# CITYWIDE CONGESTED CORRIDOR PROJECT

# BROADWAY
## (DRIGGS AVENUE TO MYRTLE AVENUE)

## BOROUGH OF BROOKLYN

# FINAL REPORT
## December 2015


City of New York
Bill de Blasio, Mayor

NEW YORK CITY DOT
Department of Transportation

A Member of the New York Metropolitan Transportation Council

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# EXECUTIVE SUMMARY

The Broadway Congested Corridors Project has been undertaken by the New York City Department of Transportation (NYCDOT) with the goals of improving mobility and safety for all street users (pedestrians, cyclists, transit users and motorists), air quality and the quality of life. This report presents recommended improvement measures based on analysis of existing and future conditions, field observations, and community input and feedback.

The study area of the Broadway corridor extends between Driggs Avenue to the northwest and Myrtle Avenue to the southeast. The study corridor traverses Brooklyn Community Boards 1, 3 and 4. Broadway is surrounded by diverse neighborhoods with many uses, including a mix of commercial, residential and manufacturing land uses. A major trip generator in the area is Woodhull Medical Center, located on the southeast corner of the Broadway and Flushing Avenue.

Most of the Broadway study corridor is under elevated subway tracks serving the J and Z lines. There are five stations at Marcy Avenue, Hewes Street, Lorimer Street, Flushing Avenue and Myrtle Avenue. There are five bus routes along the corridor, and seven bus routes that cross the corridor. The major roadways crossing the study corridor are Union Avenue, Flushing Avenue and Myrtle Avenue. The curb to curb distance of the study corridor is about 42 feet. There is one travel lane in each direction, with parking permitted on both sides. Broadway is designated as a local truck route.

Extensive outreach has been conducted in an effort to engage the public, which was considered a critical part of the study process. Outreach will continue in late 2015 and early 2016 before the recommended improvements are implemented.

The following is a summary of the major problems:

- Traffic congestion, especially between Flushing Avenue and Myrtle Avenue, westbound during the weekday AM peak period and eastbound during the weekday PM peak period.
- Double parking, especially by trucks making deliveries unable to find parking spaces.
- Deficiencies in pedestrian facilities, including discontinuous sidewalks, sidewalks that don't follow desire lines, and unsafe conditions caused by skewed and offset intersections.

In order to address these issues, improvement measures were proposed. The recommendations are summarized as follows:

- Signal timing and coordination adjustments.
- Parking regulation changes:
  - Convert some non-metered, free parking spaces to loading spaces and metered spaces.
  - Implement peak period, peak direction No Standing zones between Flushing Avenue and Myrtle Avenue.
- Intersection specific improvements:

- Pedestrian and vehicular safety improvements at Broadway, Rodney Street and South 9th Street.
- Safety and operational improvements at Broadway, Flushing Avenue and Graham Avenue.
- Pedestrian safety improvements at Broadway, Myrtle Avenue and Jefferson Street.
- Pedestrian and vehicular safety improvements at Broadway and Park Avenue.
- Pedestrian and vehicular safety improvements at Broadway and Boerum Street.
- Pedestrian and vehicular safety improvements at Broadway, Middleton Street and Throop Avenue Avenue.
- Safety, operational and transit improvements at the Williamsburg Bridge Bus Plaza.

These recommendations have been evaluated and benefits and drawbacks have been quantified using SimTraffic software, where applicable.

# CHAPTER 1 INTRODUCTION

## 1.1 Background

The Citywide Congested Corridors Project (CCCP) is a study undertaken by the New York City Department of Transportation (NYCDOT) of selected roadways across the five boroughs which experience congestion, with the goals of improving mobility and safety for all street users, air quality and the quality of life. Broadway in Brooklyn was selected as one of the congested corridors. The study is consistent with the City's goal of building "Complete Streets" that accommodate all street users including pedestrians, cyclists, transit users and motorists.

This report documents the data collection effort, presents analysis of existing conditions and future conditions without improvements, summarizes recommended improvements, and evaluates future conditions with improvements for the Broadway Congested Corridor. The identification of current issues along the corridor was based on analyses of traffic, roadway geometry, parking, safety, goods movement, transit, pedestrian and bicycle data collected as part of a comprehensive data collection effort.

Extensive outreach has been conducted in an effort to engage the public including public meetings, which was considered a critical part of the study process. The public meetings were organized in cooperation with the Brooklyn Borough Commissioners Office, Council Member Diane Reyna's office, and local community boards. The meetings were attended by representatives from the NYPD, FDNY, BIDs, Woodhull Hospital Center, religious organizations, business owners, local residents, and other interest groups. Input from these meetings and correspondence were incorporated into the development of the various potential improvement scenarios and the selection of the recommended improvements. Outreach will continue in late 2015 and early 2016 before the recommended improvements are implemented.

## 1.2 Organization of Report

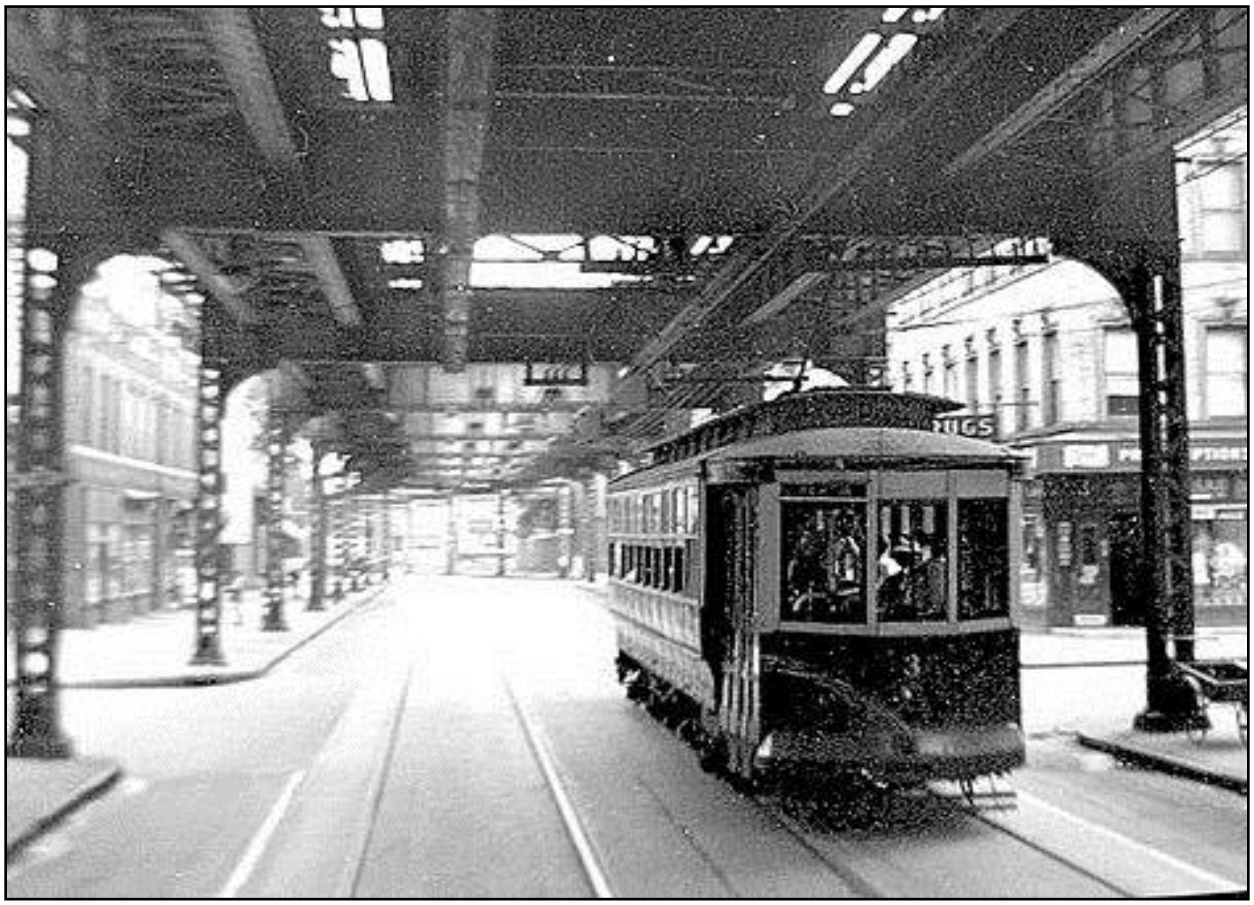
This technical memorandum is organized in the following sections:

- Section 1 "**Introduction**" is a brief overview of the study;
- Section 2 "**Data Collection**" presents a synopsis of the data collection effort;
- Section 3 "**Existing Conditions and Analysis**" summarizes the findings of existing conditions from observations, community input, and technical analysis;
- Section 4 **"Future Conditions without Improvements**" uses future-estimated traffic volumes, roadway conditions and land use changes to project conditions that can be expected along the corridor without improvements recommended as part of this study;
- Section 5 **"Improvements"** summarizes proposed improvement measures;
- Section 6 "**Evaluation**" includes comparative travel speed, LOS, and emissions analysis between the future without improvements and the future with improvement scenarios.

## 1.3 Study Area

Through an evaluation process, NYCDOT has identified Broadway in the borough of Brooklyn as one of the congested corridors to be studied under the CCCP. Broadway is a major street that runs northwest to southeast from the East River in the Williamsburg neighborhood to Jamaica Avenue/East New York Avenue in the Bushwick neighborhood. For the remainder of this report, Broadway will be considered as running east-west. Between Flushing Avenue and Eastern Parkway, Broadway forms a boundary between the neighborhoods of Bushwick to the north, and Bedford-Stuyvesant to the south. The total length of Broadway is 4.3 miles.

The first segments of Broadway, extending from East River to South 7th Street, and then further to Division Street, opened in 1830s. In 1883 rapid elevated transit known as "Broadway Elevated" was opened connecting Cypress Hill with Broadway ferry in Williamsburg. The elevated train tracks were extended further east in 1906. It is elevated train structure/subway columns and buildings that were built on both sides of Broadway that determined the roadway characteristics that exist today.



***Photograph 1: Broadway in 1943***

***Photograph 2: Broadway Today***

The study corridor is a 1.6-mile segment of Broadway between Driggs Avenue to the northwest and Myrtle Avenue to the southeast, traversing Community Boards 1, 3 and 4 in the Williamsburg, Bushwick and East New York neighborhoods. See Figure 1. Broadway within the study segment is a 42-foot wide roadway consisting of one travel lane and curbside parking in each direction. Broadway is surrounded by diverse neighborhoods with many uses, including a mix of commercial, residential and manufacturing land uses. A major trip generator in the area is Woodhull Medical Center, located on the southeast corner of the Broadway and Flushing Avenue.

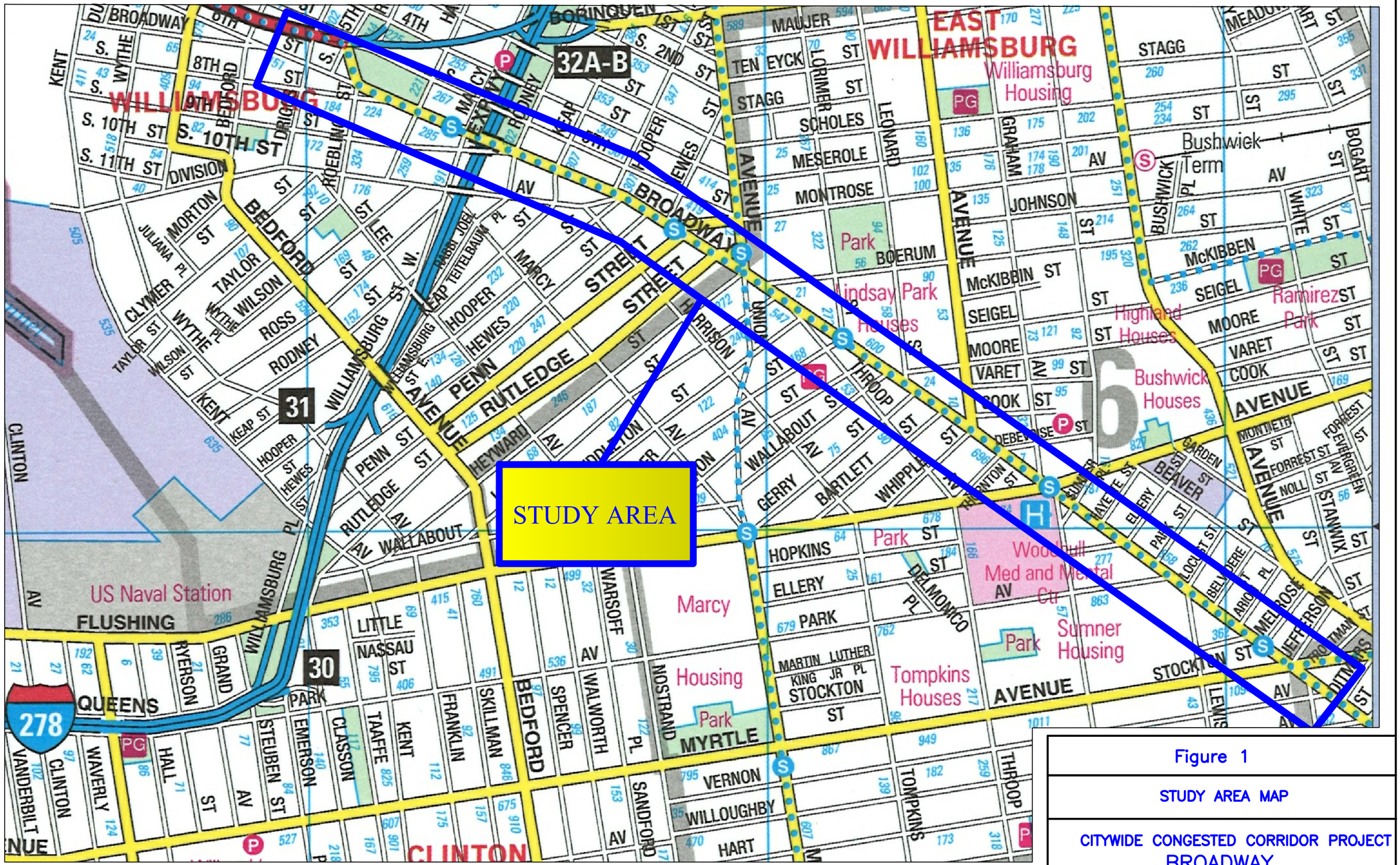



Figure 1

STUDY AREA MAP

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

There are a total of 35 intersections within the study area, of which 24 are unsignalized intersections. The following 11 are signalized intersections:

- Broadway and Roebling Street
- Broadway and Havemeyer Street
- Broadway and Marcy Avenue
- Broadway and Hooper Street
- Broadway and Montrose Avenue
- Broadway and Union Avenue
- Broadway and Lorimer Street
- Broadway and Manhattan Avenue
- Broadway and Thornton Avenue
- Broadway and Flushing Avenue
- Broadway and Myrtle Avenue

# CHAPTER 2 DATA COLLECTION

A comprehensive data collection program was conducted along the Broadway corridor. It included 24-hour automatic traffic recorder (ATR) counts at 16 locations in 15-minute intervals.

Figure 2 presents the data collection plan. Manual turning movement count (TMC) data was collected or derived from previous counts at 30 intersections. Initially, full manual turning movement counts by vehicle classification (passenger vehicle, trucks, buses and bikes) were conducted during a weekday AM (6:30 – 9:30 AM), midday (12:00 PM – 3:00 PM), PM (4:00 – 7:00 PM), and Saturday midday peak period (12:00 – 2:00 PM) at 17 intersections. Sample counts were conducted at 8 additional intersections. TMC for 13 intersections between Union Avenue and Manhattan Avenue were derived from Broadway Triangle EIS study conducted in 2009. Subsequently, additional TMC were counted at 4 major intersections: Union Avenue, Lorimer Street, Flushing Avenue and Manhattan Avenue to supplement the EIS counts. Overall, TMC were conducted or derived for 35 intersections from Driggs Avenue to Myrtle Avenue. The ATR and TMC data were used in developing balanced traffic flow maps for the weekday AM, midday, PM and Saturday midday peak hours.

Pedestrian counts were conducted at seven intersections, which were identified to have the highest pedestrian activities. Additional pedestrian counts were derived from Broadway Triangle EIS study.

Concurrent with ATR and TMC counts, travel time and delay runs using the "floating car technique" were conducted along Broadway between Driggs Avenue and Myrtle Avenue. The runs were conducted on three consecutive weekdays during the weekday AM, midday and PM periods, and a Saturday midday period. There were a total of six trials conducted per period per day.

In addition, more detailed reconnaissance was conducted to determine accurate locations of subway columns as well as other street furniture.

An inventory of existing on-street parking was conducted along the study area. Parking activities were recorded in one hour tours on one midweek day between 7:00 AM and 7:00 PM. Parking utilization on an hour-by-hour basis was documented and summarized, including vehicle classification (passenger vehicle, commercial van, truck, police or emergency vehicle), vehicle status (parked or standing), double parking, etc. Vehicle license plates were recorded to determine parking duration.

Goods movement activities at selected locations along the study corridor were observed and surveyed concurrent with parking surveys. Temporal and spatial distribution of truck activities, compliance with curbside regulations along the corridor (and major side-street approaches) were studied to determine the effect of truck traffic and loading/unloading activities on general traffic flow along the corridor.

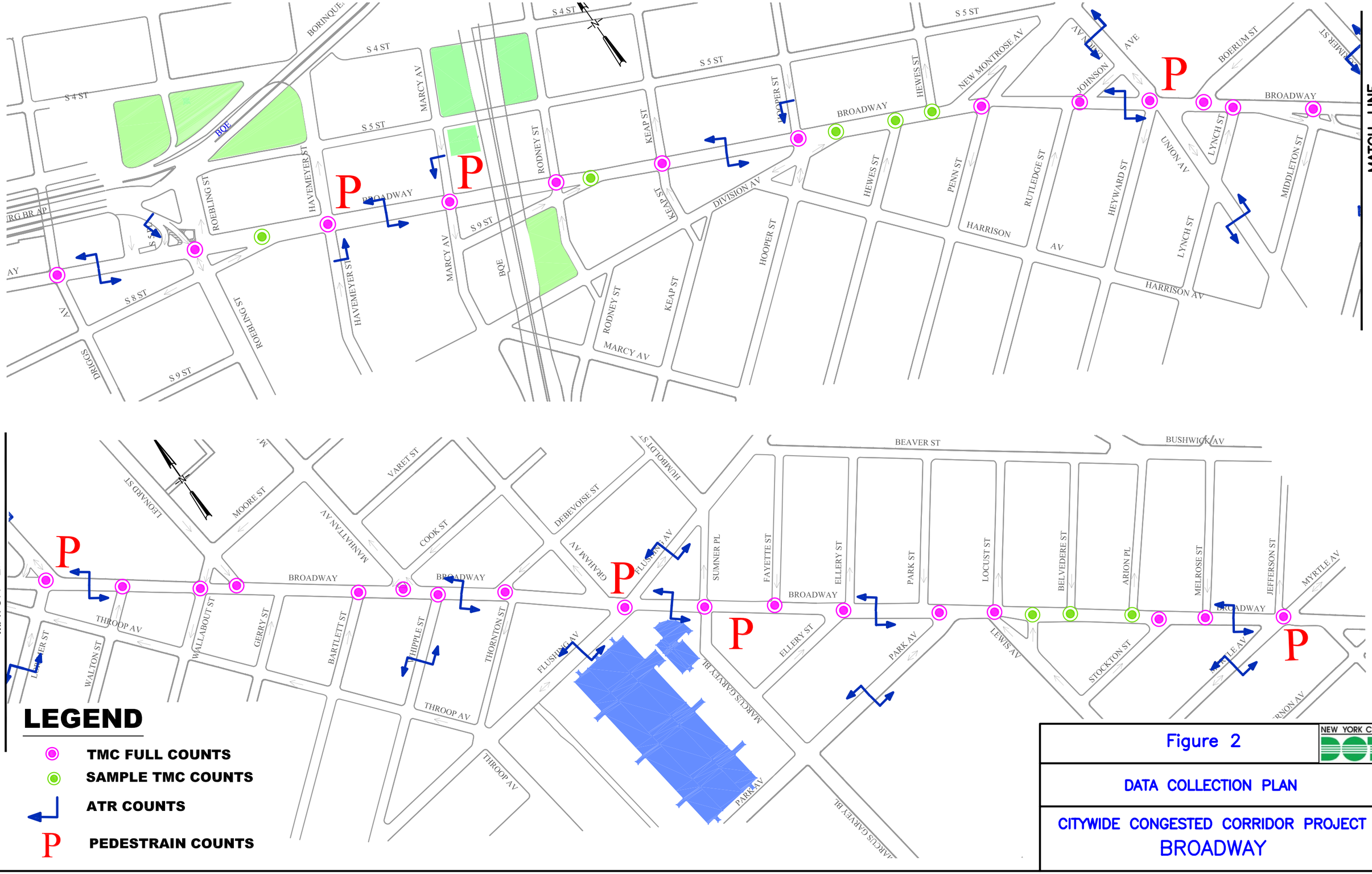



Figure 2

DATA COLLECTION PLAN

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

# CHAPTER 3 EXISTING CONDITIONS AND ANALYSIS

## 3.1 Roadway Network and Geometry

Broadway within the study area is a two-way 42 foot wide roadway consisting of one travel lane in each direction with parking permitted along both curbs, as shown in Figure 3. The roadway width varies in some sections by one or two feet. Many intersections have irregular geometry, offset intersections, T-intersections at sharp angles, and multi-leg intersections. Columns for the elevated subway are located on the edge of the sidewalk, or in the roadway in some locations, which present additional constraints as shown in Photographs 3 and 4.

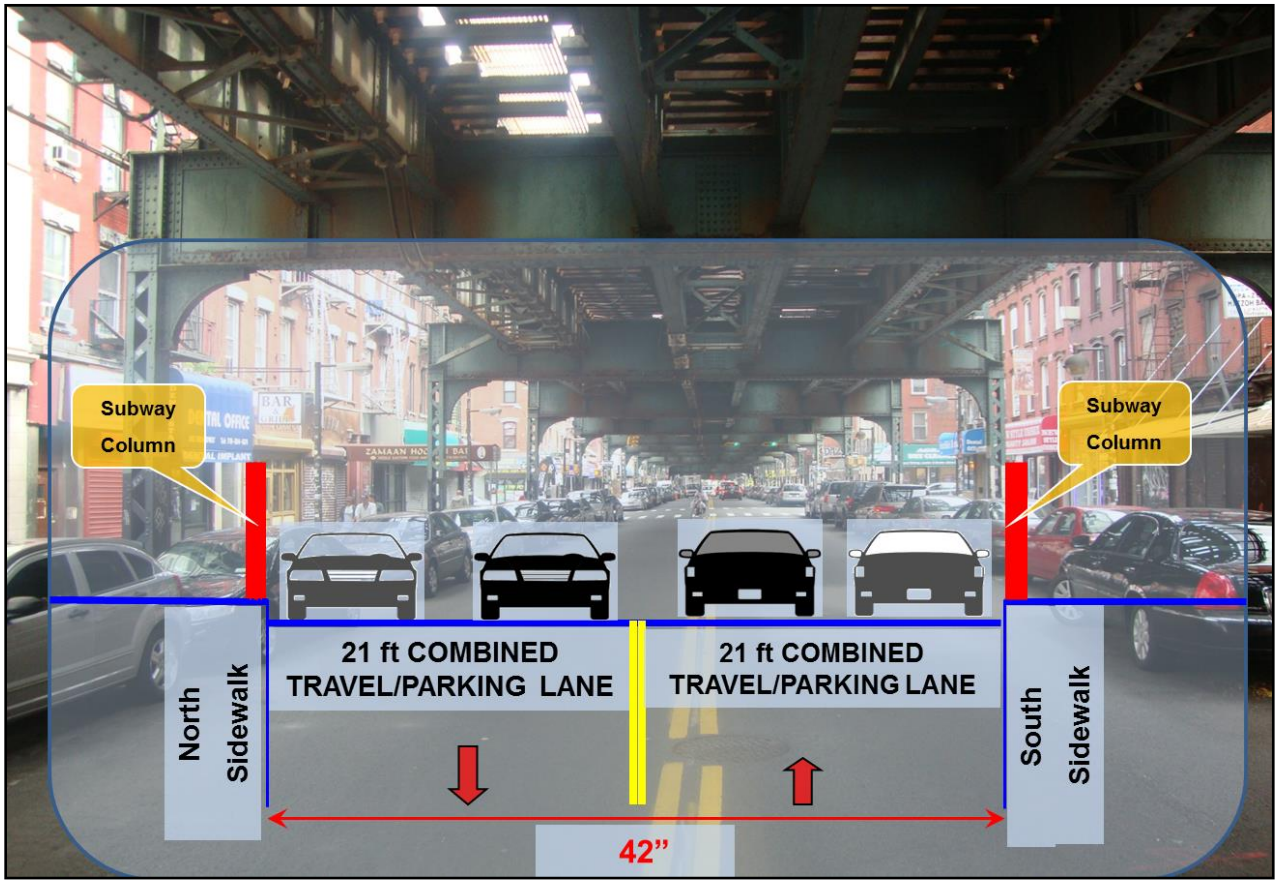



***Figure 3: Broadway Typical Cross Section***

There are 35 intersections within the study area, of which 11 are signalized. The major roadways intersecting with Broadway within the study area are Union Avenue, Flushing Avenue, and Myrtle Avenue.

***Photograph 3: Subway Columns and Elevated Subway Structure***

***Photograph 4: Subway Columns at the Intersection with Myrtle Avenue***

## 3.2 Traffic Volumes

Average weekday traffic (AWT) volumes for the eastbound direction are shown in Figure 4. AWT in the eastbound direction starts at 3,300 vehicles per day approaching Roebling Street, after which a steep surge of approximately 4,000 vehicles per day exiting from Williamsburg Bridge is added to the traffic stream. From Marcy Avenue to Park Avenue the eastbound AWT remains relatively constant, ranging from about 6,100 to 7,000 vehicles per day, and then increases to 8,300 vehicles per day approaching Myrtle Avenue.

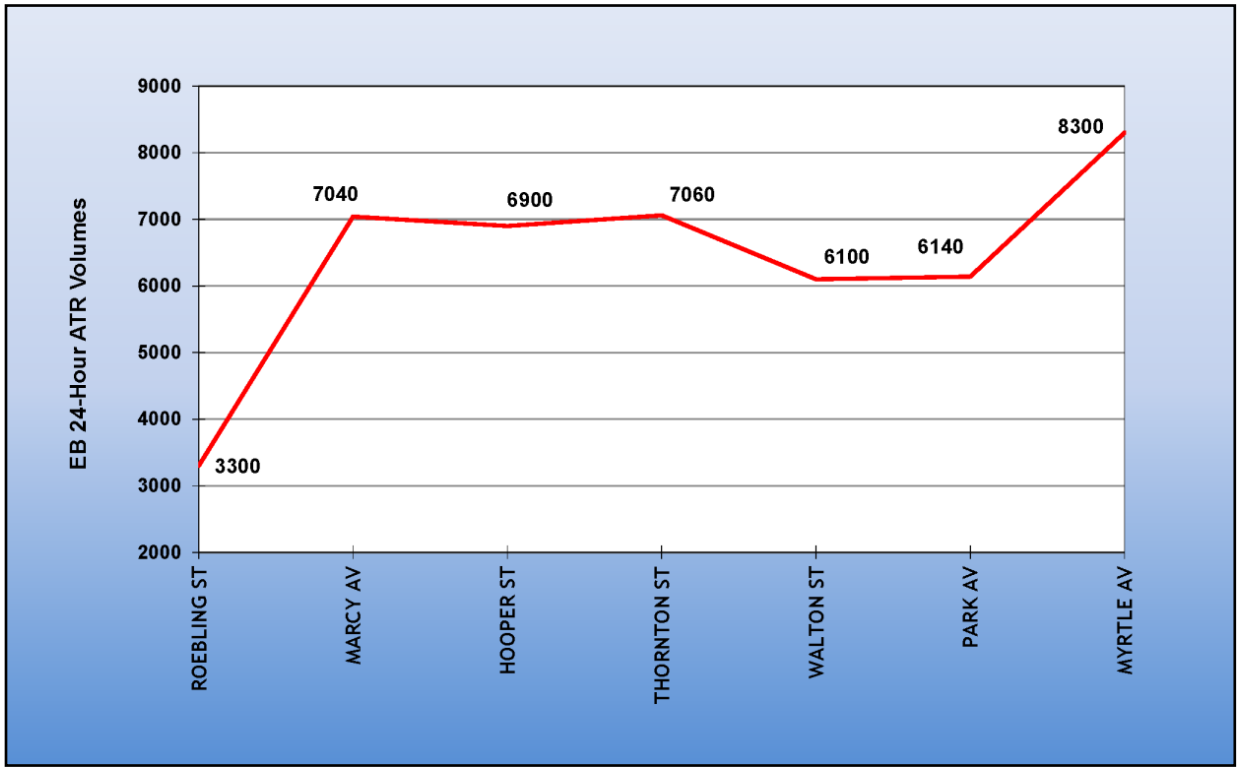



***Figure 4: Eastbound Average Weekday Traffic Volumes***

AWT volumes in the westbound direction are shown in Figure 5. About 6,100 vehicles per day approach Myrtle Avenue. Nearly 2,000 vehicles per day are added between Myrtle Avenue and Flushing Avenue, where AWT reaches 8,350. Once past Flushing Avenue, about 2,200 vehicles per day turn right onto on Graham Avenue, which leads to an entrance to the eastbound Brooklyn Queens Expressway (BQE). The AWT then holds steady between 5,500 and 6,600 vehicles per day to Driggs Avenue.

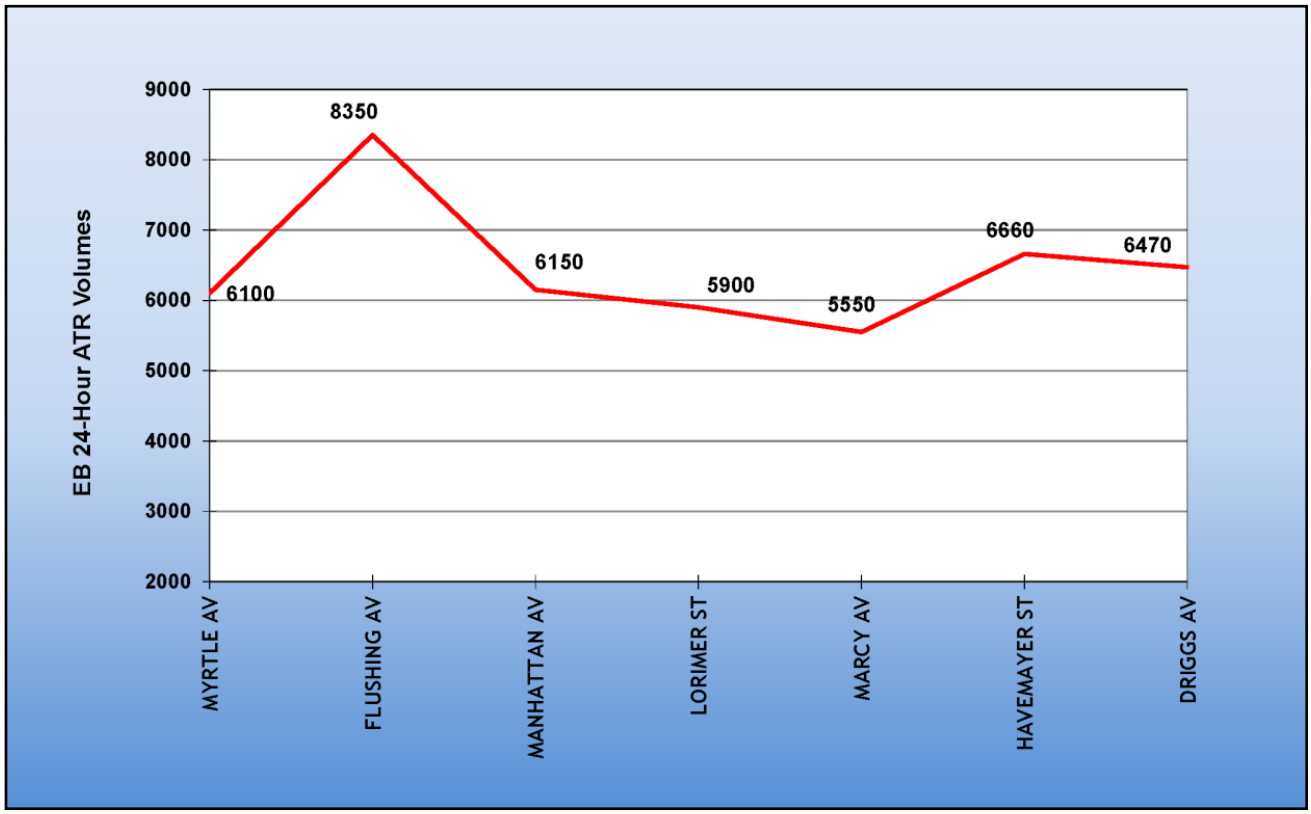



***Figure 5: Westbound Average Weekday Traffic Volumes***

Based on the traffic data collected the peak hours were determined to be:

- Weekday AM peak: 7:45 AM to 8:45 AM
- Weekday midday peak: 1:00 PM to 2:00 PM
- Weekday PM peak: 4:45 PM to 5:45 PM
- Saturday midday peak: 12:45 PM to 1:45 PM

Hourly traffic volumes for both the eastbound and the westbound directions are shown in Figures 6 through 9 for weekday AM, midday, PM and Saturday midday peak hours, respectively. The peak hour volumes follow the general trend of the AWT. Westbound volumes are highest during the weekday AM peak hour, while eastbound volumes are highest during the weekday PM peak hour, with each approaching 600 vehicles per hour at some locations. The volumes for the off-peak direction for the weekday AM and PM peak hours, and for both directions for the weekday midday and Saturday peak hours are about 300 to 400 vehicles per hour.

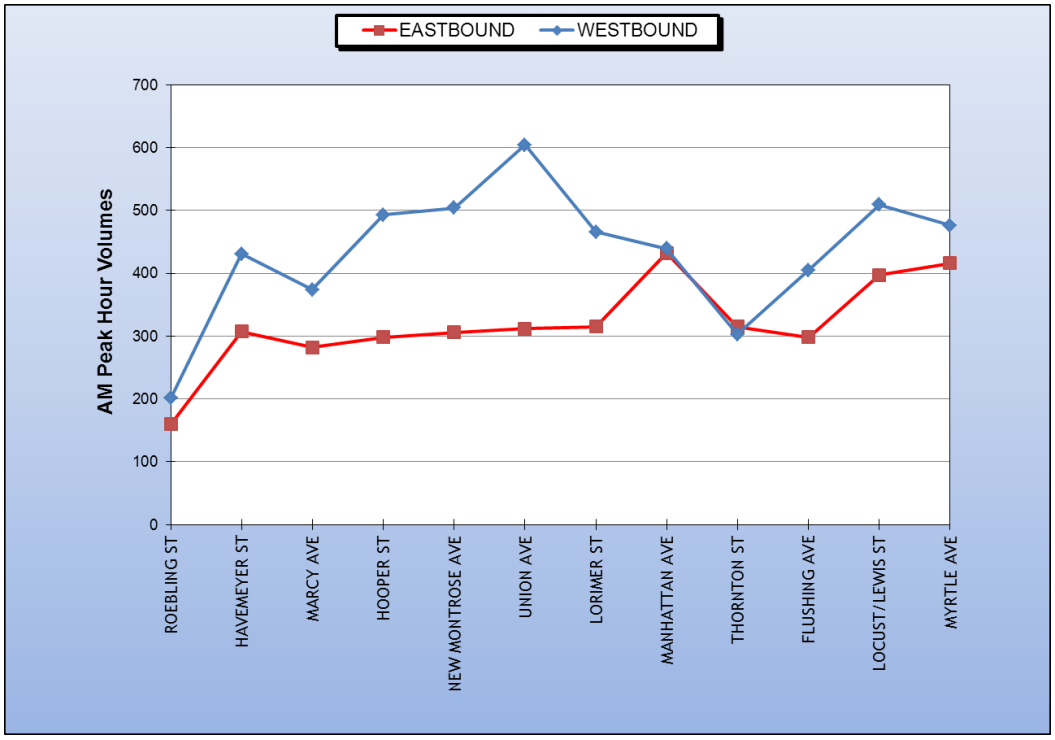



***Figure 6: Weekday AM Peak Hour Traffic Volumes***

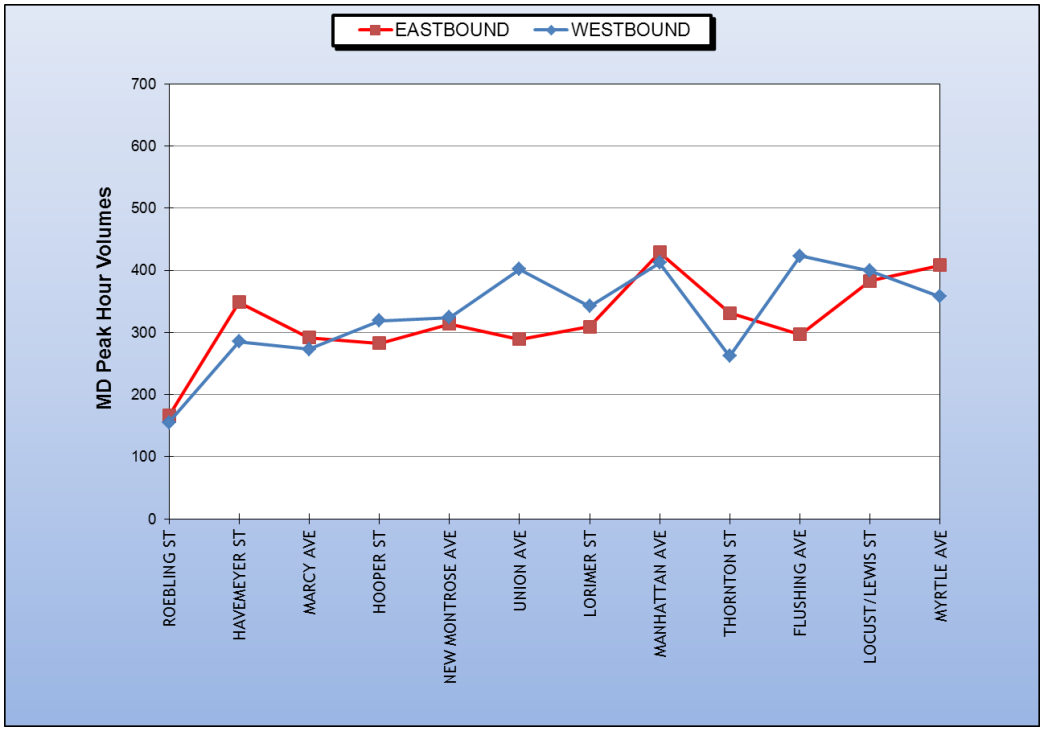



***Figure 7: Weekday Midday Peak Hourly Traffic Volumes***

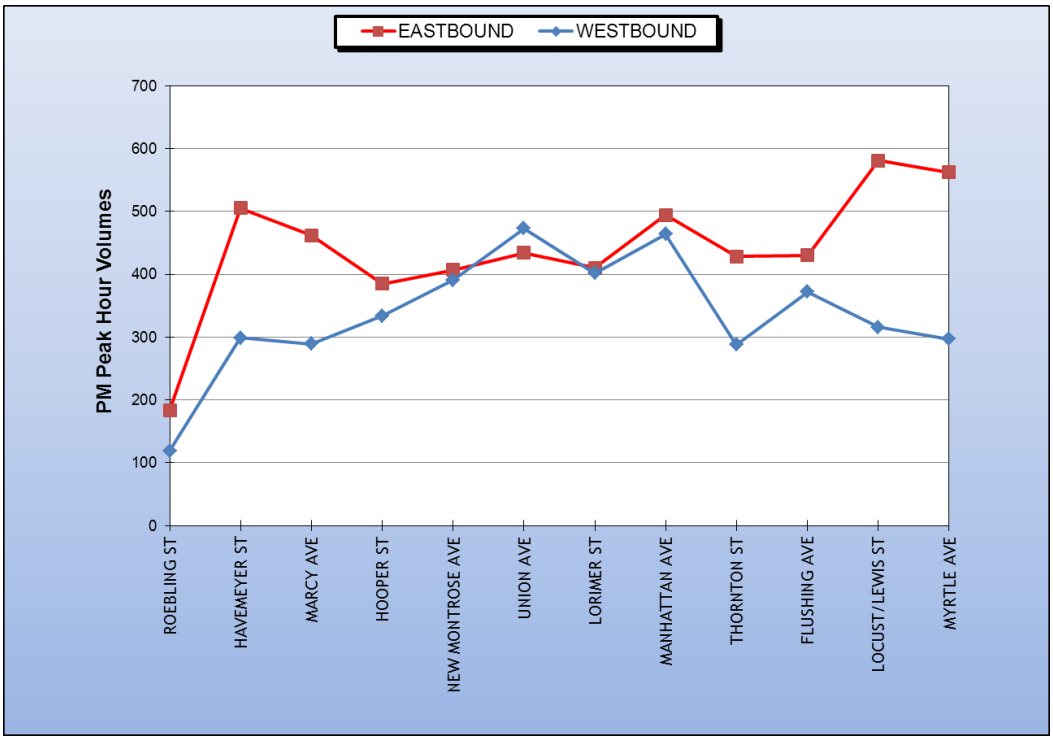



***Figure 8: Weekday PM Peak Hourly Traffic Volumes***

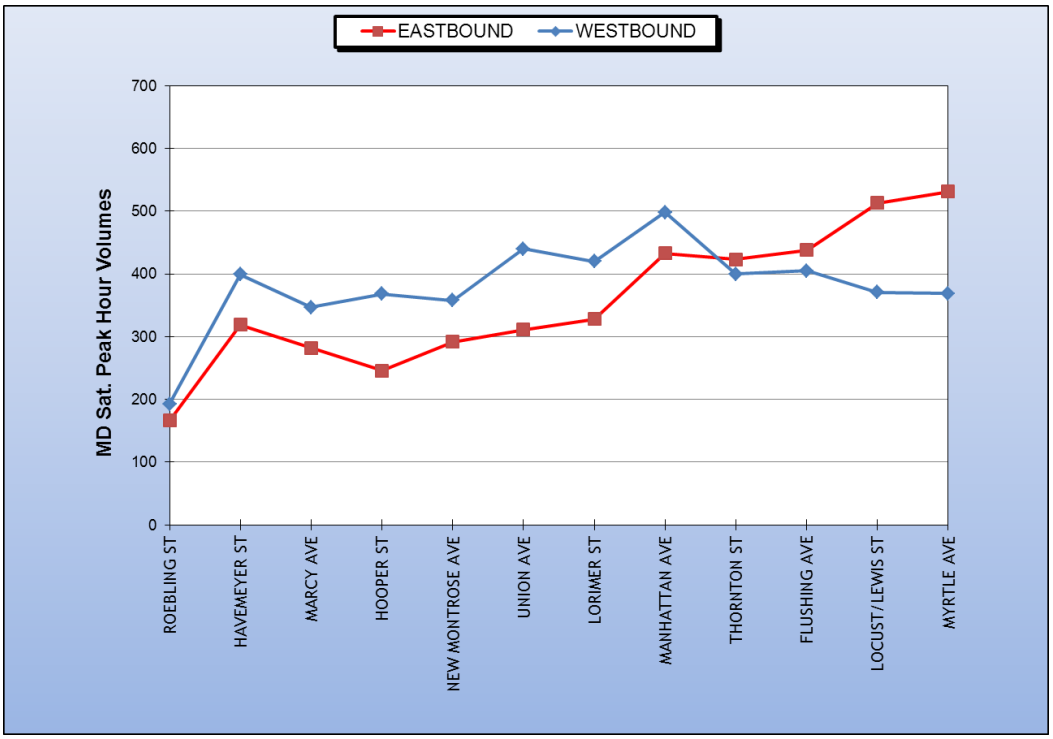
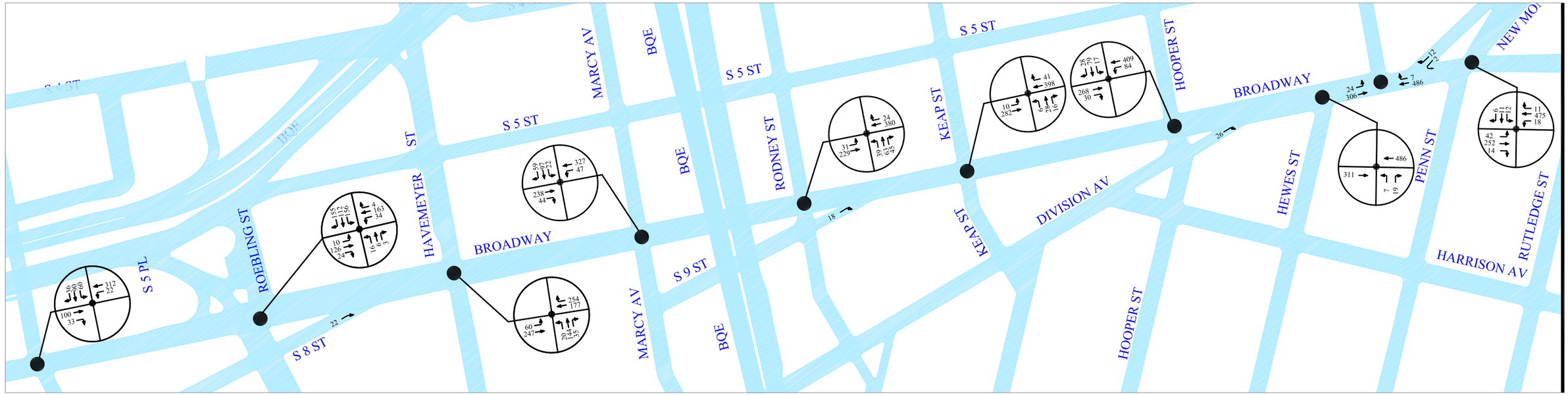


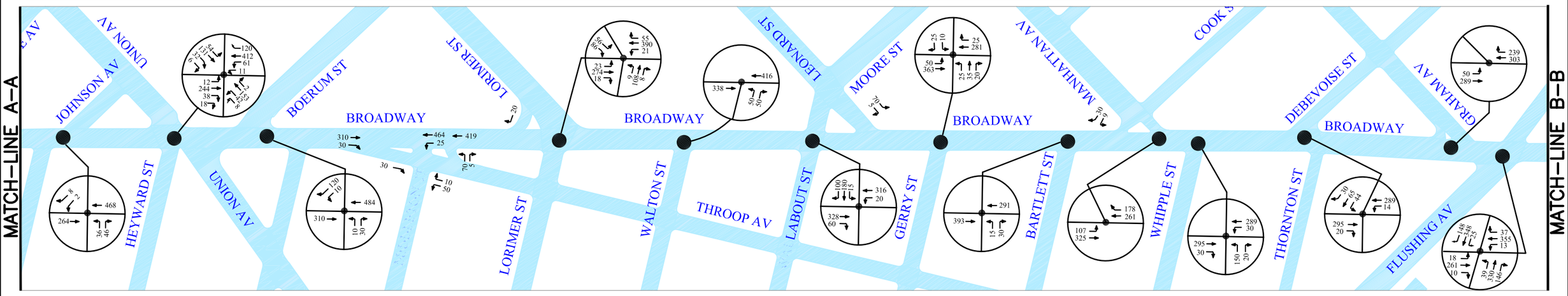

***Figure 9: Saturday Midday Peak Hourly Traffic Volumes***

Balanced traffic flow maps were developed using ATR and TMC data for the four peak hours. These are shown in Figures 10 through 13.

Broadway is designated as a local truck route. Heavy vehicle percentages were obtained from the turning movement and vehicle classification counts. Generally, trucks comprise about 10% of the overall traffic. Goods movement is discussed in more detail in Section 3.7.

There are several bus routes along Broadway and major cross streets. Buses comprise about 3 to 6% of the overall traffic volumes along Broadway, depending on the location and time of day. Transit is discussed in more detail in Section 3.8.



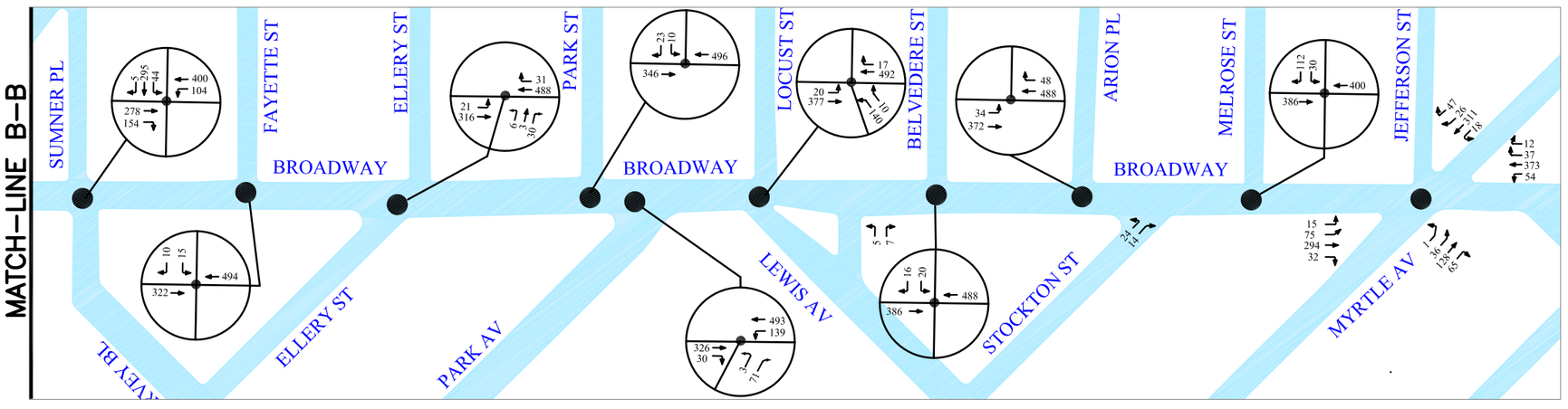



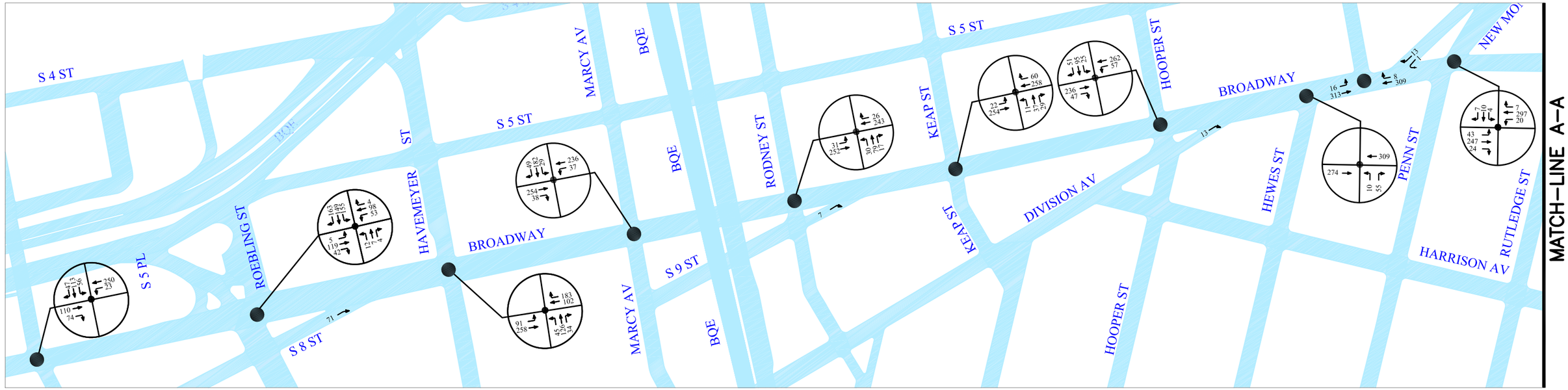

Figure 10

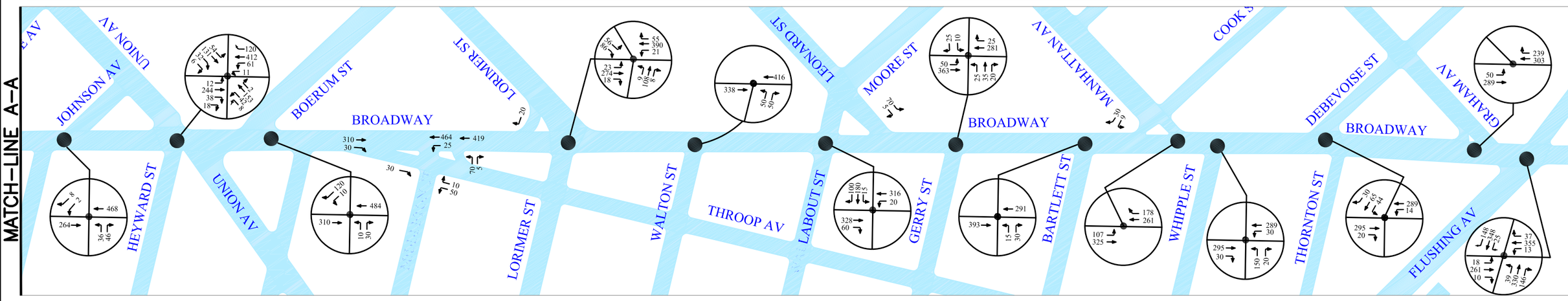
NEW YORK CITY DOT

EXISTING VEHICULAR VOLUMES
WEEKDAY AM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY



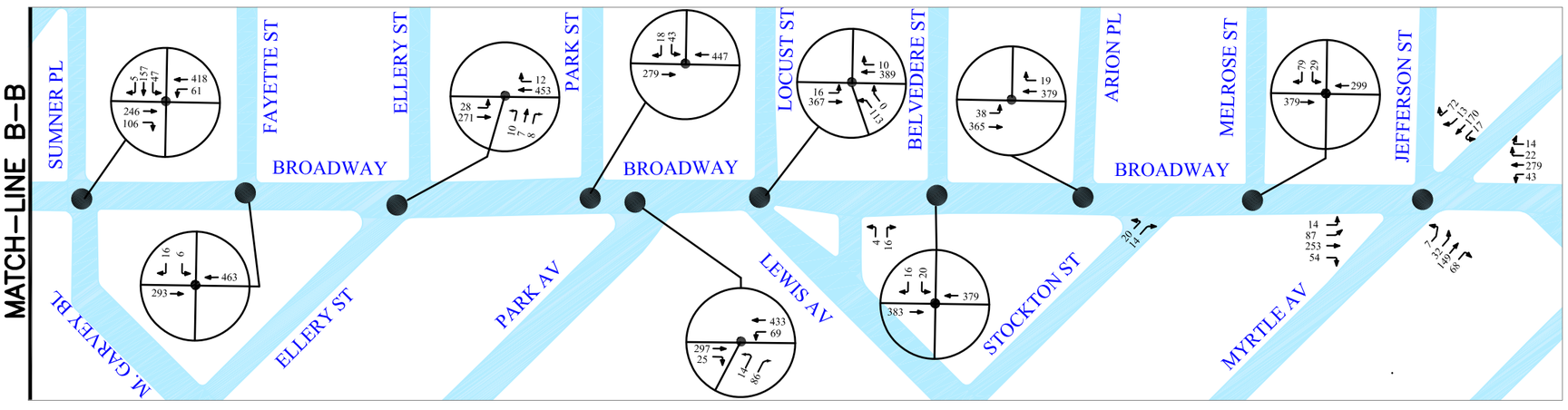
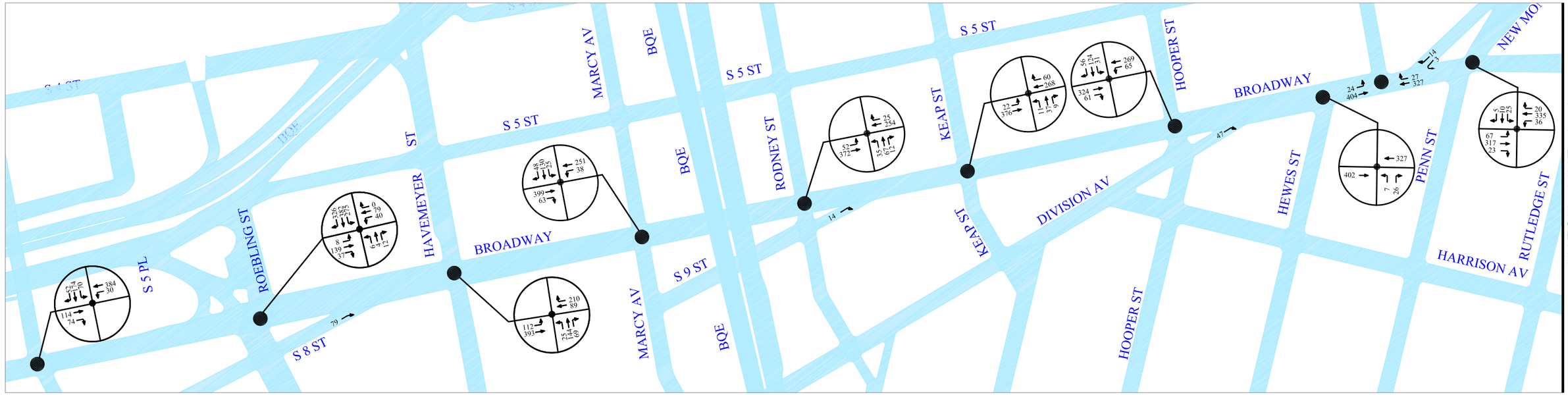



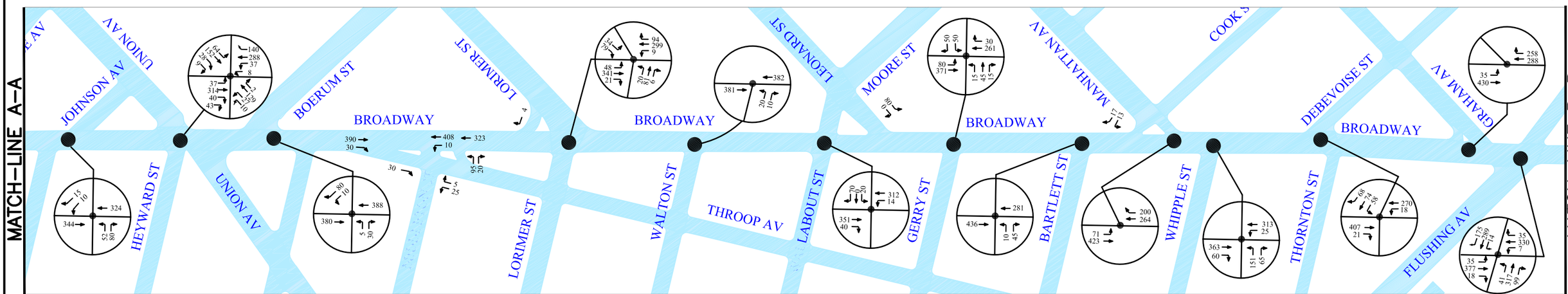

Figure 11

EXISTING VEHICULAR VOLUMES
WEEKDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY



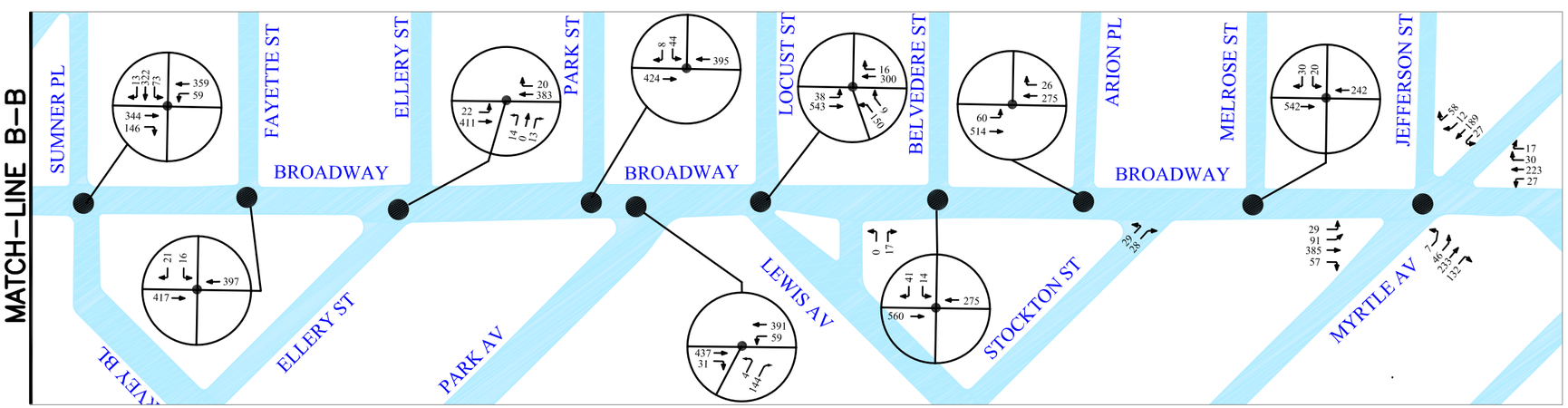
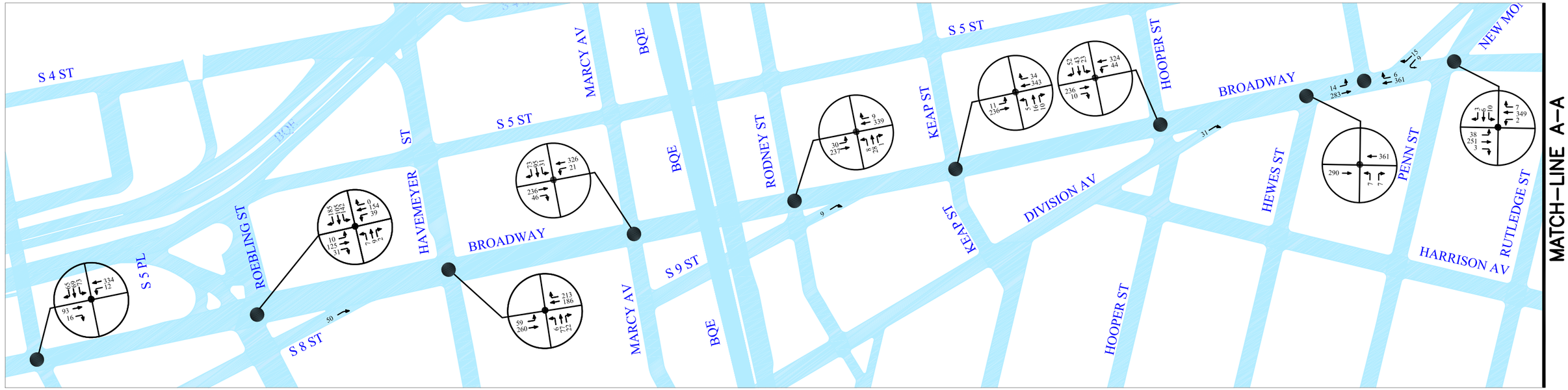




Figure 12

EXISTING VEHICULAR VOLUMES
WEEKDAY PM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY



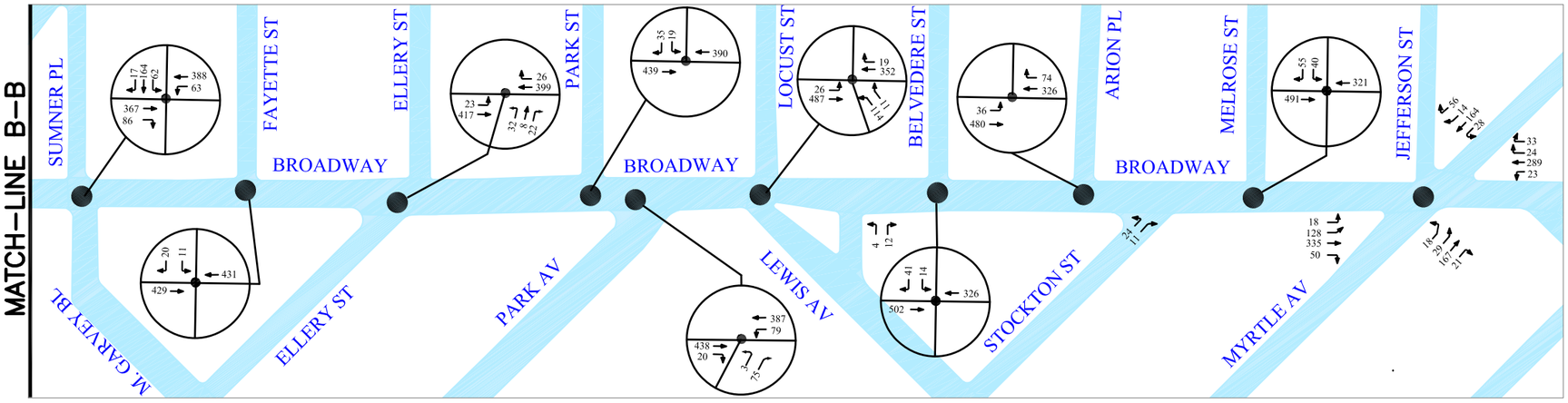




Figure 13

NEW YORK CITY DOT

EXISTING VEHICULAR VOLUMES
SATURDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 3.3 Travel Time and Delay Runs

Travel time and delay runs, using the "floating car" technique, were performed along the study corridor on three midweek days during the weekday AM, midday, PM peak periods, and one Saturday midday peak period, concurrently with the ATR and TMC data collection. Elapsed travel times were recorded between signalized intersections. Stopped time delays were recorded and classified as the result of either congestion or traffic signals.

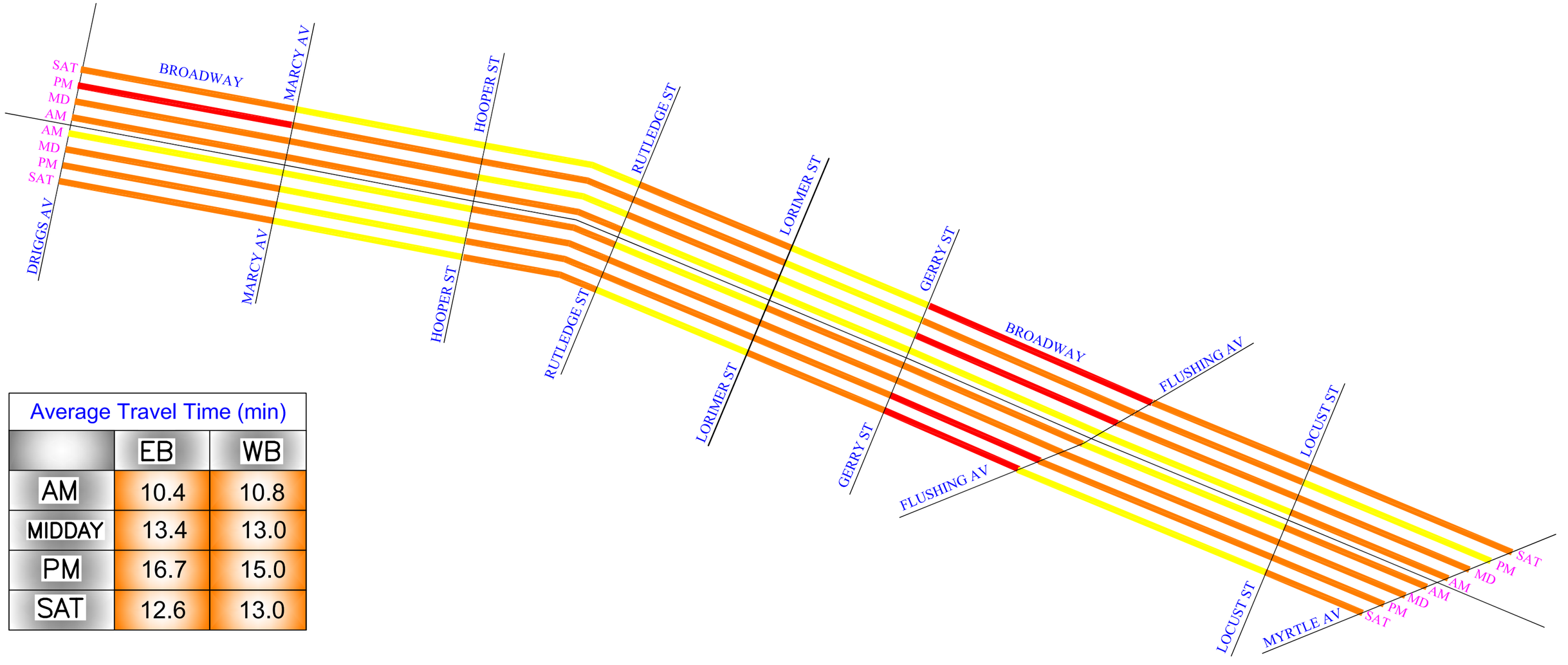
Tables 1 and 2 present an overview of the corridor travel speeds and travel times. Figure 14 illustrates the speeds within eight speed zones for each peak hour. The study area has been divided into eight speed zones, as distances between intersections are short and speeds fluctuate from block-to-block depending on traffic conditions created by double-parked vehicle, truck loading and unloading, bus activity, etc. As indicated in Figure 14, the lowest travel speeds in the eastbound direction were recorded during the PM Peak Hour (6.0 mph), and the westbound direction also during PM peak hour (6.6 mph).

**Table 1. Eastbound Travel Times and Speeds**

| From | To | Weekday AM | | Weekday Midday | | Weekday PM | | Saturday Midday | |
|---|---|---|---|---|---|---|---|---|---|
| | | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) |
| Driggs Av | Roebling St | 0.73 | 7.1 | 0.80 | 6.5 | 0.88 | 5.9 | 0.86 | 6.0 |
| Roebling St | Havemeyer St | 0.40 | 12.9 | 0.61 | 8.5 | 0.84 | 6.2 | 0.46 | 11.3 |
| Havemeyer St | Marcy Av | 0.40 | 11.6 | 0.81 | 5.7 | 0.67 | 6.9 | 0.70 | 6.7 |
| Marcy Av | Rodney St | 0.37 | 11.4 | 0.35 | 12.1 | 0.50 | 8.4 | 0.28 | 15.1 |
| Rodney St | Keap St | 0.31 | 13.0 | 0.60 | 6.6 | 0.46 | 8.8 | 0.20 | 19.8 |
| Keap St | Hooper St | 0.46 | 15.0 | 0.54 | 12.7 | 0.41 | 16.9 | 0.53 | 13.0 |
| Hooper St | Hewes St | 0.48 | 4.1 | 0.34 | 5.7 | 0.49 | 4.0 | 0.20 | 9.7 |
| Hewes St | Penn St | 0.32 | 7.8 | 0.60 | 4.1 | 0.49 | 5.1 | 0.52 | 4.8 |
| Penn St | Rutledge St | 0.42 | 7.3 | 0.37 | 8.2 | 0.49 | 6.2 | 0.39 | 7.7 |
| Rutledge St | Union Av | 0.41 | 7.6 | 0.59 | 5.3 | 0.41 | 7.6 | 0.41 | 7.6 |
| Union Ave | Lynch St | 0.37 | 8.9 | 0.40 | 8.2 | 0.46 | 7.2 | 0.16 | 21.0 |
| Lynch St | Lorimer St | 0.32 | 19.5 | 0.46 | 13.5 | 0.63 | 9.9 | 0.33 | 18.6 |
| Lorimer St | Walton St | 0.40 | 8.0 | 0.48 | 6.8 | 0.46 | 7.0 | 0.63 | 5.1 |
| Walton St | Wallabout St | 0.47 | 6.5 | 0.40 | 7.7 | 0.70 | 4.4 | 0.33 | 9.4 |
| Wallabout St | Gerry St | 0.28 | 11.7 | 0.38 | 8.7 | 0.72 | 4.6 | 0.38 | 8.7 |
| Gerry St | Whipple St | 0.53 | 11.7 | 0.89 | 7.0 | 1.89 | 3.3 | 0.78 | 8.0 |
| Whipple St | Thornton St | 0.54 | 5.5 | 0.52 | 5.8 | 0.92 | 3.3 | 1.41 | 2.1 |
| Thornton St | Flushing Av | 0.53 | 8.4 | 0.57 | 7.8 | 1.09 | 4.0 | 1.17 | 3.8 |
| Flushing Av | M. Garvey Blvd | 0.33 | 10.1 | 0.58 | 5.8 | 0.75 | 4.5 | 0.51 | 6.6 |
| M. Garvey Blvd | Park Av/Park St | 0.45 | 20.0 | 0.86 | 10.5 | 0.91 | 9.9 | 0.65 | 13.8 |
| Park Ave/Park St | Lewis Av | 0.31 | 8.2 | 0.54 | 4.8 | 0.74 | 3.5 | 0.19 | 13.9 |
| Lewis Ave | Belvidere St | 0.48 | 6.6 | 0.54 | 5.8 | 0.51 | 6.2 | 0.34 | 9.1 |
| Belvidere Sr | Stockton Av | 0.50 | 6.8 | 0.58 | 5.9 | 0.45 | 7.5 | 0.51 | 6.7 |
| Stockton Av | Myrtle Av | 0.56 | 8.5 | 0.65 | 7.2 | 0.88 | 5.3 | 0.70 | 6.7 |
| **Corridor Total/Avg.** | | **10.3** | **9.6** | **13.4** | **7.4** | **16.7** | **6.0** | **12.6** | **7.9** |

**Table 2: Westbound Travel Times and Speeds**

| From | To | AM | | MD | | PM | | Sat MD | |
|---|---|---|---|---|---|---|---|---|---|
| | | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) | Travel time (min) | Speed (mph) |
| Myrtle Ave | Stockton Av | 0.78 | 6.7 | 0.68 | 7.7 | 0.68 | 7.7 | 0.43 | 12.1 |
| Stockton Ave | Belvidere St | 0.40 | 13.0 | 0.37 | 14.0 | 0.35 | 14.8 | 0.73 | 7.2 |
| Belvidere St | Lewis Av/Locust | 0.45 | 10.2 | 0.56 | 8.2 | 0.41 | 11.3 | 0.75 | 6.2 |
| Lewis Av/Locust | Park Ave/Park St | 0.51 | 8.3 | 0.77 | 5.5 | 0.62 | 6.8 | 0.62 | 6.8 |
| Park Av/Park St | M. Garvey Blvd | 1.15 | 3.5 | 1.65 | 2.4 | 2.05 | 2.0 | 2.40 | 1.7 |
| M. Garvey Blvd | Flushing Av | 0.45 | 15.5 | 0.38 | 18.2 | 0.50 | 13.8 | 0.44 | 15.5 |
| Flushing Av | Thornton St | 0.35 | 5.7 | 0.64 | 3.0 | 0.51 | 3.8 | 0.58 | 3.4 |
| Thornton St | Whippie St | 0.31 | 8.1 | 0.48 | 5.2 | 0.51 | 4.8 | 0.45 | 5.6 |
| Whippie Street | Gerry St | 0.37 | 8.3 | 0.57 | 5.3 | 0.47 | 6.5 | 0.55 | 5.6 |
| Gerry St | Moore St | 0.38 | 8.3 | 0.31 | 10.0 | 0.48 | 6.5 | 0.26 | 11.9 |
| Moore St | Walton St | 0.33 | 9.9 | 0.36 | 9.2 | 0.54 | 6.1 | 0.36 | 9.1 |
| Walton St | Lorimer St | 0.30 | 20.9 | 0.43 | 14.6 | 0.33 | 18.9 | 0.22 | 28.4 |
| Lorimer St | Lynch St | 0.39 | 8.2 | 0.42 | 7.7 | 0.72 | 4.5 | 0.52 | 6.2 |
| Lynch St | Union Av | 0.28 | 10.8 | 0.49 | 6.3 | 0.45 | 6.9 | 0.37 | 8.4 |
| Union Av | Rutledge St | 0.26 | 12.9 | 0.50 | 6.6 | 0.48 | 6.9 | 0.68 | 4.9 |
| Rutledge St | Penn St | 0.26 | 23.7 | 0.37 | 16.9 | 0.48 | 13.1 | 0.19 | 32.5 |
| Penn St/Montrose | Hewes St | 0.29 | 10.3 | 0.37 | 8.2 | 0.44 | 6.9 | 0.16 | 18.5 |
| Hewes St | Hooper St | 0.28 | 15.7 | 0.33 | 13.3 | 0.59 | 7.5 | 0.41 | 10.8 |
| Hooper St | Keap St | 0.47 | 7.3 | 0.53 | 6.4 | 0.53 | 6.4 | 0.37 | 9.2 |
| Keap St | Rodney St | 0.42 | 21.5 | 0.50 | 18.1 | 0.61 | 14.9 | 0.38 | 23.8 |
| Rodney St | Marcy Av | 0.37 | 7.0 | 0.53 | 4.9 | 0.62 | 4.2 | 0.76 | 3.4 |
| Marcy Av | Havemeyer St | 0.41 | 7.6 | 0.44 | 7.0 | 0.78 | 4.0 | 0.50 | 6.3 |
| Havemeyer St | Roebling St | 0.78 | 4.3 | 0.61 | 5.6 | 0.92 | 3.7 | 0.50 | 6.9 |
| Roebling St | Driggs Av | 0.84 | 5.6 | 0.77 | 6.1 | 1.03 | 4.6 | 0.45 | 10.4 |
| **Corridor Total/Avg.** | | **10.8** | **9.2** | **13.0** | **7.6** | **15.0** | **6.6** | **13.0** | **7.6** |




| Average Travel Time (min) | | |
|---|---|---|
| | EB | WB |
| AM | 10.4 | 10.8 |
| MIDDAY | 13.4 | 13.0 |
| PM | 16.7 | 15.0 |
| SAT | 12.6 | 13.0 |

| Average Travel Speed (mph) | | |
|---|---|---|
| | EB | WB |
| AM | 9.6 | 9.2 |
| MIDDAY | 7.4 | 7.6 |
| PM | 6.0 | 6.6 |
| SAT | 7.9 | 7.6 |

LEGEND

- < 5 mph
- 5–10 mph
- 10–15 mph
- > 15 mph

Figure 14

TRAVEL TIMES AND TRAVEL SPEEDS

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 3.4 Pedestrians

Pedestrian counts were collected at eight intersections, concurrently with TMC . The following eight intersections were selected based on field observations to have the highest pedestrian activities:

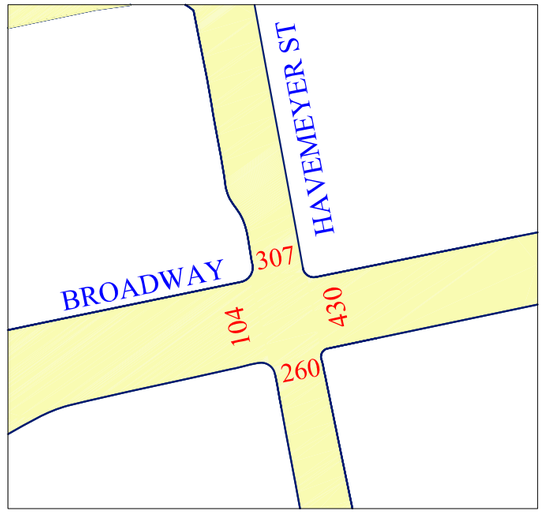
- Broadway and Havemeyer Street
- Broadway and Marcy Avenue
- Broadway and Hooper Street
- Broadway and Union Avenue
- Broadway and Lorimer Street
- Broadway and Flushing Avenue
- Broadway and Sumner Place (Marcus Garvey Boulevard)
- Broadway and Myrtle Avenue

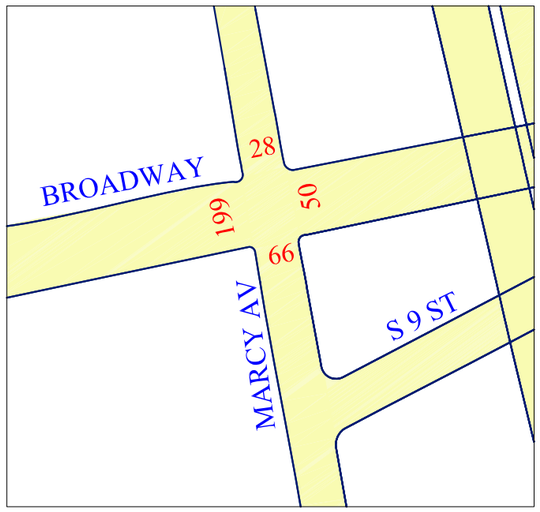
Figure 15 illustrates pedestrian volumes for all crosswalks combined at each of the eight study intersections during the weekday AM, midday, PM and Saturday midday peak hours. The busiest intersection is Broadway and Myrtle Avenue, where the pedestrian volume exceeds 1,000 pedestrians per hour for all four peak hours, with a high of 1,800 pedestrians per hour during the Saturday midday peak hour. The pedestrian volume at the intersections of Broadway at Flushing Avenue, and Broadway at Sumner Place (Marcus Garvey Boulevard) were also high, exceeding 1,000 pedestrians per hour during weekday midday, PM, and Saturday midday peak hours. At the intersection of Broadway and Havemeyer Street, pedestrian volume exceeds 1,000 pedestrians per hour during weekday AM, midday and PM peak hours.

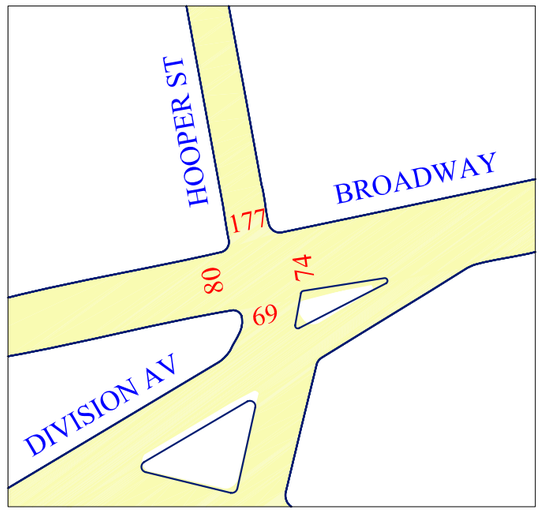

| | HAVEMAYER ST | MARCY AV | HOOPER ST | UNION AV | LORIMER ST | FLUSHING AV | SUMNER PL | MYRTLE AV |
|---|---|---|---|---|---|---|---|---|
| AM | 1101 | 343 | 400 | 592 | 530 | 937 | 539 | 1523 |
| MD | 1176 | 408 | 458 | 409 | 297 | 1449 | 1257 | 1292 |
| PM | 1585 | 604 | 430 | 597 | 436 | 1175 | 1698 | 1699 |
| Saturday | 574 | 760 | 481 | 282 | 237 | 1165 | 1529 | 1801 |

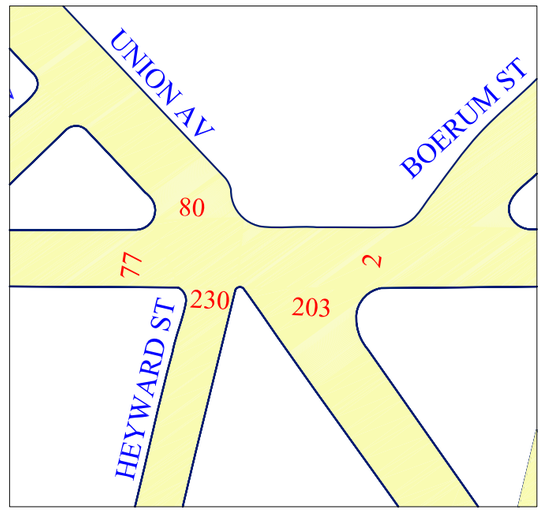
***Figure 15: Peak Hour Pedestrian Volumes***

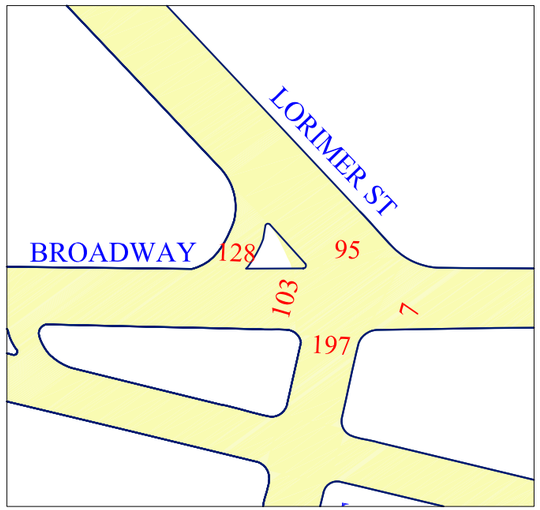
Individual crosswalk volumes for each of the eight locations are illustrated in Figures 16 through 19 for weekday AM, midday, PM and Saturday midday peak hours, respectively.

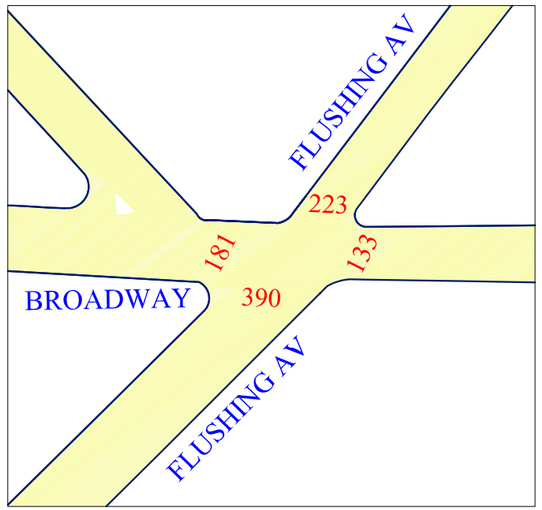


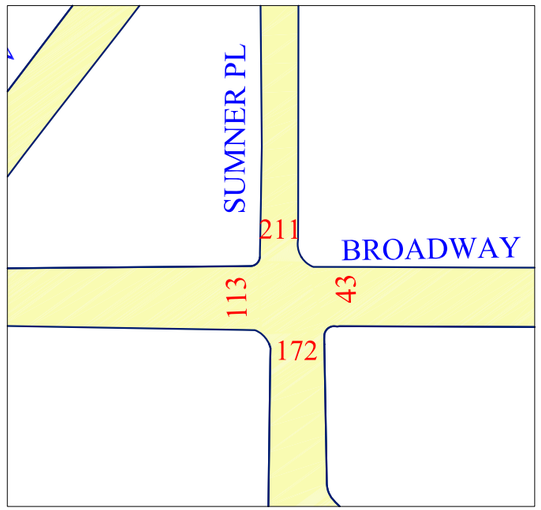



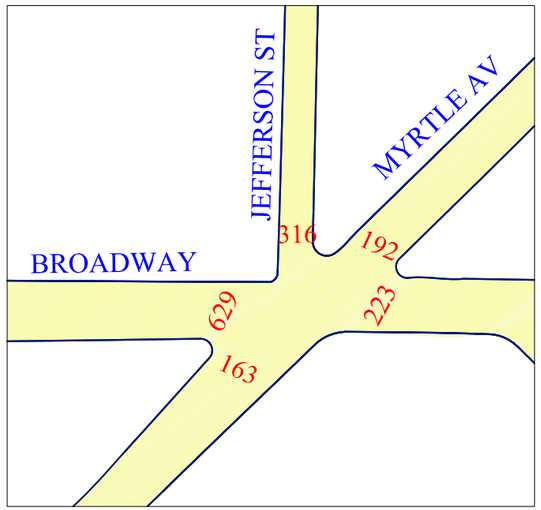



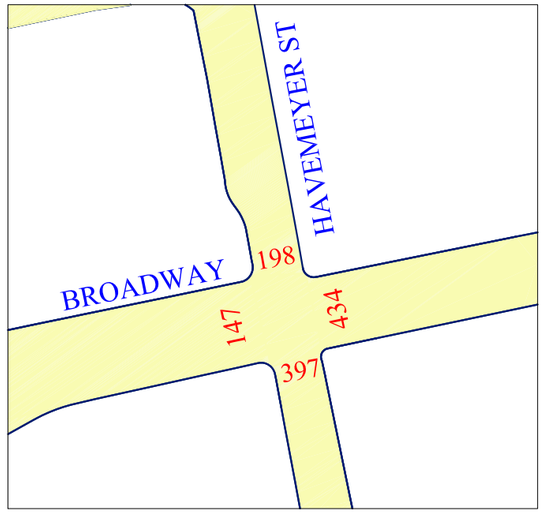

Figure 16

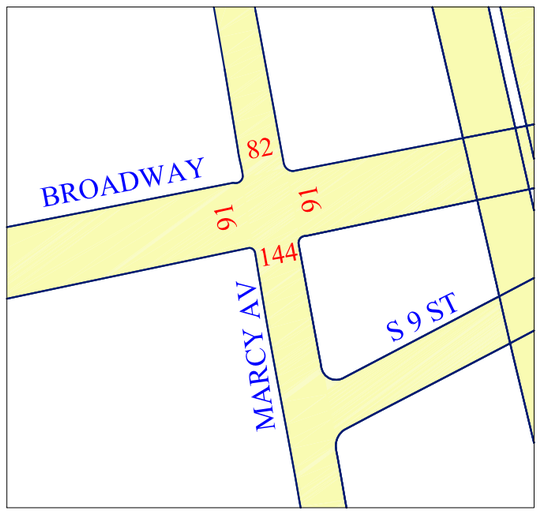
NEW YORK CITY DOT

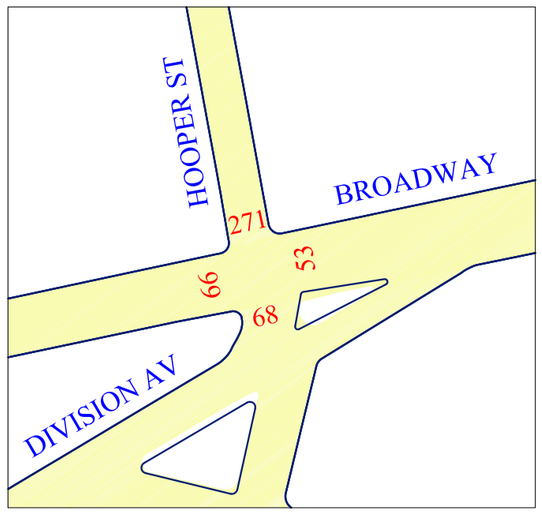
PEDESTRIAN VOLUMES
AM PEAK HOUR

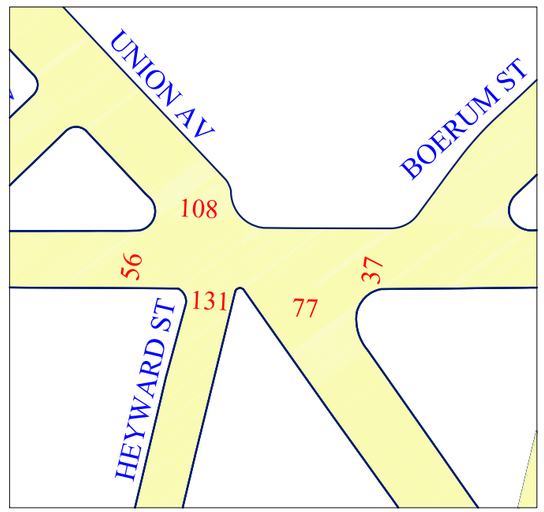
CITYWIDE CONGESTED CORRIDOR PROJECT

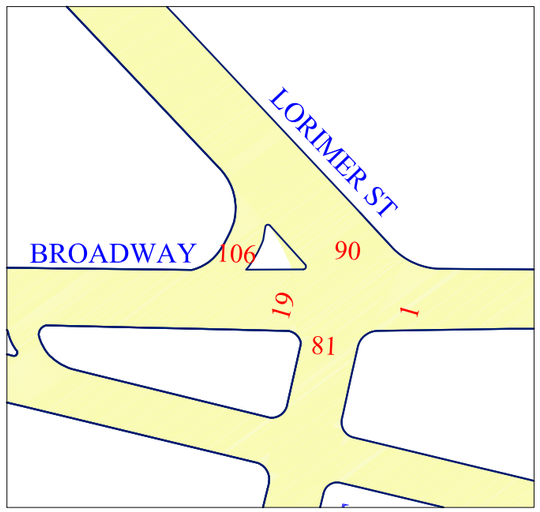
BROADWAY

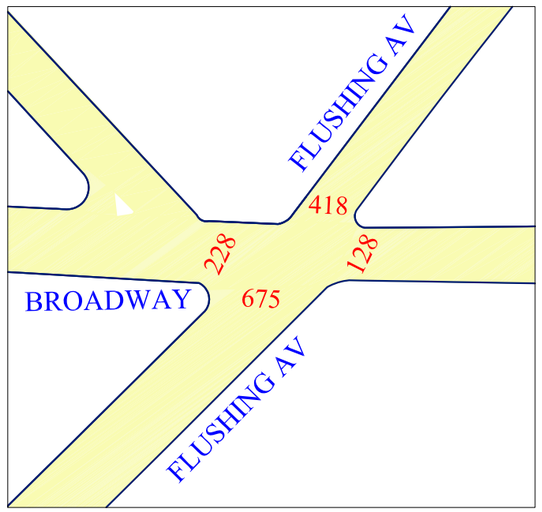


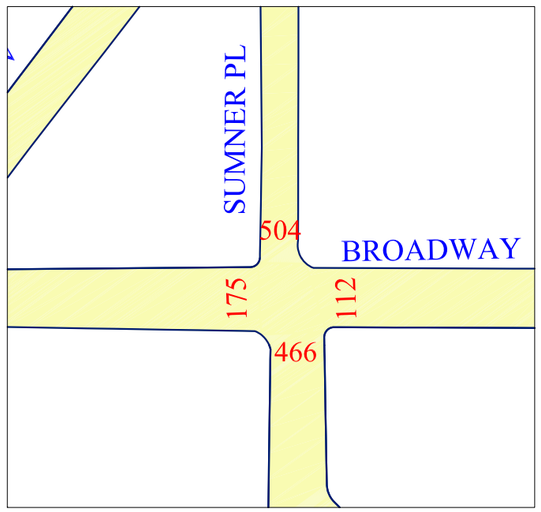



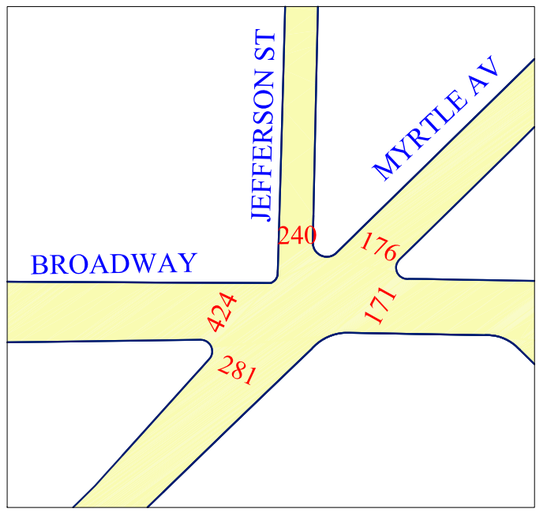



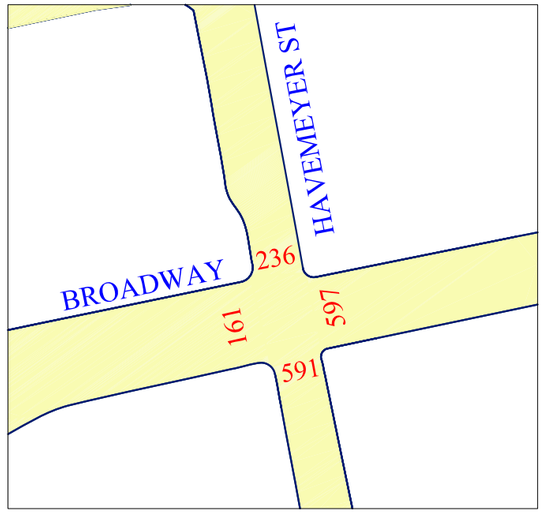

Figure 17

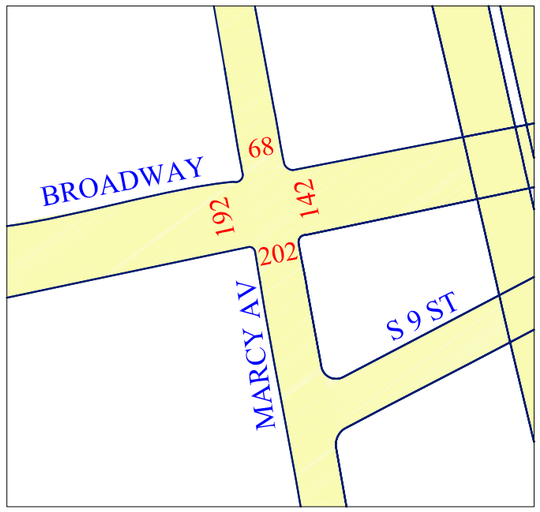
NEW YORK CITY DOT

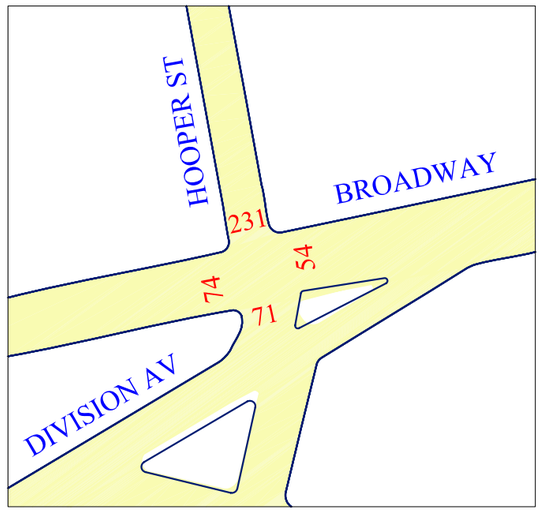
PEDESTRIAN VOLUMES
MIDDAY PEAK HOUR

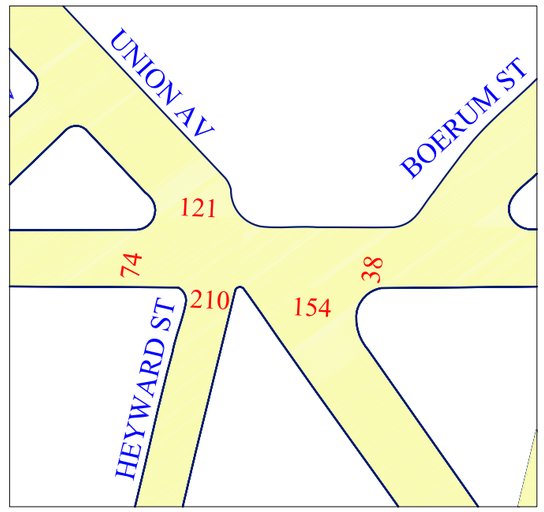
CITYWIDE CONGESTED CORRIDOR PROJECT

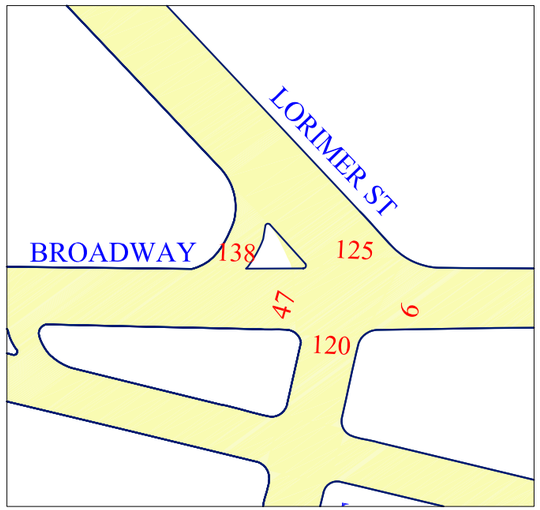
BROADWAY

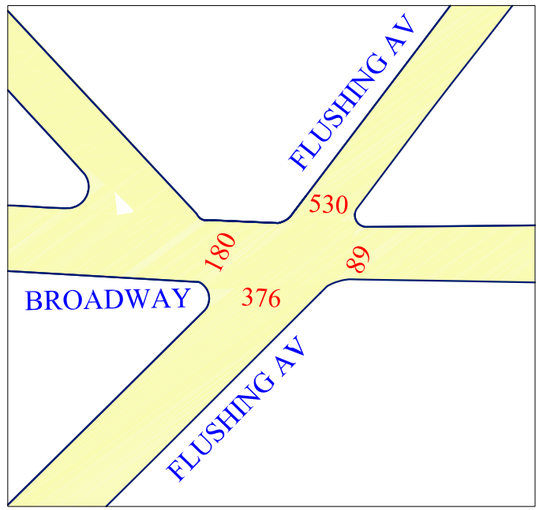


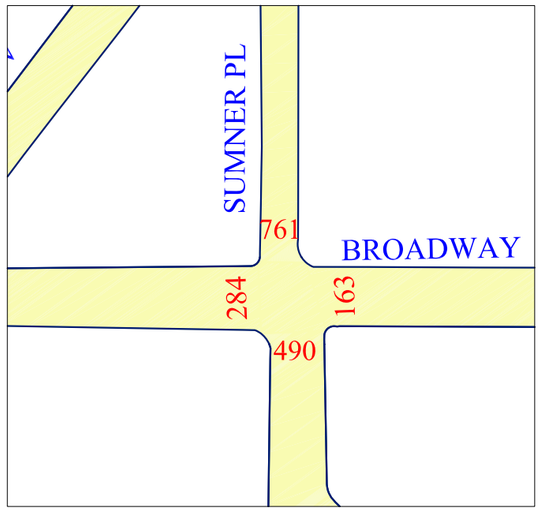



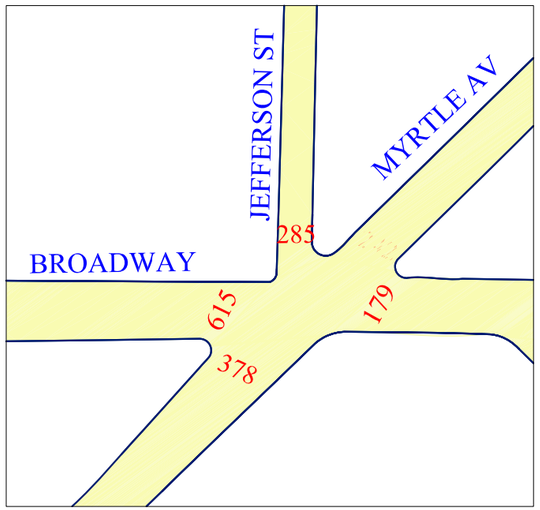
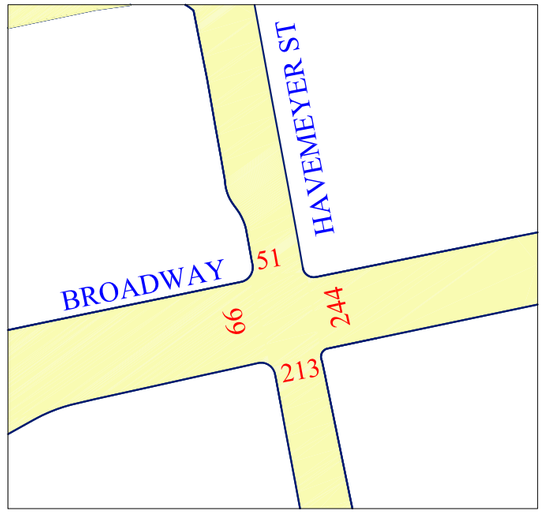



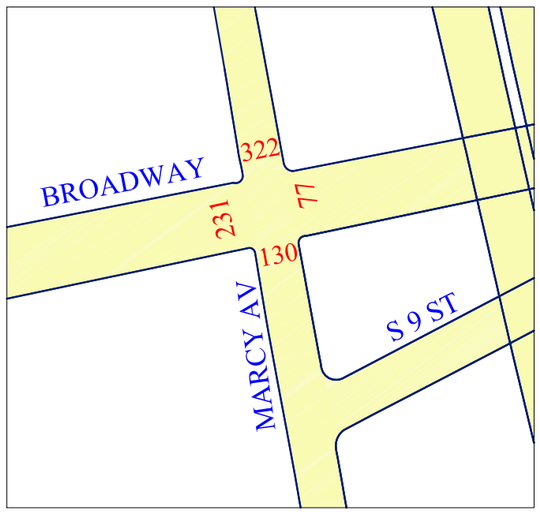

Figure 18

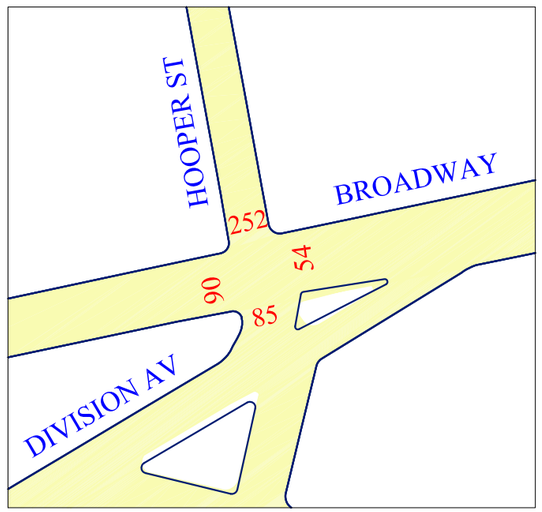
PEDESTRIAN VOLUMES
PM PEAK HOUR

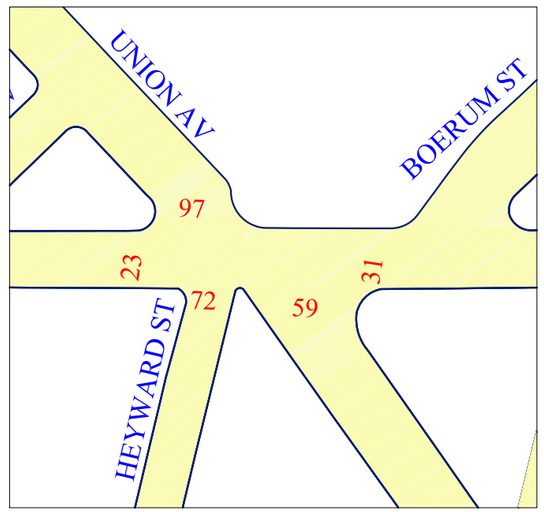
CITYWIDE CONGESTED CORRIDOR PROJECT

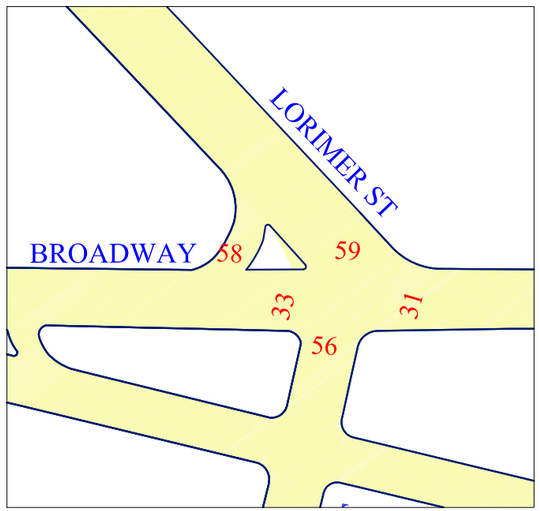
BROADWAY

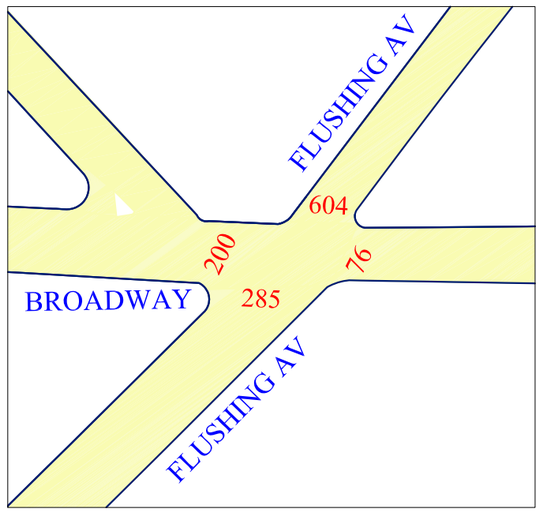


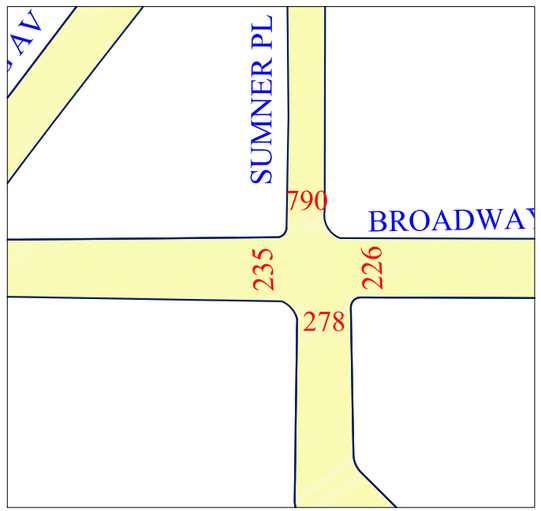



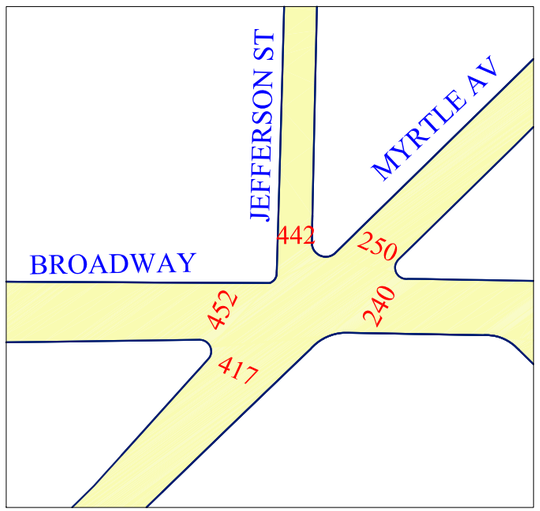




Figure 19

NEW YORK CITY DOT

PEDESTRIAN VOLUMES
SATURDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 3.5 Parking

Curbside regulations and usage is a critical element of this corridor because it affects many local businesses. These businesses require parking spaces for both customers and deliveries.

Figure 20 breaks down the types of on-street parking spaces available on weekdays. From 9 AM to 4 PM, there were a total of 381 parking spaces along the project corridor, distributed approximately evenly between the north and the south curb. Of the 381 available parking spaces, 78 are one-hour metered parking, and 26 are two-hour metered parking. Meters are in effect every day except Sunday 8:30 AM-7:00 PM on both the north and the south sides. A total of 275 parking spaces are non-metered, where only street cleaning regulations apply from 3 AM to 6 PM, Tuesday and Friday on the north side and Monday and Thursday on the south side. Two spaces are designated as loading zones. A map showing the details of the parking regulations by block is presented in Figures 21 and 22.

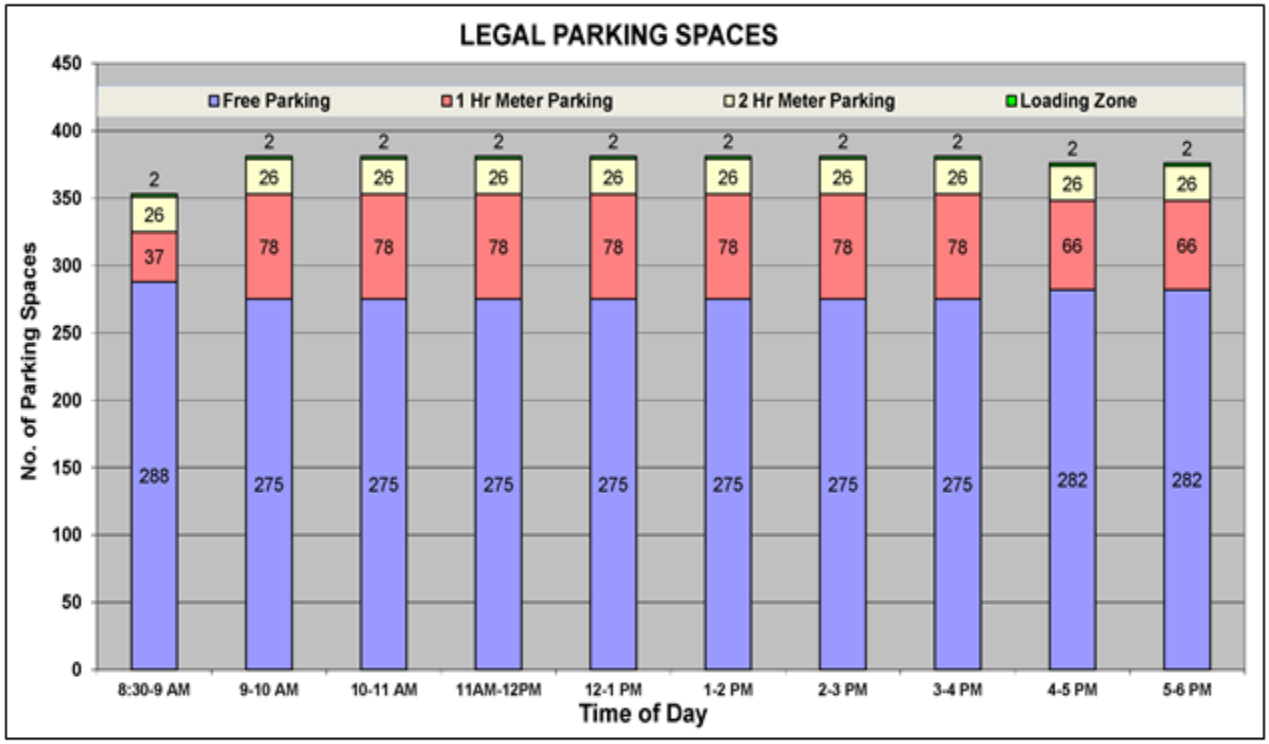
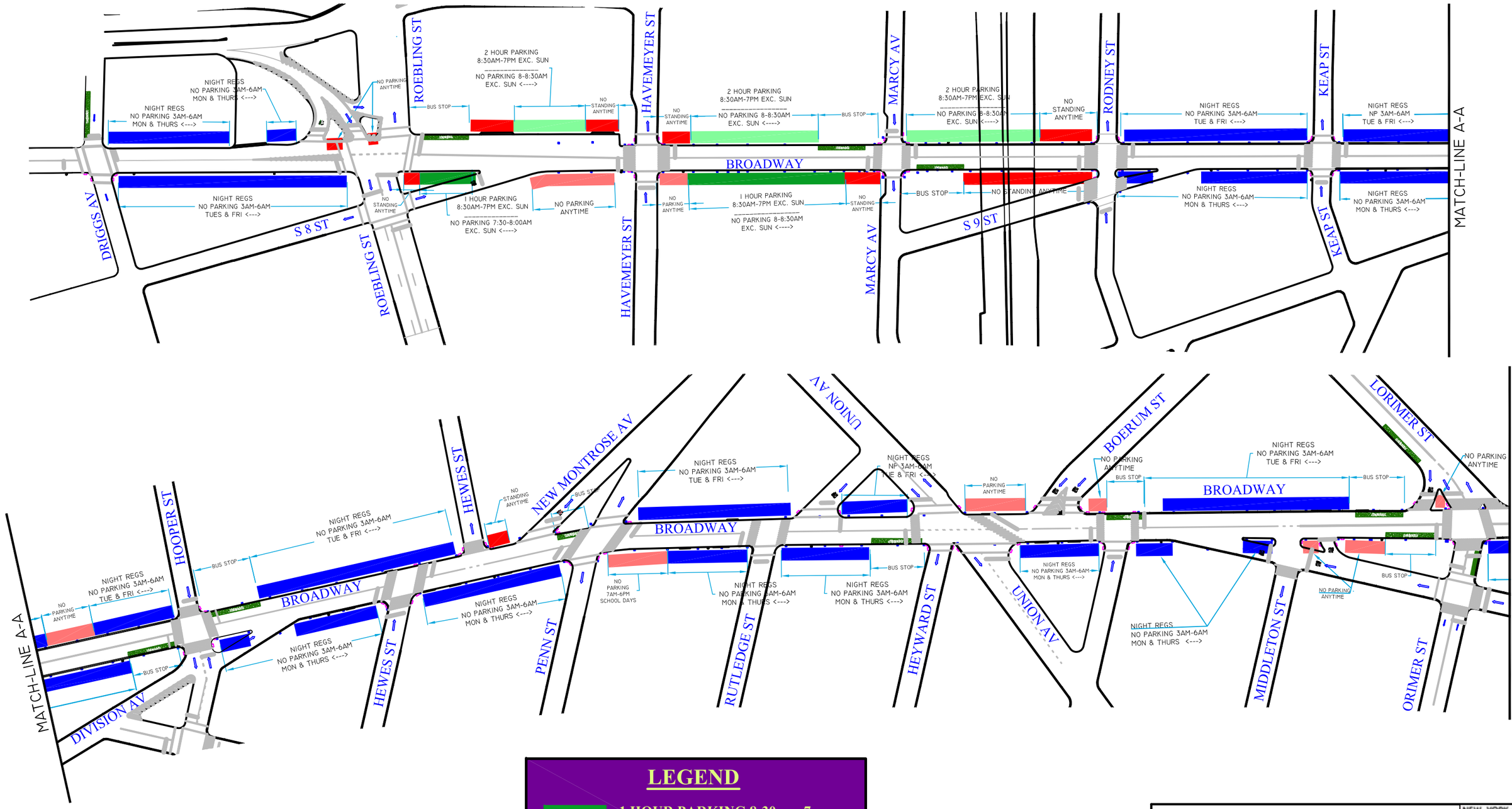



***Figure 20: Weekday Parking Supply by Time of Day***




## LEGEND

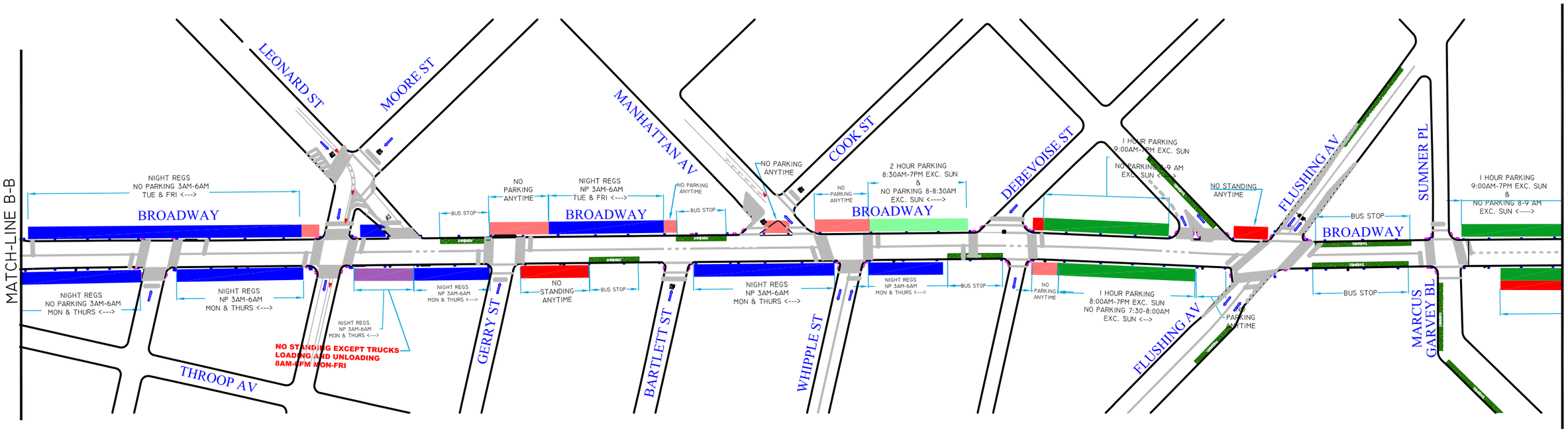
- 1 HOUR PARKING 8:30am -7pm
- 2 HOUR PARKING 8:30am - 7pm
- NON-METERED PARKING
- NO STANDING ANYTIME
- NO PARKING ANYTIME

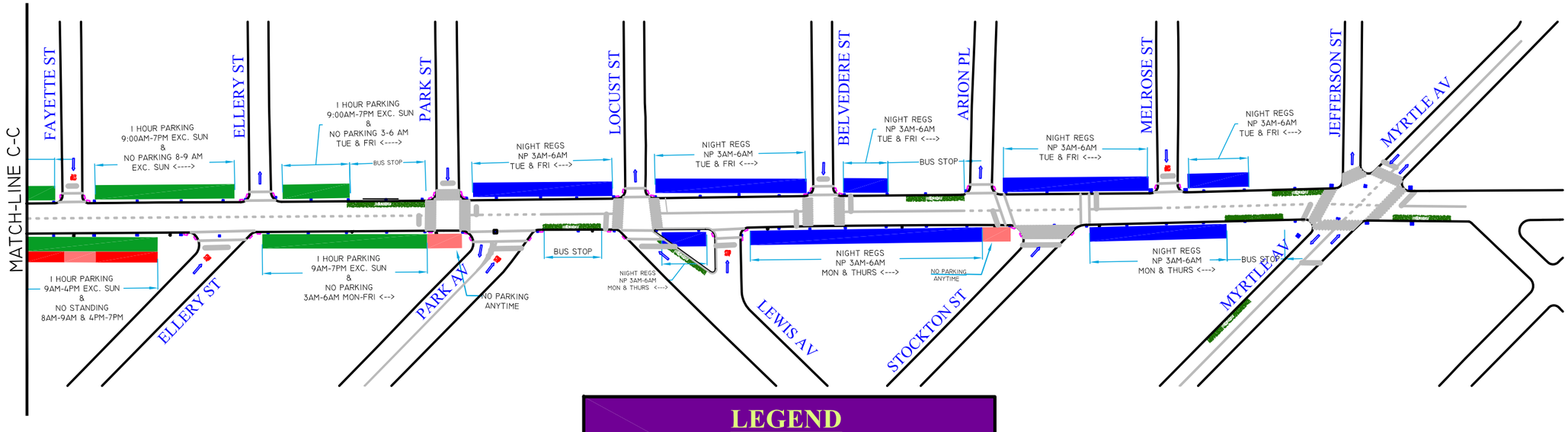
FIGURE 21

PARKING REGULATIONS (1)

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## LEGEND

- 1 HOUR PARKING 8:30am -7pm
- 2 HOUR PARKING 8:30am - 7pm
- NON-METERED PARKING
- NO STANDING ANYTIME
- NO PARKING ANYTIME

FIGURE 22

PARKING REGULATIONS (2)

CITYWIDE CONGESTED CORRIDOR PROJECT

# BROADWAY

Figure 23 presents parking utilization by hour. Utilization levels at legally-available spaces along Broadway reaches between 90-97% during the 11:00 AM – 3:00 PM period. However, this may be somewhat misleading due to the fact that although there were occasional available parking spaces, these were often blocked by double parked vehicles, including trucks loading and unloading. Further, some of the parking spaces were available only during short times between vehicles leaving the parking space and others arriving. Generally, from 11AM until 3PM, parking is tight and it is difficult to find a space. Outside of these hours, there is some excess capacity.

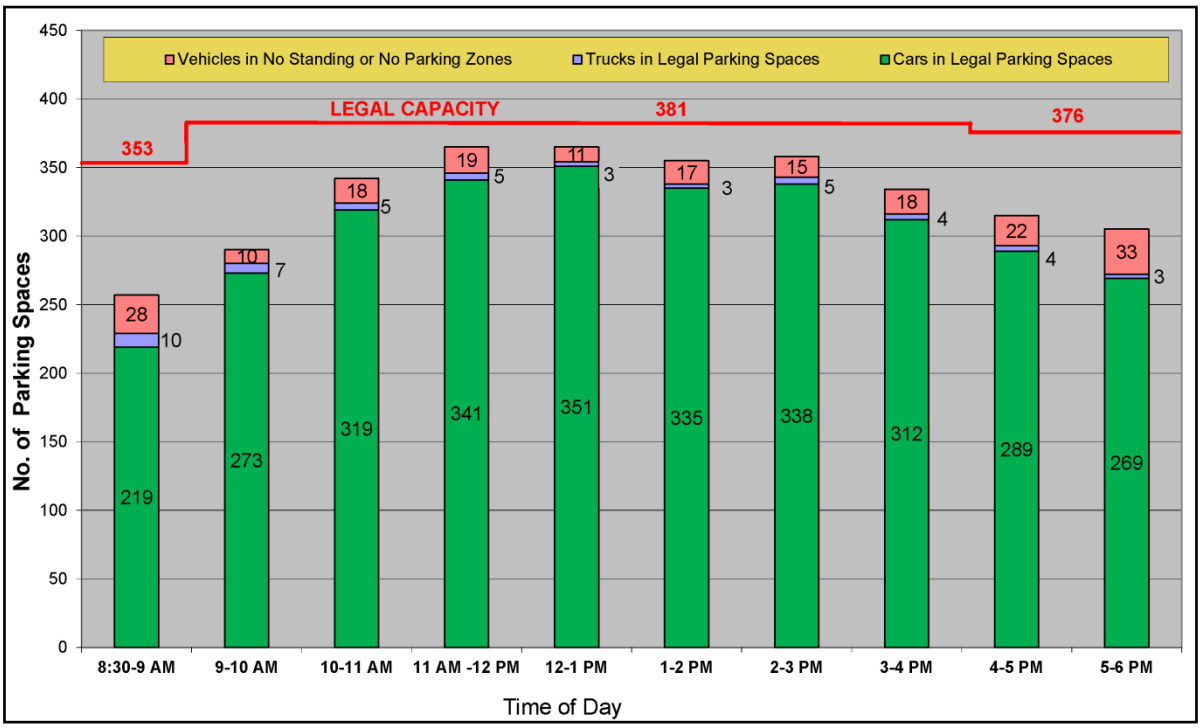



***Figure 23: Parking Utilization during a Typical Weekday***

Figure 23 also highlights the number of illegally parked cars and trucks throughout the day, reaching as high as 28 between 8:30 and 9 AM, and 33 between 5 and 6 PM. Double-parked vehicles create significant congestion issues, since there is only one travel lane in each direction.

A perceived parking problem is that some parkers refill the meter as the time has expired in order to park longer than the allowed time. Parking duration was determined for all vehicles that were parked at one- and two-hour metered spaces in order to quantify the number of vehicles that illegally "feed the meter." During the time meters were in effect, a total of 114 vehicles – 92 at one-hour spaces and 22 at two-hour spaces – exceeded the time limit. The breakdown is as follows:

(78) One -Hour Metered Parking Spaces

- 73.4% of the time meters are in effect, the one-hour time limit was not exceeded.
- 70 vehicles parked between 1 and 2 hours, accounting for 14.7% of the time meters are in effect.
- 11 vehicles parked between 2 and 3 hours, accounting for 3.8% of the time meters are in effect.
- 3 vehicles parked between 3 and 4 hours, accounting for 1.5% of the time meters are in effect.
- 8 vehicles parked longer than 4 hours, accounting for 6.6% of the time meters are in effect.

(26) Two-Hour Metered Parking Spaces

- 81.2% of the time meters are in effect, two-hour time limit was not exceeded.
- 17 vehicles parked between 2 and 3 hours, accounting for 9.8% of the time meters are in effect.
- 3 vehicles parked between 3 and 4 hours, accounting for 2.9% of the time meters are in effect.
- 2 vehicles parked longer than 4 hours, accounting for 6.2% of the time meters are in effect.

## 3.6 Safety

Reportable crashes for the five-year period (2009-20013) were summarized for intersections and mid-block locations along the Broadway corridor. A reportable crash in New York State is defined as a crash involving death, injury or at least $1,000 in property damage. These crashes were used to identify overall crash patterns and clusters along the study corridor.

Over the 5-year period, there were 521 reportable crashes along the corridor. Of these, 492 (94%) occurred at intersections while the remaining 29 crashes occurred at mid-block locations. Figure 24 presents a breakdown of the intersection crashes.

The highest number of intersection crashes occurred at the intersection of Broadway and Flushing Avenue, where 77 crashes occurred during the 5-year period. The high number of crashes here can be attributed to high traffic and pedestrian volumes, due to the proximity to the Woodhull Hospital entrance and the nearby Flushing Avenue subway station. This was followed by Myrtle Avenue (56 crashes), Marcy Avenue (28 crashes), Havemeyer Street (26 crashes) and Union Street (25 crashes).

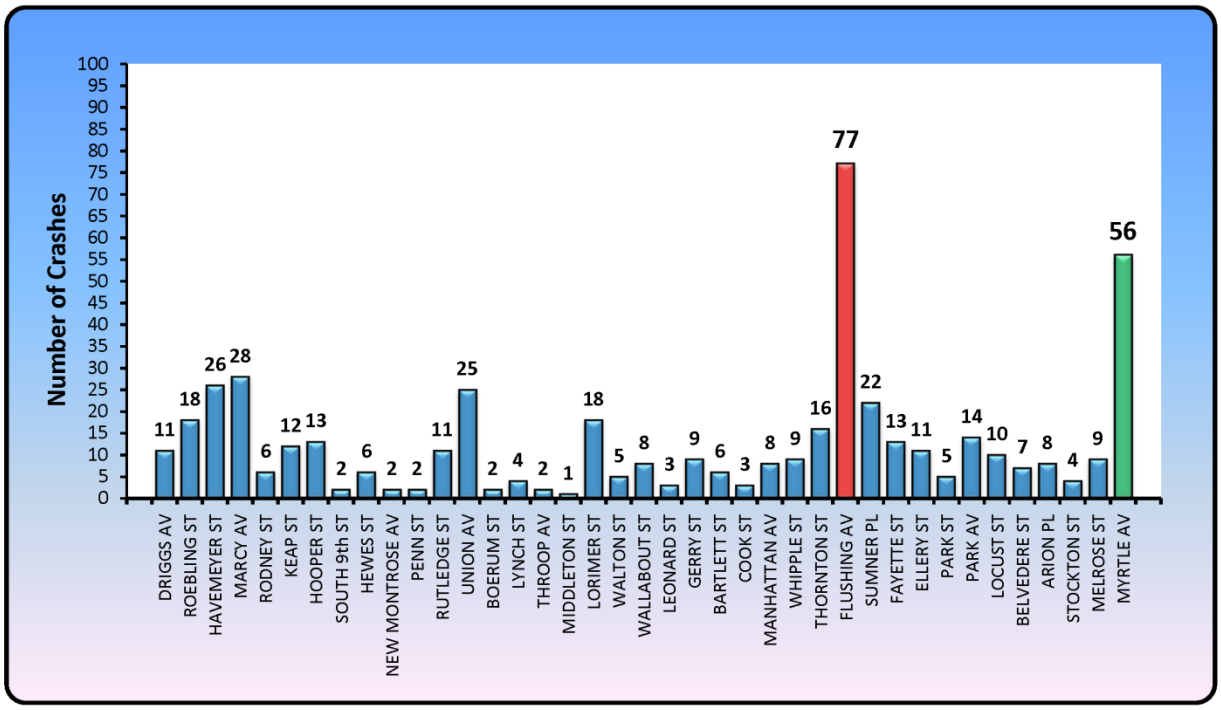



***Figure 24: Broadway Crashes at Intersections (2008 – 20012)***

Crash severity is classified into the following categories: fatal, severe injury, moderate injury, and property damage only (over $1,000). There were three fatal crashes during this analysis period. As shown in Figure 25, there were 57 crashes with severe injuries, 72 crashes with non-severe injuries, and 381 crashes with minor injuries.

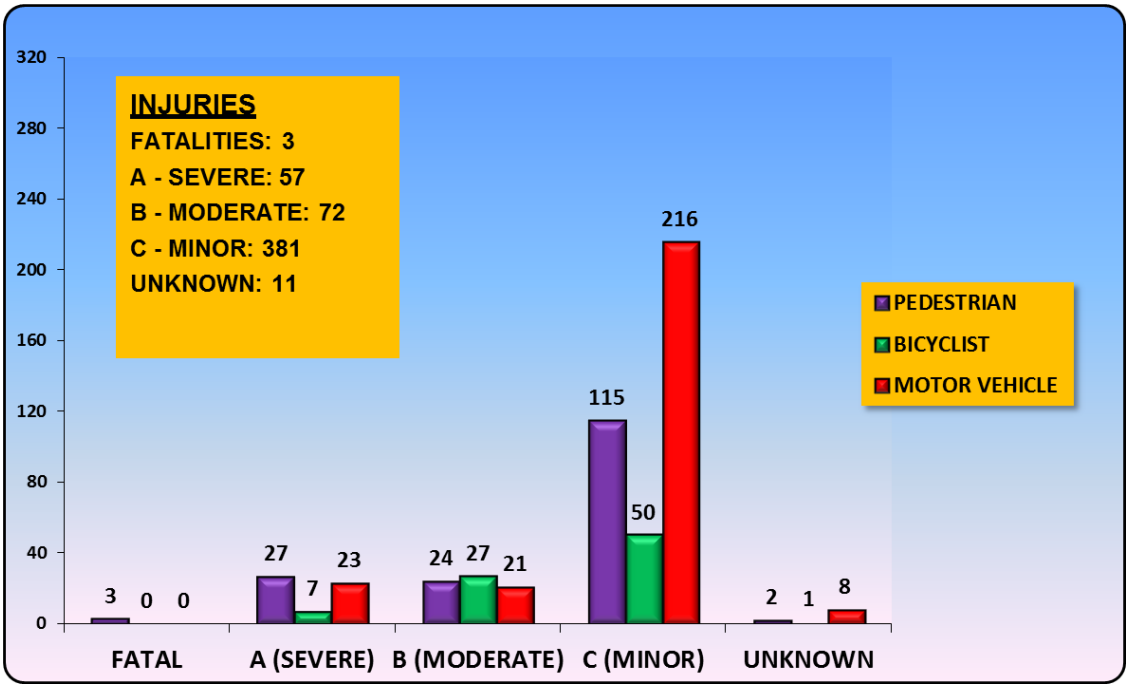



***Figure 25: Crash Severity***

Crash types are shown in Figure 26. Motor vehicle (vehicle-vehicle) crashes were the predominant type along the corridor with 240 crashes, accounting for 48% of all crashes. There were 148 (30%) crashes involving pedestrians, of which three were fatal crashes. Seventy-nine crashes involved bicycles.

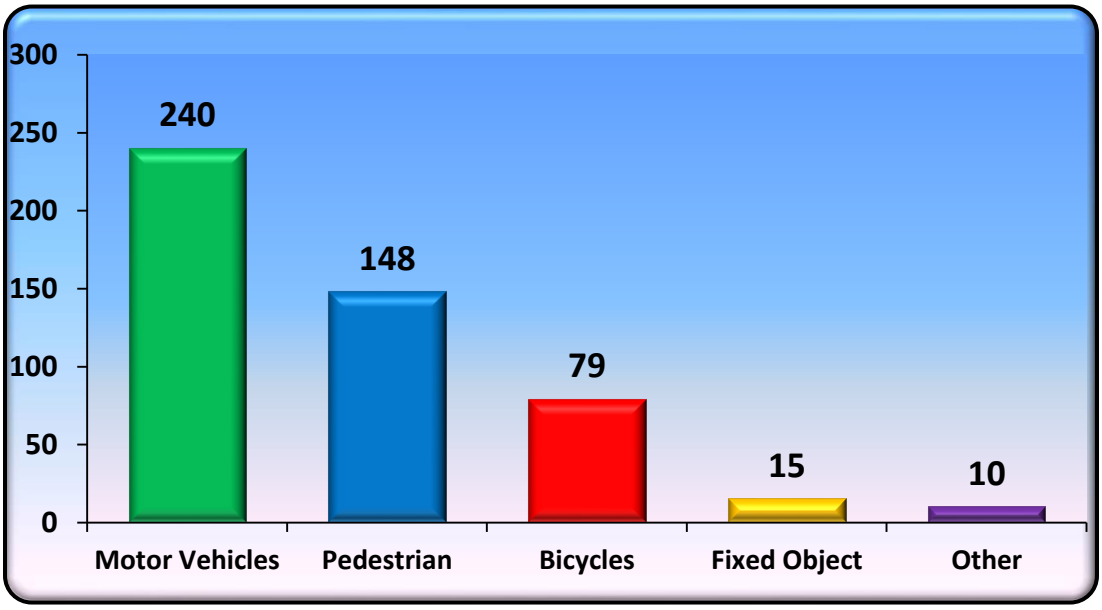



***Figure 26: Crash Type***

Figure 27 presents vehicular crashes by colision type. There were a total of 240 crashes that involved motor vehicles. The highest frequency of vehicular crashes was rear-ending collisions

with a total of 82 crashes, accounting for 34% of all crashes, followed by 50 sideswipe crashes (20.8 %), 20 right angle crashes (8.3%), and 12 left-turn crashes (5%). All other crashes were classified as "other" or "unknown."

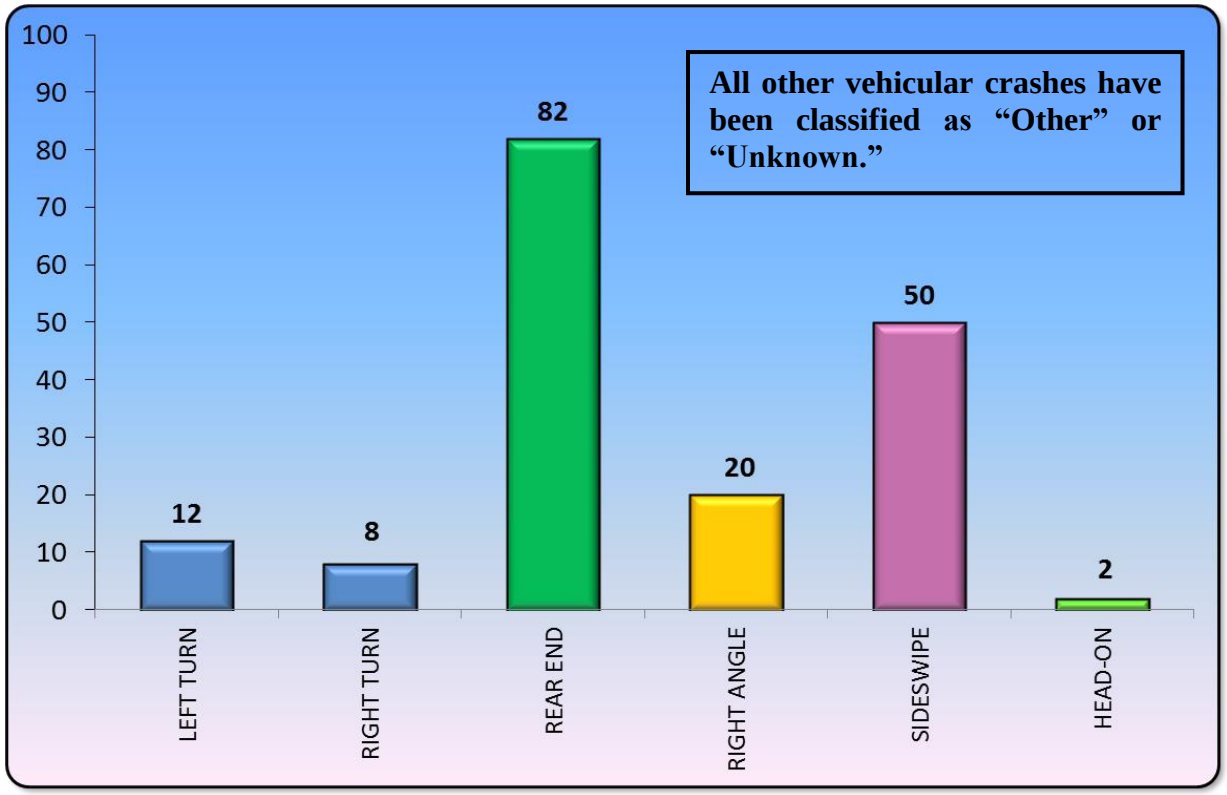



***Figure 27: Vehicular Crashes by Collision Type***

## 3.7 Goods Movement

Figure 28 illustrates the truck routes in the study area. Broadway is designated as a local truck route throughout its length. In addition, Roebling Street, Havemeyer Street, Marcy Avenue, Rodney Street, Union Avenue, Flushing Avenue and Myrtle Avenue – all of which cross Broadway in the study area - are also designated as local truck routes.


***Figure 28: Truck Routes***

The land use along the study area includes retail, restaurants and manufacturing, which require frequent deliveries of goods. In light of the fact that Broadway operates with one travel lane in each direction, and there are virtually no loading zones, trucks loading or unloading often occupy the travel lane, thus creating traffic congestion and forcing drivers to make unsafe maneuvers. The common maneuver that vehicles undertake to bypass a standing truck is to veer left across the double yellow lane onto opposing traffic, and then swing right back to travel lane. This is illustrated in Photograph 5.

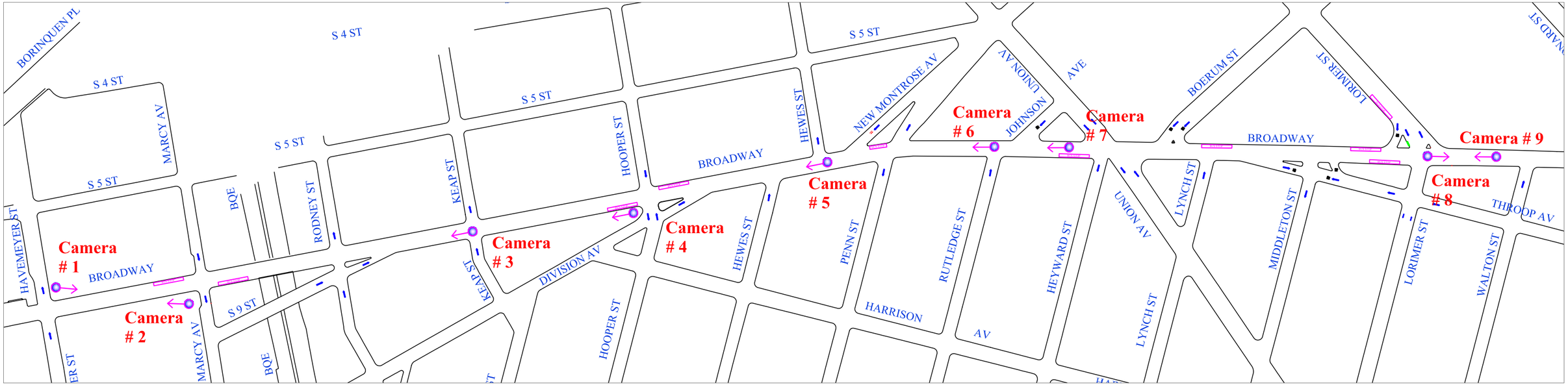
***Photograph 5: Double-Parked Truck Forcing Traffic to Cross the Double-Yellow Line***

Curbside loading and unloading activities were observed and recorded via video recording at the following 18 locations for a period of 7 days, 24 hours per day:

- Broadway btw. Havemeyer Street and Marcy Avenue – North Side (looking east)
- Broadway btw. Havemeyer Street and Marcy Avenue – South Side (looking west)
- Broadway btw. Rodney Street and Keap Street - North Side (looking west)
- Broadway btw. Hooper Street and Keap Street – North Side (looking west)
- Broadway btw. Hewes Street and Hooper Street – North Side (looking west)
- Broadway btw. Rutledge Street and Penn Street – South Side (looking west)
- Broadway btw. Heyward Street and Rutledge Street – South Side (looking west)
- Broadway btw. Walton Street and Lorimer Street – South Side (looking east)
- Broadway btw. Walton Street and Lorimer Street – South Side (looking west)
- Broadway btw. Thornton Street and Whipple Street – South Side (looking east)
- Broadway btw. Thornton Street and Whipple Street – South Side (looking west)
- Broadway btw. Flushing Avenue and Thornton Street – South Side (looking east)
- Broadway btw. Park Avenue and Ellery Street – South Side (looking west)
- Broadway btw. Park Street and Ellery Street – North Side (looking west)

- Broadway btw. Belvedere Street and Locust Street – North Side (looking west)
- Broadway btw. Stockton Street and Belvedere Street – South Side (looking west)
- Broadway btw. Melrose Street and Arion Place – North Side (looking west)
- Broadway btw. Myrtle Avenue and Stockton Street – South Side (looking west)

The video locations are illustrated in Figure 29. Photographs 5 and 6 illustrate examples of images from the videos.



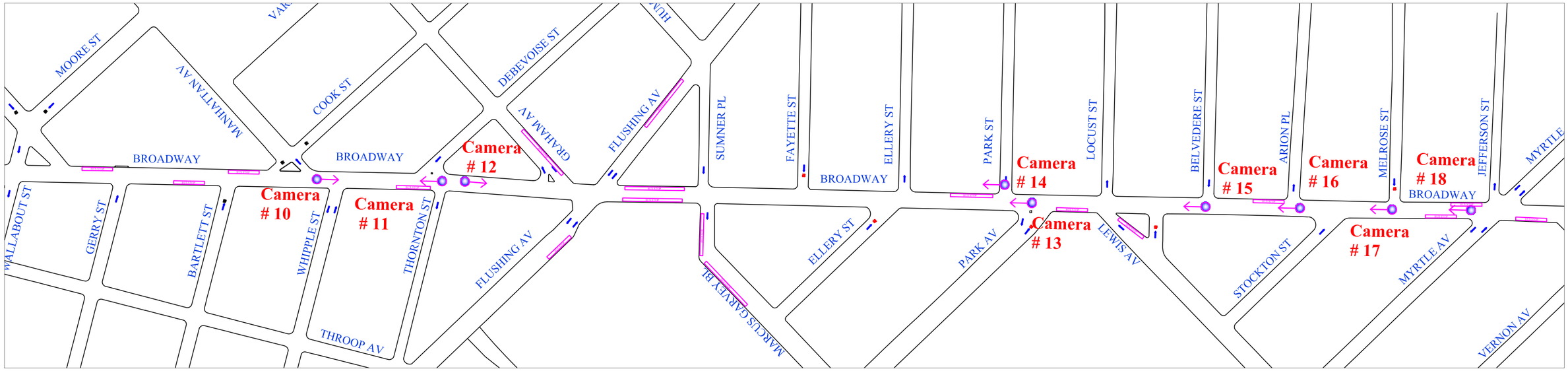
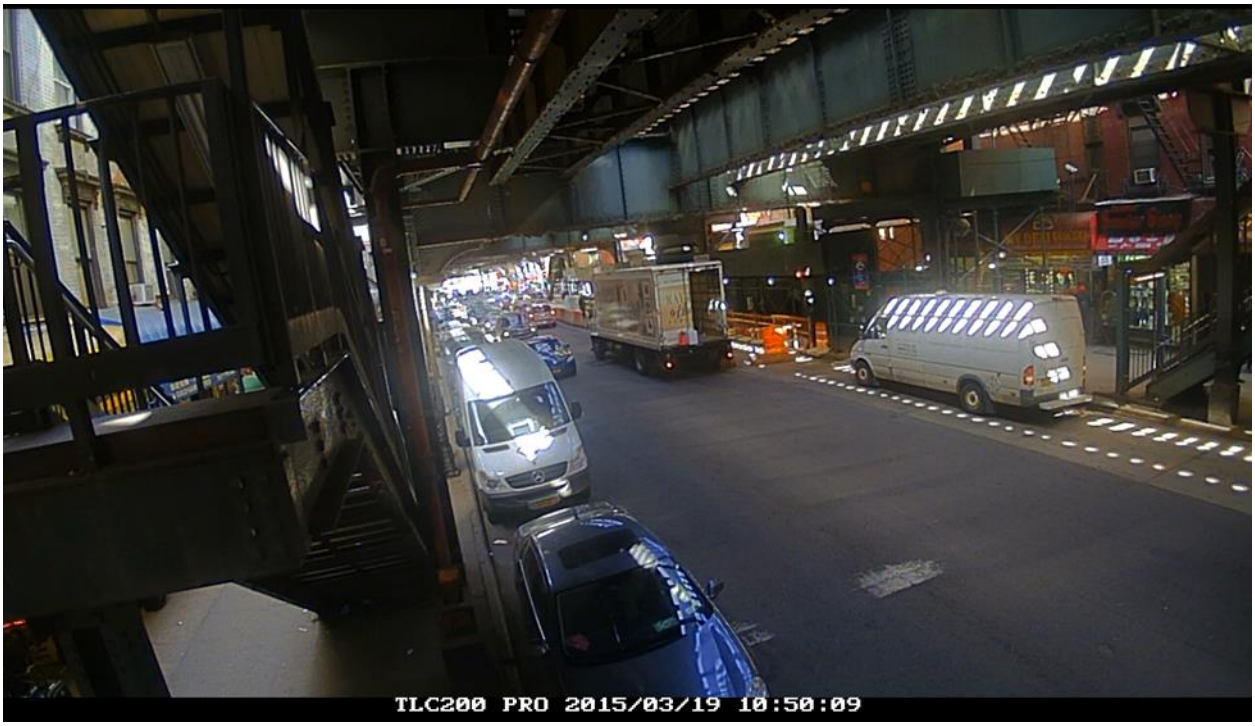




Figure 29

TIME LAPSE CAMERA LOCATION

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




***Photograph 6: Broadway at Marcy Avenue Looking West***


***Photograph 7: Broadway at Rutledge Street Looking West***

The video recordings were reviewed and results summarized. Locations where loading activity is sufficient to justify assigning curbside space as loading zones were determined. The following locations contained the most loading and unloading activity:

- Broadway btw. Hooper Street and Keap Street – North Side
- Broadway btw. Havemeyer Street and Marcy Avenue – North and South Sides
- Broadway btw. Hewes Street and Hooper Street – North Side
- Broadway btw. Hayward Street and Rutledge Street – South Side
- Broadway btw. Walton Street and Lorimer Street – South Side, and
- Broadway btw. Flushing Avenue and Thornton Avenue – South Side

## 3.8 Transit

The study area is served by MTA/NYC transit buses and subways. The service is presented in Figure 30.

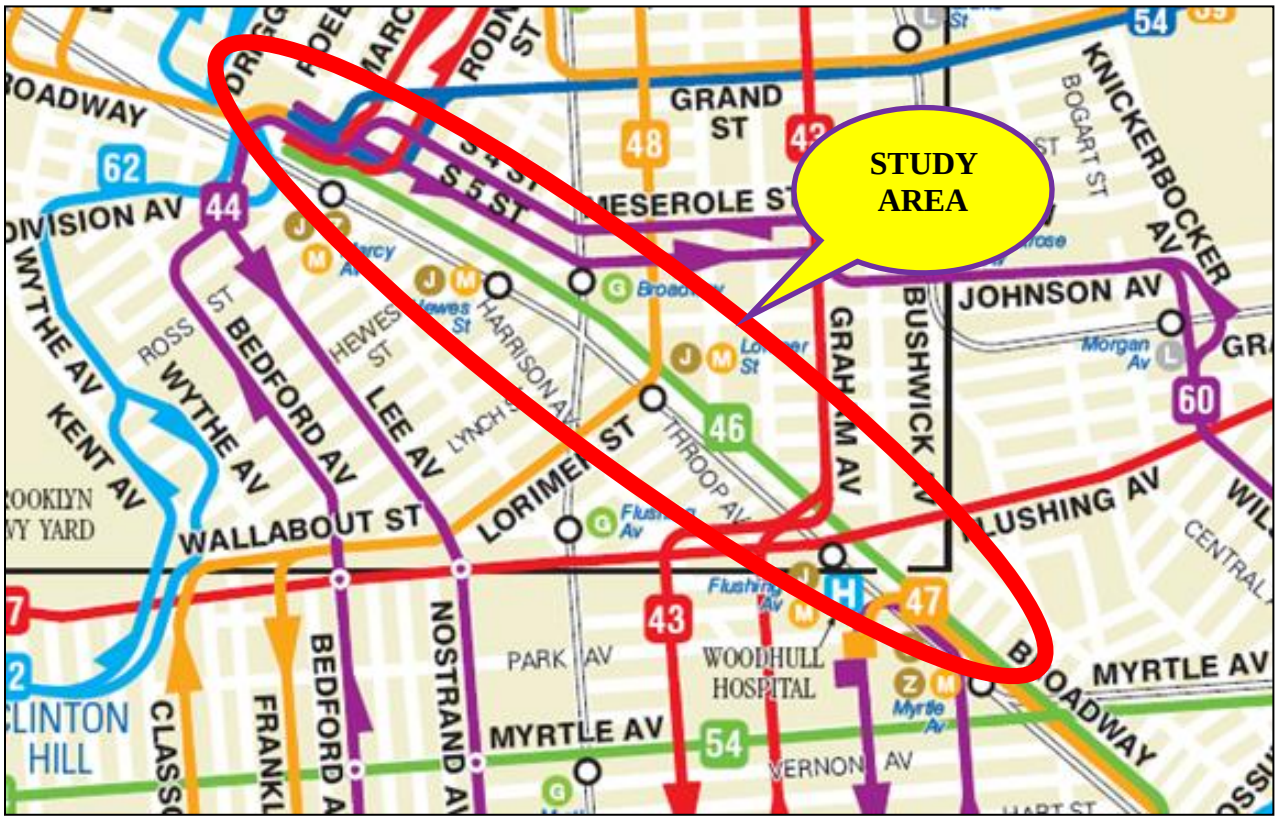



***Figure 30: Transit Routes***

The study segment of Broadway is used by five Brooklyn bus routes. The B46 operates along the entire length of the study area, while four other bus lines operate on segments of Broadway. The following are route descriptions of the five bus routes.

- B46 – Local and Limited Stop service Kings Plaza Shopping Center and Williamsburg Bridge Plaza.
- B24 – Local service between Williamsburg Bridge Plaza and Sunnyside, Queens.
- B47 – Local service between Kings Plaza Shopping Center and Marcus Garvey Blvd (Woodhull Hospital).
- B15 – Local service between JFK Airport and Bedford-Stuyvesant and Marcus Garvey Blvd (Woodhull Hospital)
- Q59 – Local service between Rego Park (Queens) and Williamsburg.

Table 3 presents the scheduled frequency of the three main bus routes operating along the Broadway corridor.

**Table 3: Bus Route Frequency along Broadway**

| **Route #** | **Weekday Frequency** (# Bus/hour) | | | **Saturday/Sunday Frequency** (# Bus/hour) |
|---|---|---|---|---|
| **Eastbound** | **AM** | **MD** | **PM** | **MD** |
| B46 | 26 | 16 | 26 | 19 |
| B47 | 6 | 7 | 8 | 6 |
| B15 | 6 | 7 | 8 | 6 |
| **Westbound** | **AM** | **MD** | **PM** | **MD** |
| B46 | 27 | 16 | 26 | 19 |
| B47 | 6 | 7 | 8 | 8 |
| B15 | 6 | 7 | 8 | 8 |

There are also seven bus lines that cross Broadway in the study area:

- B62 crosses Broadway at Roebling Street and Havemeyer Street, providing local service between Long Island City, Queens and Downtown Brooklyn.
- B44 and B44 SBS cross Broadway at Roebling Street, providing local and select bus service between Sheepshead Bay, Brooklyn and Williamsburg.
- B48 crosses Broadway at Lorimer Street, providing local service between Greenpoint, Brooklyn and Prospect-Lefferts Gardens, Brooklyn.
- B43 crosses Broadway at Thornton Street and Graham Avenue, providing local service between Greenpoint, Brooklyn and Prospect-Lefferts Gardens, Brooklyn.
- B57 crosses Broadway at Flushing Avenue, providing local service between Maspeth, Queens and Red Hook, Brooklyn.
- B54crosses Broadway at Myrtle Avenue, providing local service between Ridgewood Intermodal Terminal, Queens and MetroTech Center, Brooklyn.

There are three subway lines that operate along the elevated structure along Broadway, as shown in Figure 31. All three lines provide service to Manhattan via the Williamsburg Bridge.

- The J and Z lines operate between Jamaica Center/Parsons Blvd, Queens and Broad Street, Manhattan.
- The M line operates between Middle Village/Metropolitan Avenue, Queens and Forrest Hills, Queens, looping through Brooklyn and Lower Manhattan.

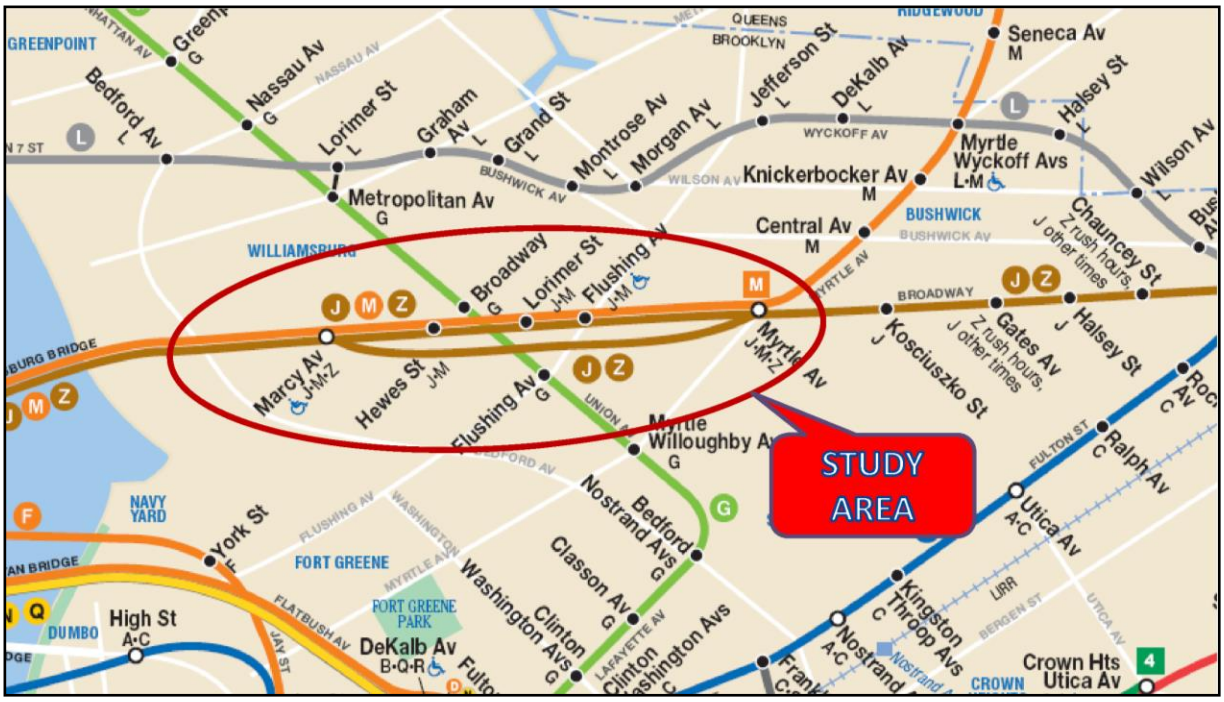



***Figure 31: Subway Routes***

There are five subway stops within the study limits:

- Marcy Avenue (J, M and Z)
- Hewes Street (J and M)
- Larimer Street (J and M)
- Flushing Avenue (J and M)
- Myrtle Avenue (J,M and Z)

All trains operate on elevated structure, as shown in Photograph 8.


***Photograph 8: Elevated subway tracks on Broadway***

In addition, the G line crosses the study corridor at Union Avenue, providing service between Church Avenue, Brooklyn and Court Square, Queens. There is a stop at Broadway, but there is no transfer to the J, M or Z lines.

## 3.9 Traffic Analysis

The baseline existing conditions traffic analysis was conducted using Synchro software. The base input parameters used to conduct the analysis (traffic volumes, peak hour factors, heavy vehicle factors, etc.) were developed from TMC and ATR counts. Pedestrian, parking and bus data, and travel time and delay runs information as well as multiple field observations were utilized to calibrate the existing condition model.

All level-of-service (LOS) analyses described in this report were performed in accordance with the procedures described in the *2000 Highway Capacity Manual (HCM)*. For signalized intersections, LOS is based on average control delay (in seconds per vehicle) for all vehicles entering the intersection during the time period evaluated. Control delays include delays associated with acceleration, deceleration and queue move-up time, in addition to stopped delay at the intersection.

LOS A, B and C generally represent favorable levels of service. At LOS D, delays increase and the influence of congestion becomes noticeable. Mid LOS "D" or better is typically considered marginally acceptable. Delay beyond mid-LOS D is considered marginally unacceptable. LOS E and F are considered to be unacceptable. Table 4 shows the relationships between average control delay and LOS for signalized intersections using the HCM methodologies.

**Table 4: Level of Service Criteria**

| Level-of-Service | Average Control Delay (seconds per vehicle) Signalized Intersections |
|---|---|
| A | ≤ 10 |
| B | > 10 and ≤ 20 |
| C | > 20 and ≤ 35 |
| D | > 35 and ≤ 55 |
| E | > 55 and ≤ 80 |
| F | > 80 |

Level-of-service analyses were conducted for each of the study intersections for the weekday AM, midday, PM and Saturday PM peak hours. Table 5 shows the existing operational performance characteristics at each signalized study intersection during each of the peak hours analyzed.

## Table 5: Existing Conditions Level of Service

| Intersection Approach[1] | Lane Group | AM Peak | | | MD Peak | | | PM Peak | | | Saturday Peak | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS |
| **1. Broadway and Roebling Street** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.33 | 22.9 | C | 0.33 | 13.0 | B | 0.37 | 23.7 | C | 0.27 | 14.7 | B |
| **WB - Broadway** | LTR | 0.35 | 34.3 | C | 0.29 | 16.5 | B | 0.23 | 19.0 | B | 0.32 | 16.8 | B |
| **NB - Roebling Street** | L | 0.03 | 17.8 | B | 0.02 | 1.2 | A | 0.02 | 10.7 | B | 0.01 | 15.3 | B |
| | TR | 0.02 | 18.0 | B | 0.02 | 1.2 | A | 0.03 | 10.6 | B | 0.02 | 15.4 | B |
| **SB - Roebling Street** | L | 0.33 | 23.0 | C | 0.29 | 18.8 | B | 0.47 | 36.5 | D | 0.25 | 18.2 | B |
| | TR | 0.25 | 22.1 | C | 0.31 | 19.4 | B | 0.73 | **75.3** | **E** | 0.21 | 17.8 | B |
| **Overall Intersection** | | | **26.1** | **C** | | **16.3** | **B** | | **46.4** | **D** | | **16.7** | **B** |
| **2. Broadway and Havemayer Street** | | | | | | | | | | | | | |
| **EB - Broadway** | LT | 0.62 | 20.3 | C | 0.72 | 30.6 | C | 1.03 | **100.6** | **F** | 0.56 | 22.7 | C |
| **WB - Broadway** | TR | 1.00 | **79.0** | **E** | 0.77 | 20.7 | C | 0.89 | 33.5 | C | 0.79 | 18.5 | B |
| **NB - Havemayer Street** | LTR | 0.57 | 38.1 | D | 0.57 | 37.9 | D | 0.73 | 47.3 | D | 0.24 | 28.7 | C |
| **Overall Intersection** | | | **51.1** | **D** | | **29.0** | **C** | | **69.2** | **E** | | **21.4** | **C** |
| **3. Broadway and Marcy Avenue** | | | | | | | | | | | | | |
| **EB - Broadway** | TR | 0.58 | 29.3 | C | 0.63 | 20.6 | C | 1.04 | **77.6** | **E** | 0.61 | 17.2 | B |
| **WB - Broadway** | LT | 0.88 | **93.1** | **F** | 0.63 | 17.9 | B | 0.77 | 25.8 | C | 0.73 | 20.0 | B |
| **SB-Rochambeau Avenue** | LTR | 0.38 | 24.2 | C | 0.49 | 26.3 | C | 0.42 | 25.0 | C | 0.44 | 25.5 | C |
| **Overall Intersection** | | | **58.7** | **E** | | **21.5** | **C** | | **50.8** | **D** | | **20.3** | **C** |
| **4. Broadway and Hooper Street** | | | | | | | | | | | | | |
| **EB - Broadway** | TR | 0.49 | 9.2 | A | 0.51 | 21.8 | C | 0.72 | 49.7 | D | 0.42 | 14.6 | B |
| **WB - Broadway** | LT | 0.91 | 25.1 | C | 0.65 | 32.3 | C | 0.71 | 15.7 | B | 0.67 | 14.2 | B |
| **SB - Hooper Street** | LTR | 0.30 | 30.0 | C | 0.42 | 32.6 | C | 0.52 | 35.4 | D | 0.31 | 24.2 | C |
| **Overall Intersection** | | | **20.6** | **C** | | **28.5** | **C** | | **34.2** | **C** | | **16.0** | **B** |
| **5. Broadway and Penn Street** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.57 | 19.1 | B | 0.48 | 27.2 | C | 0.63 | 16.1 | B | 0.49 | 34.2 | C |
| **WB - Broadway** | LTR | 0.82 | 34.3 | C | 0.61 | 35.6 | D | 0.74 | 36.0 | D | 0.60 | 35.4 | D |
| **SB - New Montrose** | LTR | 0.07 | 26.1 | C | 0.05 | 20.2 | C | 0.09 | 26.2 | C | 0.04 | 20.1 | C |
| **Overall Intersection** | | | **28.5** | **C** | | **26.2** | **C** | | **25.8** | **C** | | **28.5** | **C** |
| **6. Broadway and Union Avenue** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.54 | 13.20 | B | 0.48 | 32.5 | C | 0.75 | 25.50 | C | 0.45 | 35.1 | D |
| **WB - Broadway** | LTR | 1.03 | **60.70** | **E** | 0.81 | 19.6 | B | 0.85 | 26.40 | C | 0.79 | 17.1 | B |
| **NB - Union Avenue** | LTR | 0.61 | 39.70 | D | 0.62 | 34.8 | C | 0.69 | 43.40 | D | 0.40 | 27.1 | C |
| **SB - Union Avenue** | LTR | 0.52 | 35.50 | D | 0.37 | 25.7 | C | 0.42 | 32.80 | C | 0.27 | 23.7 | C |
| **Overall Intersection** | | | **41.90** | **D** | | **27.0** | **C** | | **30.10** | **C** | | **24.8** | **C** |
| **7. Broadway and Lorimer Street** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.59 | 14.8 | B | 0.55 | 7.0 | A | 0.84 | 23.4 | C | 0.56 | 5.5 | A |
| **WB - Broadway** | LTR | 0.91 | 36.7 | D | 0.65 | 14.2 | B | 0.84 | 23.8 | C | 0.74 | 13.6 | B |
| **NB - Lorimer Street** | LTR | 0.43 | 34.6 | C | 0.20 | 22.4 | C | 0.28 | 29.9 | C | 0.17 | 21.8 | C |
| **SB - Lorimer Street** | LTR | 0.57 | 40.0 | D | 0.27 | 24.0 | C | 0.45 | 35.6 | D | 0.14 | 21.7 | C |
| **Overall Intersection** | | | **30.5** | **C** | | **13.3** | **B** | | **25.6** | **C** | | **11.7** | **B** |
| **8. Broadway and Thornton Ave/Debevoise** | | | | | | | | | | | | | |
| **EB - Broadway** | TR | 0.52 | 13.9 | B | 0.47 | 6.0 | A | 0.77 | 47.3 | D | 0.57 | 6.5 | A |
| **WB - Broadway** | LT | 0.50 | 10.5 | B | 0.38 | 10.2 | B | 0.48 | 16.1 | B | 0.61 | 15.6 | B |
| **SB - Thornton/Debevoise Ave** | LTR | 0.33 | 30.0 | C | 0.34 | 23.7 | C | 0.43 | 32.0 | C | 0.32 | 23.2 | C |
| **Overall Intersection** | | | **15.5** | **B** | | **11.0** | **B** | | **34.1** | **C** | | **12.9** | **B** |
| **9. Broadway and Flushing Avenue** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.78 | 26.3 | C | 0.69 | 25.1 | C | 1.05 | **92.5** | **F** | 1.02 | **67.2** | **E** |
| **WB - Broadway** | LTR | 1.04 | **81.4** | **F** | 1.04 | **56.5** | **E** | 1.02 | **87.7** | **F** | 0.90 | 27.0 | C |
| **NB - Flushing Ave** | LTR | 1.04 | **100.5** | **F** | 0.75 | 32.0 | C | 0.78 | 32.0 | C | 0.98 | **62.4** | **E** |
| **SB - Flushing Ave** | LTR | 1.03 | **100.4** | **F** | 0.95 | **56.0** | **E** | 0.88 | 43.2 | D | 1.04 | **76.1** | **E** |
| **Overall Intersection** | | | **83.6** | **F** | | **44.3** | **D** | | **62.0** | **E** | | **59.5** | **E** |
| **10. Broadway and Marcus Garvey Blvd/Sumner Pl** | | | | | | | | | | | | | |
| **EB - Broadway** | LT | 0.73 | 20.0 | B | 0.61 | 9.0 | A | 1.04 | **68.4** | **E** | 0.66 | 7.0 | A |
| **WB - Broadway** | TR | 0.95 | **104.0** | **F** | 0.73 | 27.0 | C | 0.87 | **103.9** | **F** | 0.66 | 24.7 | C |
| **SB - Lewis Avenue** | LTR | 0.78 | 48.3 | D | 0.54 | 30.6 | C | 1.02 | **87.0** | **F** | 0.66 | 35.5 | D |
| **Overall Intersection** | | | **60.7** | **E** | | **21.6** | **C** | | **85.4** | **F** | | **20.0** | **B** |
| **11. Broadway and Myrtle Avenue** | | | | | | | | | | | | | |
| **EB - Broadway** | LTR | 0.87 | 44.4 | D | 0.98 | **71.9** | **E** | 1.05 | 54.7 | D | 1.02 | **76.0** | **E** |
| **WB - Broadway** | LTR | 0.92 | 47.4 | D | 0.60 | 18.8 | B | 0.50 | 19.6 | B | 0.60 | 18.5 | B |
| **NB - Myrtle Avenue** | LTR | 0.71 | 45.9 | D | 0.77 | 42.4 | D | 1.04 | **92.8** | **F** | 0.64 | 33.6 | C |
| **SB - Myrtle Avenue** | LTR | 1.04 | **92.0** | **F** | 0.85 | 51.4 | D | 0.86 | **59.1** | **E** | 0.81 | 46.6 | D |
| **Overall Intersection** | | | **58.1** | **E** | | **47.1** | **D** | | **59.2** | **E** | | **47.3** | **D** |

Overall traffic conditions from Roebling Avenue to Flushing Avenue are moderately congested in the westbound direction during the weekday AM peak hour, and in the eastbound during the weekday PM peak hour. Broadway at Flushing Avenue is the most congested intersection, followed by Broadway at Sumner Place and Broadway at Myrtle Avenue. The following is a summary of lane groups that experience unacceptable levels of service:

- At Broadway and Roebling Street, the southbound through/right lane group operates at LOS E with 75.3 seconds delay during the weekday PM peak hour.
- At Broadway and Havemeyer Street, the westbound lane group operates at LOS E with 79.0 seconds delay during the weekday AM peak hour, and the eastbound lane group operates at LOS F with 100.6 seconds delay during the weekday PM peak hour.
- At Broadway and Marcy Avenue, the westbound lane group operates at LOS F with 93.1 seconds delay during the weekday AM peak hour, and the eastbound lane group operates at LOS E with 77.6 seconds delay during the weekday PM peak hour.
- At Broadway and Union Avenue, the westbound lane group operates at LOS E with 60.7 seconds delay during the weekday AM peak hour.
- Broadway and Flushing Avenue is the busiest and most congested intersection within the study area:
  - During the weekday AM peak hour, the westbound approach operates at LOS F with 81.4 seconds delay, the northbound approach operates at LOS F with 100.5 seconds delay, and the southbound approach operates at LOS F with 100.4 seconds delay.
  - During the weekday midday peak hour, the westbound approach operates at LOS E with 56.5 seconds delay, and the southbound approach operates at LOS E with 56.0 seconds delay.
  - During the weekday PM peak hour, the eastbound approach operates at LOS F with 92.5 seconds delay, and the westbound approach operates at LOS F with 87.7 seconds delay.
  - During the Saturday midday peak hour, the eastbound approach operates at LOS E with 67.2 seconds delay, the northbound approach operates at LOS E with 62.4 seconds delay, and the southbound approach operates at LOS E with 76.1 seconds delay.
- At Broadway and Sumner Place (Marcus Garvey Boulevard) also experiences significant congestion:
  - During the weekday AM peak hour, the westbound approach operates at LOS F with 104.0 seconds delay.
  - During the weekday PM peak hour, the eastbound approach operates at LOS E with 68.4 seconds delay, the westbound approach operates at LOS F with 103.9 seconds delay, and the southbound approach operates at LOS F with 87.0 seconds delay.
- At Broadway and Myrtle Avenue also experiences significant congestion:
  - During the weekday AM peak hour, the southbound approach operates at LOS F with 92.0 seconds delay.

- During the weekday midday peak hour, the eastbound approach operates at LOS E with 71.9 seconds delay.
- During the weekday PM peak hour, the northbound approach operates at LOS F with 92.8 seconds delay, and the southbound approach operates at LOS E with 59.1 seconds delay.
- During the Saturday midday peak hour, the eastbound approach operates at LOS E with 76.0 seconds delay.

Figures 32 through 35 present the existing conditions LOS for each study intersection for the weekday AM, midday, PM and Saturday midday peak hours, respectively.

MATCH–LINE

MATCH–LINE

## INTERSECTION LEVEL OF SERVICE

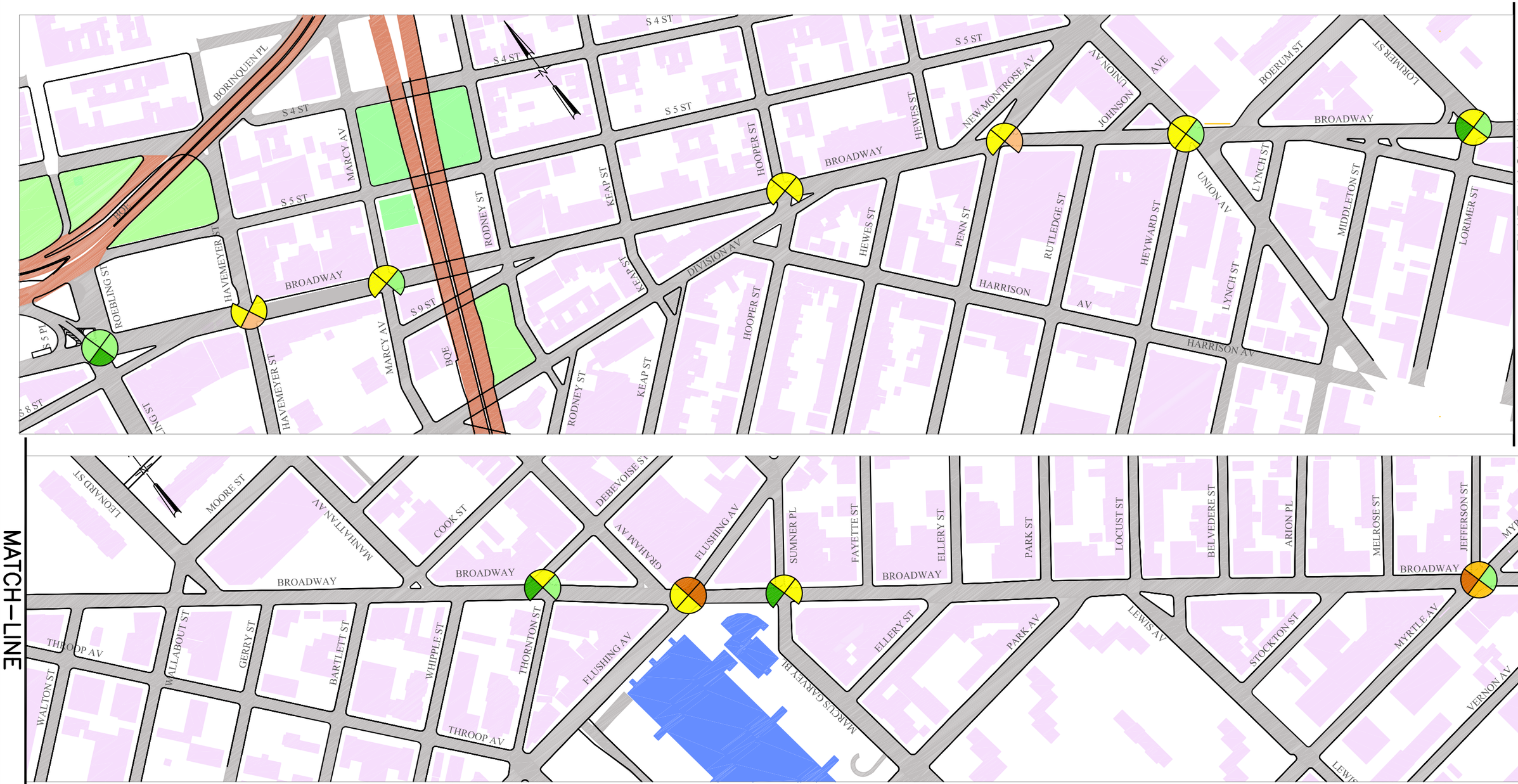
- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 32

APPROACH LEVEL OF SERVICE
AM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

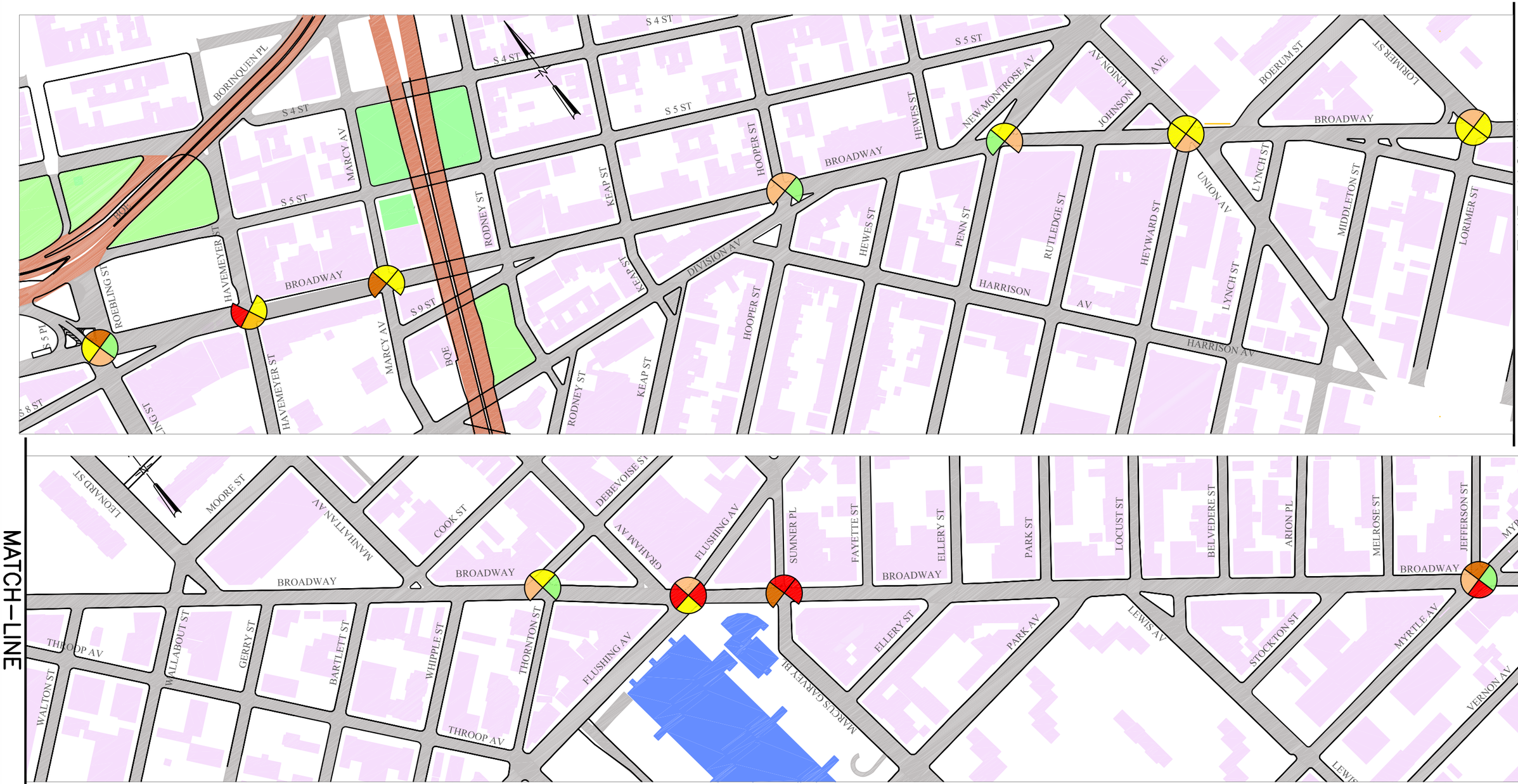
- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 33

APPROACH LEVEL OF SERVICE
WEEKDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

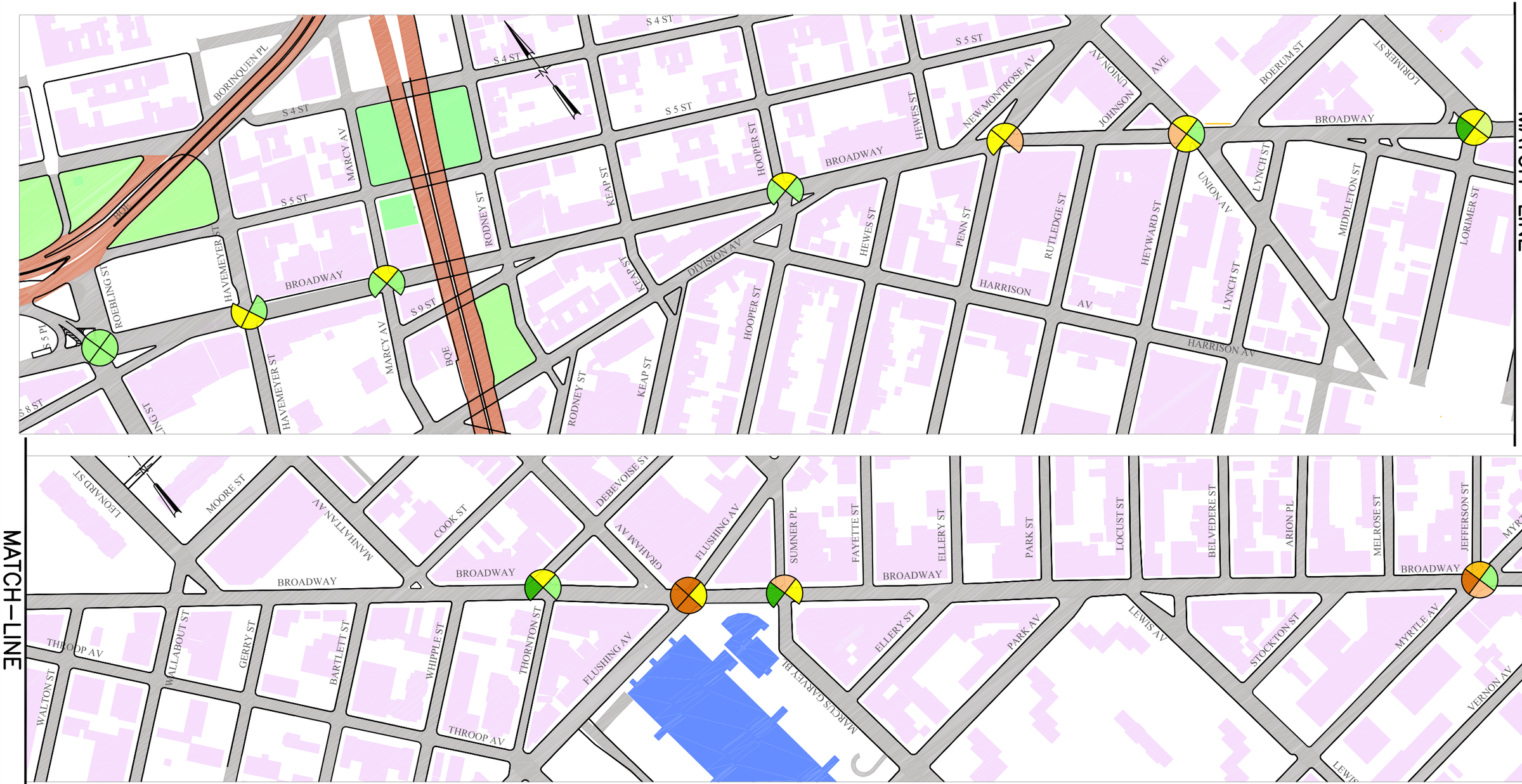
- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 34

APPROACH LEVEL OF SERVICE
PM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 35

APPROACH LEVEL OF SERVICE
SATURDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 3.10 Air Quality Analysis

Motorized traffic activity is demonstrated to be one of the significant sources contributing to air contamination. The pollutants emitted by motor vehicles include carbon monoxide (CO), volatile organic compounds (VOC), and oxides of nitrogen (NOX), among others.

Traffic congestion increases the emission rates of these contaminants in the air mix. Table 6 presents the results of the emissions analysis. During these peak hours, the CO emission rates range between 6.9 kilograms per hour in the weekday midday peak hour to 11.4 kilograms per hour in the weekday PM peak hour; the VOC emission rates range between 1.6 to 2.6 kilograms per hour; and, and NOX emission rates range between 1.3 to 2.2 kilograms per hour.

**Table 6: Existing Conditions Emissions**

| Intersection | Weekday AM Peak | | | | Weekday MD Peak | | | | Weekday PM Peak | | | | Saturday Midday Peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) |
| 1. Broadway and Roebling Street | | | | | | | | | | | | | | | | |
| Emissions | 6 | 460 | 88 | 107 | 4 | 337 | 65 | 77 | 11 | 734 | 143 | 171 | 5 | 342 | 67 | 79 |
| 2. Broadway and Havemayer Street | | | | | | | | | | | | | | | | |
| Emissions | 13 | 893 | 174 | 207 | 10 | 693 | 135 | 160 | 19 | 1276 | 249 | 296 | 8 | 551 | 107 | 128 |
| 3. Broadway and Marcy Avenue | | | | | | | | | | | | | | | | |
| Emissions | 12 | 835 | 162 | 194 | 8 | 551 | 107 | 128 | 14 | 939 | 183 | 217 | 7 | 539 | 105 | 125 |
| 4. Broadway and Hooper Street | | | | | | | | | | | | | | | | |
| Emissions | 7 | 536 | 104 | 124 | 8 | 584 | 114 | 135 | 12 | 840 | 164 | 195 | 5 | 415 | 80 | 96 |
| 5. Broadway and Penn Street | | | | | | | | | | | | | | | | |
| Emissions | 7 | 490 | 95 | 113 | 8 | 575 | 112 | 132 | 7 | 512 | 100 | 119 | 8 | 620 | 122 | 143 |
| 6. Broadway and Union Avenue | | | | | | | | | | | | | | | | |
| Emissions | 18 | 1230 | 239 | 286 | 9 | 604 | 117 | 140 | 14 | 953 | 185 | 221 | 9 | 542 | 106 | 126 |
| 7. Broadway and Lorimer Street | | | | | | | | | | | | | | | | |
| Emissions | 13 | 881 | 172 | 204 | 6 | 427 | 84 | 99 | 11 | 791 | 154 | 183 | 5 | 367 | 71 | 85 |
| 8. Broadway and Thornton Ave /Debevoise | | | | | | | | | | | | | | | | |
| Emissions | 6 | 372 | 73 | 87 | 5 | 330 | 65 | 77 | 8 | 600 | 116 | 139 | 7 | 488 | 95 | 113 |
| 9. Broadway and Flushing Avenue | | | | | | | | | | | | | | | | |
| Emissions | 31 | 2119 | 412 | 492 | 14 | 963 | 187 | 223 | 21 | 1481 | 288 | 344 | 21 | 1457 | 284 | 337 |
| 10. Broadway and Marcus Garvey Blvd/Sumner Pl | | | | | | | | | | | | | | | | |
| Emissions | 18 | 1256 | 244 | 291 | 11 | 730 | 142 | 170 | 25 | 1764 | 343 | 409 | 10 | 731 | 143 | 169 |
| 11. Broadway and Myrtle Avenue | | | | | | | | | | | | | | | | |
| Emissions | 26 | 1755 | 341 | 406 | 16 | 1139 | 221 | 264 | 22 | 1515 | 295 | 350 | 18 | 1311 | 255 | 304 |
| **TOTAL EMISSIONS (kg/h)** | **157.0** | **10.8** | **2.1** | **2.5** | **99.0** | **6.9** | **1.3** | **1.6** | **164.0** | **11.4** | **2.2** | **2.6** | **103.0** | **7.4** | **1.4** | **1.7** |

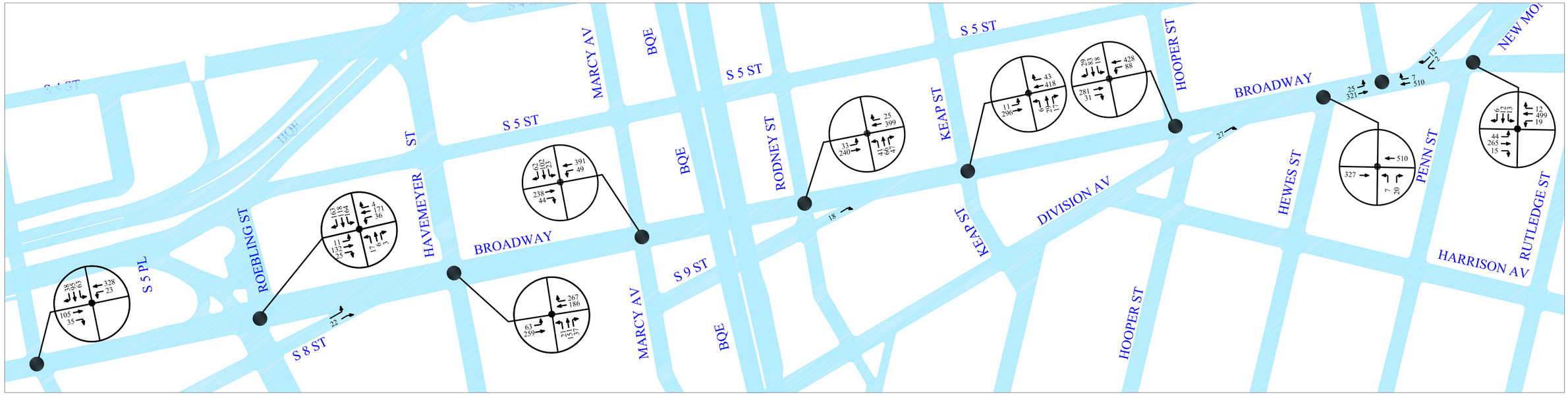
# CHAPTER 4 FUTURE CONDITIONS WITHOUT IMPROVEMENTS

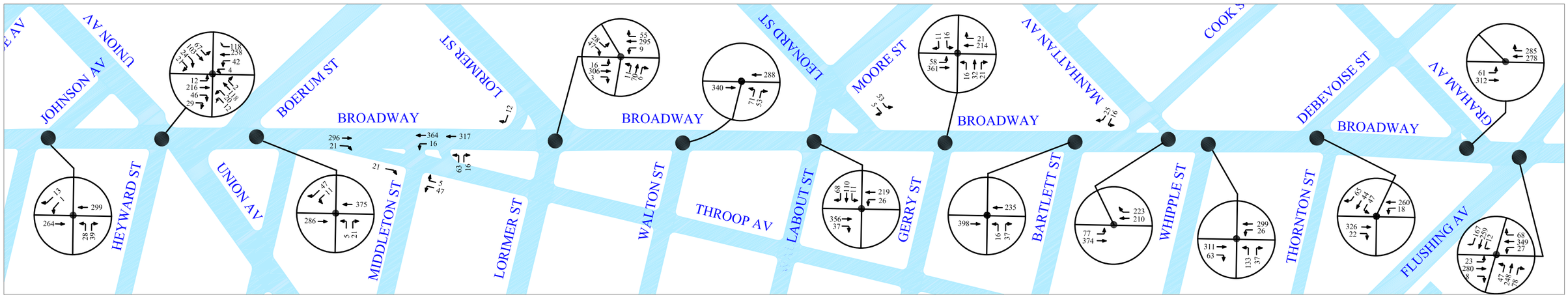
This section presents the future traffic conditions that could be expected along the Broadway corridor without improvements recommended from this study, but including other improvements or developments that would affect future traffic patterns or volumes. For analysis purposes, the future horizon year for this study has been established as 2022.

## 4.1 Traffic Volumes

The 2022 future without improvements traffic volumes consists of an annual background growth increase, which is taken from the City Environmental Quality Review (CEQR) guidelines for the borough of Brooklyn, and additional traffic volumes generated by proposed developments in the area. According to CEQR manual, the traffic volumes are projected to grow at a rate of 0.5% per year for the first five years and at a rate of 0.25% after five years. This background growth rate accumulates to 3.75% to the year 2022. There are no planned improvements or known developments that would affect traffic in the study area. The applied growth rate has been conservatively rounded up to 5.0% to include any unknown developments or other traffic generators that may occur. The growth rate was applied universally throughout the study area.

Future without improvements traffic volumes are illustrated in Figures 36 through 39 for weekday AM, midday, PM and Saturday midday peak hours, respectively.



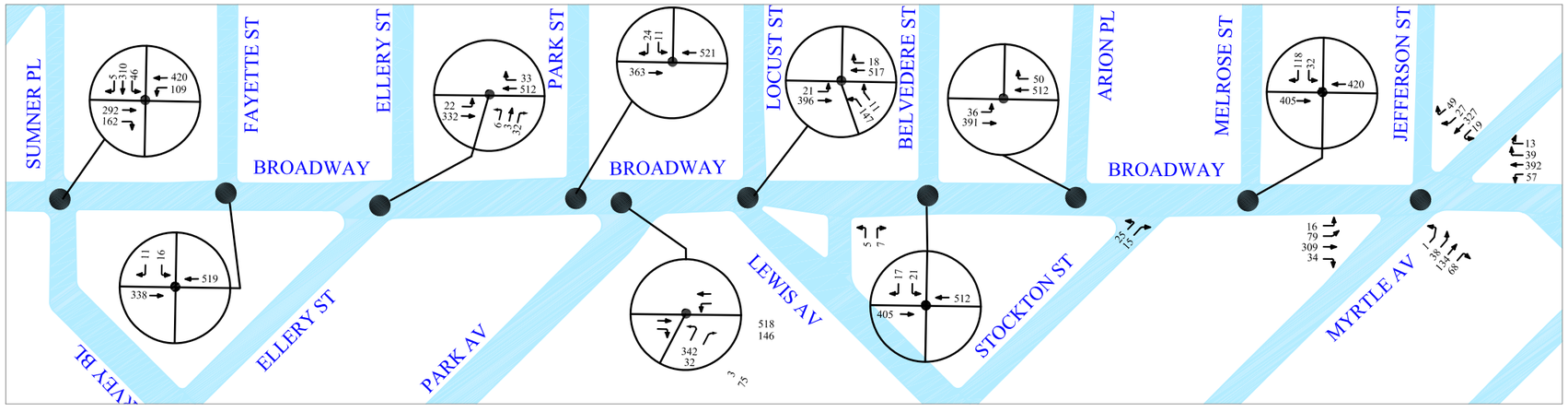



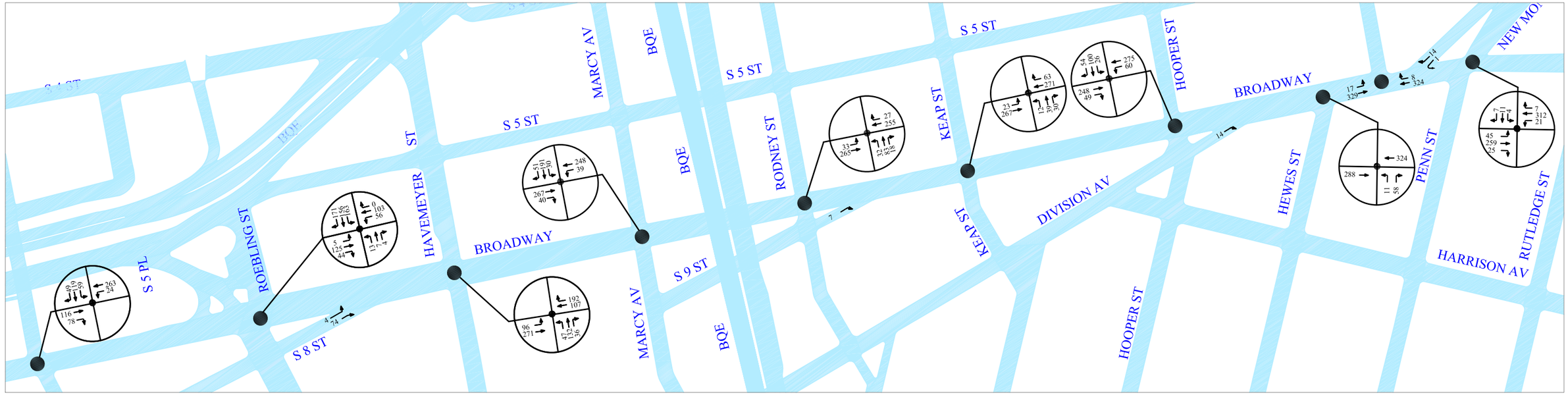

Figure 36

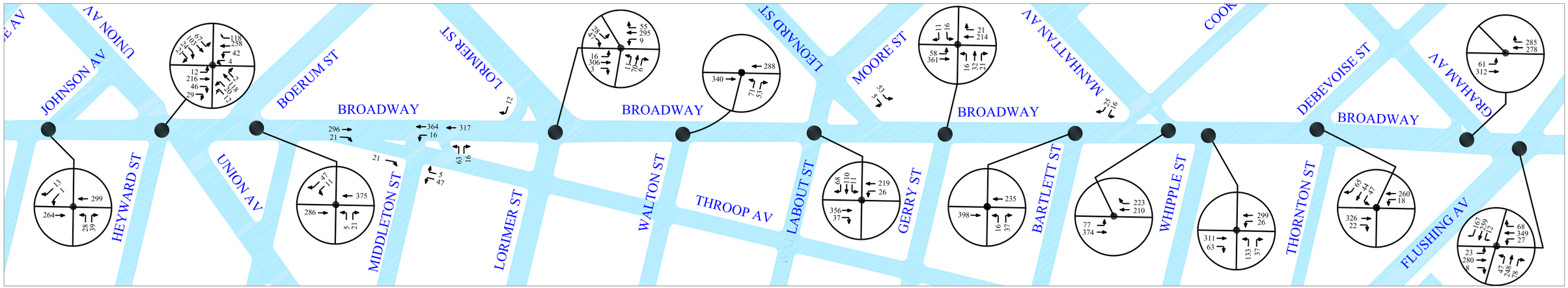
NEW YORK CITY DOT

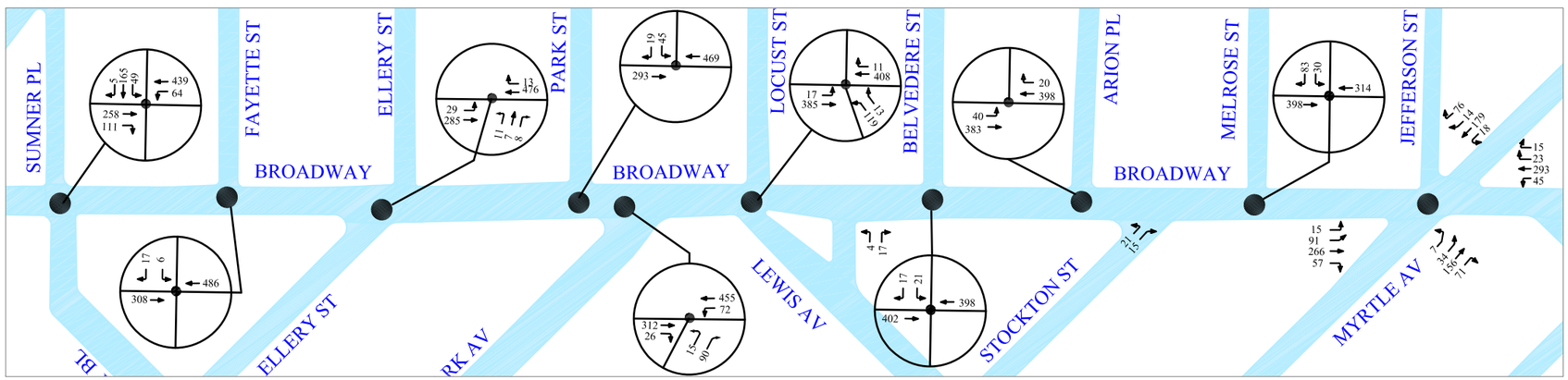
FUTURE W/O IMPROVEMENT VEHICULAR VOLUMES
WEEKDAY AM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY



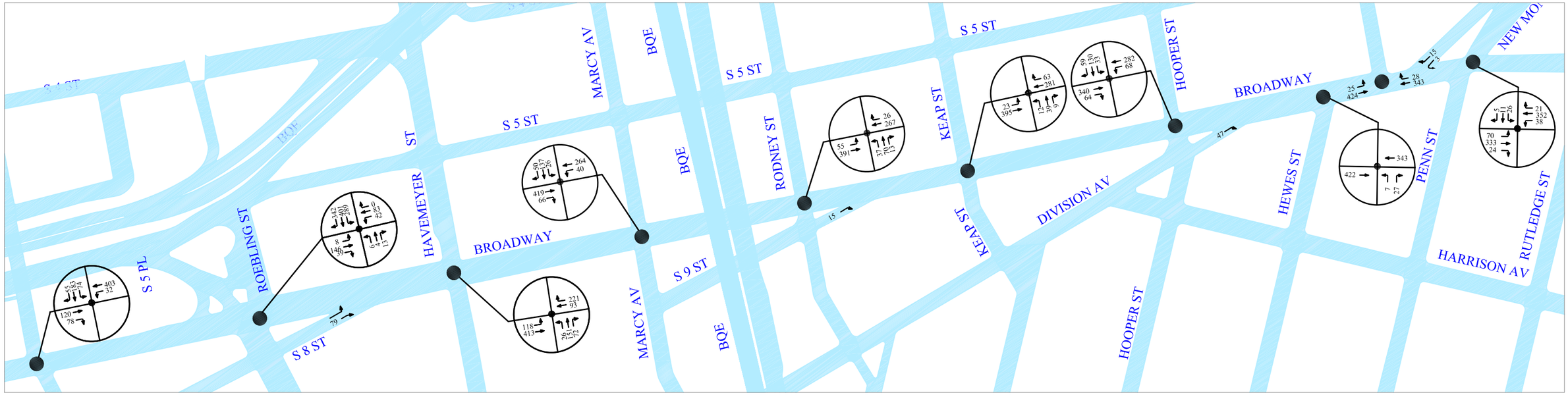

# Figure 37

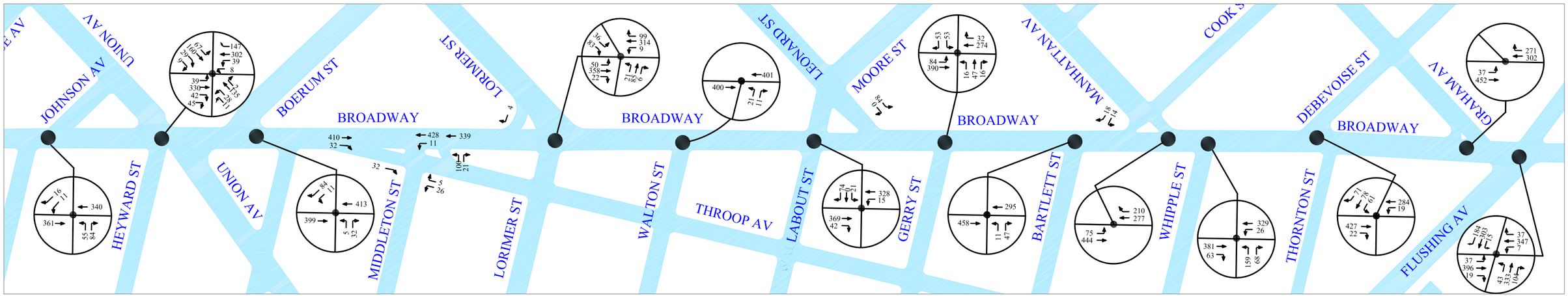
NEW YORK CITY DOT

**FUTURE W/O IMPROVEMENT VEHICULAR VOLUMES**
**WEEKDAY MIDDAY PEAK HOUR**

**CITYWIDE CONGESTED CORRIDOR PROJECT**

## BROADWAY



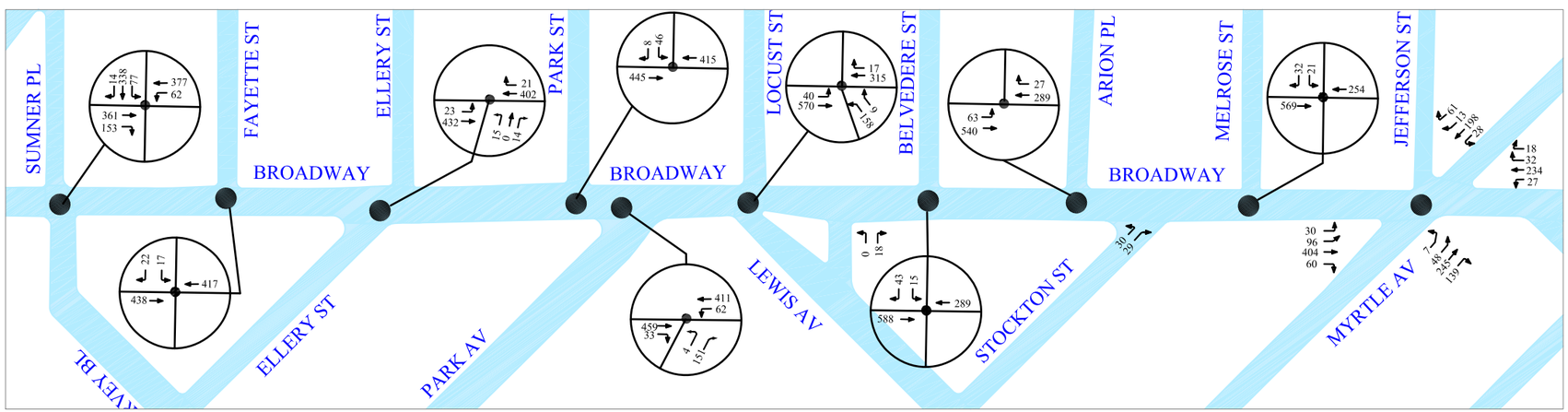



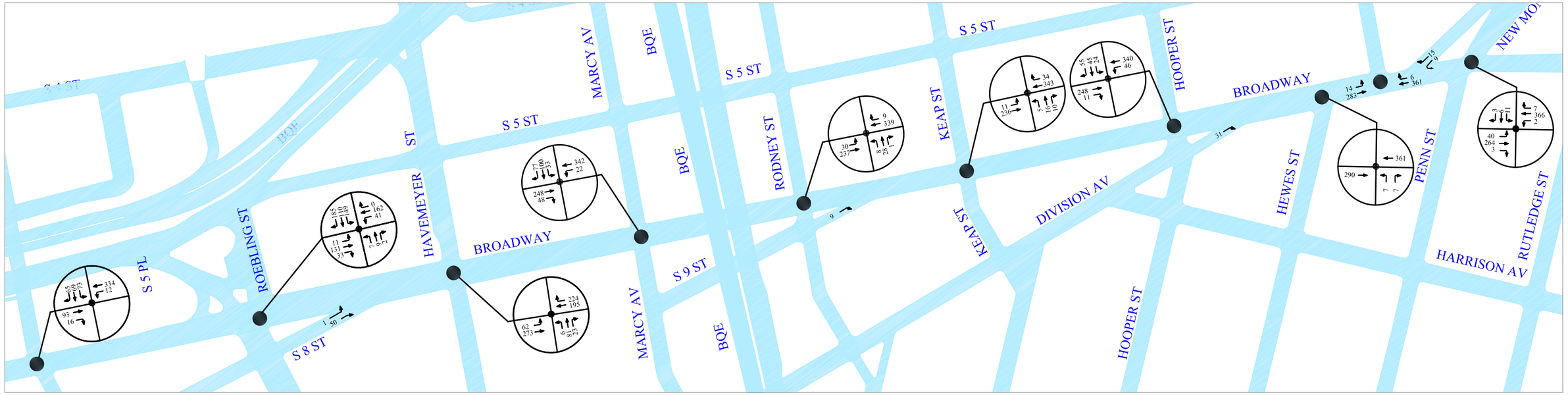

Figure 38

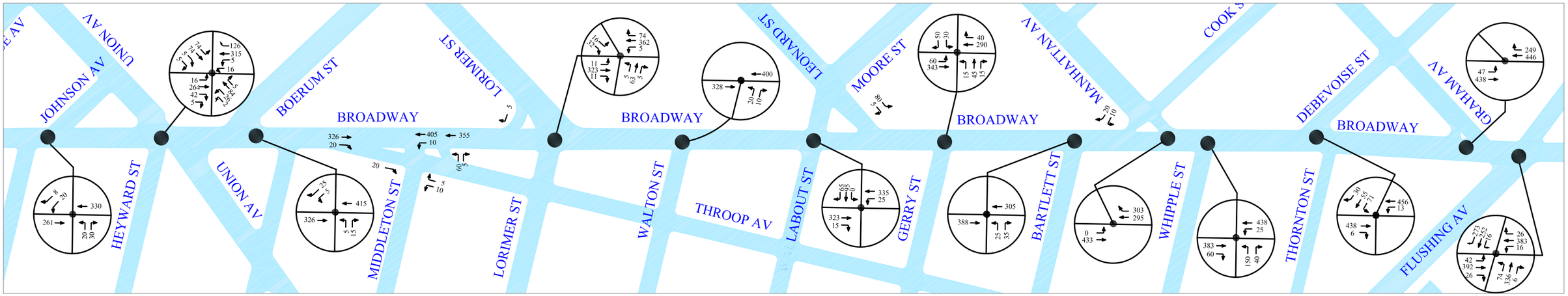
NEW YORK CITY DOT

FUTURE W/O IMPROVEMENT VEHICULAR VOLUMES
WEEKDAY PM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY



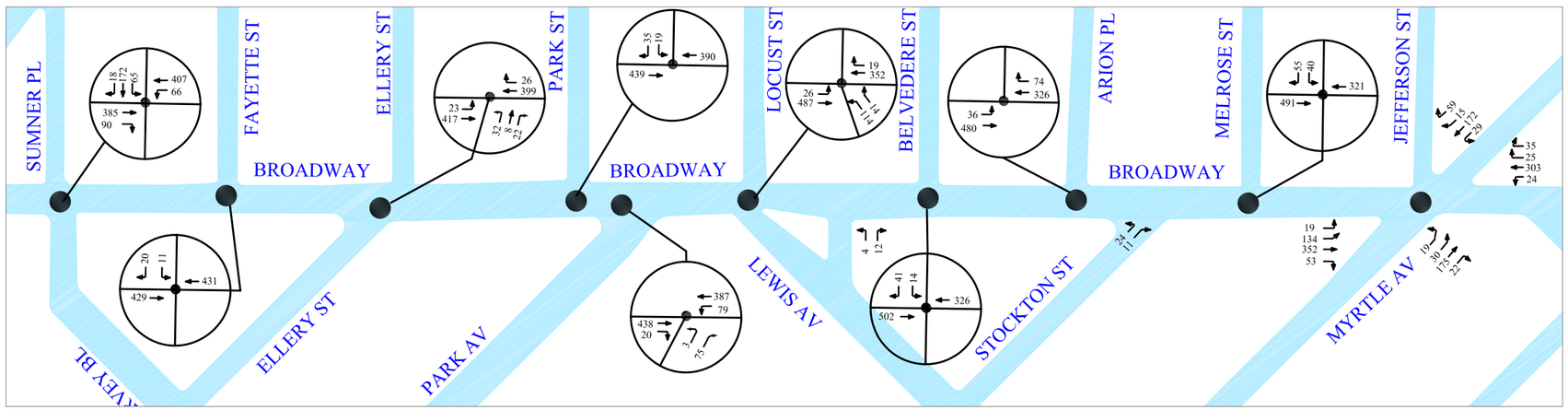




Figure 39

NEW YORK CITY DOT

FUTURE W/O IMPROVEMENT VEHICULAR VOLUMES
SATURDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 4.2 Traffic Analysis

Projected traffic volumes for year 2022 were used to conduct the Synchro LOS analysis for the future conditions without improvements. The signal timing, roadway geometry, and all other inputs – except traffic volumes – are the same as existing. Table 7 presents the LOS for the signalized intersections for the future conditions without improvements.

Average delay per vehicle is projected to increase by a few seconds for each lane group, but at some of the more congested lane groups the increase is higher, as much as 15 seconds. The following is a summary of lane groups that experience unacceptable levels of service:

- At Broadway and Roebling Street, the southbound left lane group is projected to operate at LOS F with 86.2 seconds delay during the weekday PM peak hour, and the southbound through/right lane group is projected to operate at LOS F with 92.1 seconds delay during the weekday PM peak hour.
- At Broadway and Havemeyer Street, the westbound lane group is projected to operate at LOS E with 79.1 seconds delay during the weekday AM peak hour, and the eastbound lane group is projected to operate at LOS F with 103.6 seconds delay during the weekday PM peak hour.
- At Broadway and Marcy Avenue, the westbound lane group is projected to operate at LOS F with 95.9 seconds delay during the weekday AM peak hour, and the eastbound lane group is projected to operate at LOS E with 79.6 seconds delay during the weekday PM peak hour.
- At Broadway and Hooper Street, the eastbound lane group is projected to operate at LOS E with 55.7 seconds delay during the weekday AM peak hour.
- At Broadway and Union Avenue, the westbound lane group is projected to operate at LOS E with 79.4 seconds delay during the weekday AM peak hour.
- At Broadway, Thornton Street and Debevoise Street, the eastbound lane group is projected to operate at LOS E with 73.1 seconds delay during the weekday AM peak hour.
- Broadway and Flushing Avenue is projected to continue be the busiest and most congested intersection within the study area:
    - During the weekday AM peak hour, the westbound approach is projected to operate at LOS F with 84.6 seconds delay, the northbound approach is projected to operate at LOS F with 103.0 seconds delay, and the southbound approach is projected to operate at LOS F with 105.0 seconds delay.
    - During the weekday midday peak hour, the westbound approach is projected to operate at LOS E with 73.1 seconds delay, and the southbound approach is projected to operate at LOS E with 66.9 seconds delay.
    - During the weekday PM peak hour, the eastbound approach is projected to operate at LOS F with 96.3 seconds delay, and the westbound approach is projected to operate at LOS F with 93.9 seconds delay.
    - During the Saturday midday peak hour, the eastbound approach is projected to operate at LOS F with 84.2 seconds delay, the northbound approach is projected to operate at

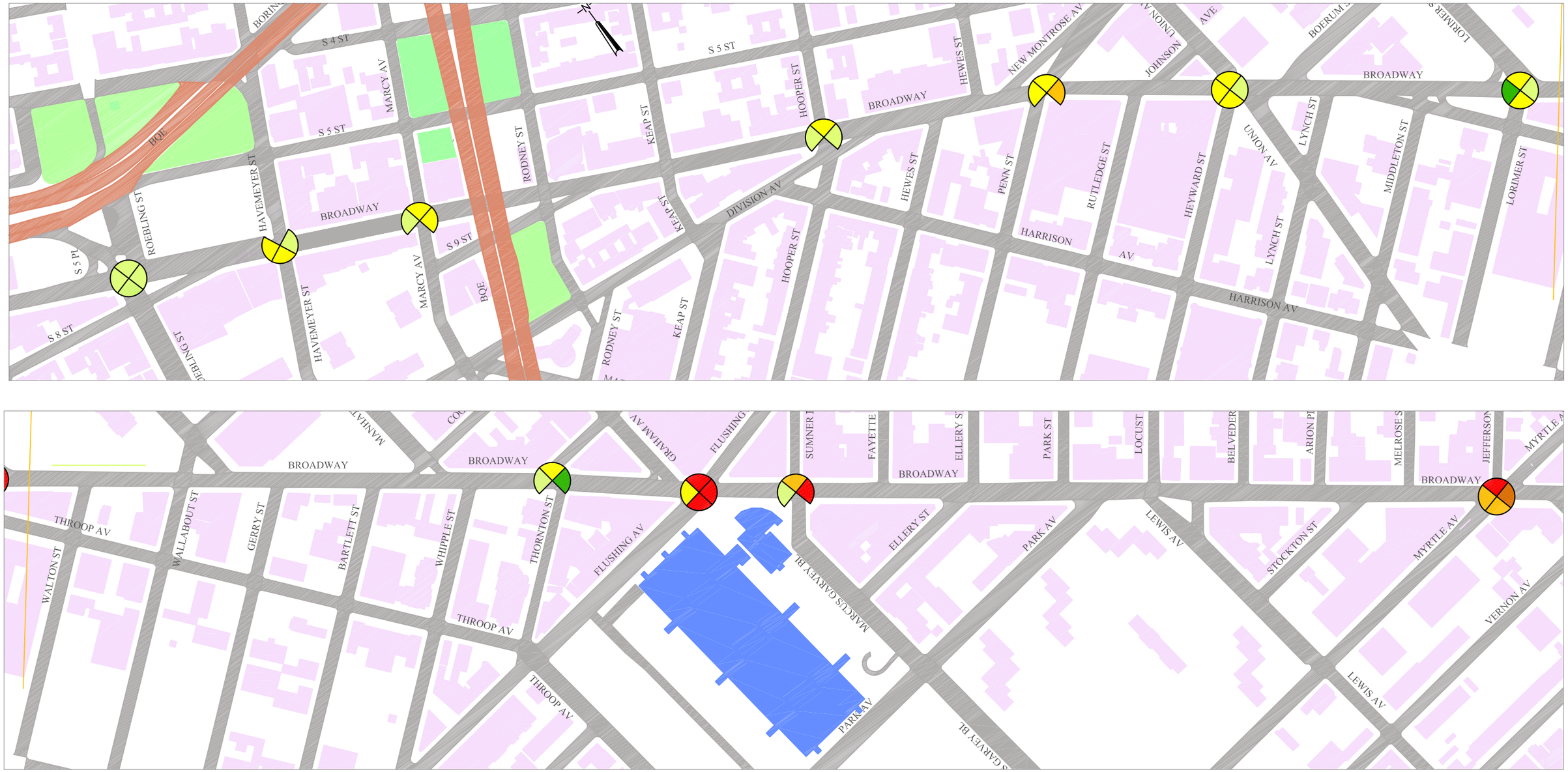
LOS E with 77.0 seconds delay, and the southbound approach is projected to operate at LOS F with 92.5 seconds delay.

## Table 7: Future Conditions without Improvements Level of Service

| Intersection Approach[1] | Lane Group | AM Peak | | | MD Peak | | | PM Peak | | | Saturday Peak | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS | v/c Ratio | Avg Delay | LOS |
| **1. Broadway and Roebling Street** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.34 | 23.2 | C | 0.34 | 13.2 | B | 0.39 | 24.0 | C | 0.28 | 14.9 | B |
| WB - Broadway | LTR | 0.37 | 34.5 | C | 0.30 | 16.7 | B | 0.24 | 19.2 | B | 0.34 | 17.1 | B |
| NB - Roebling Street | L | 0.04 | 17.8 | B | 0.02 | 1.8 | A | 0.02 | 10.9 | B | 0.01 | 15.3 | B |
| | TR | 0.02 | 18.0 | B | 0.02 | 1.8 | A | 0.03 | 10.8 | B | 0.02 | 15.4 | B |
| SB - Roebling Street | L | 0.35 | 23.4 | C | 0.30 | 19.1 | B | 0.50 | 86.2 | F | 0.27 | 18.4 | B |
| | TR | 0.26 | 22.7 | C | 0.33 | 19.7 | B | 0.77 | 92.1 | F | 0.22 | 18.0 | B |
| **Overall Intersection** | | | 26.4 | **C** | | **16.5** | **B** | | **66.8** | **E** | | **16.9** | **B** |
| **2. Broadway and Havemayer Street** | | | | | | | | | | | | | |
| EB - Broadway | LT | 0.67 | 22.3 | C | 0.78 | 34.8 | C | 1.11 | 103.6 | F | 0.61 | 24.5 | C |
| WB - Broadway | TR | 1.05 | 79.1 | E | 0.80 | 23.4 | C | 0.93 | 37.2 | D | 0.83 | 21.1 | C |
| NB - Havemayer Street | LTR | 0.60 | 39.2 | D | 0.60 | 39.0 | D | 0.77 | 50.3 | D | 0.25 | 28.9 | C |
| **Overall Intersection** | | | **51.3** | **D** | | **31.9** | **C** | | **72.3** | **E** | | **23.4** | **C** |
| **3. Broadway and Marcy Avenue** | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.61 | 29.6 | C | 0.67 | 22.3 | C | 1.09 | 79.6 | E | 0.63 | 17.8 | B |
| WB - Broadway | LT | 0.93 | 95.9 | F | 0.67 | 19.7 | B | 0.85 | 40.3 | D | 0.76 | 24.6 | C |
| SB-Rochambeau Avenue | LTR | 0.40 | 24.7 | C | 0.51 | 26.9 | C | 0.44 | 25.5 | C | 0.46 | 26.1 | C |
| **Overall Intersection** | | | **60.2** | **E** | | **22.9** | **C** | | **53.1** | **D** | | **22.6** | **C** |
| **4. Broadway and Hooper Street** | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.51 | 9.5 | A | 0.54 | 22.5 | C | 0.76 | 55.7 | E | 0.44 | 15.0 | B |
| WB - Broadway | LT | 0.97 | 36.5 | D | 0.69 | 36.1 | D | 0.77 | 20.8 | C | 0.70 | 15.5 | B |
| SB - Hooper Street | LTR | 0.31 | 30.3 | C | 0.44 | 33.2 | C | 0.54 | 36.1 | D | 0.32 | 24.4 | C |
| **Overall Intersection** | | | **26.9** | **C** | | **30.5** | **C** | | **38.7** | **D** | | **16.8** | **B** |
| **5. Broadway and Penn Street** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.60 | 20.6 | C | 0.50 | 28.3 | C | 0.67 | 18.0 | B | 0.52 | 36.4 | D |
| WB - Broadway | LTR | 0.86 | 53.3 | D | 0.64 | 36.3 | D | 0.78 | 41.2 | D | 0.63 | 35.6 | D |
| SB - New Montrose | LTR | 0.08 | 26.2 | C | 0.05 | 20.2 | C | 0.09 | 26.4 | C | 0.04 | 20.1 | C |
| **Overall Intersection** | | | **40.4** | **D** | | **32.1** | **C** | | **29.3** | **C** | | **29.6** | **C** |
| **6. Broadway and Union Avenue** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.57 | 13.80 | B | 0.51 | 34.6 | C | 0.79 | 28.20 | C | 0.48 | 38.2 | D |
| WB - Broadway | LTR | 0.99 | 45.70 | D | 0.86 | 25.6 | C | 0.89 | 31.30 | C | 0.83 | 21.9 | C |
| NB - Union Avenue | LTR | 0.65 | 41.50 | D | 0.64 | 36.0 | D | 0.73 | 45.90 | D | 0.43 | 27.3 | C |
| SB - Union Avenue | LTR | 0.55 | 36.50 | D | 0.39 | 26.1 | C | 0.44 | 33.40 | C | 0.28 | 23.8 | C |
| **Overall Intersection** | | | 50.60 | **D** | | **30.2** | **C** | | 33.40 | **C** | | 27.9 | **C** |
| **7. Broadway and Lorimer Street** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.62 | 16.1 | B | 0.58 | 7.8 | A | 0.88 | 28.0 | C | 0.59 | 6.7 | A |
| WB - Broadway | LTR | 0.95 | 43.9 | D | 0.68 | 15.1 | B | 0.87 | 27.9 | C | 0.78 | 16.0 | B |
| NB - Lorimer Street | LTR | 0.45 | 35.3 | D | 0.21 | 22.5 | C | 0.30 | 30.2 | C | 0.18 | 22.0 | C |
| SB - Lorimer Street | LTR | 0.60 | 41.4 | D | 0.28 | 24.3 | C | 0.47 | 36.5 | D | 0.15 | 21.8 | C |
| **Overall Intersection** | | | **34.3** | **C** | | **14.0** | **B** | | **29.2** | **C** | | **13.3** | **B** |
| **8. Broadway and Thornton Ave /Debevoise** | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.54 | 14.3 | B | 0.49 | 6.3 | A | 0.81 | 73.1 | E | 0.60 | 8.1 | A |
| WB - Broadway | LT | 0.52 | 10.8 | B | 0.40 | 10.6 | B | 0.51 | 16.6 | B | 0.64 | 16.8 | B |
| SB - Thornton/Debevoise Ave | LTR | 0.34 | 30.3 | C | 0.35 | 24.0 | C | 0.46 | 32.5 | C | 0.33 | 23.4 | C |
| **Overall Intersection** | | | **15.8** | **B** | | **11.4** | **B** | | **46.3** | **D** | | **14.2** | **B** |
| **9. Broadway and Flushing Avenue** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.82 | 29.1 | C | 0.73 | 27.0 | C | 1.12 | 96.3 | F | 1.08 | 84.2 | F |
| WB - Broadway | LTR | 1.09 | 84.6 | F | 1.09 | 73.1 | E | 1.07 | 93.9 | F | 0.95 | 40.3 | D |
| NB - Flushing Ave | LTR | 1.10 | 103.0 | F | 0.79 | 34.8 | C | 0.82 | 35.2 | D | 1.04 | 77.0 | E |
| SB - Flushing Ave | LTR | 1.08 | 105.0 | F | 0.99 | 66.9 | E | 0.93 | 50.6 | D | 1.09 | 92.5 | F |
| **Overall Intersection** | | | **85.3** | **F** | | **53.1** | **D** | | **65.0** | **E** | | **75.0** | **E** |
| **10. Broadway and Marcus Garvey Blvd/Sumner Pl** | | | | | | | | | | | | | |
| EB - Broadway | LT | 0.77 | 22.9 | C | 0.64 | 9.3 | A | 1.09 | 74.2 | E | 0.69 | 8.6 | A |
| WB - Broadway | TR | 1.04 | 105.7 | F | 0.77 | 29.6 | C | 0.96 | 116.5 | F | 0.72 | 27.6 | C |
| SB - Lewis Avenue | LTR | 0.82 | 51.7 | D | 0.57 | 31.5 | C | 1.07 | 101.2 | F | 0.69 | 37.4 | D |
| **Overall Intersection** | | | **63.3** | **E** | | **23.1** | **C** | | **92.3** | **F** | | **22.2** | **C** |
| **11. Broadway and Myrtle Avenue** | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.93 | 54.0 | D | 1.04 | 85.8 | F | 1.11 | 75.6 | E | 1.08 | 93.9 | F |
| WB - Broadway | LTR | 0.97 | 57.7 | E | 0.63 | 19.8 | B | 0.53 | 20.4 | C | 0.63 | 19.4 | B |
| NB - Myrtle Avenue | LTR | 0.76 | 49.9 | D | 0.81 | 46.1 | D | 1.11 | 112.1 | F | 0.68 | 35.3 | D |
| SB - Myrtle Avenue | LTR | 1.10 | 108.9 | F | 0.89 | 58.0 | E | 0.92 | 68.4 | E | 0.85 | 51.3 | D |
| **Overall Intersection** | | | **69.0** | **E** | | **53.8** | **D** | | **73.5** | **E** | | **55.2** | **E** |

- At Broadway and Sumner Place (Marcus Garvey Boulevard) is projected to continue to experience significant congestion:
  - During the weekday AM peak hour, the westbound approach is projected to operate at LOS F with 105.7 seconds delay.
  - During the weekday PM peak hour, the eastbound approach is projected to operate at LOS E with 74.2 seconds delay, the westbound approach is projected to operate at LOS F with 116.5 seconds delay, and the southbound approach is projected to operate at LOS F with 101.2 seconds delay.
- At Broadway and Myrtle Avenue is projected to continue to experience significant congestion:
  - During the weekday AM peak hour, the westbound approach is projected to operate at LOS E with 57.7 seconds delay, and the southbound approach is projected to operate at LOS F with 108.9 seconds delay.
  - During the weekday midday peak hour, the eastbound approach is projected to operate at LOS F with 85.8 seconds delay, and the southbound approach is projected to operate at LOS E with 58.0 seconds delay.
  - During the weekday PM peak hour, the eastbound approach is projected to operate at LOS E with 75.6 seconds delay, the northbound approach is projected to operate at LOS F with 112.1 seconds delay, and the southbound approach is projected to operate at LOS F with 101.2 seconds delay.
  - During the Saturday midday peak hour, the eastbound approach is projected to operate at LOS F with 93.9 seconds delay.

Figures 40 through 43 present the future conditions without improvements LOS for each study intersection for the weekday AM, midday, PM and Saturday midday peak hours, respectively.




## INTERSECTION LEVEL OF SERVICE

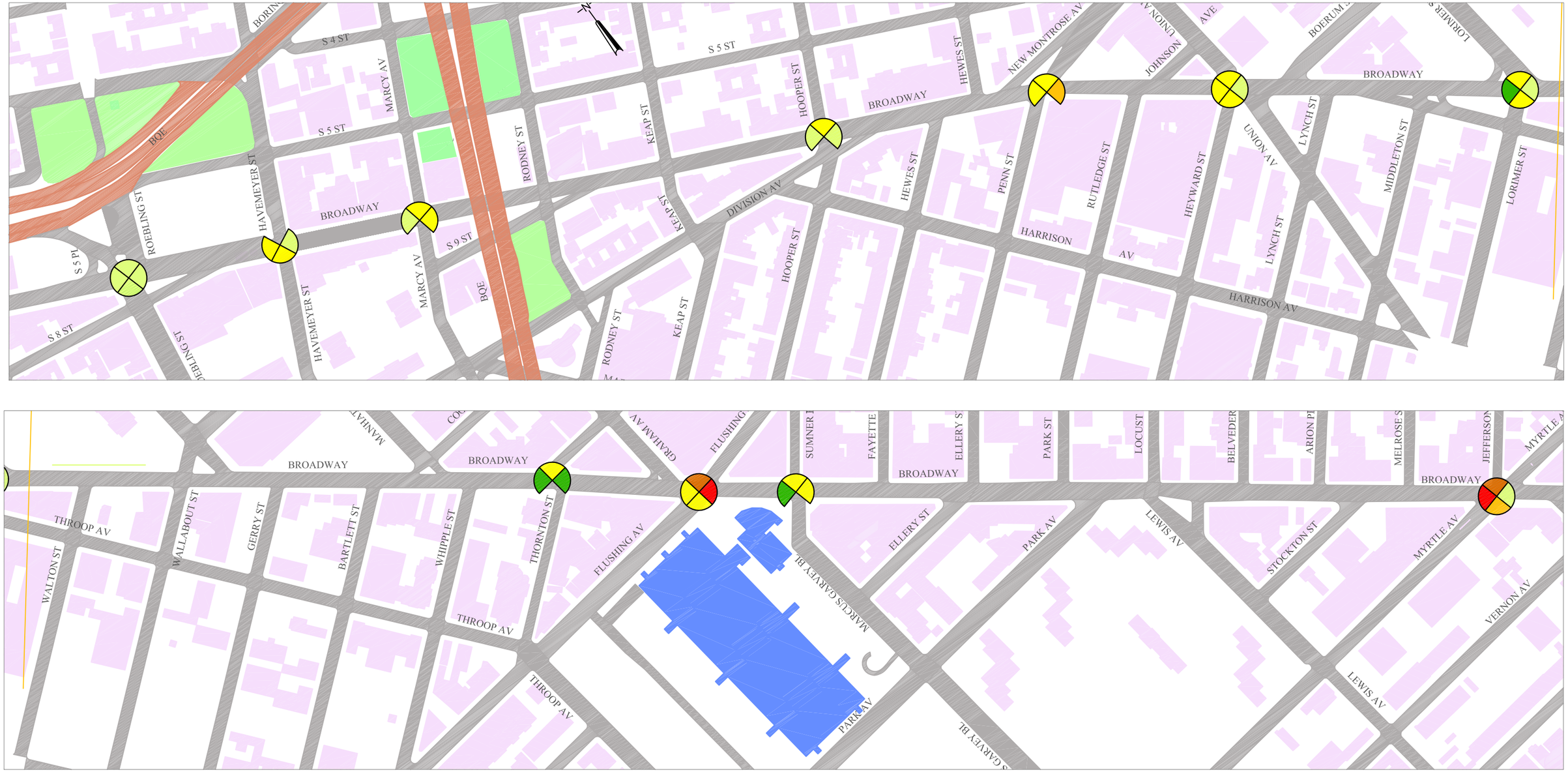
- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 40

FUTURE W/O IMPROVEMENT LEVEL OF SERVICE
WEEKDAY AM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

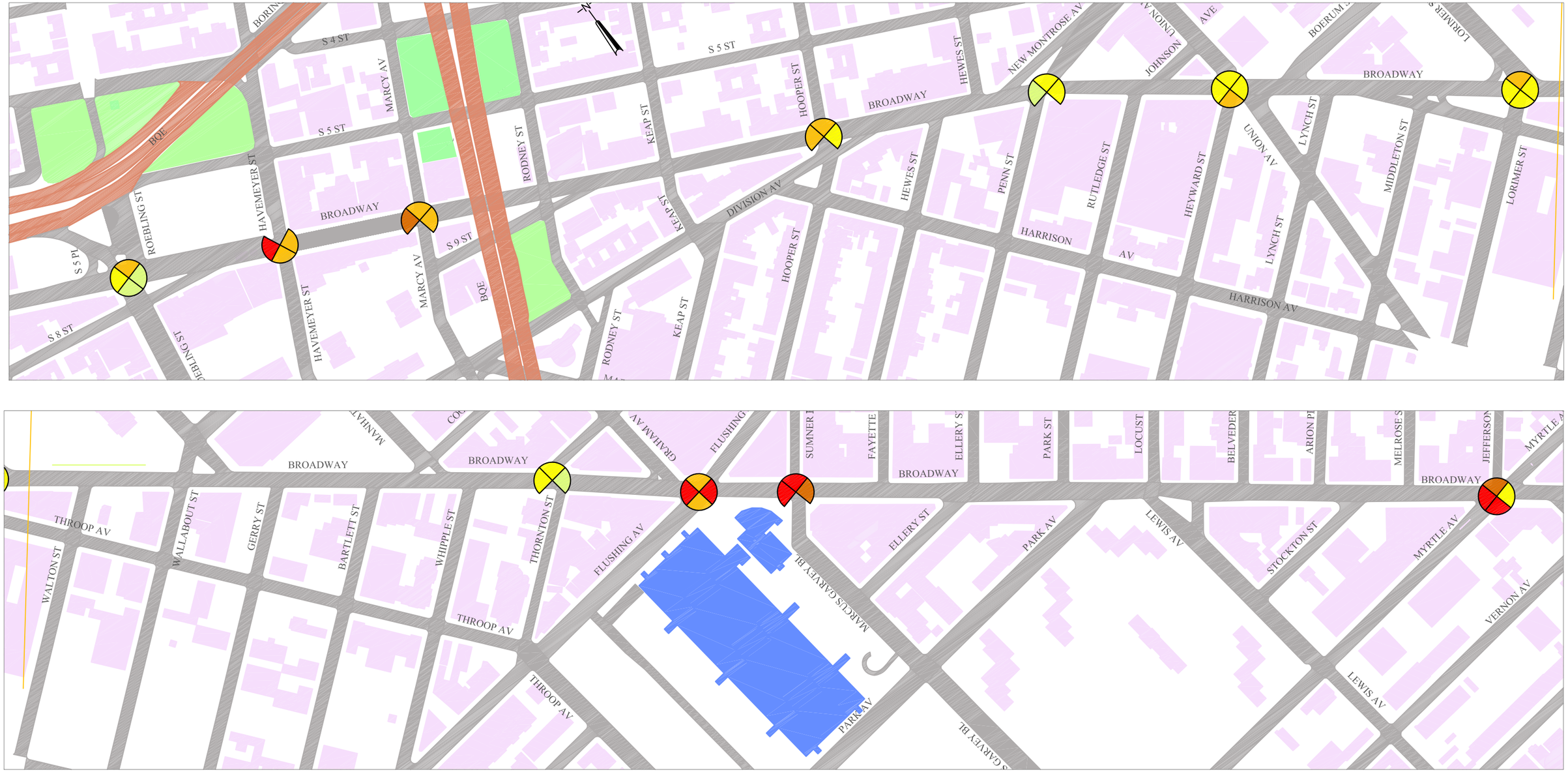
Figure 41

NEW YORK CITY DOT

FUTURE W/O IMPROVEMENT LEVEL OF SERVICE
WEEKDAY MD PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

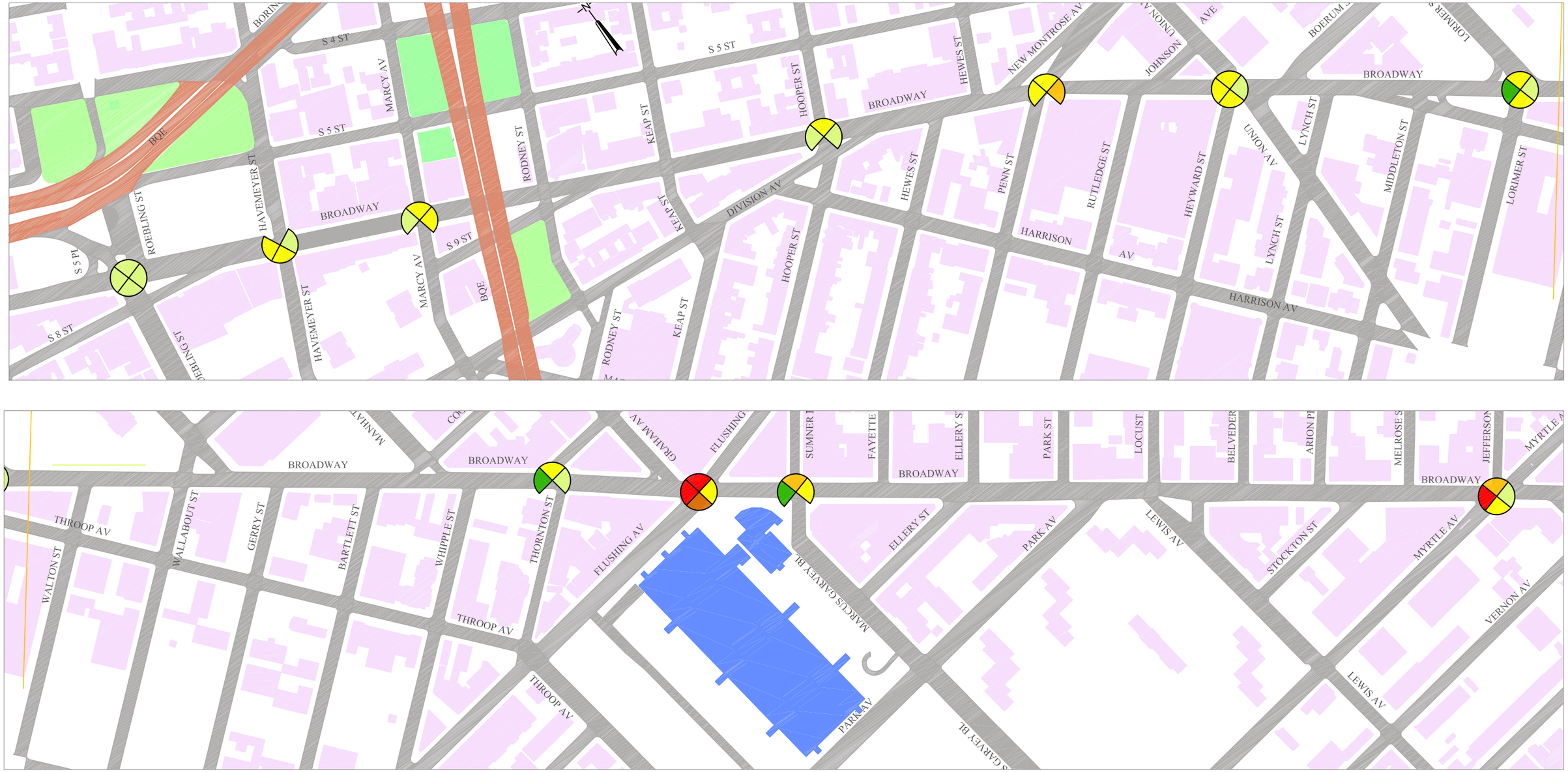
Figure 42

NEW YORK CITY DOT

FUTURE W/O IMPROVEMENT LEVEL OF SERVICE
WEEKDAY MD PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY




## INTERSECTION LEVEL OF SERVICE

- LOS A (< 10 sec)
- LOS B (10-20 sec)
- LOS C (20-35 sec)
- LOS D (35-55 sec)
- LOS E (55-80 sec)
- LOS F (> 80 sec)

Figure 43

NEW YORK CITY DOT

FUTURE W/O IMPROVEMENT LEVEL OF SERVICE
SATURDAY MD PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 4.3 Air Quality Analysis

In the 2020 future without improvements condition, the CO emission rates for the weekday AM, weekday midday, Weekday PM and Saturday midday peak hours are projected to degrade to the range of about 8.5 to 14.3 kilograms per hour. VOC emission rates are projected to degrade to the range of about 2.0 to 3.3 kilograms per hour, and NOX to the range of about 1.7 to 2.8 kilograms per hour. Please note that future projected emission rates do not account for improved emission standards or alternative fuels for new vehicles.

**Table 8. Future without Improvement Conditions Emissions**

| Intersection | Weekday AM Peak | | | | Weekday Midday Peak | | | | Weekday PM Peak | | | | Saturday Midday Peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) | Fuel (gall.) | CO (g/h) | NOx (g/h) | VOC (g/h) |
| 1. Broadway and Roebling Street | | | | | | | | | | | | | | | | |
| Emissions | 7 | 487 | 95 | 113 | 4 | 355 | 69 | 81 | 11 | 790 | 152 | 184 | 5 | 362 | 71 | 84 |
| 2. Broadway and Havemayer Street | | | | | | | | | | | | | | | | |
| Emissions | 15 | 1034 | 202 | 240 | 11 | 764 | 148 | 177 | 22 | 1549 | 302 | 358 | 8 | 633 | 124 | 147 |
| 3. Broadway and Marcy Avenue | | | | | | | | | | | | | | | | |
| Emissions | 14 | 920 | 179 | 214 | 9 | 604 | 117 | 140 | 16 | 1131 | 220 | 262 | 9 | 591 | 115 | 137 |
| 4. Broadway and Hooper Street | | | | | | | | | | | | | | | | |
| Emissions | 8 | 649 | 127 | 151 | 9 | 630 | 123 | 146 | 13 | 930 | 181 | 216 | 7 | 446 | 87 | 103 |
| 5. Broadway and Penn Street | | | | | | | | | | | | | | | | |
| Emissions | 7 | 538 | 105 | 124 | 8 | 609 | 119 | 141 | 8 | 564 | 110 | 131 | 10 | 648 | 127 | 150 |
| 6. Broadway and Union Avenue | | | | | | | | | | | | | | | | |
| Emissions | 21 | 1476 | 287 | 342 | 12 | 791 | 154 | 183 | 17 | 1224 | 238 | 284 | 10 | 689 | 134 | 160 |
| 7. Broadway and Lorimer Street | | | | | | | | | | | | | | | | |
| Emissions | 15 | 988 | 192 | 229 | 6 | 459 | 90 | 106 | 13 | 897 | 175 | 208 | 6 | 411 | 80 | 95 |
| 8. Broadway and Thornton Ave /Debevoise | | | | | | | | | | | | | | | | |
| Emissions | 6 | 409 | 79 | 94 | 6 | 348 | 68 | 81 | 8 | 648 | 126 | 151 | 8 | 528 | 104 | 123 |
| 9. Broadway and Flushing Avenue | | | | | | | | | | | | | | | | |
| Emissions | 35 | 2488 | 484 | 576 | 22 | 1599 | 310 | 371 | 33 | 2242 | 436 | 520 | 40 | 2716 | 528 | 629 |
| 10. Broadway and Marcus Garvey Blvd/Sumner Pl | | | | | | | | | | | | | | | | |
| Emissions | 22 | 1514 | 294 | 351 | 12 | 788 | 153 | 183 | 31 | 2102 | 408 | 487 | 12 | 793 | 154 | 184 |
| 11. Broadway and Myrtle Avenue | | | | | | | | | | | | | | | | |
| Emissions | 29 | 2039 | 397 | 473 | 23 | 1596 | 311 | 371 | 32 | 2216 | 430 | 513 | 26 | 1804 | 351 | 418 |
| TOTAL EMISSIONS (kg/h) | **179.0** | **12.5** | **2.4** | **2.9** | **122.0** | **8.5** | **1.7** | **2.0** | **204.0** | **14.3** | **2.8** | **3.3** | **141.0** | **9.6** | **1.9** | **2.2** |

# CHAPTER 5 IMPROVEMENTS

In a geometrically constrained facility such as Broadway, with limited curb to curb distance of about 42 feet, an elevated subway structure and intensely built-up surroundings, the most significant traffic operational benefits can be achieved by optimizing the traffic network, taking advantage of locations where geometrical spot improvements can be implemented, and applying traffic operational management strategies. Without the luxury of adding additional travel lanes or turn lanes in the constrained area, attention was focused on implementing efficient traffic control strategies and effective use of the available roadway in order to sustain growth and improve traffic and pedestrian operations and safety.

All of these improvements will be vetted by conducting additional outreach in late 2015 and early 2016.

## 5.1 Traffic Signal Timing and Offset

Table 9 presents recommended signal phasing, timing and offset improvements.

**Table 9: Signal Timing and Offset Improvements**

| *Location* | *Peak Hour* | *Existing Timing* | *Change to* |
|---|---|---|---|
| Broadway and Roebling St | **PM** | E/W=60 & N/S=60sec | E/W=55 & N/S=65sec |
| Broadway and Havemeyer Street | **AM** | E/W=72 & N/S=48 sec | E/W=75 & N/S=45sec |
| | **PM** | E/W=60 & N/S=60sec | E/W=55 & N/S=65sec |
| Broadway and Marcy Avenue | **AM** | E/W=60 & N/S=60sec | E/W=65 & N/S=55sec |
| | **PM** | E/W=60 & N/S=60sec | E/W=65 & N/S=55sec |
| Broadway and Hooper Street | **PM** | E/W=72 & N/S=48sec | E/W=75 & N/S=45sec |
| Broadway and Thornton/Debevoise Avenue | **PM** | E/W=71 & N/S=49sec | E/W=75 & N/S=45sec |
| Broadway and Flushing Avenue | **AM** | E/W=50 & N/S=70sec | E/W=46 & N/S=74sec |
| | **PM** | E/W=50 & N/S=70sec | E/W=58 & N/S=62sec |
| | **Sat. MD** | E/W=45 & N/S=45sec | E/W=42 & N/S=48sec |
| Broadway and Myrtle Street | **PM** | E/W=72 & N/S=48sec | E/W=65 & N/S=55sec |
| | **Sat. MD** | E/W=45 & N/S=45sec | E/W=42 & N/S=48sec |

## 5.2 Parking

The recommended parking changes fall into two broad groups:

- Providing loading zones – to accommodate deliveries, and metered parking – to accommodate retail customers.
- Provide No Standing regulations during peak hours for the peak direction.

### 5.2.1 Loading Zones and Metered Parking

Broadway is a commercial corridor with retail and manufacturing land uses. As noted in Section 3.5, parking is permitted on both sides of the roadway. Most parking is not metered or regulated, except for street cleaning regulations. Overall, of the 381 parking spaces, 275 (72%) are non-metered, free parking. There are only two loading spaces, and only 104 metered spaces. According to participants at public meetings, commuters from other areas who take the subway into Manhattan park in these free parking spaces all day. In addition, drivers tend to leave their vehicles at the free parking spaces over the weekend. It is recommended to convert some of these free spaces to either loading spaces – to accommodate deliveries, or metered spaces – to accommodate retail customers.

Because of the dearth of loading spaces, delivery trucks are often forced to double park in the travel lanes while loading or unloading. Vehicles in the travel lane behind double-parked trucks are forced to wait for an opportunity to bypass the truck by maneuvering to the left and crossing the double-yellow line, placing themselves in direct path of the opposite traffic flow, before turning back to travel lane, as shown in Figure 44.

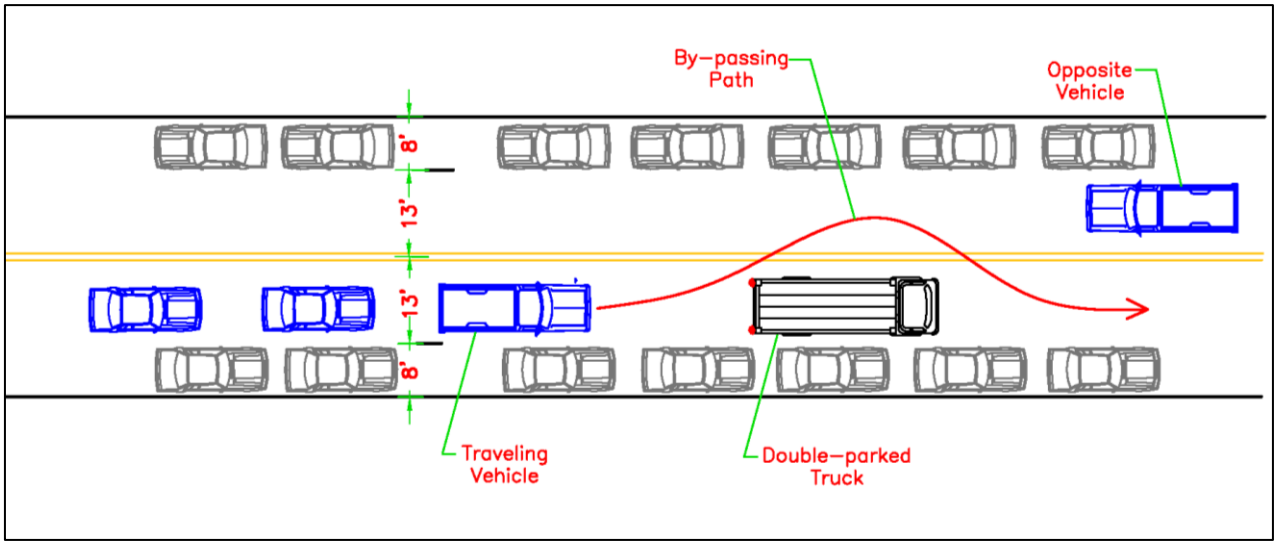



***Figure 44: Double Parked Vehicle Compromising Operations and Safety***

As noted is Section 3.5, a detailed weeklong video survey was conducted at 18 locations along the study corridor to examine loading and unloading activities. In addition, interviews were conducted with local businesses with regard to loading and unloading operations.

Based on the video survey and interviews, it is recommended that loading zones be implemented at the following locations:

- North side of Broadway between Hooper Street and Keap Street – convert from free parking to loading window 8:30AM-12PM, two-hour meter 12PM-7PM (17 spaces)
- North side of Broadway between Havemeyer Street and Marcy Avenue – convert from two-hour meter 8:30AM-7PM to loading window 8:30AM-12PM, two-hour meter 12PM-7PM (10 spaces)
- South side of Broadway between Havemeyer Street and Marcy Avenue – convert from one-hour meter 8:30AM-7PM to loading window 8:30AM-12PM, one-hour meter 12PM-7PM (13 spaces)
- North side of Broadway between Hewes Street and Hooper Street – convert from free parking to loading zone 8AM-4PM (14 spaces)
- South side of Broadway between Heyward Street and Rutledge Street – convert from free parking to loading zone 8AM-4PM (4 spaces)
- South side of Broadway between Walton Street and Lorimer Street – convert from free parking to loading window 8:30AM-12PM, two-hour meter 12PM-7PM (8 spaces)
- South side of Broadway between Flushing Avenue and Thornton Avenue Avenue – convert from one-hour meter 8:30AM-7PM to loading window 8:30AM-12PM, one-hour meter 12PM-7PM (11 spaces)

This would create an additional 77 loading spaces, for a total of 79. Of the 79 loading spaces, 20 would be in effect 8AM to 7PM, except Sunday. The remaining 59 would feature loading windows, where part of the time would be designated for loading, typically 8AM to 12PM, and part of the time would be designated for metered parking. Thirty five of these 59 spaces would have one-hour metered parking from 12PM to 7PM, and the remaining 24 would have two-hour metered parking during this time.

In addition, it is recommended to convert 57 non-metered spaces to two-hour metered spaces. This would eliminate long parking periods, particularly by commuters using the subway. The more frequent turnover would provide more parking spaces for retail customers.

The resulting parking distribution breakdown is illustrated in Figure 45. A map showing the details of the parking proposed regulations by block is presented in Figure 46 and 47.

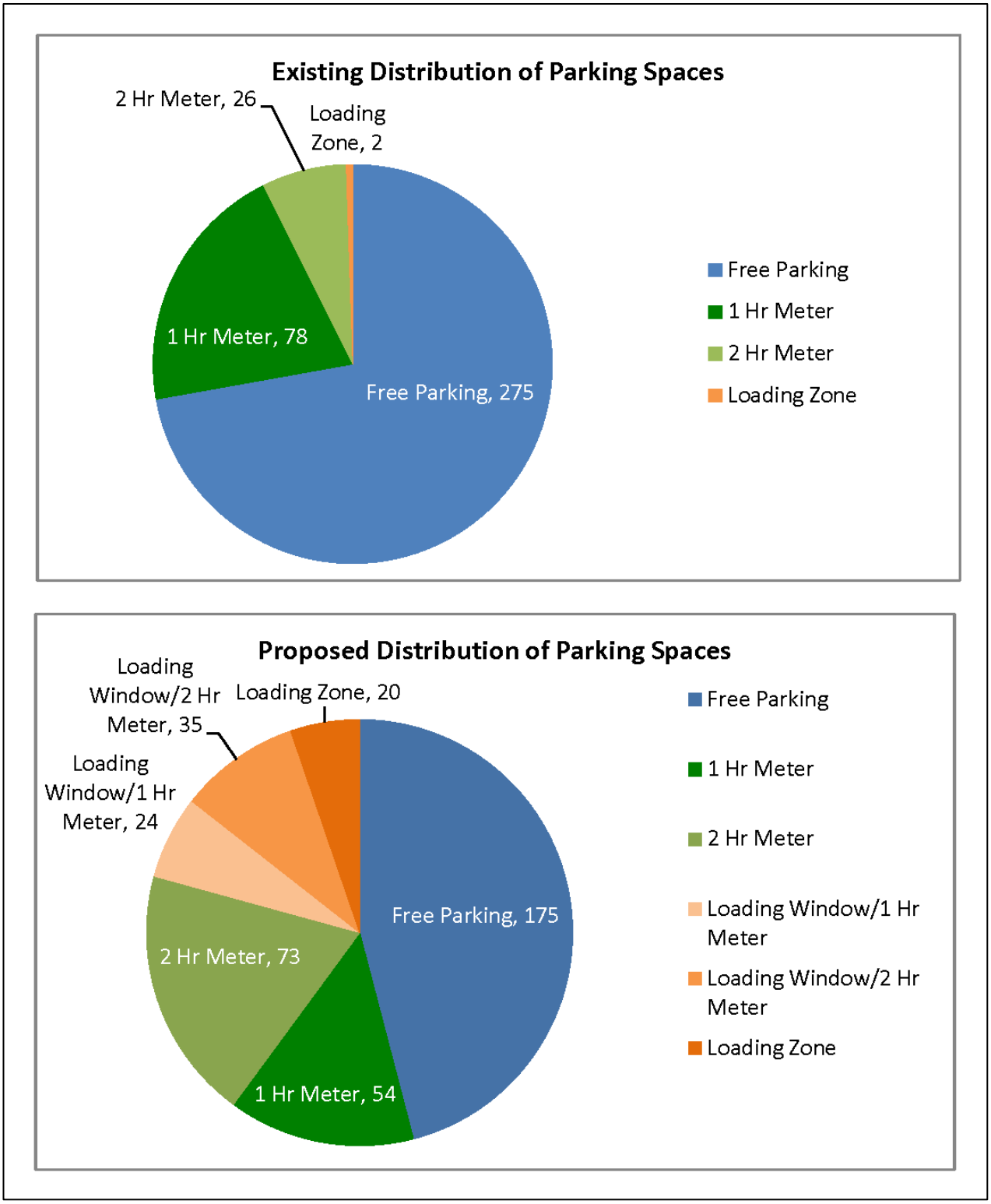
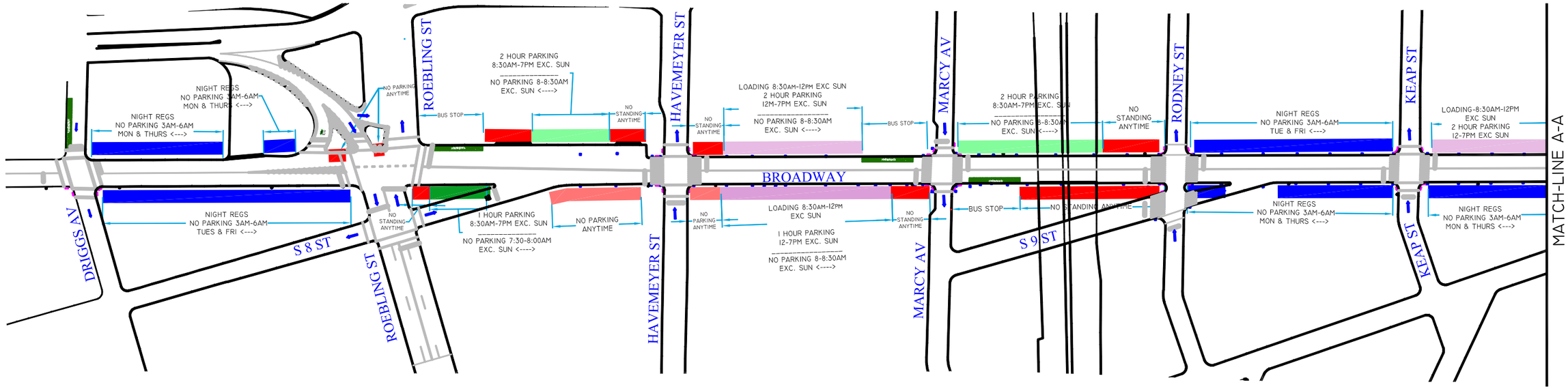
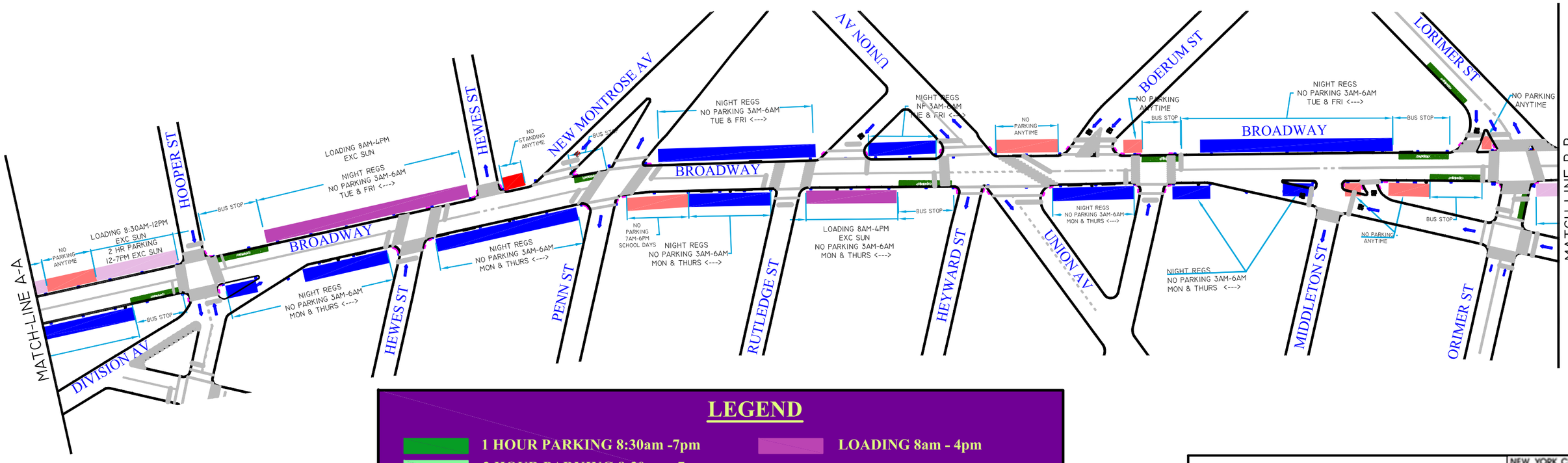



***Figure 45: Existing and Proposed Distribution of Parking Spaces***




## LEGEND

- 1 HOUR PARKING 8:30am -7pm
- 2 HOUR PARKING 8:30am - 7pm
- NON-METERED PARKING
- NO STANDING ANYTIME
- NO PARKING ANYTIME
- LOADING 8am - 4pm
- LOADING 8:30an - 12pm
  1 HOUR PARKING 12pm - 7pm
- LOADING 8:30am - 12pm
  2 HOUR PARKING 12pm - 7pm

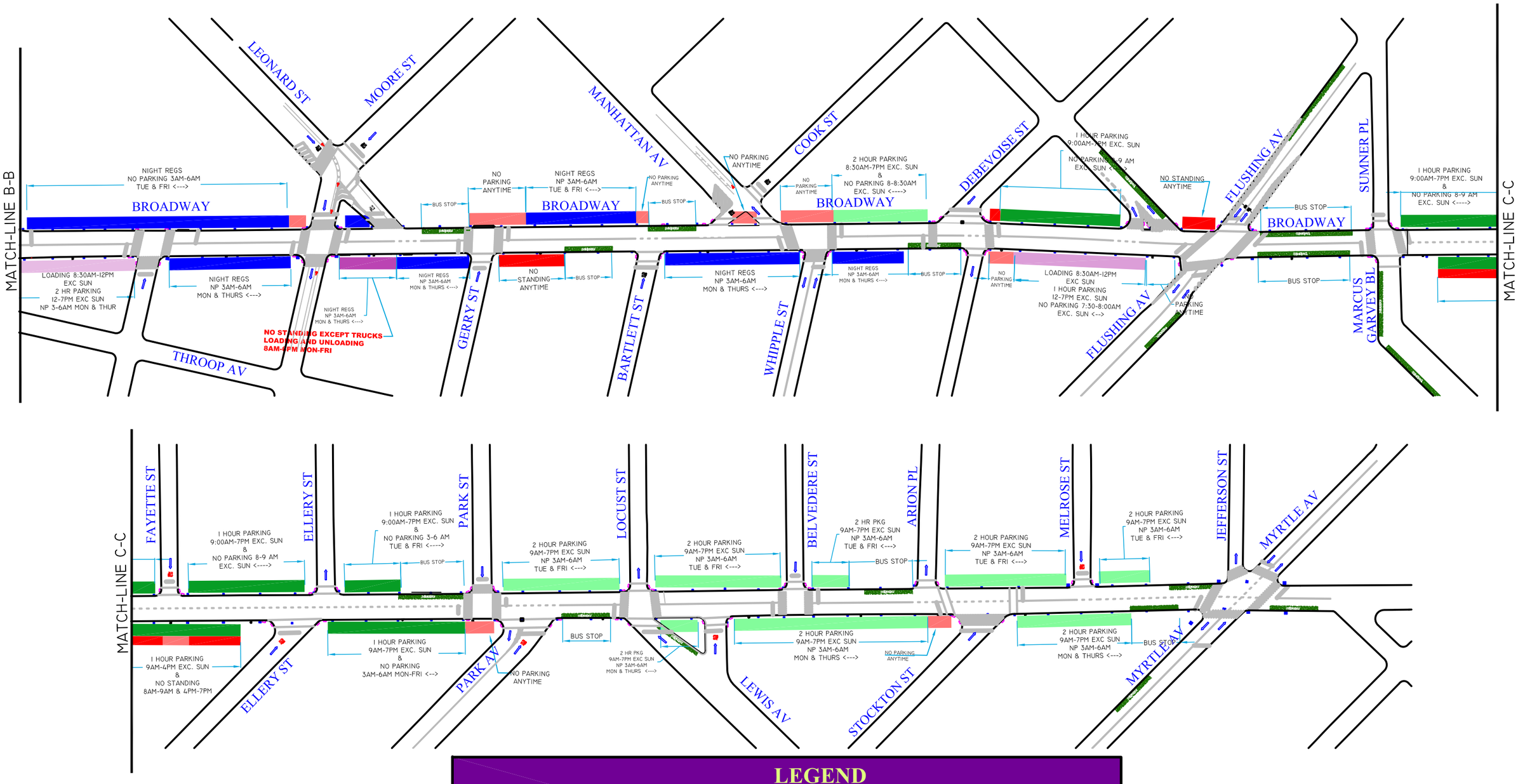
FIGURE 46

NEW YORK CITY DOT

PROPOSED PARKING REGULATIONS (I)

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY







## LEGEND

- 1 HOUR PARKING 8:30am -7pm
- 2 HOUR PARKING 8:30am - 7pm
- NON-METERED PARKING
- NO STANDING ANYTIME
- NO PARKING ANYTIME
- LOADING 8am - 4pm
- LOADING 8:30an - 12pm 1 HOUR PARKING 12pm - 7pm
- LOADING 8:30am - 12pm 2 HOUR PARKING 12pm - 7pm

FIGURE 47

PROPOSED PARKING REGULATIONS (2)

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

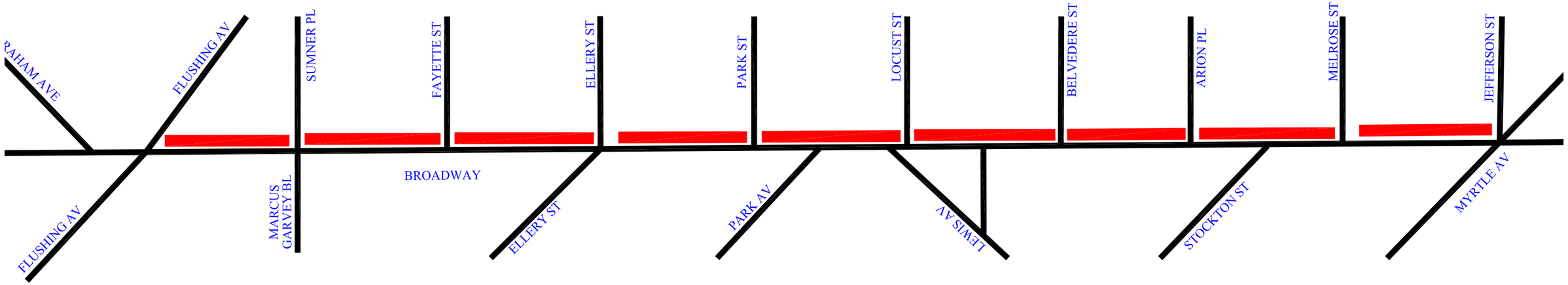
### 5.2.2 Peak Direction No Standing Regulations

As was previously noted, much of the congestion in the study area occurs between Flushing Avenue and Myrtle Avenue. During the weekday AM peak period, the heavier traffic volumes are in the westbound direction (towards the Williamsburg Bridge). However, approximately 40% of westbound traffic turns northbound on Graham Avenue (immediately past Flushing Avenue), which leads to the eastbound Brooklyn Queens Expressway. As a result, west of Graham Avenue traffic congestion is reduced significantly.

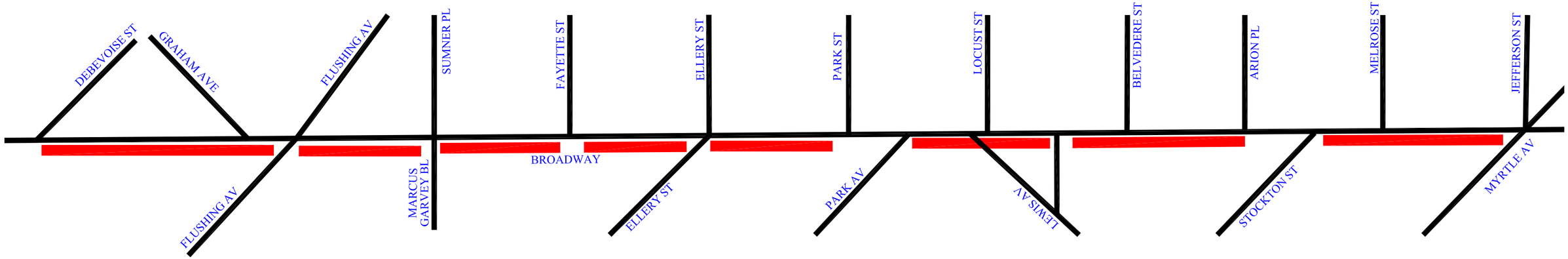
Similarly, during the PM Peak Hour period, much of the congestion is in the eastbound direction starting at Flushing Avenue, continuing to Myrtle Avenue. Thus, it is proposed that the peak period parking regulations are implemented as follows:

- Prohibit parking along the north curbside of Broadway between Myrtle Avenue and Graham Avenue from 7AM to 10AM, Monday through Friday. This would provide an extra westbound travel lane during this time. Realistically, depending on the amount of enforcement, it is expected that illegal standing would occur sporadically in this cleared curbside lane, but at least the primary travel lane would be more dependable, because it is expected to be devoid of double parking. After 10 AM, the parking regulations would revert to the regulations that currently exist, or revised according to the previous section. There would be a total loss of 59 parking spaces during this 7AM to 10AM period.
- Prohibit parking along the south curbside of Broadway between Flushing Avenue and Myrtle Avenue form 4PM to 7PM, Monday through Friday. This would provide an extra eastbound travel lane during this time. After 7PM, the parking regulations would revert to the regulations that currently exist. There would be a total loss of 41 parking spaces during this 4PM to 7PM period.

The affected area is shown in Figure 48.




**PROPOSED AM PEAK "NO STANDING 7AM-10AM"**




**PROPOSED PM PEAK "NO STANDING 4PM-7PM"**

FIGURE 48

PROPOSED AM AND PM PEAK HOUR PARKING REGULATIONS

CITYWIDE CONGESTED CORRIDOR PROJECT

BROADWAY

## 5.3 Intersection Specific Improvements

This section describes the intersection-specific improvements. In addition to relieving congestion, much of these improvements are geared towards pedestrian safety and mobility.

### 5.3.1 Broadway, Rodney Street and South 9th Street

There are no crosswalks provided for pedestrians walking along the south side of Broadway crossing Rodney Street or South 9th Street, as shown in Figure 49. In addition, the subway column at the apex of the small triangular shaped concrete island between Broadway and South 9th Street is enough of an obstruction to preclude pedestrians from having enough room to use this area as a sidewalk. Finally, since Broadway and South 9th Street share the same green time, vehicles that turn left from eastbound South 9th Street onto northbound Rodney Street always encounter a red signal approaching Broadway, but there is virtually no storage while they wait for the signal to turn green.

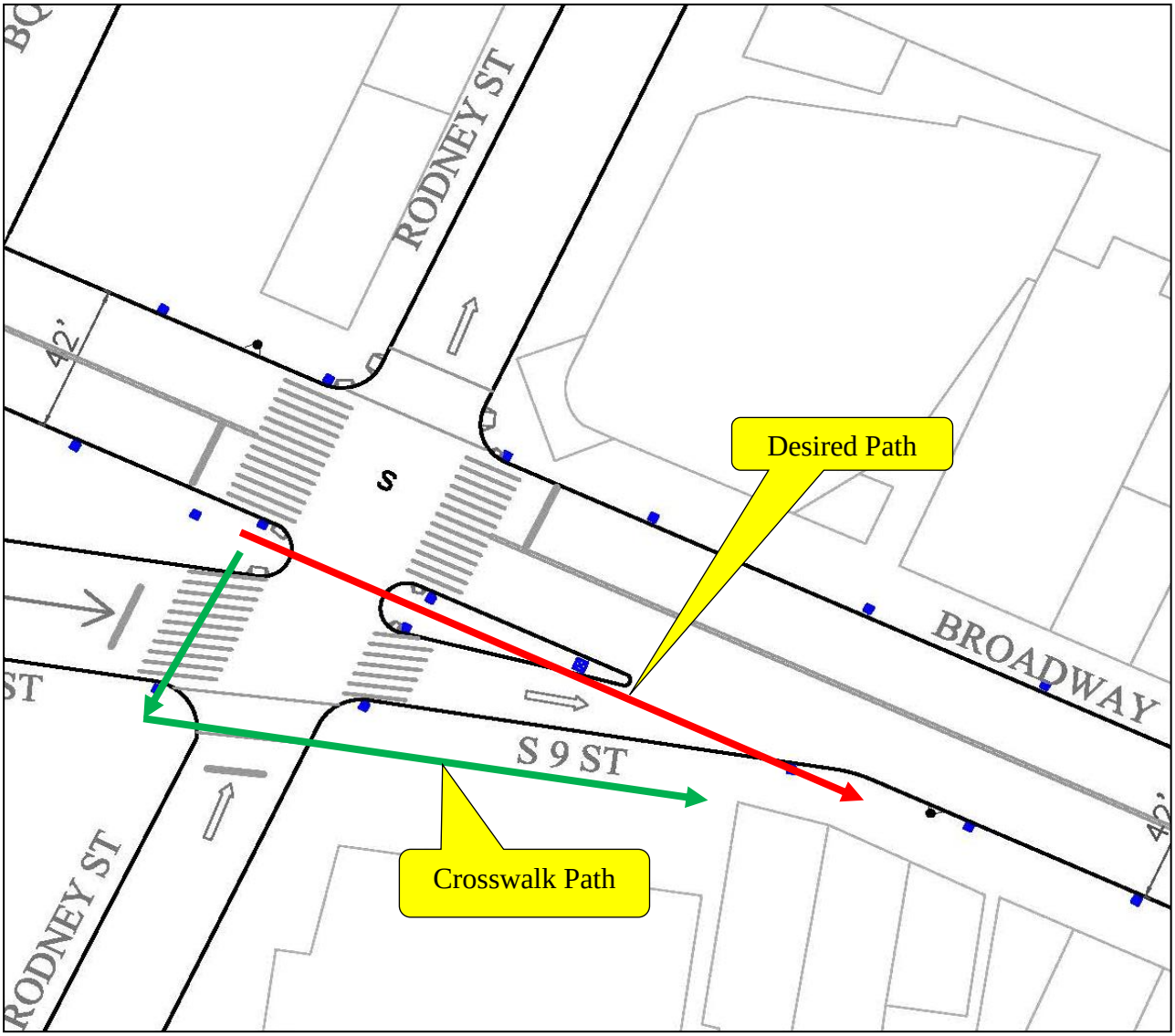



*Figure 49: Broadway, Rodney Street and South 9th Street Existing Conditions*

There are several variations of improvements for this location. The easiest would be to simply stripe crosswalks at the two locations where they are missing. However, that does not solve the problem of insufficient room for pedestrians at the apex of the existing concrete triangle, nor does it solve the problem of insufficient storage on Rodney Street between South 9th Street and Broadway. The former problem can be solved by banning the eastbound left turn from South 9th Street onto Rodney Street.

A more radical proposal would solve all the problems. The easternmost block of South 9th Street between Rodney Street and Broadway would be closed to vehicular traffic and converted into a pedestrian plaza. That would solve the problem of insufficient room at the apex of the existing concrete triangle, because the pedestrian plaza would function as a sidewalk. There are no building entrances along this block, but it would necessitate the loss of about five parking spaces. Another problem with this improvement variation is that drivers on eastbound South 9th Street, when approaching Rodney Street, would be forced to turn left onto Rodney Street, exacerbating the problem of little storage between South 9th Street and Broadway. This could be overcome by reversing the direction of South 9th Street to westbound, as shown in Figure 50. The western terminus of South 9th Street is one block away at Marcy Avenue. Preliminary investigation indicates there would not be major problems with this reversal.

All variations of improvements will be shown to the community board before deciding on the best course of action.

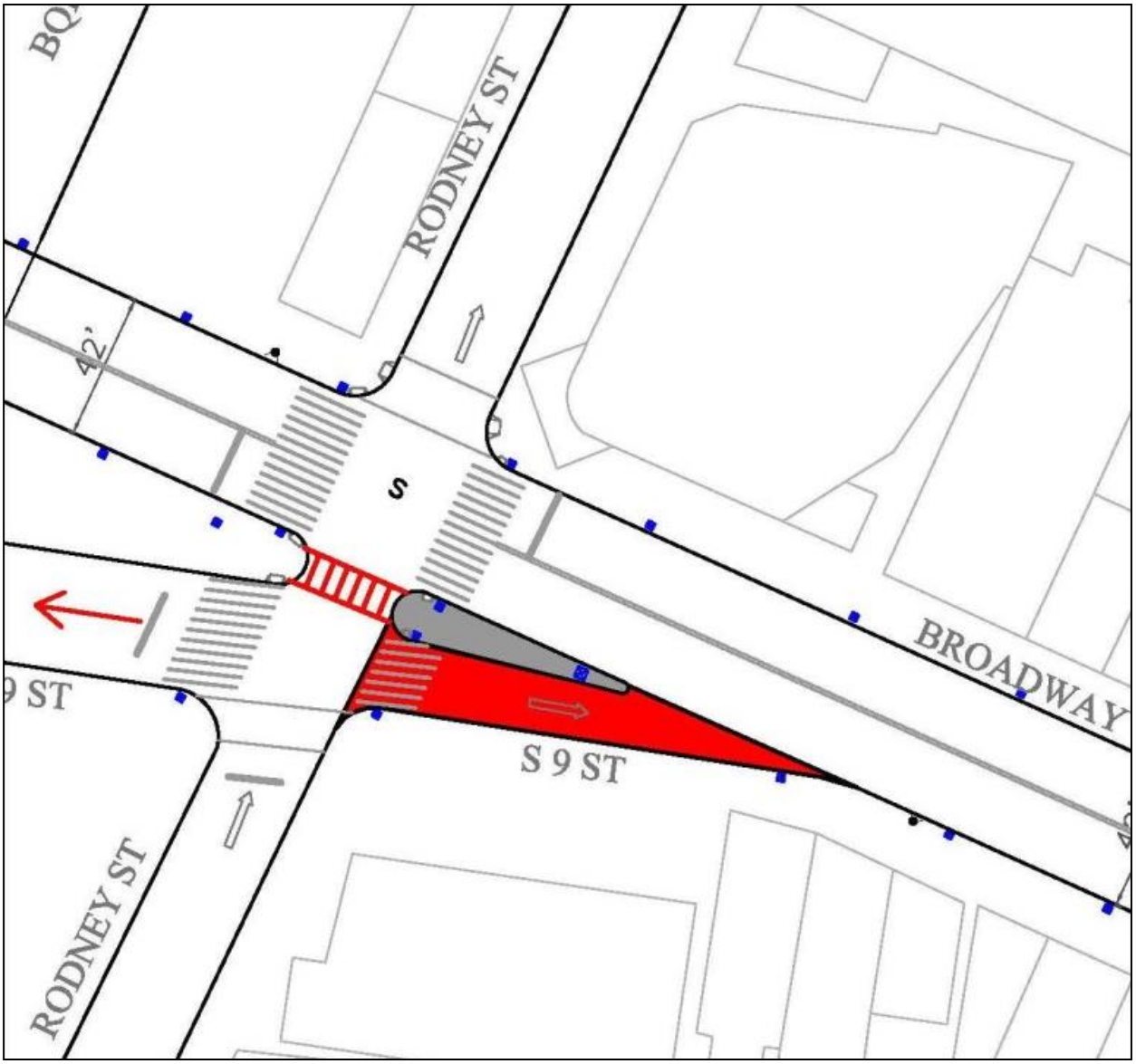



***Figure 50: Broadway, Rodney Street and South 9th Street Proposed Improvement***

### 5.3.2 Broadway, Flushing Avenue and Graham Avenue

The intersection of Broadway and Flushing Avenue is the busiest and most complicated within the study corridor. The existing layout is shown in Figure 51. During the peak hours this intersection is used by a large volume of both vehicles and pedestrians. The south side of Broadway at the approach to Flushing Avenue serves as a staging area for taxies and livery cabs, where they wait – and often double-park – for pick-up of passengers exiting the nearby subway. Field observations indicate that double-parking and jaywalking is widespread. As a result the intersection is a high-rate crash location and experiences significant traffic delays.

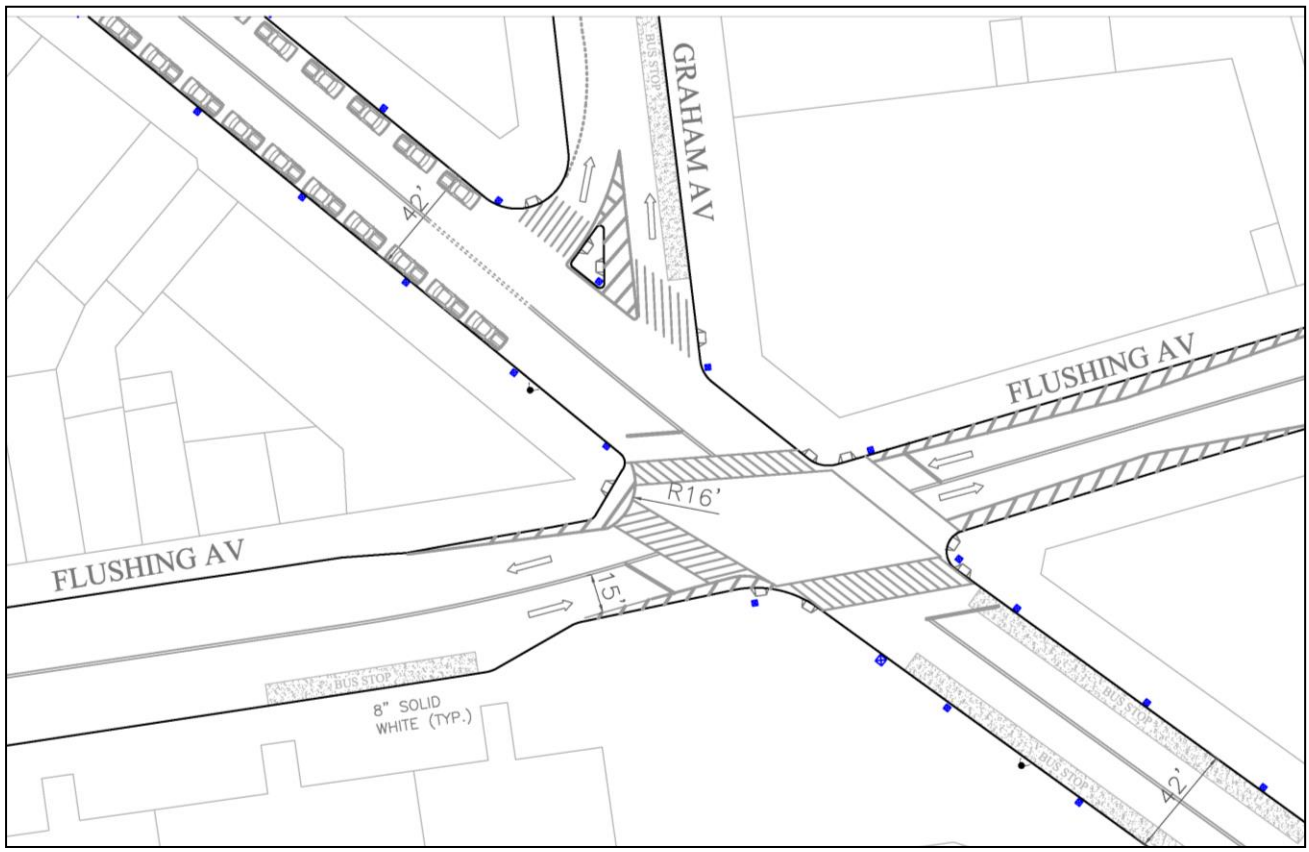



***Figure 51: Broadway and Flushing Avenue Existing Condition***

***Photograph 9: Looking West along Broadway from Flushing Avenue: Livery Cab Standing in No Parking Zone***

***Photograph 10: Looking East along Broadway towards Flushing Avenue: A Double-Parked Livery Cab***

The recommended improvements are as follows:

- Install No Standing Anytime regulations on the south curb of Broadway, extending 100 feet west from Flushing Avenue. Provide a 200-foot taxi stand on Flushing Avenue along the north curb, as shown in
- Figure ***52***. Currently taxies park or double-park along the south curb of Broadway as shown in Photographs 9 and 10. The proposed improvement will clear the eastbound approach.
- Install new, wider crosswalks as shown in Figure 53.
- Install a new expanded concrete island for pedestrian refuge on Graham Avenue, as shown in Figure 53.

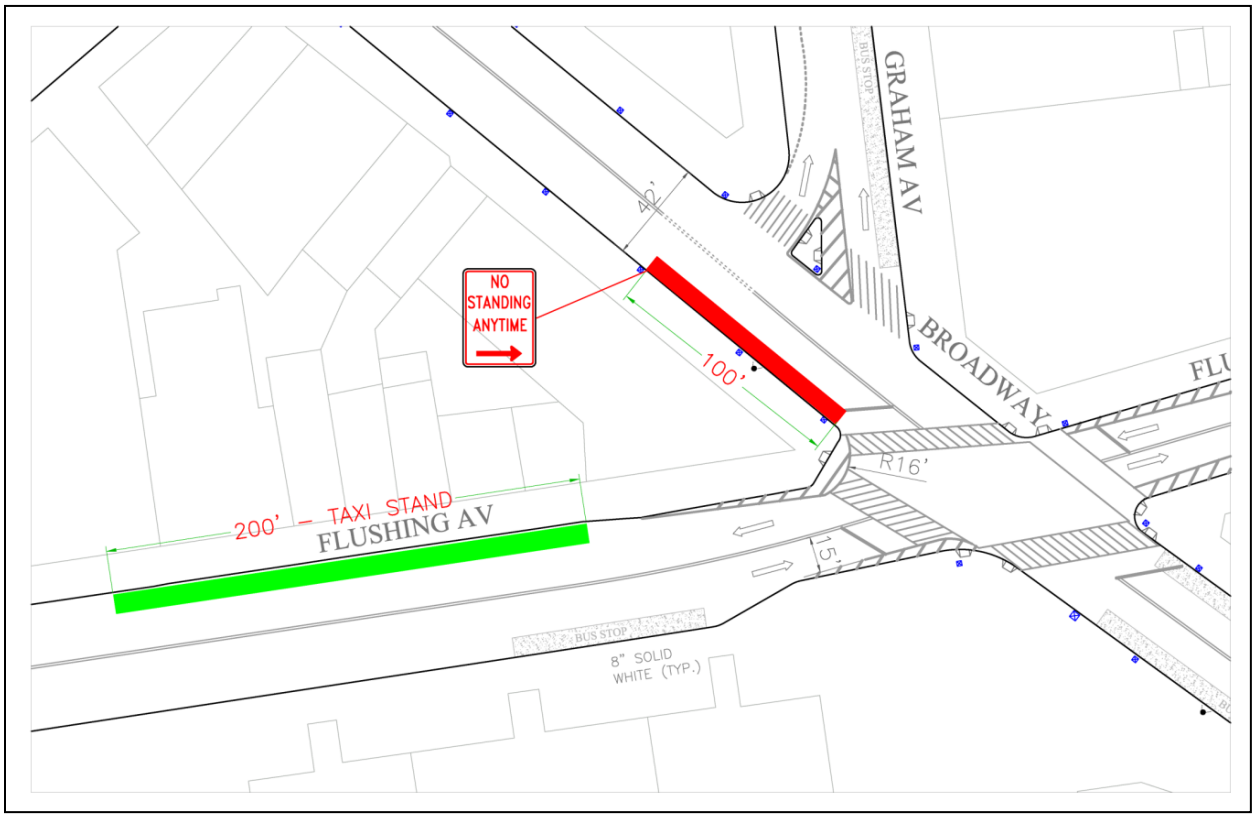



***Figure 52: Proposed Parking Changes for Broadway and Flushing Avenue***

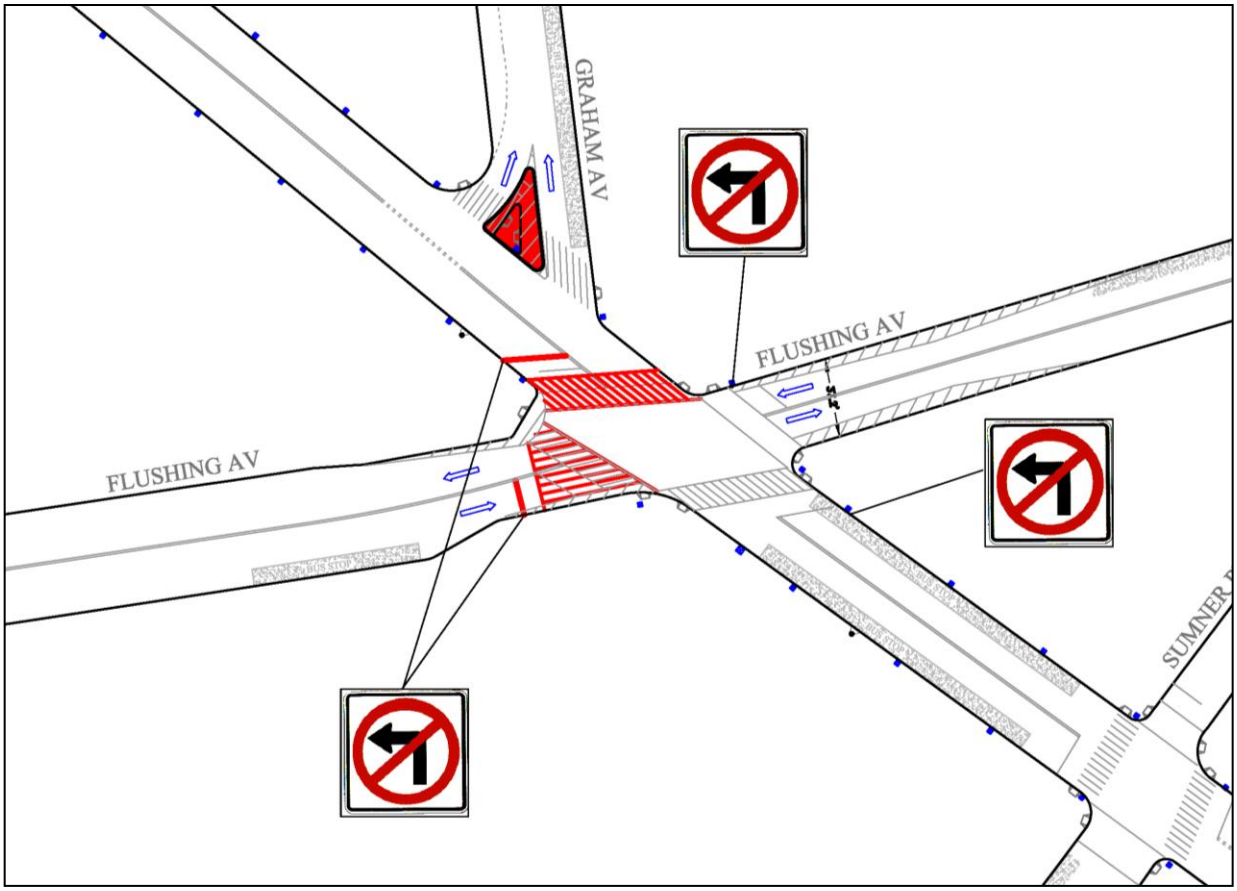



***Figure 53: Proposed Crosswalks and Concrete Islands at Broadway and Flushing Avenue***

### 5.3.3 Broadway, Myrtle Avenue and Jefferson Street

Pedestrians walking along the north side of Broadway while crossing Jefferson Street and Myrtle Avenue typically do not follow the crosswalk, but walk the direct line as shown in Figure 54, exposing them to traffic.

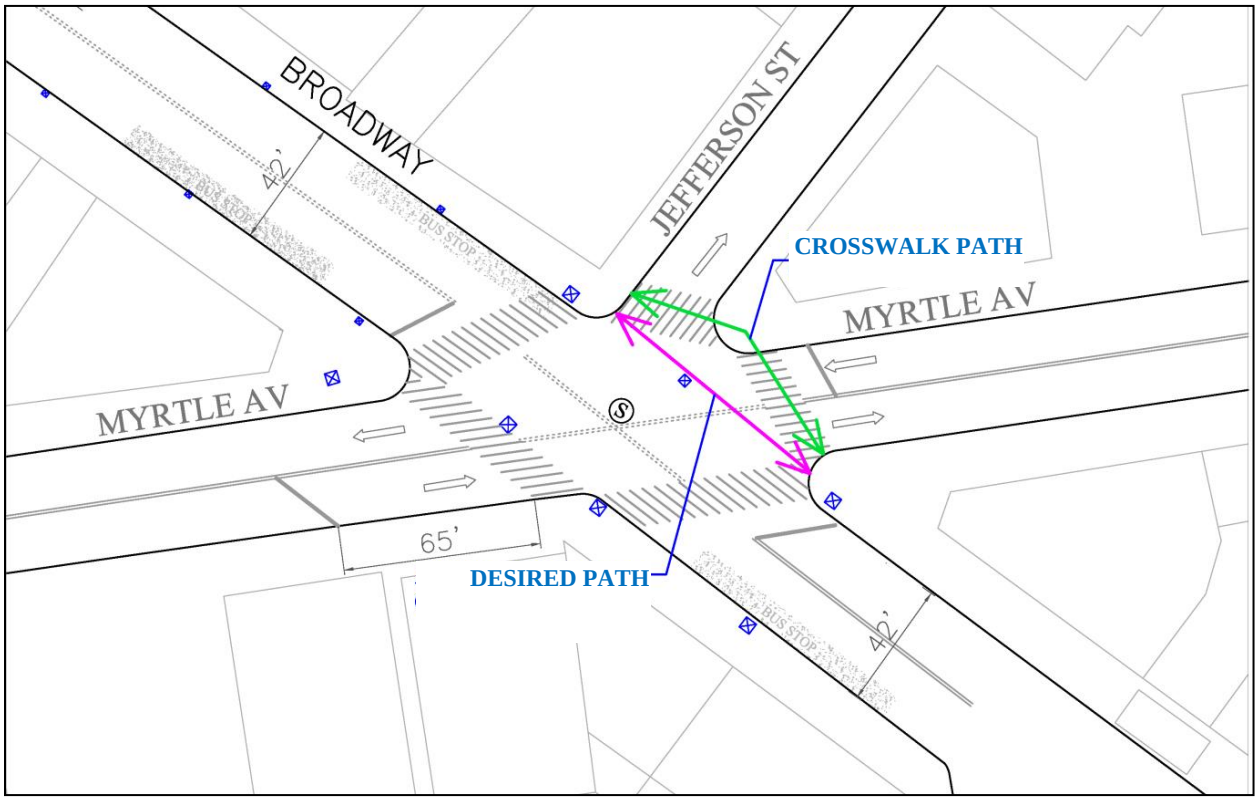



***Figure 54: Broadway and Myrtle Avenue/Jefferson Street Existing Conditions***

The recommended improvement is to install a curb extension with truffle paint and delineators at the corner between Myrtle Avenue and Jefferson Street, as shown in Figure 55, and install a new crosswalk that follows the desire line of pedestrians.

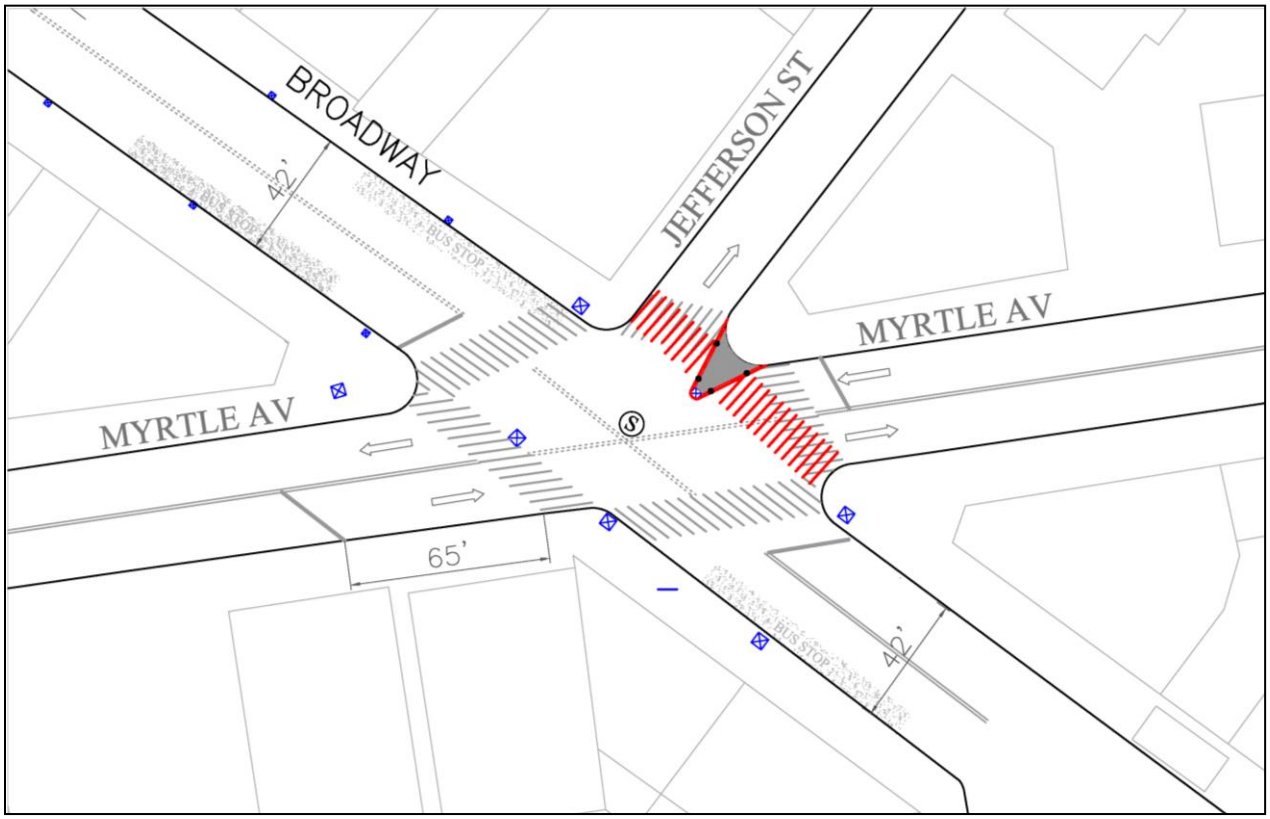



***Figure 55: Broadway and Myrtle Avenue/Jefferson Proposed Improvements***

### 5.3.4 Broadway and Park Avenue

The crossing distance for pedestrians walking along the south side of Broadway while crossing Park Avenue is 80 feet from curb to curb, due to the skewed angle of this unsignalized intersection. In addition, there is a subway column exposed to vehicular traffic in the middle of Park Avenue, as shown in Figure 56.

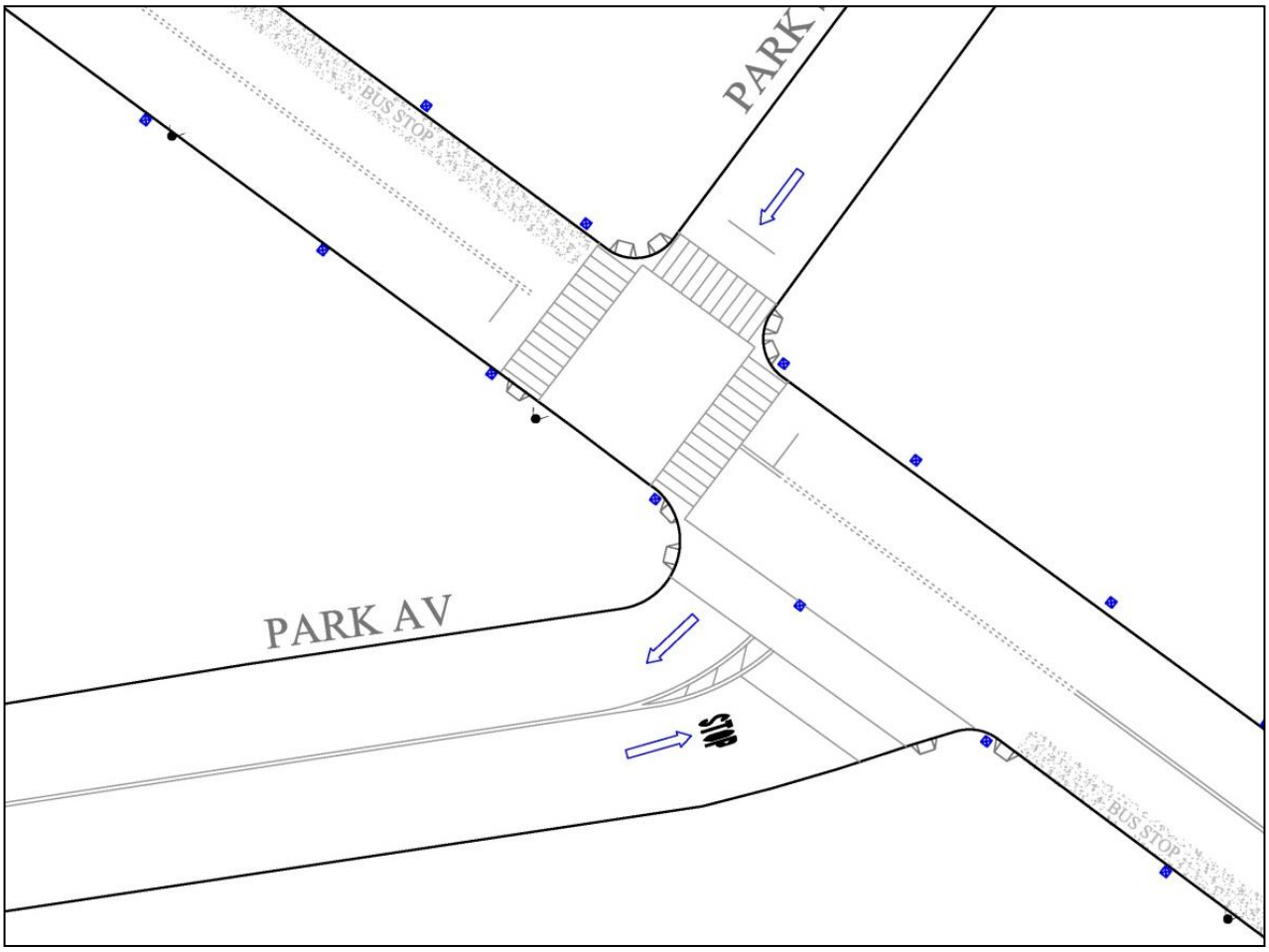



***Figure 56: Broadway and Park Avenue Existing Conditions***

The recommended improvement is to install a concrete island to serve as a refuge for pedestrians and provide protection to motorists from the subway column, as shown in  Figure 57.

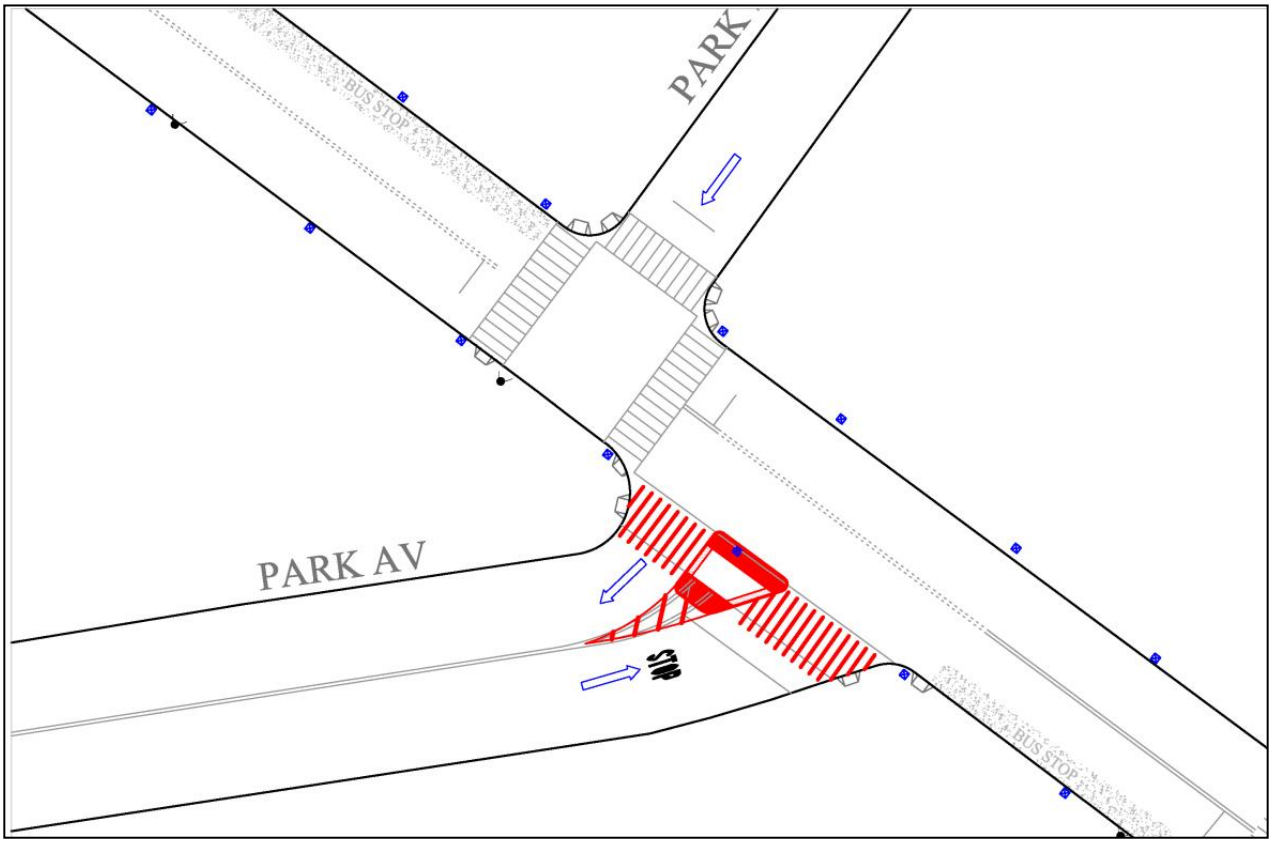



***Figure 57: Broadway and Park Avenue Proposed Improvements***

### 5.3.5 Broadway and Boerum Street

The crossing distance for pedestrians walking along the north side of Broadway while crossing Boerum Street is 80 feet from curb to curb, due to the skewed angle of this unsignalized intersection. In addition, there is a subway column exposed to vehicular traffic in the middle of Boerum Street, as shown in Figure 58.

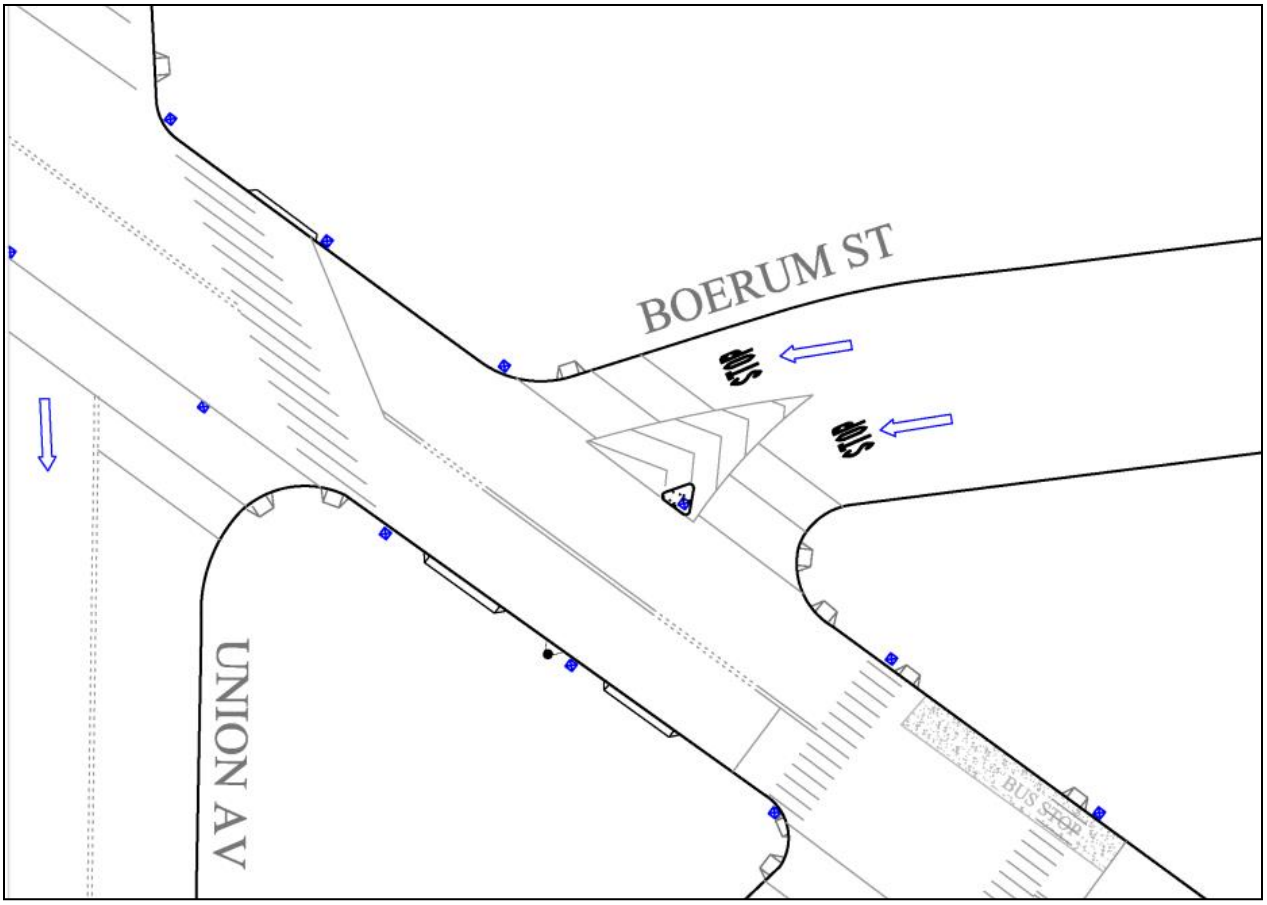



***Figure 58: Broadway and Boerum Street Existing Conditions***

The recommended improvement is to install a concrete island to serve as a refuge for pedestrians and provide protection to motorists from the subway column, as shown in  Figure 57.

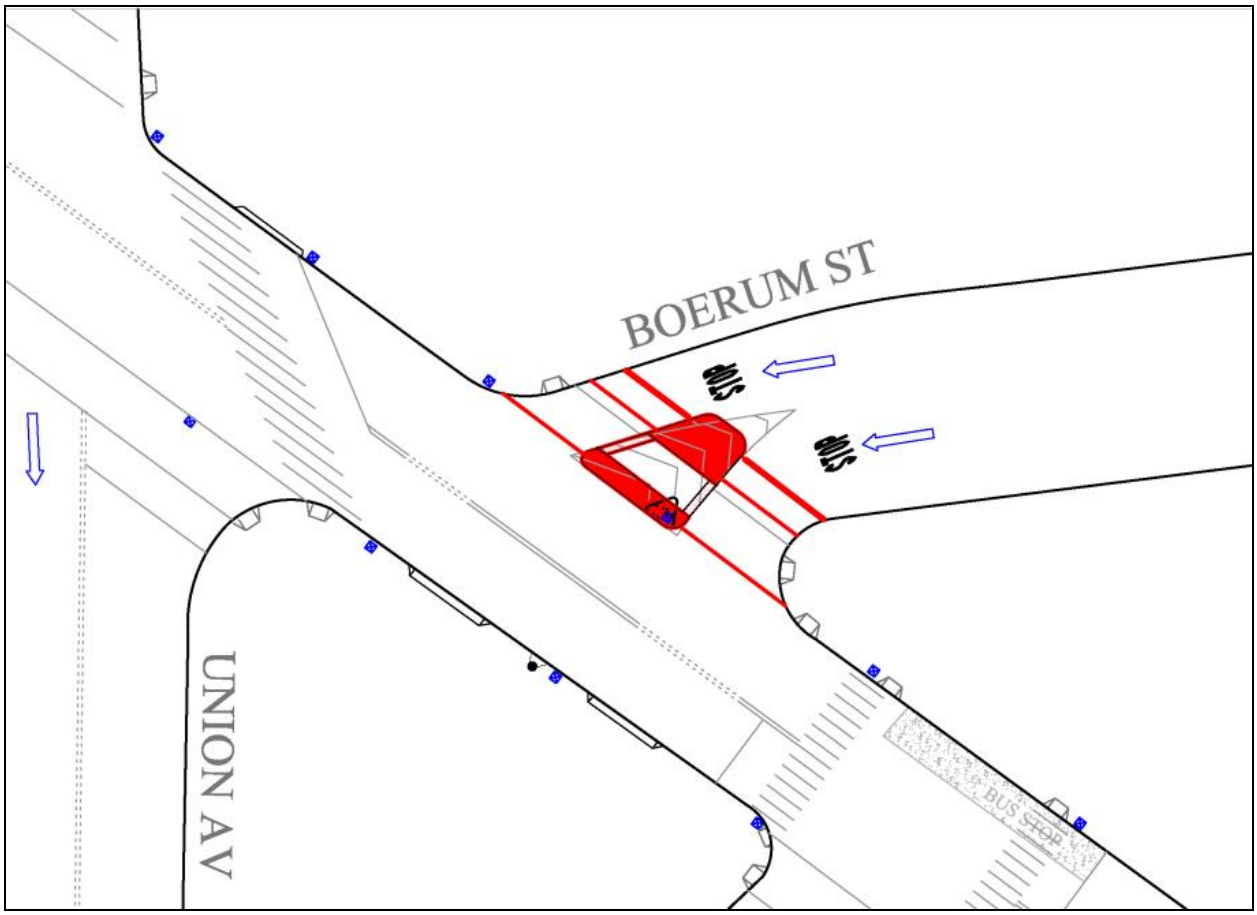



***Figure 59: Broadway and Boerum Street Proposed Improvement***

### 5.3.6 Broadway, Middleton Street and Throop Avenue

There are no crosswalks provided for pedestrians walking along the south side of Broadway crossing Throop Avenue or Middleton Street, as shown in Figure 60. Particularly dangerous is crossing Throop Avenue, as pedestrians would have to watch out for speeding vehicles making the soft right turn from eastbound Broadway onto Throop Avenue slip, as shown in Figure 60 and Photograph 11. In addition, the subway column at the apex of the small triangular shaped concrete island between Broadway and Throop Avenue west of Middleton Street is enough of an obstruction to preclude pedestrians from having enough room to use this area as a sidewalk. Finally, there is no crosswalk along either side of Middleton Street when crossing Throop Avenue, making it impossible to stay on the south side of Broadway without jaywalking, even if diverting to Throop Avenue and back via Middleton Street.

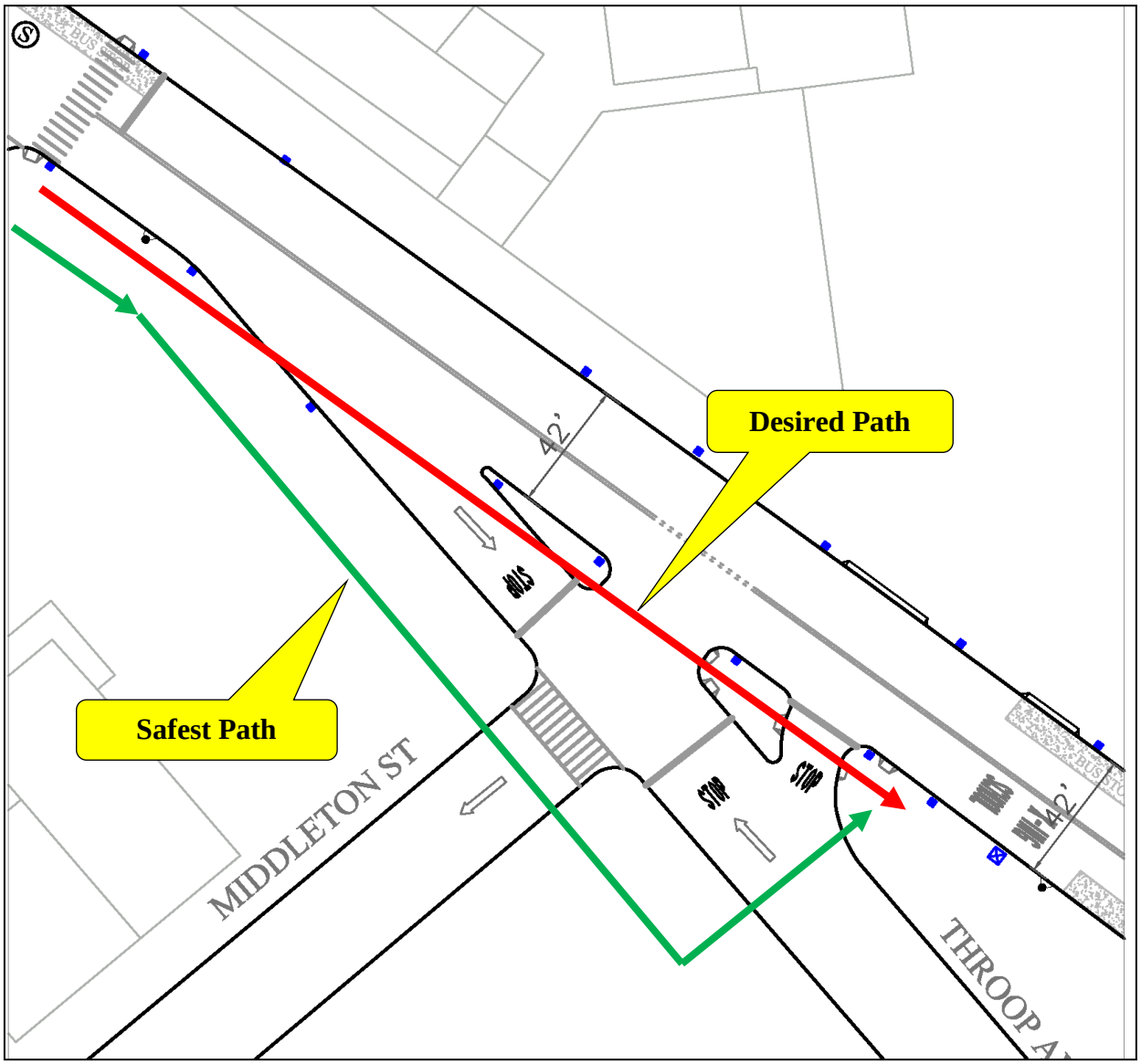



*Figure 60: Broadway, Middleton Street and Throop Avenue Existing Conditions*


***Photograph 11: Broadway (Right) and Throop Avenue (Left), Looking East***

The recommended improvement is shown in Figure 61. The slip from eastbound Broadway to Throop Avenue would be closed and converted to a pedestrian plaza. This would force vehicles to slow down to turn right from eastbound Broadway on Middleton Street, as opposed to using the high speed slip. This pedestrian plaza would provide enough room that the triangular concrete island west of Middleton Street does not. The slip from westbound Throop Avenue to Broadway would also be closed and converted into a pedestrian plaza. Traffic from westbound Throop Avenue approaching Middleton Street would be force to turn left, precluding any storage problems if they were permitted to turn right here onto Broadway. Drivers could access Broadway at the upstream intersection at Lorimer Street. This would allow a crosswalk to be striped across Middleton Street without causing any vehicle storage problems.

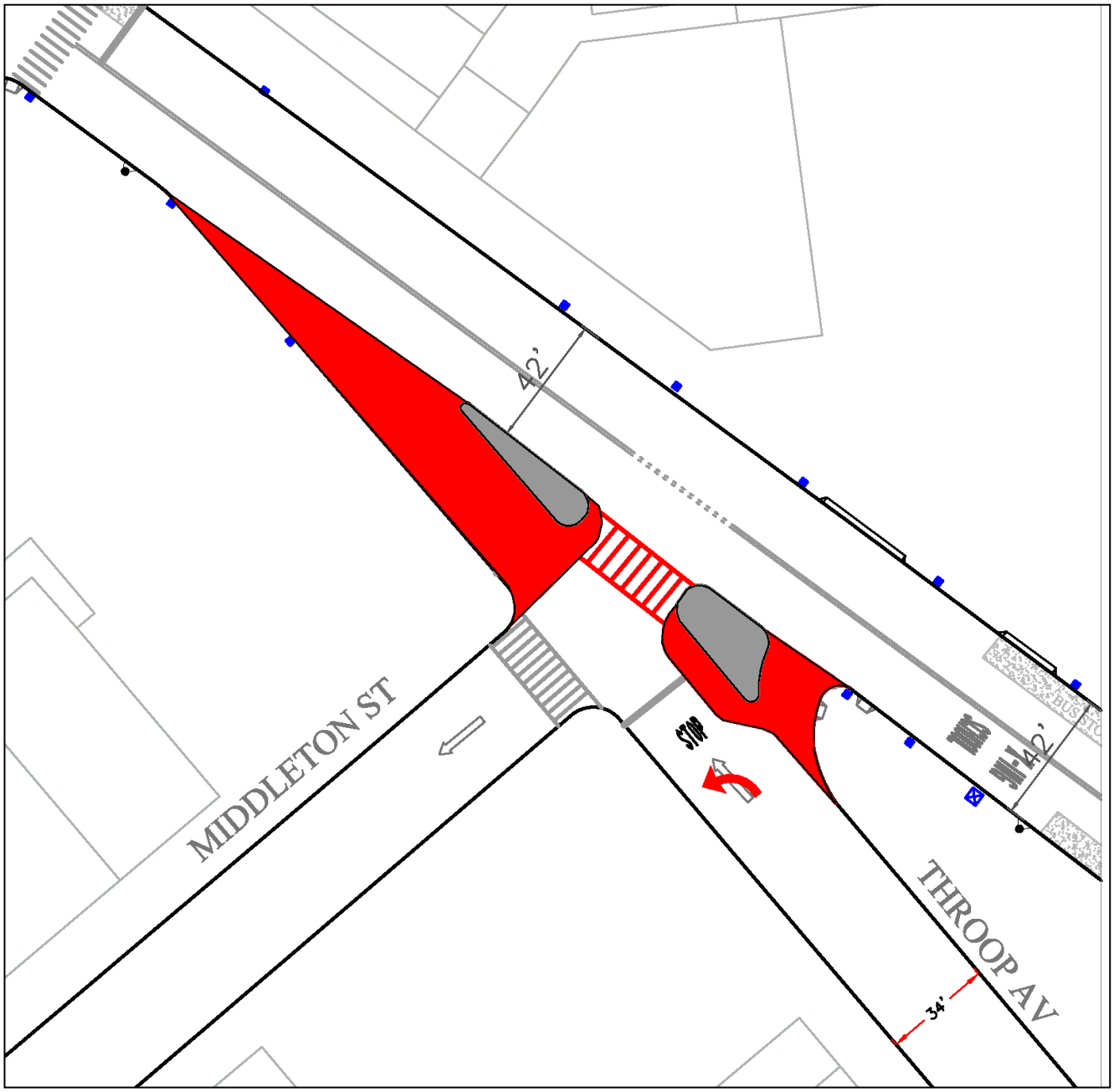



***Figure 61: Broadway, Middleton Street and Throop Avenue Proposed Improvements***

### 5.3.7 Willamsburg Bridge Bus Plaza Reconstruction Project

NYCDOT has developed a plan to reconstruct and upgrade the area surrounding Williamsburg Bridge Bus Plaza, which is currently a major bus terminal and an access point for eastbound traffic from the Williamsburg Bridge. The bus terminal is used by seven bus lines and has four entrance/exit points. The existing layout is shown in Figure 62.

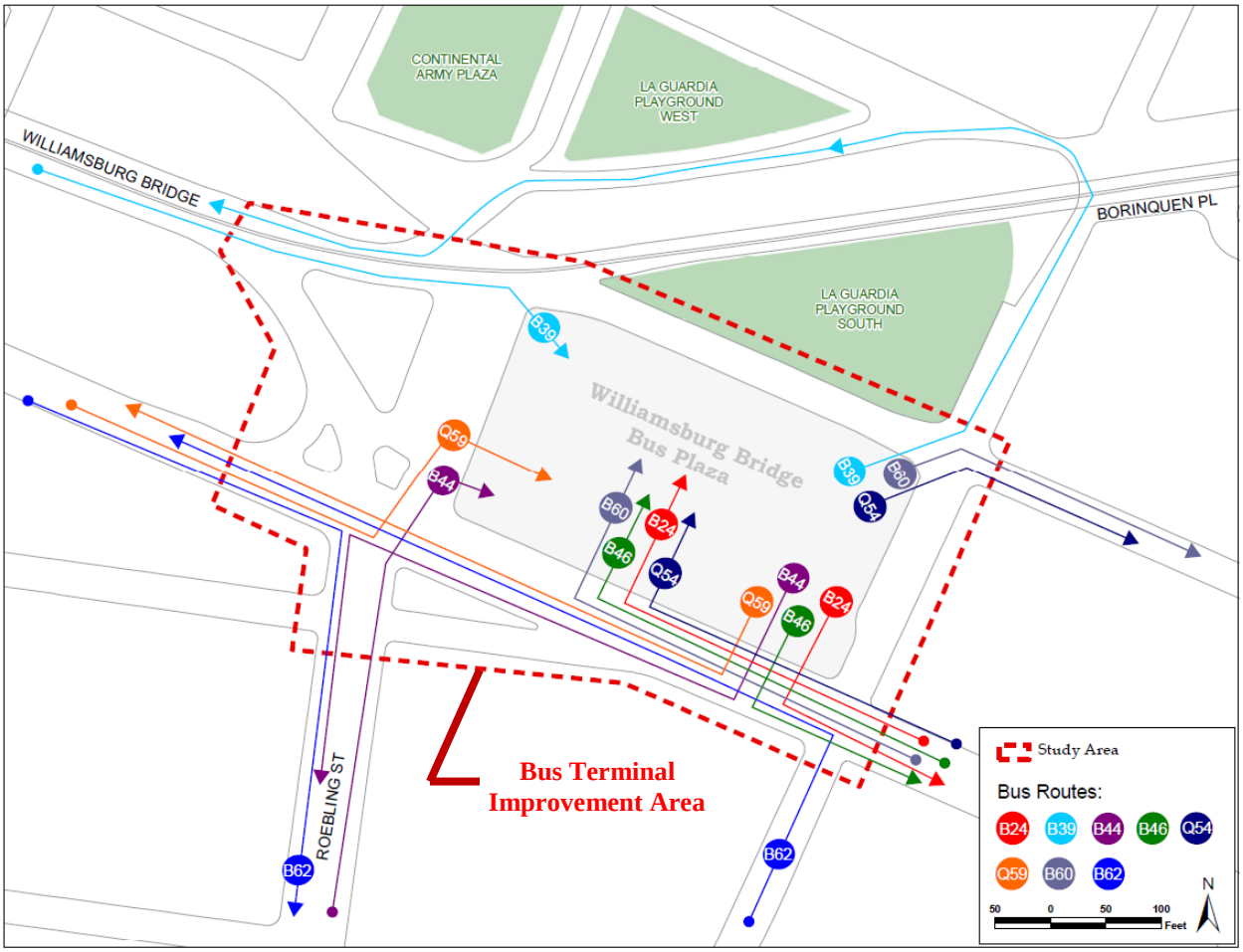



***Figure 62: Williamsburg Bus Terminal Existing Bus Routes***

Under the proposed design the bus terminal area, including the Broadway segment from Roebling Street to Havemeyer Avenue, will undergo major reconstruction. Details of the proposed changes are shown in Figure 63.

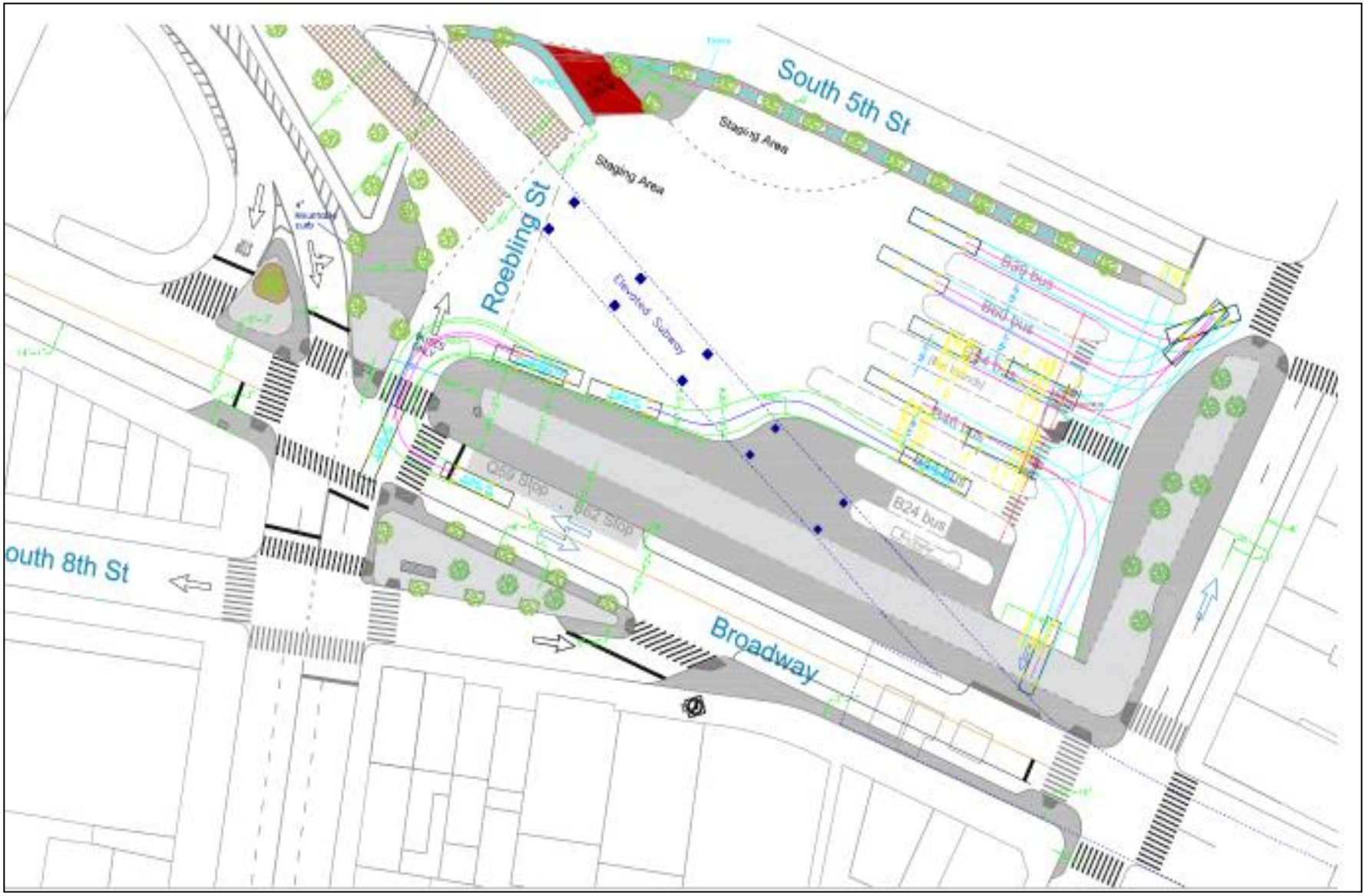



***Figure 63: Proposed Williamsburg Bridge Bus Plaza***

# CHAPTER 6 EVALUATION

This section quantifies the impact of the proposed improvements to congestion. Three service measures were projected: travel speeds, intersection levels of service, and air quality. Future without improvements conditions were compared to future with improvements conditions.

## 6.1 Travel Speeds

Table 10 and Figures 64 and 65 present a comparison of projected travel speeds on the entire study corridor of Broadway between Driggs Avenue and Myrtle Avenue. The future without improvements conditions were compared to future with improvements conditions for the year 2020. The traffic speeds are derived from SimTraffic simulation program. For the eastbound direction, travel speeds in weekday AM, midday, PM and Saturday midday peak hours are projected to improve by 9.5%, 4.5%, 18.9% and 3.5%, respectively. In westbound direction, the projected improvements are 14.4%, 3.3%, 8.0% and 7.6%, respectively.

**Table 10: Projected Travel Speeds on Broadway**

| | Eastbound | | | Westbound | | |
|---|---|---|---|---|---|---|
| | **2020 w/o Improvement (mph)** | **2020 with Improvement (mph)** | **Change %** | **2020 w/o Improvement (mph)** | **2020 with Improvement (mph)** | **Change %** |
| Weekday AM | 7.4 | 8.1 | 9.5% | 7.6 | 8.7 | 14.4% |
| Weekday MD | 11.0 | 11.5 | 4.5% | 12.0 | 12.4 | 3.3% |
| Weekday PM | 9.5 | 11.3 | 18.9% | 10.0 | 10.8 | 8.0% |
| Saturday MD | 8.6 | 8.9 | 3.5% | 9.2 | 9.9 | 7.6% |

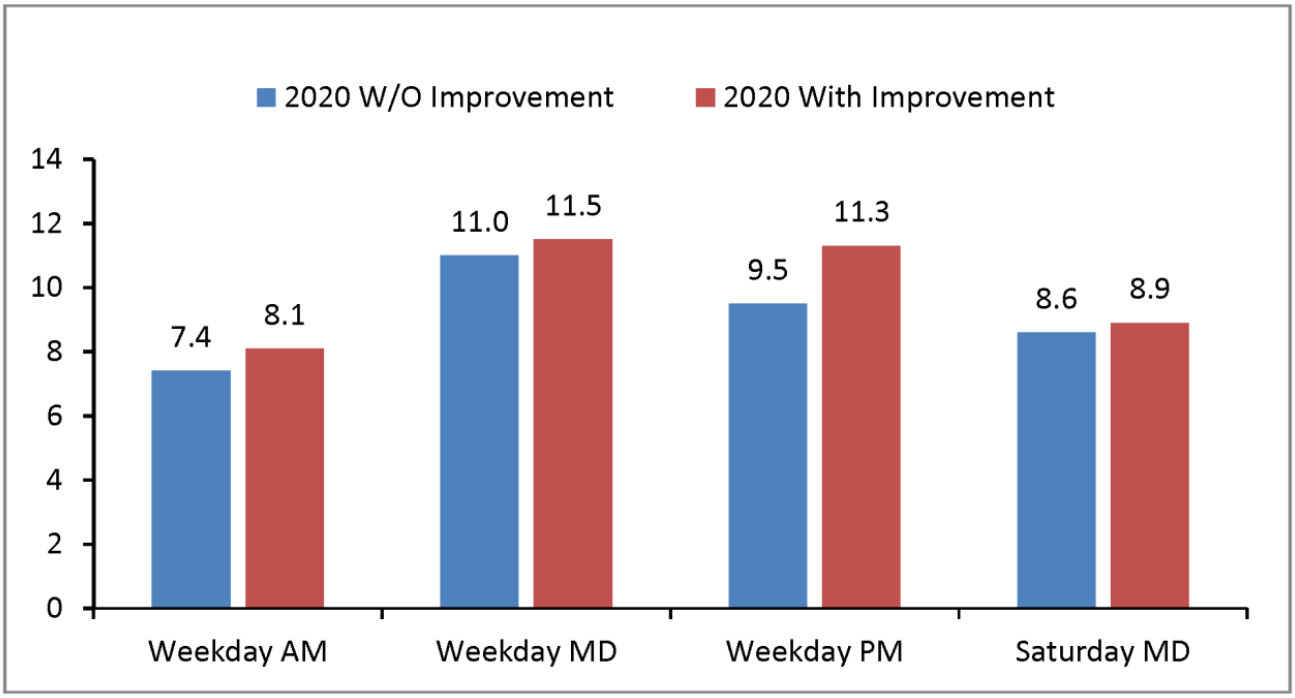



***Figure 64: Eastbound Peak Hour Travel Speeds for Broadway***

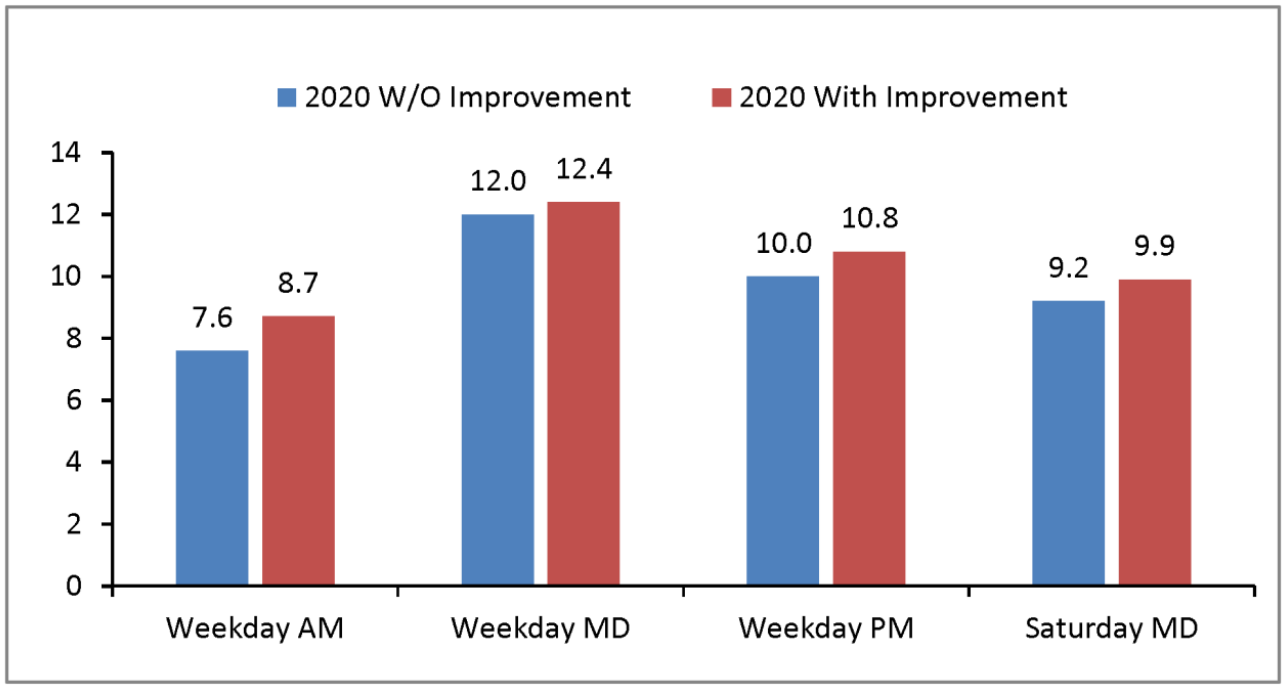



***Figure 65: Westbound Peak Hour Travel Speeds for Broadway***

## 6.2 Intersection Levels of Service

To further assess the improvements, Table 11 presents the volume to capacity (v/c) ratio, delay, and LOS for each lane group for each intersection in the study area. Results are given for future without improvements future with improvements conditions for the year 2020.

**Table 11: Future Condition with Improvements Level of Service**

| Intersection Approach[1] | Lane Group | Weekday AM Peak (7:45 - 8:45 AM) | | | | | | Weekday MD Peak (1:00 - 2:00 PM) | | | | | | Weekday PM Peak (4:45 - 5:45 PM) | | | | | | Saturday Midday Peak (12:45 - 1:45 PM) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Future W/O Improv. | | | Future with Improv. | | | Future W/O Improv. | | | Future with Improv. | | | Future W/O Improv. | | | Future with Improv. | | | Future W/O Improv. | | | Future with Improv. | | |
| | | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS | v/c | Delay | LOS |
| **1. Broadway and Roebling Street** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.34 | 23.2 | C | 0.34 | 23.2 | C | 0.34 | 13.2 | B | 0.34 | 13.2 | B | 0.39 | 24.0 | C | 0.47 | 32.8 | C | 0.28 | 14.9 | B | 0.28 | 14.9 | B |
| WB - Broadway | LTR | 0.37 | 34.5 | C | 0.37 | 33.6 | C | 0.30 | 16.7 | B | 0.30 | 16.7 | B | 0.24 | 19.2 | B | 0.29 | 24.4 | C | 0.34 | 17.1 | B | 0.34 | 17.1 | B |
| NB - Roebling Street | L | 0.04 | 17.8 | B | 0.04 | 17.8 | B | 0.02 | 1.8 | A | 0.02 | 1.8 | A | 0.02 | 10.9 | B | 0.01 | 8.3 | A | 0.01 | 15.3 | B | 0.01 | 15.3 | B |
| | TR | 0.02 | 18.0 | B | 0.02 | 18.0 | B | 0.02 | 1.8 | A | 0.02 | 1.8 | A | 0.03 | 10.8 | B | 0.03 | 8.5 | A | 0.02 | 15.4 | B | 0.02 | 15.4 | B |
| SB - Roebling Street | L | 0.35 | 23.4 | C | 0.35 | 23.4 | C | 0.30 | 19.1 | B | 0.30 | 19.1 | B | 0.50 | 86.2 | F | 0.42 | 18.9 | B | 0.27 | 18.4 | B | 0.27 | 18.4 | B |
| | TR | 0.26 | 22.7 | C | 0.26 | 22.7 | C | 0.33 | 19.7 | B | 0.33 | 19.7 | B | 0.77 | 92.1 | F | 0.62 | 48.4 | D | 0.22 | 18.0 | B | 0.22 | 18.0 | B |
| Overall Intersection | | | 26.4 | C | | 26.1 | C | | 16.5 | B | | 16.5 | B | | 66.8 | E | | 33.3 | C | | 16.9 | B | | 16.9 | B |
| **2. Broadway and Havemayer Street** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LT | 0.67 | 22.3 | C | 0.63 | 19.8 | B | 0.78 | 34.8 | C | 0.78 | 34.8 | C | 1.11 | 103.6 | F | 0.84 | 48.0 | D | 0.61 | 24.5 | C | 0.61 | 24.5 | C |
| WB - Broadway | TR | 1.05 | 79.1 | E | 0.90 | 40.4 | D | 0.80 | 23.4 | C | 0.80 | 23.4 | C | 0.93 | 37.2 | D | 0.85 | 26.9 | C | 0.83 | 21.1 | C | 0.83 | 21.1 | C |
| NB - Havemayer Street | LTR | 0.60 | 39.2 | D | 0.64 | 43.7 | D | 0.60 | 39.0 | D | 0.60 | 39.0 | D | 0.77 | 50.3 | D | 0.79 | 56.3 | E | 0.25 | 28.9 | C | 0.25 | 28.9 | C |
| Overall Intersection | | | 51.3 | D | | 34.4 | C | | 31.9 | C | | 31.9 | C | | 72.3 | E | | 43.8 | D | | 23.4 | C | | 23.4 | C |
| **3. Broadway and Marcy Avenue** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.61 | 29.6 | C | 0.56 | 24.4 | C | 0.67 | 22.3 | C | 0.67 | 22.3 | C | 1.09 | 79.6 | E | 1.00 | 68.4 | E | 0.63 | 17.8 | B | 0.63 | 17.8 | B |
| WB - Broadway | LT | 0.93 | 95.9 | F | 0.85 | 44.9 | D | 0.67 | 19.7 | B | 0.67 | 19.7 | B | 0.85 | 40.3 | D | 0.72 | 19.1 | B | 0.76 | 24.6 | C | 0.76 | 24.6 | C |
| SB-Rochambeau Avenue | LTR | 0.40 | 24.7 | C | 0.44 | 28.9 | C | 0.51 | 26.9 | C | 0.51 | 26.9 | C | 0.44 | 25.5 | C | 0.49 | 30.0 | C | 0.46 | 26.1 | C | 0.46 | 26.1 | C |
| Overall Intersection | | | 60.2 | E | | 35.1 | D | | 22.9 | C | | 22.9 | C | | 53.1 | D | | 45.3 | D | | 22.6 | C | | 22.6 | C |
| **4. Broadway and Hooper Street** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.51 | 9.5 | A | 0.51 | 10.2 | B | 0.54 | 22.5 | C | 0.54 | 22.5 | C | 0.76 | 55.7 | E | 0.73 | 46.9 | D | 0.44 | 15.0 | B | 0.44 | 15.0 | B |
| WB - Broadway | LT | 0.97 | 36.5 | D | 0.97 | 36.6 | D | 0.69 | 36.1 | D | 0.69 | 36.1 | D | 0.77 | 20.8 | C | 0.72 | 16.1 | B | 0.70 | 15.5 | B | 0.70 | 15.5 | B |
| SB - Hooper Street | LTR | 0.31 | 30.3 | C | 0.31 | 30.3 | C | 0.44 | 33.2 | C | 0.44 | 33.2 | C | 0.54 | 36.1 | D | 0.58 | 39.8 | D | 0.32 | 24.4 | C | 0.32 | 24.4 | C |
| Overall Intersection | | | 26.9 | C | | 27.1 | C | | 30.5 | C | | 30.5 | C | | 38.7 | D | | 34.3 | C | | 16.8 | B | | 16.8 | B |
| **5. Broadway and Penn Street** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.60 | 20.6 | C | 0.60 | 20.6 | C | 0.50 | 28.3 | C | 0.50 | 28.3 | C | 0.67 | 18.0 | B | 0.67 | 16.8 | B | 0.52 | 36.4 | D | 0.52 | 36.4 | D |
| WB - Broadway | LTR | 0.86 | 53.3 | D | 0.86 | 53.0 | D | 0.64 | 36.3 | D | 0.64 | 53.0 | D | 0.78 | 41.2 | D | 0.78 | 41.3 | D | 0.63 | 35.6 | D | 0.63 | 35.6 | D |
| SB - New Montrose | LTR | 0.08 | 26.2 | C | 0.08 | 26.2 | C | 0.05 | 20.2 | C | 0.05 | 20.2 | C | 0.09 | 26.4 | C | 0.09 | 26.4 | C | 0.04 | 20.1 | C | 0.04 | 20.1 | C |
| Overall Intersection | | | 40.4 | D | | 40.2 | D | | 32.1 | C | | 46.2 | D | | 29.3 | C | | 28.7 | C | | 29.6 | C | | 38.9 | D |
| **6. Broadway and Union Avenue** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.57 | 13.8 | B | 0.57 | 13.8 | B | 0.51 | 34.6 | C | 0.51 | 34.6 | C | 0.79 | 28.2 | C | 0.79 | 28.2 | C | 0.48 | 38.2 | D | 0.48 | 38.2 | D |
| WB - Broadway | LTR | 0.99 | 45.7 | D | 0.99 | 45.7 | D | 0.86 | 25.6 | C | 0.86 | 25.6 | C | 0.89 | 31.3 | C | 0.89 | 31.3 | C | 0.83 | 21.9 | C | 0.83 | 21.9 | C |
| NB - Union Avenue | LTR | 0.65 | 41.5 | D | 0.65 | 41.5 | D | 0.64 | 36.0 | D | 0.64 | 36.0 | D | 0.73 | 45.9 | D | 0.73 | 45.9 | D | 0.43 | 27.3 | C | 0.43 | 27.3 | C |
| SB - Union Avenue | LTR | 0.55 | 36.5 | D | 0.54 | 36.5 | D | 0.39 | 26.1 | C | 0.39 | 26.1 | C | 0.44 | 33.4 | C | 0.44 | 33.3 | C | 0.28 | 23.8 | C | 0.28 | 23.8 | C |
| Overall Intersection | | | 50.6 | D | | 35.6 | D | | 30.2 | C | | 30.2 | C | | 33.4 | C | | 33.3 | C | | 27.9 | C | | 27.9 | C |
| **7. Broadway and Lorimer Street** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.62 | 16.1 | B | 0.62 | 16.1 | B | 0.58 | 7.8 | A | 0.58 | 7.8 | A | 0.88 | 28.0 | C | 0.88 | 28.0 | C | 0.59 | 6.7 | A | 0.59 | 6.7 | A |
| WB - Broadway | LTR | 0.95 | 43.9 | D | 0.95 | 43.9 | D | 0.68 | 15.1 | B | 0.68 | 15.1 | B | 0.87 | 27.9 | C | 0.87 | 27.9 | C | 0.78 | 16.0 | B | 0.78 | 16.0 | B |
| NB - Lorimer Street | LTR | 0.45 | 35.3 | D | 0.45 | 35.3 | D | 0.21 | 22.5 | C | 0.21 | 22.5 | C | 0.30 | 30.2 | C | 0.30 | 30.2 | C | 0.18 | 22.0 | C | 0.18 | 22.0 | C |
| SB - Lorimer Street | LTR | 0.60 | 41.4 | D | 0.60 | 41.4 | D | 0.28 | 24.3 | C | 0.28 | 24.3 | C | 0.47 | 36.5 | D | 0.47 | 36.5 | D | 0.15 | 21.8 | C | 0.15 | 21.8 | C |
| Overall Intersection | | | **34.3** | **C** | | **34.3** | C | | **14.0** | **B** | | **14.0** | B | | **29.2** | **C** | | **29.2** | C | | **13.3** | **B** | | **13.3** | B |
| **8. Broadway and Thornton Ave /Debevoise** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | TR | 0.54 | 14.3 | B | 0.54 | 14.0 | B | 0.49 | 6.3 | A | 0.49 | 6.3 | A | 0.81 | 73.1 | E | 0.76 | 17.1 | B | 0.60 | 8.1 | A | 0.60 | 7.6 | A |
| WB - Broadway | LT | 0.52 | 10.8 | B | 0.52 | 10.7 | B | 0.40 | 10.6 | B | 0.40 | 11.2 | B | 0.51 | 16.6 | B | 0.48 | 13.6 | B | 0.64 | 16.8 | B | 0.64 | 15.9 | B |
| SB - Thornton/Debevoise Ave | LTR | 0.34 | 30.3 | C | 0.34 | 30.3 | C | 0.35 | 24.0 | C | 0.35 | 24.0 | C | 0.46 | 32.5 | C | 0.50 | 36.6 | D | 0.33 | 23.4 | C | 0.33 | 23.4 | C |
| Overall Intersection | | | 15.8 | B | | 15.7 | B | | 11.4 | B | | 11.6 | B | | 46.3 | D | | 20.2 | C | | 14.2 | B | | 13.5 | B |
| **9. Broadway and Flushing Avenue** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.82 | 29.1 | C | 0.45 | 12.4 | B | 0.73 | 27.0 | C | 0.73 | 27.0 | C | 1.12 | 96.3 | F | 0.49 | 13.9 | B | 1.08 | 84.2 | F | 1.04 | 72.0 | E |
| WB - Broadway | LTR | 1.09 | 84.6 | F | 0.59 | 26.5 | C | 1.09 | 73.1 | E | 0.92 | 25.8 | C | 1.07 | 93.9 | F | 0.86 | 39.2 | D | 0.95 | 40.3 | D | 0.91 | 34.4 | C |
| NB - Flushing Ave | LTR | 1.10 | 103.0 | F | 0.96 | 72.8 | E | 0.79 | 34.8 | C | 0.79 | 34.8 | C | 0.82 | 35.2 | D | 0.79 | 37.1 | D | 1.04 | 77.0 | E | 0.84 | 35.3 | D |
| SB - Flushing Ave | LTR | 1.08 | 105.0 | F | 0.94 | 71.9 | E | 0.99 | 66.9 | E | 0.84 | 37.5 | D | 0.93 | 50.6 | D | 0.94 | 50.0 | D | 1.09 | 92.5 | F | 1.02 | 67.7 | E |
| Overall Intersection | | | 85.3 | F | | 51.6 | D | | 53.1 | D | | 31.5 | C | | 65.0 | E | | 37.2 | D | | 75.0 | E | | 53.2 | D |
| **10. Broadway and Marcus Garvey Blvd/Sumner Pl** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LT | 0.77 | 22.9 | C | 0.77 | 23.1 | C | 0.64 | 9.3 | A | 0.64 | 9.4 | A | 1.09 | 74.2 | E | 0.50 | 9.1 | A | 0.69 | 8.6 | A | 0.69 | 6.9 | A |
| WB - Broadway | TR | 1.04 | 105.7 | F | 0.55 | 21.8 | C | 0.77 | 29.6 | C | 0.77 | 28.9 | C | 0.96 | 116.5 | F | 0.81 | 53.8 | D | 0.72 | 27.6 | C | 0.72 | 27.7 | C |
| SB - Lewis Avenue | LTR | 0.82 | 51.7 | D | 0.82 | 51.4 | D | 0.57 | 31.5 | C | 0.57 | 31.5 | C | 1.07 | 101.2 | F | 0.91 | 61.7 | E | 0.69 | 37.4 | D | 0.69 | 37.4 | D |
| Overall Intersection | | | 63.3 | E | | 30.2 | C | | 23.1 | C | | 22.8 | C | | 92.3 | F | | 39.6 | D | | 22.2 | C | | 21.5 | C |
| **11. Broadway and Myrtle Avenue** | | | | | | | | | | | | | | | | | | | | | | | | | |
| EB - Broadway | LTR | 0.93 | 54.0 | D | 0.93 | 53.2 | D | 1.04 | 85.8 | F | 0.92 | 56.9 | E | 1.11 | 75.6 | E | 0.61 | 6.8 | A | 1.08 | 93.9 | F | 1.00 | 69.0 | E |
| WB - Broadway | LTR | 0.97 | 57.7 | E | 0.97 | 57.7 | E | 0.63 | 19.8 | B | 0.63 | 19.8 | B | 0.53 | 20.4 | C | 0.61 | 27.3 | C | 0.63 | 19.4 | B | 0.58 | 15.6 | B |
| NB - Myrtle Avenue | LTR | 0.76 | 49.9 | D | 0.73 | 47.3 | D | 0.81 | 46.1 | D | 0.81 | 46.1 | D | 1.11 | 112.1 | F | 0.86 | 48.9 | D | 0.68 | 35.3 | D | 0.80 | 48.9 | D |
| SB - Myrtle Avenue | LTR | 1.10 | 108.9 | F | 0.83 | 50.9 | D | 0.89 | 58.0 | E | 0.89 | 58.0 | E | 0.92 | 68.4 | E | 0.77 | 44.1 | D | 0.85 | 51.3 | D | 0.97 | 78.2 | E |
| Overall Intersection | | | 69.0 | E | | 53.2 | D | | 59.2 | E | | 44.7 | D | | 73.5 | E | | 29.4 | C | | 55.2 | E | **0.00** | 52.7 | D |

In Table 12, each intersection is classified into one of three categories according to its overall level of service: LOS A, B, C to mid-D (acceptable for urban areas); LOS mid-D to E (marginally unacceptable); and LOS F (unacceptable). Under the future with improvements scenario, the number of marginally unacceptable or unacceptable intersections is projected to be reduced from 13 to 7 during the weekday AM peak hour; from 6 to 4 during weekday midday peak hour; from 17 to 10 during the weekday PM peak hour; and remain at 5 during the Saturday midday peak hour. Overall, all the falling levels of service (LOS F) are eliminated during all four studied peak hours.

**Table 12: Intersections Classified by LOS**

| | FUTURE 2020 W/O IMPROVEMENTS | | | FUTURE 2020 WITH IMPROVEMENT | | |
|---|---|---|---|---|---|---|
| | ACCEPTABLE LOS A, B, C to Mid-D | MARGINALLY UNACCEPTABLE LOS Mid-D to E | UNACCEPTABLE LOS F | ACCEPTABLE LOS A, B, C to Mid-D | MARGINALLY UNACCEPTABLE LOS Mid-D to E | UNACCEPTABLE LOS F |
| | **Weekday AM Peak Hour** | | | | | |
| Roebling Street | 6 | | | 6 | | |
| Havemayer Street | 2 | 1 | | 3 | | |
| Marcy Avenue | 2 | | 1 | 3 | | |
| Hooper Street | 3 | | | 3 | | |
| Penn Street | 2 | 1 | | 2 | 1 | |
| Union Avenue | 3 | 1 | | 3 | 1 | |
| Lorimer Street | 4 | | | 4 | | |
| Thornton Ave/Debevoise | 3 | | | 3 | | |
| Flushing Avenue | 1 | | 3 | 2 | 2 | |
| M. Garvey Blvd/Sumner Pl | 1 | 1 | 1 | 2 | 1 | |
| Myrtle Avenue | | 3 | 1 | 2 | 2 | |
| **TOTAL** | **27** | **7** | **6** | **33** | **7** | **0** |
| | **Weekday Midday Peak Hour** | | | | | |
| Roebling Street | 6 | | | 6 | | |
| Havemayer Street | 3 | | | 3 | | |
| Marcy Avenue | 3 | | | 3 | | |
| Hooper Street | 3 | | | 3 | | |
| Penn Street | 2 | 1 | | 2 | 1 | |
| Union Avenue | 4 | | | 4 | | |
| Lorimer Street | 4 | | | 4 | | |
| Thornton Ave/Debevoise | 3 | | | 3 | | |
| Flushing Avenue | 2 | 2 | | 4 | | |
| M. Garvey Blvd/Sumner Pl | 3 | | | 3 | | |
| Myrtle Avenue | 1 | 2 | 1 | 1 | 3 | |
| **TOTAL** | **34** | **5** | **1** | **36** | **4** | **0** |
| | **Weekday PM Peak Hour** | | | | | |
| Roebling Street | 4 | | 2 | 5 | 1 | |
| Havemayer Street | 1 | 1 | 1 | 1 | 2 | |
| Marcy Avenue | 2 | 1 | | 2 | 1 | |
| Hooper Street | 2 | 1 | | 2 | 1 | |
| Penn Street | 3 | | | 3 | | |
| Union Avenue | 3 | 1 | | 3 | 1 | |
| Lorimer Street | 4 | | | 4 | | |
| Thornton Ave/Debevoise | 2 | 1 | | 3 | | |
| Flushing Avenue | 1 | 1 | 2 | 3 | 1 | |
| M. Garvey Blvd/Sumner Pl | | 1 | 2 | 1 | 2 | |
| Myrtle Avenue | 1 | 2 | 1 | 3 | 1 | |
| **TOTAL** | **23** | **9** | **8** | **30** | **10** | **0** |
| | **Saturday Midday Peak Hour** | | | | | |
| Roebling Street | 6 | | | 6 | | |
| Havemayer Street | 3 | | | 3 | | |
| Marcy Avenue | 3 | | | 3 | | |
| Hooper Street | 3 | | | 3 | | |
| Penn Street | 3 | | | 3 | | |
| Union Avenue | 4 | | | 4 | | |
| Lorimer Street | 4 | | | 4 | | |
| Thornton Ave/Debevoise | 3 | | | 3 | | |
| Flushing Avenue | 1 | 1 | 2 | 2 | 2 | |
| M. Garvey Blvd/Sumner Pl | 3 | | | 3 | | |
| Myrtle Avenue | 2 | 1 | 1 | 1 | 3 | |
| **TOTAL** | **35** | **2** | **3** | **35** | **5** | **0** |

## 6.3 Air Quality

Table 13, Figures 66 and 67 present the comparative analysis of projected emissions in the study area under the 2020 Future without Improvements and 2020 Future with Improvements scenarios. The air quality improvements are projected to range from 5.5% to 22.4%, depending on type of emission and peak hour. The highest rates of decrease of hazardous emissions are projected to occur during the weekday PM peak hour at approximately 22.4%.

**Table 13: Future Condition with Improvements Emissions**

| | Carbon Monoxide (CO) (kg/h) | | | Oxides of Nitrogen (NOX) (kg/h) | | | Volatile Organic Compounds (VOC) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Without Improvement | With Improvement | % Change | Without Improvement | With Improvement | % Change | Without Improvement | With Improvement | % Change |
| **AM** | 12.5 | 10.7 | -15.0% | 2.4 | 2.1 | -13.2% | 2.9 | 2.4 | -16.3% |
| **MD** | 8.5 | 7.7 | -9.5% | 1.7 | 1.6 | -5.5% | 2.0 | 1.9 | -5.5% |
| **PM** | 14.3 | 11.1 | -22.3% | 2.8 | 2.2 | -22.2% | 3.3 | 2.6 | -22.4% |
| **Saturday** | 9.6 | 9.0 | -6.0% | 1.9 | 1.8 | -5.9% | 2.2 | 2.1 | -6.0% |

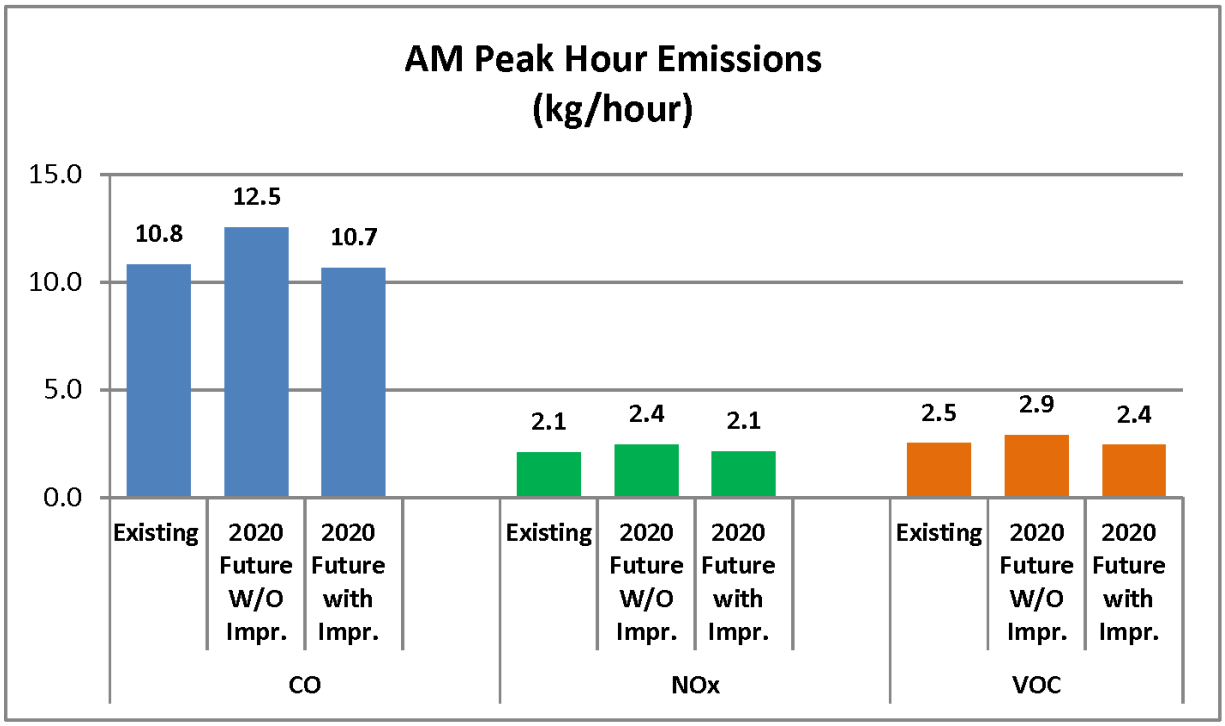



*Figure 66: Emissions Reduction in the Weekday AM Peak Hour*

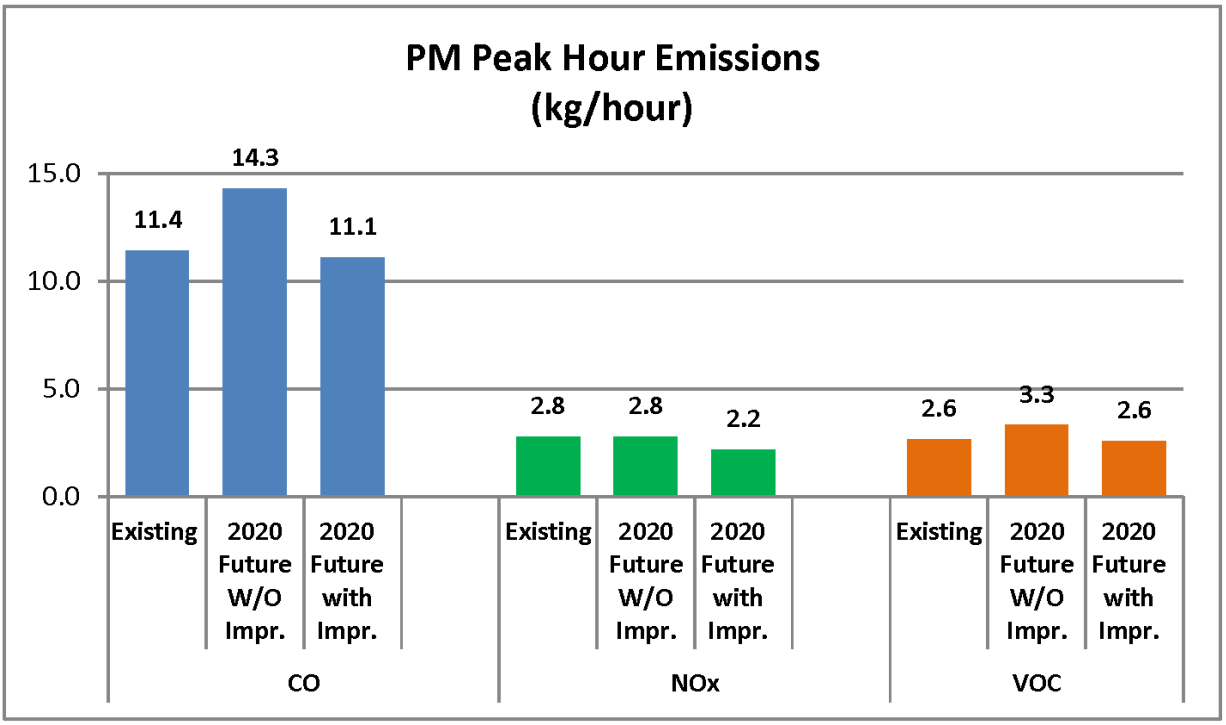



***Figure 67: Emissions Reduction in the Weekday PM Peak Hour***