156*	
Lane Group Capacity		*596*			*461*			*451*			*477*	
v/c Ratio		*0.72*			*0.99*			*0.63*			*0.33*	
Green Ratio		*0.39*			*0.39*			*0.31*			*0.31*	
Uniform Delay d_1		*17.4*			*20.4*			*19.7*			*17.6*	
Delay Factor k		*0.50*			*0.50*			*0.50*			*0.50*	
Incremental Delay d_2		*7.3*			*39.8*			*6.6*			*1.8*	
PF Factor		*1.000*			*1.000*			*1.000*			*1.000*	
Control Delay		*24.7*			*60.2*			*26.3*			*19.4*	
Lane Group LOS		*C*			*E*			*C*			*B*	
Approach Delay	*24.7*			*60.2*			*26.3*			*19.4*		
Approach LOS	*C*			*E*			*C*			*B*		
Intersection Delay	*36.7*			Intersection LOS						*D*		

BARNUM STATION FEASIBILITY STUDY

Technical Memorandum #2a: Site Station Locations/Fatal Flaw Analysis

Submitted to:
Greater Bridgeport Regional Council (GBRC)
City of Bridgeport

Submitted by:
Vanasse Hangen Brustlin, Inc.

In association with:
ICON architecture, Inc.
Vantage Point Development Advisors, LLC

February 2013

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Technical Memorandum #2a: Site Station Locations/Fatal Flaw Analysis

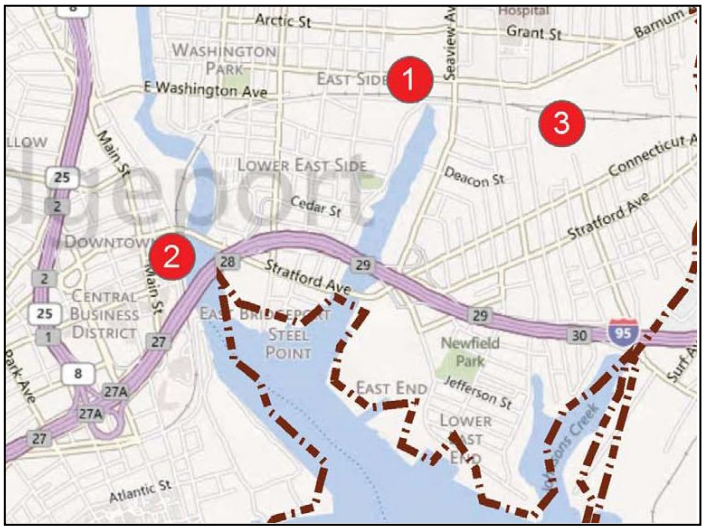
Introduction

This memorandum focuses on the existing rail constraints in East Bridgeport. It describes a number of potential service and platform options, and evaluates each of those options through a series of screening criteria. The evaluation will be augmented by other operational and ridership information, as that information becomes available. Ultimately, this process will determine if a station is feasible in East Bridgeport and will identify an optimal service, platform, and station alternative.

Existing Railroad Infrastructure Assessment

To provide a station within East Bridgeport, a number of rail system and platform geometric requirements and constraints will need to be overcome. To understand these constraints, it is useful to consider the proposed Barnum Station (#1) in the context of the downtown Bridgeport Station (#2) and Metro-North Railroad's (MNR's) East Bridgeport Rail Yard (EBRY, #3), as depicted in ***Figure 1*** below.

Figure 1: Study Area Context



The segment of track just north of Bridgeport Station running through MNR's EBRY has numerous constraints. The four-track mainline south of Bridgeport Station has switches for trains to move from the center to the outside tracks to access Bridgeport Station's side platforms. Upon exiting Bridgeport Station, the guideway curves east and crosses the Pequonnock River. Upon straightening after across the river, where the proposed Barnum Station would be located, and immediately north of that proposed station, are a series of switches needed to access EBRY. Any station platform, side or island, must be parallel to the tracks to comply with American with Disabilities Act of 1990 (ADA) requirements (limiting the gap across which patrons must step). This dictates that the track be almost totally straight (tangent). There is currently 1,050 feet of such tangent track between the yard switches to the north and the curve to the south of the proposed Barnum Station, which is exactly the length required for station platforms. ***Figure 2*** is an aerial view of the study area.

Figure 2: Aerial View of the Study Area

Currently, in the morning peak period, MNR runs three trains (#1527, #1529, and #1533) that provide express service from Bridgeport Station to Manhattan (Grand Central Station). Two of these trains make two stops and the other makes a single stop. In the evening peak period, Bridgeport has two

trains making only two stops before reaching Manhattan (#1556, #1560). Amtrak's New York City earliest inbound train leaves Bridgeport Station at 7:58 AM with the next at 11:01 AM, while its outbound trains return to Bridgeport at 4:42 PM and 7:54 PM, effectively missing both peak periods.

Station Concepts

There are three basic station configurations: 1) Side platform, 2) center platform, and 3) some combination of center and side platforms. Each has advantages and disadvantages which can vary with the specifics of the site.

- **Side platform stations** typically require no modification of the tracks. Side platform stations usually require more vertical circulation provisions than center platform stations.
- **Island/center platform stations** entail widening of the track centers within the station and for a distance on either end of the station. Center platform stations offer riders the ability to transfer between trains without the need to change platforms, something side platform stations usually require.
- **Stations with center and side platforms** have the greatest requirement for vertical circulation provisions and require widened track centers for the center platform.

The overall objective for Barnum Station is to provide the best possible access for patrons with the fewest possible impacts on rail operations for the lowest possible capital and operating cost. These factors were considered for each configuration studied in this evaluation.

Station Design Screening Criteria

The following physical, operational, and administrative constraints have been selected as the screening criteria for service and platform options at a potential Barnum Station:

- Guideway modifications
- Right-of-way (ROW) requirements
- Track and signal modifications
- Access to EBRY
- MNR and Amtrak approvals

Station Design Guidelines

The following guidelines have been used in developing the station alternatives based on the cited sources and experience on comparable projects.

1. The station must comply with MNR's "Station Standards and Guidelines."[1] This includes minimum platform widths (12 feet for side platforms and 17 feet for island/center platforms
2. The station must accommodate a full-length, peak-period MNR trainset consisting of 12 passenger cars and a locomotive. This results in a total platform length of 1,050 feet when allowances are made for stopping variations.
3. The station must meet ADA requirements, necessitating the platforms be high level to allow level boarding of the trains and nearly tangent (roughly within 1 degree) to insure the gap between the platform edge and train doorways will not exceed a gap of 3 inches.[2]
4. Because the station platforms will be elevated to match the guideway height and the line is electrified with overhead catenary, it was assumed that circulation across the guideway should be provided beneath, rather than over, the guideway. Given the height of the catenary wires, an overpass would be at least 30 feet above grade, imposing significant additional cost for vertical circulation elements and increasing patron access times to the station.
5. Impacts to the signal system should be minimized and not impact the operations or functions of MNR's use of the guideway.
6. The shortest and most direct station access will be provided for pedestrians/bicyclists, public transit users, short-term parking users, and long-term parking users in that order.
7. Safety and security for patrons will be a primary consideration.

Conceptual Station Layout Plans

Based on these guidelines, three service/platform options for Barnum Station were evaluated. Note that these options represent side platform and center and side platform stations, but do not include an island/center only station:

Scenario 1: Route Express Amtrak Trains to Barnum Station Side Platforms
This scenario involves routing express Amtrak trains that operate on the inside tracks to a side platform configuration at Barnum Station. The side platform configuration would require significant modifications to the existing trackwork that could not be accomplished without shifting Barnum Station north approximately 400 feet from the location currently under consideration. ***Figure 3*** illustrates the location needed to accommodate the trackwork modifications this option would require.

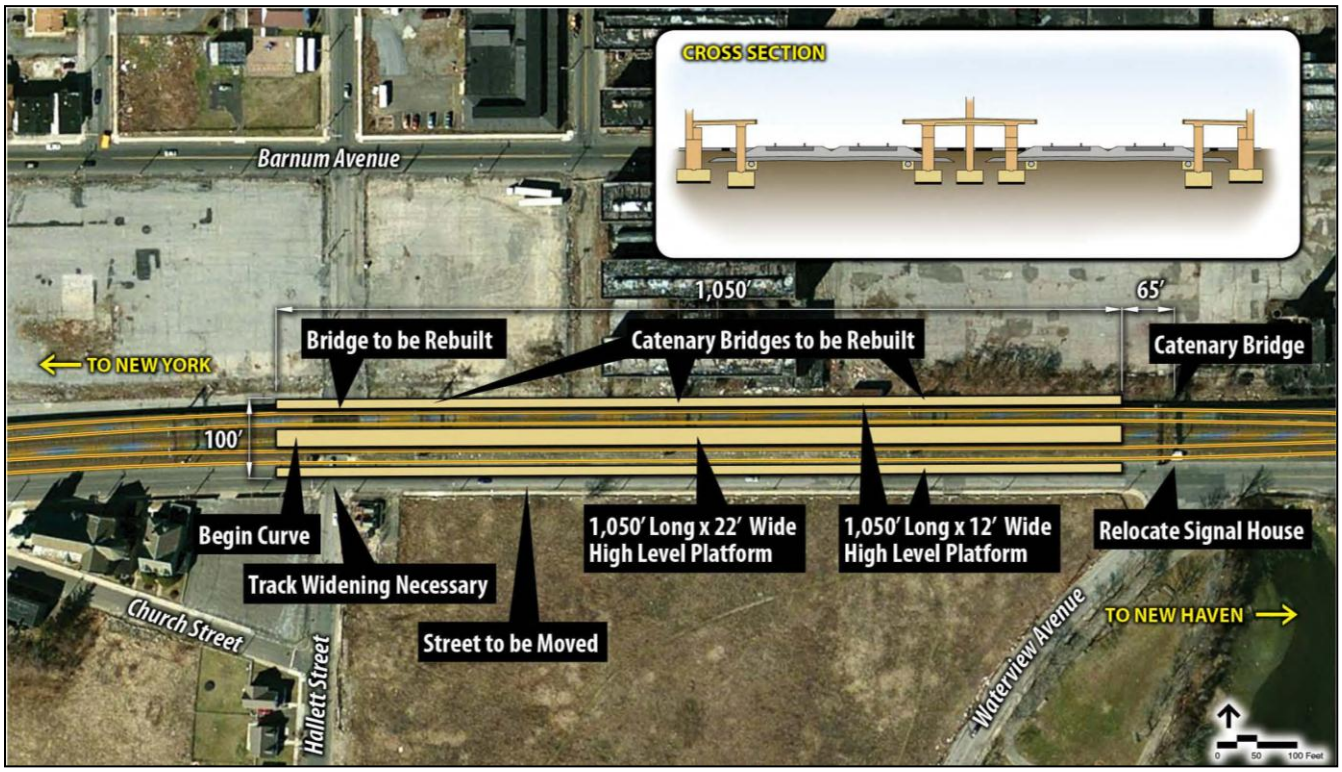
[1] Metro North Railroad Station Standards and Guidelines Revision #8, MNR, 2008.
[2] http://www.access-board.gov/adaag/about/aiacourse/ADAAG/adaag2.htm#10.3.1(9).

Figure 3: Amtrak and Local Trains to Barnum Station Side Platforms

<u>Scenario 2: Provide Center and Side Platforms at Barnum Station</u>

This scenario would involve routing express Amtrak trains to an island/center platform configuration at Barnum Station, as well as including side platforms for local MNR service, as depicted in ***Figure 4***. The addition of the 25-foot wide center platform (whether in the center or offset) would require realignment of the existing trackwork between Bridgeport Station and the proposed Barnum Station.

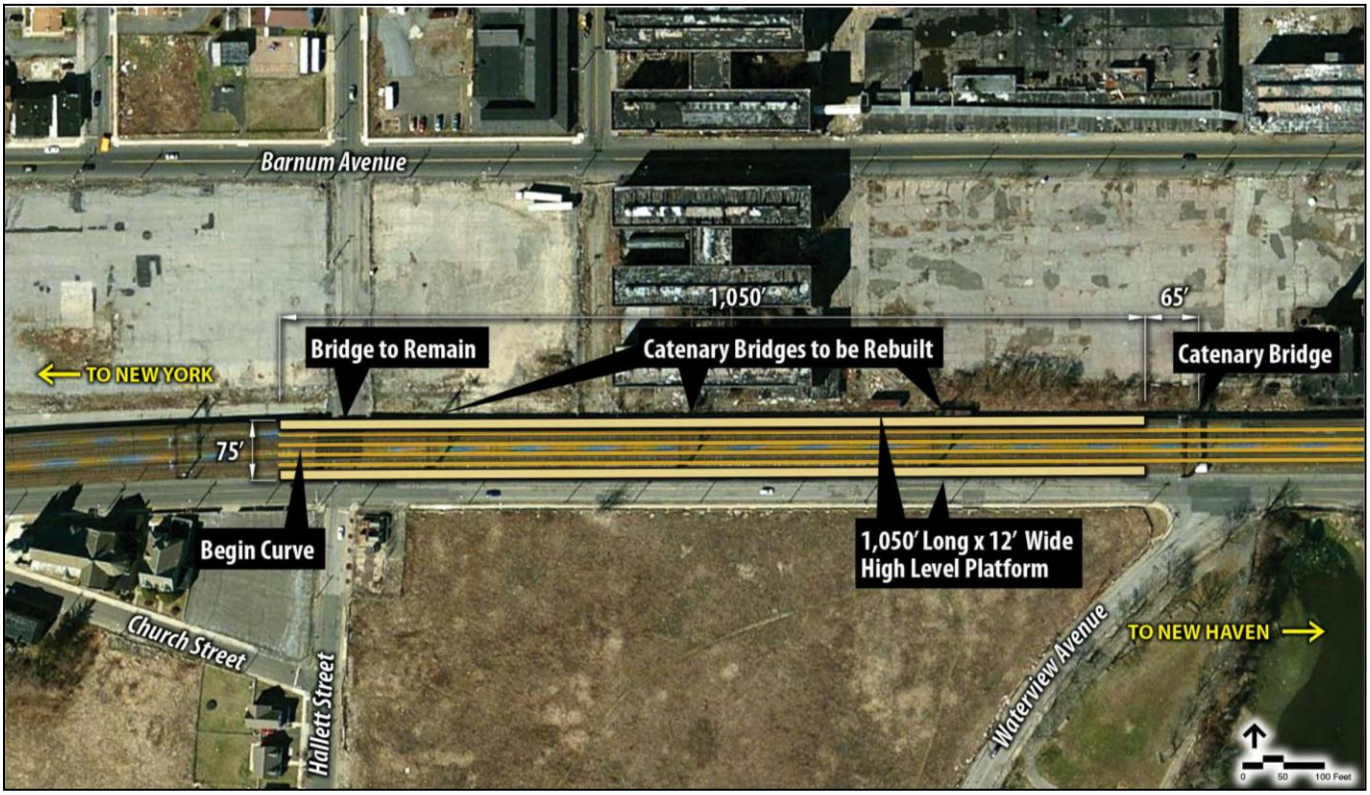
Figure 4: Amtrak Trains to Barnum Station Island Platform/Local Trains to Side Platforms



<u>Scenario 3: Extend Existing MNR Express Service from Downtown Bridgeport Station to Barnum Station Side Platforms</u>

This scenario proposes revising some or all of the existing MNR Express service trains to serve Barnum Station side platforms, instead of Bridgeport Station. Alternatively, these trains could stop at Barnum Station as well as Bridgeport Station, which would render them less "express" for Barnum and other northern/eastern riders, but unchanged for those commuting from Bridgeport to the south. See ***Figure 5***.

Figure 5: MNR Trains to Barnum Station Side Platforms



Fatal Flaw Analysis

Utilizing the screening criteria noted earlier in this memorandum, an initial fatal flaw screening of each of the scenarios was conducted.

Initial Fatal Flaw Screening

Scenario 1: Route Express Amtrak Trains to Barnum Station Side Platforms

- **Guideway modifications** – This option would not affect the guideway but would require that the station be shifted 400 feet north.
- **ROW requirements** – Because this option would not impact the guideway, it would not impact the ROW required to implement it.
- **Track and signal modifications** – This option would impact the trackwork by requiring the addition of switches to move trains from the center tracks to the outside tracks and to return those trains to the center

tracks. Relocating the platforms would entail significant signal system modifications that would likely not be acceptable to MNR or Amtrak.

- **Access to EBRY –** The side platform station location of this option would eliminate access to the EBRY from Tracks 2 and 4. Note that the location currently being considered for Barnum avoids impacting the signal system in a way that would jeopardize access to EBRY.

- **MNR and Amtrak approvals –** Amtrak approval for an additional station stop would be required. MNR approval for an additional station stop and elimination of EBRY access would be required.

Scenario 2: Provide an Island Platform at Barnum Station to be Served by Amtrak Express Trains

- **Guideway modifications –** This option would require significant modifications of the guideway, relocation of the Barnum Station northward. There would also be significant reconstruction required to the north and south of the proposed station. The existing railroad bridges would need to be replaced with wider and possibly longer bridges.

- **ROW requirements –** The widened guideway and station would require additional ROW for the 25-foot wider guideway.

- **Track and signal modifications –** The track would be shifted to accommodate the island platform and the signal system would have to be modified to accommodate trains stopping at the island platform.

- **Access to EBRY –** This option would impact and possibly eliminate access to EBRY from the south.

- **MNR and Amtrak approvals –** The indicated modifications may not be sufficient to secure approval of Amtrak or MNR. In the case of Amtrak, the addition of a new center platform station is not in Amtrak's plans for the North East Corridor. Amtrak would need to accept an additional stop for its Acela service between New Haven and Stamford, a distance of about 40 miles and 39 minutes run time. Furthermore, any high speed rail station would have to be on a siding – which is not physically possible in the Barnum Station location. For MNR, the potential loss of access to and from EBRY from the south would significantly reduce the value of that facility.

Scenario 3: Extend Existing Metro-North Railroad Express Service from Downtown Bridgeport Station to Barnum Station

- **Guideway modifications –** No guideway modifications would be required.

- **ROW requirements –** No additional ROW would be required.
- **Track and signal modifications –** The track would not require modification, but the signal system would need to be modified to support trains stopping at the Barnum Station.
- **Access to EBRY –** Access to the EBRY would be unaffected.
- **MNR and Amtrak approvals –** This scenario requires no trackwork modifications or additional construction beyond those needed for the side platform station and does not impact current rail infrastructure.

Identification of Optimum Station Conceptual Design

Analysis indicates that providing side or island/center platforms at a new Barnum Station to serve Amtrak "Express" trains would require a number of significant physical modifications and improvements, significant operational changes, and a number of administrative approvals and policy changes from MNR and Amtrak.

Extending "express" service from the downtown Bridgeport Station to a Barnum Station with side platforms would require the least amount of physical, operational, and administrative changes. Given these impacts and the overall constructability of this option, extending express service from the downtown Bridgeport Station to Barnum Station has been identified as the optimum station conceptual design.

Note that a general station platform layout will be developed and utilized as part of the station area concept planning. Order of magnitude station cost estimates will be provided for this optimal design/general platform layout.

Feasibility Measures Matrix

The following matrix highlights the modifications and improvements associated with providing express service at Barnum.

Table 1: Barnum Station Feasibility Measures Matrix

Scenario	Constraints				
	Guideway Modifications	**ROW Requirements**	**Track and Signal Modifications**	**Access to EBRY**	**Approvals**
1.Side Platforms	None	No additional ROW needed	Substantial track and signal modifications	Southern access to and from EBRY would be eliminated from Tracks 2 and 4, the tracks on the north side of the guideway.	Amtrak approval for additional station stop. MNR approval for additional station stop and elimination of EBRY access.
2.Island Platform	New guideway required both north and south of Barnum Station for several hundred feet. New guideway 25 feet wider at Barnum Station, slowly tapering back to current width. New bridges over local roadways from Pulaski Street to Seaview Avenue. Seaview Avenue overpass replacement.	Addition of 25 feet of ROW at Barnum Station slowly tapering to current ROW on either side of Barnum Station.	Substantial track and signal modifications.	Southern access to and from EBRY potentially eliminated.	Amtrak approval of additional station stop. MNR approval for additional station stop and elimination of EBRY access.
3.Extend MNR Service	None	No additional ROW needed	No additional signal modifications	Not impacted	MNR approval for additional station stop.

Barnum Station Feasibility Study

Station and Site Concepts

February 15, 2013

ICON architecture

Contents

The station acts as a catalyst for a mixed-use, transit-oriented development on vacant brownfield parcels located within its quarter-mile walking distance.

01 Introduction

The city of Bridgeport, while enjoying direct and frequent rail service to New Haven, Stamford and Manhattan, having a historic and humanely scaled fabric, and an unparalleled sense of walkability, has not enjoyed the growth that has occurred in the rest of the region for the past 50 years. Yet as demand continues to spread outward from the region's core, Bridgeport is the next logical location along the Connecticut coast for infill development.

The proposed Barnum Station, a second commuter rail station strategically located in one of the most underutilized areas of Bridgeport's urban core, could significantly enhance the development potential of this area. Well separated from the existing downtown station, situated close to Bridgeport Hospital, the city's largest employer, and with excellent vehicular and surface transit access from both Route 1 and I-95, the site is situated among large expanses of land well-suited to Transit-Oriented Development. These vacant and underutilized parcels will be studied for potential adaptive reuse and redevelopment opportunities, and existing transit data analyzed for their impacts on the neighborhood. The focus is on creating a vibrant mix of land uses with residential prioritized in the short term and office development and retail targeted on the longer horizon, resulting in a framework in place to harness upcoming demand around transit oriented communities.

01.01 Consistent Assumptions

There are many program and access variables possible in developing the concept design of the new Bridgeport Barnum Station, all of which impact the urban site design alternatives. Therefore, several assumptions had to be made consistently in order to narrow down the options presented. These include:

1. Major development plans will not be located within the FEMA 100 and 500 year flood plains.
2. Station platform length is set at 1,050 feet.
3. Bridgeport Regional bus access will be exclusively on the north side of the tracks.
4. There will be a passage beneath the viaduct for pedestrians to cross between the north and south sides of the track.

01.02 Variables

The various station area design options are differentiated with respect to the following variables:

1. In each scheme, existing and new roads are aligned in the way that best serves that particular design alternative.
2. While there will be one cut and pedestrian passage under the viaduct, its location is variable.
3. The location of the station changes within the set 1,050' platform length.

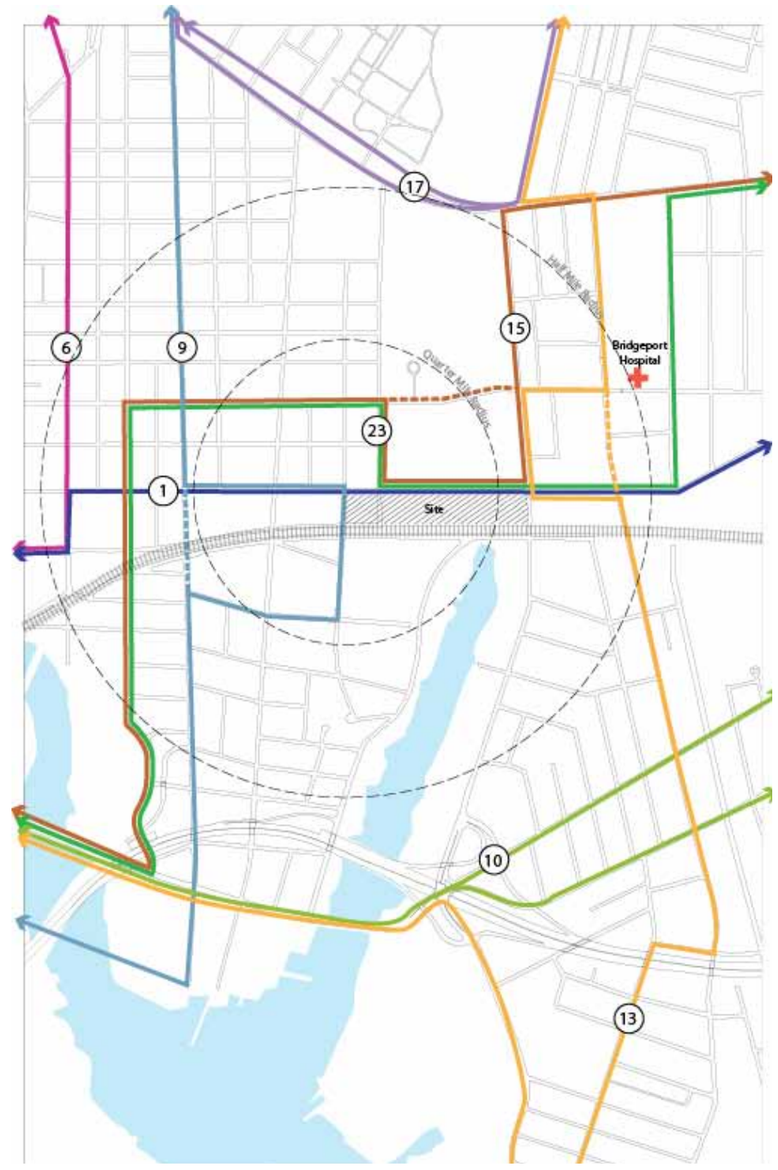


Figure 01.01 Existing bus routes, altered for station access

02 Station Design

02.01 Programmatic Assumptions

The Metro North station design guidelines are intended to provide for a safe customer and employee environment that is easily maintainable in the aesthetic standards of Metro-North's public image.

Exterior element requirements:

- Canopies (9') clearance from platforms, centered at 200' long
- Benches (need seats for 20% of peak capacity)
- Enclosed shelters (6'x20' to 6'x30'), at the NE end of platform especially, with heaters
- Ticket Vending Machines laid out in pairs
- Stairways at the center of platforms, with 5' buffer width.
- Vertical circulation outboard of platforms, including elevators in both stations
- Pedestrian Crossings (ADA width is 5' 6" minimum)
- Platform minimum length 1,050', with a 12' minimum width and a 17' island, minimum width.

- A sawtooth bus bay is 70' in length, can park three in 210'

Station building program requirements:

Metro North stations usually consist of a ticket office, a waiting room for railroad customers, separate rest rooms for ticket agents and customers, and often, but not always, a newsstand and/or refreshment stand or café, operated by a private vendor through an MTA lease.

02.02 Interactions

The existing rail tracks are 75' in width. On either side of these, a new 17' platform will be attached. This will cause the relocation of Crescent Avenue on the south side, and require a new access road on the north side. The stations will be two stories, to allow for vertical circulation and enclosed waiting rooms near the tracks.

The station has been designed with an underpass rather than an overpass, due to the already elevated nature of the existing tracks. The two stations will be connected for pedestrians by an under viaduct tunnel. There is also the potential to enhance the visibility and therefore safety of the tunnel by adjoining it to a new roadway tunnel.

02.03 Screening Criteria

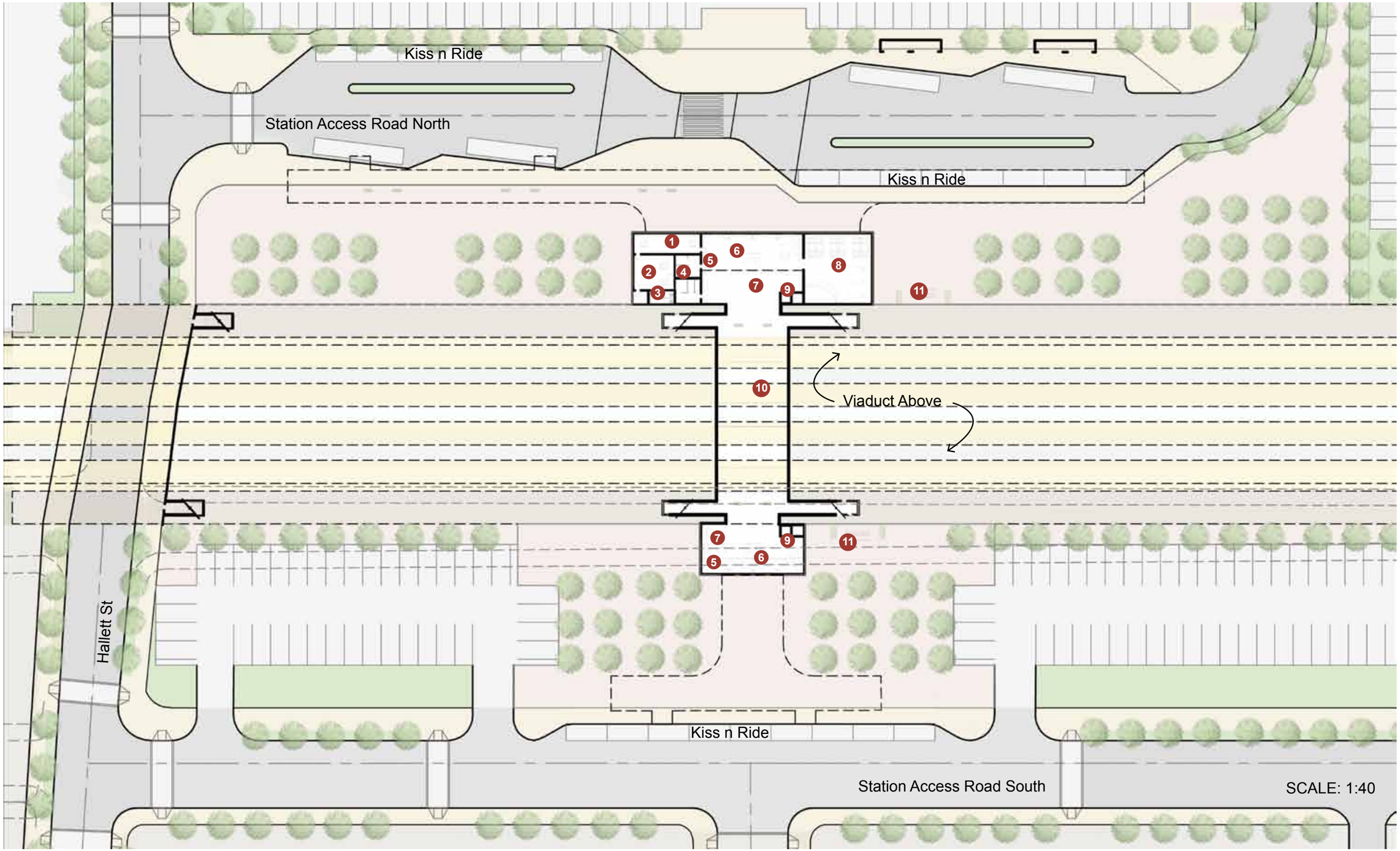
Rail operations and infrastructure screening criteria:

- Cost
- Ease of integrating new construction
- Ease of maintaining rail operations during construction

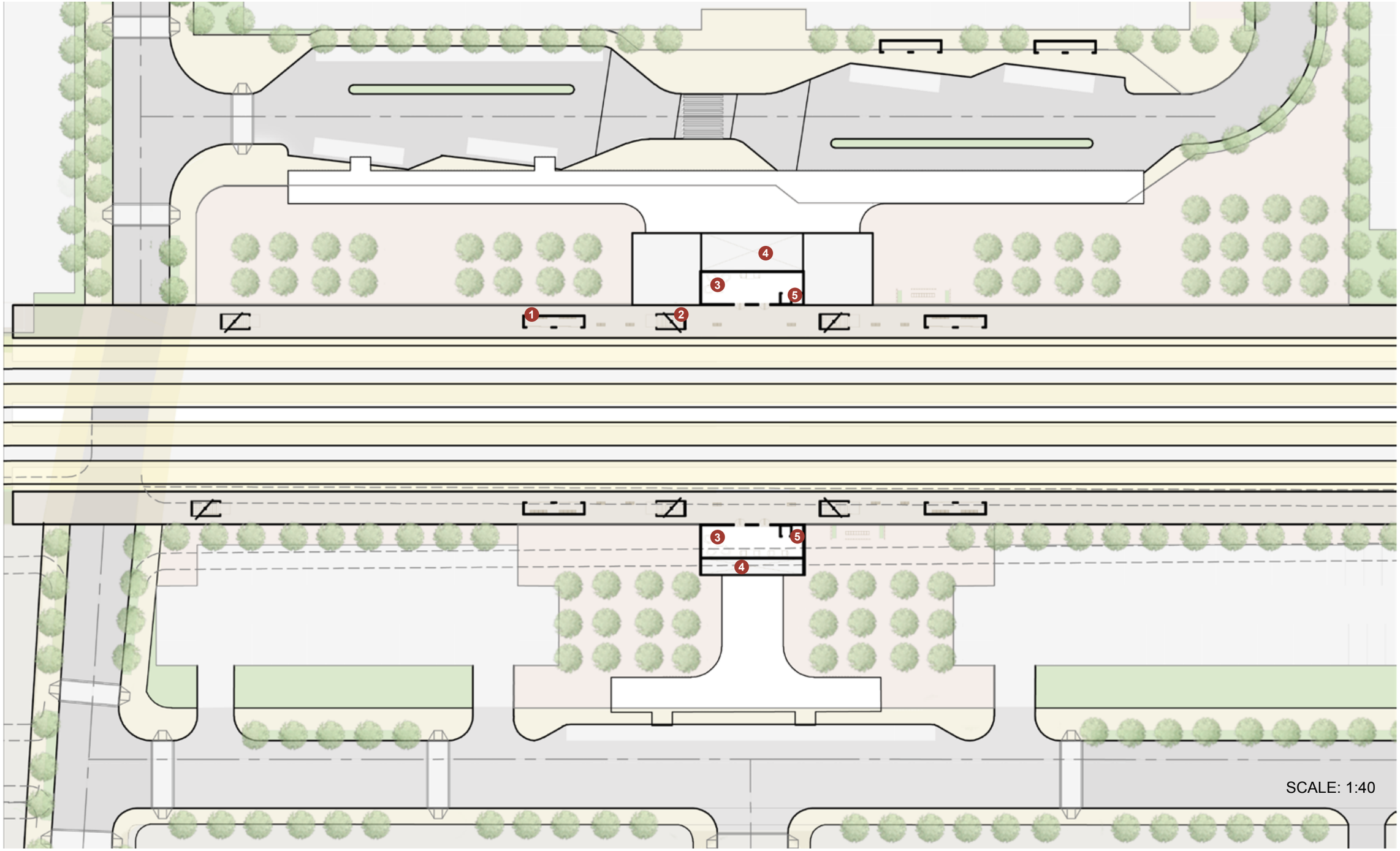
Land use and neighborhood screening criteria:

- Station accessibility in order of suggested access priorities:
    1. Pedestrian
    2. Bike
    3. Bus
    4. Kiss and Ride
    5. Park and Ride
- Park space and additions to the urban tree canopy. Each of the station plans vary in the amount of open space left at the eastern portion of the site for an addition to the Yellow Mill Creek Greenway in FEMA's 100 and 500-yr flood plains.
- Streetscaping designs and landscaping buffers to parking lots. All of the designs allow for tree lined streets and landscape buffers around the parking lots. However, the south side is more generous in this regard as it is where the most likely residential development in the near term will occur. The parking lots themselves are also very flexible and there is opportunity for landscaping within the lots.
- Traffic disruption along existing, primary throughways. Several options locate the major potential for traffic disruption, bus loading, within the site. But others have it located along a new road under the viaduct connecting Barnum Ave with the South Station Access Road.
- Green infrastructure integration. Although the details are not illustrated, each option has opportunities to add bioswales, rain gardens, and permeable pavement within the site.
- Permeable pavements will be most commonly specified for sections of the parking lot. R gardens and bioswales shall be located in the medians and around the parking's perimeter can be seamlessly integrated into parking lot designs. Benefits include urban heat island mitigation and a more walkable built environment.

STATION BUILDING		SIZE
Westbound	Concourse	4,100 sq ft
	Mezzanine	840 sq ft
Eastbound	Concourse	1,300 sq ft
	Mezzanine	840 sq ft
TOTAL SIZE		7,080 sq ft



1 Ticket Booth
2 Ticket Agent Office
3 Ticket Agent Restroom
4 ADA Public Restrooms
5 Ticket Vending Machines
6 Information Booth
7 Waiting Area
8 Vendor / Cafe / News
9 Elevator
10 Pedestrian Passage
11 Bike Storage



1. Platform Shelter
2. Stair
3. Enclosed Waiting Area
4. Two Story Overlook
5. Elevator
6. Information Booth

PLATFORM LEVEL

03 Concept Area Plan

03.01 Identifying Transit Oriented Development Land Uses

The land use pattern indicated in the diagrams are consistent with both the existing development strategies and infrastructure improvements being planned by the city of Bridgeport and with major institutional and commercial projects already in the development pipeline. Several examples of key projects along the East Bridgeport Development Corridor include:

- Seaview Ave Industrial Park, many acres of former heavy industrial uses are undergoing Federal and State mandated environmental clean-up in preparation of marketing as a campus office park and light industrial complex.
- Commercial development RFPs in urban commercial and retail uses.
- Steel Point/ Bass Pro at Seaview Plaza both will play a pivotal role in advancing the area's regional standing.
- Bridgeport Hospital is expected to expand, adding nearly 1,600 jobs to East Bridgeport.
- Bridgeport Housing Authority has a major interest in the development of the former Father Panik Village site. Over the near and mid term, the BHA expects to develop up to 1,200 units on six potential sites, four of which are within the Barnum Station study area. These four sites include Bridgeport Health and in the adjacent diagram are labeled "traditional neighborhood development", referencing their desire to mix affordable with market rate units.

The scale and mix of development proposed is also conditioned by the findings of the recent area market study conducted as a part of this planning effort. The study projected the demand through the year 2020 and included implications associated with the expansion of the study area. Development deemed reasonable through 2020 includes 600 affordable housing units (rents less than $1,300), 350 market rate units (rents greater than $1,300), approximately 175,000 square feet of office and flex space (much of that spinning off from the Hospital expansion) and 40,000 square feet of retail to support employment growth in the area.

03.02 Impact Analysis

As ranked by Reconnecting America, the Barnum Station area has a high level of transit connectivity and opportunity. As an indicator of the potential success of the area as a development catalyst, the implications are positive.

First, the proximity of downtown to the proposed station area provides considerable competitive pull for residents who would appreciate nearby cultural options, but not be located immediately in the commercial zones. Proximity to the Hospital provides great incentive for employees to reside close by. Subsequent employment will in turn support retail uses within the study area.

However, these longer term visions are to be considered aggressive by current market conditions. in order to support redevelopment in the area, the City should continue to support the Urban and Industrial Sites Reinvestment Tax Credit Program, among others, as a catalyst for the area's future development and success.

Potential Housing Sites

5. Former Father Panik Village Site
6. Housing Authority Infill
7. Bridgeport Health
9A. Transit Oriented Development

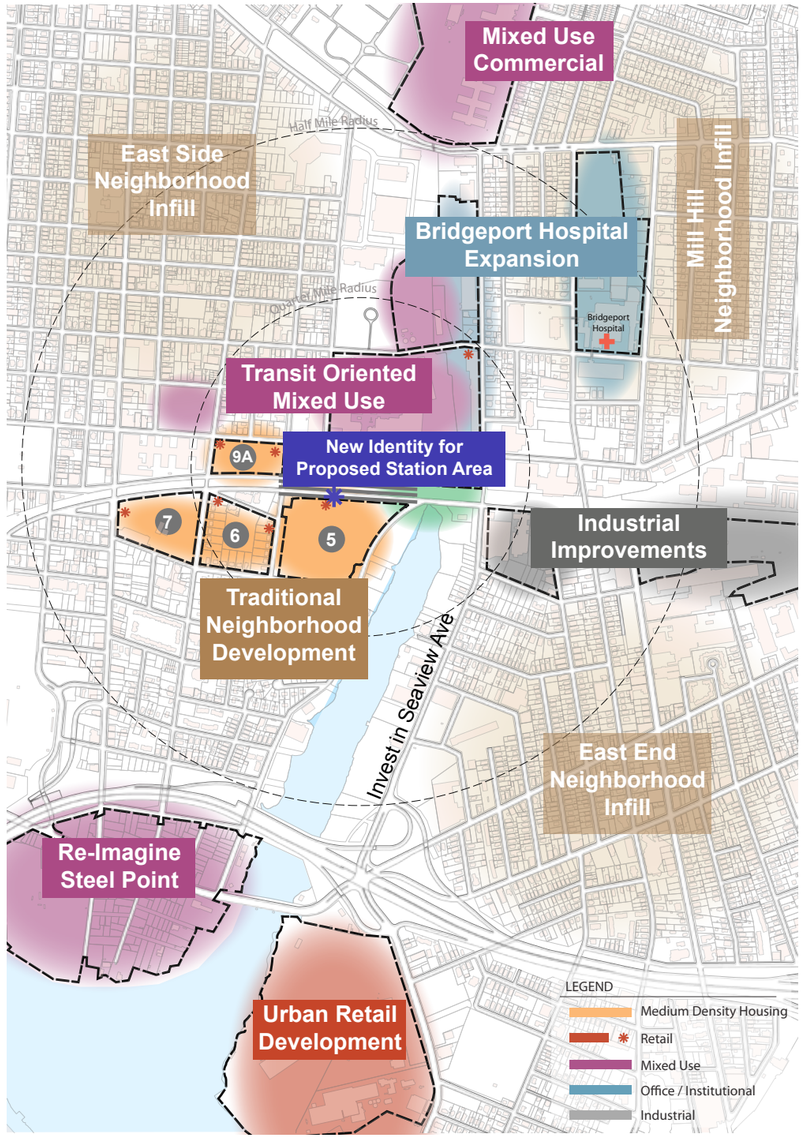


Figure 01.02 Identifies the major land use goals for the immediate station area and the larger East Side / East End neighborhoods.

03.03 Infrastructure Improvements

To accommodate and further bolster anticipated growth, several planning processes have occurred recently that support the careful consideration of the environmental opportunities presented by new development in the Barnum Station area. In 2008, the Regional Plan Authority developed a Greenway Plan for Barnum Transit Center that included a business incubator, community center, and new residential and retail development connecting to the existing marina on Yellow Mill Channel. Most importantly it indicated a desire to continue a greenbelt to Beardsley Zoo and Lakeview Cemetery.

In 2011, the City of Bridgeport's Parks System built consensus around a Master Parks Plan. With broad intentions, the plan hoped to envision the next generation of open space, recreation, and connectivity. Major components of this plan that are relevant to the Barnum Station area include:

- Renaturalizing large area parks
- Linking to Regional Rails to Trails system
- Allowing public access along the Yellow Mill Creek and Pequonnock River

Therefore, these suggestions for an interconnected network of historic and community parks have been taken into account in the station designs and site layouts for Barnum Station. Although the acerage varies per plan alternative, a significant portion of the site has been set aside for the development of the Yellow Mill Creek Greenway. Almost all of this land is also contained within the Federal Emergency Management Authority's 100 and 500 year flood plain boundaries. The intent is to endow future generations with healthier ecological, social, and economic environments.

Roadway improvements have also been planned during the Barnum Station feasibility process. Route-130, Route-127, Pembrooke Street, and Waterview Avenue are all intended to be widened to four lanes, with some addition of left turn lanes as appropriate. Grant Street, in front of the Bridgeport Hospital is already slated for closure to promote a pedestrian campus. As the station goes under construction, Barnum Avenue and Seaview Avenue will be widened to four lanes, enhanced for bus service and Crescent Avenue will be relocated to make way for new eastbound platforms.

Future Land Use / Build Out

1. Steel Point
2. Seaview Plaza
3. Seaview Avenue Industrial Corridor
4. Seaview Industrial Park
5. Bridgeport Housing Authority
6. Housing Authority Infill
7. Bridgeport Health
8. Barnum Station

9A. Transit Oriented Development
9B. Transit Oriented Development
9C. Transit Oriented Development

10. Barnum Ave Incubator
11. GE Redevelopment
12. Bridgeport Hospital Expansion
13. Lake Success
14. East End Railyard Improvements
15. East Side Neighborhood Infill
16. Mill Hill Neighborhood Infill
17. East End Neighborhood Infill

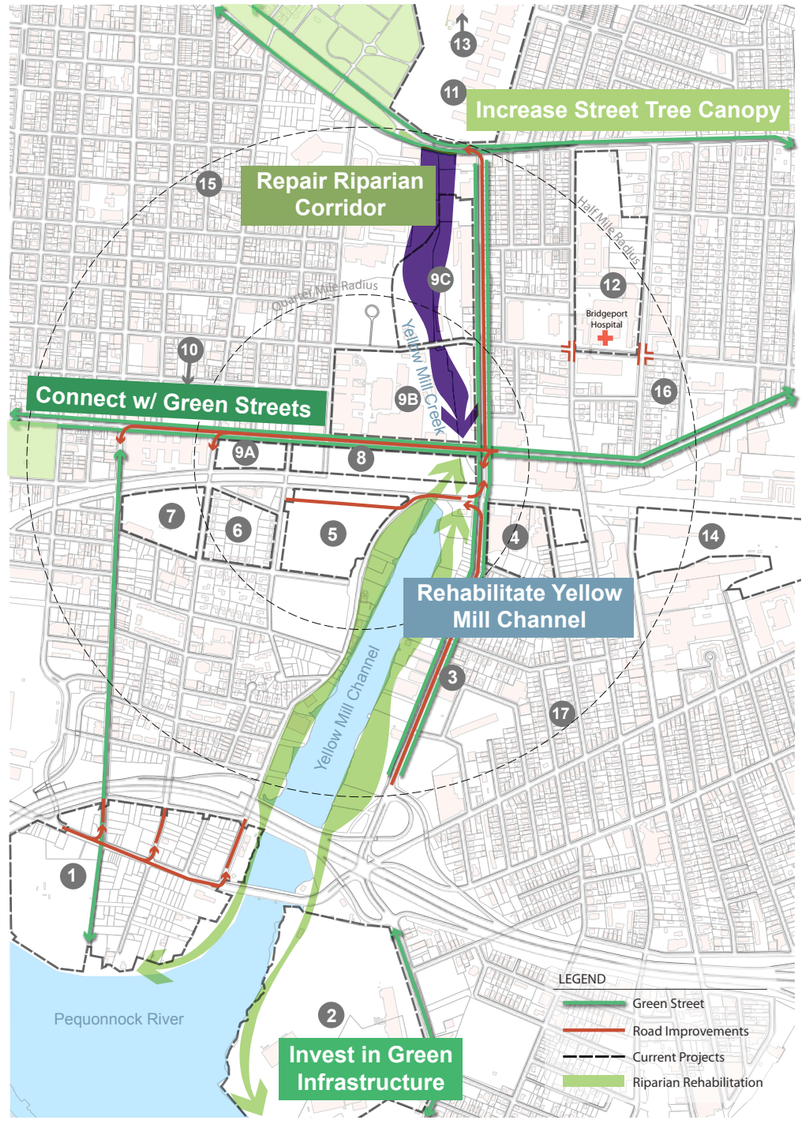


Figure 01.03 Street Infrastructure and Green Infrastructure

04 Site Alternatives

04.01 Site Assumptions

For all stations, the platform is accessed via two stairways and an elevator on both the north and south sides of the track. The tracks are crossed by tunneling under the viaduct.

Vehicular drop-offs are located on both sides of the tracks, as well as bicycle racks and pedestrian sidewalks. Bus pick ups and drop-offs are only located on the north side of the tracks. Pedestrian access from the park and ride is interrupted by the bus drop-off, so is signaled by clearly marked and raised crosswalks. Otherwise, the pedestrian walkways on site connect to the surrounding street sidewalk system without having to pass through the parking areas.

Bicycle access is encouraged with a canopy covered storage area, at a number based on projected demand. Information about bicycle routes in the area shall be available on posted, wayfinding signage.

Generally, any remaining open space in the plan has been turned into surface parking, as a type of land banking for future development. This type of preserving land for future use should also take into account the heavy impacts of stormwater runoff in urban areas caused by parking lots. Green infrastructure, using vegetation, soils and natural processes can lead to additional flood protection and cleaner water. At the scale of this site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water. Elements might include station downspout disconnection, rain water harvesting, rain gardens, planter boxes, bioswales, permeable pavements, green parking and increasing the urban tree canopy.

Additionally contributing to the neighborhood's green infrastructure, in all the options, the intersection of Crescent St with Waterview Ave has been slightly reconfigured to ensure maximum park space. This adds to the area's patchwork of natural areas that provides habitat and cleaner air.

04.02 Development Summary

For all options, the former Father Panik Village site owned by the Housing Authority of the City of Bridgeport (HACB) has been reduced by the same area, just over 2 acres, to make way for station access and infrastructure. It has been conceptually parcelized into developable scale blocks, ranging from 1.64 to 2.40 acres. Forty dwelling units per acre is a preliminary density goal based on the Housing Authority's overall development strategy for its parcels in this area. It is not in strict correlation with the proposed DVD-TOD zoning category, which does not establish specific limits for FAR or lot area per dwelling unit, as other zoning districts in Bridgeport do. However, a density of 40 units per acre (roughly 1 dwelling unit per 1000 SF) is significantly denser than the current zoning in the area of the Father Panik site, the R-C District, which allows for one dwelling unit per 2700 square feet, or about 16 units per acre.

DEVELOPMENT SUMMARY	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING
			RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre	
Block	SF	Acres	/du	/du	# spaces
Former Father Panik Village Site	490,483	11.26	182	450	
South Station Site "A"	126,109	2.90			92
Former Father Panik Village Site	364,375	8.36	135	335	
TOTALS				335	92

04.03 Option I - Church Street Re-Alignment

Option 1 locates the station to its western most extreme, near Hallett Ave. Vehicular access to the southern site 'A' is supported by an expansion of Church Street. Currently with only one direction of travel and 26-feet, curb to curb, its 38-foot right of way is too narrow to function as a major thru-way. The Saint Cyril & Methodius Church, located on the street's northern parcel recently sold a small historic structure, the former church convent, on the south side of Church Street opposite the church itself, to the Housing Authority. The Housing Authority intends to preserve and adaptively re use the structure for affordable housing.

Therefore, this option widens Church Street to 30-feet curb to curb, to include two 4-foot sidewalks, space for two 11-foot travel lanes, and an 8-foot parking lane on one side of the street, for a 38-foot right of way. Then, as a southern station access road, Crescent Avenue has been offset approximately 100-feet south from its existing location to make room for the new platforms and allow better station access. This new block includes a single, linear bay of parking and a green buffer stretched between the station and the Housing Authority neighborhood.

Taxi and kiss and ride accommodations alternate with five sawtooth bays of bus parking on the north side. Long term parking is located to the north and east of the Station Access North Road, which reconnects with Barnum Ave approximately 260 feet away from Helen Street. The long term parking lot extends to just over the FEMA 500-year flood line.

To the west of Hallett Street, the block bordered by Pembroke Street, Barnum Ave and Hallett St has been land banked entirely for future development, with 424 parking spaces and a green buffer to the street.

PRO:

- Very little flood zone encroachment
- Inexpensive - least new road construction
- Full block TOD potential in parcel North - 2 and North - 4.

CON:

- Least integration with existing and planned road network.
- No new vehicular access through viaduct.

SITE OPTION 1	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING
			RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre	
Block	SF	Acres	du	du	# spaces
North - 1					191
North - 2					350
North - 4	133,131	3.06			424
North - 5	129,687	2.98			
A	126,109	2.90			149
Former Father Panik Village Site	376,673	9	140	346	0
TOTALS				346	965

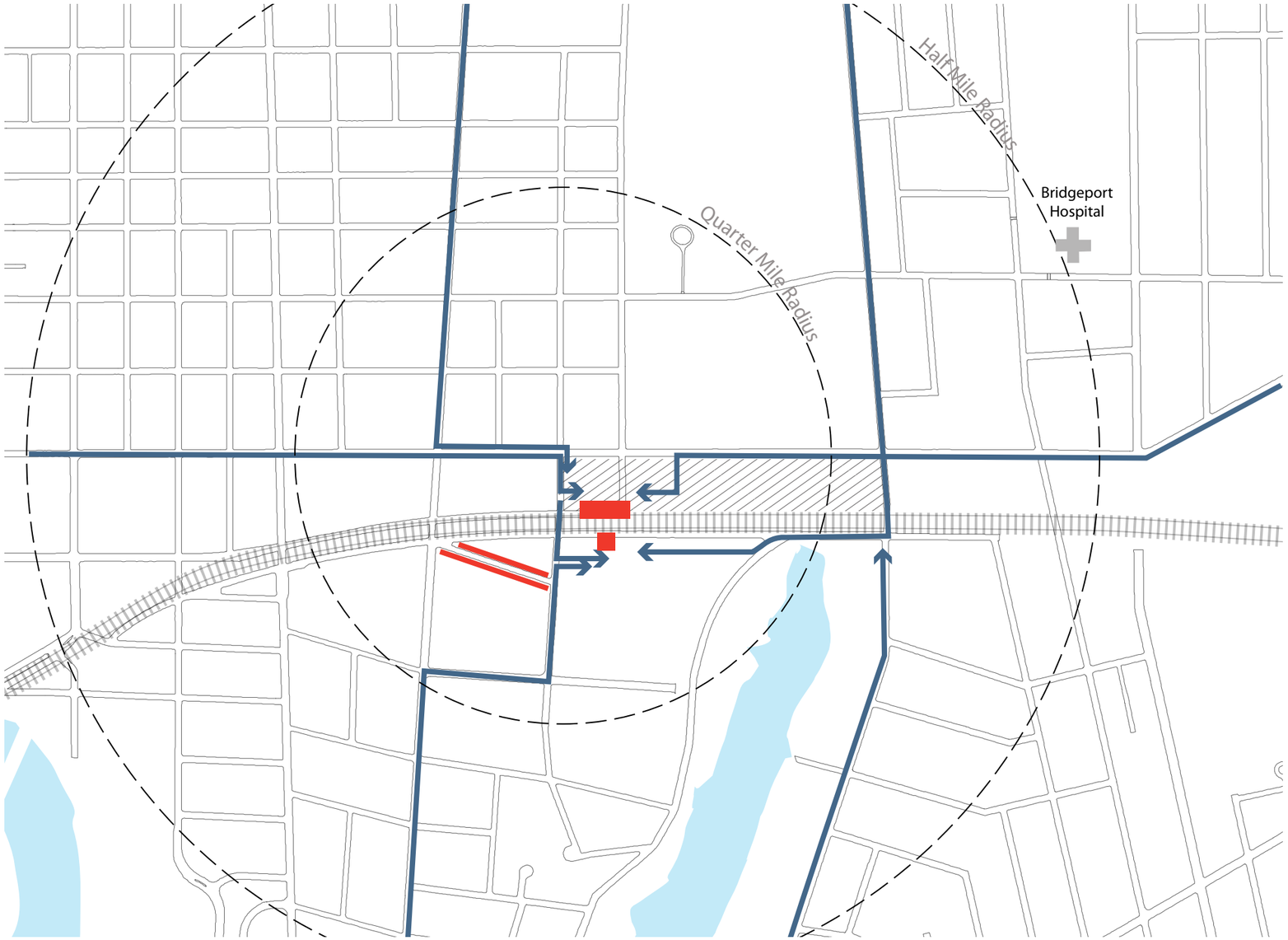
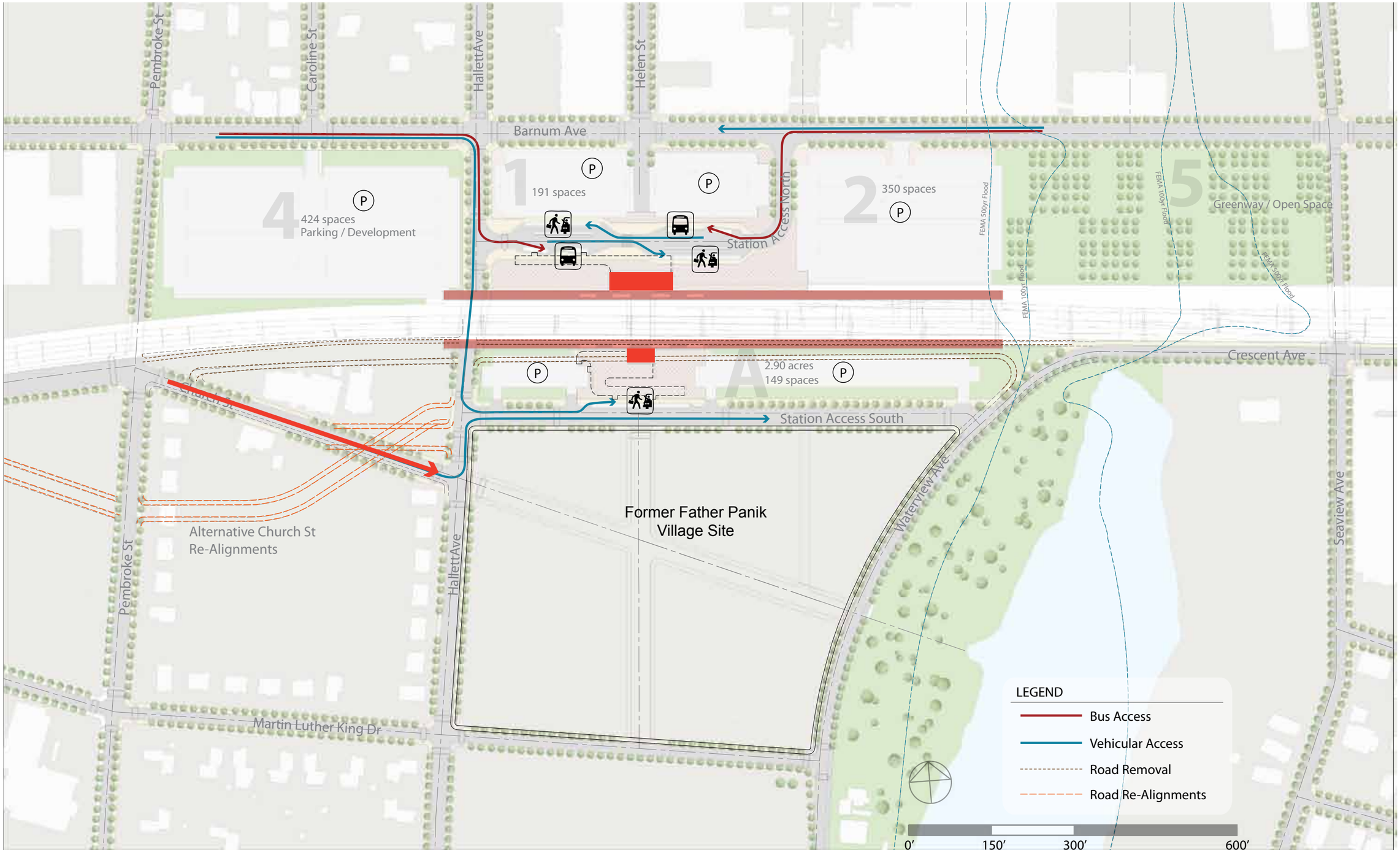


Figure 01.04 Site access from half-mile radius


Pembroke St
Caroline St
HallettAve
Helen St
Barnum Ave
1
191 spaces
4
424 spaces
Parking / Development
2
350 spaces
5
Greenway / Open Space
Station Access North
FEMA 500yr Flood
FEMA 100yr Flood
Crescent Ave
A
2.90 acres
149 spaces
Station Access South
Church St
Alternative Church St
Re-Alignments
Former Father Panik
Village Site
Waterview Ave
Seaview Ave
Martin Luther King Dr
LEGEND
Bus Access
Vehicular Access
Road Removal
Road Re-Alignments
0′
150′
300′
600′

04.04 Option 2 - E. Washington Ave Extension

Option 2 locates the station at its furthest point east, closest to Bridgeport Hospital. Vehicular access to the northern site 'A' is supported by an extension of East Washington Street. This road continues on into downtown and will remain a major throughway after the Washington Street and Congress Street bridges are completed. This extension is brought into the site via Parcel 4 on the north side, being offset from the tracks and then aligned with the North Station Access Road at the intersection of Hallett Street. This leaves Parcel 4 with space for 100 fewer parking spaces than the other options. It also creates a traffic pressure point and potential safety issue around the tunnel with a three-way intersection on both sides.

Taxi and kiss and ride accommodations are located on the side of the road closest to the parking lot while the bus drop-offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. Buses may enter from either the east bound or west bound directions and have a sawtooth bay available. Long term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Ave approximately 750 feet to the east of Helen Street, crossing into the FEMA 500-year and 100-year flood lines.

PRO:

- Closer station location to Bridgeport Hospital
- Washington St extended for improved connection to downtown
- Noise / open space buffer (North -3) between potential development (North - 1) and tracks.

CON:

- Extensive flood plain encroachment for new Station Access North Rd.
- High infrastructure costs: new road construction full length of site.
- No new vehicular access through viaduct.

SITE OPTION 2	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING
			RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre	
Block	SF	Acres	du	du	# spaces
North - 1					214
North - 2					201
North - 3					128
North - 4	142,942	3.28			324
North - 5	129,687	2.98			
A former Father Panik Village Site	126,109	2.90			149
	376,673	9	140	346	0
TOTALS				346	1016

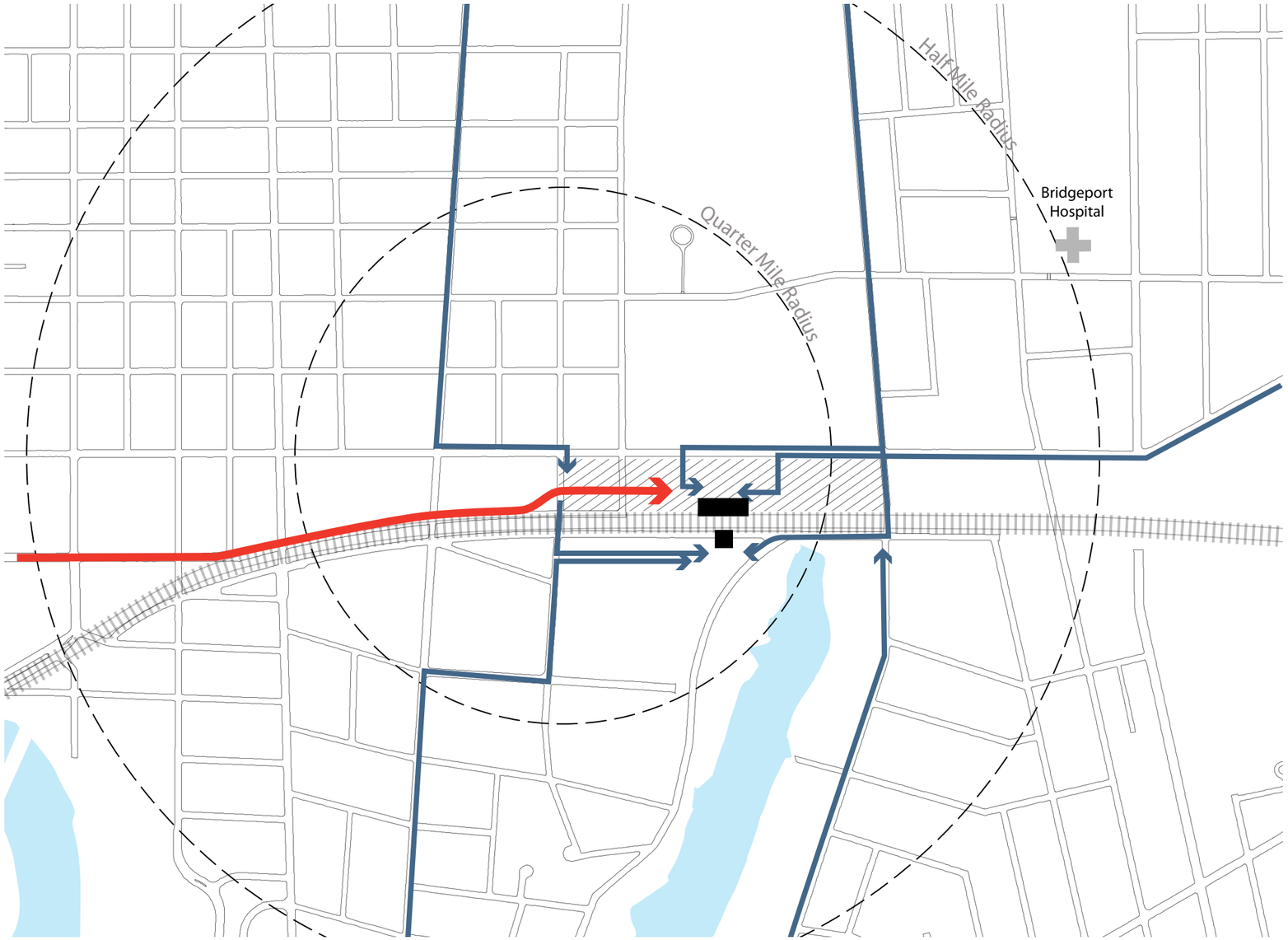
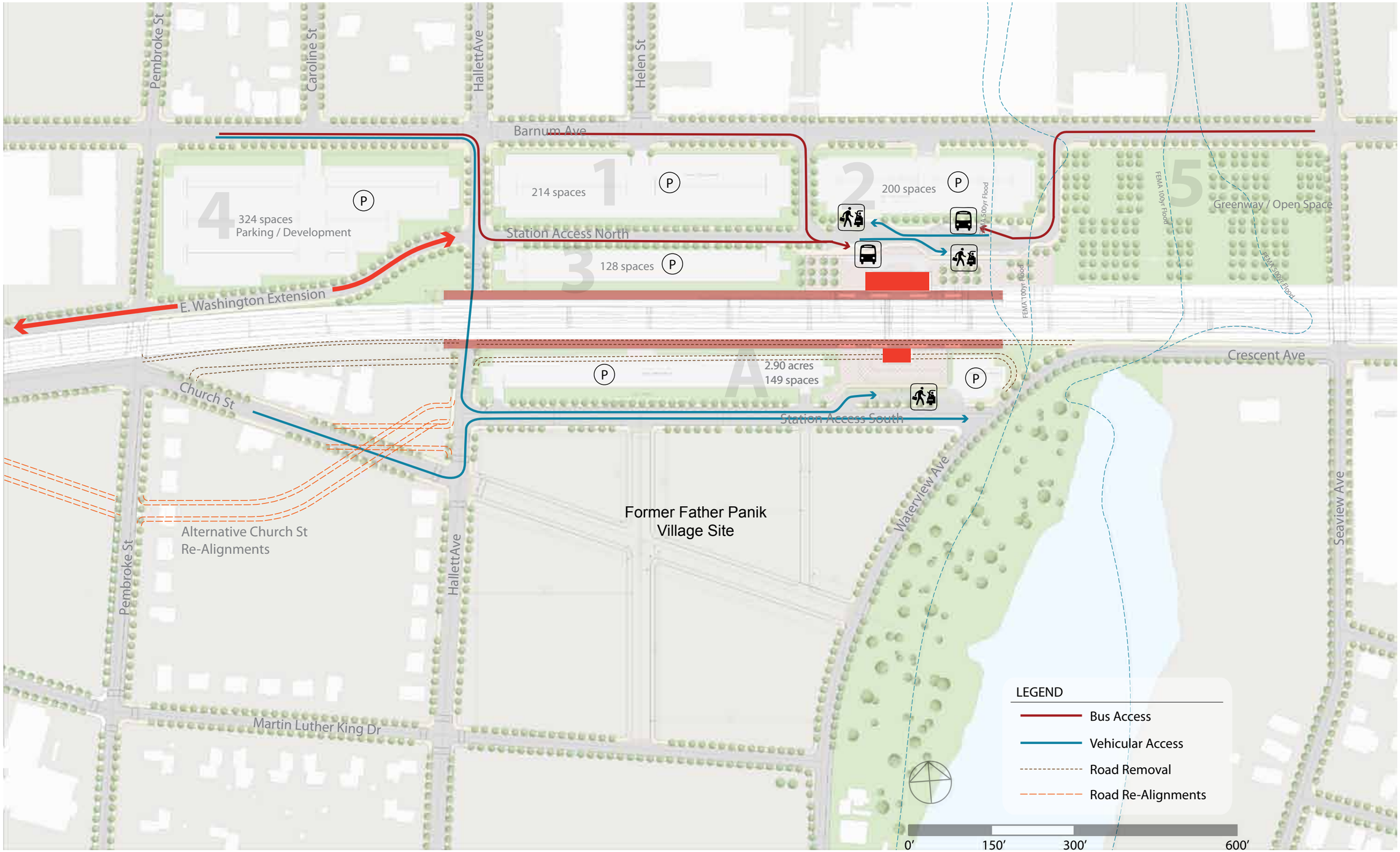
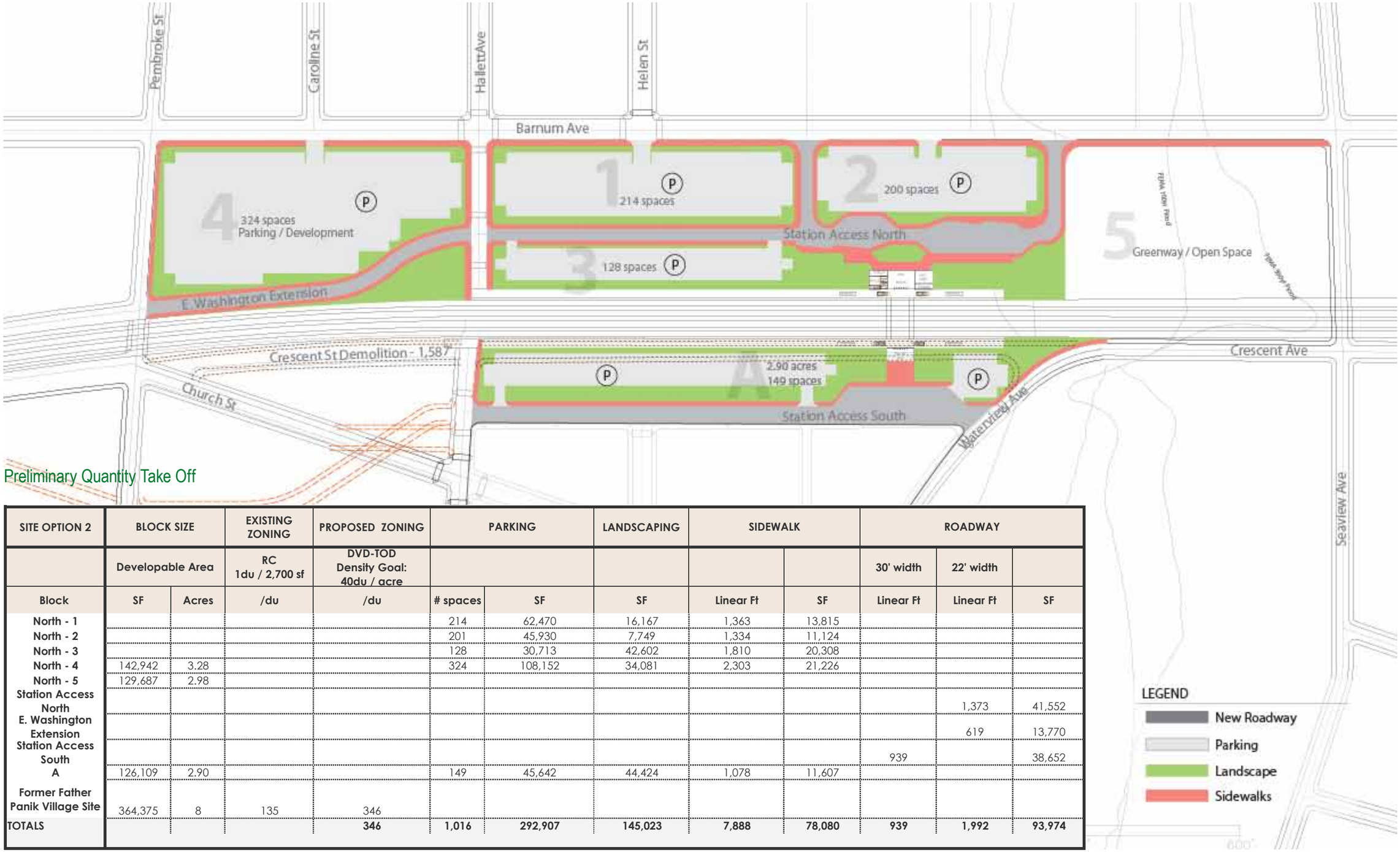


Figure 01.05 Site access from half-mile radius


Pembroke St
Caroline St
HallettAve
Helen St
Barnum Ave
1
214 spaces
2
200 spaces
3
128 spaces
4
324 spaces
Parking / Development
5
Greenway / Open Space
Station Access North
E. Washington Extension
Church St
2.90 acres
149 spaces
Station Access South
Crescent Ave
Waterview Ave
Seaview Ave
FEMA 100yr Flood
FEMA 500yr Flood
Former Father Panik
Village Site
Alternative Church St
Re-Alignments
Martin Luther King Dr
LEGEND
Bus Access
Vehicular Access
Road Removal
Road Re-Alignments
0′
150′
300′
600′



Preliminary Quantity Take Off

SITE OPTION 2	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING		LANDSCAPING	SIDEWALK		ROADWAY		
	Developable Area		RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre						30' width	22' width	
Block	SF	Acres	/du	/du	# spaces	SF	SF	Linear Ft	SF	Linear Ft	Linear Ft	SF
North - 1					214	62,470	16,167	1,363	13,815			
North - 2					201	45,930	7,749	1,334	11,124			
North - 3					128	30,713	42,602	1,810	20,308			
North - 4	142,942	3.28			324	108,152	34,081	2,303	21,226			
North - 5	129,687	2.98										
Station Access North											1,373	41,552
E. Washington Extension											619	13,770
Station Access South										939		38,652
A	126,109	2.90			149	45,642	44,424	1,078	11,607			
Former Father Panik Village Site	364,375	8	135	346								
TOTALS				346	1,016	292,907	145,023	7,888	78,080	939	1,992	93,974

04.05 Option 3 - Waterview Ave Connection

Option 3 supports an eastern station location by constructing a new road under the viaduct connecting Barnum Avenue to Waterview Avenue, just offset from the eastern edge of the station platform. An alternative alignment with a curve was also considered. Both are within the FEMA 100-year flood plain zone. This new roadway also provides an important pedestrian access to the Yellow Mill Creek Greenway, and its proposed extension on the north side of the tracks.

Taxi and kiss and ride accommodations are located on the side of the road closest to the parking lot while the bus drop offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. Buses may enter from either the east bound or west bound directions and have a sawtooth bay available. Long term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Ave approximately 700 feet to the east of Helen Street, crossing into the FEMA 500-year and 100-year flood lines.

PRO:

- Closer station location to Bridgeport Hospital.
- Station Access North Road extended fully through site.
- Better vehicular connections through viaduct.

CON:

- Extensive floodplain encroachment for new under viaduct connection.
- High infrastructure costs: new road construction full length of site.
- Two tunnels, higher infrastructure development costs.

SITE OPTION 3	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING
			RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre	
Block	SF	Acres	du	du	# spaces
North - 1					214
North - 2					201
North - 3					128
North - 4	142,942	3.28			424
North - 5	129,687	2.98			
A former Farner Panik Village Site	126,109	2.90			149
	376,673	9	140	346	0
TOTALS				346	967

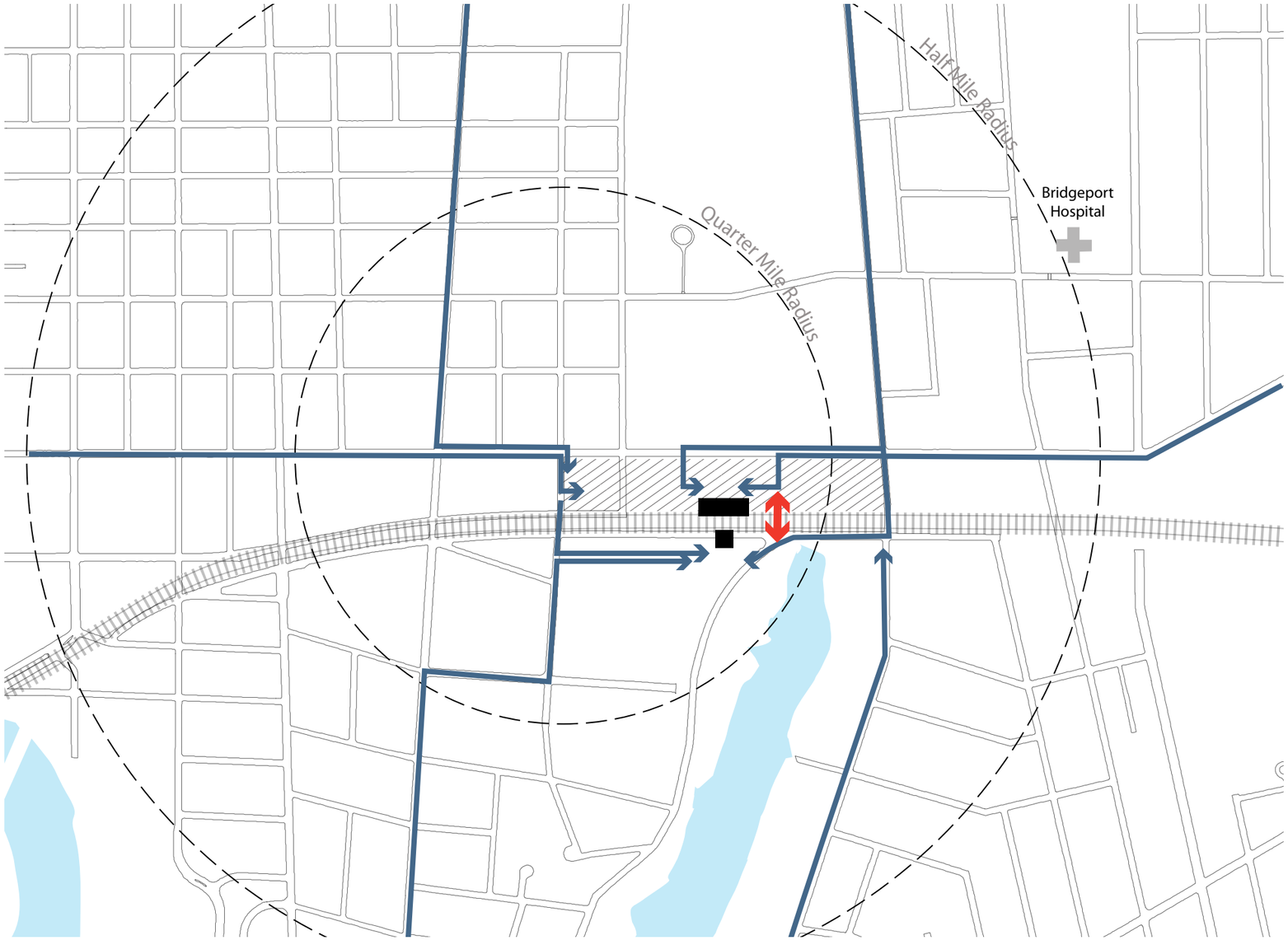
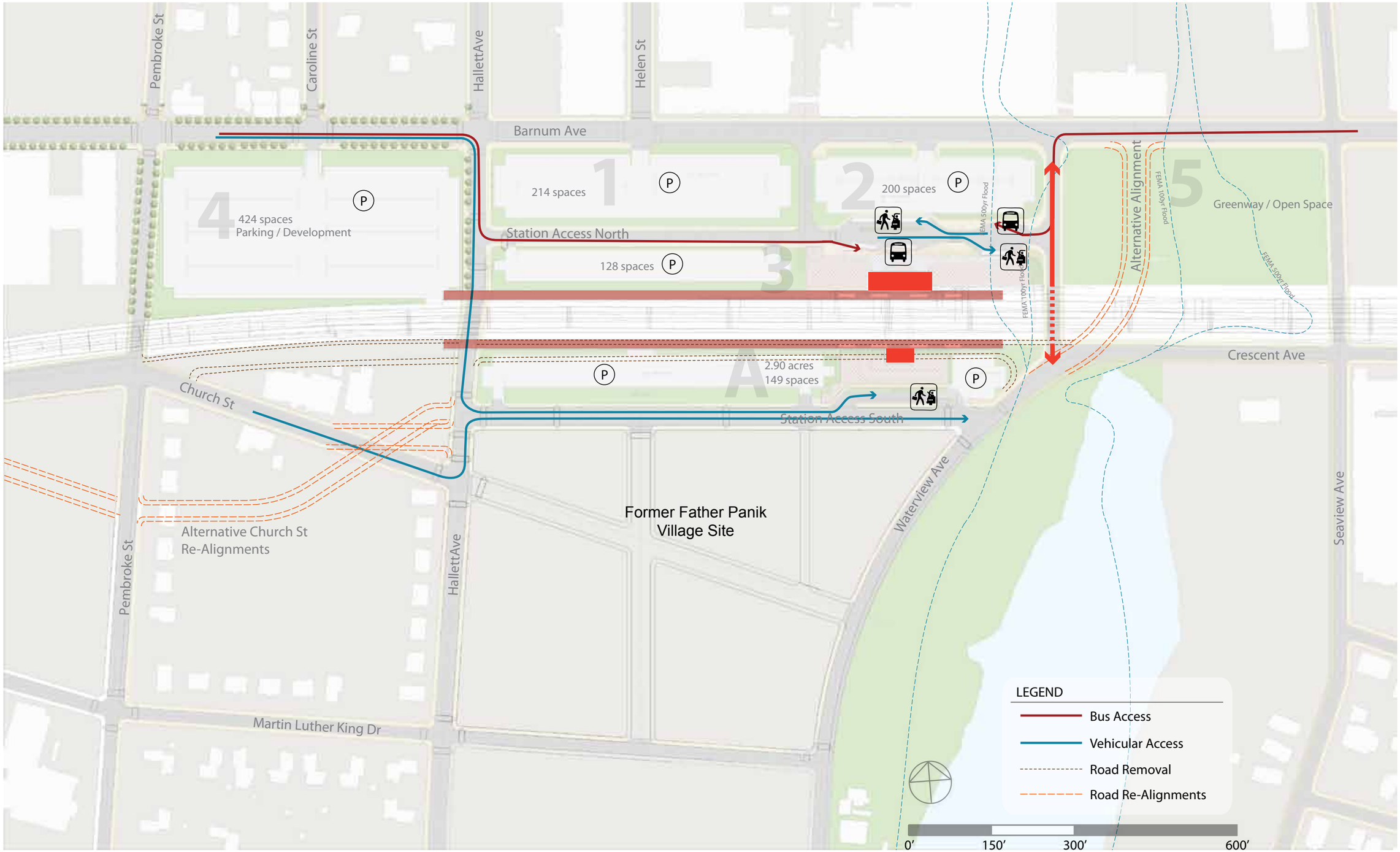


Figure 01.06 Site access from half-mile radius


Pembroke St
Caroline St
HallettAve
Helen St
Barnum Ave
4
424 spaces
Parking / Development
1
214 spaces
2
200 spaces
3
128 spaces
Station Access North
FEMA 500yr Flood
FEMA 100yr Flood
Alternative Alignment
5
Greenway / Open Space
FEMA 100yr Flood
FEMA 500yr Flood
A
2.90 acres
149 spaces
Crescent Ave
Church St
Station Access South
Former Father Panik
Village Site
Waterview Ave
Seaview Ave
Alternative Church St
Re-Alignments
Pembroke St
HallettAve
Martin Luther King Dr
LEGEND
Bus Access
Vehicular Access
Road Removal
Road Re-Alignments
0′
150′
300′
600′

04.06 Option 4 - Helen St Extension

Option 4 moves the station to a relatively centered portion of the platform by extending Helen Street through the site. Helen Street is an important connection to US-1. This leaves Block 1 as a highly developable 300' x 300' block. Moving the station westward preserves both the FEMA 100-year and 500-year flood plain zones. This new roadway also provides the potential to locate the station abutting the new street extension, allowing for a more visible, day lit, and potentially safer pedestrian crossing under the viaduct to the south station.

Taxi and kiss and ride accommodations are located off the North Station Access Road, on the side of the road closest to the parking lot while the bus drop-offs are on the side of the road closest to the station, prioritizing transit access over private vehicles. In this scenario the access road is long enough to add a raised pedestrian cross walk at the mid-point, in front of the station, connecting the parking lot in Block 2 to the front of the station. Bus drop-offs are also located under the viaduct. Buses may enter from either the east bound or west bound directions, or even continue through to the south side of the tracks and have a sawtooth bay in their desired alignment available. Long term parking is located to the north and west of the Station Access North Road, which reconnects with Barnum Ave approximately 560 feet to the east of Helen Street, crossing into the FEMA 500-year and 100-year flood lines.

PRO:

- Primary thru-way to US-1 / Boston Ave reconnected to south side of tracks, Steel Point, and Housing Authority sites.
- Full blocks available for future TOD in North-1 and North - 4 parcels.
- Largest Greenway / Open Space allowances.
- No encroachment on floodplain zone.
- Station location near midpoint of platform.
- Potential for improved pedestrian safety and visibility under viaduct via combined vehicular and pedestrian connection.

CON:

- Higher infrastructure costs due to second vehicular tunnel.

SITE OPTION 4	BLOCK SIZE		EXISTING ZONING	PROPOSED ZONING	PARKING
			RC 1du / 2,700 sf	DVD-TOD Density Goal: 40du / acre	
Block	SF	Acres	'du	'du	# spaces
North - 1					414
North - 2					
North - 3					191
North - 4	176,048	4.04			424
North - 5	181,786	4.17			
A	68,641	1.58			92
AA	30,581	0.70			49
Former Father Panik Village Site	376,673	9		346	0
TOTALS				**346**	**1121**

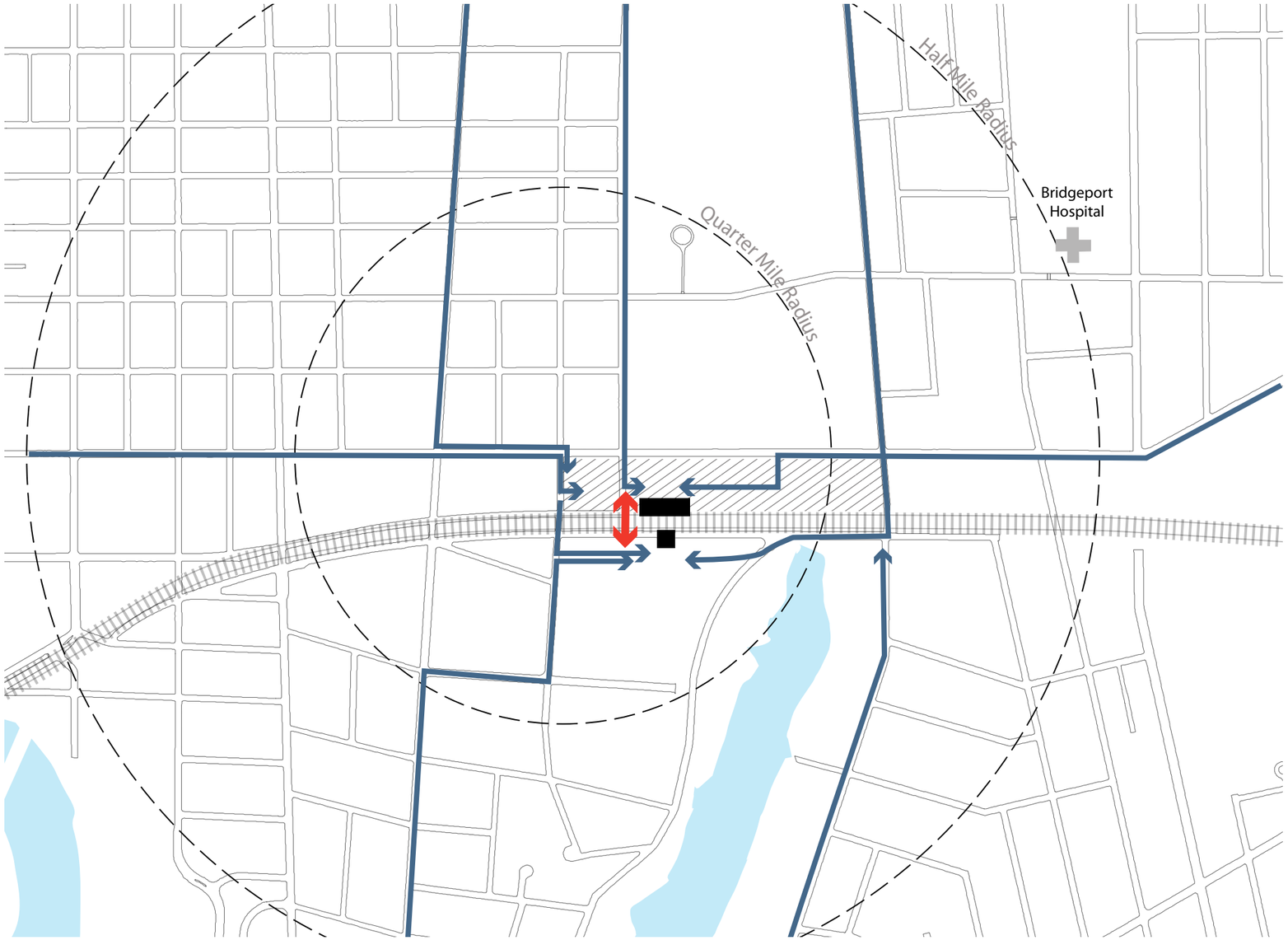
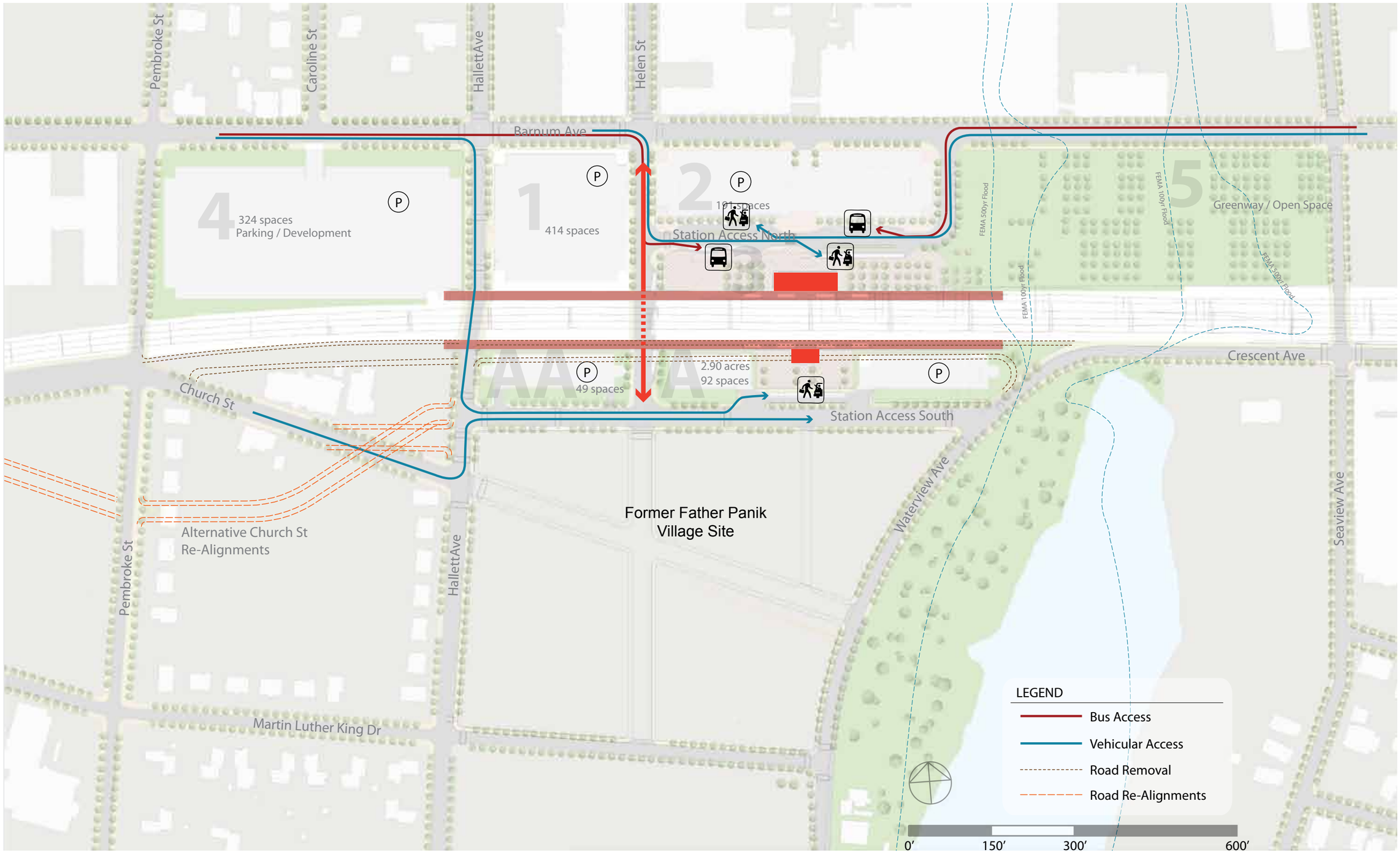
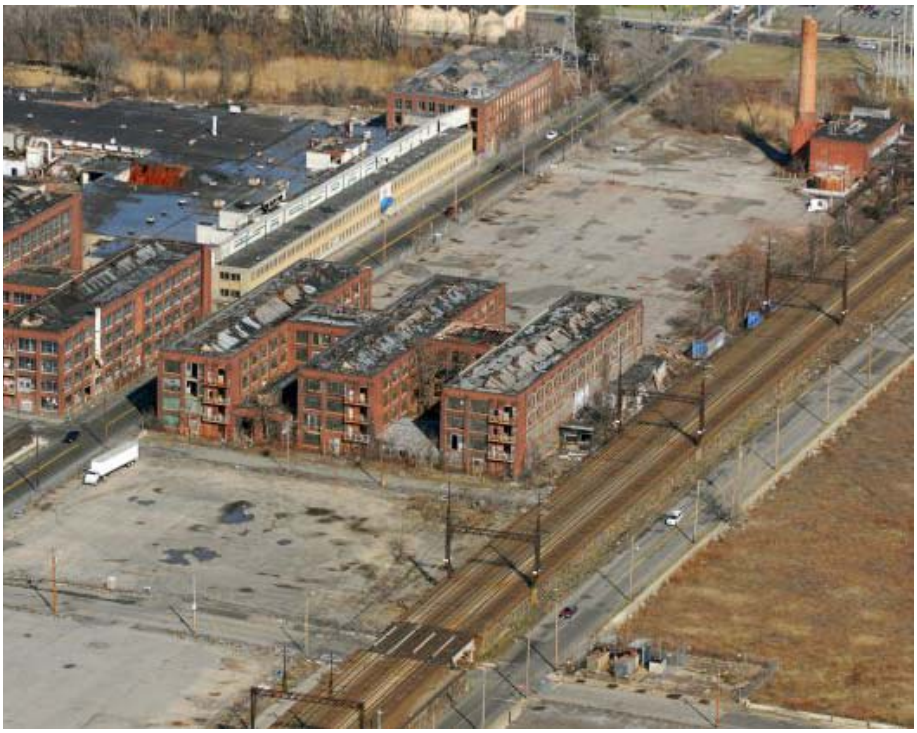


Figure 01.07 Site access from half-mile radius


Pembroke St
Caroline St
HallettAve
Helen St
Barnum Ave
4
324 spaces
Parking / Development
1
414 spaces
2
191 spaces
Station Access North
3
2.90 acres
92 spaces
49 spaces
5
Greenway / Open Space
FEMA 500yr Flood
FEMA 100yr Flood
Crescent Ave
Church St
Station Access South
Waterview Ave
Seaview Ave
Former Father Panik
Village Site
Alternative Church St
Re-Alignments
Pembroke St
HallettAve
Martin Luther King Dr
LEGEND
Bus Access
Vehicular Access
Road Removal
Road Re-Alignments
0′
150′
300′
600′



Market Overview

Barnum Station Feasibility Study

April 24, 2013

Prepared for:
Vanasse Hangen Brustlin, Inc.

Prepared by:
Vantage Point Development Advisors, LLC
111 Annapolis Street
Annapolis, MD 21401

VANTAGEPOINT
DEVELOPMENT ADVISORS

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Introduction

Project Description/Purpose

Building on initiatives and planning by the City of Bridgeport and input solicited from public outreach; there is active interest in bringing a commuter rail station to East Bridgeport. In addition to the benefits associated with commuter rail accessibility, the City intends for the newly developed Barnum Station to serve as a catalyst for redevelopment in the station area and East Bridgeport. In light of the interest associated with Barnum Station, the City has specifically made development in East Bridgeport a priority.

Reflective of the prioritization of development in East Bridgeport by the City, the *Barnum Station Feasibility Study* was commissioned by the Greater Bridgeport Regional Council to:

- Determine the feasibility of a commuter rail and intercity rail station in East Bridgeport
- Improve transit and promote Transit-Oriented Development (TOD) in East Bridgeport
- Develop alternative build-out scenarios to be considered and the related ridership forecasts
- Provide a range of housing types and options
- Improve access to jobs, education, and services
- Enhance climate resilience and environmental conditions

These objectives, as outlined above, are an integral part of the project and are addressed by the following questions.

1. Is a new rail station in the East Side neighborhood operationally feasible?
2. Which station configuration provides the best multi-modal operations and development opportunities?
3. With a strong rail station hub, what are the opportunities for redevelopment in the neighborhood and how might this impact the community, including both the East Side and East End neighborhoods and the existing rail station area in downtown Bridgeport?

In order to address these issues, the Feasibility study includes a Market Overview. The Market Overview is a review of current market conditions and the likely impact current market conditions will have over the near- and mid-term with respect to development within the study area. The intention of the Market Overview is to provide a reconnaissance evaluation of both the second and third questions, and provide general insight into the redevelopment opportunities and impacts affiliated with the presence of Barnum Station within the study area.

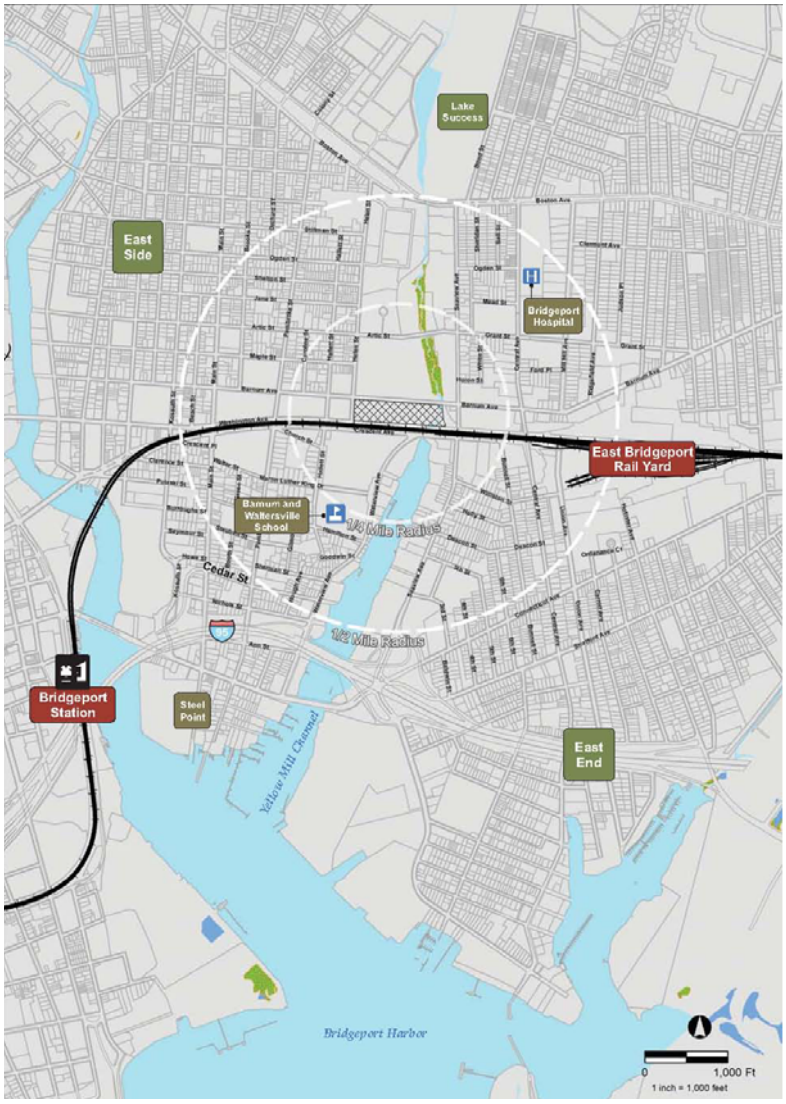
The market overview provides, general input into the supportable uses at Barnum Station for office, flex (office mixed with light industrial and assembly), retail, and residential uses. Much of the initial opportunities are based on current economic variables discussed in Technical Memorandum #1, and how these opportunities serve as a catalyst for a future long-term vision for East Bridgeport. Consideration is given to the impacts of demographic variables, such as population and employment

growth; and competitive retail, office, flex, and residential projects proximate to the proposed station. Consideration is also given to complementary development currently planned around the station and is reflective of how projected supportable initial development can serve to promote a longer-term vision for TOD.

Study Area/Site

The proposed Barnum Station is located on the site of the former RemGrit factory on Barnum Avenue. The 8 acre site lies between Barnum Avenue and Crescent Avenue and is bordered by Seaview Avenue to the east and Hallett Street to the west. Elevated and running along the south side of the site is the Metro-North New Haven Line and Northeast Corridor/Amtrak railroad right-of-way.

Figure 1: Barnum Station Proposed Location



Source: VHB

The site is proximate to several planned catalytic projects and is located within 1 mile of downtown Bridgeport. For the purpose of this overview, the Barnum Station study area is defined as being a ½ mile radius around the station site. The core study area is a ¼ mile radius around the station site and is anticipated to be the primary location for initial station area development activity.

Within the immediate area around the proposed Barnum Station, numerous development projects are underway or planned. These projects pictured in the map ***East Bridgeport Development Corridor***, include several retail, office/flex, and/or residential projects and major plans by both Bridgeport Hospital and the Bridgeport Housing Authority.

Based upon information provided by the City of Bridgeport, Bridgeport Housing Authority, Bridgeport Hospital, and the Lake Success Eco Business Park; current projects and plans include:

Seaview Industrial Park: Seaview Industrial Park lies to the east of the proposed station and includes 6 acres and the reuse of approximately 140,000 square feet of industrial space currently on the property.

Steel Point: Steel Point, 48 acres located on the waterfront to the south of the proposed station is a mixed-use development that according to city provided data, is slated to include 2,964 residential units, 1.25 million square feet of office space, 1.1 million square feet of retail space (anchored by a Bass Pro Shops) and 800,000 square feet of hotel space.

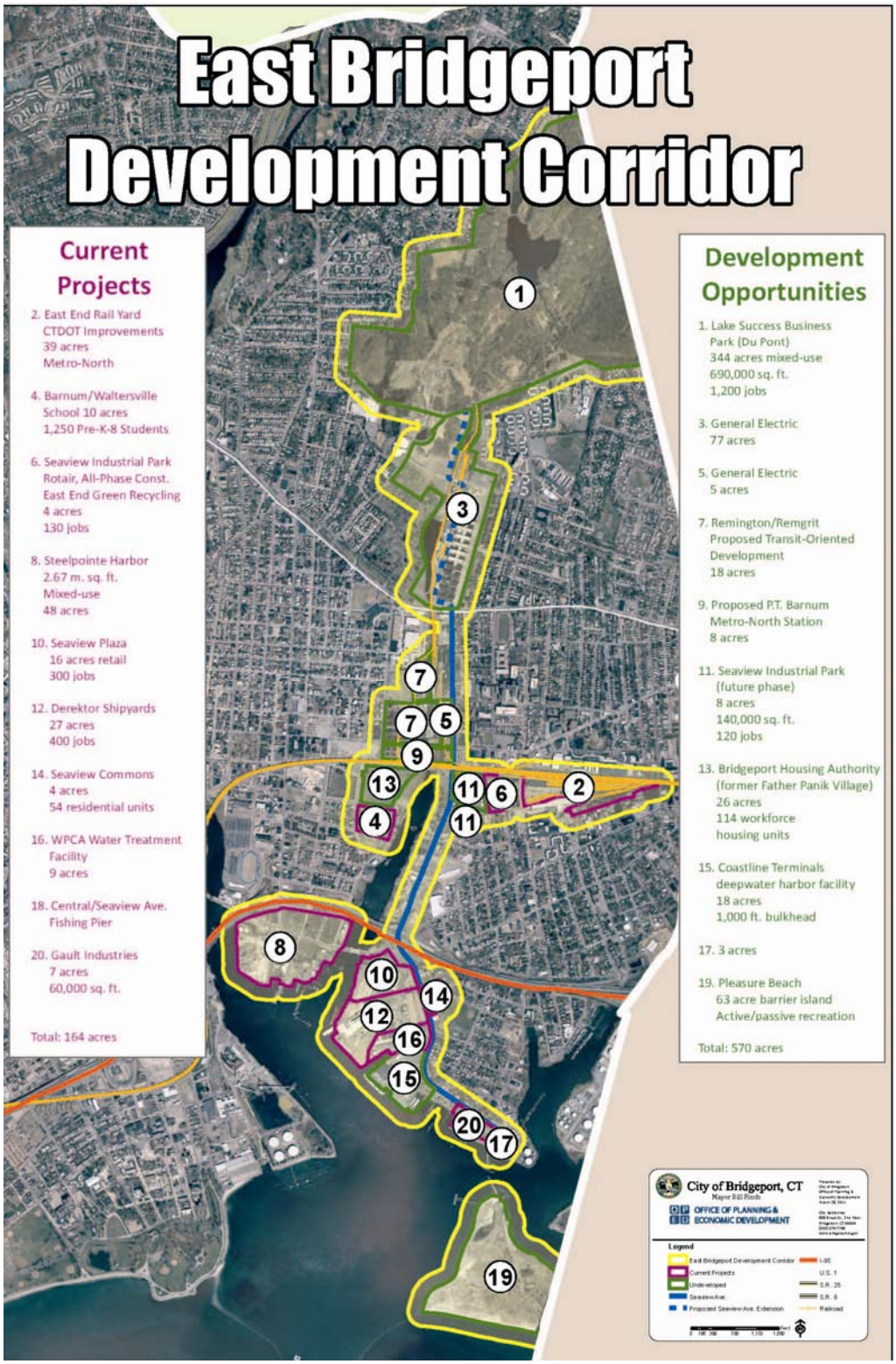
Seaview Plaza: Seaview Plaza is a 16 acre retail developments site south of the station and adjacent to the Steel Point development.

Bridgeport Hospital: Located within a half mile of the Barnum Station site, the Hospital has future expansion plans that will build on development that has occurred over the last decade. Future expansion that will occur within the study area will induce considerable growth in employment and potential residents. Expansion at the hospital will serve as a driving force for short-term development within the study area.

Bridgeport Housing Authority: The Housing Authority is a major land holder in East Bridgeport and within the study area. Considerable development plans over the near-term will serve as a catalyst for development at Barnum Station. Policy initiatives for below-market rate housing are key in the near-term and mid-term projections for the study area.

Lake Success Eco Business Park: (Note: Information provided by Lake Success Business Park updates information contained in Figure 2 provided by the City of Bridgeport) A 426 acre eco business park (344 acres in Bridgeport, 82 acres in Stratford) for corporate and industrial flex space and associated uses. Initial concepts call for up to 1,180,000 square feet of new corporate space, 400,000 square feet of new industrial flex space and a 100,000 square foot hotel and conference center.

Figure 2: East Bridgeport Development Corridor



Source: City of Bridgeport

Methodology

The Market Overview evaluates current market variables and conditions and assesses the implications associated with planned developments to determine the supportable near-term development opportunities within the Barnum Station study area which will serve as a catalyst for a long-term vision. The Market Overview identifies initial residential, office, flex, and retail development opportunities over the period through 2020 based on trends in household growth, employment growth, retail expenditures, and current market conditions. The potential longer-term implications are examined with respect to the catalytic nature of this development and the addition of Barnum Station to the East Bridgeport market.

The initial residential demand is based on household growth within two defined market areas – a 5-minute and 15-minute drive shed around the station. The demographic changes over the period through 2020, determines the likely capture of households in the market areas that could initially be realized around the new station. Households have been defined as below market rate and market rate households by the household income within the larger region and represent an attraction of households with incomes above $64,000 versus $24,500 in the immediate study area. As the site becomes redeveloped and more regionally appealing over time, the likelihood of attracting further residential demand from a larger market area is likely to occur.

Office and flex space opportunities are assessed based on new employment trends within the market area and respective of current inventory and vacancy trends and characteristics. Further, new opportunities associated with slated development in the study area are considered potential generators of spin-off demand for office and flex space. As with residential, the market area from which demand will be derived will likely expand over time as the station area is redeveloped.

Retail demand within the study area was evaluated. The potential for new retail development is evaluated with respect to the retail gaps identified (differential between demand and supply within the market) and is translated into square footage by assessing sales per square foot. Further retail expenditures resulting from growth in households and employment in the area are translated into supportable square footage for new development at the site.

An evaluation of similar projects nationwide in communities and cities that demonstrate similar characteristics as those found in East Bridgeport was also conducted. Several cities that have implemented transit service are reviewed and the impacts on economic development and TOD over the longer-term are presented to show the potential impacts that may be realized within the station area in East Bridgeport.

These processes taken sequentially provide a comprehensive outlook for initial and longer-term development potential within the Barnum Station study area. The findings are summarized below, and the methodology and subsequent results are described in greater detail in later sections.

Summary of Findings

The Market Overview identifies the initial level of supportable development potential for mixed-use development at Barnum Station including: residential, office, flex, and retail. Taken together, there is support for an initial increment of mixed-use development over the period through 2020. The Market Overview indicates predominantly residential development in the initial period. Retail is highly dependent upon residential and employment growth within the study area. Initial employment growth is driven by currently planned expansion in the study area, predominantly by Bridgeport Hospital, and supports development of new office and flex space.

The following is a summary of the initial supportable uses within the Barnum Station study area through 2020:

- **Residential:** ±600 Below Market* Rate Units, ±350 Market* Rate Units
- **Office/Flex:** 100,000 – 175,000 Square Feet
- **Retail:** ±40,000 Square Feet

*(*Based on regional characteristics, not localized characteristics – Household income of +/-$64,000)*

The supportable uses are derived from of the competitive trade area for each respective use, and consider the potential capture likely to be realized within the study area in the near-term (through 2020). In the near-term, the station's location and development within the study area faces certain constraints. Residential demand must build on the current generally depressed real estate market conditions near-term, modest employment growth; replacement of existing inventory; and the frictional demand created by those that desire relocation. The proximity and accessibility to downtown further refines the potential capture of residential units at Barnum Station. These two areas complement each other with younger households more likely to prefer a more active downtown setting. The proximity and accessibility to downtown makes Barnum Station appealing to those who desire the convenience of downtown without having to live in that type of setting.

Within the immediate vicinity, the Bridgeport Housing Authority owns underutilized land that may serve some of the residential needs that are supported within the Barnum Station study area. The Housing Authority owns two parcels totaling 30.89 acres. Both parcels are located immediately to the south of the proposed station location just across the rail line. Based on City provided information, the larger of the two parcels (26 acres) is expected to support the development of 114 workforce housing units. These would likely attract households with incomes greater than the study area and reflect below market households in the greater regional context. The Housing Authority's holding of property adjacent to the Barnum Station site will benefit the initiative to develop a mix of new residential units consistent with the projections in this report.

Development within the immediate vicinity to the Barnum Station site and study area at Steel Point is mixed-use will include 2,964 multifamily residential units. Development at this project will help to enhance East Bridgeport as a place to live.

Market Characteristics indicate near-term weak market variables for office and flex with respect to current inventory and high levels of vacancy. Combined with low near-term employment growth, demand will remain limited over the initial period assessed (2013-2020). The near-term supportable square footage will be highly dependent on industry associated with expansion at the Bridgeport Hospital. Improving market conditions, initial phases of redevelopment, the rail station access, and proximity to downtown will improve the attractiveness of locating at Barnum Station.

Bridgeport Hospital is located within the ½ mile radius of the Barnum Station site and provides considerable support for the near-term demand factors for the study area. Bridgeport Hospital is affiliated with the Yale New Haven Health Group that includes; Bridgeport Hospital, Greenwich Hospital, Yale-New Haven Hospital, and the Northeast Medical Group. Bridgeport Hospital has 425 beds and has undergone several expansions over the past decade. The hospital employs more than 2,600 people, 600 active attending physicians, 235 medical/surgical residents affiliated with Yale University, 460 volunteers, and 380 auxiliary employees.

The hospital has plans for expansion on 10 acres within the study area which will support near-term demand within the study area and East Bridgeport. New employment will bolster retail expenditures and further induce new residential demand and retail expenditures within the study area.

Sites in the Barnum Station study area and the surrounding area will serve as development opportunities for both near-term and longer-term office/flex development outside of the hospital expansion include: the General Electric site, the Remington/Remgrit site, and Seaview Industrial Park. Outside of the immediate study area, Steel Point, Lake Success, and GE-owned land to the north of the station provide ample space for future office and flex development within the vicinity of Barnum Station.

The retail market around Barnum Station will face competition from the current market supply and new development slated within the immediate trade area. The initial projections for retail demand in the study area account for retail opportunities associated with initial residential and employment growth within the study area. The demand for space over the period through 2020 (40,000 square feet) captures the expenditure potential of those currently and anticipated in the near-term to be employed or residing within the study area. This reflects the near-term competitive environment associated with Steel Point. This will likely limit near-term retail development at the station. The proximity of Steel Point will serve as a positive longer-term attraction for those who may chose to live or work in East Bridgeport or Barnum Station.

Steel Point, which will be anchored by a 150,000 square foot Bass Pro Shops, and is approved for 2.67 million square feet of mixed-use development including 1.1 million square feet of retail space. The project has taken several forms since it was first proposed in 1983. As recently as 2009, the total development package was reduced from 7 million square feet of mixed-use to its current 2.67 million square foot package. With the commitment by Bass Pro Shops, other retail development at the site will likely quickly materialize, increasing the competitive pressure on retail at Barnum Station. With the longer-term inclusion of residential units, 1.25 million square feet of office space, and 800,000 square

feet of hotel space, the Steel Point project will serve as a regional center for shopping, dining, working, and living. The presence of Steel Point will improve the longer-term attractiveness of East Bridgeport, and subsequently will improve the ability for the Barnum Station area to attract residents and employees who value the added accessibility associated with transit.

The presence of Steel Point may restrict the retail market from which Barnum Station would likely pull and thus make the retail market for the station area more localized. Therefore, retail demand is based on employment growth associated with the office and flex development and household growth within the immediate study area. However, in the longer-term as the profile of East Bridgeport improves and more amenities become available, the ability to attract additional residents and business tenants to the Barnum Station study area will also increase. Complimentary retail will be supported at Barnum Station to serve the additional residents and employees.

Review of comparable projects nationwide demonstrating similar characteristics as those identified around Barnum Station and East Bridgeport provides considerable supporting evidence for the longer-term development potential within the station study area. The projects reviewed demonstrate the positive impacts that rail service and stations can have over time on underutilized and underserved areas. The comparable projects provide insight into how development momentum, new stations and transit options will provide positive economic impacts.

Building on the results of the Market Overview by which development potential is assessed with respect to current market conditions, the longer-term vision is reviewed. Initial market projections provide a positive trend in Bridgeport, even while current market and economic conditions indicate considerable obstacles to development. However, with the presence of the hospital, the plans of the housing authority, and the implications of the addition of Barnum Station over the mid-term, the study area is poised to realize modest development potential while the region struggles to manage high vacancies and minimal population and employment growth. Further, current market conditions though weak, will likely improve over the longer-term, positioning Barnum Station to capitalize on new market opportunities.

The regional appeal of the study area will certainly broaden with the construction of Barnum Station. Further, the proximity and accessibility to downtown Bridgeport will serve as an appealing characteristic of living and working in the Barnum Station area; which is less than one mile from the downtown station. Finally, concurrent development at Steel Point, particularly in retail and entertainment will serve as an amenity for those choosing to live within the Barnum Station study area. As development occurs both at and immediately surrounding the station and the appeal of living and working at Barnum Station broadens, regional characteristics will greatly impact the growth potential relevant to the study area.

In total, the East Bridgeport Development Corridor as defined by the City of Bridgeport is uniquely positioned to provide both near- and longer-term development opportunities in support of the projected demand outlined in this report. The Corridor currently boasts several projects underway or planned in the immediate future, including Steel Point and Bridgeport Hospital, which will have a regional draw. Both will provide employment opportunities, and will increase the regional appeal of East

Bridgeport and the Barnum Station study area. The 570 acres identified as underutilized within the Corridor will support all uses including residential, retail, and office/flex.

Market Overview

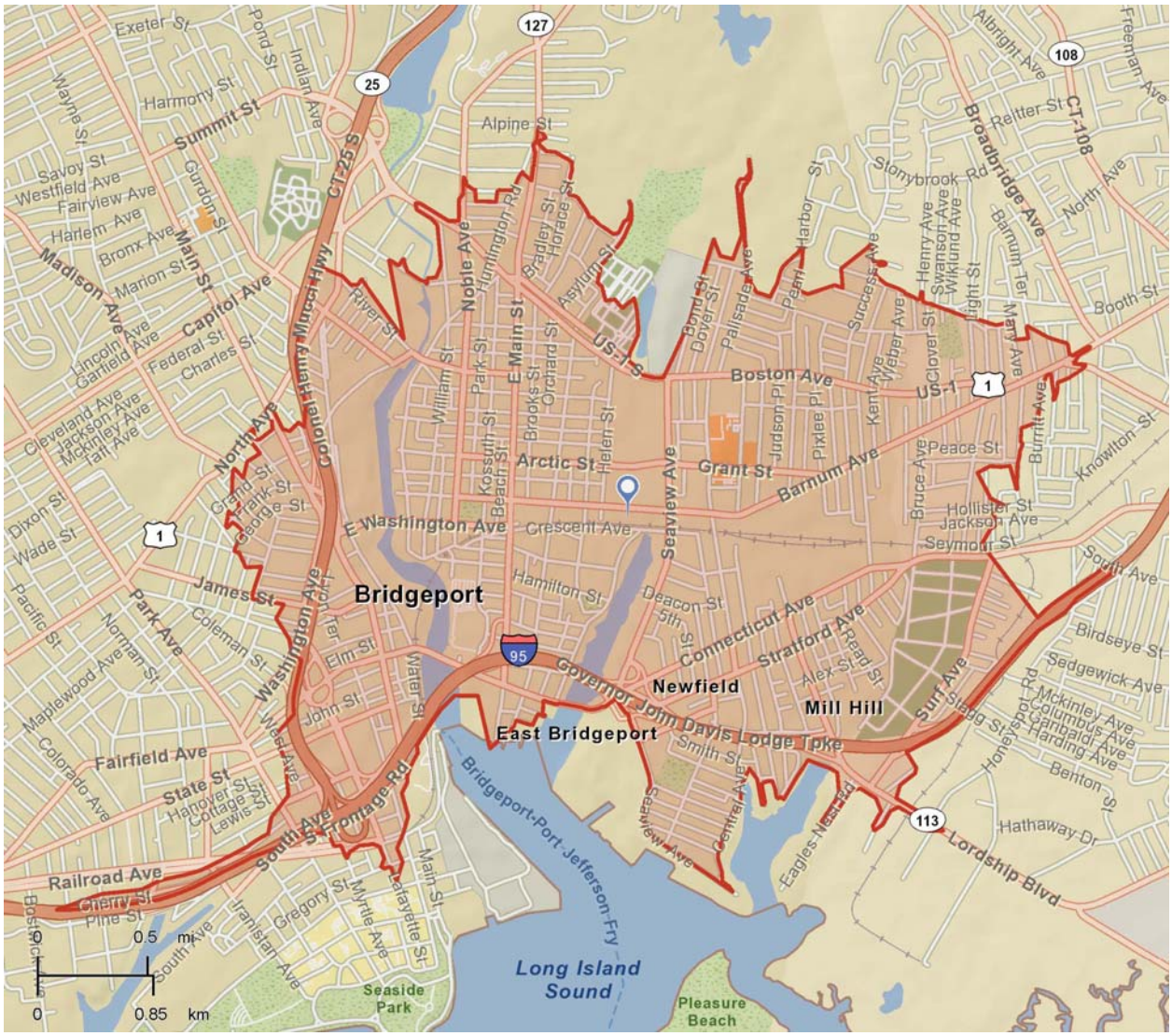
In review of the current market variables within the study area and the economic indicators evaluated in the Bridgeport area, there is evidence to suggest more limited near-term new retail, office or flex development potential driven by market demand. Residential appears to be a viable near-term development option for the Barnum Station area. Based on the residential market demand, which takes into account anticipated expansion at Bridgeport Hospital, the subsequent market demand calculations for retail, office and industrial/flex space are adjusted to reflect the demand induced by spending of new residents and employment in the market area.

Residential

The near-term supportable residential development within the Barnum Station study area, for the period through 2020 is driven by household growth, replacement, and frictional (turnover) demand in the housing market. Demand derived from these factors is calculated within defined market areas. The market areas are established by the near-term reasonableness of capturing near-term household demand within these market areas at new residential development within the Barnum Station study area. The primary and secondary market areas are defined below.

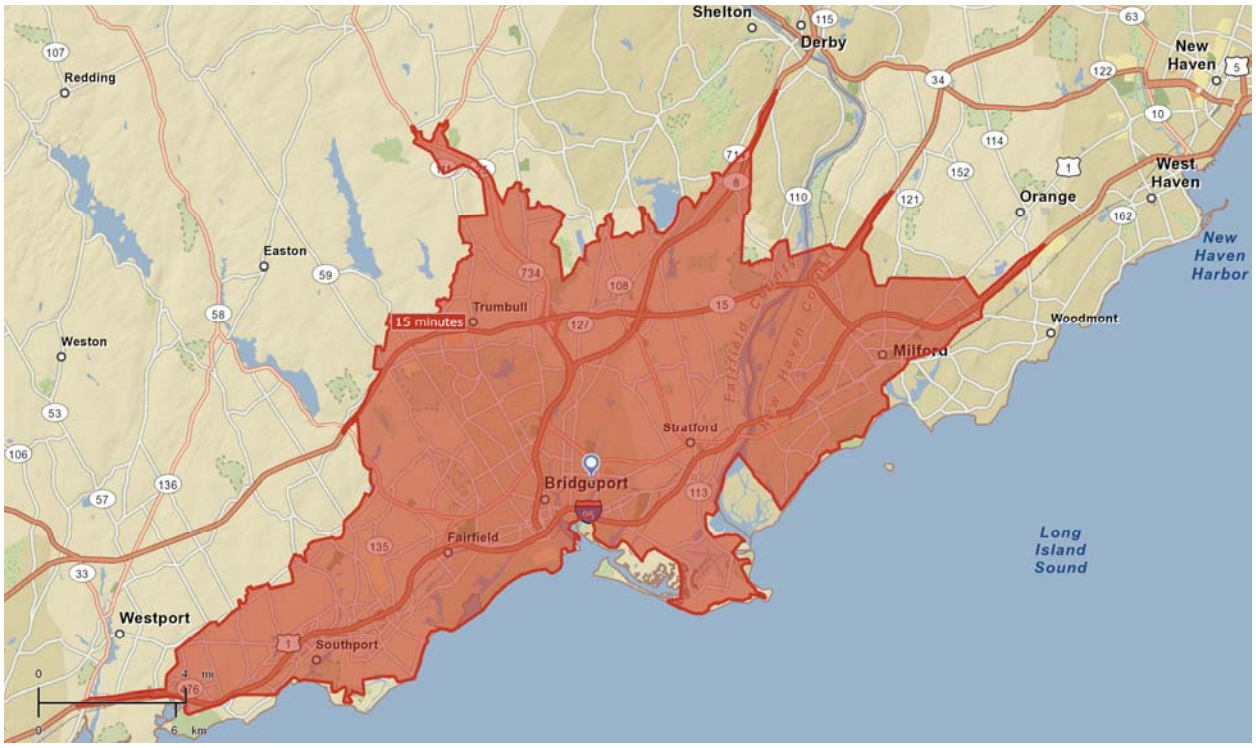
Primary Market Area: The initial primary market area represents an area that is within a 5 minute drive time to the Barnum Station site. The area holds a population of 42,120 people and 14,775 households. Projected growth in this market area will derive a quantifiable number of market supported residential units. The Barnum Station study area may capture a certain portion of these residents and therefore justify market demand for residential units at the site.

Figure 3: Primary Market Area



Secondary Market Area: The initial secondary market area represents an area that is within a 15 minute drive time to the Barnum Station site. The area holds a population of 301,647 people and 110,404 households. Projected growth in this market area, in addition to growth in the primary market area, is evaluated to determine the number of new market supported residential units. Because the secondary market area is considerably larger than the primary, and therefore subjected to greater competitive supply sources, the initial potential capture of new units in this market for the Barnum Station area is less than that of the primary market area.

Figure 4: Secondary Market Area



Household growth in each respective market area represents a potential source of demand for new residential units at Barnum Station. The growth is classified as market rate housing and below market rate housing based on regional income characteristics. The market rate for housing is derived from the median household income for the Bridgeport-Stamford-Norwalk MSA. The delineation between market rate household growth and below market rate household growth is 80% of the regional median household income. This delineation is commonly used by state and local agencies to determine the dividing line between market and below market households.

The median household income for the Bridgeport-Stamford-Norwalk MSA is $80,000. Therefore, at 80%, the distinction between market rate and below market rate housing can be made at $64,000, approximately 2.6 times greater than that within the study area ($24,500). Because the average household spends 25% of their average annual income on housing costs, the actual market rate for housing is determined to be housing with rental rates of approximately $1,300 a month and above.

The tables below outline the households within the primary and secondary market areas organized by income bracket. The red line represents the divide between above and below market households. Household growth in each bracket is also presented for the periods of 2011-2016 and 2016-2020. In both market areas, below market households are decreasing and market rate households are increasing.

Table 1

Primary (5 Minute) Growth - Total Households							
	Households		2011-2016		2020 Projection		
HH Income Range	2011	2016	Change	Percent	2020	Change	
<$15,000	3,970	4,002	32	1%	4,028	26	
$15,000-$24,999	2,283	2,004	-279	-12%	1,815	-189	
$25,000-$34,999	1,850	1,609	-241	-13%	1,448	-161	
$35,000-$49,999	2,065	1,862	-203	-10%	1,720	-142	
$50,000-$74,999	2,324	2,159	-165	-7%	2,039	-120	Below Market
$75,000-$99,999	1,047	1,459	412	39%	1,975	516	Market Rate
$100,000-$149,999	883	1,152	269	30%	1,459	307	
$150,000-$199,999	214	294	80	37%	392	98	
$200,000 +	139	174	35	25%	212	38	

Source: ESRI Business Analyst, Vantage Point

Table 2

Secondary (15 Minute) Growth - Total Households							
	Households		2011-2016		2020 Projection		
HH Income Range	2011	2016	Change	Percent	2020	Change	
<$15,000	14,458	13,982	-476	-3%	13,617	-365	
$15,000-$24,999	10,403	8,517	-1,886	-18%	7,347	-1,170	
$25,000-$34,999	9,671	7,841	-1,830	-19%	6,720	-1,121	
$35,000-$49,999	13,401	11,267	-2,134	-16%	9,899	-1,368	
$50,000-$74,999	18,969	16,394	-2,575	-14%	14,685	-1,709	Below Market
$75,000-$99,999	13,146	17,099	3,953	30%	21,598	4,499	Market Rate
$100,000-$149,999	16,364	19,369	3,005	18%	22,375	3,006	
$150,000-$199,999	6,631	8,032	1,401	21%	9,478	1,446	
$200,000 +	7,359	8,211	852	12%	8,998	787	

Source: ESRI Business Analyst, Vantage Point

Growth Demand: Growth demand is demand by the projected growth in households within the two respective market areas.

Using the growth projections for households, new market demand for residential units can be determined for the short and mid-term. In addition to household growth, other variables that can be used to determine additional residential demand within the two market areas are replacement induced demand and frictionally induced demand.

Replacement Demand: Replacement demand is demand induced by the need to replace existing, outdated housing inventory currently on the market. Based on the inventory and variables within the market, the replacement factor is determined to be 1% of existing inventory annually.

Frictional Demand: Frictional demand is demand induced by the turnover of households moving from one unit to another and/or from one market to another. The frictional factor, determined to be reflective of the specific market in Bridgeport, is 3% annually.

In order to determine the demand for residential units, specifically rental units, it is necessary to delineate the growth between rental and owner occupied housing within the two trade areas. The evaluation of the rental/owner ratio in the two market areas reveals the following make-up of rental and owner occupied housing.

Table 3

Owner/Renter Portion of Market		
	Own	Rent
Below Market		
Primary	25%	75%
Secondary	65%	35%
Market		
Primary	50%	50%
Secondary	81%	19%

Applying the rates in Table 3 to the household growth projections in Tables 1 and 2, distinguishes the rental units from owner occupied units; the resulting below market and market rate rental units in the primary and secondary markets are presented in Tables 4 and 5 below.

Table 4

Primary (5 Minute) Growth - Rental Units							
	Households		2011-2016		2020 Projection		
HH Income Range	2011	2016	Change	Percent	2020	Change	
<$15,000	2,978	3,002	24	1%	3,021	19	
$15,000-$24,999	1,712	1,503	-209	-12%	1,361	-142	
$25,000-$34,999	1,388	1,207	-181	-13%	1,086	-121	
$35,000-$49,999	1,549	1,397	-152	-10%	1,290	-107	
$50,000-$74,999	1,743	1,619	-124	-7%	1,529	-90	Below Market
$75,000-$99,999	524	730	206	39%	988	258	Market Rate
$100,000-$149,999	442	576	135	30%	730	154	
$150,000-$199,999	107	147	40	37%	196	49	
$200,000 +	70	87	18	25%	106	19	

Source: ESRI Business Analyst, Vantage Point

Table 5

Total Secondary (15 Minute) Growth -Rental Units							
	Households		2011-2016		2020 Projection		
HH Income Range	2011	2016	Change	Percent	2020	Change	
<$15,000	5,060	4,894	-167	-3%	4,766	-128	
$15,000-$24,999	3,641	2,981	-660	-18%	2,572	-409	
$25,000-$34,999	3,385	2,744	-641	-19%	2,352	-392	
$35,000-$49,999	4,690	3,943	-747	-16%	3,465	-479	
$50,000-$74,999	6,639	5,738	-901	-14%	5,140	-598	Below Market
$75,000-$99,999	2,498	3,249	751	30%	4,104	855	Market Rate
$100,000-$149,999	3,109	3,680	571	18%	4,251	571	
$150,000-$199,999	1,260	1,526	266	21%	1,801	275	
$200,000 +	1,398	1,560	162	12%	1,710	150	

Source: ESRI Business Analyst, Vantage Point

The growth in rental units for the two market areas outlined above provides the basis by which total market supportable rental units may be derived for both market and below market housing. The total net household growth for rental units by classification (market/below market); period, and primary/secondary market areas are summarized in the table below. There is a net decrease over both periods for below market rental units in both the primary and secondary markets. Market rate rental unit growth on the other hand, is relatively strong within both market areas and over the two periods. As discussed earlier, the inverse relationship between growth in market rate and below market rate implies improving income variables for the Bridgeport area.

Table 6

Net Household Growth by Period and Household Classification						
	Households			Net Change		
Market Area	2011	2016	2020	2011-2016	2016-2020	Total
Below Market Rate						
Primary	9,369	8,727	8,287	-642	-440	-1,082
Secondary	14,047	11,573	10,007	-2,473	-1,567	-4,040
Total	**23,416**	**20,300**	**18,294**	**-3,115**	**-2,007**	**-5,122**
Market Rate						
Primary	1,142	1,540	2,019	398	480	878
Secondary	7,124	8,476	9,846	1,352	1,370	2,723
Total	**8,265**	**10,015**	**11,866**	**1,750**	**1,850**	**3,601**

Source: ESRI Business Analyst, Vantage Point

Though the analysis provides evidence of market demand for residential units over the two periods, it is not reasonable to assume that the total demand for new units in the two market areas will be entirely realized within the Barnum Station study areas (¼ mile and ½ mile radius around the station). Therefore, a capture rate representing the potential units of growth induced demand that the Barnum Station site would likely capture. The table below defines the total demand induced by household growth and captured within the Barnum Station study area for residential rental units.

Note the different capture rates for the two periods, two classifications (market and below market), and two market areas (primary and secondary). This reflects, as the site becomes a residential destination over time, the site will likely appeal to a broader portion of the market area. Further, below market households reflect the particular mix of housing, which given the development plans, is reasonable to assume. Finally, the study area will capture more units from the primary than the secondary market because of proximity.

The total capture induced by household growth in the primary and secondary market is 117 market rate rental units. There is no growth based demand for below market rental units.

Table 7

Potential Capture By Household Growth and Classification						
Below Market Rate						
Market Area	2011-2016			2016-2020		
	Capture Rate	Growth	Total Capture	Capture Rate	Growth	Total Capture
Primary	10%	-642	0	15%	-440	0
Secondary	5%	-2,473	0	7.5%	-1,567	0
Total Below Market			0			0
Market Rate						
Market Area	2011-2016			2016-2020		
	Capture Rate	Growth	Total Capture	Capture Rate	Growth	Total Capture
Primary	5%	398	20	10%	480	48
Secondary	3%	1,352	41	5%	1,370	69
Total Market			60			117

Source: ESRI Business Analyst, Vantage Point

The next step is to factor the replacement induced demand into the growth based demand with the intention of determining more closely the final market support for units at Barnum Station. Replacement demand is demand induced by the need to replace existing inventory on the market that is deemed outdated. The replacement factor appropriate for this marketplace is 1% of inventory annually. In the table below, the 1% annual replacement rate is assessed to the current inventory of rental units within the two market areas and delineated between market rate and below market rate.

Table 8

Replacement Demand by Period and Classifcation						
Market Area	Total Rental Households by Period		Annual Replacement 1%	1%	Total Rental Replacement for Period	
	2011-2016	2016-2020	2011-2016	2016-2020	2011-2016	2016-2020
Below Market Rate						
Primary	8,727	8,287	87	83	436	331
Secondary	11,573	10,007	116	100	579	400
Total	**20,300**	**18,294**	**203**	**183**	**1,015**	**732**
Market Rate						
Primary	1,540	2,019	15	20	77	81
Secondary	8,476	9,846	85	98	424	394
Total	**10,015**	**11,866**	**100**	**119**	**501**	**475**

Source: ESRI Business Analyst, Vantage Point

Capture rates were estimated to be identical for replacement as they were for growth. Taken cumulatively with the growth induced demand, and for the entire period 2011-2020, the total demand for below market units is 153 over the period. The total demand for market rate residential units is 222 (177 growth based demand plus 45 replacement) over the period.

Table 9

Potential Replacement Capture by Classification						
Market Area	2011-2016			2016-2020		
	Capture Rate	Replacement	Total Capture	Capture Rate	Replacement	Total Capture
Below Market Rate						
Primary	10%	436	44	15%	331	50
Secondary	5%	579	29	7.5%	400	30
Total			**73**			**80**
Market Rate						
Primary	5%	77	4	10%	81	8
Secondary	3%	424	13	5.0%	394	20
Total			**17**			**28**

Source: ESRI Business Analyst, Vantage Point

The final element to consider with respect to comprehensively understanding demand for residential units at Barnum Station is frictional demand. Frictionally induced demand is demand caused by the turnover of households within the market and new residents entering the market over the period as households relocate. To calculate the frictionally based demand, a 3% turnover rate is applied to existing households in the primary and secondary market for the two periods. The results yielded for the respective market areas and housing classifications are provided below.

Table 10

Frictional Demand by Period and Classifcation						
Market Area	Total Households by Period		Annual Friction		Total Frictional for Period	
			3%	3%		
	2011-2016	2016-2020	2011-2016	2016-2020	2011-2016	2016-2020
Below Market Rate						
Primary	8,727	8,287	262	249	1,309	994
Secondary	11,573	10,007	347	300	1,736	1,201
Total	**20,300**	**18,294**	**609**	**549**	**3,045**	**2,195**
Market Rate						
Primary	1,540	2,019	46	61	231	242
Secondary	8,476	9,846	254	295	1,271	1,182
Total	**10,015**	**11,866**	**300**	**356**	**1,502**	**1,424**

Source: ESRI Business Analyst, Vantage Point

Because the markets considered in this case are identical to the growth and replacement demand markets utilized above, the same potential capture rates are assessed on the total frictional demand within the primary and secondary markets. The results yield the following demand for the Barnum Station site for market and below market units.

Table 11

Potential Frictional Capture by Classification						
Market Area	2011-2016			2016-2020		
	Capture Rate	Friction	Total Capture	Capture Rate	Friction	Total Capture
Below Market Rate						
Primary	10%	1,309	131	15%	994	149
Secondary	5%	1,736	87	7.5%	1,201	90
Total			**218**			**239**
Market Rate						
Primary	5%	231	12	10%	242	24
Secondary	3%	1,271	38	5.0%	1,182	59
Total			**50**			**83**

Source: ESRI Business Analyst, Vantage Point

To summarize, each step determines a portion of the input to total demand for the Barnum Station study area (½ mile radius around the site). The table below is divided to show below market rental unit demand and market rental unit demand. The total demand in the right column is a sum of the demand in each column for the specific source of the demand - growth, replacement, and friction. Total demand for each classification of rental unit is provided for the entire period 2011-2020 - 609 and 354 units for below and market rate units, respectively.

Table 12

Summary - Residential Rental Demand Capture Potential								
Market Area	Growth Induced Demand		Replacement Induced Demand		Frictionally Based Demand		Total Demand	
	2011-2016	2016-2020	2011-2016	2016-2020	2011-2016	2016-2020	2011-2016	2016-2020
Below Market Rate								
Primary	0	0	44	50	131	149	175	199
Secondary	0	0	29	30	87	90	116	120
Total	**0**	**0**	**73**	**80**	**218**	**239**	**290**	**319**
Total Demand: Below Market Rate Housing							**609**	
Market Rate								
Primary	20	48	4	8	12	24	35	80
Secondary	41	69	13	20	38	59	91	147
Total	**60**	**117**	**17**	**28**	**50**	**83**	**127**	**228**
Total Demand: Market Rate Housing							**354**	

Source: ESRI Business Analyst, Vantage Point

These projections are irrespective of potential growth associated with jobs created and housing demand associated with the expansion of Bridgeport Hospital, which lies within the ½ mile study area for Bridgeport. New jobs created in response to hospital expansion, nearly 1,600[1], and the indirect implications associated with spin-off growth from the hospital will likely improve the outlook for new units within the study area. New dwelling units capture of new employment at the hospital will likely range between 10% and 15%. Potential complementary uses that may be a spin-off of the hospital could induce further demand for households within the station area.

The proximity to the hospital serves as a comparative advantage to other housing demand sources around Barnum Station, including Steel Point and the competitive characteristics of downtown. This supports the projected market demand derived from the household growth, replacement, and frictional demand evaluated above. Further, the direct access to downtown provided by the station will serve as an amenity to many who would chose to live around Barnum Station.

The residential growth within the study area will be the source from which retail demand is derived. As more residential development occurs within the Barnum Station study area, more demand for complementary retail will exist.

Flex/Office

Initial review of the office and flex (office mixed with light industrial and assembly) space market around Barnum Station and the greater Bridgeport area suggests generally weak near-term market characteristics for new development based on current vacancies.

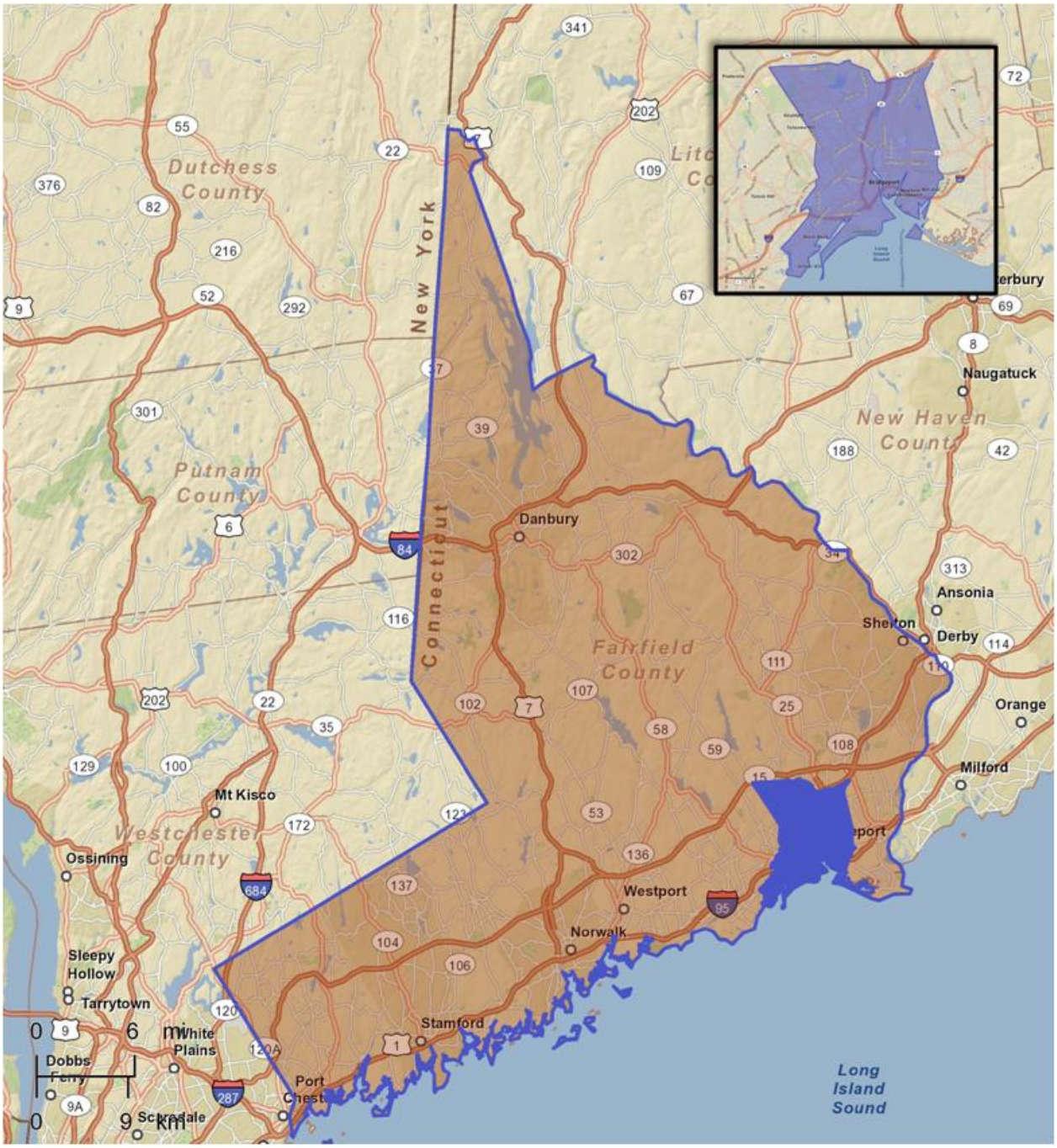
Employment growth is a primary indicator for new space. However, it is not the only factor. Age and quality of existing inventory greatly impact the need for new space as deteriorating quality space may

[1] Source: Barnum Station – Future Land Use and Build-Out: "Based upon conversations between City and Hospital"

require replacement to accommodate the need for modern facilities. Further, the vacancy within the existing inventory reduces the pressure to deliver new space to the market. Larger sources of vacancy, considered to be quality options for new tenants, will serve as a competitive option to new space - dependent on age and quality.

To evaluate these variables within the context of the Barnum Station study area, two market areas have already been described: the Bridgeport-Stamford-Norwalk MSA, and the City of Bridgeport shown on the map on the following page. Within each, employment projections, current inventory, and specific characteristics of the inventory were evaluated to determine the potential demand that may be derived relative to the site.

Figure 5: Bridgeport-Stamford-Norwalk MSA/Bridgeport, CT



The most noticeable trend within the market areas is weak projected growth in employment which would most likely occupy space that is classified as office or flex space. Growth in employment in these two sectors of the labor force is expected to be relatively stagnant within the MSA and most particularly within the City of Bridgeport. The tables below show employment within each sector in 2011. Projections for 2016 and 2020 and the growth trends for each period as total net new jobs for each

period and percent increase over each period are calculated and demonstrate the limited growth in the market.

Table 13

Employment Within Each Segment - MSA/Bridgeport						
Job Sector	2011		2016		2020	
	MSA	Bridgeport	MSA	Bridgeport	MSA	Bridgeport
Office Space	122,218	8,609	123,941	8,603	125,343	8,598
Flex Space	107,275	13,355	108,867	13,346	110,163	13,339

Employment Growth by Period and Segment - MSA/Bridgeport						
Job Sector	2011-2016		2016-2020		2011-2020	
	MSA	Bridgeport	MSA	Bridgeport	MSA	Bridgeport
Office Space	1,723	-6	1,402	-5	3,125	-11
Flex Space	1,592	-9	1,296	-7	2,888	-16

Employment Growth by Period and Segment - MSA/Bridgeport						
Job Sector	2011-2016		2016-2020		2011-2020	
	MSA	Bridgeport	MSA	Bridgeport	MSA	Bridgeport
Office Space	1.4%	-0.1%	1.1%	-0.1%	2.6%	-0.1%
Flex Space	1.5%	-0.1%	1.2%	-0.1%	2.7%	-0.1%

Source: ESRI Business Analyst, Vantage Point

The employment expectations within the two respective market areas are suggestive of very limited support for new development of either office or flex space. Some growth in the MSA as a whole might translate into demand for alternative options for both office and flex space in East Bridgeport. More precisely, accessibility improvements provided by the addition of a station and the subsequent development of residential units might benefit this segment within the study area.

This demand, if induced by modest growth in the MSA, would be highly dependent on the vacancy rate and quality/age in current inventory. The employment characteristics of the market follow the trends in flex and office space inventory within the MSA and Bridgeport. Both the office and flex markets are experiencing relatively high levels of vacancy within the MSA and Bridgeport. By most broker accounts, vacancy in the two market areas range from 10-20 percent. High vacancy coupled with limited employment growth significantly hinders opportunity for speculative office and flex space development at Barnum Station.

In the near-term, the location of Barnum Station also contributes to the competitive barriers regarding new office and flex space development. Accessibility provided by the addition of a new station will undoubtedly be an asset to the site over time. In the near-term, with decreasing rents and high vacancy rates MSA-wide, the opportunity to locate to a more central/established location will be appealing to many businesses. Further, centers such as Steel Point (1.25 million square feet office), Seaview Industrial

Park (140,000 square feet industrial), located within proximity to the site will negatively impact any potential demand at Barnum Station. In the longer-term however, redevelopment at the station will counter these trends as Barnum Station becomes more desirable.

Bridgeport Hospital, located within the secondary study area ½ mile radius) is slated to expand medical facilities. It is reasonable to expect spin-off industry that would likely prefer the advantages of locating near the hospital over the central business district and to have space requirements that would be best served by the Barnum Station study area. Therefore, the impacts of the hospital expansion must be evaluated and considered in the overall viability of office and flex space development within the study area.

Over the period through 2020, spin-off from the hospital expansion will precipitate the demand for additional flex/office space within the study area. Quantifiably, this value can be determined based on a reasonable growth in employment above the estimated incremental hospital employment associated with the expansion, 1,600 jobs. Spin-off from new hospital operations will likely drive the creation of additional, approximately equivalent jobs of which anywhere between 320-480 new jobs could be captured within the study area. New employment will support demand for new flex/office space within the study area. Based on spin-off from hospital expansion, there could likely be new demand for additional office/flex space within the study area totaling 64,000-96,000 square feet over the period through 2020.

Table 14

Spin-Off Industry - Office/Flex Space Requirements			
	Hospital Expansion	**Spin-Off (20%)**	**Spin-Off (30%)**
New Employment	1,600	320	480
Space Requirements Per Employee (Square Feet)		200	200
New Space Required (Square Feet)		64,000	96,000
Total Square Feet Required (64,000-96,000 Square Feet)			

In addition to the spin-off industry discussed above, additional demand derived from new build-to-suit projects within the study area could likely support development of additional flex space. This will likely support 2-4 new projects for flex space averaging 20,000 square feet per project in the near-term. The station's proximity to the hospital, spin-off industry and initial development is the basis for this opportunity. Increased amenities and competitive advantages such as lower cost space, free parking, ease of expansion, proximity to rail station and hospital, access to lower cost labor, and financial incentives will set apart Barnum Station from competitive sources and better ensure that the Barnum Station study area captures these potential build-to-suit tenants.

The additional mode of transportation access provided by the new station and other amenities will provide more incentives for firms to locate at, and immediately around the station. These incentives will be necessary to accommodate growth in these sectors. Demand for office and flex space over the initial period and within the study area will likely equate to total supportable office and flex space development between 104,000 square feet to as much as 176,000 square feet.

Table 15

Summary - Office/Flex		
Source	**Square Footage (Low)**	**Square Footage (High)**
Spin-Off	64,000	96,000
Build-to-Suit	40,000	80,000
Total	**104,000**	**176,000**

The additional employment within this market coupled with the household growth cited in the previous sections will further support additional retail demand.

Retail

Retail in the Barnum Station study area will be driven by the demand generated immediately in and surrounding the station area. Large residential accommodations and employment sources will generate the dominant share of this demand, since there is no regional appeal to retail within the study area that might be generated at an outlet mall or large retailer such as Bass Pro Shops (slated for Steel Point).

The first step in understanding retail potential in the study area is to review the respective market area to determine what retail categories have a retail gap. A gap represents unmet demand where demand is greater than supply and retail opportunity within the market area.

The trade area analyzed for the purpose of understanding supply and demand variables is the ½ mile radius around the Barnum Station site. The size of the market is driven by other retail sources located within proximity to the Barnum Station site, including Steel Point, and downtown Bridgeport.

In reviewing the retail supply and demand within the trade area for the retail categories, there is very limited support for additional retail opportunities. Further, with additional large scale retail development slated near-term, market supported retail development at Barnum Station is limited.

While the market variables at present do not justify new retail development at the Barnum Station site, residential growth and employment growth in the study area will create support for new retail development.

The following is a summary of the variables in the previous two sections that will justify new retail demand within the study area:

Residential

- 609 New Below Market Rate Household Units
- 354 New Market Rate Household Units

Employment

- 1,600 New Employees Created by the Hospital Expansion
- 320-480 New Employees Created by the Spin-Off Industry
- 200-400 New Employees Created by Additional Flex/Office Development Projects

The increase of households within the market will account for the dominant source of retail demand over the initial period. Demand based on new households in the study area is derived by applying a typical household retail expenditure rate (60%) to the average household income for both market and below market housing projections for the study area. A capture rate is applied to the potential expenditures for below market and market rate households. Because households are likely to travel and spend their money in multiple locations and regional attractions, a capture rate of 12% is assessed to potential retail expenditures. Below market households are more likely to rely on retail opportunities in the immediate area and therefore a capture rate of 18% is assessed to potential retail expenditures.

Table 16

Retail Expeditures Induced by New Households				
	# New Over Period	**Average HH Income**	**60% Retail Expenditures Per Household**	**Total Retail Expenditures**
Below Market Households	609	$39,500	$23,700	$14,433,300
Market Rate Households	354	$132,000	$79,200	$28,036,800
Total				**$42,470,100**

Source: Vantage Point

Table 17

Barnum Station Capture of New Retail Expenditures			
	Total Retail	**Capture Rate**	**Total Captured**
Below Market	$14,433,300	18%	$2,597,994
Market Rate	$28,036,800	12%	$3,364,416
Total			**$5,962,410**

Source: Vantage Point

The total capture of retail expenditures for the study area is estimated at $5.9 million. These sales can be translated into square footage of potential retail development. Sales per square foot of $200 (an industry average) means that a total of 30,000 square feet of retail will be supported by new households locating at Barnum Station.

The second element that will drive retail demand within the study area is the addition of new jobs over the initial period. As outlined above, new employment within the study area by the hospital and spin-off industry combined will account for between 2,120 and 2,480 new jobs. The estimated retail expenditure potential of new employment will further enhance demand within the study area. For each new job, new retail expenditures in the market will average $1,200. Therefore, new retail expenditures induced by the creation of new jobs are quantified in the following table.

Table 18

Employment Induced Retail Expenditures at Barnum Station		
Potential New Jobs	**Retail Expenditures Per New Job**	**Total Retail Expenditures**
2,120	$1,200	$2,544,000
2,480	$1,200	$2,976,000
Total : ($2.5 M - $2.9 M)		

Based on the retail expenditures that might be realized at Barnum Station for both new households and new employment, total supportable square footage of new retail development can be calculated. Combined, retail expenditures for Barnum Station will range from $8.5 million to $8.9 million (residential plus employment based retail expenditures). The total retail expenditure potential at the site is translated into square feet at $200 in sales per square foot. **The Barnum Station study area will likely initially support between 42,000 and 44,000 square feet of new retail development base upon the support from new residents and employees.**

Barnum Station – The Vision

Including the Barnum Station study area, East Bridgeport is a public priory to serve as a catalyst for future development and revitalization in Bridgeport. Support for the future of East Bridgeport is reflected by Bridgeport organizations and the Mayor of Bridgeport. However, in order to realize a vibrant future for East Bridgeport and development of and around the Barnum Station site, considerable coordination and cooperation between both public and private parties to develop a strong vision for the area is required.

Building on the results of the earlier market analysis by which development potential is assessed with respect to the Barnum Station site and in consideration of Bridgeport Hospital and the Bridgeport Housing Authority, long range potential for supportive development at the Barnum Station site can be reviewed. Initial market projections provide a positive trend in Bridgeport, even while current market and economic conditions indicate considerable obstacles to development. However, with the presence of the hospital, the plans of the housing authority, and the implications of the addition of Barnum Station over the mid-term, the study area is poised to realize modest development potential while the region struggles to manage high vacancies and minimal population and employment growth.

The regional appeal of the study area will certainly broaden with the construction of Barnum Station. Further, the proximity and accessibility to downtown Bridgeport will serve as an appealing characteristic of living and working in the Barnum Station area; which is less than one mile from the downtown station. Finally, concurrent development at Steel Point, particularly in retail and entertainment will serve as an amenity for those choosing to live within the Barnum Station study area. As development occurs both at and immediately surrounding the station and the appeal of living and working at Barnum Station broadens, regional characteristics will greatly impact the growth potential relevant to the study area.

Long-Term Vision

The long-term vision of the Barnum Station study area and East Bridgeport is to stimulate development in coordination with Barnum Station, Bridgeport Hospital, and the Bridgeport Housing Authority. The development will be highly dependent on the attractiveness of the Barnum Station study area relative to the proximity to Steel Point and downtown Bridgeport. The long-term vision for Barnum Station is one that includes considerable development around the station that is compatible and complimentary of both downtown and Steel Point.

Bridgeport Housing Authority: In conversation with the Bridgeport Housing Authority (BHA), the agency indicated major development interest in the Barnum Station study area and East Bridgeport. The Authority's strategic land holdings coupled with the vision for development within the study area will impact the profile of the area considerably. Over the near- and mid-term, the BHA expects to remove 406 units at Marina Village, located across the river in Bridgeport. These units are expected to be redeveloped with an additional 1,000 to 1,200 units on 6 potential development sites. Four of these sites are within the immediate study area of Barnum Station, and will figure to receive a portion of the new dwellings. The current BHA building program for East Bridgeport includes 913 residential units

immediately to the south of Barnum Station on the parcel referred to as "The Sponge" and 147 dwellings just to the east of The Sponge on "The Prairie".

The BHA expects this development to be urban density with approximately 40 units to the acre, 3 to 6 story buildings, and .5 parking spaces per dwelling. These plans are consistent with the addition of transit availability provided by the addition of Barnum Station. The development as envisioned by the housing authority and the eventual presence of Barnum Station will certainly complement each other in enhancing the regional appeal of East Bridgeport.

Bridgeport Hospital: Bridgeport Hospital is an important asset in East Bridgeport and the Barnum Station study area. Currently, the hospital employs more than 2,600 people, 600 active attending physicians, 235 medical/surgical residents affiliated with Yale University, 460 volunteers, and 380 auxiliary employees. The Hospital has undergone several expansion projects over the past decade and is expected to further expand over the next several years. The City expects this expansion to add nearly 1,600 jobs to East Bridgeport. Both residential and retail accommodations will be required to meet new demand from such expansion and likely spinoff development that compliments the hospital.

Steel Point: Steel point will play a pivotal role in advancing the profile of East Bridgeport from the standpoint of both local and regional appeal. This development, in planning for several decades, is a large waterfront development largely planned around retail and residential development. The recent acquisition of major retailer and anchor tenant Bass Pro Shops is a positive sign that development activity on a grander scale will, over the near- and mid-term increase. Data provided by the City demonstrates the aggressive vision for this development, including: 2,964 residential units, 1.25 million square feet of office space, 1.1 million square feet of retail space anchored by a Bass Pro Shops, and 800,000 square feet of hotel space on 48 acres.

Barnum Station Study Area: Besides the major players described above, considerable development is envisioned within the Barnum Station study area. This development will be highly dependent on the presence of Barnum Station and other complimenting projects such as the hospital expansion, Steel Point, the housing authority development. Total development within the study area (1/2 mile from the site) is outlined in the following table.

Table 19

East Bridgeport/Barnum Station - Development Program					
	Residential* (Units)	**Office (SF)**	**Retail (SF)**	**Industrial (SF)**	**Hotel (Rooms)**
Total: 1/4-Mile Radius	1,309	0	0	906,564	0
Total: 1/2-Mile Radius	2,623	103,587	2,584	938,361	0

**Includes Bridgeport Housing Authority Plans*

Source: GBRC

Regional Opportunities

Barnum Station is in a region that boasts a highly conducive environment for the success of public transit. The Bridgeport-Stamford-Norwalk MSA and the New Haven-Milford MSA, both of which represent areas from which Barnum Station may attract residents and employers over the long term, rank high nationally for transit connectivity and opportunity. This characteristic is a positive indicator for the potential success of Barnum Station as a development catalyst for East Bridgeport.

In a study titled *Are We There Yet? Creating Complete Communities for 21st Century America,* performed by Reconnecting America, various regions are analyzed with respect to their transit oriented competitiveness. In this report, the Bridgeport and New Haven region rank highly among regions with less than one million people for current transit opportunities. The following table summarizes the characteristics of the population related to transit options in the region. The rankings are based on the review of all 366 Metropolitan Statistical Areas nationwide, and are categorized by size. Both the Bridgeport-Stamford-Norwalk MSA and the New Haven-Milford MSA fall within the category of a region with a population between 500,000 and 1 million.

Table 20

Regional Transit Characteristics													
Region (Between 500,000 and 1 million population)	Households near transit		Households near Fixed-Guideway		Households living in opportunity areas*		Percent of jobs near Fixed-Guideway transit		Percent of jobs in opportunity areas*		Percent of commuters who take transit		Growth in opportunity areas* compared to region
	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Rank
Bridgeport-Stamford-Norwalk, CT MSA	13%	1	13%	1	22%	3	17%	1	27%	4	9%	1	5
New Haven-Milford, CT MSA	6%	7	7%	2	14%	9	14%	2	-	-	4%	6	6

Source: Reconnecting America: Are We There Yet? Creating Complete Communities for 21st Century America
**Opportunity Area: Areas that maintain a density of at least 7 dwelling units per acre and which the block size is less then 6 acres.*

The table demonstrates the importance of transit to the Bridgeport region, and provides positive evidence that suggests Barnum Station is positioned to capitalize on a transit oriented and dependent region. The success of the station and transit in the region will positively impact the development opportunity over the long run for the study area and East Bridgeport. As initial transit oriented development and development associated with the hospital expansion and the housing authority is realized around a new station, future development potential will be greater.

Supporting Incentives

The City of Bridgeport has established the objective to make Barnum Station a catalyst for the long term development of East Bridgeport. The initial market baseline projections made through 2020 indicate the potential for considerable development within the Barnum Station study area. This new development and other complimentary development in the area will serve as a catalyst for long-term growth and expansion in East Bridgeport. While the addition of the station will enhance the development activity in East Bridgeport, city policies and incentives may also serve to enhance development activity. Currently, Bridgeport offers and/or participates in incentive programs that would likely benefit the development baseline as presented earlier, and the development objectives outlined by the city.

Enterprise Zone Program: An Enterprise Zone is a designated area within a Targeted Investment Community for which particular incentives may be provided for business relocation and expansion within the zone. Those eligible businesses include: manufacturers, warehouse distributers, and certain service related businesses.

1. A 5-year, 80% abatement of local property taxes on all qualifying real and personal property that is new to the Grand List of the city/town as direct result of a business relocation, expansion or renovation project.
2. 10-year, 25% or 50% credit on that portion of the Connecticut Corporate Business Tax that is directly attributable to this business relocation, expansion or renovation project as determined by the Connecticut Department of Revenue Services and as provided under section 12-217(e) of the Connecticut General Statutes.
3. Exemption from real estate conveyance tax.

Within an Enterprise Zone, residential and commercial property owners are eligible for the fixing of assessments on the property for improvements made during the period in which the property is designated as being within the Enterprises Zone. The deferral on increased assessments follows a regressive schedule over a 7 year period from the improvement: 100% deferral in year 1 and 2, 50% in year 3, and declining 10% year-over-year through the end of the 7 year period.

Areas and/or projects within Targeted Investment Communities but outside of an Enterprise Zone may qualify for Enterprise Zone incentives under the following designations: Entertainment Districts, Qualified Manufacturing Plant, Railroad Depot Zone, and Urban Jobs Program.

- **Entertainment Districts:** Qualified entertainment projects are subject to Enterprise Zone benefits and are eligible for enhanced property tax benefits.
- **Qualifying Manufacturing Zone:** Vacant or underutilized manufacturing plants with an area of at least 500,000 square feet may be designated a qualified manufacturing plant and therefore qualify for Enterprise Zone incentives. Bridgeport does not currently maintain this designation.
- **Railroad Depot Zone:** Underutilized railroad depot areas may be designated a Railroad Depot Zone and therefore qualify for full Enterprise Zone incentives. Bridgeport does not currently maintain this designation.
- **Urban Jobs Program:** Enterprise Zone benefits may apply to qualifying projects in a Targeted Investment Community. Specific projects that may be eligible are manufacturers, warehouse distributors, and certain service-related businesses. The benefits for qualifying projects includes 5-year, 80% abatement of local property taxes on all new real and personal property and a 10-year, 25% credit on the Connecticut business tax that is attributable to the business relocation, expansion, or renovation project.

Urban and Industrial Sites Reinvestment Tax Credit Program: Under this program, the state may provide up to $100 million in tax credits over a ten year period to support projects that create significant jobs and capital investment in underserved areas. Projects must provide a minimum amount of $5 million in direct investment or $2 million for the preservation and redevelopment of a historical facility

for mixed-use purposes. The corporate tax credit is dispersed to the recipient over a 10-year period and the first credit is not distributed until the fourth year of the project. The table below shows the incremental increase in tax credits over the ten-year period. Eligibility is determined for both Urban Sites and Industrial Sites. An Urban Site is eligible if the project is defined as one that would add significant new economic activity, increase employment, and generate additional tax revenues to the municipality. An eligible industrial site is defined as an investment in real property or in improvements to real property which has been subjected to environmental contamination. The investment will restore the property to a viable business condition and provide significant new economic activity, employment, and generate new tax revenue to the municipality.

Table 21

Corporate Tax Credit - 10 year Schedule										
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Percentage	0%	0%	0%	0%	10%	10%	10%	20%	20%	20%

Source: State of Connecticut

Brownfield's Program: Properties within Bridgeport may also qualify for the EPA sponsored Brownfield's Program. The program enables certain projects to qualify for Assessment Grants, Revolving Loan Funds, and Cleanup Grants from the EPA. These various funding sources provide a means by which property owners may assess, quantify, and remediate contaminated property that is determined to be Brownfield. Assessment Grants are funding sources that allow the owner of the property to assess, characterize, inventory, and conduct planning and community involvement related to Brownfield sites. Revolving Loan Funds are low interest loans that may be used for states and political subdivisions to clean up sites. Finally, a Cleanup Grant is funding that is available for the cleanup of Brownfield sites.

The incentive programs available in Bridgeport will likely play a key role in further enhancing development activity in East Bridgeport in the long-run. Of particular interest may be those incentives geared towards industrial sites, manufacturing, warehousing, and the remediation of those industrial sites for future use. With considerable underutilized industrial property within the immediate vicinity of the proposed station, the ability to use this land for development will be highly dependent on the affordability of cleaning this property up and potentially repurposing it within the parameters of the long-term vision for Barnum Station.

Comparable Projects

Looking at the long-term vision for East Bridgeport and Barnum Station, and considering the policies, parties, market conditions and characteristics that will influence the future build-out potential at the station, shows strong evidence that Barnum Station will achieve the grander vision of a livable, workable transit-oriented community. Reviewing other projects with similar characteristics provides perspective on successful projects that capitalized on these similar characteristics. Below several projects are discussed that demonstrate the potential for Barnum Station and East Bridgeport.

Hudson River Waterfront – New Jersey: The introduction of the Hudson-Bergen Light Rail (HBLR) to the Hudson River waterfront in New Jersey provides an excellent comparison to East Bridgeport with respect to the economic impact of rail on a community. The riverfront in New Jersey experienced considerable economic decline beginning in the 1960's and 1970's as employment shifted from shipyards, manufacturing, rail yards, and other industries that historically lined the Hudson waterfront in New Jersey. Economic decay continued through the 1990's as employment migrated further to the suburbs, leaving the waterfront generally abandoned.

Along with interest from firms who saw the New Jersey waterfront as an excellent opportunity to locate within immediate proximity to New York City, a plan for the addition of light rail to the waterfront connecting New Jersey with New York City was initiated. Construction for the new HBLR began in 1996 to accompany additional development that had begun to spring up along the waterfront. Construction was completed in 1999 and the line was opened in 2000.

The subsequent impact of bringing light rail was a considerable increase in development activity along the New Jersey waterfront. Specifically, Exchange Place, which consisted of numerous vacant or abandoned parcels of land, saw a significant boost in development activity. Firms such as Merrill Lynch, Morgan Stanley, Lehman Brothers, and Goldman Sachs quickly positioned themselves as high profile tenants along the waterfront. Newport, once a large rail freight yard saw considerable increases in both office and residential development spurned by the addition of rail transit options along the waterfront.

Similar to East Bridgeport and the Barnum Station study area, the New Jersey waterfront capitalized on large quantities of underutilized land, proximity to traditionally competitive markets, and the hospital (Jersey City Medical Center) to convert a relatively weak economic market into a hub for new business operations and residents. To date, the HBLR has provided a competitive edge for the New Jersey waterfront, allowing it to compete regionally and nationally over the last 15 plus years. More than 7,000 new townhouses, apartments, and condominiums are contributed to the addition of light rail to the market along with corporate headquarters and retail shops.

Charlotte, North Carolina: The introduction of the Lynx in Charlotte has proven to be a catalyst for development both along the line, and adjacent to station locations. After years of planning that began in the 1980's, the Lynx light rail system was introduced to the City of Charlotte in 2007. While completion of the system is not anticipated until 2014, development along the Lynx and at station locations has been highly productive along with ridership which has far exceeded the original projections.

Adjacent to rail lines and surrounding station locations, previously vacant warehouses, mills, and industrial land has been transformed into new residential, mixed-use, and adaptive re-use developments. $1.4 billion in private real estate investments along the line and around stations includes the development and redevelopment of housing in neighborhoods that previously would have not received such interest and investment. The many vacant mills that were integrated into low income neighborhoods have been transformed into new homes, shops, and restaurants.

Since the introduction of Lynx to Charlotte, development around station locations has demonstrated the value that stations add to the surrounding market. In the initial six to seven years, in a period of strong

economic growth, 45 projects with 1,400 housing units and 700,000 square feet of retail and office space have been developed in immediate station areas. Residential units located around Lynx stations rent for a 53% premium over comparable units city-wide. Since many of these units have been developed in otherwise low-income neighborhoods, the positive impacts at Lynx stations is a strong model for East Bridgeport and Barnum Station for improving current housing conditions.

Similar to Bridgeport, the Charlotte Housing Authority is extremely active in redeveloping impoverished neighborhoods in Charlotte, particularly around Lynx stations and lines. The housing authority has been successful in acquiring four Hope VI grants allowing the authority to transform large, crime-ridden, blighted public housing structures into mixed-income, mixed-tenure communities.

The implications of the Lynx being introduced to Charlotte has provided a platform from which considerable redevelopment has been generated. The Lynx serves as an economic development engine, and provided considerable infusion of capital into otherwise underutilized areas in Charlotte. The economic impacts associated with strategically located stations in Charlotte serves as a prime example of the potential impacts that Barnum Station may have on East Bridgeport.

Cleveland, Ohio: Though not a light rail, the Cleveland Healthline is a prime example of the impacts of transit on development and the connection with the health services industry. The Cleveland Healthline, a bus rapid transit line run by the Greater Cleveland Regional Transit Authority connects research centers in University Circle, Case Washington University, the Cleveland Clinic, the VA Hospital, St. Vincent Hospital, Cleveland state university, and the financial centers downtown.

The Healthline has provided a market boost and enhanced development projects to both medical research facilities along the Euclid Corridor and mixed-use projects. Considerable development has occurred or is planned along the corridor in an otherwise weak market. Total benefits over and 18 year period through 2025 are expected to include nearly 9.2 million square feet in commercial development, 7,760 residential units, $1.75 billion in capital investment, and the generation of $55.8 million in annual local taxes.

The incorporation of medical services and research in this system proves comparable to the Barnum Station location and the commanding presence of Bridgeport Hospital. Connectivity with these medical facilities has enhanced ridership and the subsequent development associated with the presence of the Healthline in Cleveland.

Key Findings: These projects all reflect the impacts of strategically placed light rail service on communities. Stations located within communities that maintain a high inventory of underutilized and vacant industrial land and lower-income populations realize positive economic impacts and increased development activity. The impacts within these cities are highly influenced by general market conditions and require considerable tome to be realized. Nonetheless, initial development and momentum play a key role in achieving longer-term benefits. The impact of bringing Barnum Station to East Bridgeport where considerable development is already in the pipeline, will likely improve the future potential of developing the Barnum Station area consistent with the vision set forth by the City.

The Future Built on Momentum

East Bridgeport is regionally positioned to capitalize on the benefits of transit and maximize its development potential in an otherwise weak market. The near-term market baseline projections outlined within this report demonstrate positive activity for development over the period through 2020. Near-term residential, office/flex, retail, and industrial development will be driven by supporting development at the Hospital, the actions of the Bridgeport Housing Authority, and Steel Point. This development and development around the Barnum Station site will serve as a catalyst for long-term development viability and the regional attractiveness of East Bridgeport. The addition of Barnum Station will connect these projects and East Bridgeport regionally, and will serve to enhance development potential over the long-term, allowing the area to realize the vision for the study area. The market supported development defined through 2020 will serve to create an environment that is conductive to quality, long-term growth in the area.

The future for Barnum Station will build on the near-term market baseline projections made above. Expansion at the Hospital and spin off development by firms that will likely prefer to locate complimentary business operations within the immediate proximity to the hospital will provide job growth that is otherwise not projected to be substantial in the region. Residential development by the Housing Authority and residential infill projects on the heels of current investment in East Bridgeport by private sector investors will create a community that provides an enhanced living environment. Finally, development at around Barnum Station at various industrial parks and the large retail development slated for Steel Point will further enhance East Bridgeport as a community where people will chose to live, work, and play. As this development grows, the reach of potential markets from which the Barnum Station area will likely capture demand will broaden.

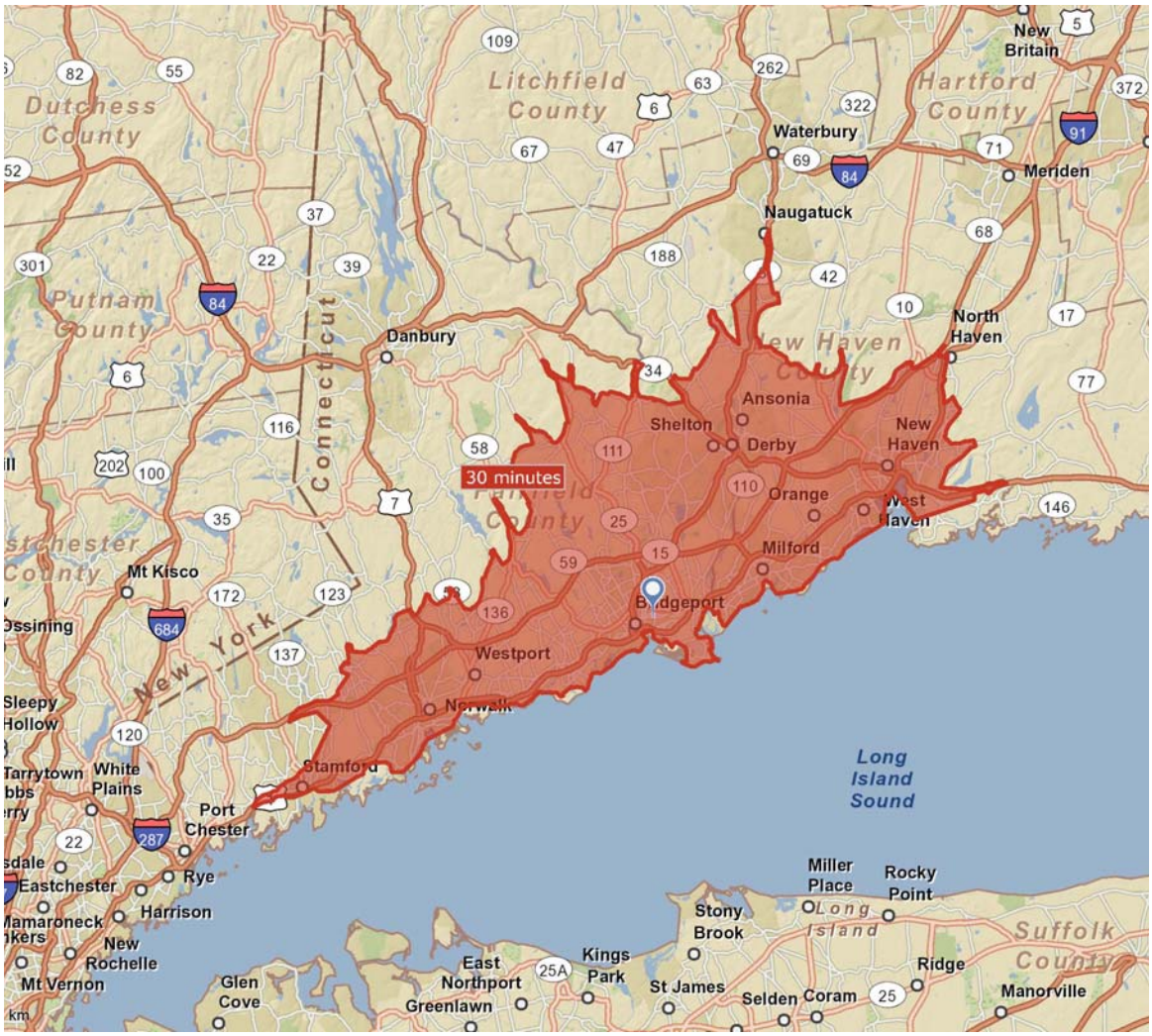
As the area becomes more regionally appealing, it is reasonable to expect that the markets from which residential and office/flex demand is derived within the Barnum Station study area will expand. Therefore, it is prudent to review the characteristics of these expanding markets with respect to population and employment growth over the coming period.

Residential: The near-term baseline market projection presented in this report (600 below market units and 350 market units) represent a catalyst on which future residential development will build. The absorption projections for demand over the period through 2020 were based on reasonable capture from a primary market area of a five minute drive time, and a secondary market of fifteen minute drive time from the station. This serves as an initial base and catalyst upon which enhanced competitive market position can be established over time.

Based upon the public sector development programs, plans and incentives and the comparable experience in other communities, over time the market potential can be expanded to serve a larger residential market area beyond the five and fifteen minute drive time. This assumes that over time Barnum Station could penetrate an expanded market area that extends a 30 minute drive time from the station. This expanded market area, as illustrated in the figure below contains an additional 278,000 households or approximately 2.5 times the number of households in the 15 minute drive shed.

The development of new, quality housing units will enhance the environment in the Barnum Station study area over the longer-term. Additional residential and retail development at Steel Point will further enhance the East Bridgeport environment into an attractive livable and sustainable transit oriented community. As this development occurs, additional demand for residential units at Barnum Station will be drawn from this larger area.

Figure 6: 30 Minute Drive Shed from Barnum Station



The expanded market area represents additional population and households from which over time residential demand may be derived. The table below outlines the population and household data for the new market area compared to the initial market area reviewed.

TABLE 22

Residential: Initial Market (15 Minute) vs. Extended Market (30 Minute)						
	2011		2016		2020	
	Initial	New Market	Initial	New Market	Initial	New Market
Population	301,647	726,372	302,981	739,038	304,054	749,364
Households	110,404	277,733	110,724	282,336	110,981	286,083

Source: ESRI Business Analyst, Vantage Point

The added regional appeal created within the study and East Bridgeport will enhance absorption potential within both the initial 15 minute drive shed reviewed and the extended 30 minute drive shed. As development increases and the regional appeal increases, absorption within the initial market area (15 minute) will be enhanced. We estimate over time, an increase of 20 to 30% in annual absorption for market rate dwelling units.

The annual absorption potential of market rate units derived from the core 15 minute drive shed is assumed over time to increase from approximately 44 to 55 units annually over the longer-term. Additional absorption of market rate units from within the expanded market area will take place over the longer term. The likely capture within the expanded market area will reflect both the larger number of households in the expanded market area, the increased level of market competition within the area, and the increased distance from the Barnum Station study area. Considering these variables, the table below summarizes the potential capture that may be realized with the expanded market area. Annual absorption of market rate units will be an additional 60-70 units (midpoint 70 units). Annual absorption potential over the longer-term will total 198 units. The table below outlines the potential annual capture and the total capture over the near- and longer-term.

Given the limited resources of the public sector and the desire to increase the proportion of market rate units over time, it is assumed that the annual commitment to below market rate units will remain approximately constant over time averaging approximately 75 units per year. Maintaining the community profile is the basis for sustaining the annual commitment to below market rate units. By stabilizing the annual commitment in below market units, the utilization of public incentives and public assistance will ensure that complete gentrification does not occur in East Bridgeport. Preserving an economically feasible balance between below market and market rate units will factor into the longer-term vision for Barnum Station and East Bridgeport.

Table 23

Expanded Market Area: Barnum Station Potential Absorption						
	Near-Term Annual Absorption (Through 2020)	Long-Term Annual Absorption w/in Initial Market Area (2020-2030)	Long-Term Annual Absorption w/in Expanded Market Area (2020-2030)	Total Annual Absorption (2020-2030)	Total Absorption (2020-2030)	Total Absorption (2012-2030)
Market Rate Units	44	55	70	125	1,250	1,600
Below Market Rate	75	0	0	75	750	1,350
Total Units	**119**	**55**	**70**	**200**	**2,000**	**2,950**

Source: Vantage Point

The results of the expanding market define long-term (through 2030) development potential of approximately 3,000 units. The proportion of housing units that are assumed to be market rate is estimated to increase from approximately 37 percent in the initial seven years to approximately 54 percent over the longer-term. The initial below market rate units, representing units at 80% of the regional income or $80,000 per household (versus the study area median household income of $30,000); will serve as an early catalyst for enhancing future capture of market rate housing units.

These projections support the vision as laid out by the city for the Barnum Station study area. The current vision includes the addition of approximately 4,000 units within the ½ mile study area. With near-term development serving as a catalyst and the addition of Barnum Station, this projection is achievable. Annual absorption at Barnum Station over the longer-term is approximately 200 units. Comparable areas which include multiple stations experience average annual absorption rates of 200 to 460 units; Charlotte (200), Cleveland (431), New Jersey Waterfront (460).

Flex/Office: In review of current market conditions for office and flex space within the competitive trade areas for Barnum Station, it was clear that prior contraction in employment and modest growth over the near- and mid-term meant limited demand for new space. Further, high levels of vacancy in the Bridgeport-Stamford-Norwalk MSA meant that new demand would likely only serve to absorb that vacancy and not create the need for new development over the near- and mid-term.

As with residential, the initial phase of flex/office space can serve as a catalyst for the longer-term and helping the area become more broadly attractive as a place to live and work. Over time, additional residential development, the presence of Bridgeport Hospital and Barnum Station, supportive public policies and proper incentives will enhance the likelihood of drawing additional demand from the expanded market including the New Haven MSA to the north. The New Haven MSA supply and demand however, is less than the Bridgeport MSA by approximately 25%.

As the appeal broadens, the market from which demand for new office and flex space will derive becomes greater. Particularly, with the presence of Bridgeport Hospital and Barnum Station, the likelihood of drawing demand from the New Haven-Milford MSA (to the north) becomes greater. The New Haven-Milford MSA office inventory is approximately 70% less than the inventory in the Bridgeport-Stamford-Norwalk MSA. As with Bridgeport, New Haven maintains a high vacancy rate at nearly 14% and 1.8 million square feet of space (Bridgeport-Stamford-Norwalk MSA vacancy rate is

18.5%). This vacancy must first be absorbed by employment growth and expanding industry before significant demand for new space becomes a reality.

Analyzing employment growth in office and flex within the New Haven-Milford MSA reveals trends consistent with those identified in the Bridgeport-Stamford-Norwalk MSA, limited but increasing employment growth for both sectors will occur through 2020. The table below shows employment characteristics for the two MSA's.

Table 24

Office/Flex: Initial Market (Bridgeport MSA) vs. Expanded Market (New Haven MSA)						
	2011		2016		2020	
	Bridgeport MSA	New Haven MSA	Bridgeport MSA	New Haven MSA	Bridgeport MSA	New Haven MSA
Total Employment	652,186	510,167	658,245	515,703	665,183	520,233
Flex	60,967	69,011	61,533	69,760	62,182	70,373
Office	130,827	73,060	132,042	73,853	133,434	74,502
Total Office/Flex	**191,794**	**142,071**	**193,576**	**143,613**	**195,616**	**144,874**

Source: ESRI Business Analyst, Vantage Point

As near-term development occurs around the station, and the regional appeal of locating within the study area grows, so too will the ability to expand into other market areas. East Bridgeport is particularly well situated to expand into markets to the north as the sites profile improves. Therefore, over the longer-term, more demand for office and flex space could be derived from the New Haven MSA. Over the longer-term, initial annual absorption rates of 13,000-22,000 square could likely increase to 20,000-33,000 square feet as the study area becomes more attractive. Additional demand could also be derived from the New Haven MSA and would likely achieve additional annual absorption between 15,000-25,000 square feet. Total annual absorption over the longer term could range from approximately 34,000-58,000 square feet with total office/flex development within the Barnum Station area likely to range from 440,000 and 750,000 square feet through 2030. The potential absorption for the study area is summarized below. This can be compared with the long-term build-out which totals approximately 2 million square feet industrial, office, and retail space.

Table 25

Expanded Market Area: Barnum Station Potential Absorption						
	Near-Term Annual Absorption (Through 2020)	Long-Term Annual Absorption w/in Initial Market Area (2020-2030)	Long-Term Annual Absorption w/in Expanded Market Area (2020-2030)	Total Annual Absorption (2020-2030)	Total Absorption (2020-2030)	Total Absorption (2012-2030)
Square Feet	13,000-22,000	20,000-33,000	15,000-25,000	34,000-58,000	340,000-580,000	440,000-750,000

Source: Vantage Point

Conclusion

Current market conditions in Bridgeport provide limited support for development in East Bridgeport and within the Barnum Station study area. However, a more comprehensive evaluation of these conditions, and casting them against development potential related to currently planned projects, and the likely impact of locating a station at the site provides a more positive outlook for new development. Housing growth in the City and the MSA provide the primary source of development potential within the study area. Spin-off office and flex uses will likely be a product of expansion that is currently planned at Bridgeport Hospital. As a result of expanding employment and households located in the study area, retail expenditures will rise, and subsequent retail development opportunities will be possible within the study area over the period through 2020.

The implications of the location are likely two-fold:

First, the downtown area is within a mile of the proposed Barnum Station location and connectivity with the Bridgeport Station would make the downtown area highly accessible to residents or employees within the Barnum Station study area. The presence of downtown provides considerable competitive pull for residents who might choose to live in the downtown setting, firms who would likely prefer to locate in the central business district, and shoppers who might prefer a more complete experience including numerous shopping, dining, and entertainment options. Further Steel Point is located immediately outside of the study area (½ mile radius). Steel Point will also be a competitive force with respect to the uses proposed at Barnum Station. Retail, office/flex, and residential are all uses proposed as being included in this developments.

On the other hand, the location within proximity to downtown and Steel Point, and the direct accessibility provided by Barnum Station implies that the area will be greatly served by these alternative amenities. Therefore residents who may not prefer to live in downtown, but rather prefer the convenience of having it nearby, may chose to locate at Barnum Station. Further, as Steel Point becomes an attractive destination for dining and shopping, so too does the option of living and working in East Bridgeport. As such, development within the Barnum Station Study area will serve to accommodate the increased appeal and subsequent demand in East Bridgeport.

There are other benefits associated with the site location. The proposed station location is close to the hospital, which lies within the ½ mile study area, and provides a basis by which considerable demand is calculated. Expansion of the hospital and spin-off industry will drive demand for office and flex space within the study area. Subsequent employment will in turn support retail uses within the study area. Further, a new Barnum Station that serves downtown means that those who may chose to live in residential units around Barnum Station will have immediate access to the downtown experience without having to locate downtown. Residential demand absorbed by the Barnum Station study area will induce additional retail demand within the immediate Barnum Station area.

In consideration of these conditions, the initial supportable uses at Barnum Station are summarized in table on the following page:

Table 26

Summary Findings - Supportable Uses		
	Through 2020	**2020-2030**
Residential	±600 Below Market Units (<$1,300/Month Rent) ±350 Market Rate Units (≥$1,300/Month Rent) Average HH Size for Market (2.7)	Additional ±750 Below Market Units (<$1,300/Month Rent) ±1,250 Market Rate Units (≥$1,300/Month Rent)
Office/Flex	100,000-175,000 Square Feet of Supporting Office and Flex Space; Spin-Off from Hospital Expansion	Additional 340,000-580,000 Square Feet of Supporting Office and Flex Space
Retail	40,000 Square Feet of Retail in Support of Employment Growth in Market and New Households	Additional 80,000 Square Feet of Retail in Support of Additional Employment and Households

Source: Vantage Point

The projected demand over the period through 2020 considers the competitive nature of the marketplace and the intrinsic implications associated with expansion within the study area. The supportable units and square footage presented are reasonable projections for the Barnum Station study area, and will be defined particularly by the accessibility provided by the location of a new station, and realizing other planned projects within the study area.

The projections through 2020 and the long-term vision for Barnum Station and portions of East Bridgeport are aggressive considering current market conditions. However, as development and redevelopment initiatives continue to increase in the area, the comparative appeal of East Bridgeport and Barnum Station will enhance the development opportunities in the area. Further, with impactful interest in East Bridgeport coming from the City, the Housing Authority, and the Bridgeport Hospital, the resources are in place to transform the study area. Initial development around the station that is currently planned by these parties and private investors will induce further development. The introduction of Barnum Station to the market and the accessibility provided by transit will serve as a catalyst for future development and the success of the vision for the area.

BARNUM STATION FEASIBILITY STUDY

Technical Memorandum #3a: Station Operational Feasibility Analysis

Submitted to:
Greater Bridgeport Regional Council (GBRC)
City of Bridgeport

Submitted by:
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In association with:
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Technical Memorandum #3a: Station Operational Feasibility Analysis

Executive Summary

This technical memorandum addresses the existing rail operational constraints in East Bridgeport and evaluates the feasibility of providing a new Barnum Station in terms of its implications on operations along the New Haven Line (NHL) of Metro-North Railroad (MNR).

The implication of locating a new station in East Bridgeport on rail operations requires analysis.

There are three levels of operations analysis:

- Full simulation of operations
- Capacity analysis based on existing system characteristics
- Schedule analysis

A full train operations simulation was beyond the scope of this study. Such an analysis would take current and projected operating characteristics, the signal system characteristics, the trackwork, and operating rules and use those to evaluate the implications of a new station on rail operations. By evaluating the risk of delays and conflicts, such an analysis would provide a high degree of confidence whether a new station has any specific operational implications. Whether those implications would be acceptable to the rail operators in the corridor would depend largely on the findings regarding potential delays and the risk of service failures.

Because a rail simulation analysis was not conducted as part of this study, the capacity of the existing systems and the potential schedule implications of a new station were analyzed. It is fully expected that, as the Barnum Station project moves forward, a full train operations analysis would be performed to fulfill the requirements of MNR and Amtrak.

Results of the analysis conclude that the existing rail infrastructure is capable of accommodating the proposed Barnum Station. However, lacking the necessary train simulation it is not possible to assess whether the addition of a new Barnum Station would preclude some of the existing

train turns that MNR now uses. Train turns are a routine part of rail operations, especially during peak periods. There are a limited number of slots available to access Grand Central Terminal (GCT). The number of trains that access GCT from the north is considered to be at the functional maximum number for reliable operations. The limitation means that trains must arrive and depart in a narrow window of time. Missing a slot can have significant implications on rail operations, causing delays that can cascade across many trains, severely disrupting the travel of thousands of commuters.

The analysis done in this study assumed that stopping at Barnum Station would add approximately three minutes to the rail schedules. This includes time for the trains to decelerate, stop, wait, and then accelerate when leaving the station, as compared to the time a train currently takes to pass the proposed station location at full speed. To avoid the risk of disruptions the schedule of service between Bridgeport and GCT was assumed to be unchanged. The same trains would run on the same schedules between Bridgeport and Manhattan. To do this, inbound trains would need to depart from New Haven three minutes earlier than they do today, since stopping at Barnum Station would add three minutes to their run times. Outbound trains traveling from Bridgeport toward New Haven would leave at their current scheduled times but would arrive at New Haven three minutes later, having stopped at Barnum Station. Note that subsequent conversations with ConnDOT have indicated that performing a full train service analysis may show the only two minutes are needed and that in most cases MNR has sufficient turn time built into the train schedule.

The result is that in the morning peak period (i.e., 6:00 AM to 9:00 AM) trains would have to depart westbound towards New York City three minutes earlier than now scheduled. Once they are at Bridgeport Station they would operate on the existing schedule inbound. In the afternoon peak period (i.e., 4:00 PM to 7:00 PM), trains would depart GCT on the current schedule, arriving at Bridgeport on the current schedule. However, after leaving Bridgeport Station they would stop at Barnum Station, delaying them by three minutes in the outbound direction towards New Haven.

The issue is that, particularly in the PM, some of the trains turn around at New Haven and recycle to GTC and back, resulting in an additional three minutes on the return cycle toward GCT. Therefore, even though the delay is intended to be absorbed solely on the Bridgeport outbound direction, it could impact inbound schedules by as much as six minutes (three minutes in the outbound direction and another three minutes in the inbound direction). Given that the schedule of trains into GCT is very fragile, there is a real possibility that this six-minute delay could be unacceptable to MNR (and its riders). Whether it is acceptable depends on how much time is included in the schedule to reverse trains at New Haven. According to ConnDOT, although some train do cycle back and forth from GCT to New Haven, many have other cycle patterns and have time built in if an issue arises.

The recommended interim solution, pending a full train simulation analysis, is to have peak period trains that recycle skip Barnum Station in both directions. There are currently 18 trains heading to GCT in the AM peak period (arriving at GCT between 5:47 and 9:47 AM). Eight of these trains travel express from Bridgeport to GCT. Therefore, under the recommended interim solution, the remaining ten trains would stop at Barnum Station before Bridgeport in the inbound direction. Under this recommended interim solution, the express trains would not stop at Barnum Station before Bridgeport in the inbound direction. Similarly, in the PM, of the 18 trains traveling outbound from GCT to Bridgeport/ Barnum, ten would stop at Barnum Station after Bridgeport, with the balance remaining on their current schedules.

Subsequent conversations with ConnDOT indicated that of the 18 peak trains, most, if not all, would not be negatively affected by the added three minutes. Therefore, most local and express trains would stop at Barnum Station since the main factor for not stopping is ridership levels and overcrowding issues, rather than impacts on the schedule.

In sum, this analysis concluded that the addition of the proposed Barnum Station to the MNR system should not impact rail operations negatively if peak period trains serving Barnum are limited to local trains only. Express and partial express trains would operate on their current schedule and would still access Bridgeport Station, but not Barnum Station. This, conservatively, would provide 10 trains stopping at Barnum Station in the morning and evening peak periods. Subsequent conversations with ConnDOT have indicated that Barnum Station could have the potential to also serve express and partial express trains. The next step in the program should include development of a full simulation of rail operations in order to better delineate these preliminary findings and refine the recommendations.

Barnum Station Operations Analysis

Because a full rail simulation analysis was not made, the capacity of the existing systems and the potential schedule implications of a new station were analyzed. What follows is a discussion of that analysis.

Study Area

A capacity analysis was performed for the NHL on the North East Corridor (NEC) between the Bridgeport Station in Bridgeport Connecticut (CP 255) and Woodmont Road in West Haven, Connecticut (CP 266). The intent of this analysis was to determine the capacity impact caused by the addition of Barnum Station, to be located within the boundaries of CB 788 (stationing 295+802) and CB 799 (stationing 299+028).

The proposed Barnum Station is to be located in the vicinity of the intersection of Waterview Avenue and Crescent Avenue. There are four mainline tracks through the station area; Tracks 1 and 3 primarily serve westbound (New York bound) trains while Tracks 2 and 4 primarily serve eastbound (New Haven bound) trains. The center two tracks (Tracks 1 and 2) are generally used for express and skip-stop service, while the outside tracks (Tracks 3 and 4) are primarily used for local service. The existing Bridgeport Station is approximately one mile west of the proposed Barnum Station. Woodmont Road is located approximately five rail miles east of the proposed Barnum Station.

Study Inputs

This report uses the current New Haven Line (NHL) passenger timetable and Amtrak's NEC timetable as the basis for evaluating the existing rail system capacity within the study limits. For future needs, data from Metro-North Communications and Signal Strategy document, dated March 28, 2007, was used to determine the capacity required for projected year 2030 operations.

The calculations were performed in accordance with MNR "Metro-North Communications & Signal Engineering Operation Manual," dated April 7, 2006. Train control plans, dated December 11, 1990, were obtained from MNR to perform the capacity calculations. The approximate location of the new Barnum Station was then inserted into these plans and new calculations performed to determine the effects of the new station in trains-per-hour (TPH) capacity. Since the new Barnum Station is only being considered as having side platforms on Tracks 3 (Westbound to New York) and Track 4 (Eastbound to New Haven) calculations were performed for only those tracks. Tracks 1 and 2 are the inside tracks used for express service.

Methodology

The following section provides an outline to the methodology process of the capacity analysis.

The current weekday New York-New Haven schedule (effective date November 17, 2012) and the current weekday Amtrak NEC schedule (effective date July 2, 2012) were analyzed to find the "peak hour" traveled for both the morning peak and evening peak periods. This number represents the largest number of trains presently traveling in one hours' time through the study limits. New Haven arrival times were then used as the comparison point in the schedule to find the "peak hour" of travel. The capacity impact caused by the addition of Barnum Station was used in reference to the current day "peak hour" capacity, providing a baseline comparison of the implications the proposed Barnum Station will have on the capacity of the

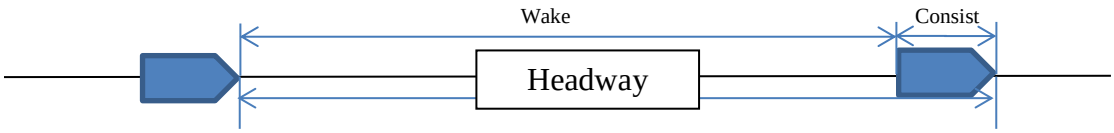
NHL. The calculations used for the peak hour derived from the existing schedules are provided in the ***Appendix*** (Page A3).

The section of the NHL analyzed (CP 255 to CP 266) was used to calculate the Theoretical capacity (C_t). This mathematical value represents the optimum capacity of TPH in an ideal setting – how many trains per hour. Theoretical capacity does not factor stations, planned crossover movements (speed reductions), and real life conditions such as wet rails, long dwell times, braking, and accelerating. Theoretical capacity was calculated in accordance with the MNR "Metro-North Communications & Signal Engineering Operation Manual," dated April 7, 2006, which calls for the following:

- No train shall encounter a signal aspect that limits its speed to less than would be allowable for the route it is traveling under optimum conditions, i.e., remaining at maximum authorized speed (MAS).
- A second clear signal will be included to the last MAS signal aspect in order to maintain a conservative calculation

The time interval (in seconds) between two trains is known as "headway" or, the time from the nose of a train to the nose of the following train, traveling the same route. The trailing distance is known as the "train's wake." Each of these elements is shown in ***Figure 1***. The train's wake plus the length of a full consist divided by the MAS (for each of the blocks in the trains wake) results in total headway for a train at the given location being considered.

Figure 1
Headway Elements



The routing and block plans (from CP 255 to CP 266) were used to determine the allowable number of blocks behind a train at any given point within the study limits that are necessary for the trailing train to receive the first "clear" signal (i.e., allowing the trailing train to move at MAS without influencing or being influenced by the leading train). The lengths of blocks are a predetermined aspect of a track line and are design-derived from the Signal Design Speed (SDS) of the track.

Headway was calculated for each block by dividing the length of the block (in feet) by its respective MAS (in feet per second). Headway was also calculated for the train length (assumption of 1,020 feet) and was adjusted for each of the train's respective locations with their respective MAS. These headway values (in seconds) were then totaled for each respective train wake. The breakdown of train wakes and their respective locations are provided in the ***Appendix*** (Pages A1 and A2). The total headway for each train location was then divided across a one-hour time span to calculate the

Theoretical capacity. The Theoretical capacity for each available train location within the zone of influence (the length of track occupied by the train plus the distance needed to insure against collisions between trains) were then averaged, resulting in the number of theoretical trains that can travel through the study limits within one hour's time.

However, these ideal conditions calculated from the Theoretical capacity do not factor the time loss due to the operation mechanics such as station stops, planned crossover movements, and long dwell times. As stated in the MNR "Metro-North Communications & Signal Engineering Operation Manual," dated April 7, 2006, 75 percent of the total Theoretical capacity is considered the Practical Capacity (C_p) of the track. Due to the need to calculate further implications from the addition of Barnum Station within the study limits, this 75 percent was reduced further. This additional reduction factor was derived from time loss (in both the eastbound and westbound directions due to variances in track infrastructure) due to braking time, dwell time, and acceleration time in and out of Barnum Station.

Braking time was calculated using braking distance. The required braking distance for both the eastbound and westbound directions was derived from Metro North's 2007 MW-4 Appendix D – Table A, utilizing the MAS of the blocks on approach to the future Barnum Station. The grades were averaged within the safe braking limits of the station (3677 feet in the eastbound direction and 3343 in the westbound direction). The adjustment factor was required for the eastbound direction due a negative average grade. The calculations used for the braking adjustment factor are included in the ***Appendix*** (Page A4). From the adjusted braking distances, the deceleration rate was then calculated. Deceleration rate was then used to determine braking time from MAS to full stop over the provided safe braking distances.

Acceleration time was calculated from stop to each respective direction's next available MAS. A conservative assumption of 2.35 feet-per-second was assumed for the MNR Electric Multiple Unit's acceleration rate along the NHL. The full calculation for braking and accelerating time can be found in the ***Appendix*** (Page A5).

Dwell time at the station was based assumed to be no greater than 90 seconds. Average dwell times for commuter rail typically are about 45 seconds, but delays can occur that extend this time. This is usually due to passengers taking longer to alight and board than usual, which can result from crowding on the platform, riders with luggage, persons with mobility issues and weather related issues. The use of a longer dwell time provides a buffer that allows trains to recover from delays to maintain their schedules.

These time losses were totaled and rounded to the closest minute. ***Table 1*** below provides a summary of calculated time loss due to Barnum Station.

Table 1
Time Loss Due to Barnum Station

Direction of Service	Braking Time (sec)	Dwell Time (sec)[1]	Acceleration Time (sec)	Total Time Loss (min)
Westbound (Track 3)	67	90	47	3
Eastbound (Track 4)	61	90	28	3

Note: [1]Conservatively assumed as 90 seconds. Subsequent conversations with ConnDOT have revealed that 45-60 seconds at a maximum may be more practical.

Total time loss was then subtracted from one hour and capacity was recalculated from the reduced time. The difference in capacity from the Theoretical capacity, based on one hour of time, and the adjusted Barnum Station capacity, based on one hour of time minus time loss from the station, was used to calculate the percent of capacity remaining. This capacity percent was used as an adjustment factor in order to reduce the Theoretical capacity results with the time loss resulting from the addition of Barnum Station. This reduction factor capacity was represented as (C_t with Barnum). The full calculation for percent of capacity remaining is presented in the ***Appendix*** (Page A6). The Barnum Station time loss westbound resulted in a 5 percent reduction in Theoretical capacity, and the eastbound direction resulted in a 5 percent reduction in Theoretical capacity. The new Theoretical capacities, which include the Barnum adjustment, were then used to calculate the Practical capacity. As stated earlier, from the MNR "Metro-North Communications & Signal Engineering Operation Manual," dated April 7, 2006, Practical capacity is calculated as a 75 percent reduction in Theoretical capacity. The full calculation of the Theoretical and Practical capacities is located in the ***Appendix*** (Page A7).

■

Track Capacity Analysis

Track capacity is the number of trains that can be operated safely at the MAS over a section of track between two given points, without being delayed by other trains. Track capacity is based on several key component values. In a fixed-signal block system, such as MNR along the NHL, the SDS establishes safe breaking distances between traveling trains. The higher the SDS, the longer the breaking distance, so the higher the SDS, the further apart trains need to be apart to operate safely. Derived from the SDS, MAS for a given territory (track segment) is based upon civil speed restrictions and track infrastructure such as track elevation, grades, curves, and switches.

A track capacity analysis was performed using the Practical capacity method, as described above. The calculations concluded that the average existing capacity of the NHL within the study limits is 14 TPH. Today, this territory operates eight TPH at the peak of the rush hour (roughly from 7 to 8 AM and 5 to 6 PM), leaving room for schedule recovery and trains operating slightly off schedule. The calculations also indicate that the capacity requirements

identified in MNR's Strategy report of 12 TPH can also be met without any changes to the existing operations and infrastructure, leaving as many as two additional trains that can be supported on both Track 3 (Westbound to New York) and Track 4 (Eastbound to New Haven). ***Table 2*** below provides a summary of these findings.

Table 2
Train Capacity Summary

Direction of Service	Existing Capacity	2012 Peak Hour Needs	2030 Strategy Report Needs	Additional Capacity
Westbound (Track 3)	14	8	12	2
Eastbound (Track 4)	14	8	12	2

While this is a positive finding and a significant first step, it is highly recommended that a full computer based simulation be run to quantitatively determine which existing trains can be stopped at new Barnum Station without impacting service to the East and West of the study limits.

■

Train Stop Analysis

The analysis done in this study established that stopping at Barnum Station would add three minutes to the rail schedules. This includes time for the trains to decelerate, stop, wait, and then accelerate when leaving the station, as compared to the time a train now takes to pass the proposed station location at full speed. To avoid the risk of disruptions the schedule of service between Bridgeport and GCT was unchanged. The same trains would run on the same schedules between Bridgeport and Manhattan. To do this, inbound trains would need to depart from New Haven three minutes earlier than they do today, since stopping at Barnum Station would add three minutes to their run times. Outbound trains traveling from Bridgeport toward New Haven would leave at their current scheduled times but would be three minutes later arriving at New Haven, having stopped at Barnum Station. Note that subsequent conversations with ConnDOT have indicated that performing a full train service analysis may show the only two minutes are needed due to the use of M-8 Electric Multiple Units (EMUs) being used for service. Further, ConnDOT indicated that although adding three minutes to each train in a cycle could impact the turn time, in most cases MNR has sufficient turn time built into the train schedule.

The result is that in the morning peak period (i.e., 6:00 to 9:00 AM) trains would have to depart westbound towards New York City three minutes earlier than now scheduled. Once they are at Bridgeport Station they would operate on the existing schedule inbound. In the afternoon peak period (i.e., 4:00 to 7:00 PM), trains would depart GCT on the current schedule, arriving at Bridgeport on the current schedule. However, after leaving Bridgeport Station they would stop at Barnum Station, delaying them by three minutes in the outbound direction towards New Haven.

The issue is, particularly in the PM, that some of the trains turn around at New Haven and recycle to GTC and back, resulting in an additional three minutes on the return cycle toward GCT. Therefore, even though the delay is intended to be absorbed solely on the Bridgeport outbound direction, it could impact inbound schedules by as much as six minutes (three minutes in the outbound direction and another three minutes in the inbound direction). Given that the schedule of trains into GCT, there is a possibility this six-minute delay could be unacceptable to MNR (and its riders). Whether it is acceptable depends on how much time is included in the schedule to reverse trains at New Haven. According to ConnDOT, although some train do cycle back and forth from GCT to New Haven, many have other cycle patterns and have time built in if an issue arises.

The recommended interim solution, pending a full train simulation analysis, is to have – in the peak periods only - trains that recycle skip Barnum Station in both directions. There are currently 18 trains heading to GCT in the AM Peak Period (arriving at GCT between 5:47 and 9:47 AM). Eight of these trains travel express from Bridgeport to GCT. Therefore, under this recommended interim solution, the remaining ten trains would stop at Barnum Station before Bridgeport in the inbound direction. Under this recommended interim solution, express trains would, therefore, not stop at Barnum Station before Bridgeport in the inbound direction. Similarly, in the PM, of the 18 trains traveling outbound from GCT to Bridgeport/ Barnum, ten would stop at Barnum Station after Bridgeport, with the balance remaining on their current schedules.

Subsequent conversations with ConnDOT indicated that of the 18 peak trains, most, if not all, would not be negatively affected by the added three minutes. Therefore, most local and express trains would stop at Barnum Station since the main factor for not stopping is ridership levels and overcrowding issues, rather than impacts on the schedule.

Recommendations and Conclusions

This analysis concluded that the addition of the proposed Barnum Station to the MNR system should not impact rail operations negatively if peak period trains serving Barnum are limited to local trains only. Express and partial express trains would operate on their current schedule and would still access Bridgeport Station, but not Barnum Station. This, conservatively, would provide 10 trains stopping at Barnum Station in the morning and evening peak periods. Subsequent conversations with ConnDOT have indicated that Barnum Station could have the potential to also serve express and partial express trains. The next step in the program should include development of a full simulation of rail operations in order to better delineate these preliminary findings and refine the recommendations.

Appendix

Track 3 - Westbound to New York

EXISTING WESTBOUND

Track Circuit Location	CB 734 - CB 755	CB 755 - CB 771	CP 255 *CP 255 A	CP 255 *CP 255 B	CB 775 - CB 784	CP 256 CB 784 - CB 788	CB 788 - CB 799	CP 257 CB 799 - CB 804	CB 804 - CB 817	CB 817 - CB 835	CB 835 - CB 857	*CP 261 A	CP 261 *CP 261 B	*CP 261 C	CB 872 - CB 897	CB 897 - CB 920	CB 920 - CB 940	CB 940 - CB 960	CP 266 CB 960 - CB 960 A
Track Circuit Distances (FT)	< A	3975	529	529	2043	1433	3226	1553	3934										
	13 TPH	< B	529	529	2043	1433	3226	1553	3934										
		16 TPH	< C	529	2043	1433	3226	1553	3934										
			16 TPH	< D	2043	1433	3226	1553	3934										
				17 TPH	< E	1433	3226	1553	3934	5474	6667	3701							
					10 TPH	< F	3226	1553	3934	5474	6667	3701							
						11 TPH	< G	1553	3934	5474	6677	3701							
							13 TPH	< H	3934	5474	6677	3701							
								14 TPH	< I	5474	6677	3701	995						
									15 TPH	< J	6677	3701	995						
										21 TPH	< K	3701	995	995	7482	7075	5973		
											10 TPH								

SDS	75 MPH						80 MPH	85 MPH			80 MPH				85 MPH		
MAS (MPH)	70		30		45		60	75			60	40	60	75	60	75	
MAS (FPS)	103		44		66		88	110			88	59	88	110	88	110	
Headway (sec)		38.7	12.0	12.0	31.0	21.7	36.7	14.1	35.8	49.8	60.7	42.1	17.0	11.3	68.0	80.4	54.3	

PROPOSED BARNUM WESTBOUND

Track Circuit Location	CB 734 - CB 755	CB 755 - CB 771	CP 255 *CP 255 A	CP 255 *CP 255 B	CB 775 - CB 784	CP 256 CB 784 - CB 788	CB 788 - CB 799	CP 257 CB 799 - CB 804	CB 804 - CB 817	CB 817 - CB 835	CB 835 - CB 857	*CP 261 A	CP 261 *CP 261 B	*CP 261 C	CB 872 - CB 897	CB 897 - CB 920	CB 920 - CB 940	CB 940 - CB 960	CP 266 CB 960 - CB 960 A
Track Circuit Distances (FT)	< A	3975	529	529	2043	1433	3226	1553	3934										
	12 TPH	< B	529	529	2043	1433	3226	1553	3934										
		15 TPH	< C	529	2043	1433	3226	1553	3934										
			15 TPH	< D	2043	1433	3226	1553	3934										
				16 TPH	< E	1433	3226	1553	3934	5474	6667	3701							
					9 TPH	< F	3226	1553	3934	5474	6667	3701							
						10 TPH	< G	1553	3934	5474	6677	3701							
							12 TPH	< H	3934	5474	6677	3701							
								13 TPH	< I	5474	6677	3701	995						
									14 TPH	< J	6677	3701	995						
										20 TPH	< K	3701	995	995	7482	7075	5973		
											9 TPH								

SDS	75 MPH						80 MPH	85 MPH			80 MPH				85 MPH		
MAS (MPH)	70		30		45		60	75			60	40	60	75	60	75	
MAS (FPS)	103		44		66		88	110			88	59	88	110	88	110	
Headway (sec)		38.7	12.0	12.0	31.0	21.7	36.7	14.1	35.8	49.8	60.7	42.1	17.0	11.3	68.0	80.4	54.3	

< # # >	Train Location
	Trains Wake
*	Interlocking intermediaries based on approximated distances

Track 4 - Eastbound to New Haven

EXISTING EASTBOUND

Track Circuit Location	CB 734 - CB 755	CB 755 - CB 771	CP 255 *CP 255 A	*CP 255 B	CB 775 - CB 784	CP 256 CB 784 - CB 788	CB 788 - CB 799	CP 257 CB 799 - CB 804	CB 804 - CB 817	CB 817 - CB 835	CB 835 - CB 857	*CP 261 A	CP 261 *CP 261 B	*CP 261 C	CB 872 - CB 897	CB 897 - CB 920	CB 920 - CB 940	CB 940 - CB 960	CP 266 CB 960 - CB 960 A
Track Circuit Distances (FT)															7482	7075	5973	6022	A >
														1954	7482	7075	5973	B >	10 TPH
														1954	7482	7075	C >	12 TPH	
													2040	1954	7482	D >	15 TPH		
									3934	5474	6677	1697	2040	1954	E >	20 TPH			
									3934	5474	6677	1697	2040	F >	12 TPH				
									3934	5474	6677	1697	G >	13 TPH					
									3934	5474	6677	H >	15 TPH						
							3226	1553	3934	5474	I >	17 TPH							
	6611	3975	529	529	2043	1433	3226	1553	3934	J >	19 TPH								
	6611	3975	529	529	2043	1433	3226	1553	K >	10 TPH									
									11 TPH										

SDS	75 MPH						80 MPH	85 MPH			80 MPH					85 MPH		
MAS (MPH)	70		30		45		60	75			60	40	60	75	60	75		
MAS (FPS)	103		44		66		88	110			88	59	88	110	88	110		
Headway (sec)	64.4	38.7	12.0	12.0	31.0	21.7	36.7	14.1	35.8	49.8	60.7	19.3	34.8	22.2	68.0	80.4	54.3	54.7	

ROPOSED BARNUM EASTBOUN

Track Circuit Location	CB 734 - CB 755	CB 755 - CB 771	CP 255 *CP 255 A	*CP 255 B	CB 775 - CB 784	CP 256 CB 784 - CB 788	CB 788 - CB 799	CP 257 CB 799 - CB 804	CB 804 - CB 817	CB 817 - CB 835	CB 835 - CB 857	*CP 261 A	CP 261 *CP 261 B	*CP 261 C	CB 872 - CB 897	CB 897 - CB 920	CB 920 - CB 940	CB 940 - CB 960	CP 266 CB 960 - CB 960 A
Track Circuit Distances (FT)															7482	7075	5973	6022	A >
														1954	7482	7075	5973	B >	10 TPH
														1954	7482	7075	C >	11 TPH	
													2040	1954	7482	D >	14 TPH		
									3934	5474	6677	1697	2040	1954	E >	19 TPH			
									3934	5474	6677	1697	2040	F >	11 TPH				
									3934	5474	6677	1697	G >	12 TPH					
									3934	5474	6677	H >	14 TPH						
							3226	1553	3934	5474	I >	16 TPH							
	6611	3975	529	529	2043	1433	3226	1553	3934	J >	18 TPH								
	6611	3975	529	529	2043	1433	3226	1553	K >	9 TPH									
									11 TPH										

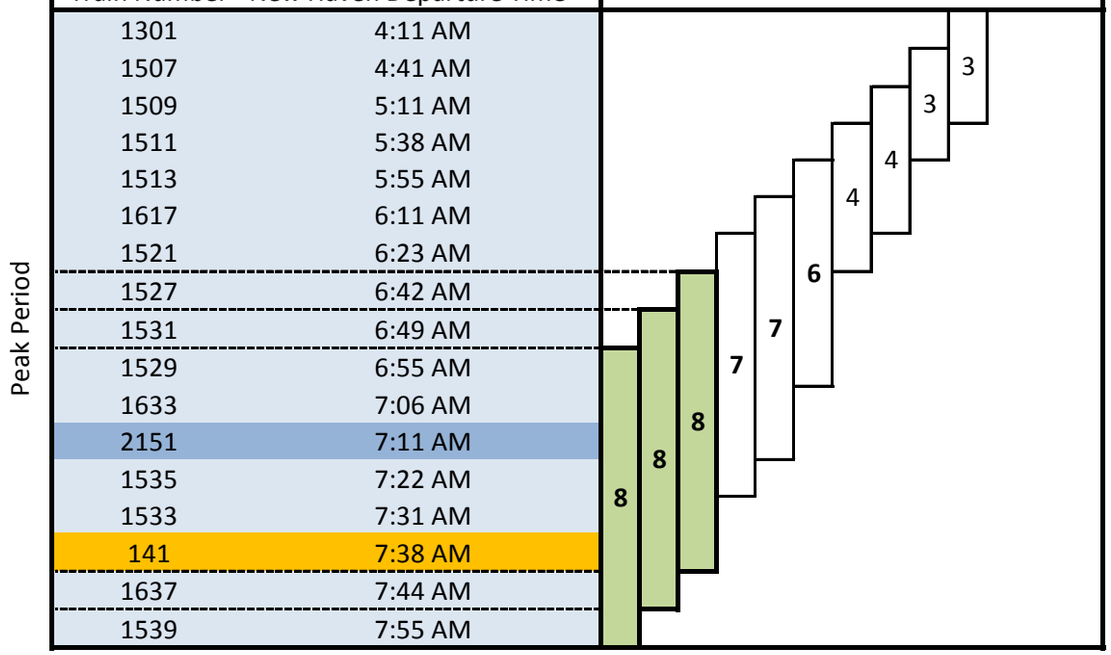
SDS	75 MPH						80 MPH	85 MPH			80 MPH					85 MPH		
MAS (MPH)	70		30		45		60	75			60	40	60	75	60	75		
MAS (FPS)	103		44		66		88	110			88	59	88	110	88	110		
Headway (sec)	64.4	38.7	12.0	12.0	31.0	21.7	36.7	14.1	35.8	49.8	60.7	19.3	34.8	22.2	68.0	80.4	54.3	54.7	

< # # >	Train Location
	Trains Wake
*	Interlocking intermediaries based on approximated distances

Existing Peak Hour Trip Count

Westbound Peak Period

TO NEW YORK		Trips per Hour
Train Number	New Haven Departure Time	
1301	4:11 AM	
1507	4:41 AM	
1509	5:11 AM	
1511	5:38 AM	
1513	5:55 AM	
1617	6:11 AM	
1521	6:23 AM	
1527	6:42 AM	
1531	6:49 AM	
1529	6:55 AM	
1633	7:06 AM	
2151	7:11 AM	
1535	7:22 AM	
1533	7:31 AM	
141	7:38 AM	
1637	7:44 AM	
1539	7:55 AM	



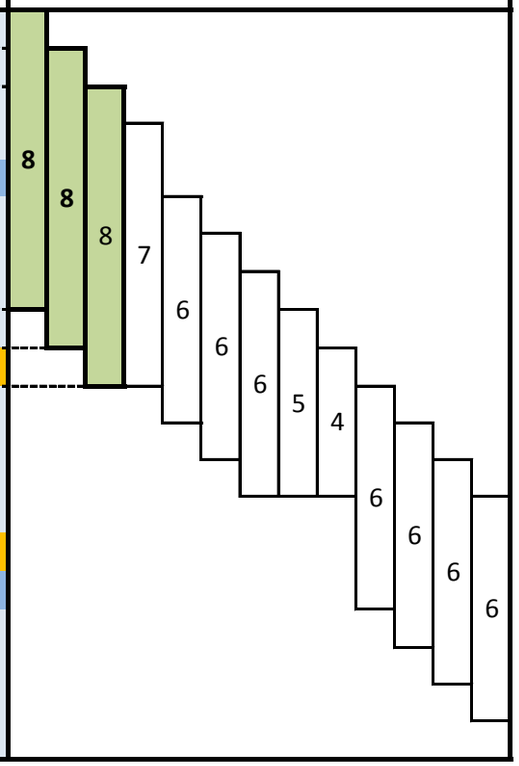
	Metro North Commuter
	Northeast Regional
	Acela Express

	Peak Hour

Westbound Peak Hour Number of Trips	8

Eastbound Peak Period

TO NEW HAVEN		Trips per Hour
Train Number	New Haven Arrival Time	
1542	5:55 PM	
1644	6:01 PM	
1544	6:10 PM	
1546	6:16 PM	
2168	6:27 PM	
1548	6:32 PM	
1552	6:45 PM	
1554	6:54 PM	
1556	7:01 PM	
94	7:10 PM	
1560	7:27 PM	
1562	7:36 PM	
1568	7:50 PM	
1570	8:12 PM	
148	8:19 PM	
2172	8:27 PM	
1572	8:32 PM	
1574	8:47 PM	
1576	9:05 PM	
1578	9:26 PM	



Easttbound Peak Hour Number of Trips	8

Braking Distance Adjustment Factor - Average Grades

Average Grade				
CP	Stationing (ft)	Distance (ft)	Ft per Mile	Grade (%)
	294+369			
		000+041	-	0.720
CP 256	294+410			
		000+805	-	0.000
	295+215			
		000+235	-	-0.742
	295+450			
		000+300	-	-0.742
	295+750			
		000+400	-	0.500
	296+150			
		001+005	26	0.492
	297+155			
		000+260	0	0.000
	297+415			
		002+100	-15.8	-0.299
CP 257	299+515			
		000+500	-15	-0.284
	300+015			
		001+000	0	0.000
	301+015			
		001+500	4.5	0.085
	302+515			
		000+600	-19.5	-0.369
	303+115			
		001+000	-26	-0.492
	304+115			
		000+400	-10	-0.189
	304+515			
		001+500	1.6	0.030
	306+015			
		001+000	5	0.095
	307+015			
		001+600	0	0.000
	308+615			
		001+400	25.5	0.483
	310+015			
		000+400	0	0.000
	310+415			
		002+100	26	0.492
	312+515			
		002+000	-1.3	-0.025
	314+515			
		000+700	3	0.057
	315+215			
		001+300	21.5	0.407
	316+515			
		000+800	26.4	0.500
	317+315			
		001+100	15.5	0.294
CP 261	318+415			
		001+600	0	0.000
	320+015			
		001+000	28.7	0.544
	321+015			
		000+500	30	0.568
	321+515			
		002+500	28.8	0.545
	324+015			
		000+700	0	0.000
	324+715			
		001+200	-26.6	-0.504
	325+915			
		001+100	0	0.000
	327+015			
		003+400	21	0.398
	330+415			
		000+500	-15	-0.284
	330+915			
		002+100	-26.6	-0.504
	333+015			
		001+500	-30.6	-0.580
	334+515			
		000+400	-25.3	-0.479
	334+915			
		002+800	-4.2	-0.080
	337+715			
		002+800	-28.5	-0.540
	340+515			
		000+500	-4.7	-0.089
	341+015			
		001+700	-14.3	-0.271
	342+715			
		004+300	26.3	0.498
	347+015			
		001+500	0	0.000
	348+515			
		001+022	-8	-0.152
CP 266	349+537			
		000+478	1.6	0.030
	350+015			
		000+500	14	0.265
	350+515			
		000+210	25	0.473
	350+725			

Safe Braking Zone of Influence

Average Grade for ZOI:	-0.0472

From 2007 Metro North MW-4 Appendix D Table B - Correction Factor	
Eastbound Braking Correction Factor	10%
Westbound Braking Correction Factor	0%

Braking and Acceleration Time Calculations

Braking Distance	
FROM:	**2007 Metro North MW-4** **Appendix D - Table A** Braking Distance Table for MNR

Traveling Speed	Braking Distance (ft)
70 MPH - 0 MPH	2940 ft
80MPH - 0 MPH	3746 ft
75 MPH Average:	**3343 ft**

Adjustment Factor	
FROM:	**2007 Metro North MW-4** **Appendix D - Table B** Passenger and Freight Braking Distance Adjustment Factor
Average Slope from CP 256 to CP 266 Average Slope:	-0.047%
Adjustment:	**10%** **of Braking Distance**

*see Braking Distance Adjustment Factor - Average Grade calculation

EASTBOUND BRAKING DISTANCE	
with 10% Adjustment Factor (see above)	
Level Braking Distance	3343 ft
with Grade Adjustment	10% of 3343 ft
Adjusted Braking Distance	**3677 ft**

WESTBOUND BRAKING DISTANCE	
Unchanged:	**3343 ft**

Calculated Braking Distance (ft)		
Eastbound	d_E	**3677 ft**
Westbound	d_W	**3343 ft**

Acceleration Rate

$$V_f{}^2 = V_i{}^2 + 2ad$$

Where:

*V_i = Velocity Initial (ft/sec)
*V_f = Velocity Final (ft/sec)
$a = acceleration$ (ft/sec^2)
$d = braking\ distance$ (ft)

**Velocities are directional specific based on MAS for the proceeding segment of track*

Solving for **a = Acceleration**

Eastbound Acceleration =	**-1.645 ft/sec^2**
Westbound Acceleration =	**-1.809 ft/sec^2**

Braking Time	
Solving for **t = time** $V_f = V_i + a(t)$	
Eastbound Braking Time	
Eastbound Braking Time	67 seconds
Westbound Braking Time	61 seconds

Calculation for Acceleration Time

Based on Acceleration
a = 2.35 ft/sec^2

$$V_f = V_i + a(t)$$

*V_i = Velocity Initial
*V_f = Velocity Final
$a = acceleration$

**Velocities are directional specific based on MAS for the proceeding segment of track*

Solving for t = time

Eastbound Acceleration Time	47 seconds
Westbound Acceleration Time	28 seconds

Barnum Station Capacity Percent Remaining Calculations

Eastbound Capacity Percent Remaining w/ Barnum Station stop				
TRACK 3				
Train Location	**Headway** (Seconds)	**Ct** 1 hour (Trains/Hour)	**Ct w/ Barnum Time Loss** 57 minutes (Trains/Hour)	**Capacity Remaining (Percent)**
A >	266.73	13.50	12.82	95%
B >	223.30	16.12	15.32	95%
C >	169.00	21.30	20.24	95%
D >	107.88	33.37	31.70	95%
E >	225.82	15.94	15.14	95%
F >	216.84	16.60	15.77	95%
G >	205.57	17.51	16.64	95%
H >	157.82	22.81	21.67	95%
I >	145.58	24.73	23.49	95%

Based on eastbound time loss of 3 minutes

Eastbound Capacity Percent Remaining w/ Barnum Station stop				
TRACK 4				
Train Location	**Headway** (Seconds)	**Ct** 1 hour (Trains/Hour)	**Ct w/ Barnum Time Loss** 57 minutes (Trains/Hour)	**Capacity Remaining (Percent)**
A >	266.73	13.50	12.82	95%
B >	234.19	15.37	14.60	95%
C >	179.89	20.01	19.01	95%
D >	136.59	26.36	25.04	95%
E >	231.76	15.53	14.76	95%
F >	211.88	16.99	16.14	95%
G >	182.80	19.69	18.71	95%
H >	157.82	22.81	21.67	95%
I >	145.58	24.73	23.49	95%

Based on eastbound time loss of 3 minutes

Westbound Capacity Percent Remaining w/ Barnum Station stop				
TRACK 3				
Train Location	**Headway** (Seconds)	**Ct** 1 hour (Trains/Hour)	**Ct w/ Barnum Time Loss** 57 minutes (Trains/Hour)	**Capacity Remaining (Percent)**
< A	254.52	14.14	13.44	95%
< B	213.99	16.82	15.98	95%
< C	197.56	18.22	17.31	95%
< D	178.75	20.14	19.13	95%
< E	128.99	27.91	26.51	95%
< F	282.31	12.75	12.11	95%
< G	242.57	14.84	14.10	95%
< H	231.31	15.56	14.79	95%
< I	214.31	16.80	15.96	95%

Based on westbound time loss of 3 minutes

Westbound Capacity Percent Remaining w/ Barnum Station stop				
TRACK 4				
Train Location	**Headway** (Seconds)	**Ct** 1 hour (Trains/Hour)	**Ct w/ Barnum Time Loss** 57 minutes (Trains/Hour)	**Capacity Remaining (Percent)**
< A	231.74	15.53	14.76	95%
< B	191.22	18.83	17.89	95%
< C	174.78	20.60	19.57	95%
< D	173.79	20.71	19.68	95%
< E	124.03	29.03	27.57	95%
< F	288.25	12.49	11.86	95%
< G	271.28	13.27	12.61	95%
< H	242.21	14.86	14.12	95%
< I	214.31	16.80	15.96	95%

Based on westbound time loss of 3 minutes

Capacity Calculations

Eastbound Capacity Calculations				
Track 3				
Train Location	**Headway (Seconds)**	**Theoretical Capacity (Trains/Hour)**	**Existing Practical Capacity (Trains/Hour)**	**Practical Capacity w/ Barnum (Trains/Hour)**
A >	212.0	17.0	12.7	12.1
B >	223.3	16.1	12.1	11.5
C >	169.0	21.3	16.0	15.2
D >	107.9	33.4	25.0	23.8
E >	225.8	15.9	12.0	11.4
F >	216.8	16.6	12.5	11.8
G >	205.6	17.5	13.1	12.5
H >	157.8	22.8	17.1	16.3
I >	145.6	24.7	18.5	17.6
J >	211.2	17.0	12.8	12.1
K >	175.5	20.5	15.4	14.6
Average:	186 Seconds	20 Trains/Hour	15 Trains/Hour	14 Trains/Hour

Eastbound Capacity Calculations				
Track 4				
Train Location	**Headway (Seconds)**	**Theoretical Capacity (Trains/Hour)**	**Existing Practical Capacity (Trains/Hour)**	**Practical Capacity w/ Barnum (Trains/Hour)**
A >	266.7	13.5	10.1	9.6
B >	234.2	15.4	11.5	11.0
C >	179.9	20.0	15.0	14.3
D >	136.6	26.4	19.8	18.8
E >	231.8	15.5	11.6	11.1
F >	211.9	17.0	12.7	12.1
G >	182.8	19.7	14.8	14.0
H >	157.8	22.8	17.1	16.3
I >	145.6	24.7	18.5	17.6
J >	275.6	13.1	9.8	9.3
K >	239.9	15.0	11.3	10.7
Average:	206 Seconds	18 Trains/Hour	14 Trains/Hour	13 Trains/Hour

Westbound Capacity Calculations				
Track 3				
Train Location	**Headway (Seconds)**	**Theoretical Capacity (Trains/Hour)**	**Existing Practical Capacity (Trains/Hour)**	**Practical Capacity w/ Barnum (Trains/Hour)**
< A	211.9	17.0	12.7	12.1
< B	173.2	20.8	15.6	14.8
< C	174.4	20.6	15.5	14.7
< D	162.4	22.2	16.6	15.8
< E	276.2	13.0	9.8	9.3
< F	254.5	14.1	10.6	10.1
< G	214.0	16.8	12.6	12.0
< H	197.6	18.2	13.7	13.0
< I	161.8	22.3	16.7	15.9
< J	129.0	27.9	20.9	19.9
< K	282.3	12.8	9.6	9.1
Average:	203 Seconds	19 Trains/Hour	14 Trains/Hour	13 Trains/Hour

Westbound Capacity Calculations				
Track 4				
Train Location	**Headway (Seconds)**	**Theoretical Capacity (Trains/Hour)**	**Existing Practical Capacity (Trains/Hour)**	**Practical Capacity w/ Barnum (Trains/Hour)**
< A	211.9	17.0	12.7	12.1
< B	173.2	20.8	15.6	14.8
< C	174.4	20.6	15.5	14.7
< D	162.4	22.2	16.6	15.8
< E	253.5	14.2	10.7	10.1
< F	231.7	15.5	11.7	11.1
< G	191.2	18.8	14.1	13.4
< H	174.8	20.6	15.4	14.7
< I	139.0	25.9	19.4	18.5
< J	124.0	29.0	21.8	20.7
< K	288.3	12.5	9.4	8.9
Average:	193 Seconds	20 Trains/Hour	15 Trains/Hour	14 Trains/Hour

Train locations can be found on pages A1 and A2 of the appendix

BARNUM STATION FEASIBILITY STUDY

Technical Memorandum #3b: Ridership Report

Submitted to:
Greater Bridgeport Regional Council (GBRC)
City of Bridgeport

Submitted by:
Vanasse Hangen Brustlin, Inc.

In association with:
ICON architecture, Inc.
Vantage Point Development Advisors, LLC

March 2013

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Technical Memorandum #3b: Ridership Report

Introduction

An integral part of conducting a feasibility study for a new rail station is achieving an understanding of the ridership potential at the proposed station. The purpose of this memorandum is to summarize the travel demand modeling process and the resultant forecasts. This document presents the modeling assumptions, the modeling results, as well as the potential ridership from area employment centers including Bridgeport Hospital and potential future development by the Bridgeport Housing Authority in East Bridgeport.

Modeling Methodology

The development of the projected rail ridership (boardings and alightings) at the proposed Barnum Station site was a cooperative effort between the Connecticut Department of Transportation (ConnDOT), the Greater Bridgeport Regional Council (GBRC), and the Consultant Team (led by VHB). ConnDOT was responsible for running the statewide travel demand model to generate the projected riderships. GBRC and the Consultant Team, was responsible for providing, and confirming model input assumptions, including roadway network changes and land use build out around the station, and as well as reviewing and commenting on ridership results.

ConnDOT conducted four model runs:

1. 2010 Existing Conditions
2. 2040 No Build
3. 2040 Partial Build
4. 2040 Full Build

The No Build run assumed ConnDOT's base-line 2040 land use forecasts. The 2040 Partial Build included the addition of Barnum Station and also assumed ConnDOT's baseline 2040 land use forecasts. The 2040 Full Build included the addition of Barnum Station, but assumed a land use build-out around the

proposed station. The methodology utilized in determining the land use build-out is described below.

Land Use Assumptions

Before the ridership model runs were conducted, GBRC reviewed ConnDOT's 2040 land use forecasts and determined them to be appropriate for this study. ConnDOT's 2040 land use forecasts were used for the No-Build as well as the Partial Build analysis. For the Full Build analysis, GBRC developed a potential build-out scenario for development. This build-out was based on existing zoning, potential zoning, vacant land suitable for development, and development plans in the area. The build-out land use was provided to ConnDOT. ***Table 1*** shows the Statewide Model's 2010 and 2040 base-line land use assumptions for Bridgeport, as well as the Build-Out forecasts.

Table 1
Land Use Inputs for the Study Area

	2010	2040 No Build	2040 Full Build
Population	144,229	144,977	161,326
Households	51,255	54,527	60,305
Retail Employment	5,015	5,803	9,577
Non-Retail Employment	37,099	40,989	50,636
Total Employment	42,114	46,792	60,213

Roadway Network Assumptions

The 2010 existing model roadway network, as well as the 2040 forecast roadway network was reviewed by GBRC for consistency with actual roadways and planned roadway projects.

The following changes were made to the 2010 Existing Conditions roadway network in the model:

- Grand Street Bridge was removed—Arctic Street does not connect across the bridge to Grand Street.
- Congress Street Bridge was removed—Crescent Avenue does not connect across the bridge to Congress Street.
- East Washington Avenue between East Main Street and Helen Streets was removed.

The following changes were made to the 2040 No-Build roadway network in the model:

- Route 130 (Stratford Avenue), between Pequonnock River and Yellow Mill Channel, was widened to four lanes.
- Route 127 (East Main Street), between Ann Street and Route 130, was widened to four lanes.

- Pembroke Street, between Ann Street and Route 130, was widened to four lanes.
- Waterview Avenue, between Ann Street and Route 130, was widened to four lanes.
- Grant Street, between Central Avenue and Mill Hill Avenue, was closed to vehicular traffic.

The following changes were made to the 2040 Partial and Full Build roadway networks in the model:

- Barnum Avenue, between Route 127 (East Main Street) and Seaview Avenue, was widened for bus-only lanes and left-turn lanes were added at Route 127, Pembroke Street, and Seaview Avenue.
- Seaview Avenue, between I-95 southbound ramps and US Route 1 (Boston Avenue), was widened to four lanes and left-turn lanes were added at US Route 1, Crescent Avenue and I-95 SB ramps.
- Crescent Avenue, between Pembroke Street and Seaview Avenue, was widened to provide bus-only lanes, was relocated south to accommodate potential rail platforms, and left-turn lanes were added at Seaview Avenue.

Transit Network Assumptions

Before model runs were started, GBRC provided ConnDOT information on existing bus routes in the study area. ConnDOT adjusted the model's existing and future bus routes as needed.

In additional to the potential of a new rail station at Barnum, there has been discussion of a future bus rapid transit (BRT) line, as well as a shuttle bus in the study area. The proposed BRT would potentially travel between Stratford Station, stopping at Barnum Station, Bridgeport Station, Fairfield Metro Station, and ending at Fairfield Station. The proposed shuttle bus would potentially provide a connection between downtown Bridgeport, Steel Point, Seaview Plaza, the Seaview Avenue corridor, Barnum Station, Bridgeport Hospital, and the GE site. Initially, it was thought that these two routes should be included in the Partial and Full Build model runs. However, it was later decided that Barnum Station should be evaluated as a stand-alone transit improvement and that these two transit improvements should not be included in the Partial and Full Build alternatives[1].

GBRC and VHB provided ConnDOT with service assumptions for the proposed station to estimate the ridership for Barnum Station. The Statewide Model estimates ridership for a morning peak period (trains arriving at Grand Central Station (GCT) between approximately 6 AM and 10 AM), as well as an off-peak (trains arriving at Grand Central Station (GCT) between

[1] Note that it is anticipated that the proposed BRT and shuttle service, along with Barnum Station, would be modeled as part of the Bridgeport Regional TOD Pilot Project, scheduled to begin later in 2013.

approximately between 10 AM and 4 PM) condition. The model uses home-based work trips to estimate the morning peak period conditions and non-work trips to represent the off-peak condition. Adding a stop at Barnum Station will add three minutes to the schedule of each train stopping at Barnum Station, as detailed in Technical Memorandum #3a[2]. For the inbound morning peak and off-peak condition, the operation plan assumed that the schedule between Bridgeport Station and Grand Central Terminal (GCT) would remain the same by having the trains leaving New Haven start three minutes earlier. For the outbound morning peak and off-peak condition, the operation plan assumed that the schedule between New York City and Bridgeport would remain the same and that the trains arriving east of Bridgeport would arrive three minutes later than now. In order to incorporate Barnum Station into the Statewide Model it was assumed that the distance between Stratford Station and Barnum Station was half the distance than the distance between Barnum Station and Bridgeport Station.

In the inbound morning peak period there are currently nineteen trains heading to New York (arriving at GCT between 5:47 AM and 9:47 AM). Eight of these trains travel express from Bridgeport Station to GCT. These express trains would not stop at Barnum Station and would operate on their current schedules. This study assumed that the remaining ten trains would stop at Barnum Station before Bridgeport Station.

In the inbound off-peak period there are currently eleven trains heading to New York (arriving at GCT between 10:01 AM and 4:04 PM). Two of these trains travel express from Bridgeport Station to GCT, making fewer stops. The study assumed that the remaining nine trains would stop at Barnum Station before Bridgeport Station; the express trains would not stop at Barnum Station before Bridgeport Station.

In the outbound morning peak, period six trains currently head from GCT (arriving at Bridgeport Station between 7:21 AM and 10:01 AM). None of these trains travel express from GCT to Bridgeport Station. The study assumed that all six trains would stop at Barnum Station after Bridgeport Station.

In the outbound off-peak period there are currently eight trains heading from GCT (arriving at Bridgeport between 10:32 AM and 3:54 PM). None of these trains travel express from GCT to Bridgeport Station. The study assumed that all eight trains would stop at Barnum Station after Bridgeport Station.

[2] Note that subsequent conversations with ConnDOT have indicated that performing a full train service analysis may show the only two minutes are needed and that in most cases MNR has sufficient turn time built into the train schedule. Further, ConnDOT indicated that Barnum Station could have the potential to also serve express and partial express trains. The analysis as part of this study, however, is based on a conservative approach that express and partial express trains would operate on their current schedule and would still access Bridgeport Station, but not Barnum Station.

The fare assumed in the modeling for Barnum Station was based on the current fares currently in place at Bridgeport and Stratford Stations. The fare was adjusted based on the distance between Barnum Station and the existing stations.

In order to forecast ridership at the proposed Barnum Station, Traffic Analysis Zones (TAZs) in the model were defined as having walk access/ egress to the station and/ or having drive access to the station. Five TAZs were assigned walking access to the new station: 454, 455, 456, 491, and 497. The drive access and walk access areas for Barnum Station are shown in ***Figure 1***. For these TAZs, the majority of the land use fell within a half mile of the proposed Barnum Station. Drive access links define which TAZs have drive access to station. VHB provided drive access assumptions to ConnDOT based on the geographical extent of the drive access TAZs for existing area stations.

The Statewide Model does not take into account parking costs and excess parking demand at rail stations along the line. Therefore, such costs or demand were not determined for the Barnum project.

Model Ridership Results

As described above, GBRC and VHB provided ConnDOT the necessary model input assumptions. ConnDOT then ran the statewide model for the Existing Conditions, the 2040 No-Build condition, the 2040 Partial Build condition, and the 2040 Full Build condition. For each condition, ConnDOT provided VHB total rail boardings and alightings by station, as well as mode of access/ egress for each station.

Table 2 displays actual existing boardings, 2010 projected boardings, as well as 2040 forecast boardings without Barnum Station (2040 No-Build).

Table 2
Weekday Passenger Boardings—Metro-North Railroad*

Station	2010 Actual Boardings	2010 Model Boardings	2040 Model Boardings
Stratford	1,427	1,670	2,764
Bridgeport	3,110	3,879	6,445
Fairfield Metro Center	NA	NA	2,315
Fairfield (Town Center)	3,009	3,214	4,196
Southport	375	468	916
TOTAL	**7,921**	**9,231**	**16,636**

*NOTE: *Model ridership excludes rail-to-rail transfers*

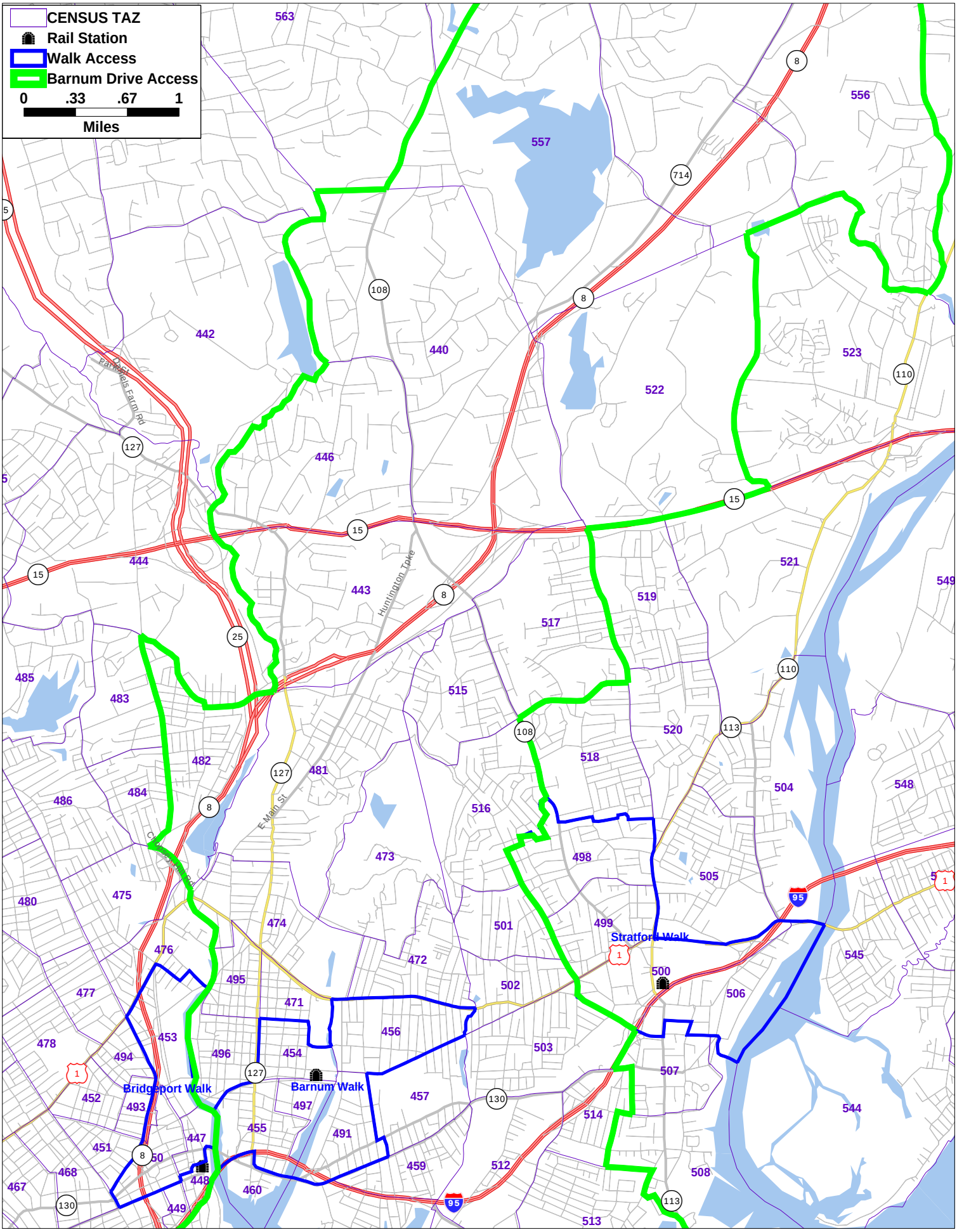

Figure 1: Model Access Assumptions - Proposed Barnum

ConnDOT also ran the model for the Partial Build and the Full Build.

The results of the Partial Build are shown in ***Table 3*** and summarized below.

- For the morning peak condition (work trips), boardings from Stratford and Bridgeport Stations shift to the proposed Barnum Station. There is more of a shift from Stratford Station.
- The overall ridership on the New Haven Line (NHL) of Metro-North Railroad (MNR) for the morning peak period does not increase.
- For the off-peak condition (non-work trips), boardings from Stratford and Bridgeport Stations shift to the proposed Barnum Station. There is more of a shift from Bridgeport Station.
- In the off-peak condition, there is an increase in total rail boardings with the addition of Barnum Station. The new riders are primarily short trips between Stratford, Barnum, and Bridgeport Stations.
- The number of boardings accessing a rail station and the number of alighting accessing their final destination by bus decreases. Barnum Station brings them closer to their origin and destination. This indicates Barnum Station provides enhanced regional mobility (better access to employment).The forecast ridership at Barnum Station is similar in magnitude to the 2040 forecast ridership at Stratford Station.
- Although the addition of Barnum Station shifts riders from Stratford and Bridgeport Stations, there is still substantial ridership at these stations.

Table 3
Weekday Passenger Boardings with Barnum Station—Metro-North Railroad*

Station	2040 No-Build AM Boardings	2040 Partial Build AM Boardings	Difference AM Boardings	2040 No-Build Total Boardings	2040 Partial Build Total Boardings	Difference Total Boardings
Stratford	1,852	1,286	-566	2,764	1,913	-851
Barnum	--	712	712	--	2,848	2,848
Bridgeport	2,099	1,969	-130	6,445	5,455	-990
Fairfield Metro Center	1,389	1,391	2	2,315	2,312	-3
Fairfield (Town Center)	2,971	2,969	-2	4,196	4,197	1
Southport	544	545	1	916	915	-1
TOTAL	**8,855**	**8,872**	**17**	**16,636**	**17,640**	**1,004**

*NOTE: *Model ridership excludes rail-to-rail transfers*

The 2040 full build alternative was also tested using the Statewide Model. Given the limitations of the Statewide Model, it was not possible to extract meaningful ridership results for this alternative. The build-out land use included a substantial increase in employment (13,421 jobs) and housing (5,778 residential units) around Barnum Station. A major component of the build-out is the future plans of the Bridgeport Housing Authority (BHA) to construct replacement housing for Marina Village on the former Father Panik Village site, which is located immediately south of the rail right-of-way, west

of Waterview Avenue and Yellow Mill Channel. Given the size of the site (approximately 29 acres) and its location adjacent to a potential rail station, the site was considered under a higher density than permitted under existing zoning. The overall increase in land use, as portrayed in the build-out, most certainly would increase the number of rail trips starting at Barnum Station, as well as the number of rail trips destined to Barnum Station and the employment centers near the station.

Employment Centers

The largest employment center near the proposed station is Bridgeport Hospital. Bridgeport Hospital is one of the largest employers in Bridgeport and is within walking distance to the proposed Barnum Station. The hospital has about 425 beds, employs over 2,600 people, and has nearly 600 attending physicians. The current employee parking rate is low and very few employees take transit to commute to work. With the addition of Barnum Station, it would be easier for employees to commute to work by rail. The hospital provided VHB employee home zip code data. Based on this data nearly half of the current employees live along a rail line and could potentially commute to work by commuter rail. This does not include the potential patients that could also travel to the hospital by rail. Based upon discussions with Bridgeport Hospital in February 2013, since the Hospital is a member of the Yale New Haven Health System and is affiliated with the Yale University School of Medicine, they expect that employees would be able to commute between New Haven and Bridgeport, should Barnum Station be constructed. Further, the Hospital has plans to expand its campus northwards towards Boston Avenue (with Harding High School relocating to the GE site). As part of that expansion, the Hospital is contemplating providing housing on its campus, notably for nursing students. Finally, the Hospital indicated that they expect to have additional patients as a result of the outpatient satellite facilities in Trumbull, Stratford, Shelton, Monroe, Fairfield, and Huntington. All of these future plans and factors indicate that the Hospital would be a larger destination for transit riders in the future and would also be a generator of ridership (boardings/ alightings) that currently is not captured in the model.

TOD

As part of the Bridgeport Regional TOD Pilot Study, Greater Bridgeport Transit (GBT), GBRC, the City of Bridgeport and the Town of Stratford, will be studying further how land use development, particularly transit-oriented development, affects rail ridership around a rail station. It is expected that as part of this future study, the build-out land use and its effect on Barnum Station ridership will be analyzed further. “Increasing land use mixing involves locating land uses with complementary functions close enough to

one another such that travel distances are minimized. Focusing dense development on transit stations and corridors provides the density necessary for efficient mass transit service and encourages transit use. In combination, these land use patterns may reduce vehicle travel by allowing individuals to walk or take transit among housing, shopping, and employment: to reduce vehicle trip lengths; and to combine trips rather than taking separate vehicle trips. A regional land use strategy might target new development to specific transit corridors or encourage infill development in existing communities and raise transit ridership sufficiently to realize a new reduction in greenhouse gases."[3]

Conclusions

The daily ridership along the New Haven Line in the Partial Build increases with the additional of Barnum Station between Stratford and Bridgeport Stations. In the peak-period, the forecast ridership at Barnum Station is mainly comprised of current ridership shifting from Stratford and Bridgeport Stations. The ridership in the off-peak period is a combination of existing riders shifting from Stratford and Bridgeport Stations, as well as new riders. The new rail riders are primarily short trips traveling between area stations. The additional of Barnum Station improves regional mobility by bringing residents closer to their origin or destination.

The Full Build alternative was tested using the Statewide Model however due to limitations of the Model it was not possible to extract meaningful results. The Barnum Station ridership for the Full Build will be revisited as part of the Bridgeport Regional TOD Pilot Study which will be studying further how land use development, particularly transit-oriented development, affects rail ridership around a rail station.

[3] Transportation and Global Climate Change: A Review and Analysis of the Literature. Strategies to Reduce Greenhouse Gas Emissions from Transportation Sources, FHWA.

BARNUM STATION FEASIBILITY STUDY

Capital Cost Estimate

Submitted to:
Greater Bridgeport Regional Council (GBRC)
City of Bridgeport

Submitted by:
Vanasse Hangen Brustlin, Inc.

In association with:
ICON architecture, Inc.
Vantage Point Development Advisors, LLC

March 2013

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Barnum Station Capital Cost Estimate

Introduction

This memorandum documents the capital cost estimate for the Barnum Station. This estimate is based on the Washington Street Extension option of the potential station concept designs. It is a conceptual order-of-magnitude cost estimate reflecting the current preliminary level of design and site information available for the Barnum Station. Consequently, it includes a contingency allowance to cover aspects of the design not yet detailed as well as the site conditions and variables not yet known.

Station Design

The station design is fully documented in other technical memoranda, but for completeness in understanding this estimate, they are summarized in this document as well. The overall objective for Barnum Station is to provide the best possible access for patrons with the fewest possible impacts on rail operations for the lowest possible capital and operating cost.

In addition, the following guidelines were used in developing the station layout based on the cited sources and experience on comparable projects.

- The station must comply with Metro-North Railroad's (MNR) "Station Standards and Guidelines."[1] This includes minimum platform widths (12 feet for side platforms and 17 feet for island/center platforms
- The station must accommodate a full-length, peak-period MNR trainset consisting of 12 passenger cars and a locomotive. This results in a total platform length of 1,050 feet when allowances are made for stopping variations.
- The station must meet ADA requirements, necessitating the platforms be high level to allow level boarding of the trains and nearly tangent

[1] Metro-North Railroad Station Standards and Guidelines Revision #8, MNR, 2008.

(roughly within one degree) to insure the gap between the platform edge and train doorways will not exceed a gap of three inches.[2]

- Because the station platforms will be elevated to match the guideway height and the line is electrified with overhead catenary, circulation across the guideway was provided beneath, rather than over, the guideway. Given the height of the catenary wires, an overpass would be at least 30 feet above grade, imposing significant additional cost for vertical circulation elements and increasing patron access times to the station.
- Impacts to the signal system were minimized and should not impact the operations or functions of MNR's use of the guideway.
- The shortest and most direct station access has been provided for pedestrians/bicyclists, public transit users, short-term parking users, and long-term parking users in that order.
- Safety and security for patrons have been a primary consideration.

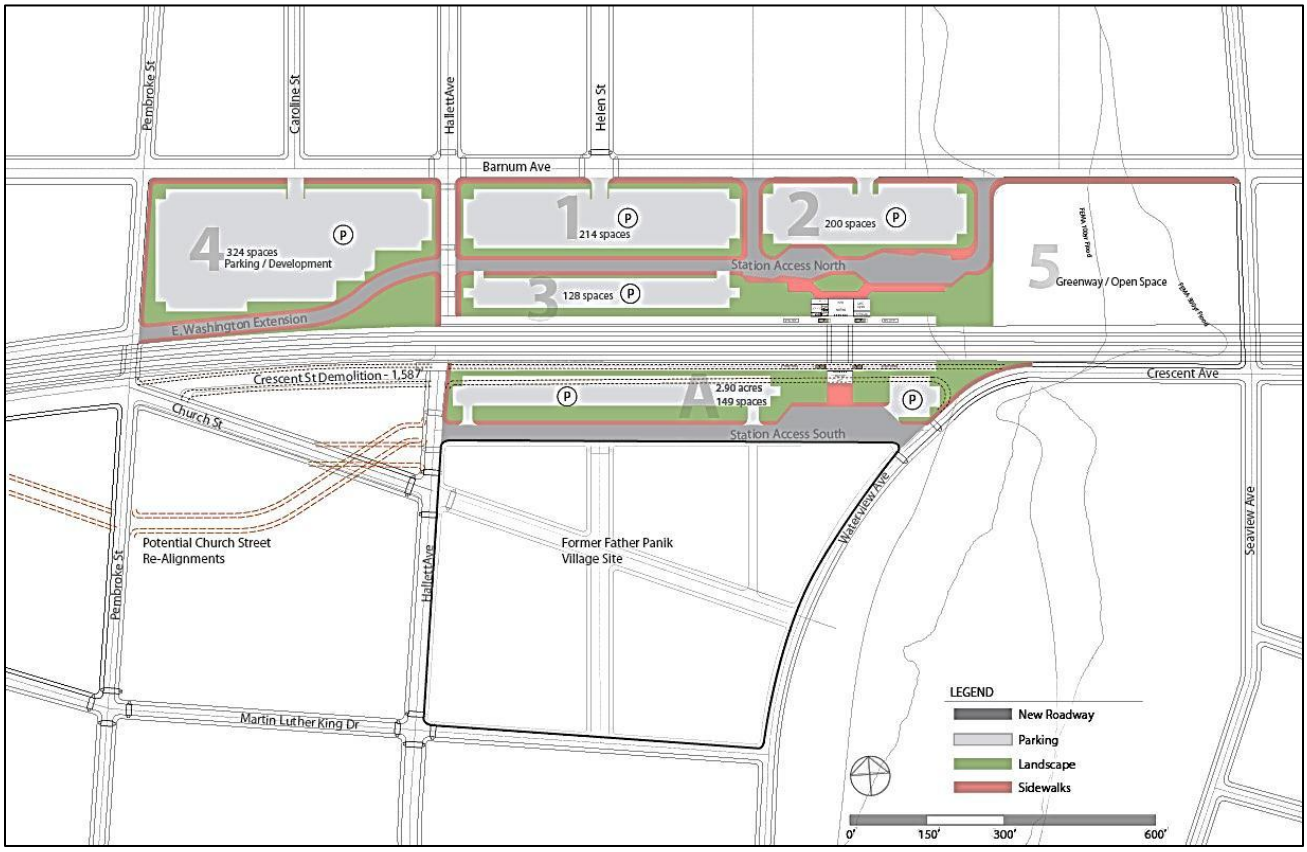
Conceptual Station Layout

Figure 1, Washington Street Extension portrays the station layout reflected in this estimate. This layout provides for 1,015 parking spaces and 36 drop-off spaces, about 0.2 miles of roadway of 30-foot width, 0.5 miles of roadway 22-feet wide, and the Barnum Station including two 1,050-foot long side platforms. Included in the station building would be two 2-story buildings, one on either side of the guideway, each containing an elevator, a stairway to the platform level and such station elements as a small waiting area and, possibly, ticket vending equipment.

Connecting the two station buildings would be a pedestrian tunnel constructed beneath the guideway. Busbays would be positioned immediately outside the north station entrance with drop-off spaces on either side of the station. Sidewalks connecting to the surrounding streets would penetrate the site providing direct and unimpeded access to the station entrances.

[2] http://www.access-board.gov/adaag/about/aiacourse/ADAAG/adaag2.htm#10.3.1(9).

Figure 1: Conceptual Barnum Station -Washington Street Extension



Conceptual Order-Of-Magnitude Capital Cost Estimate

The conceptual order-of-magnitude capital cost estimate for Barnum Station is approximately $48 million in present day dollars (2013). This estimate is comprised of the following elements:

Station Infrastructure **$7.9 million**
Includes two station buildings, elevators, stairways, a pedestrian tunnel and exit stairways and ramps.

Parking and Roadways **$11 million**
Includes 0.75 miles of roadways and 1,016 surface parking spaces.

Platforms **$7.4 million**
Includes two 1,050 feet long platforms with a 150-foot canopy each and retaining wall repairs (the platform extensions across Hallett Street are included in this item as bridges since they would have to be suspended over the roadway).

Catenary **$1.2 million**
Includes new overhead catenary structures (five total).

Engineering Services **$6.7 million**
Based on FTA allowances, providing for Preliminary Engineering, Final Design, Project Management, Construction Administration and Management, Insurance, Legal Permits, Agency Review Fees, Surveys, Testing, Investigation and Inspection and Agency Force Account Work.

Construction Contingency **$13.8 million**
An allowance of 50 percent to cover unknowns and additional design detail.

GRAND TOTAL **$48 million**

Comparable—West Haven Station

The West Haven Station is a recent new station that was selected as the most comparable one to the Barnum Station.

The $95 million West Haven Station project, when completed, will include:

- Two 12-car, high-level covered platforms,
- A full-service station building,
- At-grade parking for 650 vehicles with infrastructure in-place to support, structured parking,
- An accessible, Americans with Disabilities Act (ADA) compliant pedestrian bridge connecting the eastbound and westbound platforms,
- Site access improvements for pedestrians and vehicles and
- Accommodation of intermodal connections.

While the West Haven Station is comparable, it had a broader scope of work. Rail-related improvements involved a five-mile section and included track, signals, and communication system upgrades and electrification to restore the section to main line operating conditions. Construction of this project along the busy New Haven Main Line (Northeast Corridor) which included shared MNR/Amtrak/freight rail operations required careful planning, extensive coordination with the railroads, and rigorous construction management.

Appendix

Detailed Capital Cost Estimate

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
STATION INFRASTRUCTURE				**$7,895,000**
Station Building (total area)	10,550	SF	$400	$4,220,000
Elevators (incl. associated int. stairway)	2	EA	$600,000	$1,200,000
Jacked/mined Pedestrian Tunnel	1,050	CY	$1,500	$1,575,000
Ext. Stairways and Ramps (to and from tunnel)	2	EA	$450,000	$900,000
PARKING LOT AND ROADWAYS				**$10,960,000**
Roadway (30 feet wide and greater)	0.20	MILE	$1,500,000	$300,000
Roadway (less than 30 feet wide)	0.50	MILE	$1,000,000	$500,000
Parking Spaces	1,016	EA	$10,000	$10,160,000
PLATFORM				**$7,412,000**
Passenger Platform (12 FT x 1050 FT)	2,000	LF	$2,125	$4,250,000
Platform Canopies (150 LF, 2 per platform)	600	LF	$2,750	$1,650,000
Pedestrian Bridges (Hallett Street)	1,320	SF	$350	$462,000
Retaining Walls (with fence/railing)	2,100	LF	$500	$1,050,000
CATENARY				**$1,250,000**
New OCS Structures	5	EACH	$250,000	$1,250,000
SUBTOTAL - CONSTRUCTION COST				**$27,517,000**
ENGINEERING SERVICES				
Preliminary Engineering	4.5000%			$1,238,265
Final Design	8.3000%			$2,283,911
Project Management - Design & Construction	4.6000%			$1,265,782
Construction Administration & Management	3.1000%			$853,027
Insurance	3.0000%			$825,510
Legal Permits, Agency Review Fees, Etc.	0.3000%			$82,551
Surveys, Testing, Investigation, & Inspection	0.3000%			$82,551
Agency Force Account Work	0.3450%			$94,934
SUBTOTAL - ENGINEERING SERVICES				**$6,726,531**
CONSTRUCTION CONTINGENCY				
Construction Contingency	50.00%			$13,758,500
SUBTOTAL - CONSTRUCTION CONTINGENCY				**$13,758,500**
TOTAL ESTIMATED CONSTRUCTION COST				**$48,002,031**

Estimate Assumptions

STATION INFRASTRUCTURE

- Each station building is two levels, same area first and second floor Elevators priced separately from buildings, one for each platform, two-floor access. Stairway provided as alternate means of access.
- Pedestrian tunnel will be constructed beneath existing railroad using methods that will have minimal impact on rail service. Assume $1,500 per cubic yard for excavation, earth support and tunnel construction.
- Exterior stairs and ramps provide access from existing grade down to pedestrian tunnel.

PARKING LOT AND ROADWAYS

- Roadways include full depth construction, sidewalks, and any roadway appurtenances (curbing, guard rails, etc.).
- Parking lots priced by number of parking spaces, with price including all parking lot features such as curb, sidewalk, drainage and landscape.

PLATFORM

- Platform includes warning strips, structure, and appurtenances (benches, etc.).
- Platform canopies are 150 feet long, two per platform.
- Pedestrian bridges span Hallett Street, extending the pedestrian platforms southerly.
- Fencing and retaining walls provided at backside of platforms, with prices including all fill materials retained.

CATENARY

- New catenary structures will be provided, price includes removal of old structures.

OTHER

- Property takings not included.
- Track shifts are not anticipated (tunnel will be jacked or mined beneath existing track).
- Geotechnical requirements and groundwater remediation are not included.
- Hazardous materials remediation not included.
- Utility impacts not included.
- Building demolition not included.
- Asbestos abatement not included.
- Track and signal work not included.
- 1,587 feet of linear roadway demolition for Crescent Avenue not included.
- 592 feet of potential Church Street widening not included.