



Routes 7/15 Interchange
Norwalk, Connecticut
State Project 102-358

Analysis, Needs, and Deficiencies
Report

Prepared for:
CTDOT

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December 6, 2017
(Revised August 8, 2018)

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Attachment A – Memo containing additional Skycomp O-D graphics



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Introduction

December 6, 2017 (Revised July 2, 2018)

1.0 INTRODUCTION

The Connecticut Department of Transportation (CTDOT) proposes to construct improvements (Project) at the Route 7 and the Merritt Parkway (Route 15) interchange and to improve Route 7/Route 15 interconnections with local roads in the City of Norwalk (Norwalk), Connecticut. The principal elements of the Project are designed to provide a full directional interchange with direct access between Route 7 and Route 15 and to improve traffic operations and safety at the Route 15 and Main Avenue interchange as well as along Main Avenue and Glover Avenue in the vicinity of the interchange. This Project does not preclude any potential for further improvements to the Route 7 corridor though, as of now, there are no formal plans to do so.

The Project is being reviewed pursuant to the Connecticut Environmental Protection Act (CEPA) and the National Environmental Policy Act (NEPA). This memorandum, as the title implies, focuses on identifying transportation-related deficiencies and issues in the Project study area. This document presents detailed existing conditions data and information regarding the following transportation topics:

- Transportation network including highways, interchanges, and intersections;
- Transit facilities;
- Bicyclist and pedestrian facilities;
- Traffic volumes;
- Travel speeds;
- Origin-Destination patterns;
- Crash data and safety;
- Traffic operations (Level of Service); and
- Roadway geometry.

The data presented in this report focuses on existing traffic operations and roadway conditions and pays specific attention to particular movements, locations, and elements that are deficient.



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2.0 TRANSPORTATION NETWORK

This section describes the key roadways, interchanges, and intersections and discusses the specific movements lacking in the study area. The available transit options as well as the status of bicyclist and pedestrian facilities in the study area are also discussed herein.

2.1 ROADWAY NETWORK

The project area (presented in Figure 2.1 on the following page) extends along Route 15 from approximately 0.5 miles west of Route 7 to approximately 0.5 miles east of Main Avenue and along Route 7 from approximately 0.5 miles south of New Canaan Avenue to approximately 0.5 miles north of Route 15.

Due to the projected changes in mobility associated with the project, the traffic study area extends well beyond the overall project area. The expanded traffic study area was developed based on a review of the surrounding roadway network, a review of prior documentation for the proposed improvements to the Routes 7/15 Interchange, and coordination with CTDOT. As shown in Figure 2.2, the traffic study area generally includes longer portions of Route 7 and Main Avenue through New Canaan Avenue (Route 123) in Norwalk as well as a portion of the Route 7 corridor in Wilton.

A study area was also identified for pedestrian and bicyclists to assure that those modes of transportation are evaluated as part of the project. The pedestrian and bicyclist study areas were developed based on a review of the surrounding bicycle and pedestrian network and coordination with CTDOT. The pedestrian and bicyclist study areas are generally comprised of the area surrounding the Route 15 /Main Avenue interchange:

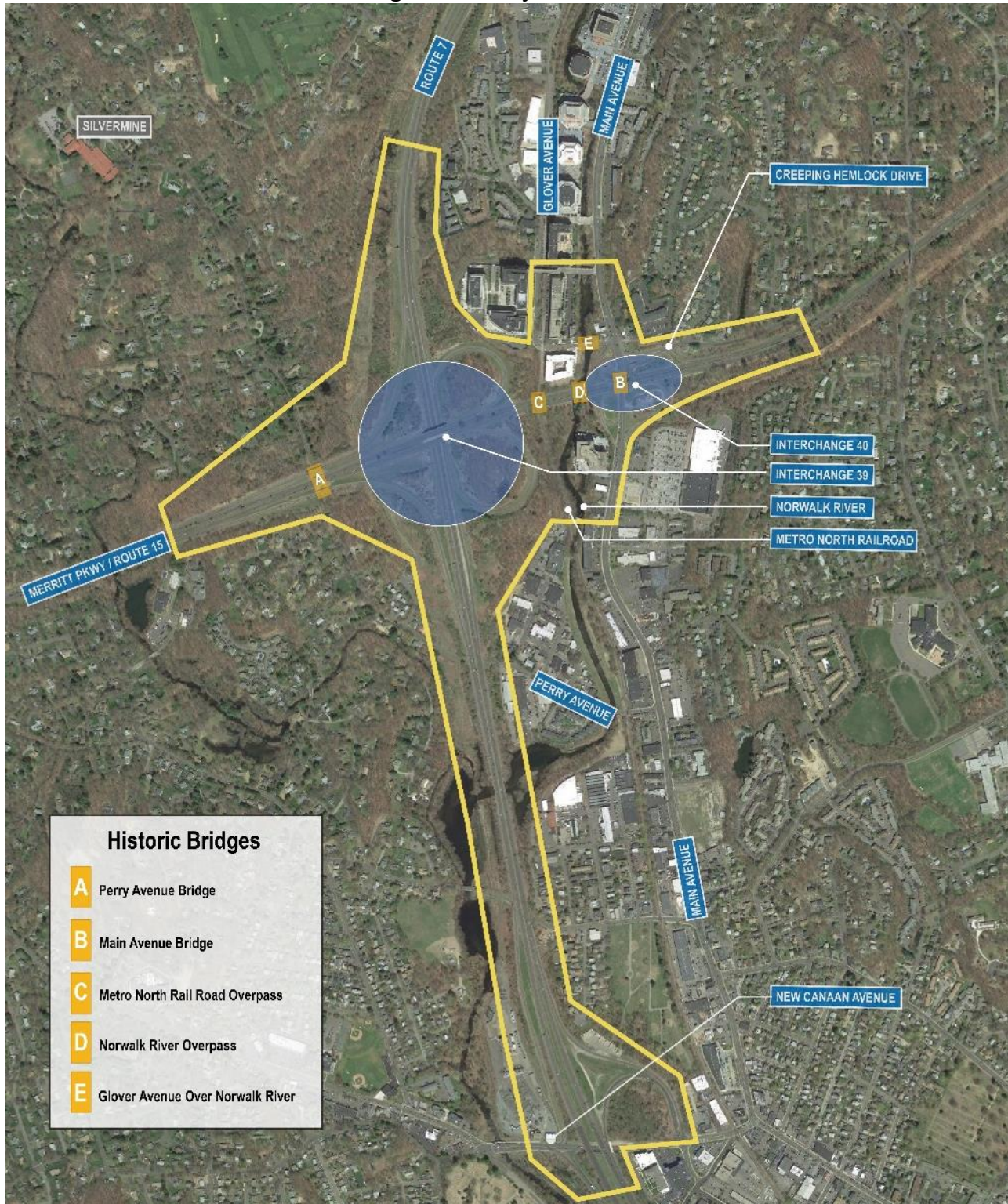
- **Main Avenue** – The segment of Main Avenue between the Creeping Hemlock Drive / Glover Avenue and Merritt View / Shopping Center intersections;
- **Creeping Hemlock Drive** – The segment of Creeping Hemlock Drive between the Main Avenue and Silent Grove Court intersections; and
- **Glover Avenue** – The segment of Glover Avenue between the Main Avenue intersection and the Metro-North Danbury Branch Railroad crossing.



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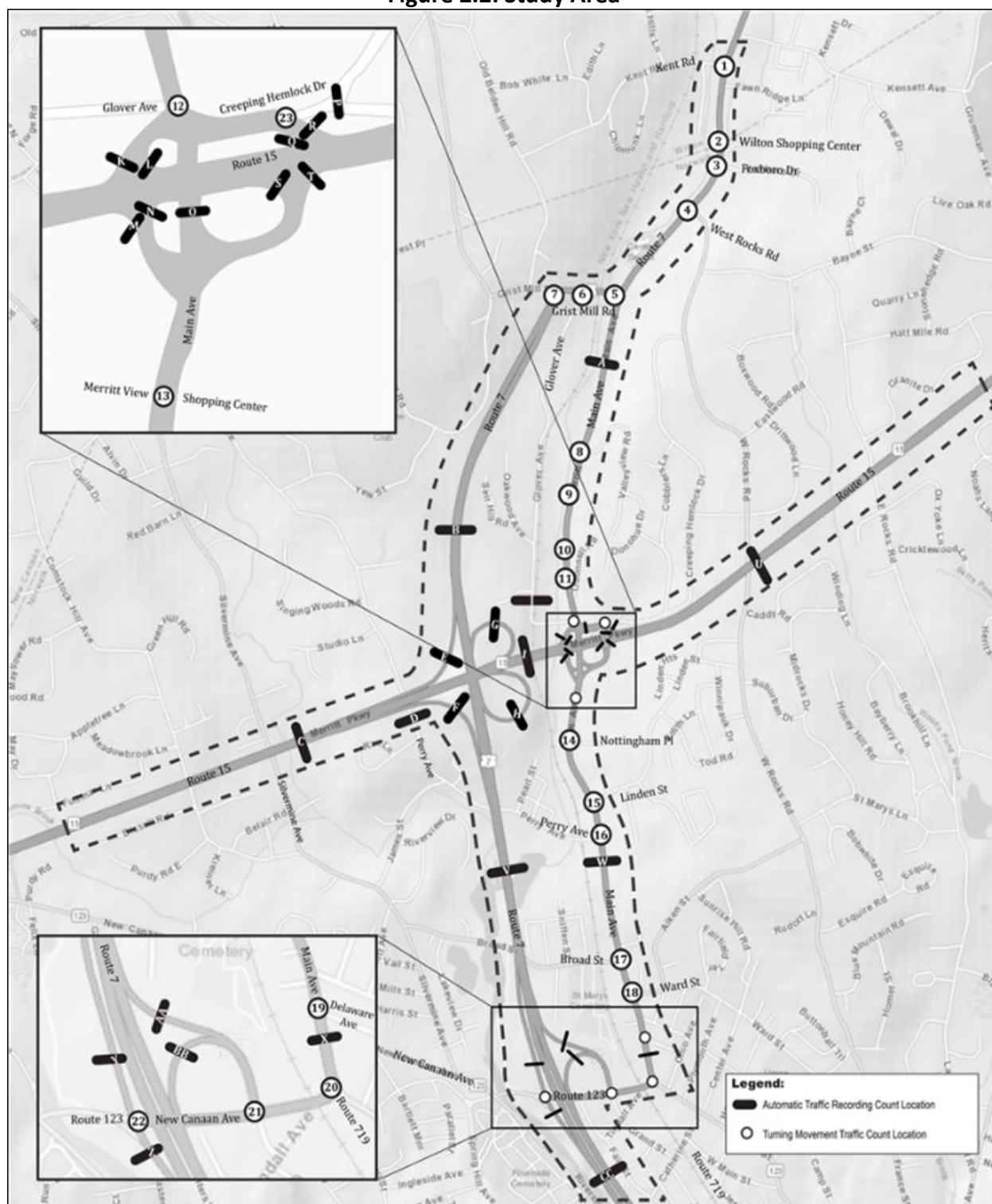
Figure 2.1: Project Area



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Figure 2.2: Study Area



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2.1.1 Mainlines and Interchanges

This section of the report provides further information on the following critical mainlines and interchanges as they each relate to the Project:

- Merritt Parkway (Route 15) Corridor;
- Route 7 Corridor;
- Route 15 and Route 7 Interchange (No. 39);
- Route 15 and Main Avenue Interchange (No. 40); and
- Route 7 and New Canaan Avenue (Route 123) Interchange.

2.1.1.1 Merritt Parkway (Route 15) Corridor

The Merritt Parkway, also known as Route 15, is approximately 37 miles long and connects the Hutchinson River Parkway at the New York State line in Greenwich to the Wilbur Cross Parkway at the Housatonic River in Stratford. In the traffic study area, the Route 15 corridor is generally bounded by Silvermine Avenue to the west and West Rocks Road to the east. It carries traffic over Perry Avenue, Route 7, and Main Avenue as well as the Norwalk River and the Danbury Branch of Metro North Railroad. The area includes the partially completed interchange with Route 7 (No. 39) and the full interchange with Main Avenue (No. 40); these two interchanges are approximately 1,500 feet apart. Within the traffic study area, the Route 15 corridor consists of two travel lanes in each direction and has posted speeds of 55 MPH. Median treatments vary along the urban freeway between concrete and box wooden posts and shoulders are generally not present along either side of the roadway. Acceleration and deceleration lanes are present along some but not all of the ramps connecting to and from Route 15 at these two interchanges.

2.1.1.2 Route 7 Corridor

Regionally, Route 7 serves as an important north-south transportation corridor in southwestern Connecticut, connecting Interstate 84 (I-84) in Danbury and Interstate 95 (I-95) in Norwalk. Throughout the corridor, Route 7 provides essential service to residential communities and businesses in the towns of Ridgefield, Redding, and Wilton as well as the cities of Danbury and Norwalk. The traffic study area for the Route 7 corridor is generally bounded by Kent Road to the north (in the Town of Wilton) and Route 123 to the south. Within the traffic study area, the Route 7 corridor operates as both a local roadway and a limited access facility.

North of Grist Mill Road, Route 7 is a State maintained urban principal arterial with a posted speed limit of 35 MPH and is generally comprised of two travel lanes in each direction. There are multiple driveways accessing various commercial and/or retail uses along either side of the



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corridor. Left turn bays are present along certain intersection approaches where the roadway geometry permits. There are no shoulders along either side of the roadway.

South of Grist Mill Road, Route 7 is a State maintained urban freeway. This portion of Route 7 has a posted speed limit of 55 MPH and consists of two travel lanes in each direction with paved shoulders and a concrete median barrier. The limited access portion of Route 7 has two interchanges within the study area: the partially completed interchange with Route 15 (Exit 3) and the full interchange with Route 123 (Exit 2). It should be noted that the posted speed limit along northbound Route 7 is reduced to 40 MPH approximately 2,000 feet south of Grist Mill Road (just north of Route 15).

2.1.1.3 Route 15 and Route 7 Interchange (No. 39)

Interchange No. 39 provides partial connections between Route 7 and Route 15. Connections are provided from Route 7 northbound to Route 15 southbound, from Route 7 southbound to Route 15 southbound, from Route 15 northbound to Route 7 northbound, and from Route 15 northbound to Route 7 southbound. Connections between Route 7 and Route 15 to and from the north/east are not provided. Due to the missing connections, southbound Route 15 motorists must use the Route 15/Main Avenue interchange to access Route 7 northbound (via Exit 40B and Main Avenue) and to access Route 7 southbound at the Route 123 interchange (via Exit 40A or Exit 40B, Main Avenue, and New Canaan Avenue). Similarly, motorists on Route 7 have no direct access to Route 15 northbound and therefore must use Main Avenue to access Route 15. Figure 2.3 identifies the complete and missing movements at Interchange No. 39.

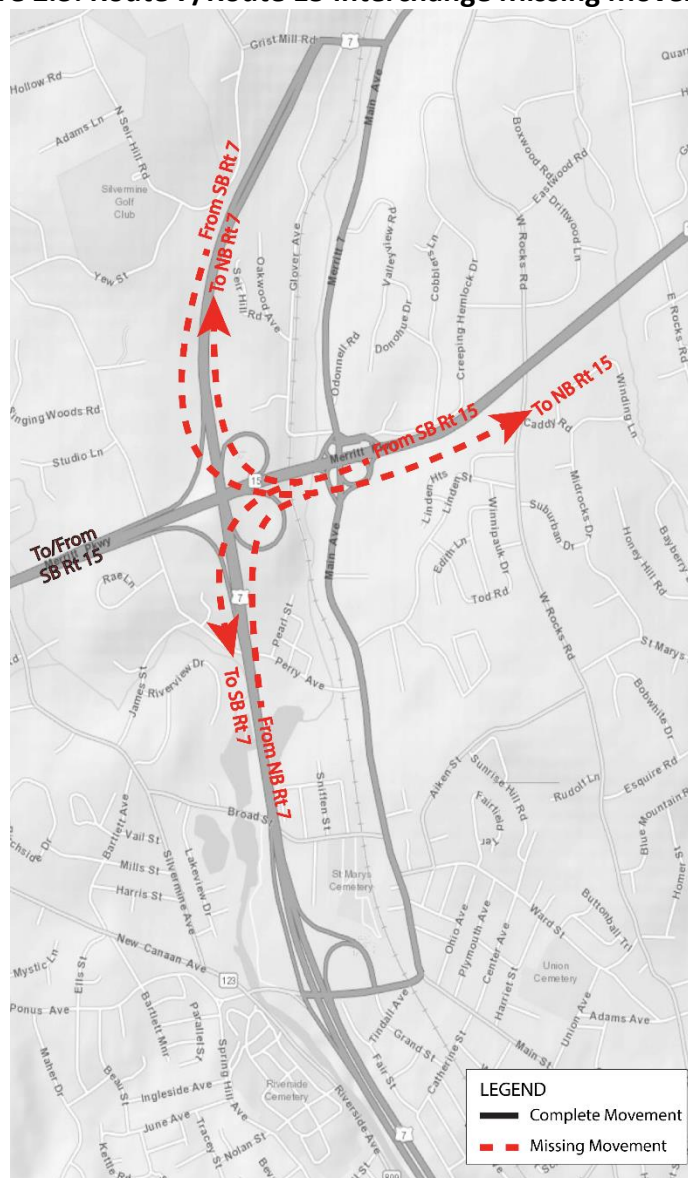


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Figure 2.3: Route 7/Route 15 Interchange Missing Movements



2.1.1.4 Route 15 and Main Avenue Interchange (No. 40)

Interchange No. 40 is located approximately 1,500 feet east of the Route 7 and Route 15 interchange and provides connections in all directions between Route 15 and Main Avenue. Two of the Route 15 on-ramps at this interchange are stop-controlled and have no acceleration lanes; Main Avenue southbound to Route 15 northbound; and Main Avenue northbound (via Creeping Hemlock Drive) to Route 15 southbound as noted in Figure 2.4 below.



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Figure 2.4: Route 15/Main Avenue Stop Control Ramps without Acceleration Lanes



Although this interchange generally resembles a typical cloverleaf interchange, its proximity to the Main Avenue intersection with Glover Avenue and Creeping Hemlock Drive results in several unusual ramp movements (particularly for traffic entering and exiting Route 15 southbound). In both directions on Route 15, Exit 40A is intended for vehicles heading southbound on Main Avenue, and Exit 40B is intended for vehicles going northbound on Main Avenue. However, Exit 40B southbound directs traffic onto Creeping Hemlock Drive which then permits vehicles to turn left toward Main Avenue southbound at the signalized intersection. Vehicles have been observed to follow this circuitous route rather than using Exit 40A southbound due to the tight loop off-ramp immediately west of Main Avenue.

Northbound traffic on Main Avenue is directed to turn right onto Creeping Hemlock Drive to access Route 15 southbound via a STOP controlled on-ramp. Instead, some northbound vehicles turn left at the signalized intersection onto the Route 15 southbound on-ramp near Glover Avenue (which is not STOP controlled). Similarly, even though southbound traffic on Main Avenue is directed to turn right at the Glover Avenue intersection for access to Route 15, vehicles are also permitted to turn left toward the Route 15 southbound on-ramp (via Creeping Hemlock Drive).

2.1.1.5 Route 7 and New Canaan Avenue (Route 123) Interchange

This interchange in the southern part of traffic study area provides connections in all directions between Route 7 and Route 123. These access ramps intersect Route 123 at signalized



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intersections located less than 1,000 feet apart from each other. The signalized intersection providing access to and from Route 7 northbound is less than 500 feet from the Danbury branch railroad crossing, which is just to the west of the Route 123 intersection with Main Avenue.

2.1.2 Local Roads and Key Intersections

This section of the report provides further information on the following local roads and key intersections as they each relate to the Project:

- Main Avenue Corridor;
- New Canaan Avenue (Route 123) Corridor;
- Grist Mill Road Corridor;
- Main Avenue at Glover Avenue/Creeping Hemlock Drive; and
- Main Avenue at Merritt View Drive/Shopping Center.

2.1.2.1 Main Avenue Corridor

The traffic study area for the Main Avenue (Route 719) corridor is bounded by Grist Mill Road to the north and Route 123 to the south. Main Avenue operates as a City maintained urban minor arterial within the traffic study area. Generally, there are multiple driveways accessing various commercial, retail, and/or residential uses along either side of the corridor. Left turn bays are present along certain intersection approaches where the roadway geometry permits. There are no shoulders along either side of the roadway and sidewalks are generally present on at least one side of the road. Main Avenue is generally comprised of two travel lanes in each direction. The posted speed limit of Main Avenue is 30 MPH. Connections between Route 7 and Main Avenue do not exist in the vicinity of Interchange No. 39 or Interchange No. 40.

The traffic signals along the Main Avenue corridor are part of a Computerized Traffic Signal System (CTSS). This coordinated, closed loop system consists of 25 traffic signals within the City of Norwalk and a portion of the Town of Wilton. All of the traffic signals along Main Avenue between Route 123 in Norwalk and Grumman Hill Road in Wilton are part of the CTSS. Per discussions with CTDOT, the interconnections for the CTSS has been compromised due to the addition of traffic signals into the original (existing) CTSS. The CTSS is over 25 years old and is not adequate to handle the volume of data received from traffic control signal devices. Furthermore, the system is not equipped to handle further expansions as needed to accommodate potential changes to the roadway network.

It should be noted that the traffic study area does not include three intersections that are in the CTSS but are further away from the Routes 7/15 Interchange (Kensett Avenue, Driveway to/from the Perkin Elmer Building, and Grumman Hill Road in Wilton).



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2.1.2.2 New Canaan Avenue (Route 123) Corridor

The traffic study area for the Route 123 corridor is bounded by Route 7 to the west and Main Avenue (Route 719) to the east. Route 123 is a State maintained urban minor arterial with two travel lanes in each direction. Within the traffic study area, the corridor has a posted speed limit of 30 MPH.

The Route 123 / Main Avenue intersection is a 3-legged signalized intersection that is less than 200 feet from the Danbury branch railroad crossing. Traffic turning from Main Avenue onto New Canaan Avenue, traffic coming from New Canaan Avenue west of the crossing, and traffic exiting northbound Route 7 at New Canaan Avenue have been observed to queue for up to five minutes as Danbury branch trains pass through Route 123.

All of the traffic signals along the Route 123 corridor within the traffic study area are part of the CTSS.

2.1.2.3 Grist Mill Road Corridor

Grist Mill Road, located in the northern portion of the traffic study area, is a 0.3-mile segment of roadway connecting neighborhood streets west of Route 7 to Main Avenue. Within that small stretch, Grist Mill Road has three signalized intersections with Route 7, Glover Avenue, and Main Avenue.

West of the Route 7 intersection, Grist Mill Road operates as a City maintained urban minor arterial with one travel lane in each direction. The speed limit along this segment of Grist Mill Road is 25 MPH (it is not posted).

East of the Route 7 intersection, Grist Mill Road operates as a State maintained urban principal arterial with a speed limit of 25 MPH (which is not posted). This section of the corridor is generally comprised of five lanes (two travel lanes in the westbound direction and three travel lanes in the eastbound direction). There is less than 500 feet between the Grist Mill Road intersections with Route 7, Glover Avenue, and Main Avenue.

Both the limited access portion of Route 7 and Glover Avenue terminate with “T” intersections at Grist Mill Road. Double turn bays are provided for several high-volume movements: (1) northbound Route 7 vehicles turning right onto eastbound Grist Mill Road, (2) northbound Route 7 vehicles turning left onto northbound Main Avenue, and (3) southbound Route 7 vehicles turning left from Grist Mill Road and heading south towards the Route 15 interchange. Most vehicles who turn right from northbound Route 7 continue onto northbound Main Avenue; similarly, most vehicles who turn right onto Grist Mill Road from southbound Main Avenue continue onto southbound Route 7.

All of the traffic signals along the Grist Mill Road corridor within the traffic study area are part of the CTSS.



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2.1.2.4 Main Avenue at Glover Avenue/Creeping Hemlock Drive

Glover Avenue connects with Creeping Hemlock Drive at the signalized intersection with Main Avenue. Glover Avenue carries traffic over the Norwalk River to and from the Merritt 7 train station located north of Route 15 between Route 7 and Main Avenue. The Danbury branch crosses Glover Avenue approximately 500 feet west of the Main Avenue intersection. Creeping Hemlock Drive continues eastward past the ramps to/from southbound Route 15 into the residential community northeast of the Route 15/Main Avenue interchange.

The intersection that ties Main Avenue, Glover Avenue, and Creeping Hemlock Drive together is also interconnected to the Route 15/Main Avenue interchange. For instance, the northbound right turn lane to Creeping Hemlock Drive also serves vehicles accessing the ramp to Route 15 southbound.

2.1.2.5 Main Avenue at Merritt View Drive/Shopping Center

The signalized intersection at Main Avenue and Merritt View Drive/Shopping Center is approximately 250 feet south of the on and off ramps to and from Route 15 northbound. Congestion on Route 15 northbound can lead to queues spilling back onto Main Avenue northbound at this intersection. In the same way, queues at the southbound approach to this intersection can prevent vehicles from merging onto Main Avenue from the Exit 40A exit ramp.

2.2 TRANSIT NETWORK

Bus and rail service in the study area is provided by the Norwalk Transit District bus service and Metro-North Railroad, respectively. Although the project does not directly address transit services, improvements to the existing roadway network should improve access to Merritt 7 train station and improve service and reliability of the bus routes that pass through the study area.

2.2.1 Bus Transportation

The Norwalk Transit District's *WHEELS hub* is located about 1 mile south of the traffic study area east of Route 7. As shown by Figure 2.5, several bus routes use Main Avenue and Route 7 including the 7 Link which passes the Merritt 7 train station and serves employment sites along the Route 7 corridor between Danbury and Norwalk.

Additional bus routes that travel along the study area's key corridors include:

- WHEELS Route 3 (shown in Figure 2.5)
- Main Ave Shuttle
- Merritt 7 – Glover Ave Commuter Shuttle
- 10-20 Westport Rd Shuttle



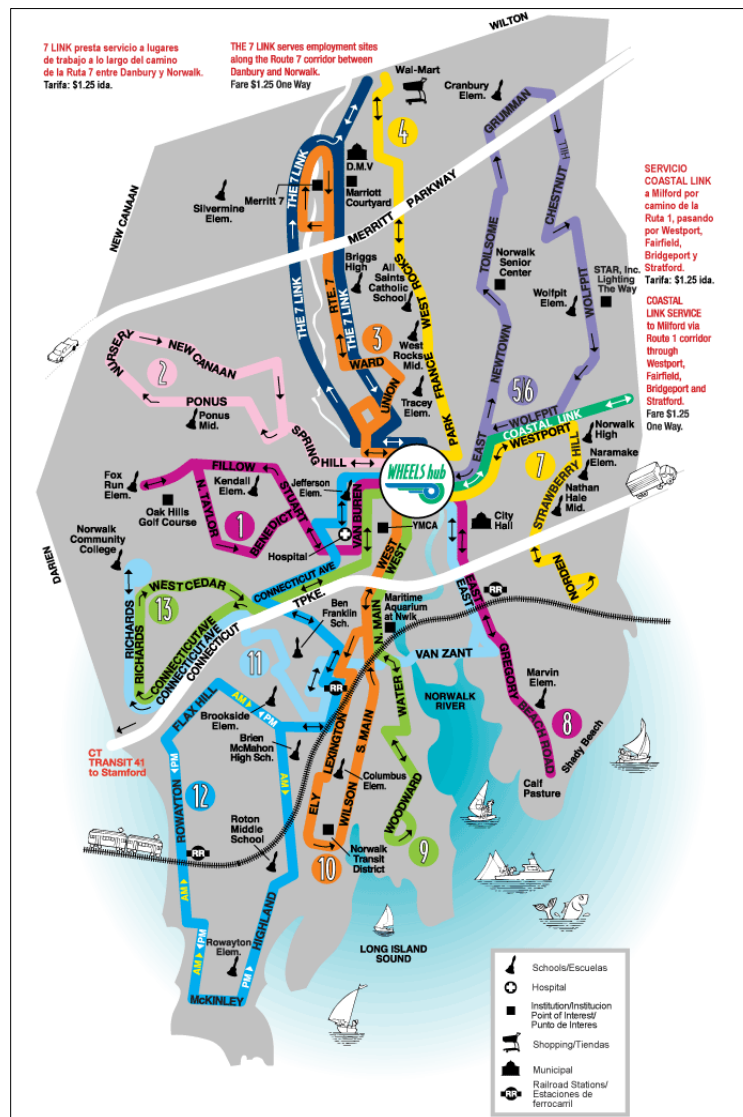
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While the WHEELS Route 3 and Main Ave Shuttle have daily bus service, the 7 Link, Merritt 7 – Glover Ave Commuter Shuttle, and 10-20 Westport Rd Shuttle are only operated Monday through Friday. The 7 Link provides hourly bus service between 6am and 9am and between 3pm and 6pm. WHEELS Route 3 operates every 20 minutes during the week (3 buses per hour), every 40 minutes on Saturdays, and no service on Sundays. The Main Ave Shuttle operates hourly during weekday and Saturday evenings and hourly on Sundays from 9am to 6pm. Both the Merritt 7 – Glover Ave and 10-20 Westport Rd shuttles coincide their schedules with train arrival times, operating approximately every 15 to 30 minutes during the week (approx. 3 buses per hour). These schedules result in at least 10 buses per hour during the morning and evening peak periods.

Figure 2.5: Norwalk Transit District Fixed Routes Map



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2.2.2 Rail Transportation

The Merritt 7 train station, located along Glover Avenue just north of the Project, is the first stop on the Danbury Branch of Metro-North Railroad's New Haven Line. All parking (including overnight) for the train station is free, but on a first-come first-serve basis. Although parking is limited (approximately 75 spaces), the lot is rarely fully utilized. Connecting bus services to all routes mentioned in the prior section except for the Main Ave Shuttle are available to and from the Merritt 7 train station.

With the exception of peak period, peak-directional service, branch trains operate with 2 hour headways in each direction (one train per hour on the single-track branch line). Peak period, peak-directional service operates with typical headways of 30-40 minutes.

2.3 BICYCLIST AND PEDESTRIAN ACCESSIBILITY

Existing pedestrian and bicycle facilities were identified and assessed using an array of different methods and resources. A field visit was conducted, pedestrian and bicycle counts were taken at two major intersections, and several plans relating to transportation in Norwalk were reviewed.

As previously mentioned in Section 2.1, the pedestrian and bicyclist study areas are comprised of the area surrounding the Route 15 /Main Avenue interchange:

- **Main Avenue** – The segment of Main Avenue between the Creeping Hemlock Drive / Glover Avenue and Merritt View / Shopping Center intersections;
- **Creeping Hemlock Drive** – The segment of Creeping Hemlock Drive between the Main Avenue and Silent Grove Court intersections; and
- **Glover Avenue** – The segment of Glover Avenue between the Main Avenue intersection and the Metro-North Danbury Branch Railroad crossing.

However, it should be noted that additional information regarding bicyclist and pedestrian accessibility within the bigger, traffic study area has been provided to provide better context to overall accessibility in the area.

2.3.1 Assessment of Key Roadways

The area in the immediate vicinity of the Route 7/15 Interchange is largely commercial, with increasing amount of apartment buildings projected in the project area. To the east of Main Avenue are neighborhoods generally composed of single-family houses and condominium complexes. The Metro-North Railroad tracks run through the area, parallel to the Norwalk River and Main Avenue. Commercial and office buildings line either side of Main Avenue. These uses lead to significant numbers of pedestrians and bicycles traveling along and crossing Main Avenue. There are sidewalks in some parts of the study area, but they are not continuous and do not



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encourage bicycle and pedestrian travel. Smaller streets in the area, to the east and west of Main Avenue, generally have even poorer sidewalk conditions. The following is a description of the streets in the study area and the pedestrian and bicycle facilities that each provides.

The remainder of this section provides an assessment of the Main Avenue, Creeping Hemlock Drive, and Glover Avenue corridors in the context of bicyclist and pedestrian accessibility.

2.3.1.1 Main Avenue

Main Avenue runs parallel to the Norwalk River, the Metro-North Railroad tracks, and Route 7. Commercial and office buildings line Main Avenue, but the buildings sit behind large parking lots, encouraging vehicular travel. Main Avenue is a four-lane roadway with high vehicle speeds. This is also the primary corridor for north-south pedestrian and bicycle travel in the area. There are sidewalks on both sides of Main Avenue from the Merritt View Shopping Center (on the southern end) to the northbound Route 15 on/off ramps, just south of Route 15. The sidewalks on Main Avenue up to the Route 15 on/off ramps are between three and five feet wide but are narrower where utility poles or signage create an obstruction. North of the Route 15 on/off ramps, the sidewalk coverage along Main Avenue is discontinuous. At some of the transitions between sidewalk and street, there are no curb ramps. There is no dedicated bike lane, and shoulder widths are less than one foot in most places. Vehicle speeds are too high for most bicyclists to feel comfortable riding in the roadway. Thus, most bicyclists in the area generally ride on the sidewalks. The only marked crosswalks on Main Avenue exist at the Merritt View Shopping Center intersection. Crosswalks within the study area are also located on Main Avenue at 101, 201 & 301, 401, 601 Merritt 7 Buildings and at Linden Street.

2.3.1.2 Creeping Hemlock Drive

Creeping Hemlock Drive is located just north of Route 15, east of Main Avenue. This roadway serves as the on/off-ramp for southbound traffic on Route 15 and connects Main Avenue to the Creeping Hemlock Neighborhood. In the westbound direction, there are two vehicle lanes, while there is only one vehicle lane in the eastbound direction. A median separates the two travel directions on Creeping Hemlock Drive. There are no sidewalks here, and the shoulders are less than one foot wide.

2.3.1.3 Glover Avenue

Glover Avenue is a north/south roadway located west of Main Avenue and originating at a bridge over the Norwalk River north of Route 15. Glover Avenue is a two-lane roadway that provides access to the Merritt 7 Railroad station from Main Avenue. There are no bike lanes on this street and no shoulders. However, the roadway is narrower than Main Avenue, which discourages high vehicle speeds and makes bicycle travel in the roadway more appealing. There are sidewalks on both sides of Glover Avenue from the Norwalk River in the east to the Metro North Railroad tracks in the west. The sidewalks and curb ramps in this segment are fully compliant with ADA



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(Americans with Disabilities Act) standards. Street trees and building frontage on either side of Glover Avenue in this segment lend to a more enclosed feeling for pedestrians and bicyclists, which help provide a friendlier bicycle and pedestrian environment. After Glover Avenue crosses the railroad tracks, there is only a sidewalk on the western side of the roadway until the railroad station. The sidewalk width along Glover Avenue varies between three and five feet until Glover Avenue reaches the Merritt 7 Railroad station.

2.3.2 Field Review of Bicycle and Pedestrian Environment

A field review of the bicycle and pedestrian environment in the area revealed that there are a significant number of pedestrian and bicyclists that travel through the area, despite a lack of facilities and numerous deficiencies in the network. The most critical deficiencies in the network that were observed are listed below.

Issues Concerning Bicycle Travel:

- There are no bike lanes in the study area;
- All shoulders in the area are less than 1 foot wide and are not wide enough for bicyclists to use;
- None of the roadways in the study area are marked or signed as sharrows (shared use lanes with lane markings); and
- Vehicle speeds on Main Avenue are too high for bicyclists to feel comfortable traveling in the roadway. Bicyclists were observed using the sidewalks for travel along Main Avenue.

Issues Concerning Bicycle Crossings:

- There are no curb ramps at several crossing locations along Main Avenue;
- Bicyclists traveling on the sidewalks must dismount their bicycles at these locations without curb ramps; and
- Painted crosswalks along Main Avenue in the study area are limited to the intersection of Main Avenue and Merritt View Shopping Center and at 101, 201 & 301, 401, 601 Merritt 7 Buildings and at Linden Street.

Issues Concerning Pedestrian Travel:

- There are no sidewalks at the following locations:
 - Along the eastern side of Main Avenue from the Route 15 on/off ramps to Creeping Hemlock Drive. The sidewalk on the eastern side of Main Avenue ends abruptly at the



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- Route 15 on/off ramps with no crosswalk provided here that would allow pedestrians to cross to the western side of Main Avenue. The nearest crosswalk across Main Avenue is located at the Merritt View Plaza intersection;
 - On either side of Creeping Hemlock Drive. This prevents pedestrians and bicyclists from safely accessing the Creeping Hemlock Neighborhood from Main Avenue;
 - On either side of Glover Avenue from Main Avenue to the point at which Glover Avenue crosses the Norwalk River; and
 - On the eastern side of Glover Avenue from the point at which Glover Avenue crosses the Metro-North Railroad tracks to the Merritt 7 Train Station.
- The existing sidewalk on the western side of Main Avenue is extremely narrow (approximately 3 feet) underneath the Route 15 bridge.

Issues Concerning Pedestrian Crossings:

- There is no curb ramp between the transition from the sidewalk to the street at the locations listed below. This presents a serious problem for disabled persons in wheelchairs, the vision-impaired, the elderly, and for bicyclists who may be using the sidewalk:
 - The intersection of Main Avenue and the eastbound on/off ramps to Route 15 on the western side of Main Avenue;
 - The intersection of Main Avenue and the westbound on/off ramps to Route 15 on the western side of Main Avenue; and
 - The intersection of Main Avenue and Glover Avenue.
- Pedestrians must travel approximately 80 feet to cross Main Avenue (a four/five-lane road);
- Painted crosswalks along Main Avenue in the study area are limited to the intersection of Main Avenue and Merritt View Shopping Center and at 101, 201 & 301, 401, 601 Merritt 7 Buildings and at Linden Street.
- No intersections in the study area have crosswalks along all four legs of the intersection;
- Except for the Main Avenue intersections at Perry Avenue, Linden Avenue, 101/201 Merritt 7 Buildings, and West Rocks Road/iPark Driveway, exclusive pedestrian phases are not present at signalized intersections in the study area; and
- The sidewalk ends abruptly, with no immediate crosswalk provided at the following locations:
 - Along the eastern side of Main Avenue at the eastbound on/off ramps to Route 15; and



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- Along the eastern side of Main Avenue at the driveway to Extended Stay America.

2.3.3 Review of ADA Issues

Within the study area, only one segment (approximately 300' in length) along Glover Avenue, between the Norwalk River and the Metro-North Railroad tracks, is fully compliant with ADA standards. Other areas were not ADA compliant because one or more of the following facilities was not present:

- Tactile material to warn visually impaired pedestrians of the transition between the sidewalk and the street edge at the curb ramps;
- Sidewalk on either side of the roadway;
- Curb ramps to provide a sloped curb from the sidewalk to the street;
- Crosswalks at intersections – none of the intersections in the area have crosswalks along all four legs of the intersections; and
- Audible information for visually impaired pedestrians where there is a pedestrian push button provided at signalized intersections.

In addition, street furniture, such as lamp posts and utility poles, block the center of the sidewalk in several locations and inhibit pedestrians' pathways.

2.3.4 Bicycle and Pedestrian Counts

As part of the overall traffic analysis, bicycle and pedestrian counts were collected throughout a typical weekday as well as on a Saturday afternoon at 23 locations presented in Table 2.1 on the following page. Although the pedestrian and bicycle study area are centered around the Main Avenue/Route 15 interchange, data has been presented for all 23 locations to provide additional information on peak period pedestrian and bicycle usage in the area.

Creeping Hemlock Drive / Main Avenue The data indicated that the majority of pedestrian and bicycle traffic occurs in the evening hours from 4pm – 6pm. Except for certain intersections, there was very little pedestrian and bicycle traffic in the morning hours which suggests that most of the pedestrian and bicycle trips are not people commuting from home to work. Instead, these trips likely represent people traveling from work to nearby restaurants or retail locations throughout the work day. It should be noted that pedestrian and bicycle volumes are considered to be low given that peak hour volumes are under 100 pedestrians and/or bicycles.

Table 2.1: Total Pedestrians and Bicycles by Intersection

Int. No	Intersection	AM Peak Period	PM Peak Period
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1	Main Ave (US 7) at Kent Rd	0	0
2	Route 7/Gateway Plaza South Dr./Strip Mall	0	0
3	Route 7/Foxboro Drive	0	0
4	Route 7/West Rocks Rd	3	3
5	Route 7/Main Av/DMV	0	0
6	Route 7/Grist Mill/Glover	0	0
7	Route 7/Grist Mill Rd	0	0
8	Main Ave at Valley View Rd / Merritt 201/301	16	19
9	Main Ave at Merritt 401/501 / Shopping Center	17	35
10	Main Ave at Merritt 601	55	37
11	Main Ave at Merritt River Towers 801/901	12	20
12	Main Ave at Glover Avenue / Creeping Hemlock Dr. / SB CT 15 Ramps	3	25
13	Main Ave at Merritt View/Shopping Center	3	29
14	Main Ave at Nottingham Pl	1	17
15	Main Ave at Linden St	0	4
16	Main Ave at Perry Ave	2	15
17	Main Ave at Broad St	4	12
18	Main Ave at Ward St	2	9
19	Main Ave at Delaware Ave/Shopping Center	4	18
20	Main Ave at New Canaan Ave (CT 123)	1	4
21	New Canaan Ave at NB US 7 Ramps	0	1
22	New Canaan Ave at SB US 7 Ramps	1	2
23	Creeping Hemlock Dr. at SB CT 15 Ramps	0	0

2.3.5 Bicycle and Pedestrian Crash Analysis

Bicycle and pedestrian crash records for the years of 2012-2015 were obtained from the Connecticut Crash Data Repository (CTCDR). There were 12 bicycle crashes and 30 pedestrian crashes in the City of Norwalk across the 4-year period. Only one of these crashes occurred in the vicinity of the study area. It was a pedestrian crash that occurred at the intersection of Main Avenue and Linden Street. The crash was attributed to “unsafe use of highway by the pedestrian.” This could mean, e.g., that the pedestrian was crossing the street without a crosswalk. The majority of the other bicycle and pedestrian crashes occurred on the southern portion of Main Avenue.

2.3.6 Bicycling and Walking Demand Analysis

Assessment of Current Biking and Walking Origins and Destinations



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There are several office buildings, dining options, and retail establishments along Main Avenue. Examples are General Electric Capital Corporation, the Merritt 7 Corporate Park, and Stop & Shop. The commercial establishments attract bicycle and pedestrian activity, particularly during lunch hours on weekdays. Many people cross Main Avenue during this time to access the dining options.

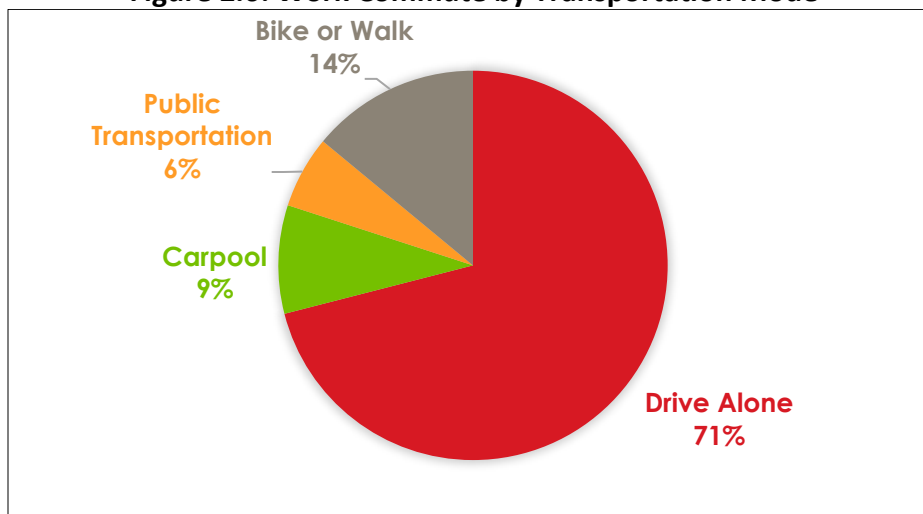
There are also several residential developments in the area, such as the Merritt River Apartments, that contribute to a high level of bicycle and pedestrian activity. Many of these residents walk or bike to and from work as well as for recreation. Approximately 1,500 apartment units are planned to be built just south of Grist Mill Road, which would contribute to an increase in the number of people walking and biking in the area. The surrounding area primarily consists of suburban development.

Walking and Biking Latent Demand Analysis

According to US Census data collected between the years of 2009-2013, approximately 58% of employed residents in Norwalk commute to surrounding areas for work, with the majority of people traveling to Stamford, Greenwich, Westport, Wilton, or locations in New York.

Of the remaining employed residents, i.e. those that both live and work in Norwalk (approximately 42%), the majority of people drive to work alone. The full breakdown by transportation mode is shown in the graph below.

Figure 2.6: Work Commute by Transportation Mode



Based on the proportion there is currently only a small amount of estimated latent walking and biking demand in comparison to the amount of motorists whom drive alone to and from the area. Field reviews of the biking and walking in the area support this finding. The demand for walking and biking will, however, continue to increase with future residential and commercial developments that prioritize pedestrian and bicyclist friendly environments along with increased



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investment in facilities for bicyclists and pedestrians throughout the city's transportation network.



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3.0 EXISTING TRAVEL PATTERNS

From a regional perspective, peak travel movements are generally in the southbound direction during the AM rush hour (towards points both south and west) and the northbound direction (towards points north and east) during the PM rush hour. Within the study area, traffic along study area corridors mostly follow regional travel trends. An example to how localized travel varies from regional travel is Main Avenue, where travel is actually higher in the southbound direction during the PM rush hour. This is primarily due to the influx of traffic from the Merritt 7 office buildings and other office building further north in Wilton to either Route 15 or I-95 further south in Norwalk.

Consequently, peak hour travel demand results in congestion and slow travel speeds along study area corridors. Vehicles making the missing movements at the Route 7/Route 15 interchange are directed to travel via local roads such as Main Avenue, increasing congestion on the local roadway network. There is a safety concern surrounding the Main Avenue/Route 15 interchange; the two stop-controlled on-ramps have severe congestion and queueing, the Main Avenue intersection with Creeping Hemlock Drive/Glover Avenue/southbound Route 15 ramps operates at poor levels of service, and most of interchange off-ramps either have minimal or no deceleration lanes. The intersection of Route 7 at Grist Mill Road also operates at below-average levels of service and there are safety concerns at that location as well (e.g., high amounts of crashes).

3.1 TRAFFIC VOLUMES

To evaluate traffic conditions, a comprehensive data collection program was conducted in September 2016 (additional data were collected in October and December 2016). Generally, weekday morning and weekday evening peak periods were targeted for analysis purposes as traffic volumes are highest during these periods of time. However, as discussed below, some counts were performed for several days or during other time periods to confirm that the data are reflective of typical traffic conditions. The data collection program consisted of the following:

- Turning movement counts (TMCs);
- Automatic traffic recorders (ATRs);
- Travel time / speed data; and
- Origin-Destination counts (O-D).

To the extent practicable, data were collected during dry weather conditions with good visibility, and while local public schools and colleges were open. All ATR and TMC count locations are shown in Figure 3.1. It should be noted that the noise monitoring locations are also shown in Figure 3.1 (see *Noise* section of the EA/EIE for more information).

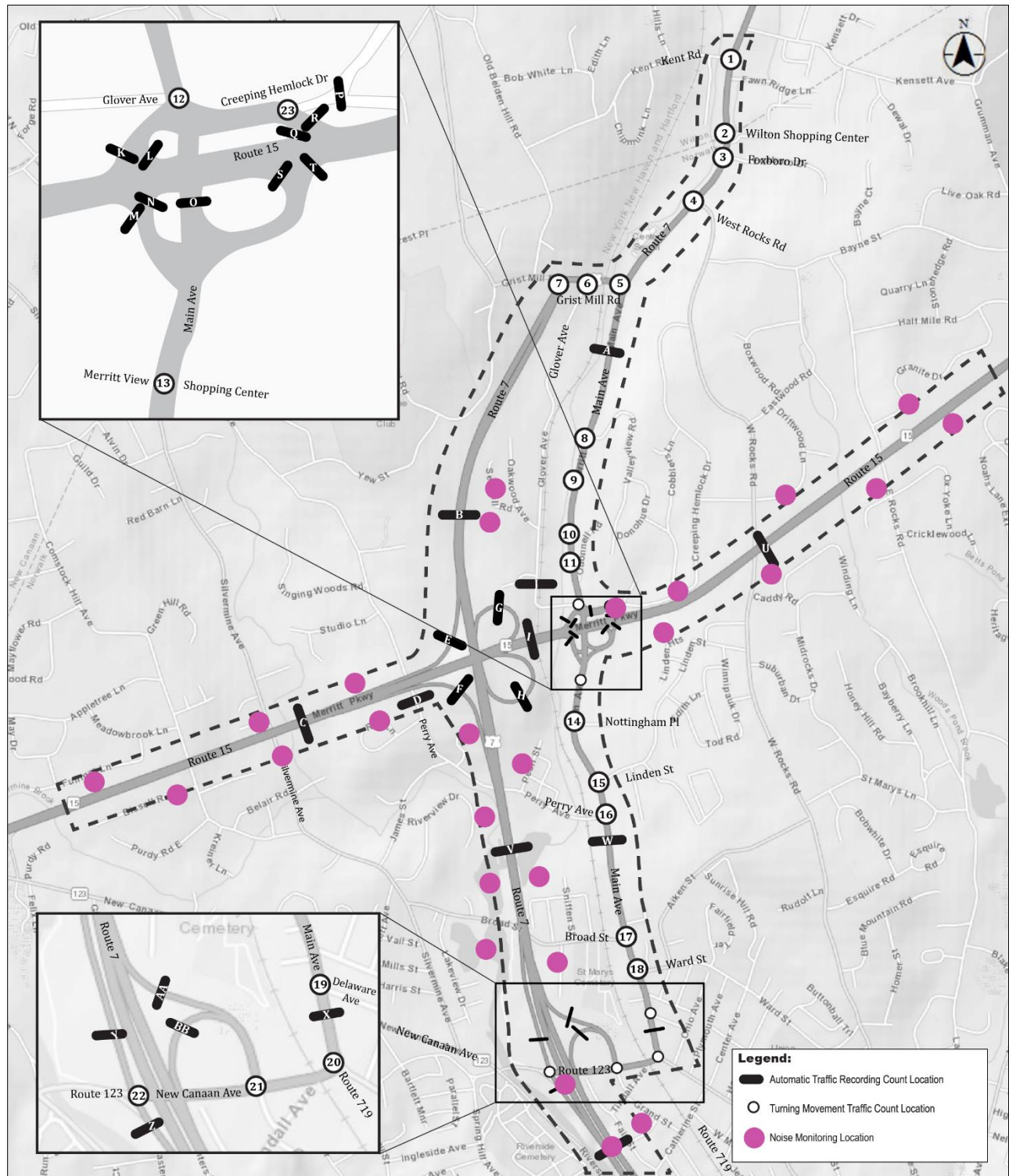


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Figure 3.1: Count Location Map



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3.1.1 Turning Movement Counts (TMC)

2015 TMC data were obtained from CTDOT in 15-minute intervals. Counts were collected on Monday, September 14, 2015 and Tuesday, September 15, 2015 during the AM (7:00 AM to 9:00 AM), midday (11:00 AM to 1:00 PM), and PM (4:00 PM to 6:00 PM) peak periods at the intersections listed in Table 3.1.

Table 3.1: Turning Movement Counts at Selected Intersections, Peak Periods, 2015

Location No.	Description	Type
1	Route 7 at Kent Rd	Signalized
2	Route 7 at Wilton Shopping Center	Signalized
3	Route 7 at Foxboro Dr	Signalized
4	Route 7 at West Rocks Rd	Signalized
5	Grist Mill Rd at Main Ave (CT 719)	Signalized
6	Grist Mill Rd at Glover Ave	Signalized
7	Grist Mill Rd at Route 7	Signalized

The 2016 count program collected TMCs in 15-minute intervals on Tuesday, September 20 and Wednesday, September 21, 2016. Counts were conducted during the AM (7:00 AM to 9:00 AM), midday (11:00 AM to 1:00 PM), and PM (4:00 PM to 6:00 PM) peak periods at the signalized and unsignalized intersections listed in Table 3.2.

Table 3.2: Turning Movement Counts at Selected Intersections, Peak Periods, 2016

Location No.	Description	Type
8	Main Ave at Valley View Rd/Merritt 7 (201/301)	Signalized
9	Main Ave at Merritt 7 (401/501)/Shopping Center	Signalized
10	Main Ave at Merritt 7 (601)	Signalized
11	Main Ave at Merritt River Towers (801/901)	Signalized
12	Main Ave at Glover Avenue/Creeping Hemlock Dr	Signalized
13	Main Ave at Merritt View/Shopping Center	Signalized
14	Main Ave at Nottingham Pl	Unsignalized
15	Main Ave at Linden St	Signalized
16	Main Ave at Perry Ave	Signalized
17	Main Ave at Broad St	Signalized
18	Main Ave at Ward St	Signalized
19	Main Ave at Delaware Ave/Shopping Center	Signalized
20	Main Ave at New Canaan Ave (CT 123)	Signalized
21	New Canaan Ave at NB Route 7 Ramps	Signalized
22	New Canaan Ave at SB Route 7 Ramps	Signalized
23	Creeping Hemlock Dr at SB Route 15 Ramps	Unsignalized



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It should be noted that the intersection of Main Ave at Merritt 7 (101/201) was not analyzed due to ongoing construction at that entrance during the Fall of 2016.

After an evaluation of the TMC data collected at the intersections listed above, the peak hours for the study area were determined to be 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM. The resulting observed AM and PM peak hour traffic volumes were submitted to CTDOT for review and further analysis. CTDOT then produced demand-adjusted volume diagrams for use in Stantec's traffic analyses. These adjustments were necessary in order to accurately analyze traffic operations as the analysis of lower traffic volumes, reflecting the peak hour congestion that is present along study area roadways, would produce more favorable analysis results which would not correlate to actual traffic operations. Furthermore, this would result in more favorable analysis results when evaluating future year traffic conditions with and without proposed improvements. The adjusted AM and PM peak hour traffic volume diagrams are shown in Figure 3.2 and Figure 3.3.

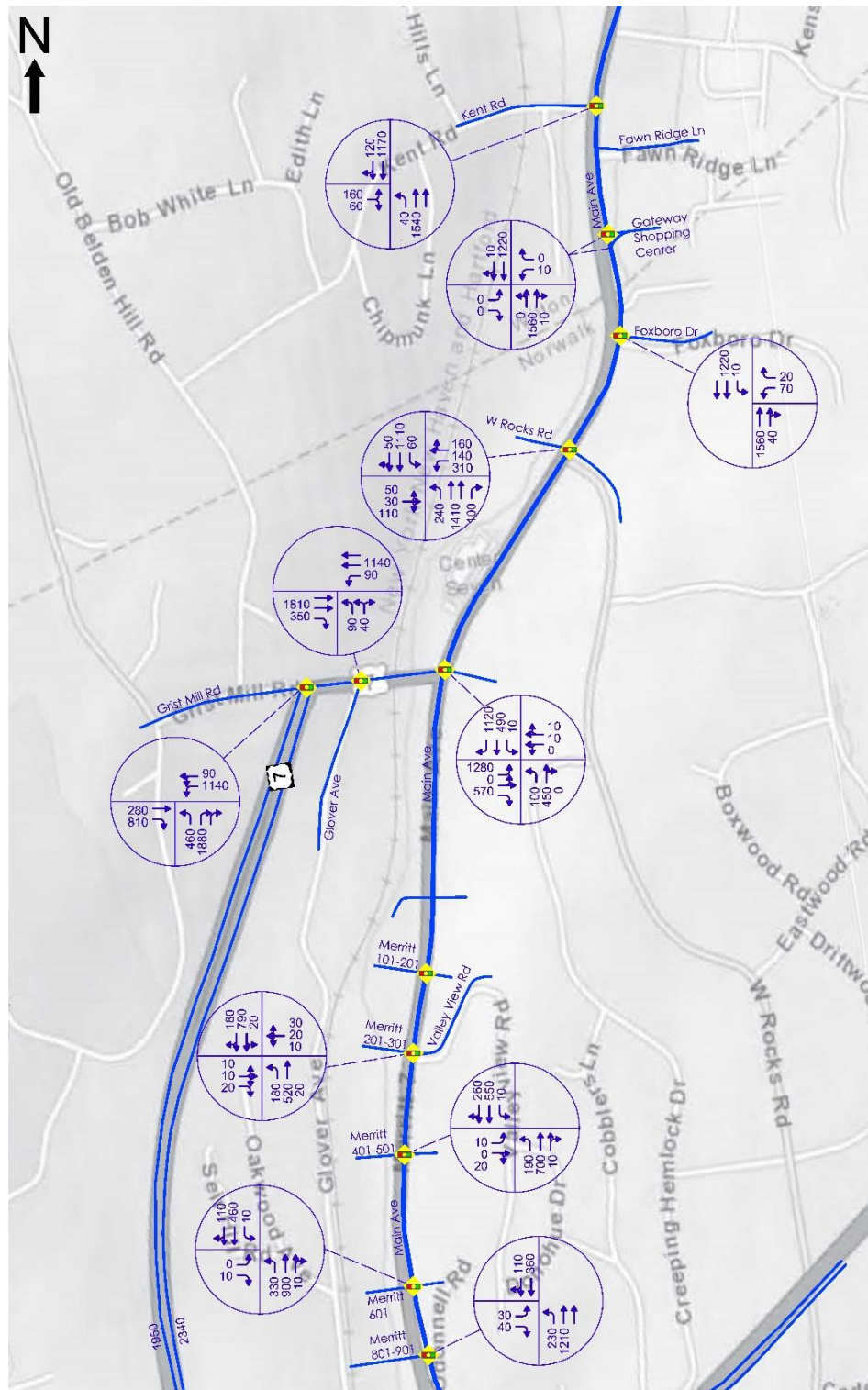


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Figure 3.2: Adjusted 2016 Traffic Volumes, AM Peak Hour 8 AM to 9 AM

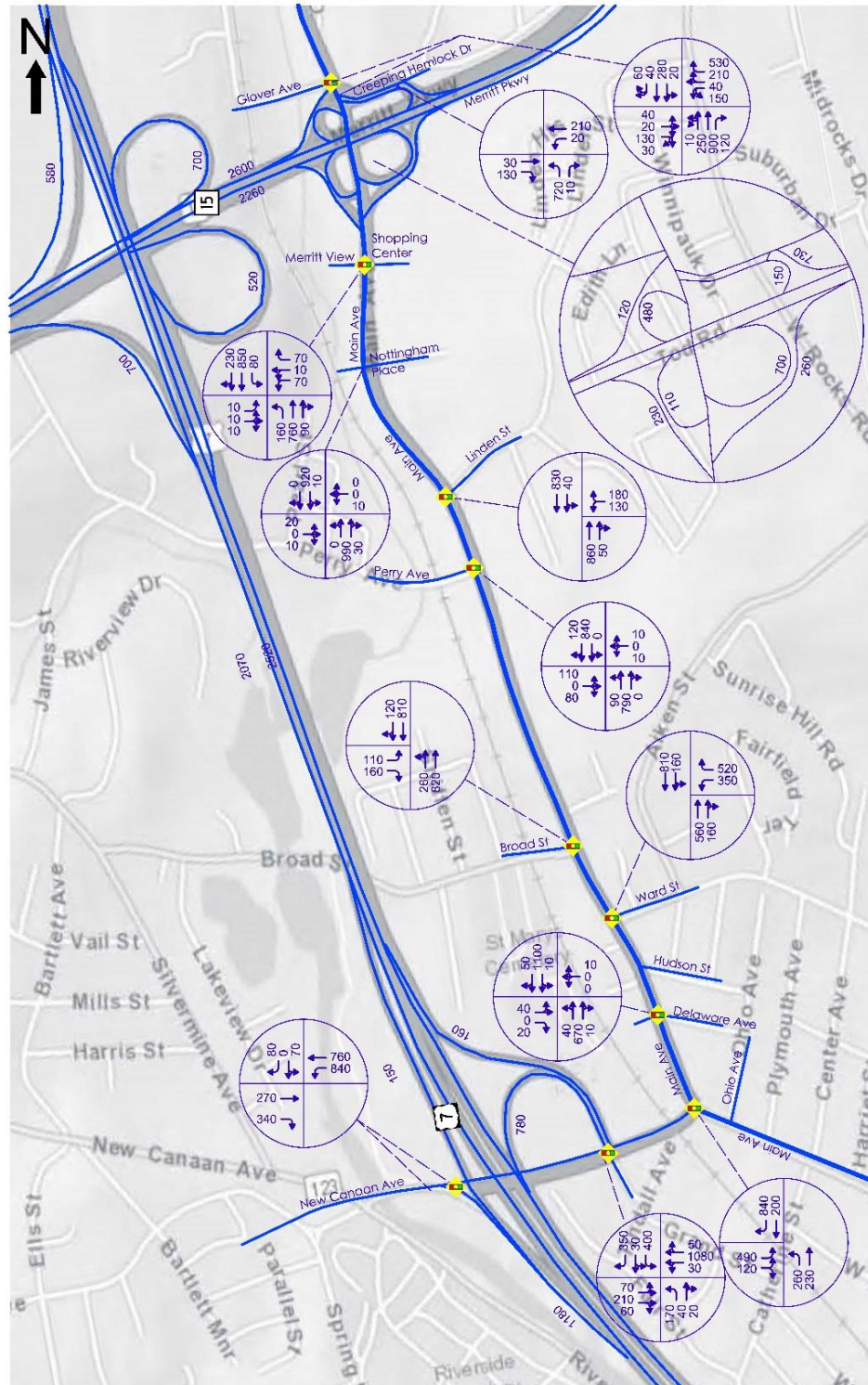


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Figure 3.2: Adjusted 2016 Traffic Volumes, AM Peak Hour 8 AM to 9 AM (continued)

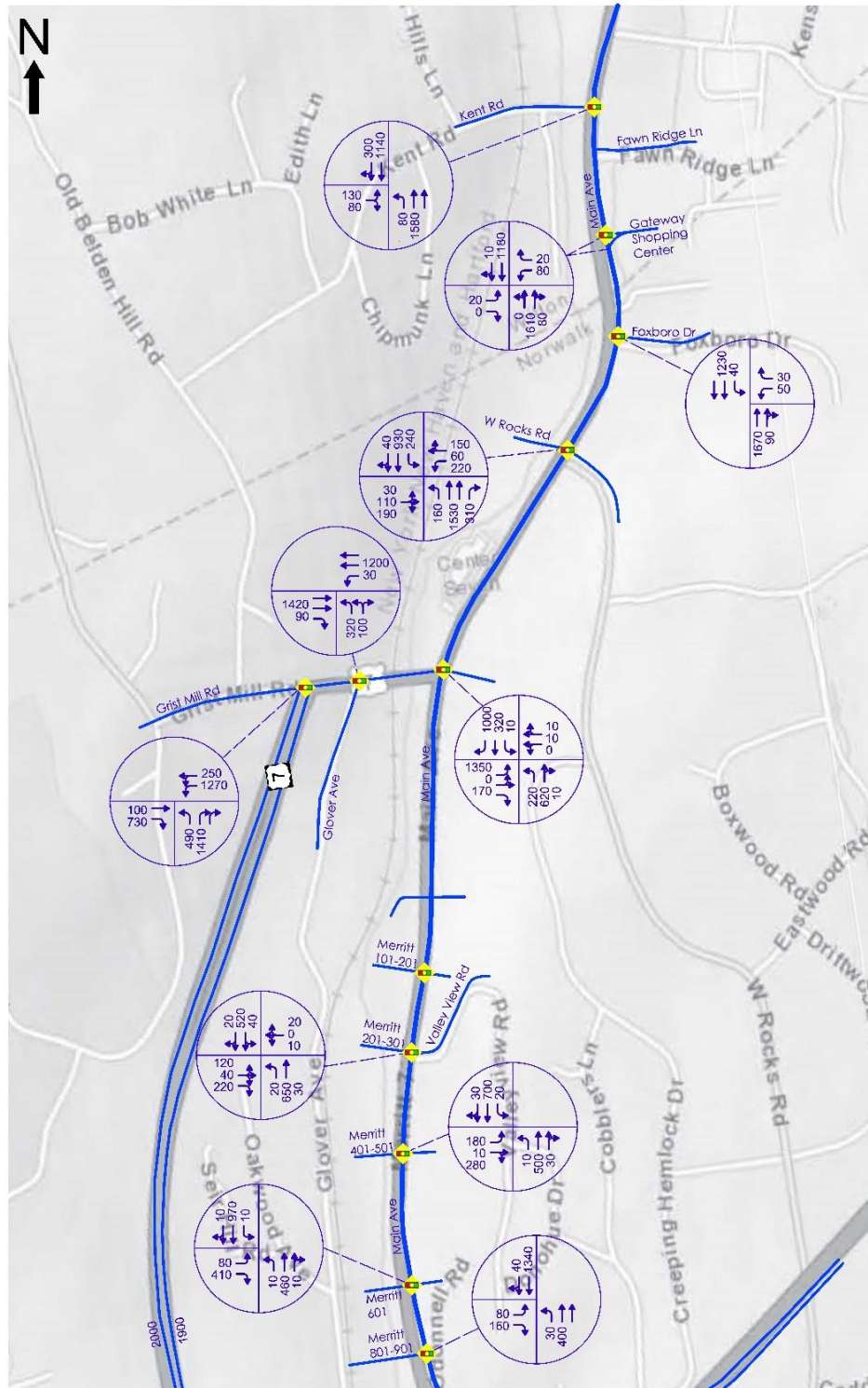


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Figure 3.3: Adjusted 2016 Traffic Volumes, PM Peak Hour 5 PM to 6 PM

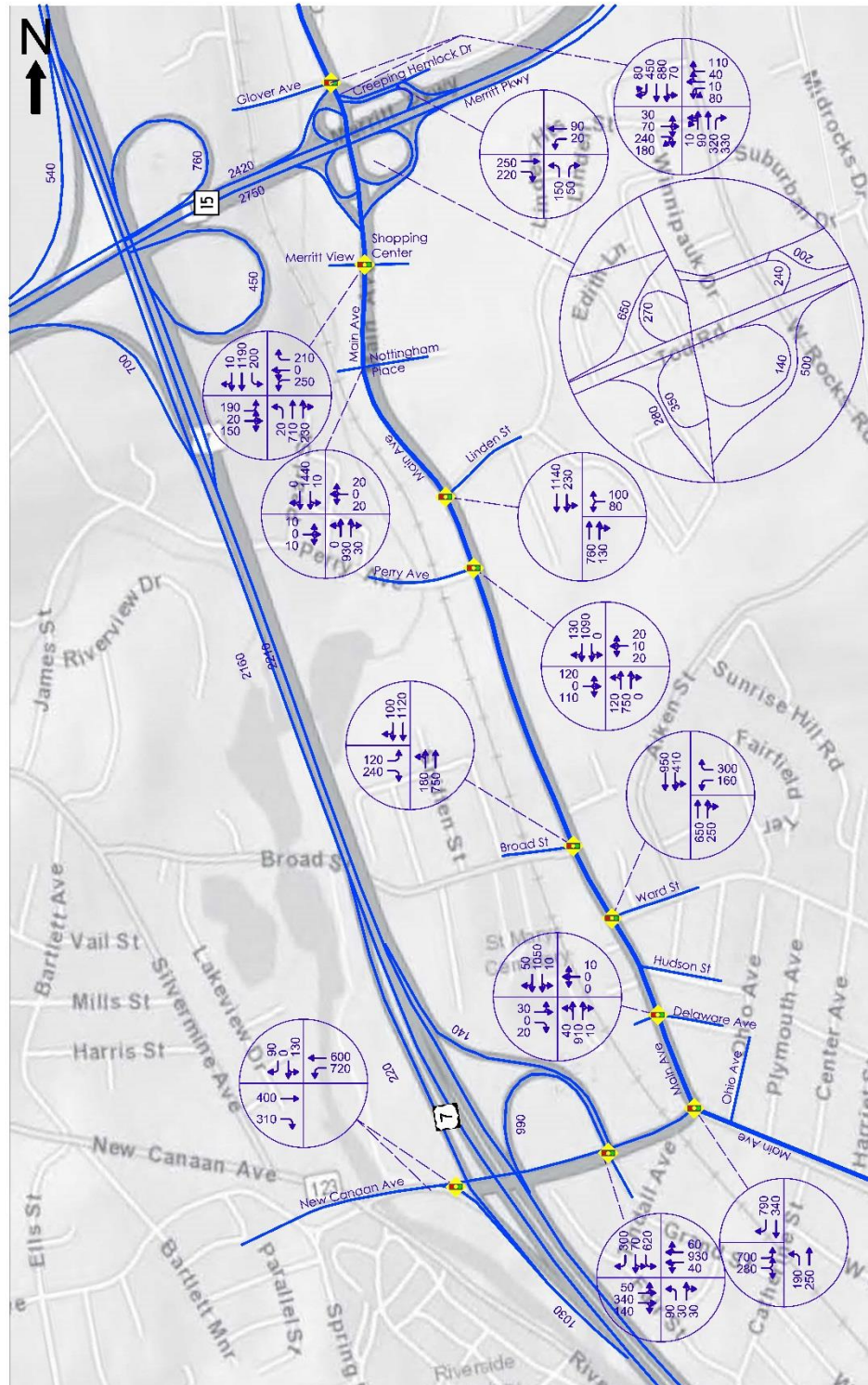


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Figure 3.3: Adjusted 2016 Traffic Volumes, PM Peak Hour 5 PM to 6 PM (continued)



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3.1.2 Automatic Traffic Recorders (ATR)

Automated traffic recorder (ATR) counts were conducted for a 3-day to 7-day period to obtain volume data, 85th percentile speed data, and/or the vehicular classification (“class”) distinction between passenger vehicles and heavy vehicles (e.g., trucks and buses) during a typical weekday. ATRs collected hourly traffic volume data for several weeks in Fall 2016 at the locations identified by Figure 3.1 and summarized in Table 3.3. Video (Miovision) was used to record two full days of traffic data on high-speed roadways on the dates listed in Table 3.3.

Table 3.3: ATR Count Descriptions

Location No.	Description	Type	Dates
A	Main Ave south of Grist Mill Rd	Volume/Speed/Class	12/1 – 12/8
B	Route 7 south of Grist Mill Rd	Volume (Miovision)	9/20 – 9/22
C	Route 15 east of Silvermine Ave	Volume (Miovision)	10/5 – 10/7
D	Perry Ave south of Route 15 overpass	Volume/Speed/Class	12/1 – 12/8
E	SB Route 7 off-ramp to SB Route 15	Volume	9/20 – 9/27
F	NB Route 15 off-ramp to SB Route 7	Volume	9/20 – 9/27
G	NB Route 7 off-ramp to SB Route 15	Volume	9/20 – 9/27
H	NB Route 15 off-ramp to NB Route 7	Volume	9/20 – 9/27
I	Route 15 west of Metro-North underpass	Volume (Miovision)	11/30–12/2
J	Glover Ave west of Metro-North Station	Volume/Speed/Class	12/1 – 12/8
K	SB Route 15 on-ramp from SB Main Ave	Volume	9/20 – 9/27
L	SB Route 15 off-ramp to SB Main Ave	Volume	9/20 – 9/27
M	NB Route 15 off-ramp to SB Main Ave	Volume	9/20 – 9/27
N	NB Route 15 on-ramp from SB Main Ave	Volume	9/20 – 9/27
O	Main Ave south of Route 15 bridge	Volume/Speed/Class	12/1 – 12/8
P	Creeping Hemlock Dr east of SB Route 15 ramps	Volume	9/20 – 9/27
Q	SB Route 15 on-ramp from NB Main Ave	Volume	9/20 – 9/27
R	SB Route 15 off-ramp to NB Main Ave	Volume	12/1 – 12/8
S	NB Route 15 off-ramp to NB Main Ave	Volume	9/20 – 9/27
T	NB Route 15 on-ramp from NB Main Ave	Volume	9/20 – 9/27
U	Route 15 east of West Rocks Rd	Volume (Miovision)	10/4 – 10/6
V	Route 7 south of Perry Ave underpass	Volume (Miovision)	9/20 – 9/22
W	Main Ave north of Broad St	Volume/Speed/Class	12/1 – 12/8



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Location No.	Description	Type	Dates
X	Main Ave south of Delaware Ave	Volume/Speed/Class	12/1 – 12/8
Y	SB Route 7 off-ramp to Route 123	Volume/Class	9/20 – 9/27
Z	SB Route 7 on-ramp from Route 123	Volume/Class	9/20 – 9/27
AA	NB Route 7 on-ramp from Route 123	Volume/Class	9/20 – 9/27
BB	NB Route 7 off-ramp to Route 123	Volume/Class	12/1 – 12/8
CC	Route 7 south of New Canaan Ave	Volume (Miovision)	10/4 – 10/7

It should be noted that 85th percentile speed data could only be obtained along local roadways as CTDOT prohibits the collection of speed data along the Merritt Parkway and Route 7 due to safety concerns. To collect 85th percentile speed data safely along limited access roadways, travel time runs were performed (see Section 3.2 for more information).

3.1.2.1 Volumes by Day of Week

An examination of peak hour data collected by the ATRs confirms the AM and PM peak hours, as determined by TMC data, of 8:00 AM to 9:00 AM and 5:00 PM to 6:00 PM. Comparisons of average Tuesday to Thursday (average weekday) data to Saturday and Sunday data for four locations along Main Avenue (where weekend data was collected) are presented in Figure 3.4 through Figure 3.7. The comparisons confirm that weekend peak hour volumes are generally lower than highest weekday peak hour volumes. It should be noted that Saturday midday peak hour traffic is slightly higher than weekday midday peak hour traffic at locations south of interchange 40, which is primarily due to traffic that is destined to various commercial uses along the Main Avenue corridor; however, these volumes are still lower than weekday peak hour volumes, further validating that the weekday peak hours represent the highest volumes of traffic in the study area. These graphs also show that the hourly volumes are more even throughout the day over the weekend whereas the average weekday volumes fluctuate more rapidly.



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Figure 3.4: Traffic Volumes by Day of Week (ATR Location A; Main Ave south of Grist Mill Rd)

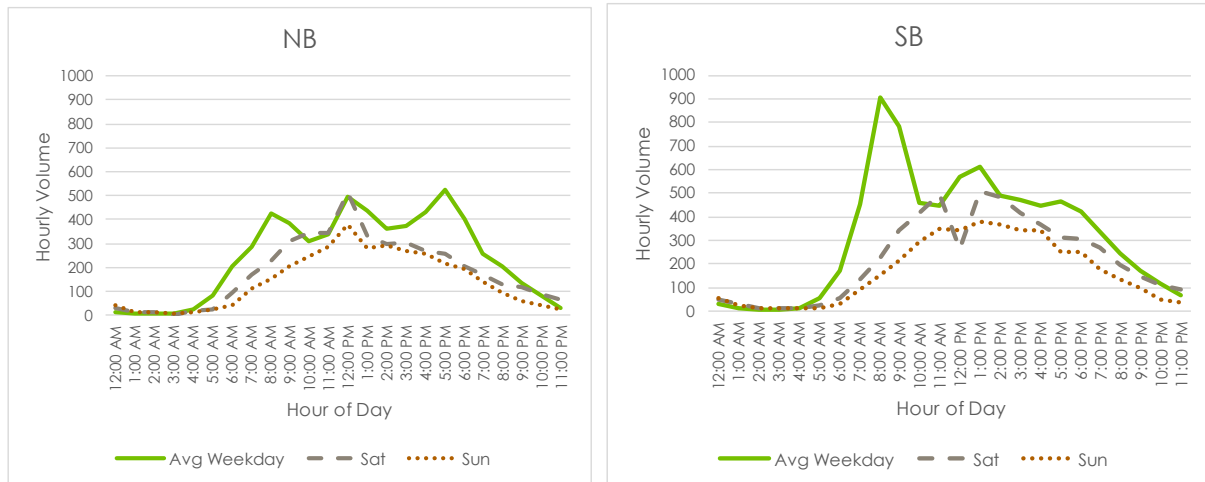
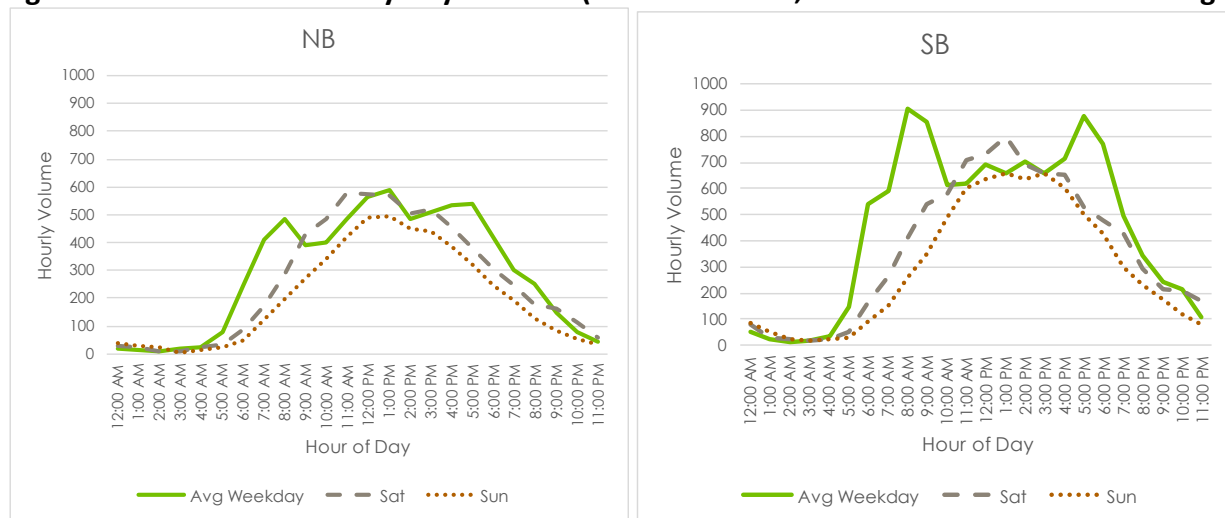


Figure 3.5: Traffic Volumes by Day of Week (ATR Location O; Main Ave south of Rt. 15 Bridge)



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Figure 3.6: Traffic Volumes by Day of Week (ATR Location W; Main Ave north of Broad St)

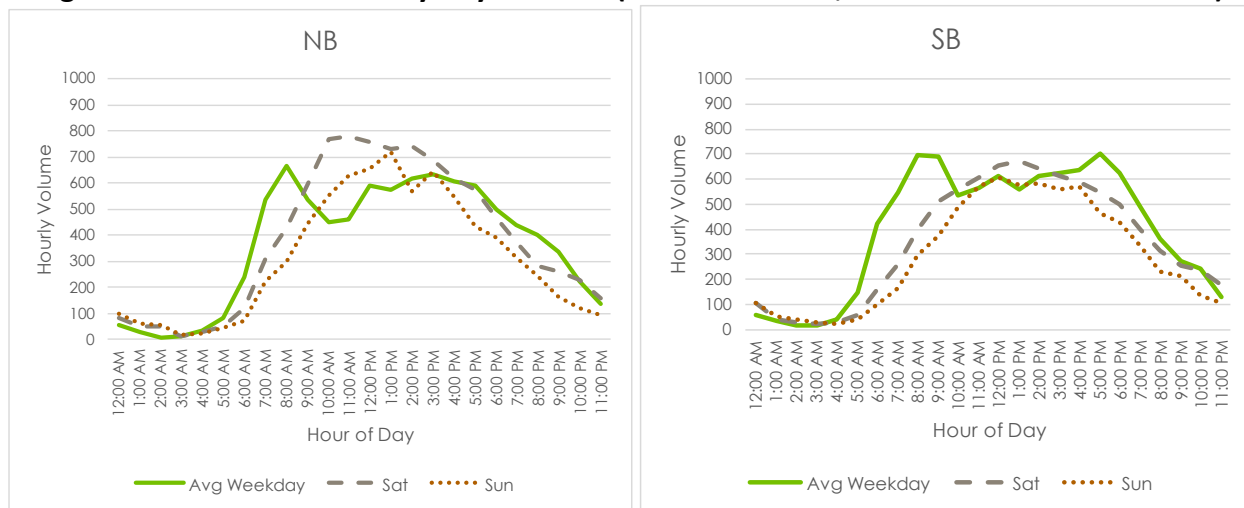


Figure 3.7: Traffic Volumes by Day of Week (ATR Location X; Main Ave south of Delaware Ave)



3.1.2.2 Average Weekday Corridor Volumes

Hourly profiles presented in Figure 3.8 through Figure 3.10 show the variation in traffic volumes along the three major study corridors.

Along Route 15 (both west of the Route 7 interchange and east of the Main Avenue interchange), weekday traffic peaks in the southbound direction during the AM peak hour and in the northbound direction during the PM peak hour. The corridor carries a maximum of 3,400 vehicles per hour in the peak direction. Between the Route 7 and Main Avenue interchanges, the hourly distributions are similar. The overall trend on Route 15 is typical of commuter flows and signifies



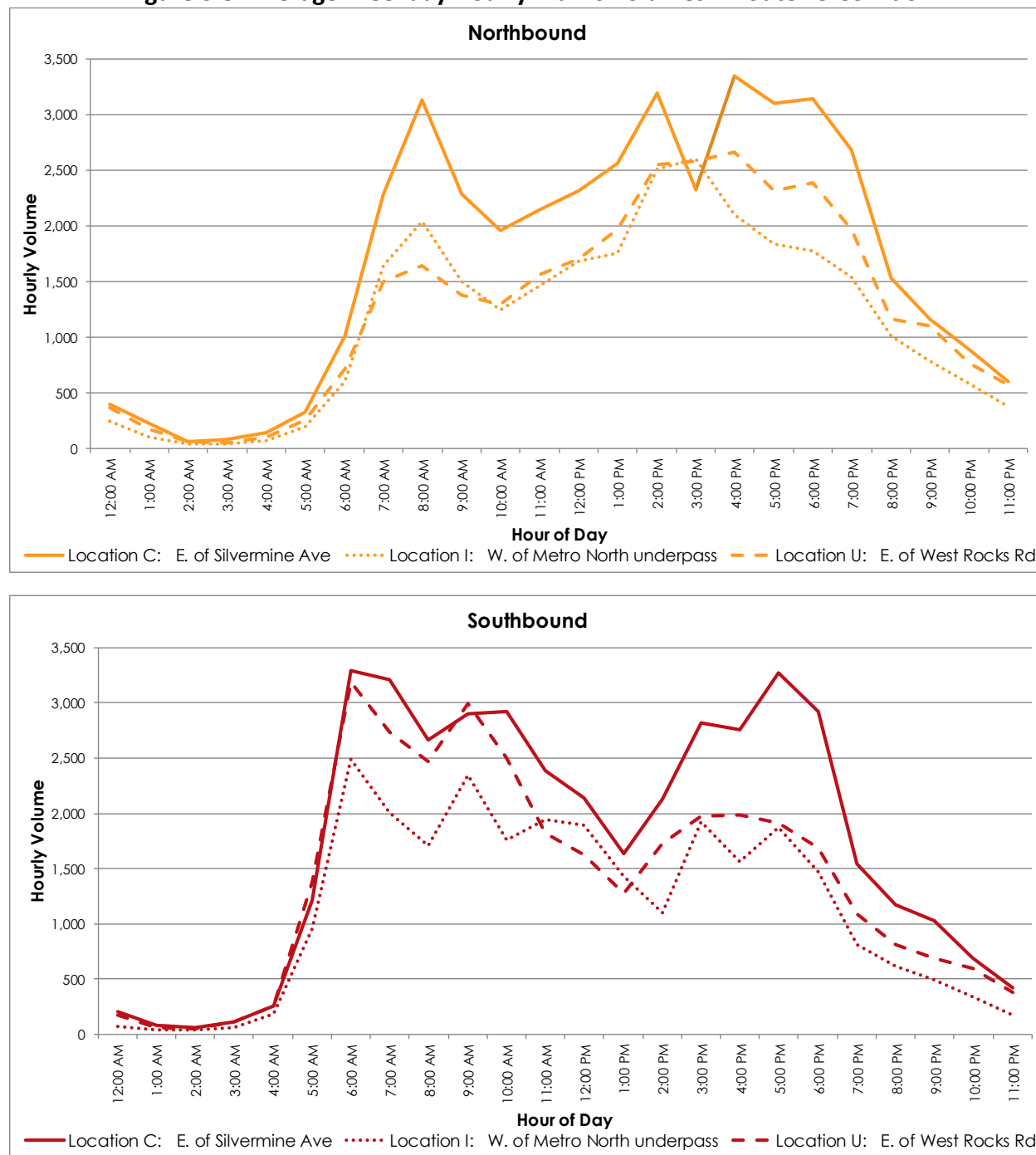
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local travel to work in Norwalk, Stamford, and points further south from towns and cities to the east. The similar distribution of traffic on Route 15 between Route 7 and Main Avenue is indicative of north-south traffic whom use either Route 7 or Main Avenue to connect between Route 7 and I-95.

Figure 3.8: Average Weekday Hourly Traffic Volumes – Route 15 Corridor



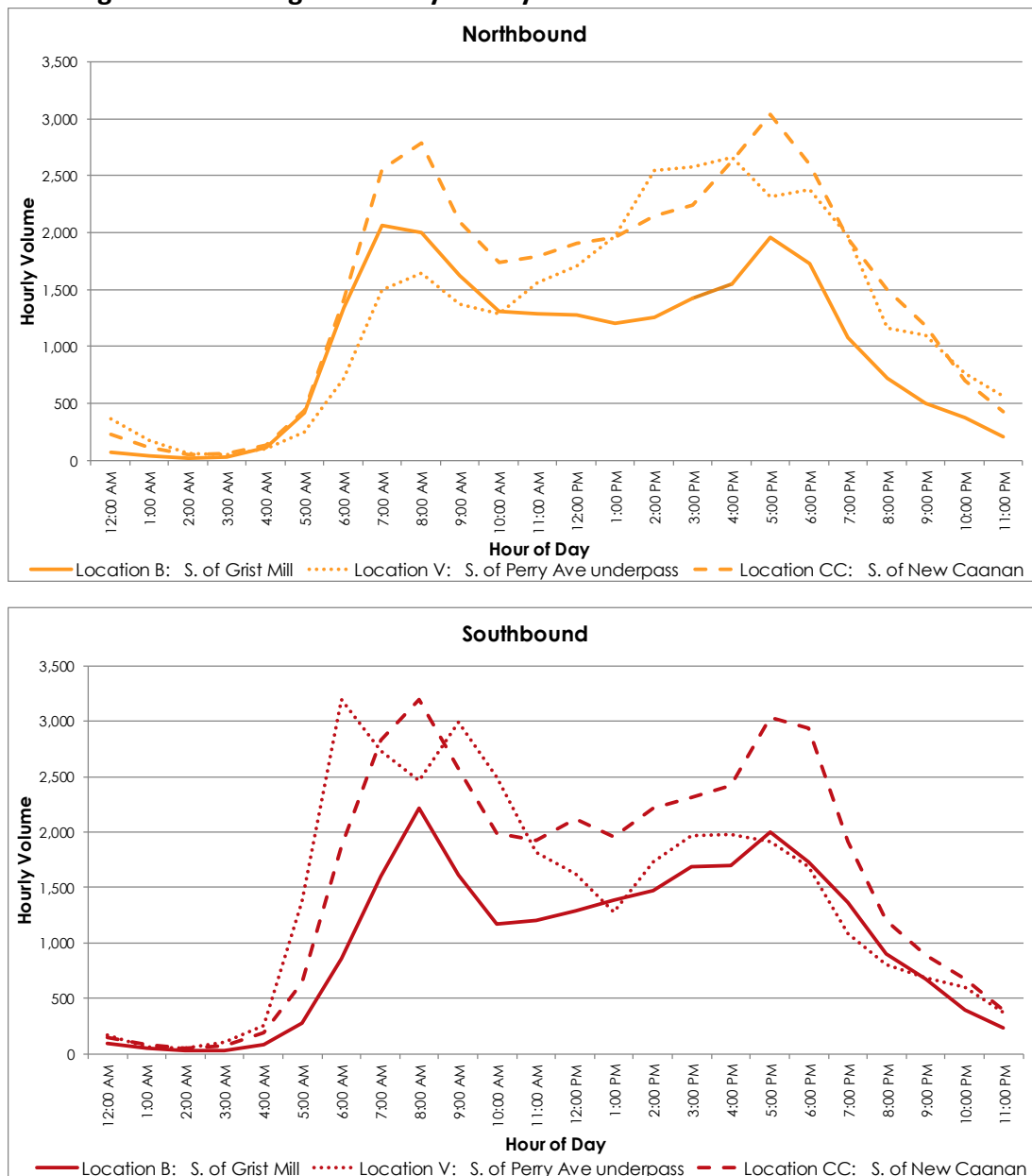
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The AM and PM hourly volume peaks are more even on Route 7, shown by Locations CC and B in Figure 3.9, and on Route 15 west of the Main Avenue interchange (Location C). Overall, the corridor carries a maximum of 3,200 vehicles per hour in the peak direction. This trend is indicative of corridors that serves as thoroughfares in both directions during the peak hours. Location V (Route 7 between the Route 15 and New Canaan Ave interchanges), peaks in the southbound direction in the morning and in the northbound direction in the evening.

Figure 3.9: Average Weekday Hourly Traffic Volumes – Route 7 Corridor



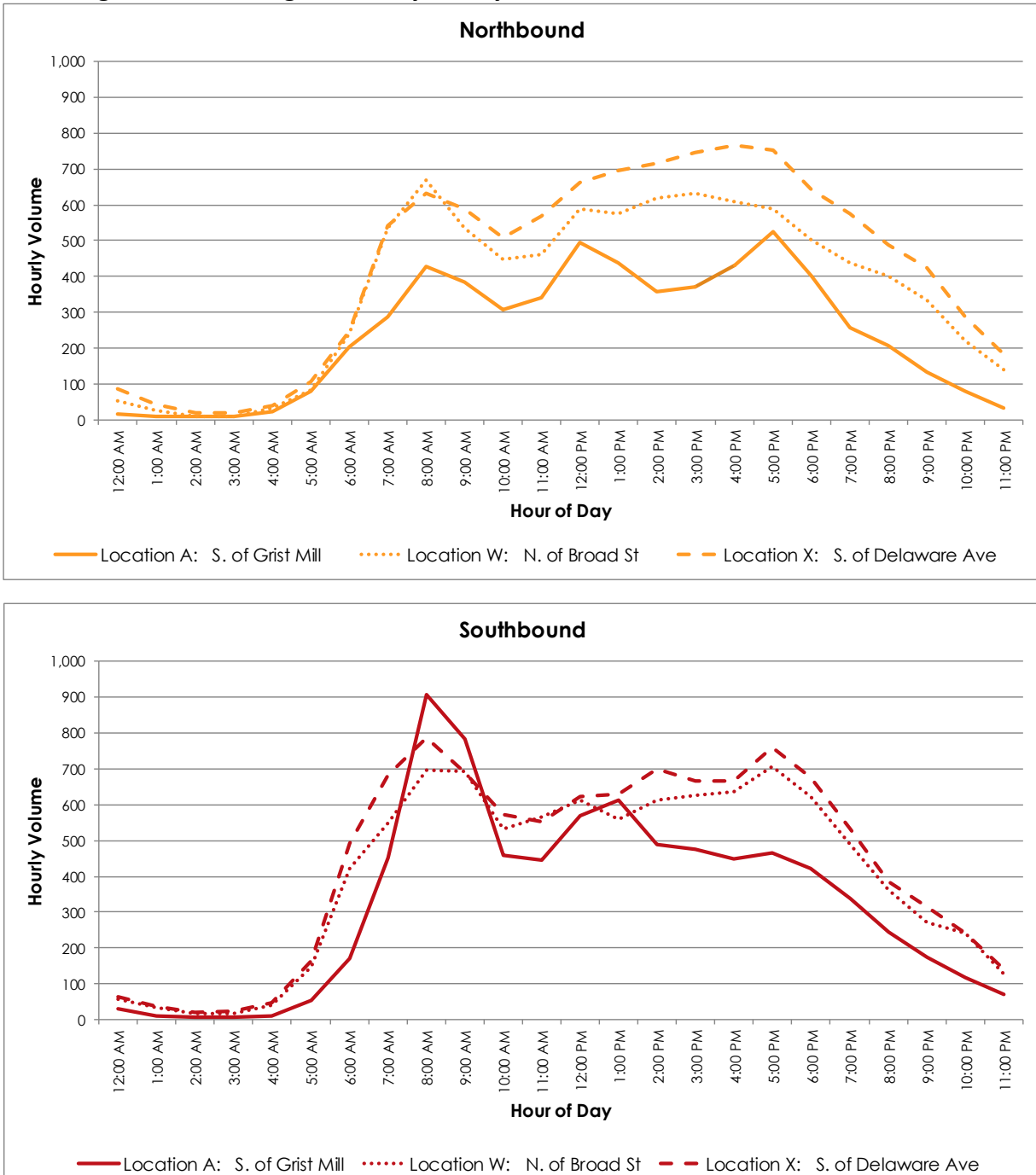
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The hourly distribution of traffic along Main Avenue is generally a bit more even than on both Route 7 and Route 15. The Main Avenue corridor carries a maximum of 900 vehicles per hour in the peak direction.

Figure 3.10: Average Weekday Hourly Traffic Volumes – Main Avenue Corridor



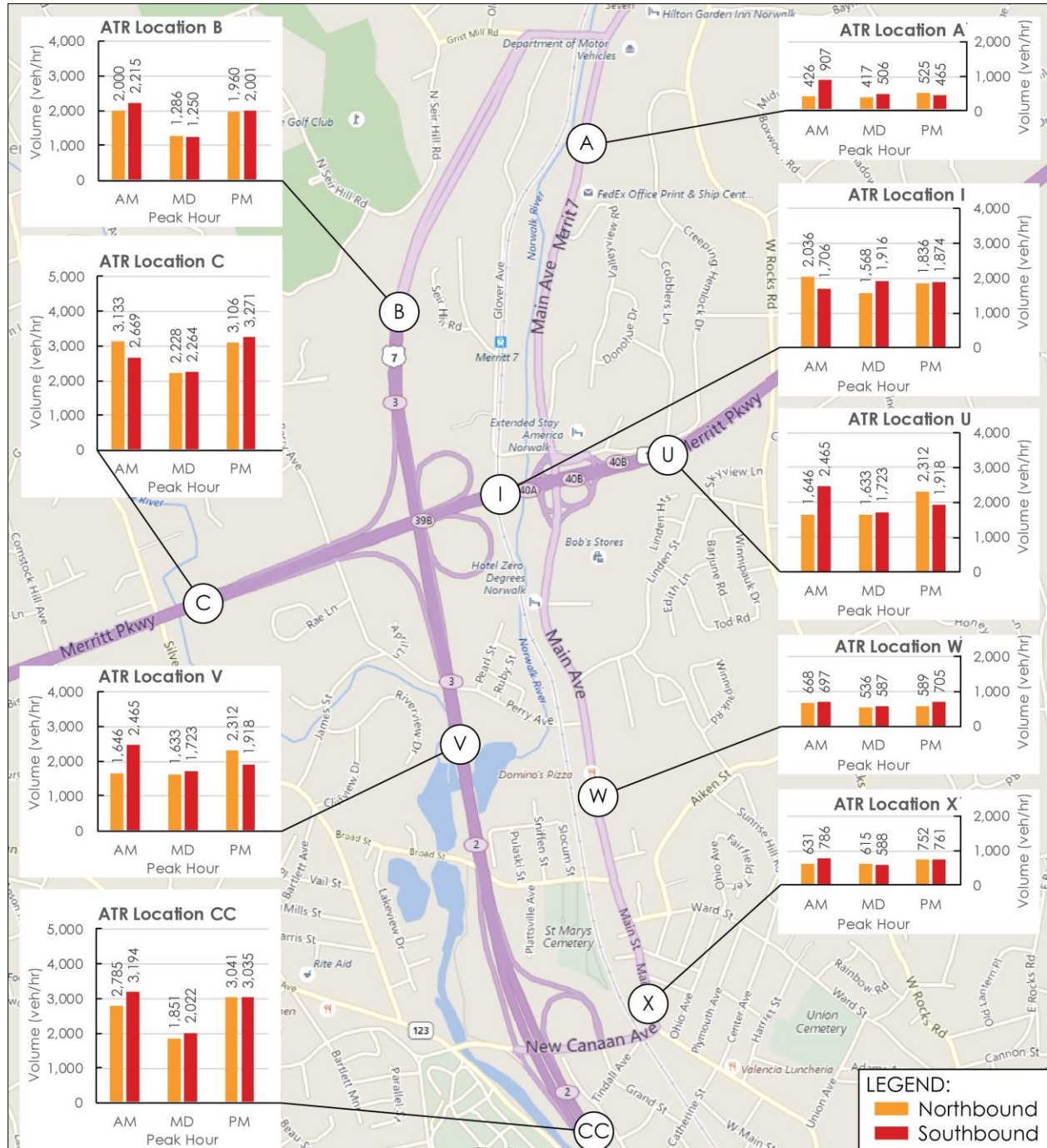
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Figure 3.11 compares the average weekday peak hour volumes in both directions at various locations. As previously stated, weekday morning and evening peak hour traffic volumes are generally greater than weekday midday peak hour traffic volumes.

Figure 3.11: Average Weekday Peak Hour Traffic Volumes – Various Corridors



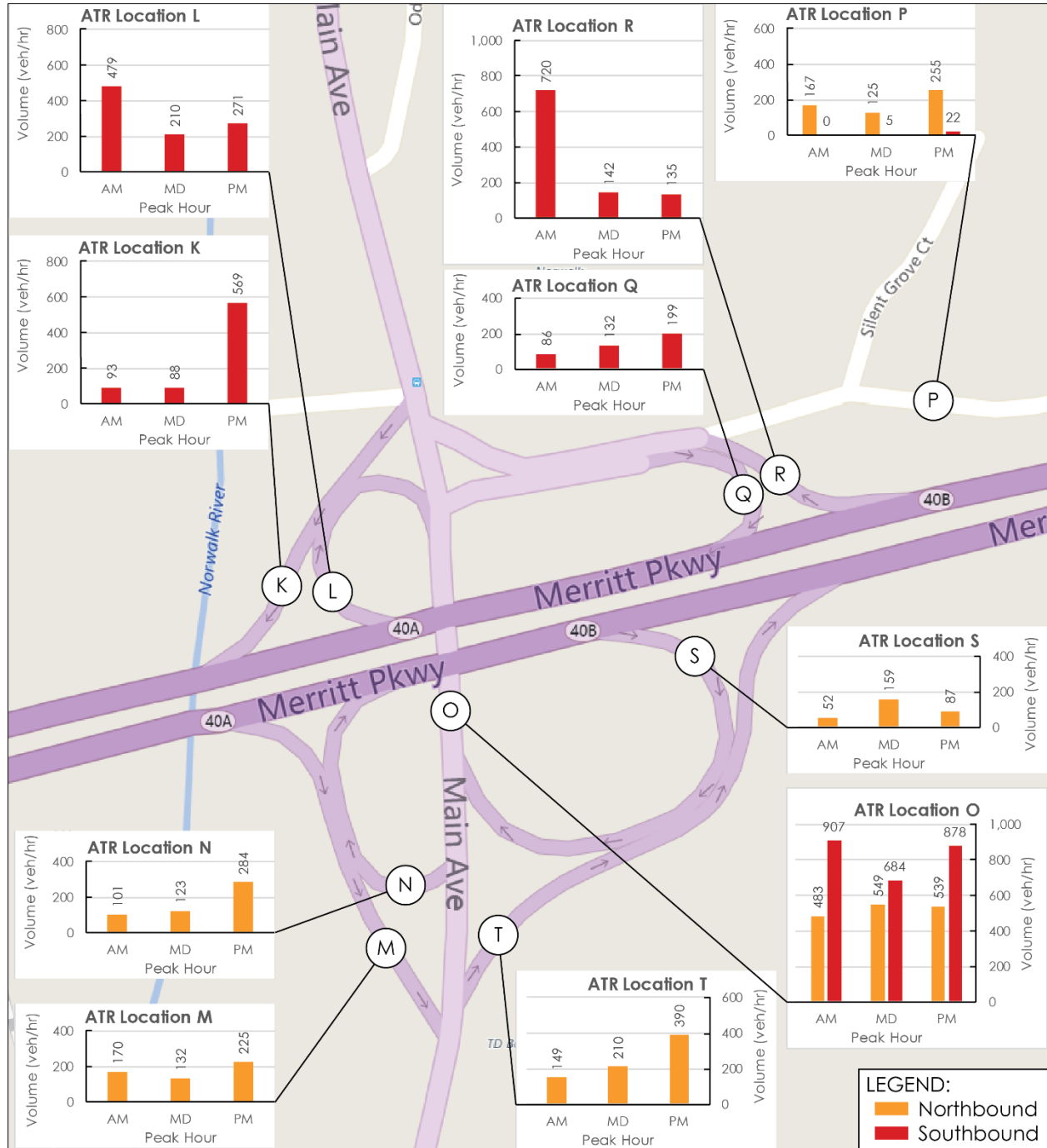
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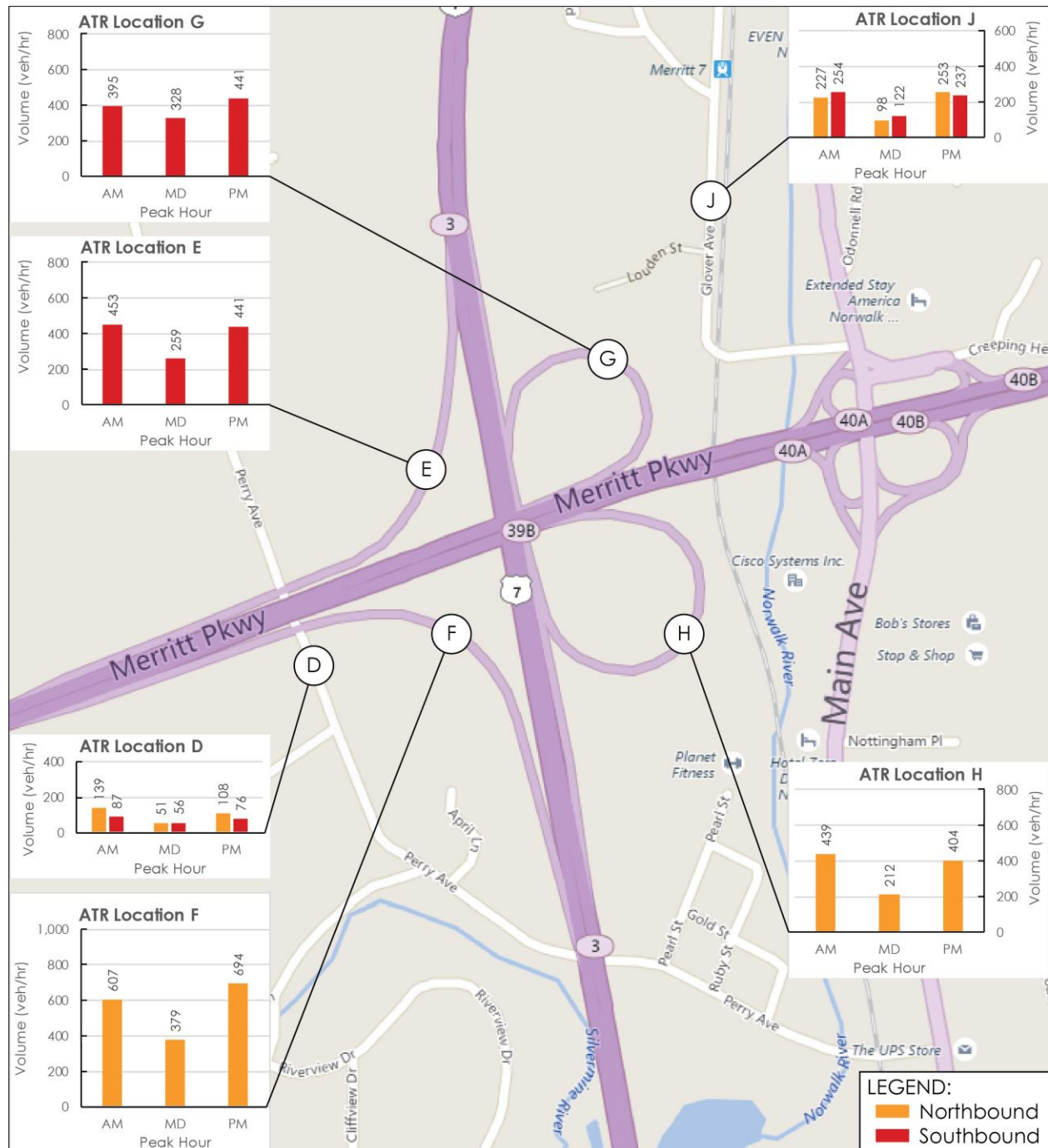
Figure 3.12, Figure 3.13, and Figure 3.14 show the average weekday peak hour volumes at certain key intersections within the traffic study area.

Figure 3.12: Average Weekday Peak Hour Traffic Volumes – Main Avenue at Route 15 Interchange



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Figure 3.13: Average Weekday Peak Hour Traffic Volumes – Route 7/15 Interchange, Perry Avenue, and Glover Avenue

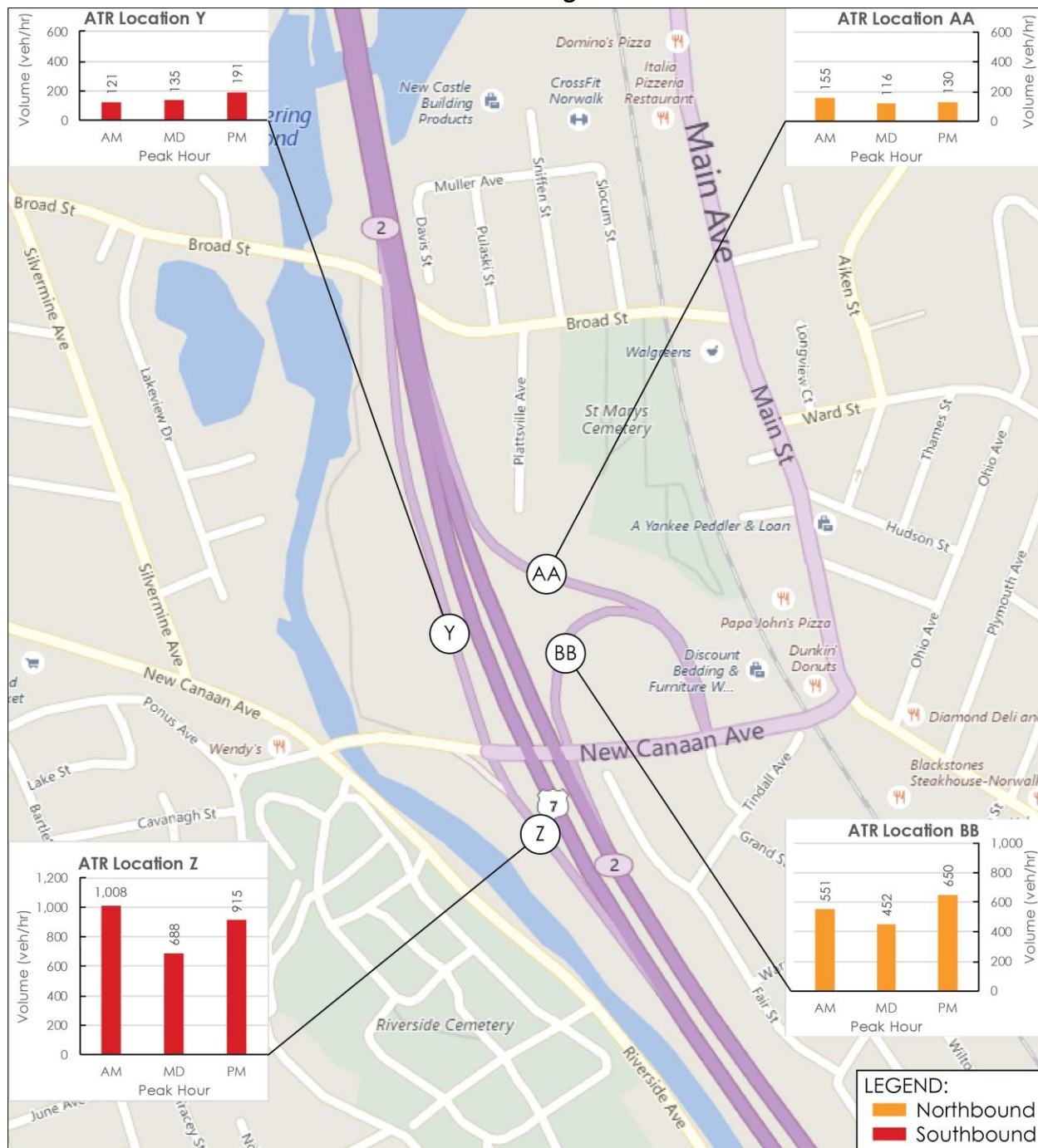


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Figure 3.14: Average Weekday Peak Hour Traffic Volumes – Route 7 and New Canaan Avenue Interchange



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3.1.3 Heavy Vehicles

Peak period classification data showed that truck traffic as a percentage of total traffic volume varied between zero and seven percent along the Main Avenue corridor. Truck traffic percentages on the Route 7 ramps to and from the north averaged between one and three percent. Truck traffic percentages were higher – between five and eight percent – on the Route 7 ramps to and from the south. No trucks travel on Route 15 since trucks are prohibited.

3.2 TRAVEL SPEEDS

3.2.1 Travel Time Studies

Travel time studies were conducted on Tuesday, September 20 and Wednesday, September 21, 2016 during the AM and PM peak periods using the floating car method and data collected from a GPS device. During the AM peak period, delay and queuing was recorded on Route 15 in the southbound direction from West Rocks Road to Route 123, averaging as low as nine miles per hour (mph) through the Main Avenue and Route 7 interchanges. The PM peak period experienced delays in the northbound direction along the same segments (Table 3.4). Observed speeds from the Route 15 travel time runs conducted in the off-peak directions (northbound in the AM peak and southbound in the PM peak) are shown in Figure 3.15 and Figure 3.16. Speeds along the Route 15 corridor were observed to be free-flow, or 50 mph or greater. It was observed to take about 8 minutes to travel the 6.5-mile segment of Route 15 in either off-peak period direction.

Table 3.4: Route 15 Peak Period Travel Speed Summary

Route 15 Speeds (MPH)		Northbound		Southbound	
Segment From	Segment To	AM	PM	AM	PM
Route 123	Silvermine Rd	59	<u>39</u>	<u>20</u>	48
Silvermine Rd	Route 7	59	<u>20</u>	<u>9</u>	-
Route 7	Main Ave	49	<u>10</u>	<u>9</u>	<u>3</u>
Main Ave	West Rocks Rd	-	<u>10</u>	<u>12</u>	<u>29</u>

*Underlined speeds indicate travel speeds greater than or equal to 10 mph below speed limit.

Note: Some segments missing data due to circuitous travel route during data collection.

Figure 3.17 shows the northbound observed speeds from two of the Route 15 PM peak period travel time runs. Northbound congestion begins as early as 4:00 PM east of Route 123 and east of Route 53 towards Wilton. By 5:30 PM, congestion is along the entire length of the corridor with speeds of 25 mph or less between Route 7 and Route 33. As observed by the travel time runs, it takes about 20 minutes to travel the 6.5-mile northbound section of Route 15 in evening.

During the AM peak period, southbound Route 15 speeds are mostly 35 mph or less around 7:30 AM as shown by Figure 3.18. After 9:00 AM, speeds are somewhat faster with segments more severe congestion near New Canaan Avenue/Route 123. To travel southbound on this 6.5-mile segment in the morning, it can take 20 to 30 minutes as determined by the travel time runs.

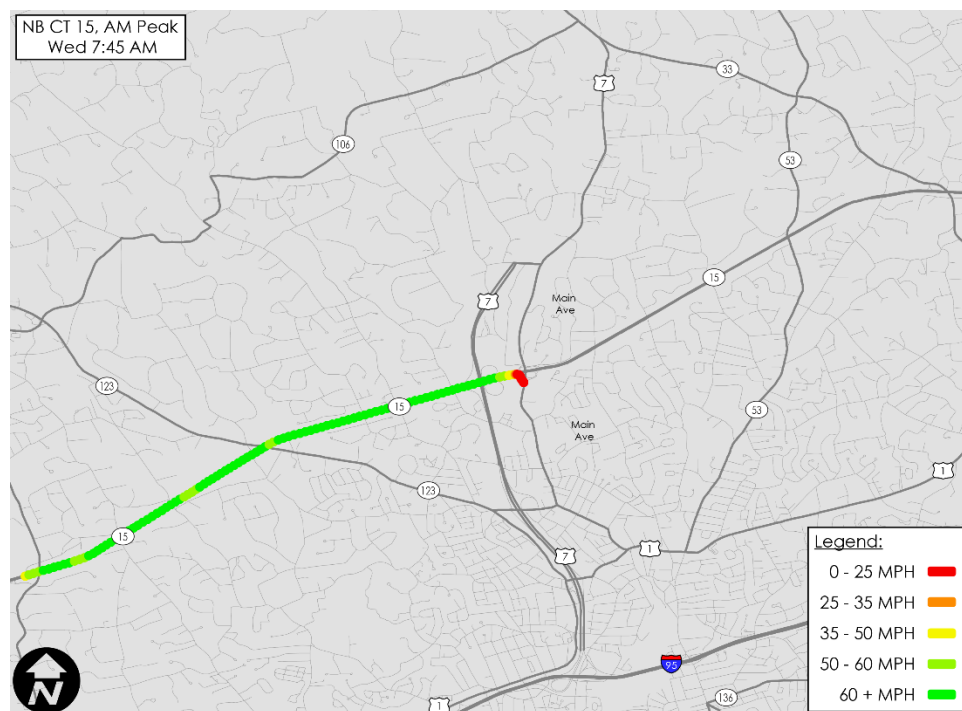
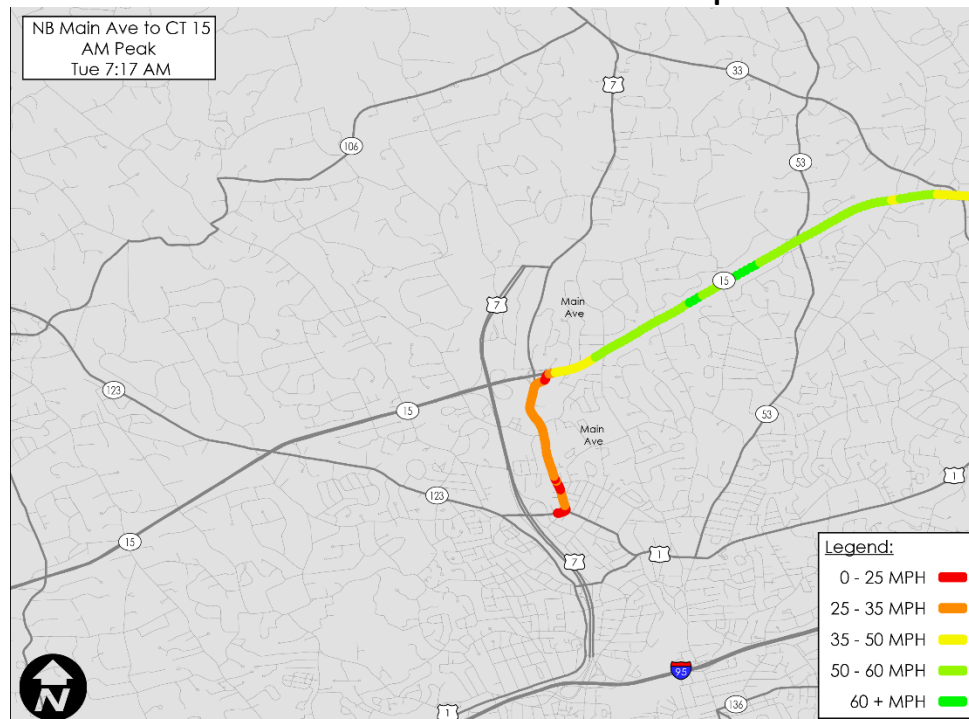


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Figure 3.15: Northbound Main Ave and Route 15 Travel Speeds – AM Peak Period

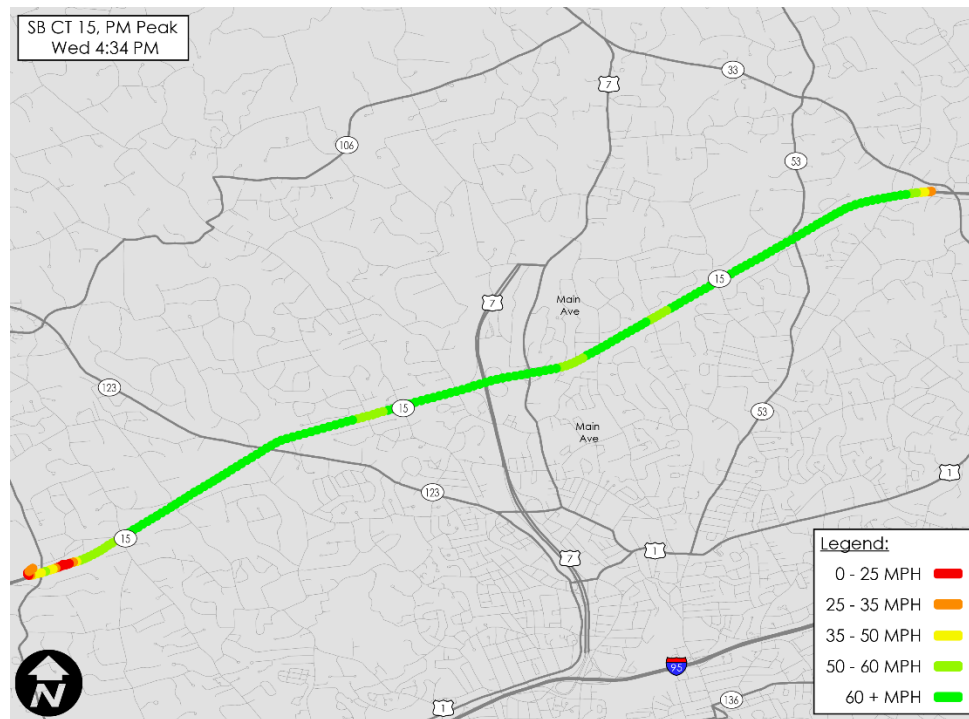
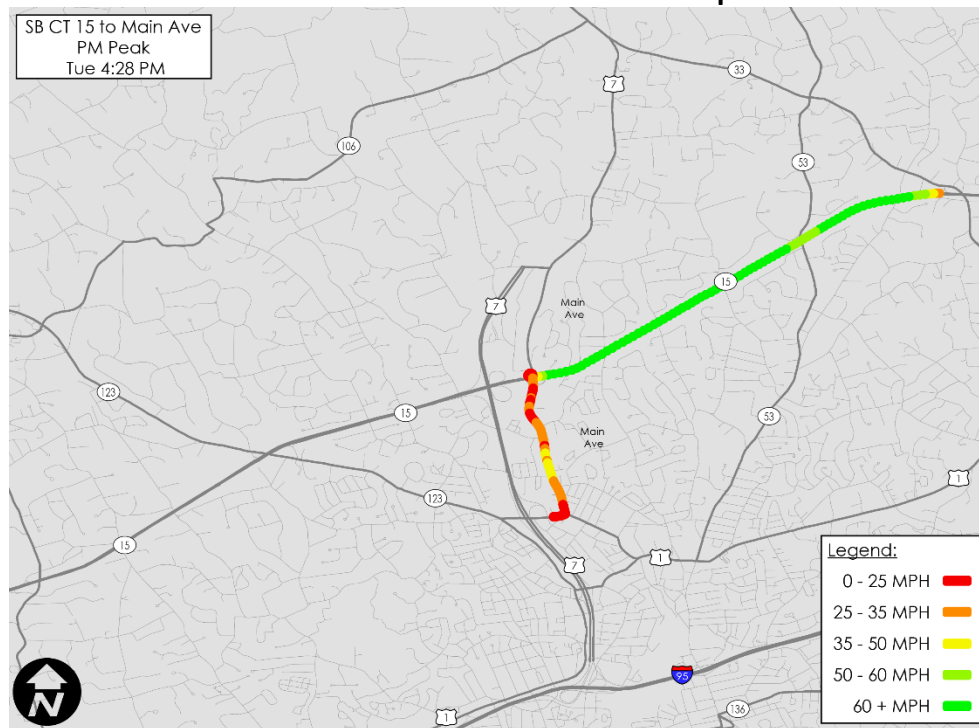


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Figure 3.16: Southbound Route 15 and Main Ave Travel Speeds – PM Peak Period

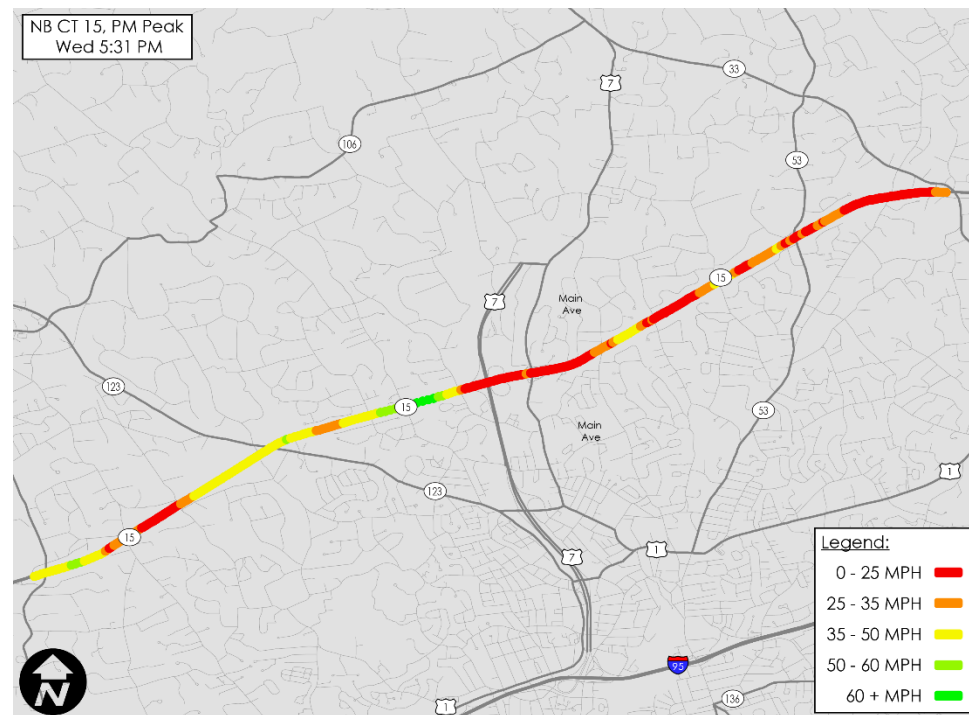
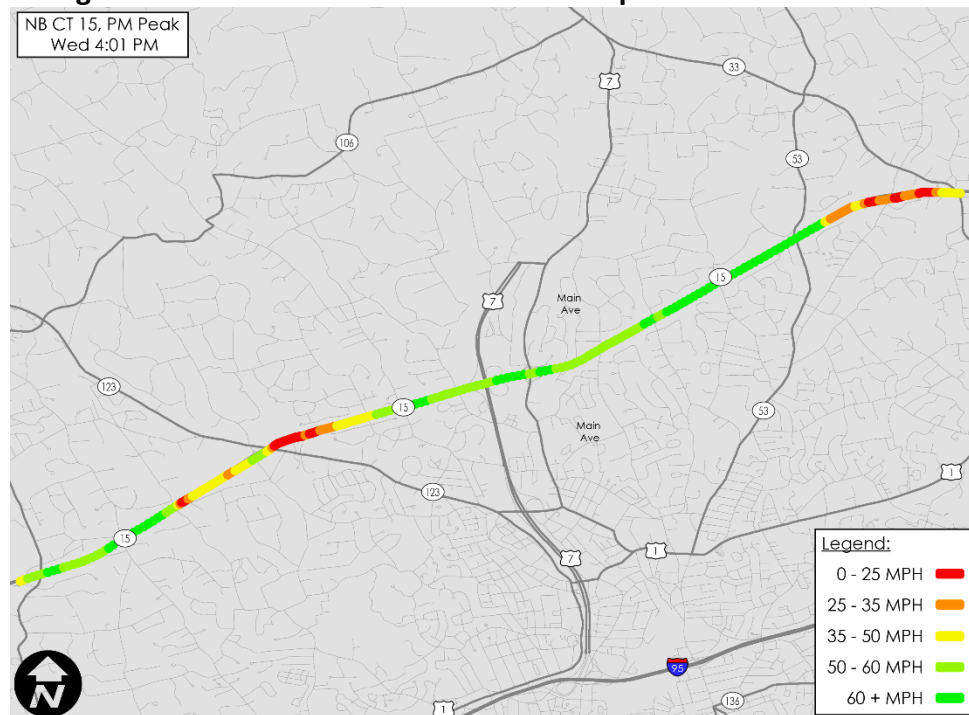


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Figure 3.17: Northbound Route 15 Travel Speeds – PM Peak Period

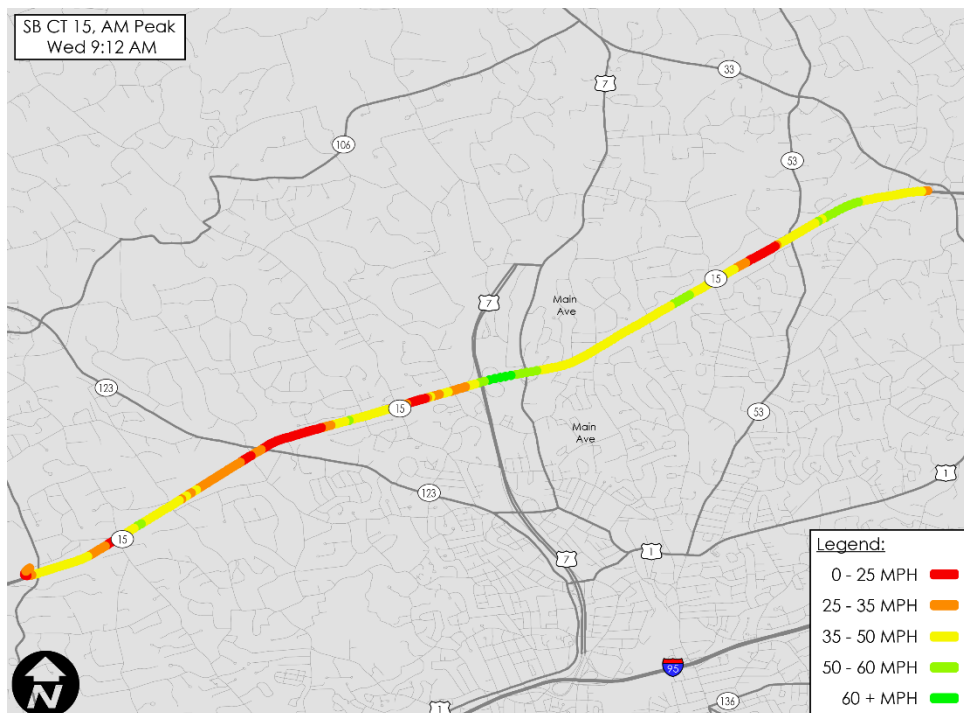
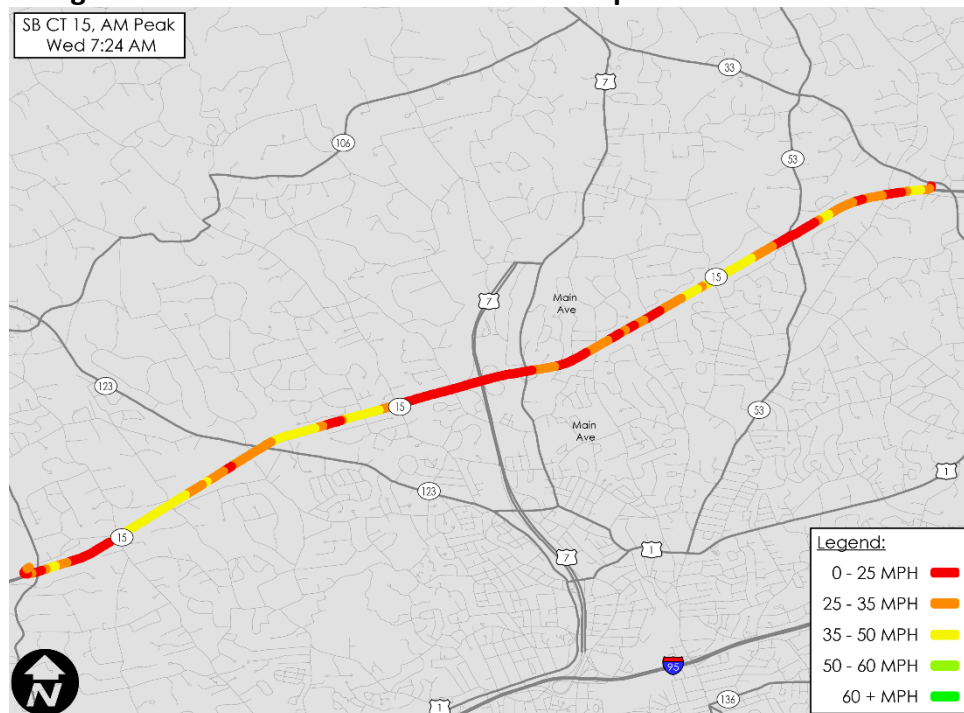


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Figure 3.18: Southbound Route 15 Travel Speeds – AM Peak Period



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Route 7 experiences congestion along the signalized corridor in the northbound and southbound directions during both the AM and PM peak periods. The heaviest Route 7 congestion occurs along Grist Mill Road to Main Avenue and sometimes further north to West Rocks Road. During the PM peak period, some delay and queuing was recorded on Route 7 between Route 123 and the Norwalk River in both directions (Table 3.5), primarily due to the changes in topography at this area.

Table 3.5: Route 7 Peak Period Travel Speed Summary

Route 7 Speeds (MPH)		Northbound		Southbound	
Segment From	Segment To	AM	PM	AM	PM
Route 123	Broad St	60	<u>22</u>	63	<u>15</u>
Broad St	Route 15	58	69	67	75
Route 15	Grist Mill Rd	56	<u>28</u>	57	62
Grist Mill Rd	Main Ave	<u>7</u>	<u>7</u>	<u>7</u>	<u>6</u>
Main Ave	Kensett Ave	<u>17</u>	<u>13</u>	<u>11</u>	-

*Underlined speeds indicate travel speeds greater than or equal to 10 mph below speed limit.

Note: Some segments missing data due to circuitous travel route during data collection.

Figure 3.19 through Figure 3.22 present observed speeds collected during travel time studies along Route 7. As shown in these maps, speeds of 25 mph or less were observed to be isolated to northern segments close to Grist Mill and Main Avenue (signalized intersections are along this portion of the corridor). Generally, the travel time runs showed that it took less than 5 minutes to traverse the 2.5-mile segment of Route 7 between Route 123 and Main Avenue despite the queuing at the northern portion of the corridor.



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Figure 3.19: Northbound Route 7 Travel Speeds – AM Peak Period

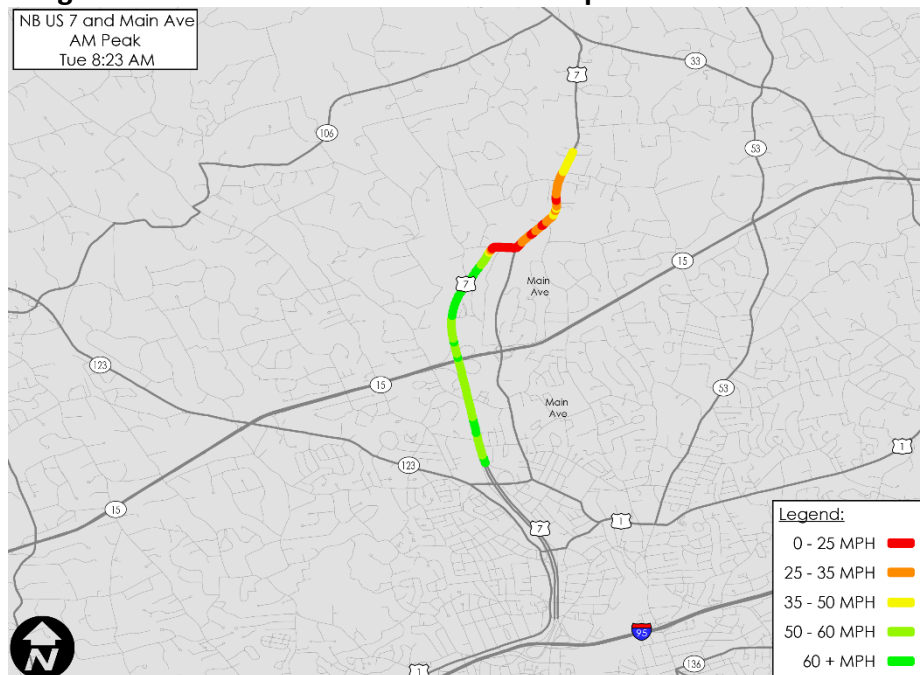
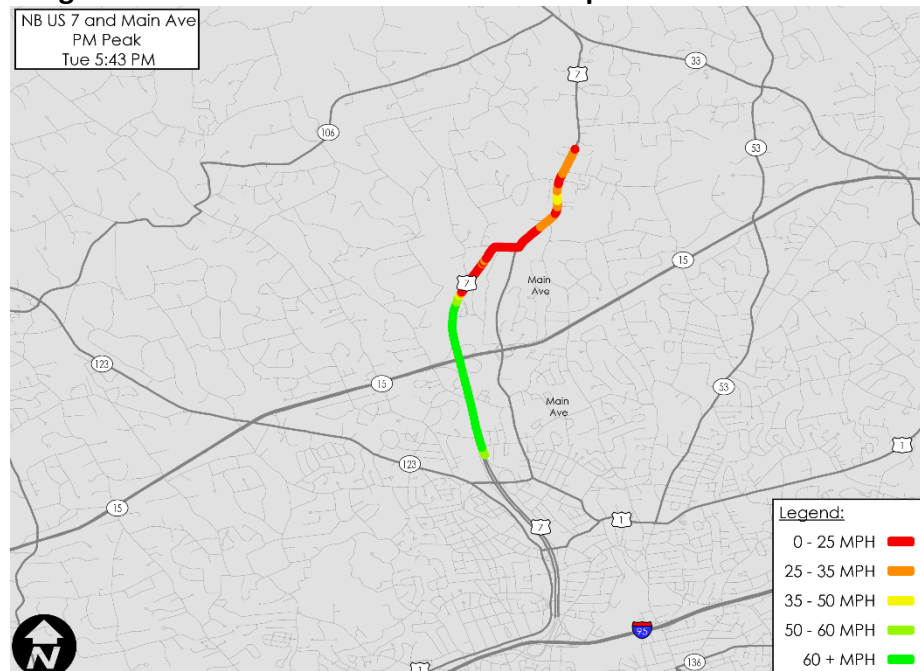


Figure 3.20: Northbound Route 7 Travel Speeds – PM Peak Period



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Figure 3.21: Southbound Route 7 Travel Speeds – AM Peak Period

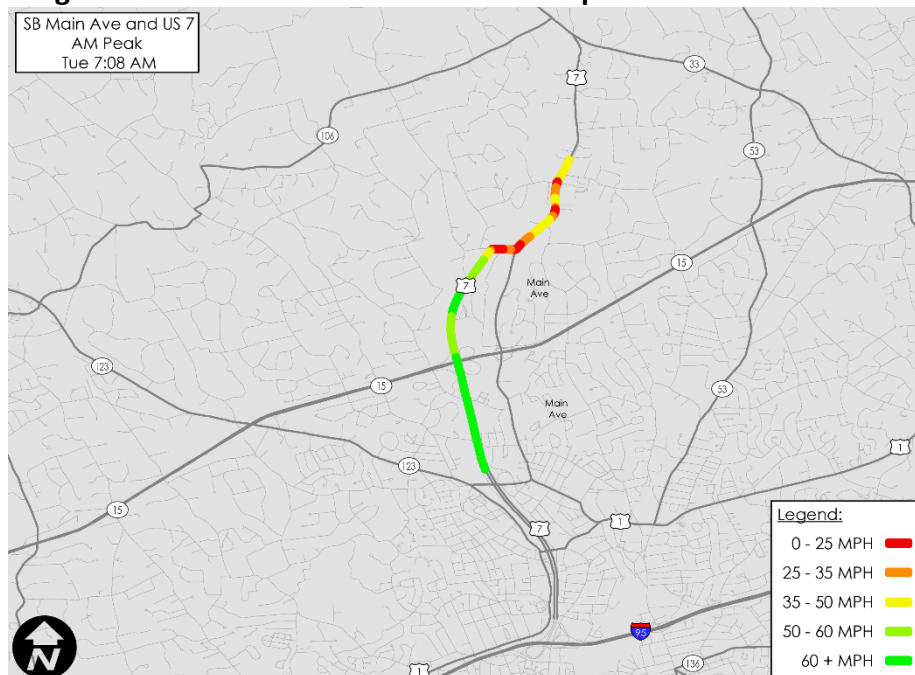
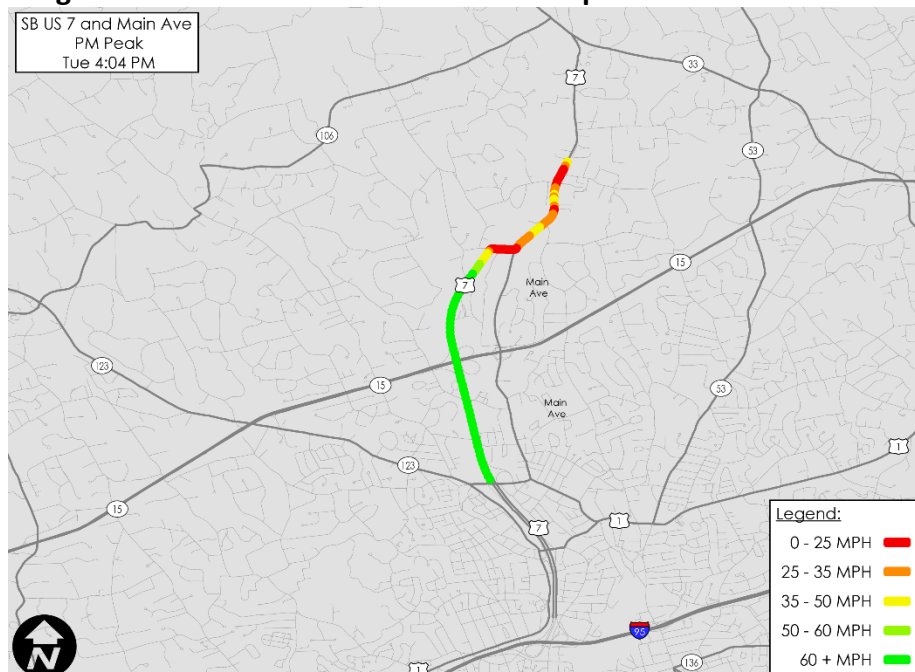


Figure 3.22: Southbound Route 7 Travel Speeds – PM Peak Period



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Main Avenue experiences periodic congestion along the signalized corridor in the northbound and southbound directions during both the AM and PM peak periods. The heaviest Main Avenue congestion occurs during the PM peak period between New Canaan and Glover Avenue. Traffic north of Grist Mill Road was observed to be particularly affected by left-turning vehicles entering and exiting businesses. This observation was prevalent in both directions and both AM and PM peak periods.

Table 3.6 Main Avenue Peak Period Travel Speed Summary

Route 7 Travel Speeds (MPH)		Northbound		Southbound	
Segment From	Segment To	AM	PM	AM	PM
Route 123	Broad St	31	<u>15</u>	<u>11</u>	24
Broad St	Perry Ave	34	36	28	<u>15</u>
Perry Ave	Linden St	<u>7</u>	<u>18</u>	36	<u>5</u>
Linden St	Merritt View/Stop & Shop	24	<u>5</u>	34	30
Merritt View/Stop & Shop	Glover Ave	<u>15</u>	<u>14</u>	21	26
Glover Ave	Merritt River Towers 801/901	31	37	<u>5</u>	26
Merritt River Towers 801/901	Merritt 601	34	45	<u>22</u>	<u>19</u>
Merritt 601	Merritt 401/501 / Shopping Center	43	37	37	37
Merritt 401/501 / Shopping Center	Valley View Rd / Merritt 201/301	39	39	39	39
Valley View Rd / Merritt 201/301	Grist Mill Rd	26	<u>15</u>	37	41
Grist Mill Rd	Kensett Ave	<u>19</u>	<u>21</u>	<u>13</u>	<u>21</u>

*Underlined speeds indicate travel speeds greater than or equal to 10 mph below speed limit.

Figure 3.23 through Figure 3.26 present the observed speeds for each travel time run along the Main Avenue corridor. These maps reflect the behavior of a congested, signalized corridor such that all speeds are less than 50 mph with small segments of speeds slower than 25 mph close to the signalized intersections. It was observed to take between 7 and 11 minutes to travel this 2.75-mile segment of Main Avenue with the longest travel time occurring during the PM peak period in the northbound direction (11 minutes), and second-longest travel time occurring during the AM peak period in the southbound direction (9 minutes). There are 17 signals along this 2.75-mile segment of Main Avenue.



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Figure 3.23: Northbound Main Ave Travel Speeds – AM Peak Period

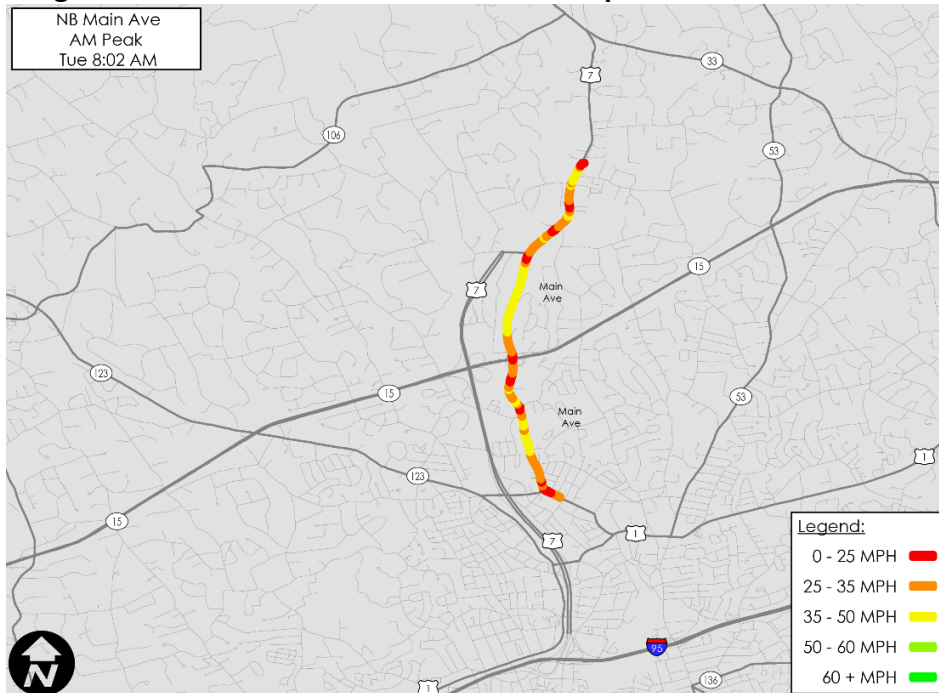
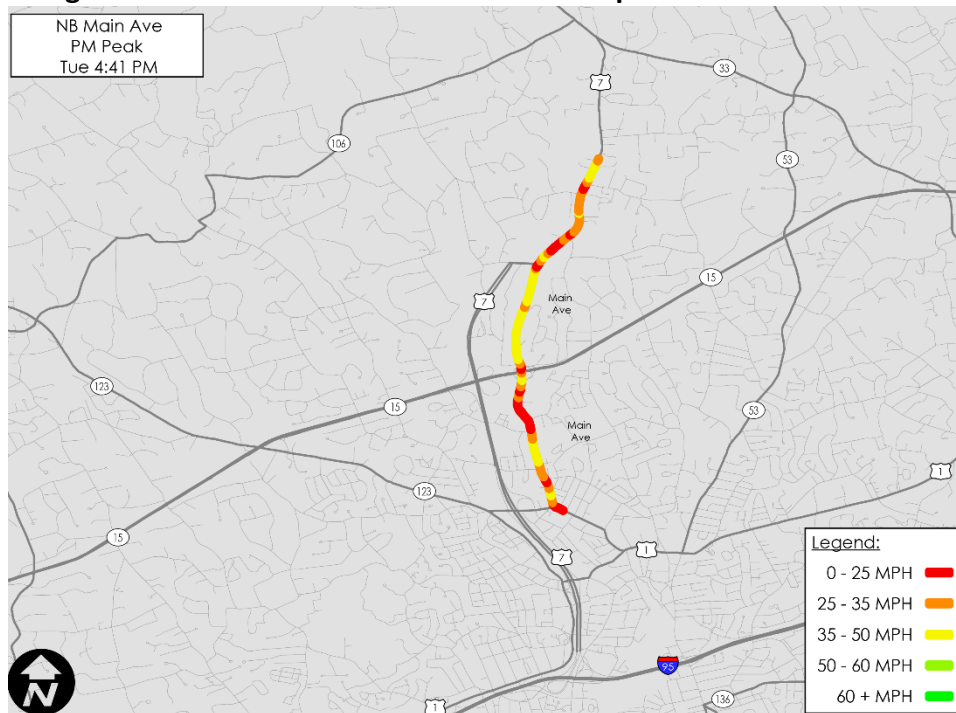


Figure 3.24: Northbound Main Ave Travel Speeds – PM Peak Period



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Figure 3.25: Southbound Main Ave Travel Speeds – AM Peak Period

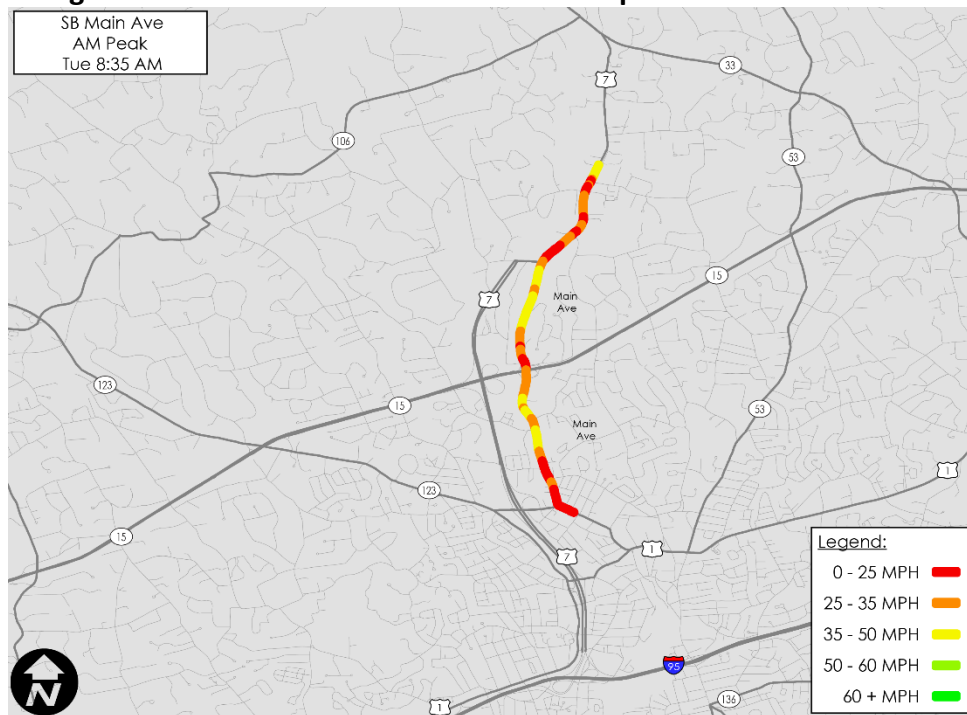
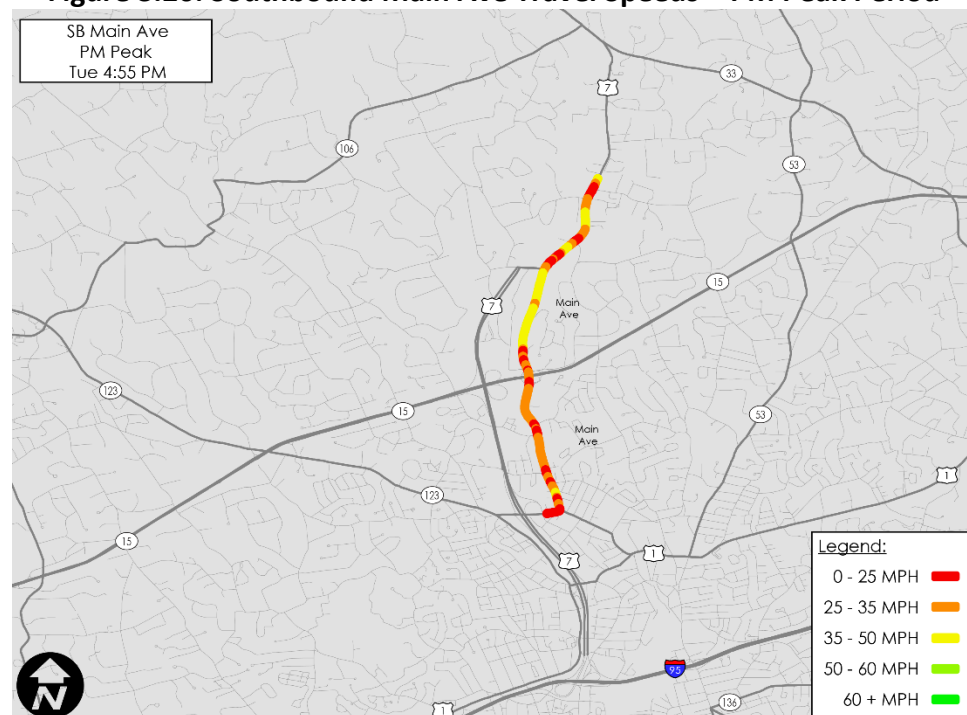


Figure 3.26: Southbound Main Ave Travel Speeds – PM Peak Period



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3.2.2 85th Percentile (Free Flow) Travel Speeds

In addition to collecting travel speeds during the peak periods, where congestion is typically at its greatest, off-peak travel speeds were also collected using the floating car method. This supplemented speed data collected by ATRs at certain locations. Both of these sources were used to derive 85th percentile (free flow) speeds for the study area corridors. Calculated 85th percentile travel speeds along with the posted speed limits are shown in Table 3.7. In general, 85th percentile speeds are 5-10 MPH above the posted speed limit.

Table 3.7 85th Percentile Travel Speed Summary

Corridor (Segment)	85 th Percentile Travel Speeds (MPH)	Posted Speed Limit
Main Avenue (Route 123-Glover Avenue)	35	30
Main Avenue (Glover Avenue-Grist Mill Road)	40	35
Route 7 (Route 123- Route 15 Interchange)	65	55
Route 7 (Route 15 Interchange-Grist Mill Road)	60	40
Route 7 (Grist Mill Road; Route 7 – Main Avenue)	30	25
Route 7 (Grist Mill Road-Kent Road)	40	35
Route 15 (Route 124 (Darien) – Route 33 (Wilton))	65	55

3.2.3 Speed Validation

Travel time data were collected as part of Skycomp’s analysis of origin-destination pairs which is discussed in further detail in Section 3.3. Table 3.8 shows a comparison of travel time data collected by both Stantec and Skycomp. Travel times and speeds observed during Stantec’s field visit are comparable and validated by Skycomp’s data.

Table 3.8: Travel Time Comparison – Stantec Data vs Skycomp Data

Segment			AM Travel Time		PM Travel Time	
From	To	Direction	Stantec	Skycomp	Stantec	Skycomp
Main Ave at Route 123	Main Ave at Grist Mill Rd	NB	5.0	5.8	8.7	8.7
Main Ave at Grist Mill Rd	Main Ave at Route 123	SB	6.1	4.5	5.5	7.0
Route 7 at Route 123	Main Ave at Grist Mill Rd	NB	3.8	3.2	4.3	3.6
Main Ave at Grist Mill Rd	Route 7 at Route 123	SB	3.2	3.5	3.3	3.6
Route 7 at Route 123	Route 15 at Main Ave	NB	4.0	4.7	5.7	8.0
Route 15 at Main Ave	Route 7 at Route 123	SB	No data	5.6	5.3	5.8



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3.3 ORIGIN-DESTINATION PATTERNS

Origin-destination data were recorded on Tuesday, September 20, 2016 (weekday PM peak period) and Wednesday, September 21, 2016 (weekday AM and MD peak periods) using rapid aerial digital photography by Skycomp. Skycomp used helicopters to hover over the study area and take high-resolution photos every second to be able to track vehicles from their origin to their destination.

The origin and destination points of all vehicles were tracked at eight specific points, or “assignment lines”, through the study area roadway network and surrounding the partial Route 7/Route 15 interchange and the associated missing movements as shown previously in Figure 2.3. A sample number of vehicles were selected at eight locations, or “assignment lines” across main roadways at the north, south, and east ends of the survey area and were traced backward to their origins and/or forward to their destinations. Figure 3.27 through Figure 3.29 shows the assignment lines (AL) which were traced.

The vehicles crossing these lines are traced to origins and destinations marked by the white boxes. Vehicles were traced as needed until leaving (or entering) the survey area across a black boundary line. A sample rate at each AL was selected to produce a sample size of 10% of 90 minutes of flow, or 150 vehicles, whichever was larger, for each AL for each peak period. The sample size was selected in coordination with Skycomp and represents a threshold where the sampled data is statistically significant enough to discern travel patterns. In order to produce reliable tracing results, Skycomp used proprietary software to perform computer-assisted manual tracing from the aligned aerial imagery.

Figure 3.27: Skycomp O-D Study AL's – Route 7 at Grist Mill Road and Main Avenue



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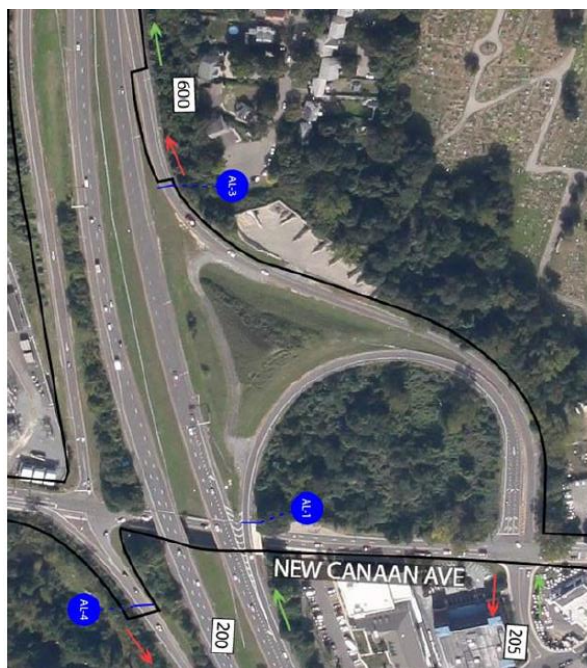
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Figure 3.28: Skycomp O-D Study AL's – Main Avenue / Route 15 Interchange



Figure 3.29: Skycomp O-D Study AL's – Route 7 / Route 123 Interchange



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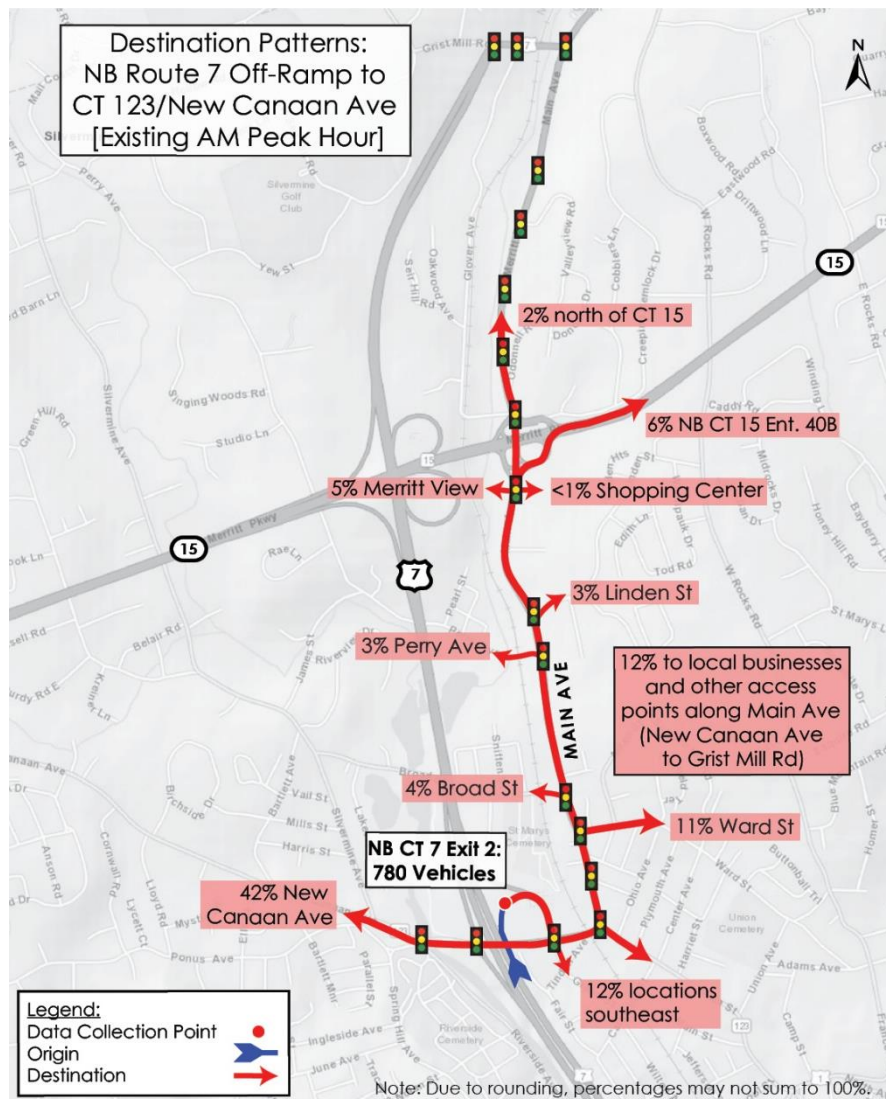
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The origin-destination study brought about a better understanding of travel patterns in, around, and through the study area and allows for a further analysis of current traffic currently making the missing movements at the Route 7/Route 15 interchange. Figure 3.30 through Figure 3.33 illustrate weekday AM and weekday PM travel patterns for the incomplete movement between Route 7 to/from the south and Route 15 to/from the east.

As shown in Figure 3.30, approximately 20% of vehicles getting off at from northbound US 7 onto Route 123 have destinations within reasonable proximity to the Main Avenue/Route 15 interchange. The average recorded travel time to get to these destinations is five minutes.

Figure 3.30: Weekday AM Peak Hour Patterns – Northbound Route 7 Off-Ramp to Route 123



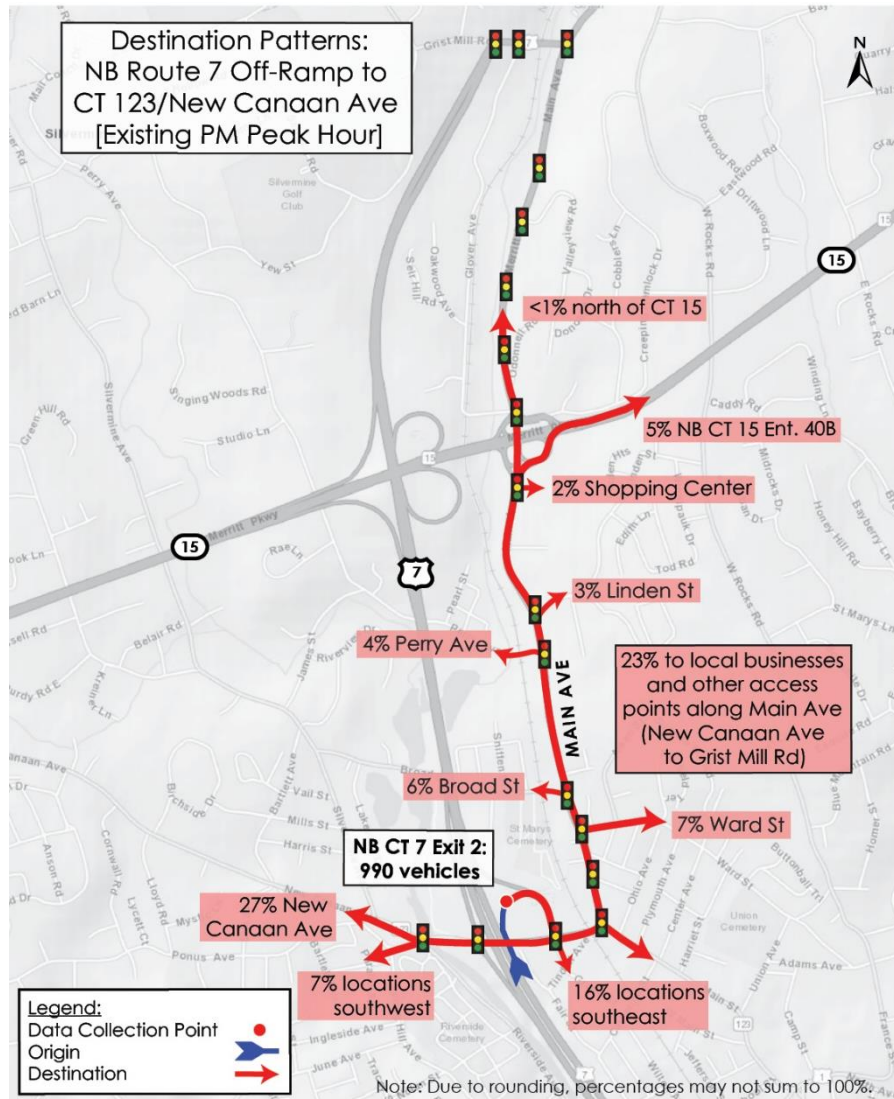
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Figure 3.31 illustrates evening peak hour travel patterns for the northbound Route 7 off-ramp to Route 123. Approximately 15% of vehicles getting off have destinations within 1 mile of the Main Avenue/Route 15 interchange. The average recorded travel time to get to these destinations at this hour is 8 minutes.

Figure 3.31: Weekday PM Peak Hour Patterns – Northbound Route 7 Off-Ramp to Route 123



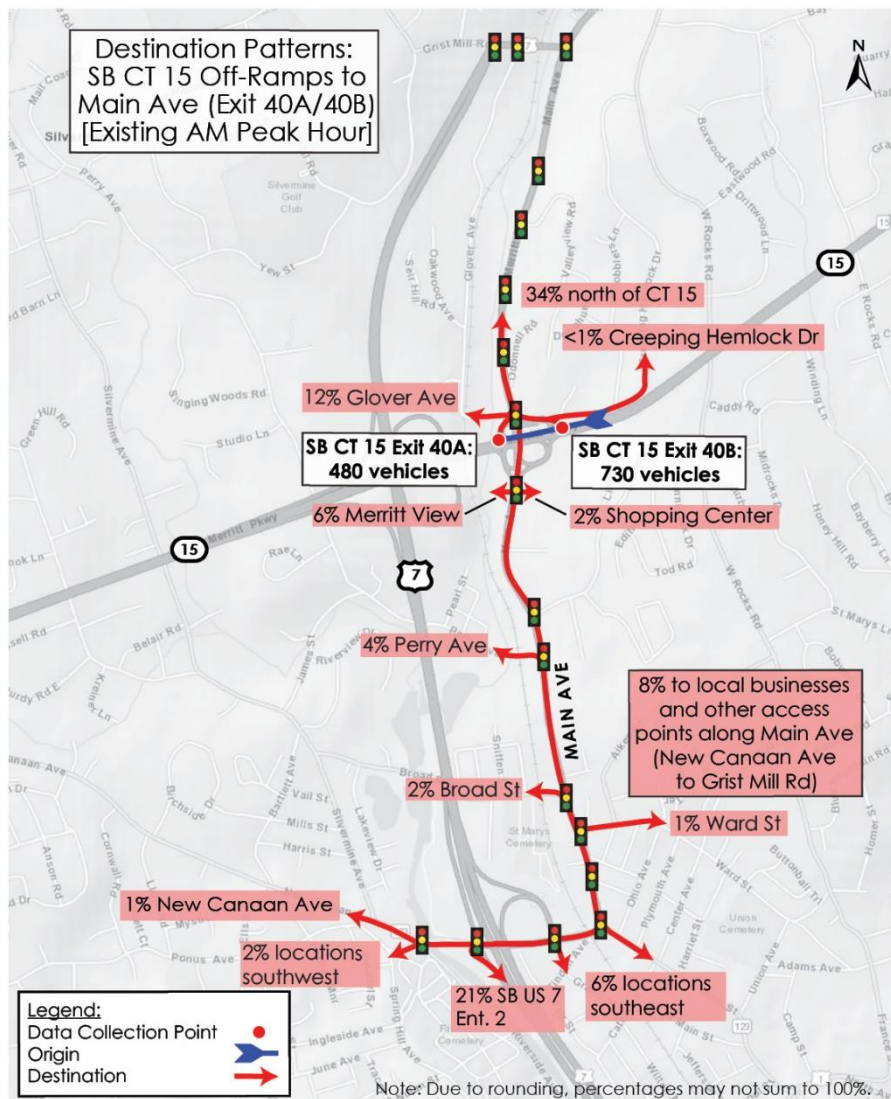
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Figure 3.32 illustrates the weekday morning peak hour travel patterns for the southbound Route 15 off-ramps at the Main Avenue interchange. Approximately 20% of vehicles getting off southbound Route 15 at Main Avenue are destined to southbound Route 7 and approximately one in every three vehicles exiting southbound Route 15 at Main Avenue have destinations in reasonable proximity to the interchange. The average recorded travel time to get to these destinations at this hour is 6 minutes.

Figure 3.32: Weekday AM Peak Hour Patterns – Southbound Route 15 Off-Ramps to Main Ave



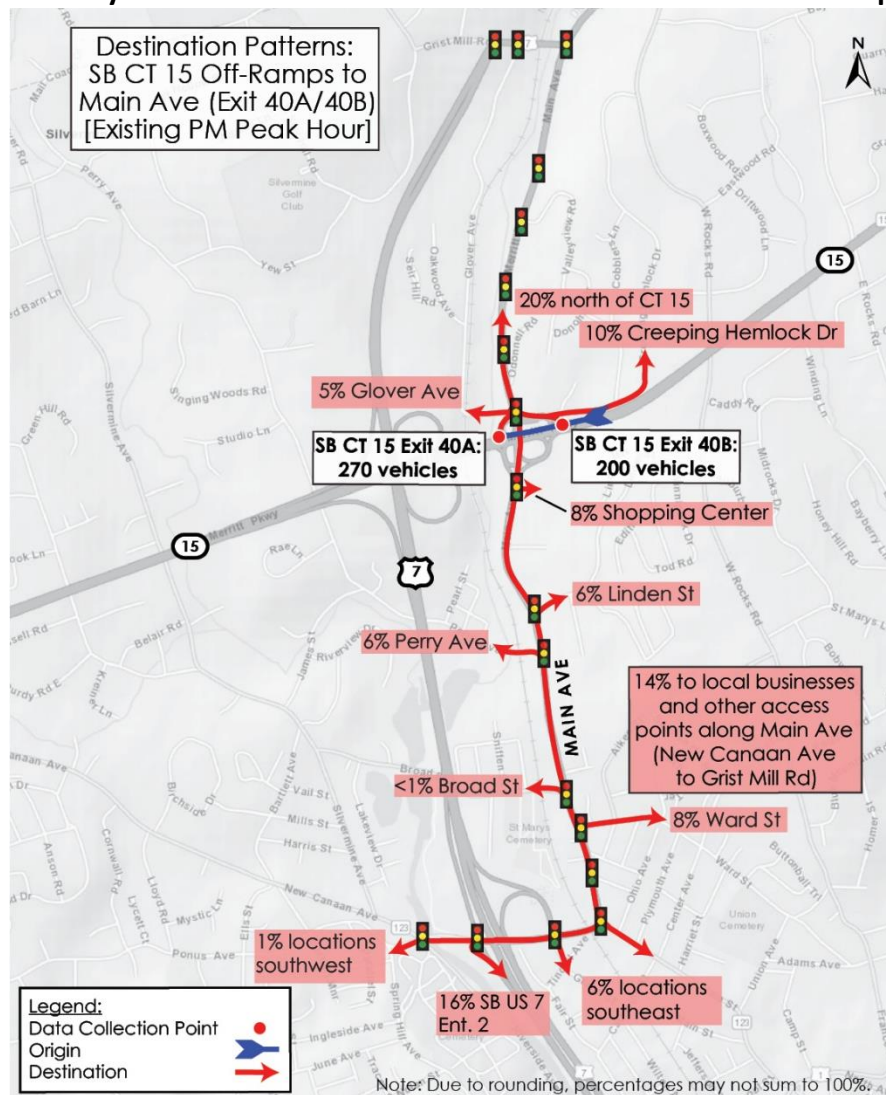
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Figure 3.33 illustrates the weekday evening peak hour travel patterns for the southbound Route 15 off-ramps at the Main Avenue interchange. Approximately 15% of vehicles getting off southbound Route 15 at Main Avenue are destined to southbound Route 7 and approximately one in every five vehicles exiting southbound Route 15 at Main Avenue have destinations in reasonable proximity to the interchange. The average recorded travel time to get to these destinations at this hour is 7 minutes.

Figure 3.33: Weekday PM Peak Hour Patterns – Southbound Route 15 Off-Ramps to Main Ave



A supplemental memo which contains O-D graphics for each of the AL's are presented in Attachment A.



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A further review of the O-D data indicates that the most intensive use of Main Avenue as a supplemental link between points north of Grist Mill Road and south of Route 123 occurs during the AM peak hour. Nearly 250 vehicles use Main Avenue to make the connection from southbound Route 15 to southbound Route 7 during the AM peak hour. As shown in Table 3.9, there is an unmet demand of at least 390 AM peak hour vehicles that would benefit from a completed 7/15 interchange and bypass Main Avenue between Grist Mill Road and New Canaan Avenue entirely. The heaviest demand is from southbound Route 15 to southbound Route 7. It should be noted that the northbound Route 15 to northbound Route 7 demand could be higher than what is exhibited during the peak hour due to the fact that typical peak period travel in the corridor is more concentrated in the morning whereas peak period travel is spread out amongst a greater number of hours due to additional trip making that typically occurs in the afternoon/evening.

Table 3.9: Skycomp O-D Study Summary – Peak Hour Traffic Volumes and Average Travel Time for Route 7 / Route 15 Incomplete Movements

Missing Movement	AM Peak Hour Volume	Avg. Travel Time (min)	PM Peak Hour Volume	Avg. Travel Time (min)
NB Route 7 to NB Route 15	47	4.7	52	7.9
SB Route 7 to NB Route 15	21	—*	49	4.8
SB Route 15 to SB Route 7	248	6.0	75	6.4
SB Route 15 to NB Route 7	76	2.7	76	3.9
Total	392		252	

*Not enough samples to establish an average travel time.



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4.0 CRASH ANALYSES

Crash records obtained through the Connecticut Crash Data Repository from January 2012 through December 2014 documented that 1,634 total crashes with 327 injuries and two fatalities occurred along the Route 7, Route 15, Route 719 and Route 123 corridors within the study area. 403 of the reportable crashes occurred at 28 study area intersections. This represents the latest data set that is available for use as data for years 2015 and onward have not been closed yet, which indicates that summaries may not include all available crash data. A crash analysis was performed for each study area intersection, the Route 7/Route 15 interchange, and the Main Avenue/Route 15 interchange. Findings are tabulated in Table 4.1, Table 4.2, Table 4.3, and illustrated in Figure 4.2.

Table 4.1: Three-year (2012-2014) Crash Summary – Route 7/15 Interchange

Roadway	Mile Marker Begin	Mile Marker End	Length (mi)	Total Crashes	Injury Crashes	Fatal Crashes	Ramp Crashes
Route 7	2.6	3.20	0.61	29	8	0	6
Merritt Parkway	16.77	17.42	0.66	48	10	0	4
Total Interchange				77	18	0	10

Table 4.2: Three-year (2012-2014) Crash Summary – Route 15/Main Avenue Interchange

Roadway	Mile Marker Begin	Mile Marker End	Length (mi)	Total Crashes	Injury Crashes	Fatal Crashes	Ramp Crashes
Main Ave	1.03	1.18	0.16	25	6	0	--*
Merritt Parkway	17.43	17.78	0.36	75	214	1	33
Total Interchange				100	220	1	33



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Table 4.3: Three-year (2012-2014) Intersection Crash Summary

Intersection	Property Damage Only	Injury	Fatality	Total
CT 123/New Canaan Avenue				
New Canaan Avenue & Route 7 Southbound Ramps	4	2	0	6
New Canaan Avenue & Route 7 Northbound Ramps	4	1	0	5
New Canaan Avenue & Railroad Tracks/Dunkin' Donuts	4	1	0	5
Total*	12	4	0	16
CT 719/Main Avenue				
Main Avenue & New Canaan Avenue	25	4	0	29
Main Avenue & Delaware Avenue	19	1	0	20
Main Avenue & Hudson Street	5	3	0	8
Main Avenue & Ward Street	18	1	0	19
Main Avenue & Broad Street	26	4	0	30
Main Avenue & Maplewood Terrace	0	1	0	1
Main Avenue & Perry Avenue	8	2	0	10
Main Avenue & Linden Street	14	2	0	16
Main Avenue & Nottingham Place	3	0	0	3
Main Avenue & Stop & Shop Entrance	8	1	0	9
Main Avenue/Glover Avenue/SB Merritt Parkway Ramps	15	5	0	20
Main Avenue & 601 Merritt 7 Apartments	1	1	0	2
Main Avenue & 401/501 Merritt 7 Apartments	2	0	0	2
Main Avenue & Valley View Road	3	3	0	6
Main Avenue & 101 Merritt 7 Apartments	1	1	0	2
Main Avenue & Grist Mill Road	6	2	0	8
Total*	154	31	0	185
Route 7				
Route 7 & Grist Mill Road	49	12	1	62
Route 7 & Glover Avenue	23	5	0	28
Route 7 & Route 719/Main Avenue	38	7	0	45
Route 7 & West Rocks Road	24	8	0	32
Route 7 & Foxboro Drive	4	0	0	4
Route 7 & Heathcote Road	1	1	0	2
Route 7 & Fawn Ridge Lane	2	0	0	2
Route 7 & Kent Road	3	2	0	5
Route 7 & Kensett Avenue	17	5	0	22
Total*	161	40	1	202

*Totals do not include midblock crashes.



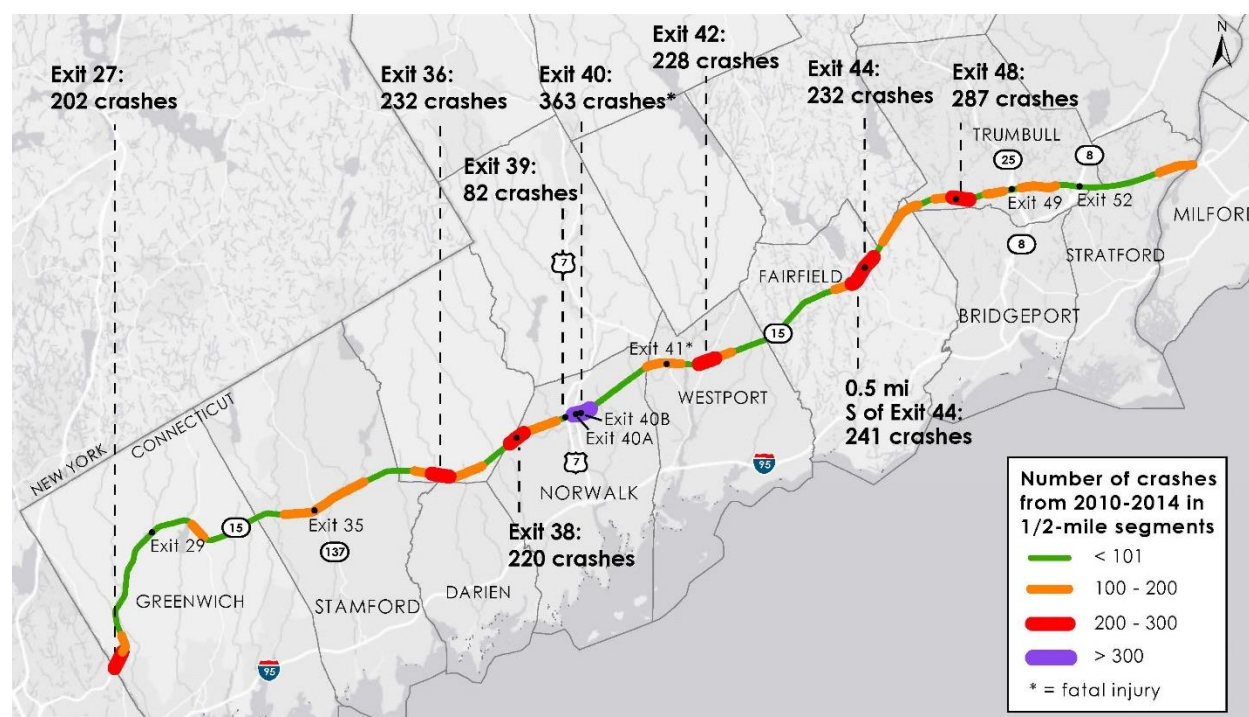
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To further understand crash patterns at the Route 15 interchanges with Route 7 and Main Avenue, additional analyses were performed to determine how crash patterns at the interchanges compare in relation to other locations along the Route 15 corridor. Crashes per 0.5-mile segment were summarized based on crash records obtained through the Connecticut Crash Data Repository from January 2010 through December 2014. Although a three-year period is typical for crash analyses, a five-year period was evaluated to further understand historical crash patterns. As shown in Figure 4.1, the highest density of crashes along the entire Route 15 corridor occurs at the Exit 40 interchange with Main Avenue. It is the only location which has more than 300 crashes within a 0.5-mile segment within a five-year period.

Figure 4.1: Route 15 Crash Summary (2010-2014)

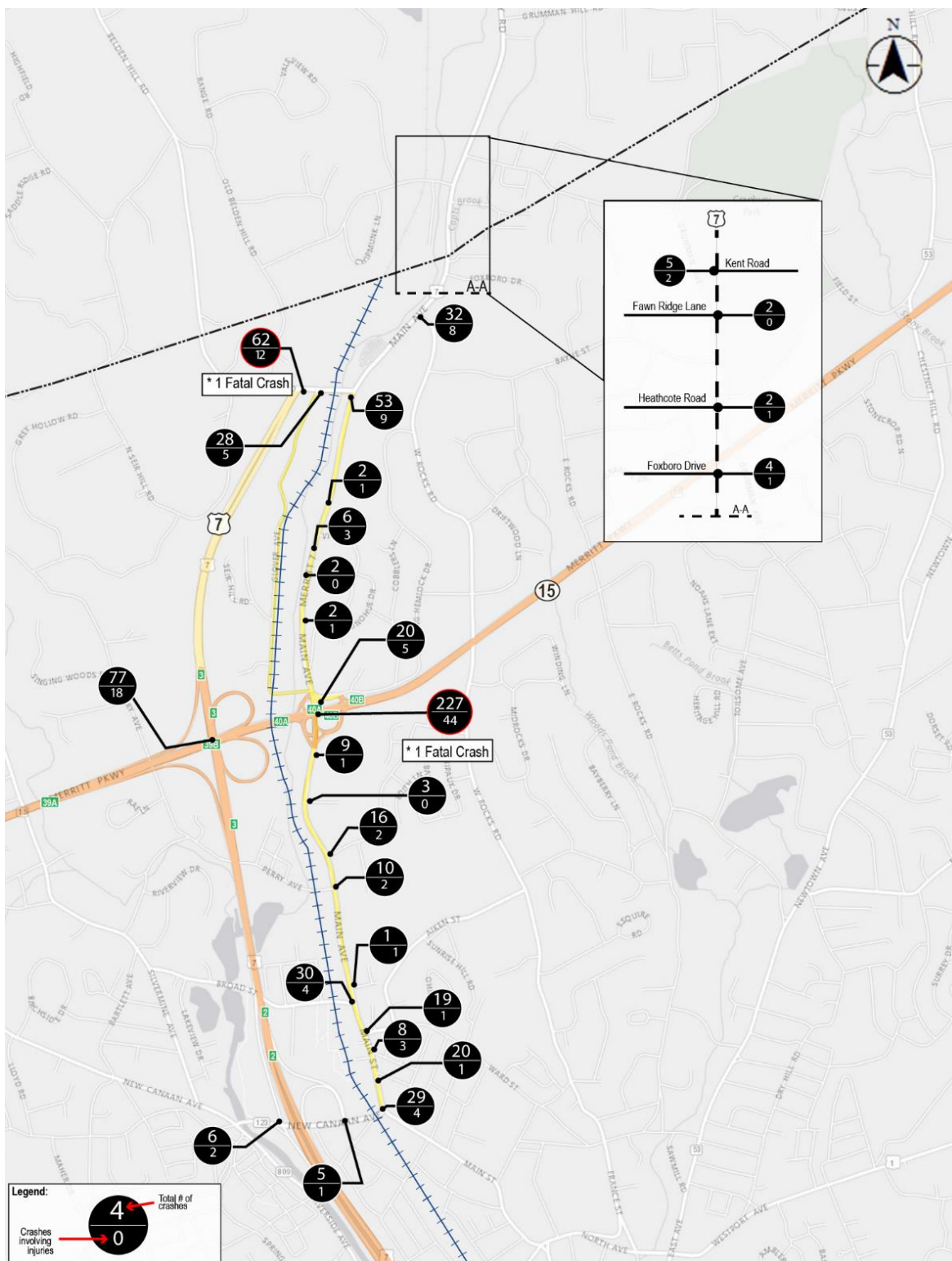


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Figure 4.2: Study Area Crash Summary (2010-2014)



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5.0 EXISTING TRAFFIC OPERATIONS

This section of report describes existing traffic operations within the traffic study area.

5.1 VISSIM CORRIDOR ANALYSIS

A VISSIM micro-simulation model of the Route 7/15 interchange and adjoining roadways was developed as a tool to evaluate various roadway improvement alternatives. This section discusses the model development and calibration to existing traffic conditions.

5.1.1 Methodology/Criteria

A VISSIM micro-simulation model, discussed herein, was developed to be one of the tools for traffic evaluation. Generally, micro-simulation models simulate traffic on an individual car-by-car basis. This approach differs from models such as Highway Capacity Software (HCS) or Synchro, which are regression based in nature, and represent a macroscopic modeling approach. The VISSIM model is meant to be a companion to the HCS and Synchro models, with that caveat that the VISSIM model looks at traffic from a dynamic perspective; while the HCS and Synchro models focus on individual elements, the VISSIM model looks at everything as a system.

The micro-simulation model focuses on operations on the Route 7/15 interchange, including its adjoining roadways: Route 7, Route 123, Main Avenue, Glover Avenue, and Grist Mill Road. The model simulates traffic during the AM Peak hour of 8 AM to 9 AM and the PM peak hour of 5 PM to 6 PM. The coverage area of the model is described as follows:

- Main Avenue south of Route 123 and north of Grist Mill Road
- Glover Avenue between Grist Mill Road and Main Avenue
- US 7 between Grist Mill Road and south of Route 123
- Route 15 east of Main Avenue to west of Route 123

The following section discusses the development of the 2016 Base Year (Existing Conditions) micro-simulation model and calibration.

5.1.1.1 Base Year Model Development and Calibration

The micro-simulation modeling process requires four general steps described below:

1. Coding the roadway network to be analyzed (lanes, ramps, intersections, local roadways);
2. Adding traffic control devices to the model (traffic signals, stop signs, etc.);
3. Developing and inputting traffic volumes; and



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4. Iteratively calibrating the VISSIM model to match observed existing conditions, such that it is a reliable predictor of current and future traffic operations.

Roadway Network

In the case of the Route 7/15 micro-simulation model, the network includes Main Avenue, Grist Mill Road, Glover Avenue, Route 7, Route 15, and Route 123. The boundaries are Grist Mill Road to the north, Route 123 to the south, the West Rocks Road Bridge over Route 15 to the east, and Route 123 at the Route 15 interchange to the west. Figure 5.1 shows the extents of the simulation model network.

Traffic Signals

Following the development of the roadway network, traffic signals and stop signs were coded. The simulation area includes 21 signalized intersections and are modeled along Main Avenue, Grist Mill Road, and CT 123 / New Canaan Avenue. Traffic signal timings were taken from CTDOT records, as verified via independent field observations. These timings vary with time of day, so AM and PM peak hour timings are different in response to changes in traffic demand.

Volumes

The primary traffic input for the VISSIM micro-simulation model is an origin and destination (O-D) matrix of volumes for the AM and PM peak hours. Balanced existing conditions traffic volumes for the AM and PM peak hours are used in conjunction with O-D patterns taken from aerial surveys to develop an O-D matrix. These volumes result in each simulated vehicle being assigned a network origin and destination. For example, an origin would be defined with a place designation, for example, Main Avenue south of CT 123, while a destination would be defined similarly, for example, Grist Mill Road west of US 7. O-D volumes were developed for 8-9 AM and 5-6 PM peak hours. To accurately simulate traffic, it is necessary to pre-load the traffic network with vehicles prior to the start of the peak hour to be analyzed. Traffic O-D matrices were developed for the 6:45-8:00 AM, and 3:45-5:00 PM periods in order to preload the network with traffic and complete the peak hour simulation. It should be noted that the O-D volume matrices developed are representative of traffic demand in the corridor during the AM and PM peak hours, irrespective of whether the throughput is as high; that is, it is possible that only 3,500 vehicles could be processed on southbound Route 15 during the 8-9 AM hour even though that there is a demand for 4,000 vehicles to want to travel south on Route 15 during that same hour.



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Figure 5.1: VISSIM Simulation Model Roadway Network



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Model Calibration, General Procedure

Before the model can be used to simulate the impact of potential roadway improvements on traffic, it is necessary to tune, or calibrate, the model so that it can be considered a reliable predictor of traffic conditions. There are three general goals of the calibration process:

1. Match the model's traffic volume capacity to levels observed during field observations;
2. Match the model's travel speeds to levels observed during field observations; and
3. Match the relative distribution of traffic between parallel roadways (e.g., Route 7 vs. Main Avenue).

To calibrate the model, an iterative process of adjusting driver behaviors such as typical headways between vehicles, lane changing, and desired travel speeds was employed to replicate the throughput volumes and field observations seen during the traffic data collection program. Sensitivity to travel time savings and distance traveled were adjusted until the balance of traffic volume across the model's various roadways was deemed satisfactory.

Simulation models in general will deviate somewhat from observed traffic volumes, speeds, and queues, so a set of guidelines was employed to identify whether the model is replicating existing travel behavior at an acceptable level. The standards, sourced from the FHWA's *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software, July 2004*, and presented in Table 5.1 were used as a guideline for determining whether the model was sufficiently calibrated.

Table 5.1: Overall Model Performance

Statistic	AM Peak	PM Peak
Overall Traffic Volume GEH	2.5	2.5
% of TMCS within GEH 5	90%	90%
Travel Times within 15%	87%	87%

A review of various calibration statistics, including volumes and speeds, using the GEH statistic¹, demonstrated that both the AM and PM peak hours were well represented by the model. Further information on calibrated traffic volumes and speeds are presented in Table 5.2 and Table 5.3. Queues and travel times were also calibrated to match existing conditions on study area roadways.

¹ The GEH statistic, named for inventor Geoffrey E. Havers, is used for a variety of traffic analysis purposes. The statistic compares two sets of volumes and is used when comparing modelled traffic volumes versus collected traffic volumes. Typically, a GEH value of less than 5.0 represents a good match between modelled and collected traffic volumes.



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Table 5.2: Volume Calibration – Select Segments

Select Volume Targets	AM Peak			PM Peak		
	Target	Actual	GEH	Target	Actual	GEH
SB Route 15 north of Main Ave	2,500	2,800	2.10	2,500	2,800	2.10
NB Route 15 north of Main Ave	2,700	2,200	2.10	2,700	2,200	2.10
SB Route 15 south of Route 7	3,500	3,100	3.00	3,500	3,100	3.00
NB Route 15 south of Route 7	3,100	2,500	4.50	3,100	2,500	4.50
NB Route 7 south of Grist Mill Rd	2,500	2,000	3.89	2,500	2,000	3.89
SB Route 7 south of Grist Mill Rd	2,500	2,000	4.33	2,500	2,000	4.33
NB Main Ave south of Grist Mill Road	800	750	0.00	800	750	0.00
SB Main Ave south of Grist Mill Road	500	499	0.40	500	499	0.40
WB Grist Mill Road east of Route 7 Intersection	750	750	0.00	750	750	0.00
EB Grist Mill Road east of Route 7 Intersection	651	499	0.40	651	499	0.40
NB Main Ave south of Route 15	800	750	0.00	800	750	0.00
SB Main Ave south of Route 15	500	499	0.40	500	499	0.40

Table 5.3: Speed Calibration – Select Segments

Select Travel Times	AM Peak			PM Peak		
	Target	Actual	GEH	Target	Actual	GEH
CT 15 SB end to end	12	8	2.10	12	8	2.10
CT 15 NB end to end	11	7	2.10	11	7	2.10
Main Ave NB	11	7	3.00	11	7	3.00
Main Ave SB	11	7	4.50	11	7	4.50

5.1.2 Results

The existing conditions VISSIM model showed numerous areas of congestion during the AM and PM peak hours. The modeled congestion and volumes are consistent with levels of congestion observed during field observations.

5.1.2.1 AM Peak Hour - Modeled Congestion

Measures of Effectiveness

Several measures of effectiveness are collected in the microsimulation model to quantify operations, including vehicle miles of travel and vehicle hours of travel per segment, and average speed and travel time on each segment. During the morning peak period, the vehicle hours of travel and travel time on southbound Merritt Parkway are significantly larger relative to the northbound direction.



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Table 5.4: AM Peak Hour Measures of Effectiveness

Mainline	Segment Start	Segment Finish	VMT	VHT	Avg Spd	Travel Time
NB Route 15	Main Ave	East Rocks Road	1,460	24	60.4	0.9
	US 7	Main Avenue	657	13	52.2	0.3
	Silvermine River	US 7	1,428	24	60.4	0.5
	CT 123	Silvermine River	3,303	61	53.6	1.1
SB Route 15	East Rocks Road	Main Ave	1,847	223	8.4	6.1
	Main Avenue	US 7	474	84	5.6	2.9
	US 7	Silvermine River	1,255	149	8.3	3.6
	Silvermine River	CT 123	2,731	199	13.7	4.1
NB Main Ave	CT 123	Merritt Parkway	977	40	24.9	2.4
	Merritt Parkway	Grist Mill Road	540	19	26.8	1.7
SB Main Ave	Grist Mill Road	Merritt Parkway	750	36	21.8	2.8
	Merritt Parkway	CT 123	453	16	25.2	1.8
NB Route 7	CT 123	NB US 7 Svc Rd S	5,484	94	56.9	2.4
	NB US 7 Svc Rd S	NB US 7 Svc Rd N	136	3	52.5	0.3
	NB US 7 Svc Rd N	Grist Mill Road	1,706	58	29.2	1.5
SB Route 7	Grist Mill Road	NB US 7 Svc Rd N	3,338	56	60.0	1.6
	NB US 7 Svc Rd N	NB US 7 Svc Rd S				
	NB US 7 Svc Rd S	CT 123	2,039	36	56.4	1.4

Southbound Route 15 throughout the study area

Route 15 is severely over capacity during the AM peak hour, and congestion was observed to start near Route 123 by 7:00 AM. The model shows average travel times of 12 minutes to traverse the three miles of Route 15 from Wilton to Route 123, which translates to a speed of 15 mph. It should be noted that Route 15 congestion is rooted from the High Ridge Road interchange (Exit 35) in Stamford CT, over five miles away. Southbound congestion continues further east through the study area and into Wilton and points east by the end of the AM peak hour. Both areas east and west of the study area are not modeled and therefore CT 15 congestion is modeled as fixed.

Southbound Route 7 (Main Avenue approaching Grist Mill Road)

During the AM peak hour, a high southbound right turn volume (over 1,000 vehicles) from southbound Main Avenue onto westbound Grist Mill Road results in southbound queuing on Route 7. The model shows queues of over 1,200 feet during the AM peak hour, and matched field observed queues which extend as far north as West Rocks Road. The model shows throughput during the peak hour of approximately 1,050 vehicles, which is within 3.5 percent of the observed 1,020 vehicles. On average, vehicles making the movement from southbound Main Avenue to



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westbound Grist Mill Road can complete the maneuver in 3 minutes, for an average speed of 5 miles per hour; it should be noted that these are not the queue jumper vehicles who merge into the lane at the last minute but are vehicles which are in the right most lane from West Rocks Road. The primary cause of congestion is the high demand for the movement and low capacity. The low capacity is attributable to the availability of only 1-lane for the right turning traffic, and 30 seconds of green time out of a 90 second cycle.

Southbound Route 7 (Grist Mill Road)

The model shows westbound Grist Mill Road operating with high volumes and an average speed of 10 miles per hour. The high-volume movement is the left turn onto southbound Route 7 towards Route 15 and I-95. This left turn is modeled with throughput of 1,060 vehicles per hour which is in-line with observed traffic counts. Additionally, the steep upgrade from Main Avenue to the east also reduces the throughput of traffic.

Southbound Main Avenue at Route 123

A high southbound right turn volume from Main Avenue onto northbound Route 123 results in some congestion and queuing. The model shows vehicles queuing for approximately 200 feet along Main Avenue while just under 900 vehicles per hour are processed at this intersection. Further, the railroad tracks immediately west of this intersection also creates additional queuing since the tracks are required to be clear at all times.

5.1.2.2 PM Peak Hour - Modeled Congestion

Measures of Effectiveness

Similar to the morning peak period, measures of effectiveness are collected from the microsimulation model. During the PM Peak Hour, the vehicle hours of travel and travel time on northbound Merritt Parkway are significantly larger relative to the southbound direction, as expected. In addition, the northbound US 7 approach to Grist Mill Road experiences increased vehicle hours of travel, and lower average speed, as northbound vehicles navigate the congested intersection.



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Table 5.5: PM Peak Hour Measures of Effectiveness

Mainline	Segment Start	Segment Finish	VMT	VHT	Avg Spd	Travel Time
NB CT 15	Main Ave	East Rocks Road	2,275	223	10.2	5.4
	US 7	Main Avenue	570	62	9.1	2.0
	Silvermine River	US 7	1,179	65	18.1	1.7
	CT 123	Silvermine River	2,728	177	15.0	3.9
SB CT 15	East Rocks Road	Main Ave	1,608	27	57.5	0.9
	Main Avenue	US 7	608	11	55.7	0.3
	US 7	Silvermine River	1,593	29	55.6	0.5
	Silvermine River	CT 123	3,362	58	57.9	1.0
NB Main Ave	CT 123	Merritt Parkway	887	39	22.9	2.6
	Merritt Parkway	Grist Mill Road	558	41	14.9	3.0
SB Main Ave	Grist Mill Road	Merritt Parkway	1,331	68	19.3	3.1
	Merritt Parkway	CT 123	601	39	19.6	2.3
NB US 7	CT 123	NB US 7 Svc Rd S	5,030	85	57.9	2.3
	NB US 7 Svc Rd S	NB US 7 Svc Rd N	92	2	53.6	0.3
	NB US 7 Svc Rd N	Grist Mill Road	1,267	46	27.1	1.5
SB US 7	Grist Mill Road	NB US 7 Svc Rd N	3,364	56	59.8	1.6
	NB US 7 Svc Rd N	NB US 7 Svc Rd S				
	NB US 7 Svc Rd S	CT 123	2,170	39	56.2	1.4

Northbound Route 15 throughout the study area

The simulation model shows heavy congestion along northbound Route 15 for the length of the study area during the 5-6 PM peak hour. The three-mile trip along Route 15 within the study area takes 17 minutes in the model during the 5:30 PM to 6:00 PM period, which translates to an average travel speed of 11 miles per hour. Congestion forms from further north along Route 15, well east of the study area and that congestion limits the amount of traffic that northbound Route 15 can process during the peak hour (over 2,200 vehicles near the West Rocks Road overpass).

Northbound Route 7 (Grist Mill Road)

The model shows queuing along northbound Route 7 approaching Grist Mill Road during the PM peak hour. Queues extend approximately one-third of a mile south of the intersection at Grist Mill Road, which is shorter than one-half mile queue observed at the tail end of the peak hour. A high amount of turning vehicles (over 400 vehicles turning left and over 1,400 vehicles turning right during the peak hour) coupled with capacity constraints due to traffic signals along both Grist Mill Road and Main Avenue are the principal source of congestion.



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Main Avenue at Grist Mill Road (Route 7)

The model demonstrates congestion on northbound Route 7 approaching the Main Avenue intersection. The high volume eastbound left turn to northbound Main Avenue, is shown to process over 1,300 vehicles per hour. This high demand contributes to the queuing observed in the model and verified in the field through observations. Southbound Main Avenue, like during the AM peak hour, also experiences congestion during the PM peak hour. The high demand southbound right turn is modeled with about 1,000 vehicles per hour, which contributes to modeled queues of about 650 feet (halfway between the Main Avenue intersections at Grist Mill Road and West Rocks Road).

5.2 CAPACITY ANALYSIS

Capacity analysis, a procedure used to estimate the traffic-carrying ability of roadway facilities over a range of defined operating conditions, was performed for study area intersections using Synchro 9 traffic analysis software, which conforms to the 2000 Highway Capacity Manual (HCM)². This software package provides average control delay and level-of-service (LOS) for each lane group and for the overall intersection. Control delay at a signalized intersection is generally defined as the delay attributed to the traffic signal operation.

5.2.1 Synchro Analyses

Synchro is the preferred application for transportation networks with a series of closely-spaced signalized intersections, such as the Main Avenue corridor within the study area. Under these conditions, Synchro can accurately model the effects that the traffic operations (such as poor LOS or extensive queuing) at one intersection may have on operations at an adjacent intersection.

5.2.1.1 Methodology/Criteria

Intersection LOS is an evaluation of the quality of operation based on the measure of the average delay a driver experiences while traveling through the intersection. LOS is dependent upon a range of defined operating conditions such as roadway lane geometry and traffic signal timing.

LOS ranges from scores of A to F based upon the extent of average calculated control delay per vehicle. For a signalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay greater than 80 seconds per vehicle. For an unsignalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay greater than 50 seconds per vehicle. An intersection is generally assumed to operate acceptably if it operates at overall LOS D or better. The 2000 Highway

² The 2010 version of the HCM was not used for intersection analyses since it currently does not allow for the analysis of intersections with pedestrian phasing, which is present at most intersections within the traffic study area.



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Capacity Model (HCM) delay criteria for signalized and unsignalized intersections are summarized in Table 5.6.

Table 5.6: LOS Criteria – Signalized and Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	
	Signalized	Unsignalized
A	Less than or equal to 10.0	Less than or equal to 10.0
B	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0
C	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0
D	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0
E	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0
F	Greater than 80.0	Greater than 50.0

Source: 2000 Highway Capacity Manual

Traffic conditions were analyzed during the weekday morning and weekday evening peak periods as traffic flow and congestion within the study area is at its greatest.

5.2.1.2 Results

2016 Existing Condition intersection volumes for the AM and PM peak hours, as summarized in Table 5.7, were modeled in Synchro 9 to determine capacity analysis results. All existing intersections within the study area were determined to operate at LOS D or better except for the following:

1. *Main Avenue at Glover Avenue / Creeping Hemlock Drive / SB Route 15 Ramps* operates at LOS F and E in the AM and PM peak hour, respectively;
2. *Route 7 at West Rocks Road* operates at LOS E in the PM peak hour; and
3. *Route 7 at Grist Mill Road* operates at LOS F and E in the AM and PM peak hour, respectively.

Table 5.7: Intersection LOS Summary

Intersection	AM LOS	PM LOS
Main Ave at Kent Rd	B	B
Main Ave at Gateway Shopping Ctr	A	A
Main Ave at Foxboro Dr	A	A
Main Ave at West Rocks Rd	C	E
Main Ave at Grist Mill Rd	C	D
Glover Ave at Grist Mill Rd	B	B
Route 7 at Grist Mill Rd	F	E
Main Avenue at Valley View Road/Merritt 7 (201/301)	B	B
Main Avenue at Merritt 7 (401/501)/Shopping Center	A	B
Main Avenue at Merritt 7 (601)	A	C
Main Avenue at Merritt River Towers (801/901)	A	B
Route 15 SB On-Ramp/Glover Ave/Creeping Hemlock Dr at Main Ave	F	E
Main Ave at Merritt View/Main Ave Shopping Center	B	C



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Intersection	AM LOS	PM LOS
Main Ave at Nottingham Place	A	A
Main Ave at Linden St	C	C
Main Ave at Perry Ave	B	B
Main Ave at Broad St	A	B
Main Ave at Ward St	C	B
Main Avenue at Delaware Avenue/Shopping Center	A	A
Route 123 at Main Ave	C	B
Grand St/Route 7 NB Off-Ramp at Route 123	D	C
SB Route 7 On/Off Ramps at Route 123	B	B

*Red text denotes intersections with unacceptable LOS.

5.2.2 HCS Segment Analysis

Traffic conditions within the study area were analyzed following the standard methodology set forth in the 2010 HCM using Highway Capacity Software (HCS), Version 6.1. The traffic analysis considers a variety of prevailing conditions, including inputs such as traffic volumes, corridor free-flow speed, and a variety of geometric conditions (e.g., lane widths, lengths of weaving sections). Per HCM guidance, the highest hourly volumes from peak travel periods were used as inputs to the HCS model to determine an appropriate level-of-service (LOS). A roadway segment is generally assumed to operate acceptably if it achieves LOS D or better.

5.2.2.1 Methodology/Criteria

Freeway Sections

Capacity analyses were performed at most freeway mainline segments along Route 7 and Route 15 within the study area. The analyses were performed using the HCS Basic Freeway Segments module within the HCS software package. The analysis area is comprised of a one-directional freeway segment between merge, diverge or weaving locations. It includes all through lanes within the vicinity (the “influence area”). The LOS within the influence area is determined by the density (measured in passenger cars per mile per lane, or pc/mi/ln) for all cases of stable operation (LOS A-E). LOS F exists when corridor demand exceeds the capacity of the corridor segment or where the off-ramp demand exceeds the off-ramp capacity. Table 5.8 presents the LOS criteria for freeway sections.



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Table 5.8: LOS Criteria – Basic Freeway Segments

LOS	Density (pc/mi/ln)
A	≤ 11
B	$> 11 - 18$
C	$> 18 - 26$
D	$> 26 - 35$
E	> 35
F	Demand exceeds capacity

Source: 2010 Highway Capacity Manual

Merge / Diverge Roadway Sections

Capacity analyses were performed at all ramp merge and diverge sections within the study area. The analyses were performed using HCS Ramp Junctions module within the HCS software package. The influence area is bounded by a distance of 1,500 feet downstream and upstream of the merge/diverge point and includes the acceleration/deceleration lane and the right two lanes of the mainline. The LOS of the influence area is determined by the traffic density (measured in passenger cars per mile per lane, or pc/mi/ln) for all cases of stable operation (LOS A-E). LOS F exists when corridor demand exceeds the capacity of the corridor segment or where the off-ramp demand exceeds the off-ramp capacity. Table 5.9 presents the LOS criteria for merge and diverge sections.

Table 5.9: LOS Criteria – Merge and Diverge Sections

LOS	Density (pc/mi/ln)
A	≤ 10
B	$> 10 - 20$
C	$> 20 - 28$
D	$> 28 - 35$
E	> 35
F	Demand exceeds capacity

Source: 2010 Highway Capacity Manual

Weaving Segments

Capacity analyses were performed at all weaving segments along Route 7 and Route 15 corridors within the study area. The analyses were performed using the HCS Weaving module within the HCS software package. The influence area is defined by the distance between barrier markings and includes all continuous lanes through the weaving segment. One-sided weaving segments between multi-lane roadways are present along the Route 7 and Route 15 corridors. The LOS of the weaving segment is determined by the traffic density (pc/mi/ln) for all cases of stable



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operation (LOS A-E). LOS F exists when demand exceeds the capacity of the weaving segment. Table 5.10 presents the LOS criteria for weaving segments.

Table 5.10: LOS Criteria – Weaving Segments

LOS	Density (pc/mi/ln)
A	≤ 12
B	$> 12 - 24$
C	$> 24 - 32$
D	$> 32 - 36$
E	> 36
F	Demand exceeds capacity

Source: 2010 Highway Capacity Manual

5.2.2.2 Results

Freeway Mainlines

2016 Existing Condition freeway volumes for the AM and PM peak hours, as summarized in Table 5.11 and Table 5.12, were modeled in Highway Capacity Software to determine capacity analysis results. All existing freeway mainlines were determined to operate at LOS D or better except for the following segments:

1. *Southbound Route 15 from Exit 37 to Exit 38* operates at LOS E during the AM peak hour; and
2. *Northbound and southbound Route 15 from Exit 38 to Exit 39A* operates at LOS E during the AM peak hour.

Table 5.11: Route 15 LOS Summary

Road	From Exit	To Exit	Northbound		Southbound	
			AM	PM	AM	PM
Route 15 Mainline	37	38	D	D	E	D
	38	39A	E	D	E	D
	39A	39B	D	D	D	D
	39B	40A	B	C	C	C
	40B	41	B	D	D	B

*Red text denotes mainline locations with unacceptable LOS.



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Table 5.12: Route 7 LOS Summary

Road	From Exit	To Exit	Northbound		Southbound	
			AM	PM	AM	PM
Route 7 Mainline	2 off	2 on	C	B	B/A*	B/A*
	2 on	3 off	C	B	B	B
	3 off	3 on	B	B	B	B
	3 on	Grist Mill Rd	C	B	B	B

Freeway Ramps

2016 Existing Condition freeway ramp volumes for the AM and PM peak hours, as summarized in Table 5.13 and Table 5.14, were modeled in Highway Capacity Software to determine capacity analysis results. All existing freeway ramps were determined to operate at LOS D or better except for the following locations:

1. *Northbound Route 15 Exit 39A off-ramp* operates at LOS E in both the AM and PM peak hours;
2. *Northbound Route 15 Exit 40A stop-controlled on-ramp* operates at LOS E and F in the AM and PM peak hour, respectively;
3. *Southbound Route 15 Exit 40B off-ramp* operates at LOS E in the PM peak hour; and
4. *Southbound Route Exit 40B stop-controlled on-ramp* operates at LOS F in both the AM and PM peak hours.

Table 5.13: Route 15 On-/Off-Ramp LOS Summary

Roadway	Interchange	Northbound		Southbound	
		AM	PM	AM	PM
Route 15 Ramps	39A off/on	E	E	D	D
	39B off/on	C	C	C	C
	40A off	C	D	D	C
	40A on ¹	E	F	C	C
	40B off	C	D	E	C
	40B on ¹	B	D	F	F

Notes:

Stop controlled on-ramps LOS shown in bold and calculated based on approach delay.

(*) Red text denotes mainline locations with unacceptable LOS.



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Table 5.14: Route 7 On-/Off-Ramp LOS Summary

Roadway	Interchange	Northbound		Southbound	
		AM	PM	AM	PM
Route 7 Ramps	2 off	C	C	B	B
	2 on	C	C		
	3 off	C	C	B	B
	3 on	C	B	B	B

5.2.3 Summary

Figure 5.2 and Figure 5.3 illustrate a holistic view of LOS throughout study area corridors, including intersections, ramps, and along mainlines for the weekday AM and weekday PM peak hours, respectively.



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Figure 5.2: Intersection, Mainline, and Ramp LOS Summary – Weekday AM Peak Hour



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Figure 5.3: Intersection, Mainline, and Ramp LOS Summary – Weekday AM Peak Hour



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6.0 EXISTING ROADWAY GEOMETRY AND STRUCTURES REVIEW

This section describes the evaluation of existing roadway geometry and structures within the project study area (see Figure 2.1). Locations which do not currently meet highway design guidelines and other pertinent criteria will be identified, as well as their potential impacts to traffic operations and safety. The evaluation centers around the Route 15 interchanges with Route 7 (Exit 39) and Main Avenue (Exit 40) as well as the Main Avenue corridor (also known as Route 719) in the vicinity of the interchange with Route 15.

The Route 15 interchanges with Route 7 and Main Avenue were constructed in 1991 and 1942, respectively. As such, these interchanges were designed to what was considered to be the appropriate design standards and design year traffic volumes at that time. Since these interchanges have been designed, traffic volumes along the Route 15 corridor have continued to increase, resulting in further increases in congestion and deteriorations in safety. Roadway geometries evaluated within this section of the memo have been compared to the latest available standards, which are further identified below:

- CTDOT, *Highway Design Manual* (2003 Edition including Revisions to February 2013) (CTHDM); and
- American Association of State Highway and Transportation Officials (AASHTO), *A Policy on Geometric Design of Highways and Streets* (6th Edition, 2011).

6.1 ROADWAY GEOMETRY REVIEW

6.1.1 Methodology

Using information gathered from several field visits, and ongoing reviews of the latest record plans, photogrammetry and survey data, and inspection reports, and the latest available design criteria, geometric conditions were evaluated for the Route 15 interchanges with Route 7 and Main Avenue. This review includes an evaluation of the following design criteria:

- Posted Speed Limit;
- Lane Width;
- Shoulder Width;
- Horizontal Curvature;
- Superelevation;
- Cross Slope;
- Stopping Sight Distance;
- Maximum / Minimum Grades; and
- Vertical Clearance.



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In addition to controlling design, the following operational characteristics were also reviewed:

- Interchange Spacing; and
- Highway Ramp Weaving.

Minimum design values for each controlling design criteria listed are predicated on roadway classifications and selected corresponding speed. Based on the latest functional classification maps, CTDOT classifies both Route 15 and Route 7 as a Principal Arterial – Other Expressway. For this project, the following geometric conditions for Route 7 and Route 15 were reviewed based on recommended standards from the CTDOT (Figure 5B) for Multi-Lane Principal Urban Arterials. Table 6.1, below, summarizes typical design criteria for this class of highway for comparison purposes. Further information on each design element follows.

Table 6.1: Route 7 and Route 15 Design Criteria

Design Element	Design Criteria
Corridor Travel Speed	55 MPH (Posted)
Travel Lane Width	12'
Shoulder Width – Right	4' – 8'
Shoulder Width – Left	2' – 4'
Horizontal Curvature	1,065'
Superelevation (e max)	6.0%
Cross Slope (Travel Lane)	1.5 – 2.0%
Stopping Sight Distance	495'
Vertical Curve (K value -crest)	114
Vertical Curve (K value sag)	115
Maximum Grade	6%
Minimum Grade	0.5%
Vertical Clearance (Highway over Minor Arterial)	16'-3"
Vertical Clearance (Highway over non-Electrified Railroad)	20'-6"

Posted Speed Limit

The posted speed limit creates a driver expectation of safe operating speed on a highway or interchange ramp. The posted speed is evaluated for each facility based on the following factors:

- 85th percentile speed
- Roadway geometrics
- Functional classification and type of area
- Type and density of roadside development
- Crash experience
- Pedestrian activity



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Route 15 and Route 7 are the two mainline roadways within the project area and have posted speed limits of 55 mph. The geometry of both mainline roadways consists of large radii or tangent sections that extend throughout the project area. There are twelve ramps connecting the Route 7/15 and Route 15/Main Avenue interchanges with posted advisory speeds varying from 40 mph to stop conditions. Several ramps do not have posted advisory speed limits.

Lane Width

Based on the CTHDM and AASHTO, lane widths will influence the level of comfort for motorists and may vary between 9 feet and 12 feet depending on the functional classification, traffic volumes. On Route 15, where no commercial traffic is permitted, lane widths in both the northbound and southbound directions are 11 feet. Route 7, where commercial traffic is permitted, travel lanes in both directions are 12 feet wide. In general, the ramps connecting the Route 7 / 15 and Main Avenue / Route 15 interchanges have a 12-foot travel way.

Shoulder Width

Based on AASHTO Section 4.4.1, the general description of a shoulder is the portion of the roadway contiguous with the travel way that accommodates stopped vehicles, emergency use and lateral support of subbase, base, and surface course. The “useable” width of a shoulder is the actual width that can be used when a driver makes an emergency or parking stop.

Several of the traffic related advantages of a well-designed and maintained shoulder are as follows:

- Space is provided away from the travel lanes for vehicles to stop (emergencies, flat tires, mechanical difficulties, consult maps);
- Space is provided for evasive maneuvers to avoid potential crashes or reduce their severity;
- Sight distance is improved in cut sections, thereby potentially improving safety;
- Highway capacity is improved because uniform speed is encouraged; and
- Space is provided for maintenance operations such as snow removal and storage.

For the Route 7 and Route 15 corridors, the CTHDM (Figure 5B) requires that the right shoulder should be between 4 feet and 8 feet and the left shoulder between 2 feet and 4 feet. For a typical one lane or two lane ramp sections, the CTHDM (Section 12-4.02) requires the standard 4-foot left shoulder and 10-foot right shoulder.

Horizontal Curvature

For Route 7 and Route 15 mainline roadways, Figure 5B in the CTHDM requires a minimum radius of 1065 feet for at 55 mph design speed. Figure 8-2A in the CTHDM list minimum radius for ramps (excluding loop ramps). Figure 8-2A indicated a minimum radius for 30 mph is 275 feet with a superelevation rate of 6.0 percent.



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Loop ramps may be design for 25 mph where mainline design speeds are greater than 50 mph. Figure 11-4D “Minimum Radii for Turning Roadways” in the CTHDM may be used for loops ramp minimum radii where a 25 mph design speed requires a 145 foot minimum radius with a superelevation of 6.0 percent.

Ramp radii within the Route 7 / Route 15 interchange meet the minimum criteria for horizontal curvature, whereas all ramps located within the Route 15 / Main Avenue interchange do not meet the minimum horizontal criteria.

Superelevation

Superelevation is the amount of cross slope or “bank” provided on a horizontal curve to help counterbalance, in combination with side friction, the centrifugal force of a vehicle traveling on a curve. There is a specific superelevation for each combination of horizontal curve and speed of travel. Based on Figure 5B “Multi Lane Principal Urban Arterials” in the CTHDM for the Route 7 and Route 15 design criteria, the maximum superelevation (e_{max}) is 6.0 percent for 55 mph. The maximum superelevation rate for interchange ramps is also 6.0 percent per CTHDM Section 12-4.

The relatively flat horizontal curves and / or tangent sections along Route 7 and Route 15 do not require superelevation. The interchange ramp connecting the Route 7 / Route 15 mainline roadways are adequately superelevated whereas the Main Avenue / Route 15 interchange ramps are not.

Cross Slope

Surface cross slopes are required for proper drainage of travel lanes on tangent sections. As per the CTHDM, cross slopes for Two-Lane and Multi-Lane Highways that do not require superelevation should be between 1.5 percent and 2.0 percent sloping away from the roadway centerline. Cross slopes on ramp not requiring superelevation should be 1.5 percent.

Stopping Sight Distance

Stopping Sight Distance (SSD) is the sum of the distance traveled during a driver’s perception/ reaction or break reaction time and the distance traveled while breaking to a stop. Stopping Sight Distance is evaluated based on both the vertical and horizontal roadway geometry. Fixed objects may restrict the line of sight of motorists on the inside of horizontal curves. Figure 5B in the CTHDM requires a SSD of 495 feet for a 55 mph design speed. A design speed of 30 mph on ramps requires a 200-foot SSD.



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Maximum / Minimum Grade

Longitudinal grades will significantly impact vehicular operations and safety. Maximum grades are based on functional classification, urban/rural location and design speeds. The maximum length of an upgrade should also be considered for truck traffic. The minimum longitudinal grade for all types of roadways is 0.5 percent to provide for surface drainage.

For Route 7 and Route 15, the CTHDM requires a maximum grade of 6 percent for a design speed of 55 mph. Figure 12-4C in the CTHDM gives maximum ramp grades ranging between 6-8 percent for 25 mph, between 5-7 percent for 30 mph, and between 4-6 percent 40 mph.

Existing longitudinal grades on all roadways within the project area fall within the required maximum grade criteria with the exception of Route 15 for the segment between Main Avenue and West Rocks Road where the grade is approximately 7 percent.

Vertical Clearance

Vertical clearance is the distance above a roadway that is free of obstructions. The minimum vertical clearance depends on its functional classification. Table 6.2 below is based on Section 9-4 of the CTHDM which summarizes the minimum vertical clearances for new bridges for various highway classifications and conditions. These minimum clearances apply to the entire roadway width. Table 6.3 summarizes existing vertical clearances for the eleven bridges within study area limits.

Table 6.2: Minimum Vertical Clearances

Roadway Type	Clearance
Freeway/Expressway/Arterial Under	16'-3"
Collector/Local Under	14'-6"
Railroad Under Highway (electrified)	22'-6"
Railroad Under Highway (non-electrified)	20'-6"
Railroad Under Freeway	23'-0"
Highway Under Sign Truss or Pedestrian Bridge	17'-3"



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Table 6.3: Existing Bridge Vertical Clearances

Bridge	Facility Carried	Feature Crossed	Vertical Clearance
00530A	NB Route 15	Main Avenue (SR 715)	14'-5"
00530B	SB Route 15	Main Avenue (SR 719)	13'-10"
00719	Route 15	Perry Avenue	12'-8"
00720	Route 15	Metro-North RR	21'-7"
00721	Route 15	Norwalk River	n/a
00722	Route 15	West Rocks Road	13'-3"
04155	Glover Avenue	Norwalk River	n/a
06066	Route 7 & On-Ramp	Perry Avenue	15'-4"
06067	Route 7 Off-Ramp	Perry Avenue	14'-4"
06068	Route 7 On-Ramp	Perry Avenue	15'-8"
06069	Route 15 & On/Off-Ramps	Route 7	20'-9"

6.1.2 Review of Mainline Geometrics

This section presents the review of geometric conditions along study area mainlines. It should be noted that, in all of the below tables, values denoted in red indicate values that are not to standard.

6.1.2.1 Route 15 (Merritt Parkway) Corridor

The Route 15 corridor has several tangent sections with two horizontal curves extending through the project area between Perry Avenue and West Rocks Road. The first horizontal curve consists of a 2,865-foot radius, approximately 350 feet long, located between the Route 7 and Main Avenue interchanges. The second horizontal curve consists of an 1,860-foot radius, approximately 768-foot long, located between Main Avenue and West Rocks Road. Longitudinal slopes along the mainline within the project limits.

The vertical alignment has a high point between Route 7 and Perry Avenue and a low point near the Main Avenue overpass with longitudinal slopes of approximately 7 percent between Main Avenue and West Rocks Road, approximately 5 percent between Route 7 and Main Avenue, and slopes of 2 percent and flatter between Perry Avenue and Route 7.

A summary of mainline geometrics for the Route 15 corridor, including at the interchanges with Route 7 and Main Avenue, is presented in Table 6.4.



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Table 6.4: Route 15 Mainline Review

Design Element	CTHDM Section	Standard	Route 15 Interchange with Route 7	Route 15 Interchange with Main Avenue
Functional Classification		Principal Arterial	-	-
Posted / Evaluated Speed	6-2.02	55 mph (suburban area)	55 mph	55 mph
Travel Lane Width	Figure 5A	12'	12'	12'
Right Shoulder Width	Figure 5A	10'	2'-10'	2'-4'
Left Shoulder Width	Figure 5A	8' (4' paved + 4' graded)	0.5'-2'	0.5'-2'
Cross Slope Travel Lane	10-1.01.02	1.5 – 2.0 %	1.5 – 2.0 %	1.5 – 2.0 %
Stopping Sight Distance	7-1.0	495	1400'	2900'
Minimum Radius (e=6.0%)	8-2.02	1065	2820'	1825'
Maximum Superelevation	8-2.02	6.0%	3.5%	5.0%
Maximum Grade	9-2.03	5.0%	5.5%	7.25%
Minimum Grade	9-2.03	0.5%	0.5%	0.5%
Vertical Clearance – Highway over Minor Arterial	9-4.0	16'-3"	-	-
Vertical Clearance – Arterial Under	9-4.0	16'-3"	-	-
Vertical Clearance – Non-Electrified RR	9-4.0	20'6"	-	-

6.1.2.2 Route 7 Corridor

The Route 7 horizontal alignment is tangent from the south project limits through the Route 15 interchange with a 3,800-foot radius located near the northern limit of the project are. Route 7 has a CD Roadway that distributes traffic to and from the Route 15 on and off loop ramps.

There are no high or low points within the Route 7 project limits. The roadway longitudinal slope ranges from approximately 1 percent to approximately 2.5 percent and increase from the south to north direction.

A summary of mainline geometrics for the Route 7 corridor, including at the interchange with Route 15, is presented in Table 6.5.



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Table 6.5: Route 7 Mainline Review

Design Element	CTHDM Section	Standard	Route 7 Interchange with Route 15
Functional Classification		Principal Arterial	-
Posted / Evaluated Speed	6-2.02	55 mph (suburban area)	55 mph
Travel Lane Width	Figure 5A	12'	12'
Right Shoulder Width	Figure 5A	10'	10'
Left Shoulder Width	Figure 5A	8' (4' paved + 4' graded)	6'
Cross Slope Travel Lane	10-1.01.02	1.5 – 2.0 %	1.56%
Stopping Sight Distance	7-1.0	495	1,090'
Minimum Radius (e=6.0%)	8-2.02	1,065	3,800
Maximum Superelevation	8-2.02	6.0%	5.21%
Maximum Grade	9-2.03	5.0%	1.785%
Minimum Grade	9-2.03	0.5%	0.606%
Vertical Clearance – Highway over Minor Arterial	9-4.0	16'-3"	N/A
Vertical Clearance – Arterial Under	9-4.0	16'-3"	N/A
Vertical Clearance – Non-Electrified RR	9-4.0	20'-6"	N/A

6.1.3 Review of Interchange Ramp Geometrics

This section presents the review of geometric conditions at study area interchanges. It should be noted that, in all of the below tables, values denoted in red indicate values that are not to standard.

The Route 15 project corridor has one full interchange with Main Avenue and one partial interchange with Route 7. AASHTO defines a “ramp” as all types, arrangements, and sizes of turning roadways that connect two or more legs at an interchange. Ramp types are defined by their geometry consisting of direct connections, semi-direct connections, diagonals, loops and outer connections are generally designed with one-way traffic.

Ramp design speeds are based on their horizontal curvature, vertical alignment and stopping sight distance. Design speeds for ramps listed in Figure 12-4A of the CTHDM and is shown below in Table 6.6 and refer to the ramp proper, not the highway / ramp junction. Table 6.6 provides acceptable ranges of ramp design speed based on the design speed of the mainline. The design speed for direct connections should not be less than 40 mph while design speeds for semi-direct ramps should be between the mid and high ranges but not less than 30 mph. For mainline speeds greater than 50 mph, loop ramp design speeds should not be less than 25 mph.



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Table 6.6: Review of Ramp Design Speeds (MPH)

Mainline Design Speed	45 MPH	50 MPH	55 MPH	60 MPH	65 MPH	70 MPH
High-Range (85%) Ramp Design Speed	40	45	50	50	55	60
Mid-Range (70%) Ramp Design Speed	35	35	40	45	45	50
Low-Range (50%) Ramp Design Speed	25	25	30	30	30	35

Minimum radius for all ramps, except loop ramps, are indicated in Figure 8-2A of the CTHDM. Minimum radius for 30 mph is 275', 35 mph is 385' and 40 mph is 510. Loop ramp follow the criteria in Figure 11-4D of the CTHDM for "Minimum Radii for Turning Roadways" where a design speed of 25 mph requires a 145' radius with a 6.0 percent superelevation.

Deceleration and acceleration ramps should provide safety comfortably allow vehicles to exit or enter the highway. Minimum lengths of deceleration lanes are given in F12-3A of the CTHDM and are based on the mainline design speed and the ramp design speed. These deceleration lengths should also be adjusted for upgrades and downgrades greater than 3 percent.

Minimum lengths of acceleration lanes are indicated in Figure 12-3D and are also based on the mainline design speed and ramp design speed. Grade adjustments should also be used for upgrades or downgrades greater than 3 percent.

6.1.3.1 Route 7/15 Interchange

The Route 15 interchange with Route 7 has two loop ramps located in the northeast and southeast quadrants with connection from NB Route 7 to SB Route 15 and from NB Route 15 to NB Route 7. Two direct ramps provide connections from SB Route 15 to NB Route 7 and From NB Route 15 to SB Route 7. The Route 7 / 15 interchange has two missing ramp connections; one from SB Route 15 to SB Route 7 and from NB Route 7 to NB Route 15. A summary of ramp geometrics for the Route 7/15 interchange is presented in Table 6.7.

6.1.3.2 Main Avenue/Route 15 Interchange

Route 15 has a full cloverleaf interchange with Main Avenue. Eight ramps provide access to/from both northbound and southbound Route 15. The ramp types vary at the interchange and include loops, semi direct, diagonals and outer connections. Due to tight constraints within the interchange, all four loop ramps have very tight radii ranging from 50' to 125'. The four other ramps consist of outer connection adjacent to the loops ramps. A summary of ramp geometrics for the Main Avenue/Route 15 interchange is presented in Table 6.8.



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Table 6.7: Route 7/15 Interchange Ramp Geometrics Review

Design Element	CTHDM Section	CTDOT Standard	(Ramp 'SW') Route 15 SB ON	(Ramp 'NW') Route 15 SB ON	(Ramp 'WS') Route 15 NB OFF	(Ramp 'WN') Route 15 NB OFF
			From NB Route 7	From SB Route 7	To SB Route 7	To NB Route 7
Functional Classification / Ramp Type	-	-	Loop Ramp	Directional	Directional	Loop Ramp
Posted Speed Limit (Mainline)	6-2.02	55 mph	55 mph	55 mph	55 mph	55 mph
Posted (Ramps)	-	-	Not Posted	40 mph	Not Posted	25 mph
Travel Lane Width	12-4.02	12'	12'	12'	12'	12'
Right Shoulder Width	12-4.02	10'	6'	6'	6'	6'
Left Shoulder Width	12-4.02	4'	6'	6'	6'	6'
Cross Slope Travel Lane & Right Shoulder	12-4.02 Fig 12-4B	1.50%	1.80%	1.80%	6.25%	6.25%
Cross Slope Left Shoulder	12-4.02 (5) Fig 12-4B	4.00%*	1.80%	1.80%	6.25%	6.25%
Acceleration or Deceleration Length / Available Length	13-3.0	Varies by Grade (criteria / actual)	880'	400' weave	400' weave	750'
Stopping Sight Distance	7-1.0	200'	250'	365'	310'	290'
Minimum Radius (e=6.0%)	8-2.02	275'	230'	600'	550'	300'
Maximum Superelevation	8-2.02	6.0%	4.50%	5.75%	5.00%	7.50%
Maximum Grade	12-4.04	7.0%	5.53%	7.00%	6.87%	7.00%
Minimum Grade	9-2.03	0.5%	0.70%	1.92%	1.12%	0.71%
Vertical Clearance – Highway over Arterial	9-4.0	16'-3"	N/A	N/A	N/A	N/A
Vertical Clearance – Highway over Arterial	9-4.0	20'-6"	N/A	N/A	N/A	N/A

*4' width of shoulder should be sloped in opposite direction of ramp cross slope



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Table 6.8: Main Avenue/Route 15 Interchange Ramp Geometrics Review

Design Element	CTHDM Section	CTDOT Standard	Route 15 SB OFF	Route 15 SB ON	Route 15 SB OFF	Route 15 SB ON	Route 15 NB OFF	Route 15 NB ON	Route 15 NB OFF	Route 15 NB ON
			To NB Main Ave	From NB Main Ave	To SB Main Ave	From SB Main Ave	To SB Main Ave	From SB Main Ave	To NB Main Ave	From NB Main Ave
Functional Classification / Ramp Type	-	-	Outer Ramp	Loop Ramp	Loop Ramp	Outer Ramp	Outer Ramp	Loop Ramp	Loop Ramp	Outer Ramp
Posted Speed Limit (Mainline)	6-2.02	55 mph	55 mph	55 mph	55 mph	55 mph	55 mph	55 mph	55 mph	55 mph
Posted (Ramps)	-	-	25 mph	Stop Condition	Not posted	Yield Condition	25 mph	Stop Condition	25 mph	Not Posted
Travel Lane Width	12-4.02	12'	12'	12'	12'	12'	12'	12'	12'	12'
Right Shoulder Width	12-4.02	10'	10'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'
Left Shoulder Width	12-4.02	4'	4'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'	0' – 2'
Cross Slope Travel Lane & Right Shoulder	12-4.02 Fig 12-4B	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Cross Slope Left Shoulder	12-4.02 Fig 12-4B	4.05%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Acceleration or Deceleration Length / Available Length	13-3.0	Varies by Grade (criteria / actual)	100'	0'	0'	150'	100'	0'	0'	250'
Stopping Sight Distance	7-1.0	200'	215'	184'	215'	184'	215'	184'	215'	184'
Minimum Radius (e=6.0%)	8-2.02	275'	105'	50'	70'	115'	120'	60'	118'	155'
Maximum Superelevation	8-2.02	6.0%	5%	5%	6.5%	7.25%	5%	5%	5%	6.5%
Maximum Grade	12-4.04	7.0%	6.3%	5.0%	5.5%	4.0%	5.0%	5.6%	5.0%	4.6%
Minimum Grade	9-2.03	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Vertical Clearance – Highway over Arterial	9-4.0	16'-3"	16'-3"	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical Clearance – Highway over Arterial	9-4.0	20'-6"	20'-6"	N/A	N/A	N/A	N/A	N/A	N/A	N/A

6.1.4 Review of Local Roadway Geometrics

This section presents the review of geometric conditions along various local roadways that interact with the Main Avenue / Route 15 interchange, such as Main Avenue, Glover Avenue, and Creeping Hemlock Drive, respectively. It should be noted that, in all of the below tables, values denoted in red indicate values that are not to standard.



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Table 6.9: Main Ave Geometrics Review

Design Element	CTHDM Section	Standard	Main Ave
Functional Classification		Minor Urban Arterial	-
Posted / Evaluated Speed	6-3.02	40 mph	40 mph
Travel Lane Width	10-1.01	11' – 12'	12'
Right Shoulder Width	10-1.02	4' - 8'	2' – 4'
Left Shoulder Width	10-1.02	2' – 4'	2' – 4'
Cross Slope Travel Lane	10-1.01.02	1.5 – 2.0 %	2%
Stopping Sight Distance	7-1.0	305'	260'
Minimum Radius (e=4.0%)	8-2.02	490'	680'
Maximum Superelevation	8-2.02	4.0%	6%
Maximum Grade	9-2.03	8.0%	3.17%
Minimum Grade	9-2.03	0.5%	0.50%
Vertical Clearance – Highway over Minor Arterial	9-4.0	16'-3"	13'-10"
Vertical Clearance – Arterial Under	9-4.0	16'-3"	n/a
Vertical Clearance – Non-Electrified RR	9-4.0	20-6"	n/a

Table 6.10: Glover Ave Geometrics Review

Design Element	CTHDM Section	Standard	Glover Ave
Functional Classification		Minor Urban Arterial	-
Posted / Evaluated Speed	6-3.02	30 mph	30 mph
Travel Lane Width	10-1.01	11' – 12'	11'
Right Shoulder Width	10-1.02	4' - 8'	0'
Left Shoulder Width	10-1.02	2' – 4'	0'
Cross Slope Travel Lane	10-1.01.02	1.5 – 2.0 %	2%
Stopping Sight Distance	7-1.0	200'	200'
Minimum Radius (e=4.0%)	8-2.02	230'	830'
Maximum Superelevation	8-2.02	4.0%	5.1%
Maximum Grade	9-2.03	9.0%	1.7%
Minimum Grade	9-2.03	0.5%	0.50%
Vertical Clearance – Highway over Minor Arterial	9-4.0	16'-3"	n/a
Vertical Clearance – Arterial Under	9-4.0	16'-3"	n/a
Vertical Clearance – Non-Electrified RR	9-4.0	20-6"	n/a



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Table 6.11: Creeping Hemlock Drive Geometrics Review

Design Element	CTHDM Section	Standard	Creeping Hemlock Drive
Functional Classification		Urban Collector Streets	-
Posted / Evaluated Speed	6-3.02	30 mph	30 mph
Travel Lane Width	10-1.01	11' – 12'	11'
Right Shoulder Width	10-1.02	4' - 8'	0'
Left Shoulder Width	10-1.02	4' - 8'	0'
Cross Slope Travel Lane	10-1.01.02	1.5 – 2.0 %	2%
Stopping Sight Distance	7-1.0	200'	83'
Minimum Radius (e=4.0%)	8-2.02	230'	167'
Maximum Superelevation	8-2.02	4.0%	6.1%
Maximum Grade	9-2.03	11.0%	5.3%
Minimum Grade	9-2.03	0.5%	0.50%
Vertical Clearance – Highway over Minor Arterial	9-4.0	16'-3"	n/a
Vertical Clearance – Arterial Under	9-4.0	16'-3"	n/a
Vertical Clearance – Non-Electrified RR	9-4.0	20-6"	n/a



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6.2 ROADWAY STRUCTURES REVIEW

6.2.1 METHODOLOGY

The existing condition of structures within study area limits were assessed and documented utilizing the latest bridge inspection report data available from CTDOT.

6.2.1.1 General Description of Bridges

There is a total of eleven bridges within study area limits that were assessed in this report. These bridges carry, overpass, or underpass the Route 15 mainline, local City streets, the Norwalk River, and Metro-North Railroad. A majority of the bridges were built either in the 1930s or in the 1990s.

General information about each bridge is presented in Table 6.12. For information on vertical clearances, please see Table 6.3.



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Table 6.12: Bridge Construction, Rehabilitation, and Inspection Data

Bridge	Facility Carried	Feature Crossed	Structure Type	Bridge Length	Bridge Width	Year Construction Completed	Year Reconstruction Completed	On National Register of Historic Places (NRHP)?	Date of Latest Inspection
00530A	NB Route 15	Main Ave (SR 719)	Concrete Rigid Frame	52.0'	36.7'	1938		Yes, contributing structure within the Merritt Parkway Historic District	12/15/2016
00530B	SB Route 15	Main Ave (SR 719)	Concrete Rigid Frame	52.0'	36.7'	1938	2016	Yes, contributing structure within the Merritt Parkway Historic District	12/15/2016
00719	Route 15	Perry Avenue	Concrete Rigid Frame	33.0'	66.8'	1936		Yes	6/5/2017
00720	Route 15	Metro-North RR	Concrete Rigid Frame	37.0'	105.5'	1937		Yes	8/25/2017
00721	Route 15	Norwalk River	Concrete Arches	99.0'	158.0'	1938	1988	Yes, contributing structure within the Merritt Parkway Historic District	6/21/2016
00722*	West Rocks Road	Route 15	Steel Frame	90.0'	36.1'	1938	1986	Yes	11/13/2017
04155	Glover Avenue	Norwalk River	Masonry Arch	84.0'	34.5'	1912		No; may be eligible	7/13/2016
06066	Route 7 & On-Ramp	Perry Avenue	Prestressed Concrete Multi-Girder	109.0'	110.0'	1991		No; not eligible	12/22/2014
06067	Route 7 Off-Ramp	Perry Avenue	Prestressed Concrete Multi-Girder	97.0'	27.8'	1990		No; not eligible	6/5/2017
06068	Route 7 On-Ramp	Perry Avenue	Prestressed Concrete Multi-Girder	97.0'	27.8'	1990		No; not eligible	6/5/2017
06069	Route 15 & On/Off-Ramps	Route 7	Steel Multi-girder	212.0'	122.2'	1991		No; not eligible	8/19/2014

*Being rehabilitated under Project No. 102-356



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6.2.2 Existing Structural Conditions

Condition ratings established by the National Bridge Inspection Standards (NBIS) are used to describe an existing bridge compared with its conditions if in fact the bridge was new. As bridges are inspected, they are assigned conditions ratings. Ratings range from a high of 9 (excellent condition) to a low of 0 (failed condition). The rating scale is summarized in Table 6.13.

Table 6.13: NBIS Rating Scale

NBIS Code	Condition Description
9	Excellent Condition
8	Very Good Condition – no problems noted
7	Good Condition – some minor problems
6	Satisfactory Condition – structural elements show minor deterioration
5	Fair Condition – all primary structural elements are sound but may have minor corrosion, cracking or chipping. May include minor erosion on bridge piers.
4	Poor Condition – advanced corrosion, deterioration, cracking or chipping. Also, significant erosion of concrete bridge piers.
3	Serious Condition – corrosion, deterioration, cracking and chipping, or erosion of concrete bridge piers have seriously affected deck, superstructure, or substructure. Local failures possible.
2	Critical Condition – advanced deterioration of deck, superstructure, or substructure. May have cracks in steel or concrete, or erosion may have removed substructure support. It may be necessary to close the bridge until corrective action is taken.
1	“Imminent” Failure Condition – major deterioration or corrosion in deck superstructure, or substructure, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	Failed Condition – out of service and beyond corrective action.
N	Not Applicable

The NBIS rating scale is used in evaluating bridge components such as the deck, superstructure, substructure, and culvert/channel as well as in evaluating the bridge overall. Condition ratings for each bridge element along with the overall structural evaluation for each bridge within study area limits are presented in Table 6.14.



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Table 6.14: Bridge Condition Ratings and Overall Structural Evaluation Summary

Bridge	Deck	Superstructure	Substructure	Channel	Deck Geometry	Structural Evaluation
00530A	N	5	6	N	2	5
00530B	N	6	7	N	2	6
00719	N	6	7	N	3	6
00720	N	5	5	N	4	5
00721	N	6	6	5	2	6
00722*	4	5	6	N	2	5
04155	N	5	5	5	2	5
06066	6	6	7	N	9	6
06067	7	6	6	N	7	6
06068	7	7	7	N	7	7
06069	7	7	7	N	7	7

*Being rehabilitated under Project No. 0102-0356



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Summary of Deficiencies

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7.0 SUMMARY OF DEFICIENCIES

This section summarizes area-wide, interchange specific, and corridor specific deficiencies that have been previously identified in earlier sections of the report.

7.1 CORRIDOR DEFICIENCIES

7.1.1 Route 15 Corridor

- Substandard left and right shoulder widths throughout the corridor.
- Substandard roadway grades throughout the corridor.
- Insufficient capacity on southbound Route 15 west of the merge with southbound Route 7.
- Insufficient capacity on northbound Route 15 west of the diverge with southbound Route 7.
- Mainline crashes attributed to roadway geometry and peak period congestion at the Main Avenue (Exit 40) interchange.

7.1.2 Route 7 Corridor

- Substandard left shoulder width throughout the corridor.
- Insufficient capacity along both northbound and southbound Route 7 approaching the intersections with Grist Mill Road, Glover Avenue, Main Avenue, West Rocks Road, and Foxboro Drive.
- Mainline crashes attributed to roadway geometry and peak period congestion at the intersections with Grist Mill Road, Glover Avenue, and Main Avenue.

7.1.3 Main Avenue Corridor

- Substandard stopping sight distance at the Route 15 bridge.
- A lack of sidewalks along either side of Main Avenue at and adjacent to the Route 15 bridge.
- No accommodations for bicycles along the corridor.
- Limited transit and rail service on or adjacent to the corridor.
- Lacking accommodations for transit along the corridor (bus stop signage, etc.).
- Insufficient capacity along both northbound and southbound Main Avenue approaching the intersection with Glover Avenue / Creeping Hemlock Drive.
- Congestion on northbound and southbound Main Avenue between Linden Street and Perry Avenue and between Ward Street and New Canaan Avenue. It should be noted that the congestion on Main Avenue just north of New Canaan Avenue contributes to the congestion on New Canaan Avenue just west of Main Avenue, both to the west and east of the at-grade crossing with the Metro-North Railroad's Danbury Branch.
- Mainline crashes attributed to roadway geometry and peak period congestion at the intersections with Grist Mill Road, Glover Avenue, and Main Avenue.



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7.1.4 Glover Avenue Corridor

- No left or right shoulders between Main Avenue and the Metro-North Railroad crossing.
- Substandard superelevation along the corridor.
- Lack of sidewalks on the north side of the Glover Avenue Bridge and a lack of sidewalks leading to and from the intersection with Main Avenue.
- No accommodations for bicycles along the corridor.
- Insufficient capacity on the eastbound Glover Avenue approach to the Main Avenue intersection.

7.1.5 Creeping Hemlock Drive

- No left or right shoulders between Main Avenue and the southbound Route 15 ramps.
- Substandard stopping sight distance along the corridor.
- Substandard minimum radius along the corridor.
- Substandard superelevation along the corridor.
- Insufficient capacity on the westbound Creeping Hemlock Drive approach to the Main Avenue intersection.

7.2 ROUTE 7/15 INTERCHANGE DEFICIENCIES

- Substandard right shoulders on all ramps.
- Substandard left shoulder cross slopes on all ramps.
- Substandard acceleration/deceleration lane lengths on ramps onto Route 15.
- Substandard grades on ramps.
- Congestion on the Route 7 ramps onto southbound Route 15.

7.3 MAIN AVENUE/ROUTE 15 INTERCHANGE DEFICIENCIES

- Substandard left and right shoulder widths on all ramps except for the southbound Route 15 off-ramp to northbound Main Avenue and the southbound Route 15 on-ramp from Creeping Hemlock Drive.
- Substandard radii on all ramps.
- Substandard super elevation on the southbound Route 15 off-ramp to northbound Main Avenue and the northbound Route 15 on-ramp from northbound Main Avenue/Creeping Hemlock Drive.
- Substandard acceleration and deceleration lanes on all ramps.
- Congestion on two substandard, STOP controlled on-ramps – southbound Main Avenue to northbound Route 15 and Creeping Hemlock Drive to southbound Route 15.
- Insufficient capacity and congestion on the southbound Route 15 off-ramp to Creeping Hemlock Drive.



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- Poor sight distance on southbound Route 15 approaching the off-ramp to Creeping Hemlock Drive causes abrupt vehicular stops resulting in congestion on both the ramp and the mainline.

