

CITYWIDE CONGESTED CORRIDORS PROJECT

LIBERTY AVENUE (WOODHAVEN/CROSS BAY BLVD TO VAN WYCK EXPWY)

BOROUGH OF QUEENS

FINAL REPORT

February 2016



City of New York
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Department of Transportation
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A Member of the New York
Metropolitan Transportation Council

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EXECUTIVE SUMMARY

The Liberty Avenue 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, as well as community input and feedback.

The study area of the Liberty Avenue corridor extends from Woodhaven/Cross Bay Boulevard on the west to Van Wyck Expressway on the east. It is contained within Queens Community Boards 9 and 10. Liberty Avenue is surrounded by diverse neighborhoods with many uses, including a mix of commercial, residential with many small and medium size businesses.

The western part of the study corridor, from Woodhaven/Cross Bay Boulevard to Lefferts Boulevard, is under elevated subway tracks serving A line. There are four subway stations at Rockaway Boulevard, 104th Street, 111th Street and the terminus at Ozone Park-Lefferts Boulevard.

Bus line Q112 uses Liberty Avenue throughout the length. In addition, several bus routes cross Liberty Avenue along Rockaway Boulevard (Q7), 111th Street (Q37), Lefferts Boulevard (Q10), 127th Street (Q41) and Van Wyck Expressway Service Road (Q63 and Q9). The major roadways crossing the study corridor are Cross Bay Boulevard, Rockaway Boulevard, Lefferts Boulevard and Van Wyck Expressway Service Roads. There are on and off ramps connecting Liberty Avenue with the northbound and the southbound Van Wyck Expressway. 103rd Avenue located immediately to the north runs parallel to Liberty Avenue in the east-west direction.

The curb to curb distance of the study corridor is 44 feet wide providing one travel lane in each direction and parking line both curbs. East 134th Avenue the roadway is 70 feet wide with two travel lanes in each direction.

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 the future before the recommended improvements are implemented.

The following is the summary of the identified major problems:

- Traffic congestion created by double parking, mostly during weekend days
- Traffic congestion created by loading/unloading activities
- 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.
- Loading zones at locations with high loading/unloading activities
- Pedestrian and safety improvements at Liberty Avenue and 133rd Street
- Coordination of traffic signal timing near Van Wyck Expressway
- LPI at Liberty Avenue and Lefferts Boulevard

- Coordination of traffic signal timing near Van Wyck Expressway
- LPI at Liberty Avenue and Lefferts Boulevard
- Delivery windows at five locations

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

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. Liberty Avenue 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 Liberty Avenue 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.

The public outreach effort to obtain community input was a critical component throughout the study process. The participants consisted of various stakeholders including residents, local businesses, transportation providers, Community Board members, elected officials, city and state agencies, and various interest groups. Input from the outreach effort helped identify issues and were incorporated into the development of various potential improvements and the selection of the recommended improvements.

1.2 ORGANIZATION OF REPORT

This technical memorandum is organized into the following sections:

- Section 1 “**Introduction**” provides a brief overview of the study;
- Section 2 “**Data Collection**” presents a synopsis and results of the data collection effort;
- Section 3 “**Existing Conditions and Analysis**” summarizes the existing conditions from field observations, public input, and technical analysis;
- Section 4 “**Future Conditions without Improvements**” uses future-estimated traffic volumes, roadway conditions and land use changes to project future traffic conditions that can be expected along the corridor without improvements recommended as part of this study;
- Section 5 “**Improvements**” summarizes the recommended 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 Liberty Avenue as one of the congested corridors in the borough of the Queens to be studied under the CCCP. Liberty Avenue is an important approximately 8.0 mile long thoroughfare that extends from Mother Gaston Boulevard, Brownsville Neighborhood in Brooklyn to Farmers Boulevard in Hollis Section of Queens. The segment being studied in this report is nearly 2 miles long section of Liberty Avenue between Woodhaven Boulevard and Van Wyck Expressway.

The study area is located between Richmond Hill and South Ozone Park neighborhood and traversing Community Boards 9 and 10 (Figure 1). Liberty Avenue from Woodhaven Boulevard to 134th Street is mostly 44-foot wide roadway consisting of one travel lane and parking in each direction, while from 134th Street to Van Wyck Expressway is 60 foot wide roadway consisting of two travel lanes and parking along curblin. Liberty Avenue Bridge over Van Wyck Expressway is 70 foot wide consisting five travel lanes and no parking is permitted. The corridor is surrounded by a diverse neighborhood with a mix of commercial and residential land uses. A total of 33 intersections are signalized, while the rest of the intersections are either unsignalized or uncontrolled.

There are numerous intersections within the study corridor; however, the following major intersections have been selected for detailed analysis:

- Liberty Avenue and 104th Street
- Liberty Avenue and 109th Street (unsignalized) (subway stairs)
- Liberty Avenue and 111th Street
- Liberty Avenue and 113th Street (unsignalized) (high crash location)
- Liberty Avenue and 117th Street (high crash location)
- Liberty Avenue and Lefferts Boulevard
- Liberty Avenue and 120th Street (high crash location)
- Liberty Avenue and 121st Street
- Liberty Avenue and 122nd Street
- Liberty Avenue and 123rd Street north
- Liberty Avenue and 123rd Street south (unsignalized)
- Liberty Avenue and 132nd Street (unsignalized) (high crash location)
- Liberty Avenue and 133rd Street
- 103rd Avenue and 133rd Street
- Liberty Avenue, 134th Street and 103rd Avenue (unsignalized)
- Liberty Avenue and Van Wyck Expressway west service road and southbound exit ramp
- Liberty Avenue and Van Wyck Expressway east service road and northbound on-ramp

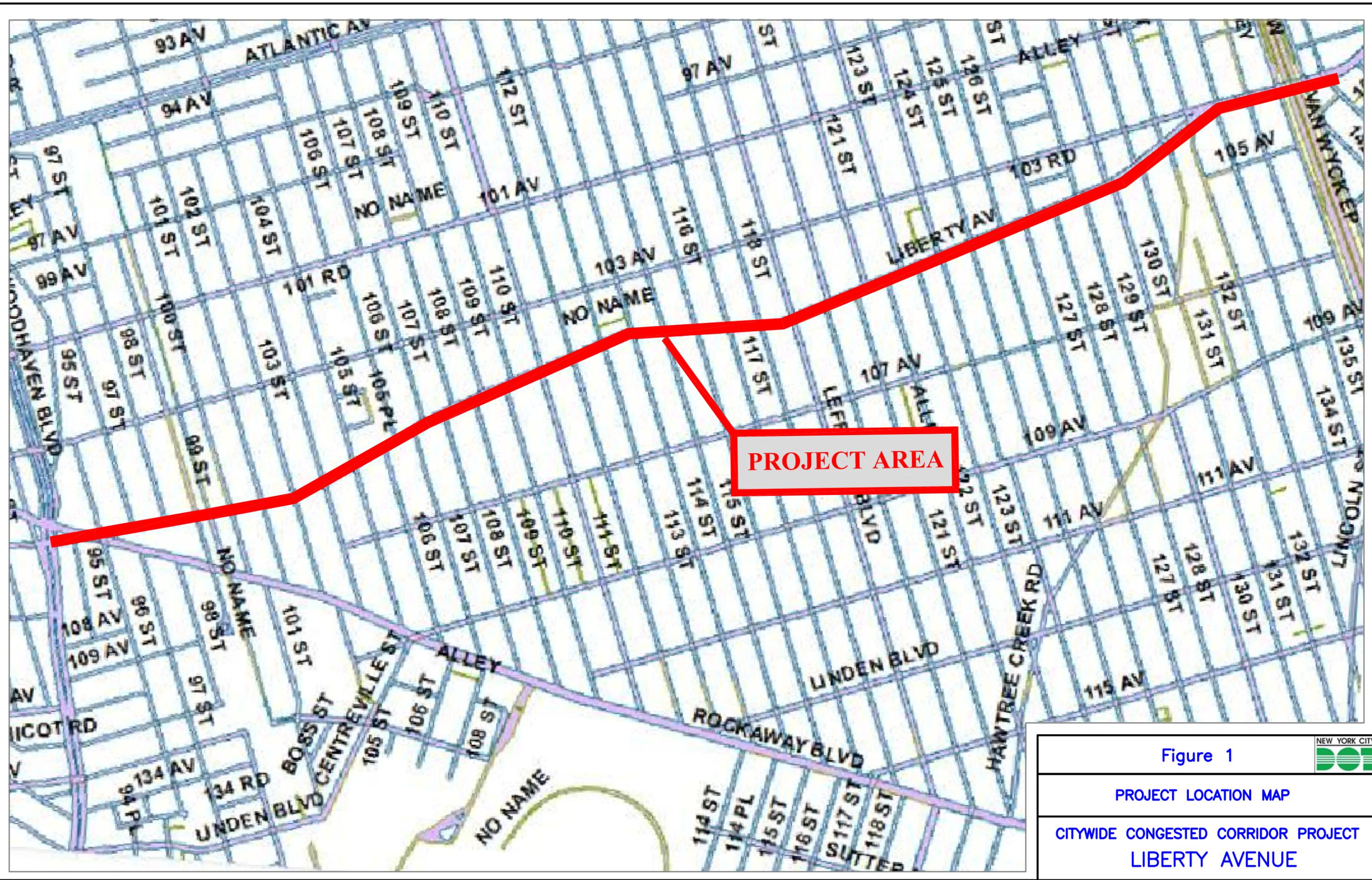


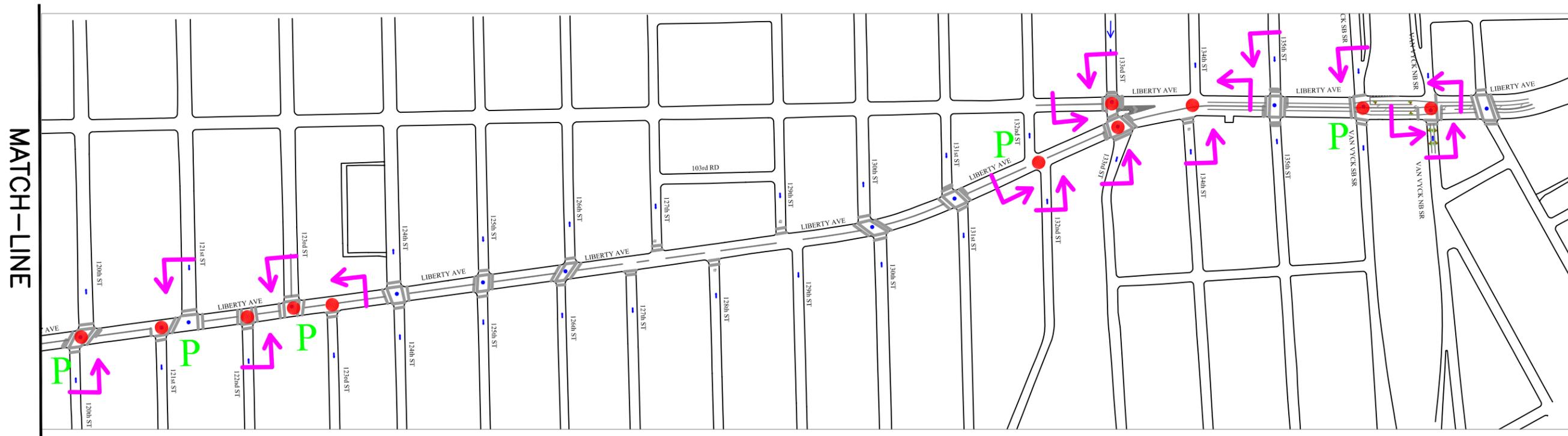
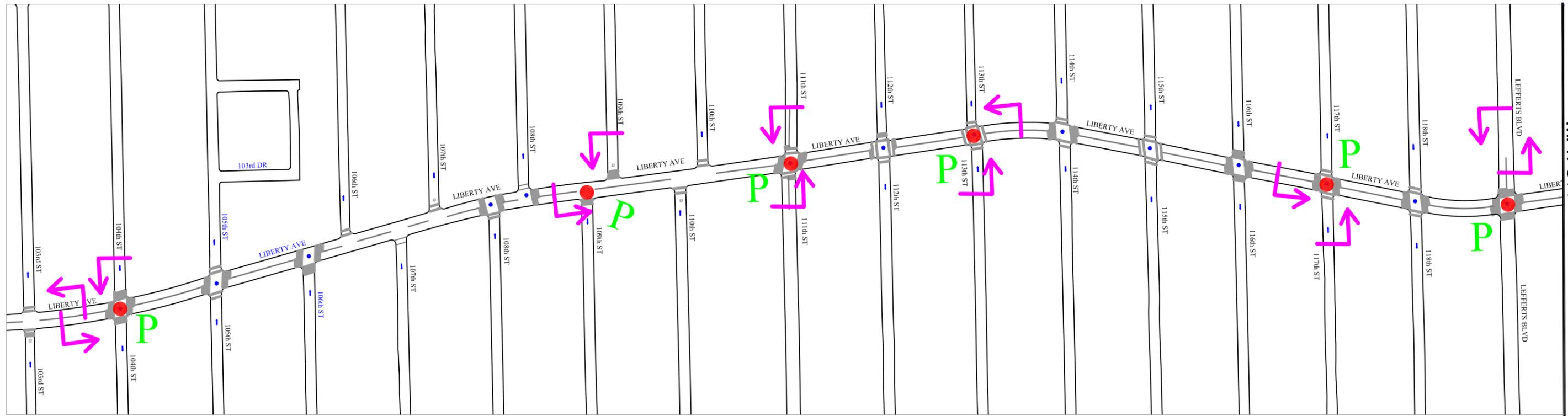
Figure 1
PROJECT LOCATION MAP
CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE



2. DATA COLLECTION

The comprehensive data collection program was conducted along the corridor in order to obtain a full understanding of the existing physical and traffic conditions currently present on Liberty Avenue. The collection plan is presented in Figure 2 and summarized below. Supplemental data was also obtained from the Woodhaven Boulevard Congested Corridor study.

- **Physical Inventories** – Geometries for each study intersection were inventoried and included the included the number of lanes per direction, lane widths, pavement markings, sidewalk widths, corner radii, crosswalk widths and lengths, curbside parking regulations, but stops, signal timings and all other traffic signs.
- **ATR machines** – Automatic Traffic Recorder machines were placed at 30 locations covering 17 intersections, recording in 15-minute intervals, for 24-hours per day over a 9 day period.
- **TMC and VCC** – Manual Turning Movement and Vehicle Classification (cars, trucks and buses) counts were conducted over a three day mid-week period, during the same week as the ATRs. Because of the numerous intersections along the corridor only some intersections were counted for a full peak period. However, in order to be able to analyze the corridor as a balanced network, the rest were counted as 15-minute samples within the peak period.
 - Full Counts – 17 locations were counted for the full peak periods in 15-minute intervals from 7:00-10:00 AM, 12:00-2:00 PM, 3:30-7:00 PM on weekdays and from 12:00-3:00 on Saturday.
 - Sample Counts – 28 locations were counted as a sample count for 15-minutes within the peak periods.
- **Pedestrian Counts** - Pedestrian volumes were counted in 15-minute intervals concurrent with the TMCs during the same peak periods for 12 selected locations identified to have high pedestrian activities.
- **Travel Time Runs** – Travel time and delay runs were conducted using the ‘floating car technique’ to measure travel speeds and delays. Approximately 4 to 5 runs were performed for each direction for three mid-week days and two Saturdays during the four peak periods mentioned above and concurrent with the TMCs.
- **Parking Inventory** – In addition to curbside regulations collected mentioned above, a detailed parking analysis was conducted, which included overall on-street parking capacity, curbside parking occupancy and turnover rates on an hour-by-hour basis, loading/unloading frequencies, and double parking occurrences and duration.



- LEGEND**
- TMC FULL COUNTS
 - ↖ ATR COUNTS
 - P PEDESTRAIN COUNTS


Figure 2
DATA COLLECTION PLAN
CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE

3. EXISTING CONDITIONS AND ANALYSIS

3.1 ROADWAY NETWORK AND GEOMETRY

Liberty Avenue within the study area is a two-way east-west roadway. The intersection of Cross Bay Boulevard/Woodhaven Boulevard and Liberty Avenue is a large and complicated intersection used by very high traffic volumes. Liberty Avenue is closed with jersey barriers at this intersection and Liberty Avenue is a one-way (eastbound) roadway between Woodhaven /Cross Bay Boulevard and Rockaway Boulevard. The western section between 96th Street and 133rd Street is a 44-foot wide roadway consisting of two 12-foot travel lanes in each direction and curbside parking on both sides (Figure 3). The eastern section between 134th Street and Van Wyck Expressway southbound Service Road consists of two travel lanes in each direction with parking along both curbsides. The Liberty Avenue segment east of Van Wyck Expressway southbound Service Road widens to 70 foot wide roadway consisting of two through lanes in both directions and left turn lanes. Parking is not permitted at any time on this section.

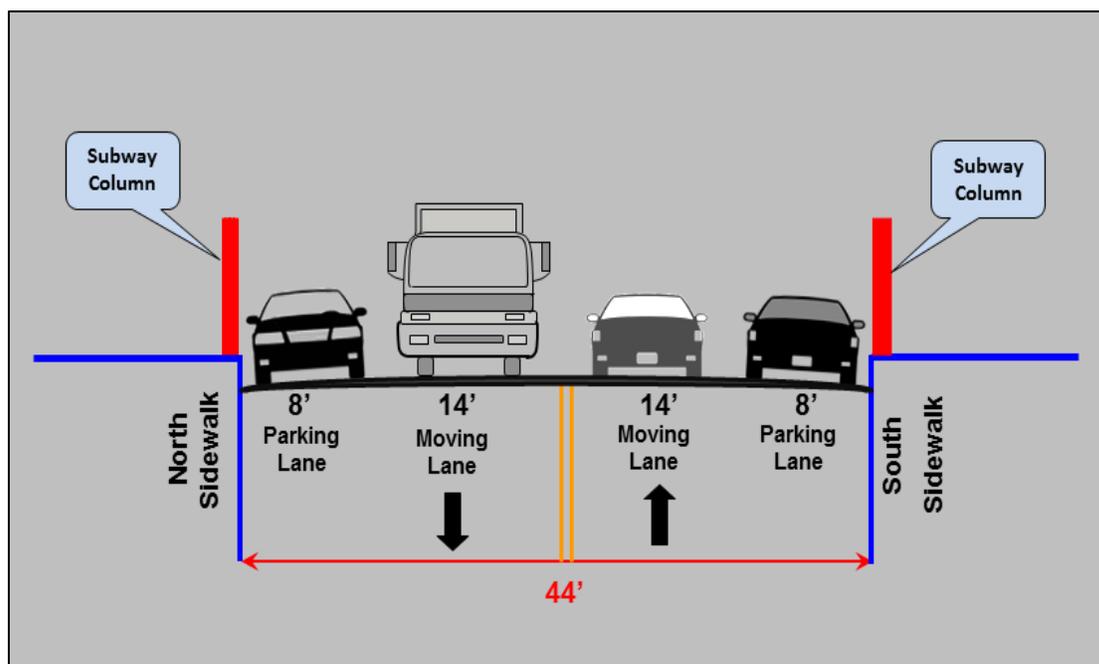


Figure 3: Liberty Avenue Typical Cross Section

There are nearly 50 intersections within the project limits, of which 30 are signalized and the remaining are either STOP controlled or not controlled. Most traffic activity is concentrated either at southwest end of the study area at the intersections of Liberty Avenue and Woodhaven/Cross bay Boulevard or the north-east end at the intersections of Liberty Avenue with Van Wyck Expressway ON and OFF Ramps. The intersection of Liberty Avenue and Woodhaven/Cross Bay Boulevard has been studied in year 2010 as part of NYC-DOT street improvement project. All side roadways crossing Liberty Avenue are one-way streets with exception 111th Street, Lefferts Boulevard and the north leg of the 123rd Street which are two-way roadways.

3.2 TRAFFIC VOLUMES

Directional average weekday daily traffic (AWDT) volumes vary at different points along Liberty Avenue, generally increasing from east to west. As indicated in the charts the highest volumes are found in the vicinity of the Van Wyck Expressway interchange reaching 10,879 vehicles/day in the eastbound direction, and 13,707 vehicles/day in the westbound direction. However, daily traffic volumes become lower in the western side of the project limits and remains relatively consistent between 4000-5000 vehicle/per hour between 104th Street and 134th Street. Figures 4 and 5 present directional AWDT volumes.

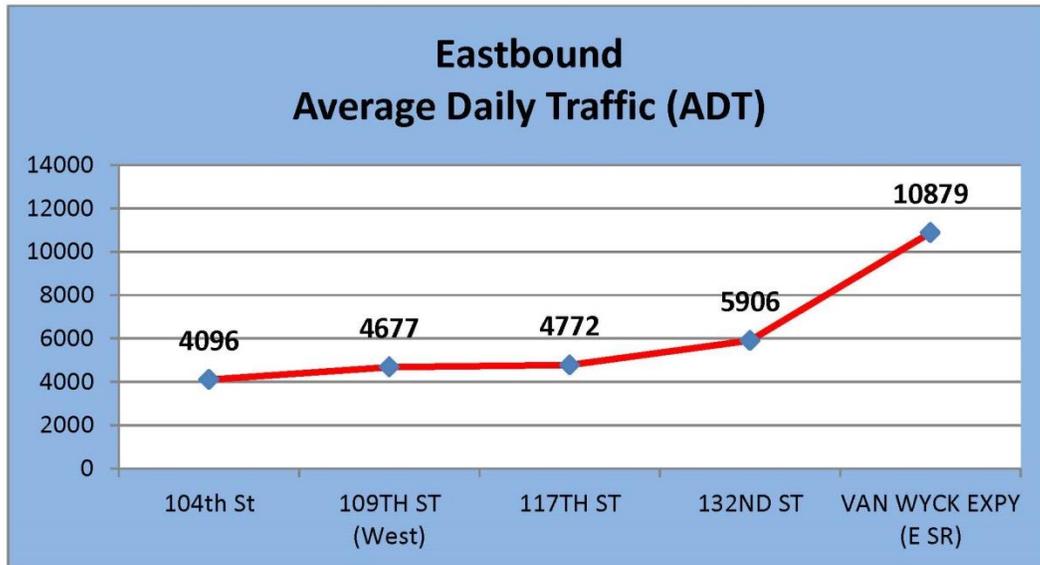


Figure 4: Eastbound Average Weekday Daily Traffic Volumes

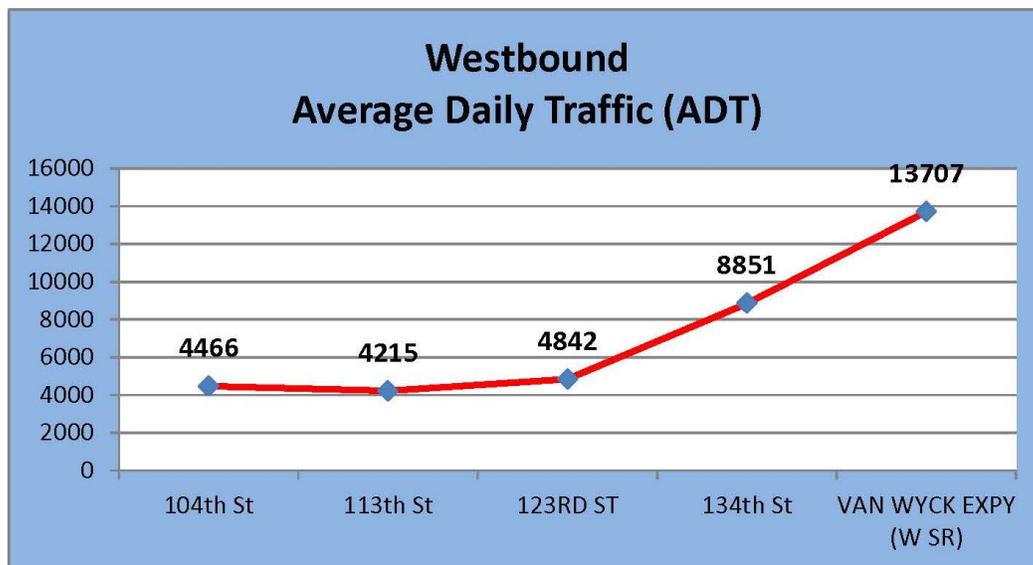


Figure 5: Westbound Average Weekday Daily Traffic Volumes

Hourly traffic volumes are shown in Figures 6 and 7 for weekday AM, PM and Saturday midday peak hours, respectively, for both the eastbound and the westbound directions. Based on the traffic data collected, the peak hours were determined to be:

- Weekday AM peak: 7:45 AM to 8:45 AM
- Weekday PM peak: 5:15 PM to 6:15 PM
- Saturday Midday peak: 1:00 PM to 2:00 PM

The eastbound peak hour traffic volumes for the AM, PM and Saturday Midday are shown in Figure 6. As shown below, traffic volumes generally increase from west to east during any of the studied peak hours. Generally, traffic volumes from 96th Street to 133rd Street stay under 500 vehicles/hour. From 133rd Street to Van Wyck Expressway Service Roads traffic volumes gradually increase while remaining at about 700 vehicle/hour, except in AM Peak, when volumes reach the highest recorder volumes at nearly 900 vehicles/hour.

The westbound peak hour traffic volumes follow similar pattern as the eastbound traffic, where volumes are higher in the eastern end and then continue to decrease for all peak hours. During the AM peak from 111th Street to 96th Street volumes increase from nearly 250 vehicles/hour to nearly 550 vehicles/hour.

Generally, traffic volumes are not excessive at any traffic directions, not any of the study periods.

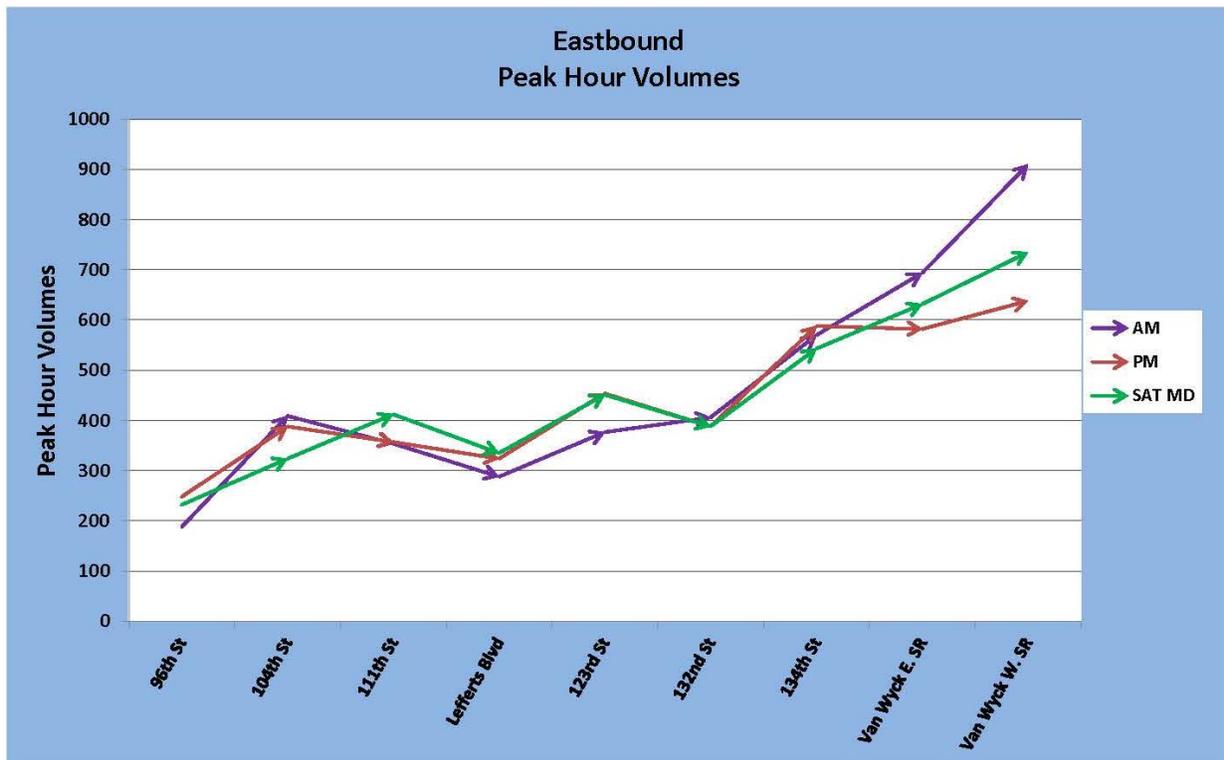


Figure 6: Eastbound Peak Hour Traffic Volumes

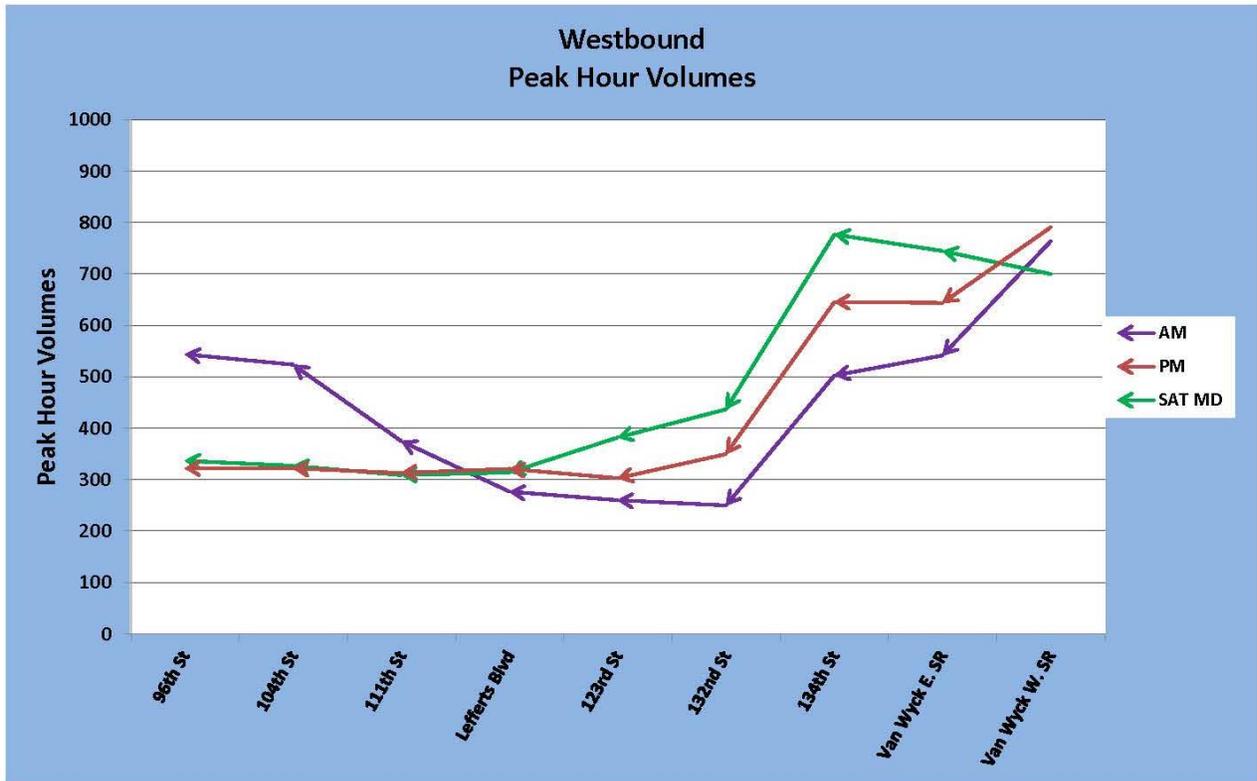


Figure 7: Westbound Peak Hour Traffic Volumes

Balanced traffic flow maps, developed using both ATR and TMC data for the four peak hours, are shown in Figures 8 through 11.

Liberty Avenue is a designated local truck route. There are also several bus routes along East Gun Hill Road, and along major cross streets – Jerome Avenue, Bainbridge Avenue, Webster Avenue and White Plains Road)

Heavy vehicle percentages were obtained from the vehicle classification counts. Generally, trucks comprise about 6% to 10% of the overall traffic during the AM Peak, 5% during the PM Peak and 3% on Saturdays.

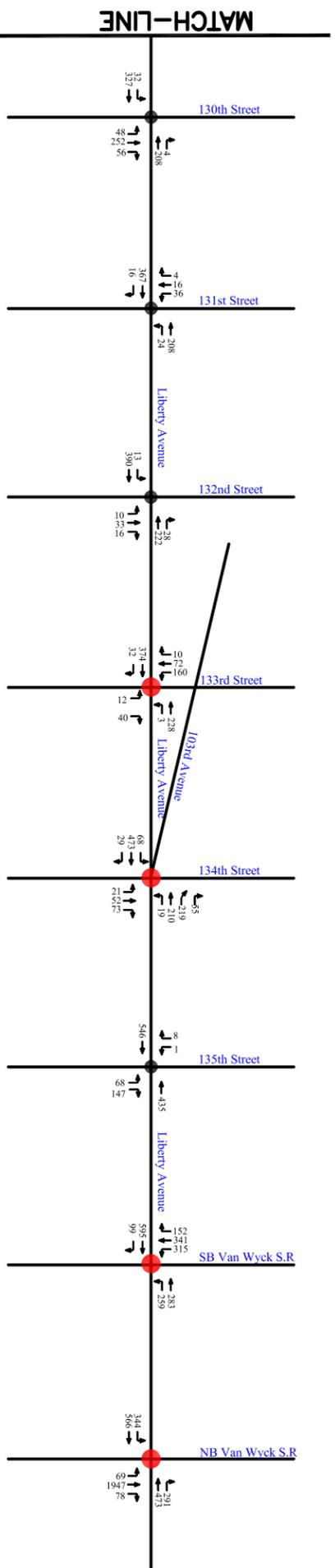
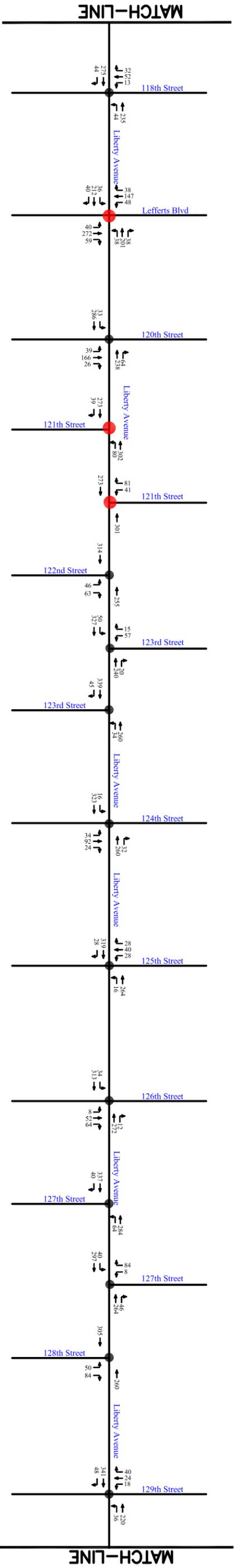
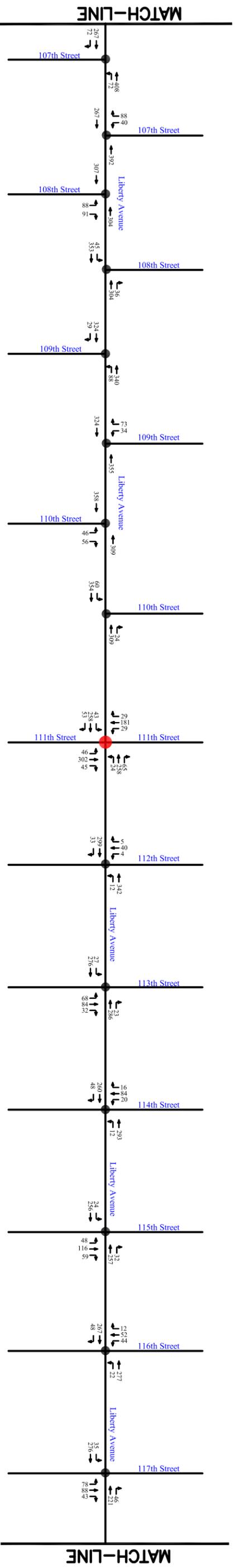
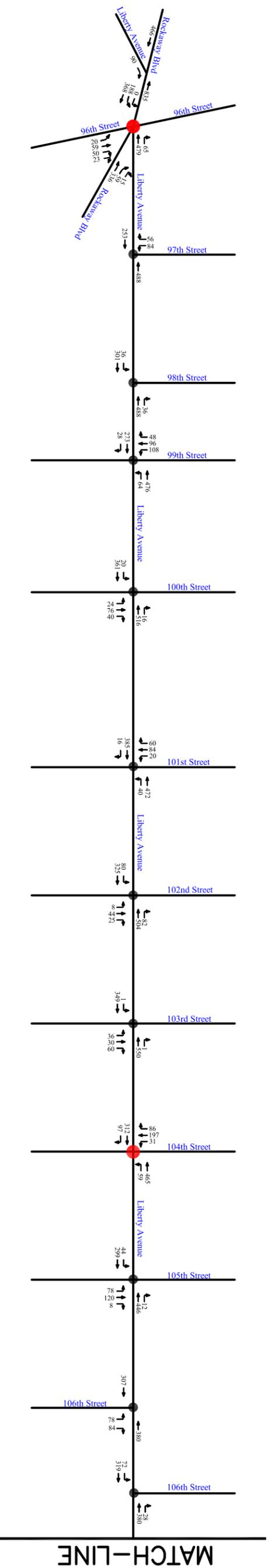


Figure 8

**EXISTING VEHICULAR VOLUMES
WEEKDAY AM PEAK HOUR**

**CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE**



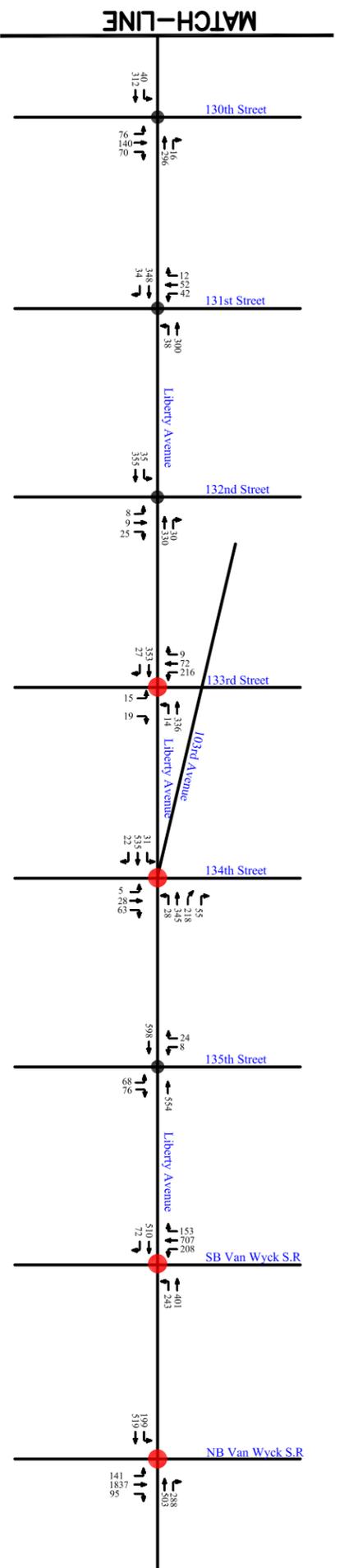
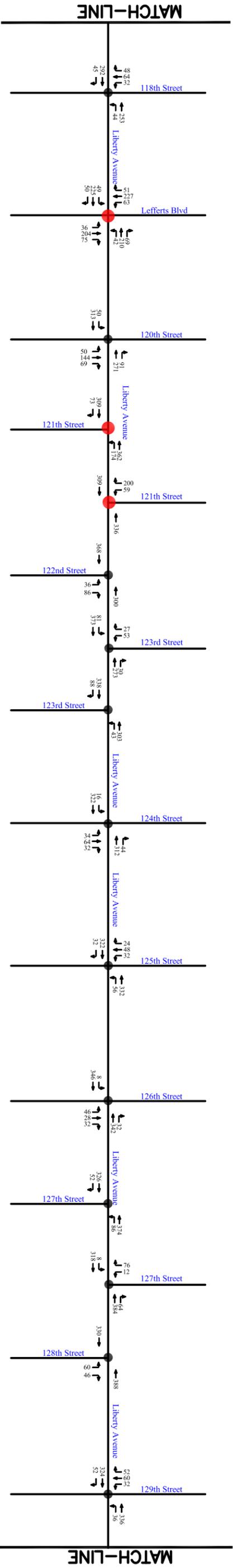
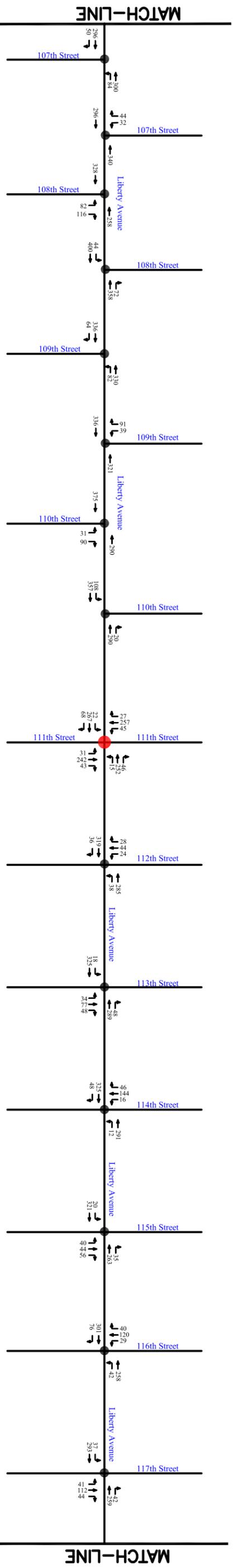
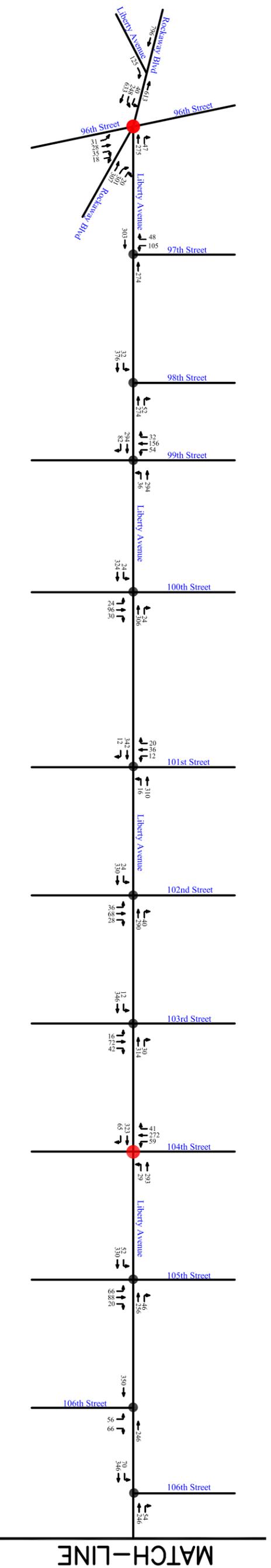


Figure 9

**EXISTING VEHICULAR VOLUMES
WEEKDAY PM PEAK HOUR**

**CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE**



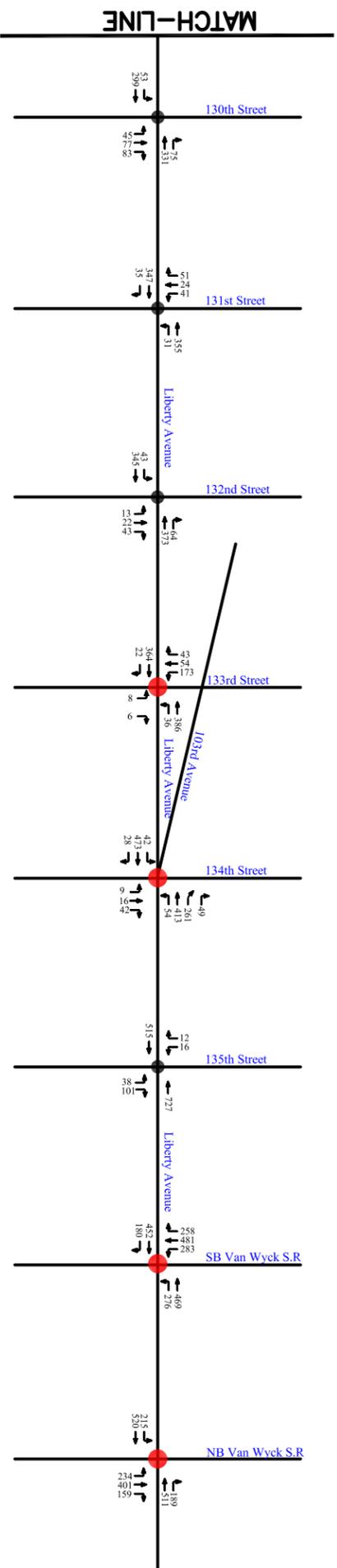
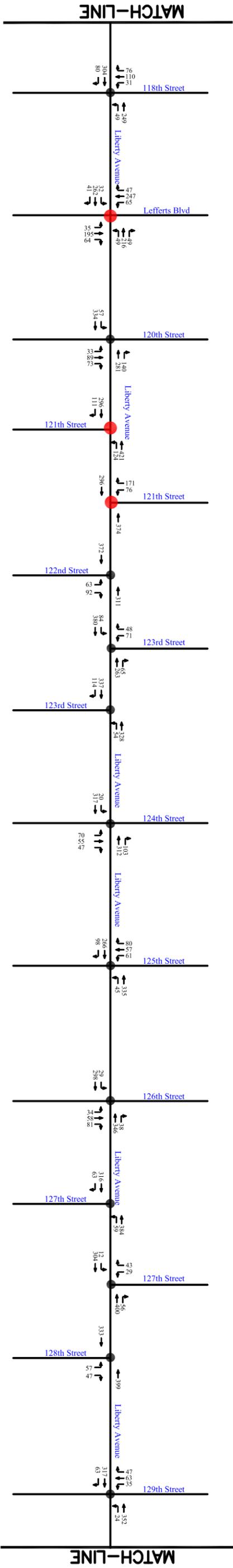
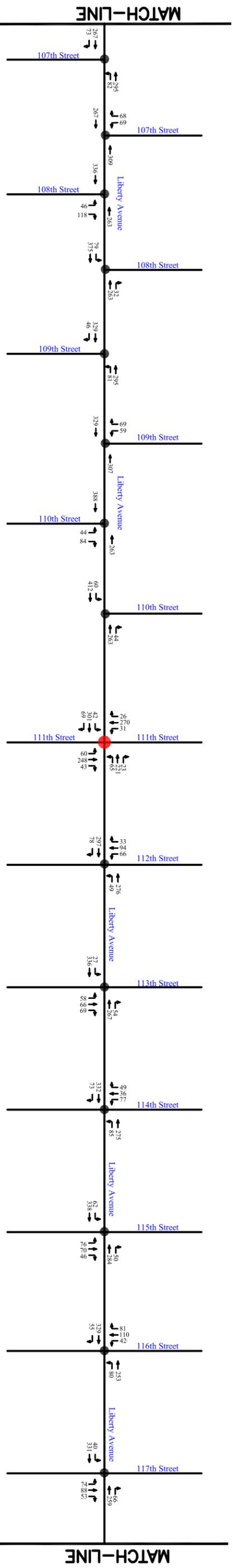
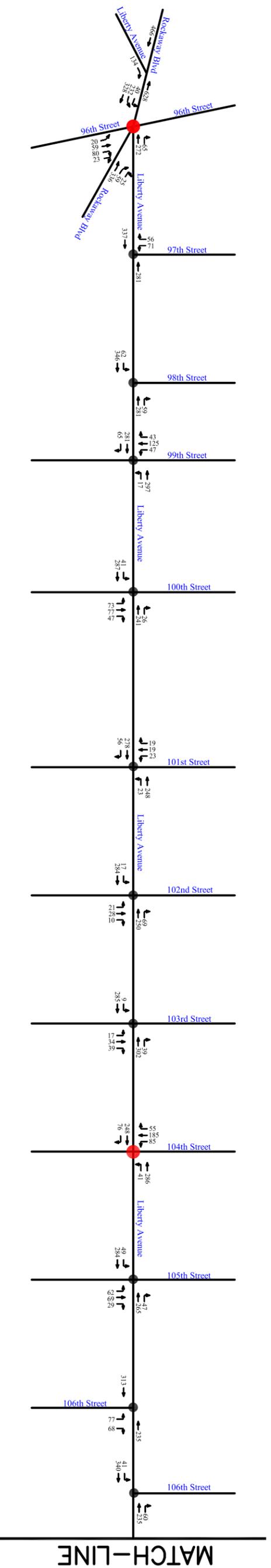


Figure 10



**EXISTING VEHICULAR VOLUMES
SATURDAY MD PEAK HOUR
CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE**

3.3 TRAVEL TIMES 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 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 presents the details of the corridor travel times and travel speeds for each peak hour.

TABLE 1: EASTBOUND TRAVEL TIMES & 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)
Cross Bay Blvd	104 th Street	1.76	14.2	2.2	11.4	2.42	10.4	3.13	8.0
104 th Street	111 th Street	1.57	13.8	1.66	13.0	1.86	11.6	2.27	9.5
111 th Street	Lefferts Blvd	1.89	12.2	3.09	7.5	2.59	8.9	5.0	4.6
Lefferts Blvd	123 rd Street	1.08	9.8	1.50	7.0	1.31	8.0	2.08	5.1
123 rd Street	133 rd Street	2.12	13.8	2.45	11.9	2.91	10.0	3.65	8.0
133 rd Street	Van Wyck Expwy East Service Road	1.7	6.5	1.02	10.8	1.59	6.9	1.39	7.9
Corridor Total/Avg.		10.12	11.9	11.92	11.0	12.69	9.5	17.5	6.9

TABLE 2: WESTBOUND TRAVEL TIMES & SPEEDS

From	To	Weekday AM		Weekday Midday		Weekday PM		Saturday Midday	
		Travel time (min)	Speed (mph)						
Van Wyck Expwy East Service Road	133 rd Street	1.17	9.4	1.36	15.29	1.16	9.5	1.43	7.7
133 rd Street	123 rd Street	1.84	15.8	2.46	16.87	2.05	14.2	3.72	7.8
123 rd Street	Lefferts Blvd	0.91	11.6	1.49	9.28	1.64	6.4	2.16	4.9
Lefferts Blvd	111 th Street	1.46	15.8	2.17	15.20	1.97	11.7	2.98	7.7
111 th Street	104 th Street	1.45	14.9	1.53	22.20	1.57	13.8	1.70	12.7
104 th Street	Rockaway Blvd	3.64	6.8	2.84	12.27	3.29	7.5	3.48	7.1
Corridor Total/Avg.		10.47	11.5	11.85	10.0	11.6	10.3	15.46	7.8

As indicated in Tables 1 and 2, the lowest travel speeds in the westbound direction were recorded during Saturday Midday Peak Hour in both eastbound and the westbound directions.

3.4 PEDESTRIANS

Pedestrian counts were conducted at seven intersections, which were selected based on field observations to have the highest pedestrian activities.

Figure 11 illustrates the pedestrian volumes during the weekday AM, PM and Saturday midday peak hours. Generally, the highest pedestrian volumes were between 117th Street and 121st Street. The highest pedestrian volumes were found to be during the Saturday midday peak, which is consistent with the fact that Liberty Avenue is a major shopping destination on Saturdays. The highest pedestrian volume during a single peak hour was 2127 pedestrians/hour at 120th Street during the Saturday midday peak hour. Detailed pedestrian counts by movement are illustrated in Figures 12 to 14 for weekday AM, PM and Saturday midday peak hours, respectively.

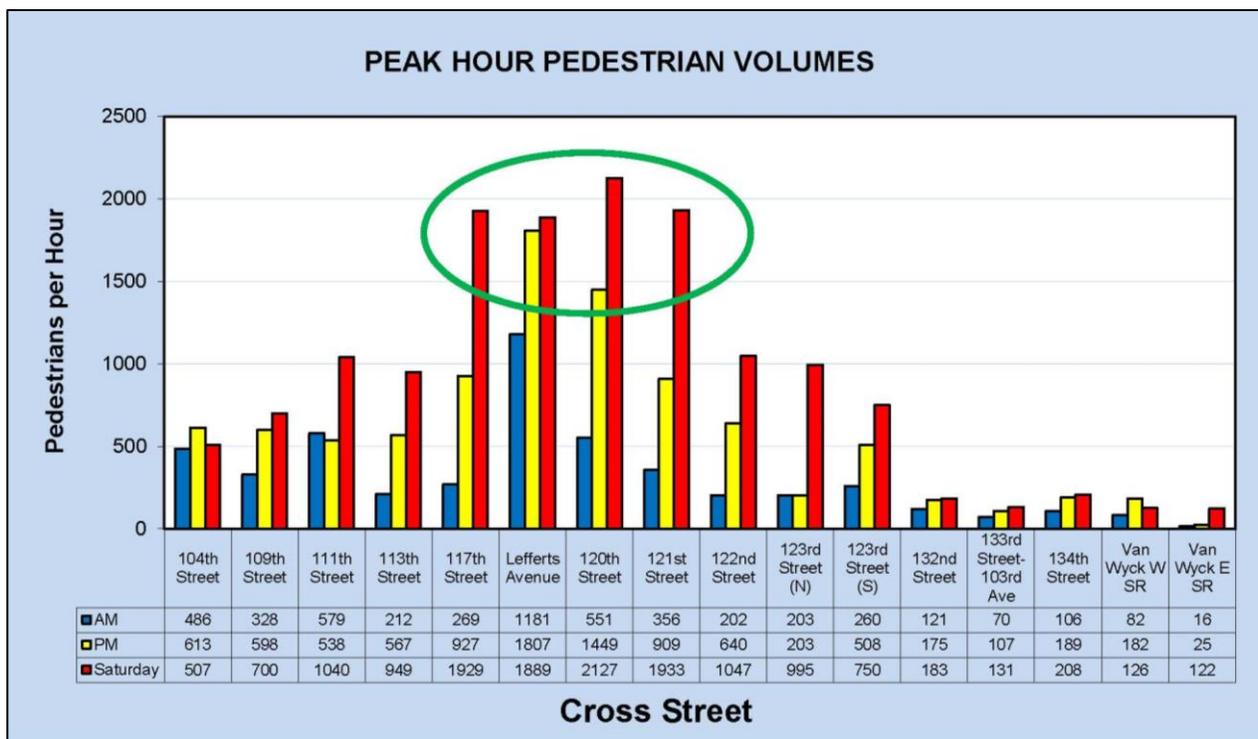


Figure 11: Peak Hour Pedestrian Volumes

Analysis of pedestrian flow involves quantifying the comfort level for pedestrians using level-of-service designations were conducted for 11th Street and Lefferts Avenue. Corners and crosswalks are analyzed using parameters such as pedestrian volume, effective street corner/crosswalk area, conflicting turning vehicles, obstructions, and pedestrian signal timings.

Pedestrian flow conditions were analyzed using the Highway Capacity Manual (HCM) methodology for corners and crosswalks. The methodology for these analyses is based on pedestrian spacing, expressed as square feet per pedestrian during the peak 15-minute period.

All operate at LOS C or better.

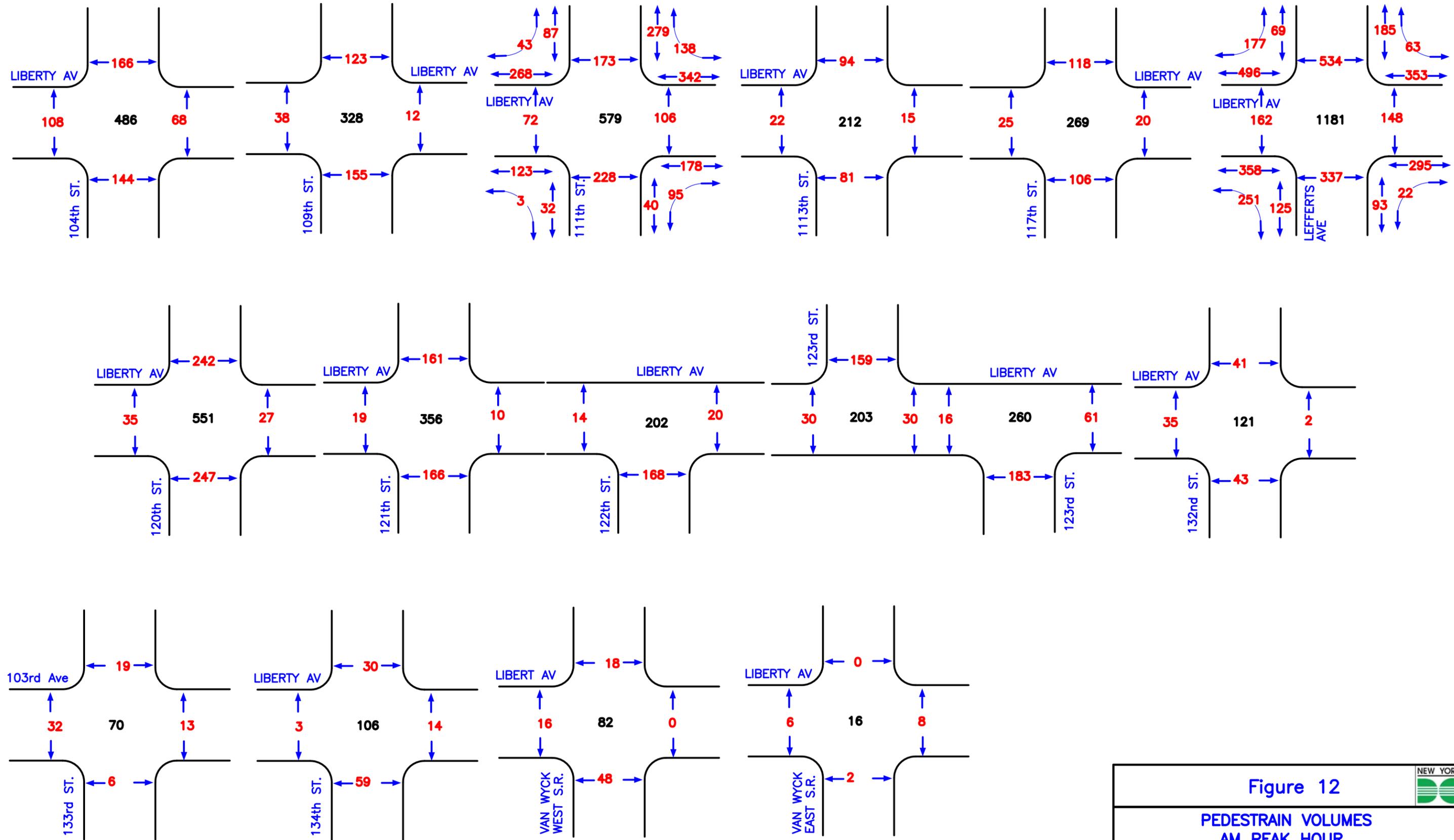


Figure 12
 PEDESTRAIN VOLUMES
 AM PEAK HOUR
 CITYWIDE CONGESTED CORRIDOR PROJECT
 LIBERTY AVENUE



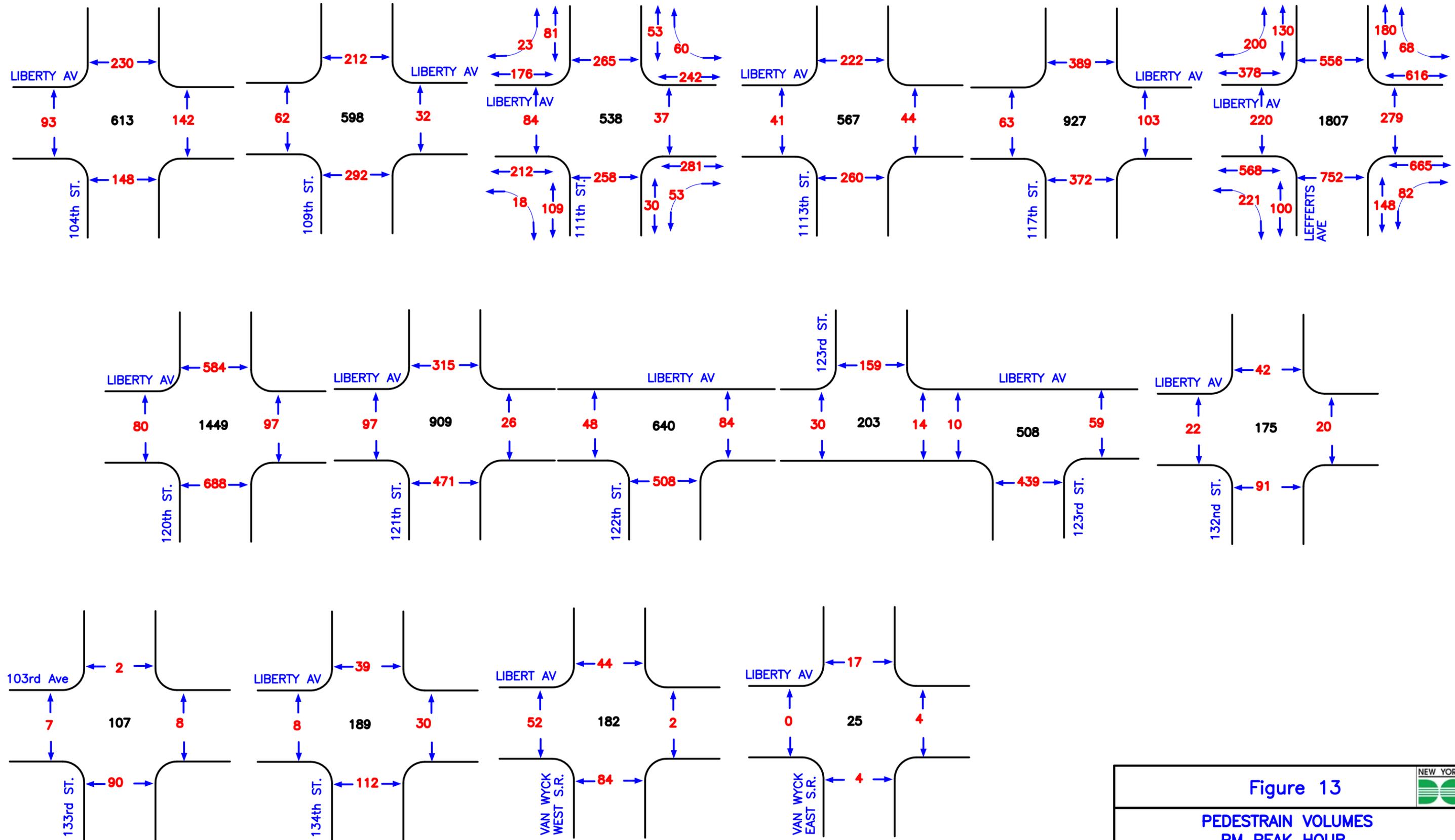




Figure 13
 PEDESTRAIN VOLUMES
 PM PEAK HOUR
 CITYWIDE CONGESTED CORRIDOR PROJECT
 LIBERTY AVENUE

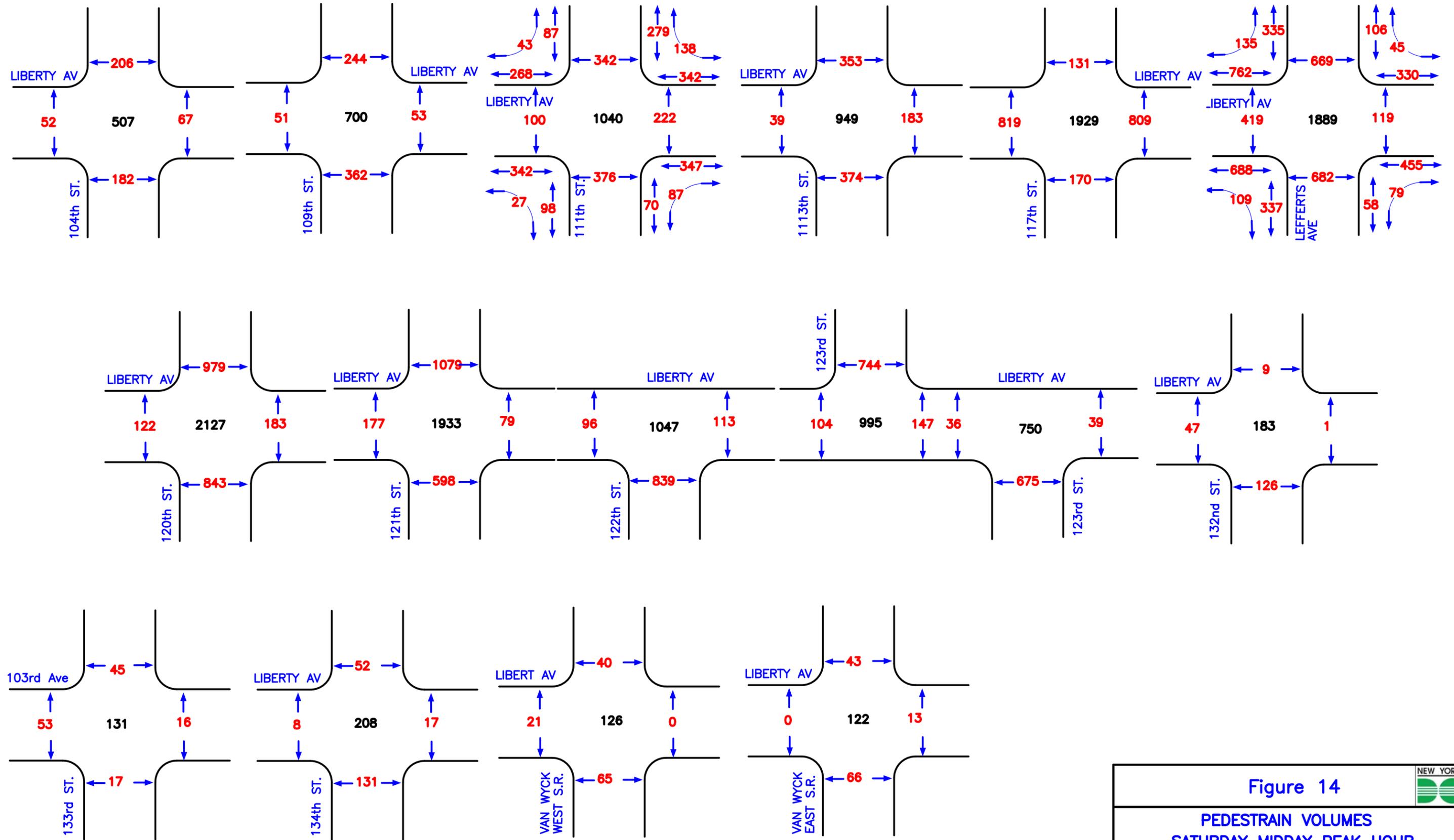




Figure 14

PEDESTRAIN VOLUMES

SATURDAY MIDDAY PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT

LIBERTY AVENUE

3.5 PARKING

An inventory of existing on-street parking was conducted along Liberty Avenue between Cross Bay and Van Wyck Expressway East Service Road. The details of the parking regulations are presented in Figure 17.

There are 459 legal parking spaces on Liberty Avenue between Cross Bay and Van Wyck Expressway East Service Road. A total of 219 spaces are located along the north curb, and 240 are along the south curb. There are 400 metered parking spaces and 59 non-metered parking spaces. In the western part of the project from 104th Street to 124th Street parking is permitted as “One hour parking 9am-7pm”, while on the eastern part from 124th Street to Van Wyck Expressway parking is permitted as “Two hour parking 9am-7pm”.

Street cleaning regulations apply along both the north and south curblines.

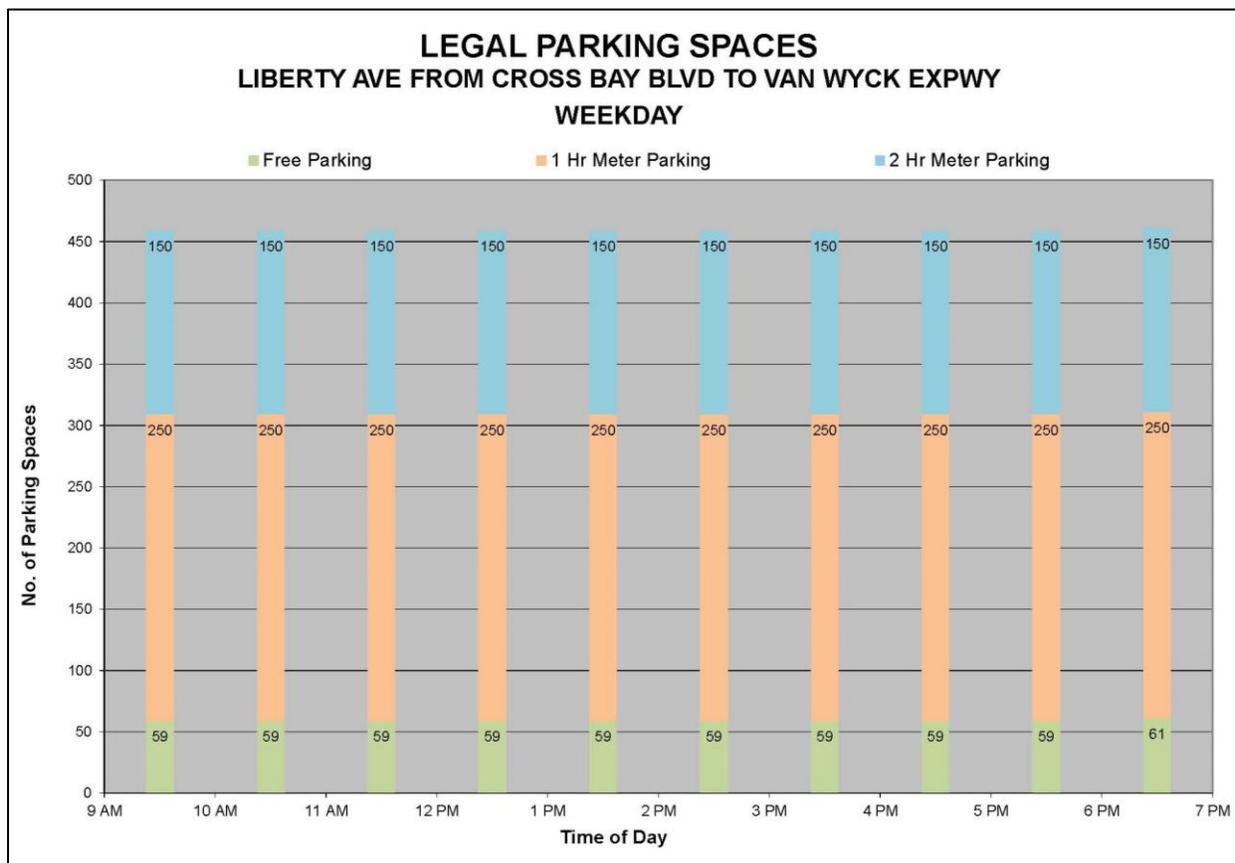
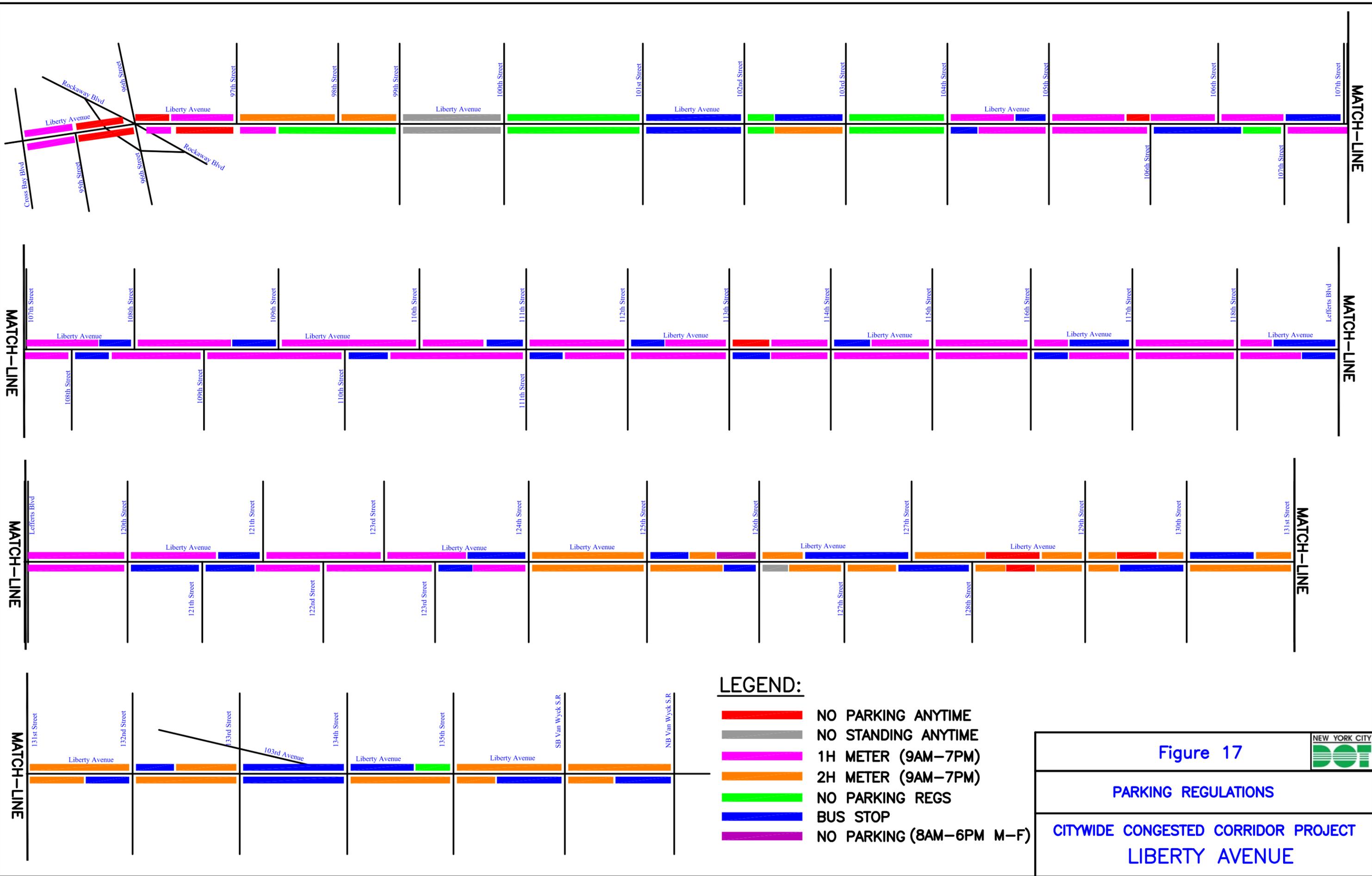


Figure 15: Weekday Parking Supply by Time of Day



Figure 16: Weekend (Saturday) Parking Supply by Time of Day



A summary of parking occupancy is presented in Figure 18 and 19. The 459 parking spaces fall into three categories: one-hour, two-hour and free (not regulated) parking. The one- and two-hour time limits are in effect every day except Sunday 9:00AM-7:00PM on both the north and the south side. The free parking spaces are mostly located between 97th Street and 104th Street. There are also significant section of the study area where parking is not permitted during any times.

Parking activities were recorded in one hour tours on one midweek day between 7AM and 7PM in November 2011. Vehicle types were classified as passenger vehicle, commercial van, truck, police, fire or other emergency vehicle. Illegally parked vehicles were recorded as double parked, fire hydrant, standing in no-standing areas, etc. Hourly utilization was determined for each blockface. License plates were recorded to determine parking duration.

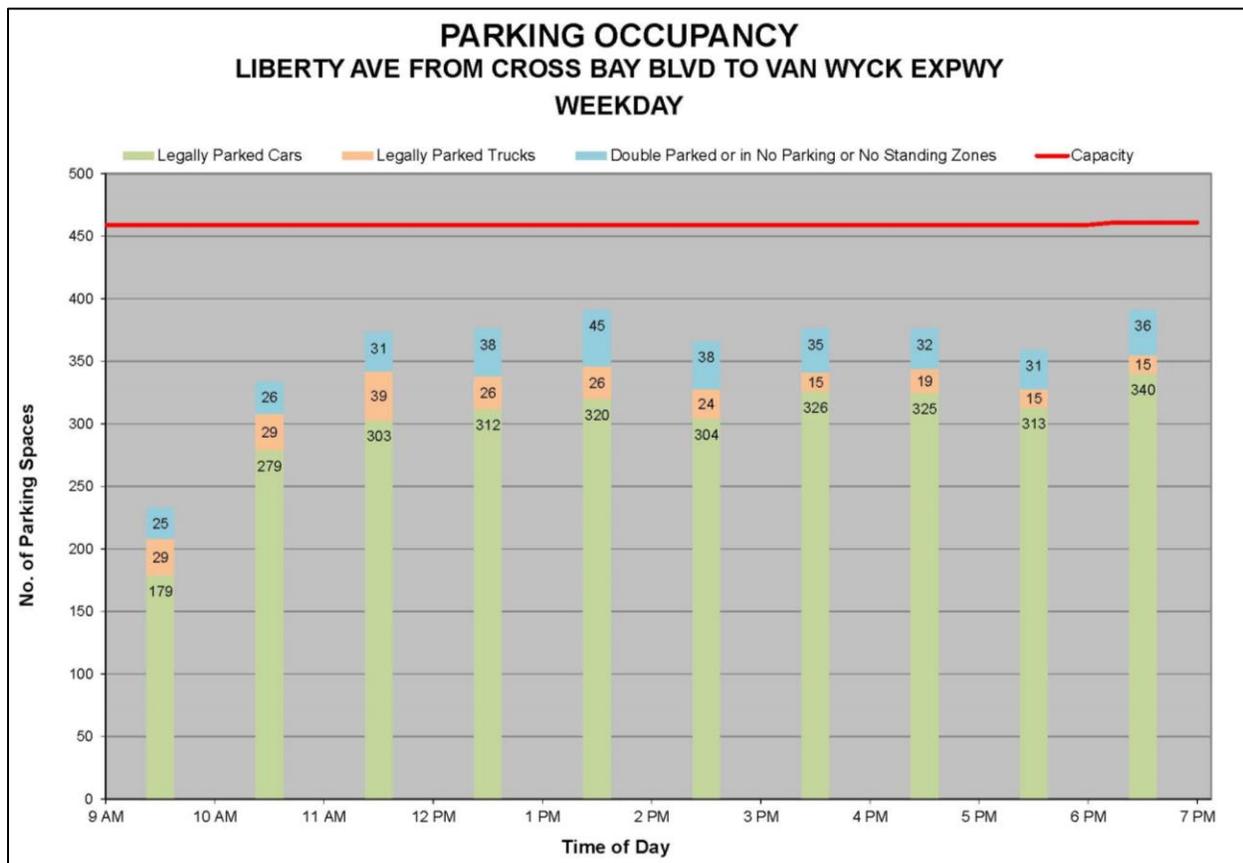


Figure 18: Weekday Parking Occupancy by Time of Day

As indicated in Figure 18, during any time of the day during a typical weekday parking occupancy is well under capacity. However, during the Saturday parking occupancy is close to capacity or exceeding capacity. The highest occupancy rate is during the midday, which is consistent with fact that Saturday is the busiest day of the week for shopping.

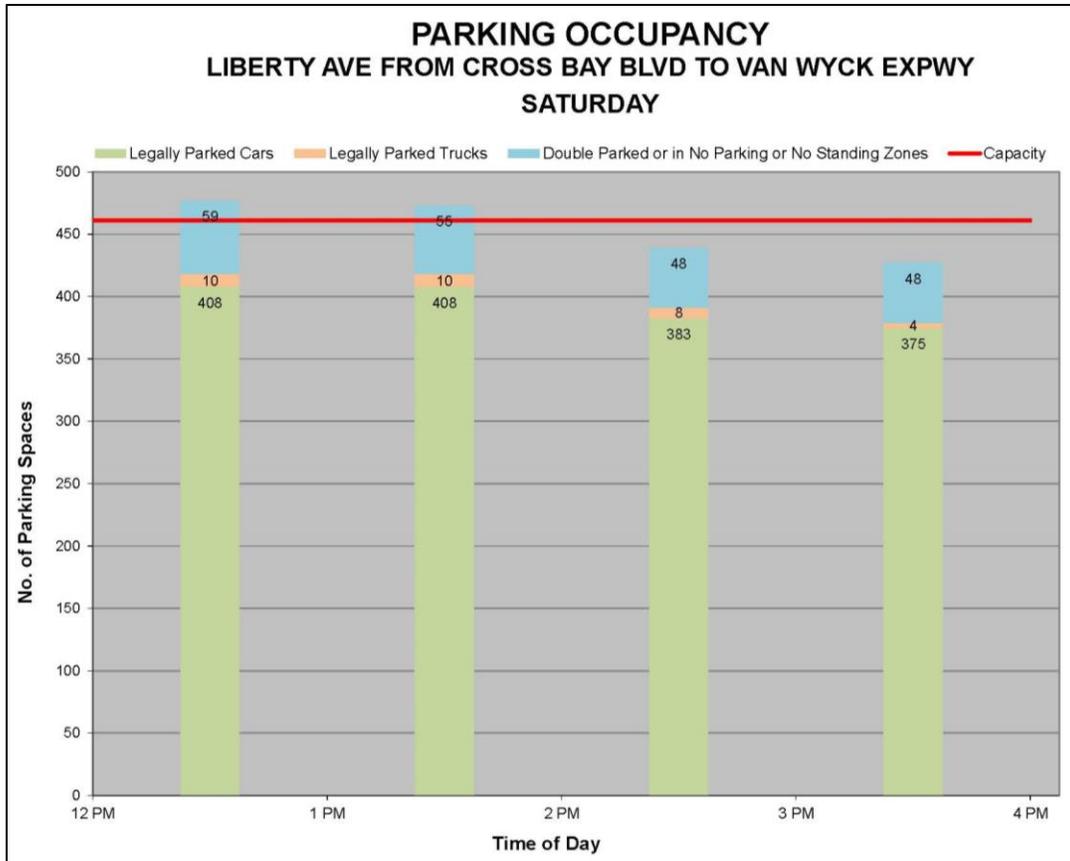


Figure 19: Weekend (Saturday) Parking Occupancy by Time of Day

3.6 SAFETY

Reportable crashes for the most recent three-year period were summarized for intersections and mid-block locations along Liberty Avenue 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.

Crash Frequency

Over the 5-year period, there were 518 reportable crashes along the corridor. Of these, 488 (94%) occurred at intersections while the remaining 30 crashes occurred at mid-block locations.

There were in total three fatalities (all pedestrian), and 23 severe injuries.

TABLE 2: INJURY SUMMARY, 2008-2015			
	Total	Severe	Fatalities
Pedestrian	149	7	3
Bicyclist	23	2	0
Vehicle Occupant	14	14	0
Total	452	23	3

Table 3 below summarizes number of injuries on per year basis, indicating that injuries per year have increased between 2011 and 2013.

TABLE 3: INJURIES BY YEAR 2008 - 2013				
Year	Pedestrian	Bicyclist	Vehicle	Total
2009	27	3	54	84
2010	25	6	61	92
2011	29	2	52	83
2012	31	3	57	91
2013	37	9	56	102
Total	149	23	280	452

The highest number of intersection crashes occurred at Cross Bay Boulevard and Van Wyck Expressway Service Road, 40 at each location. This was followed by Lefferts Boulevard (24 crashes), Van Wyck Expressway West Service Road Avenue (22 crashes), 11th Street (20 crashes) and 96th Street/Rockaway Boulevard (20 crashes). The crash data indicates that the busiest is the intersection the higher is the number of crashes.

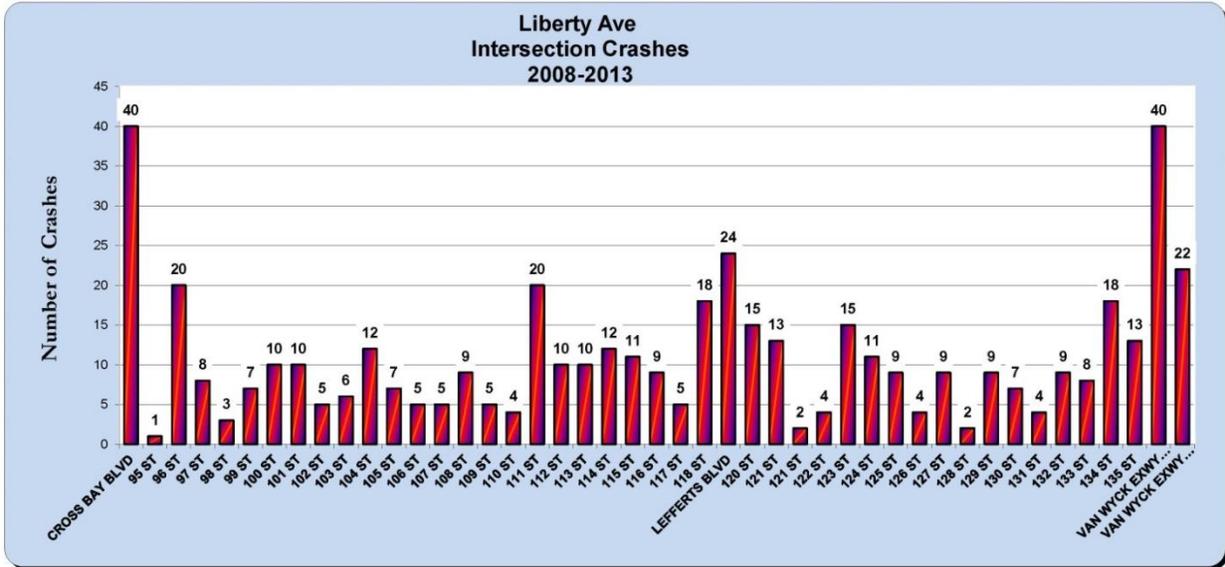


Figure 20: Liberty Avenue Crashes

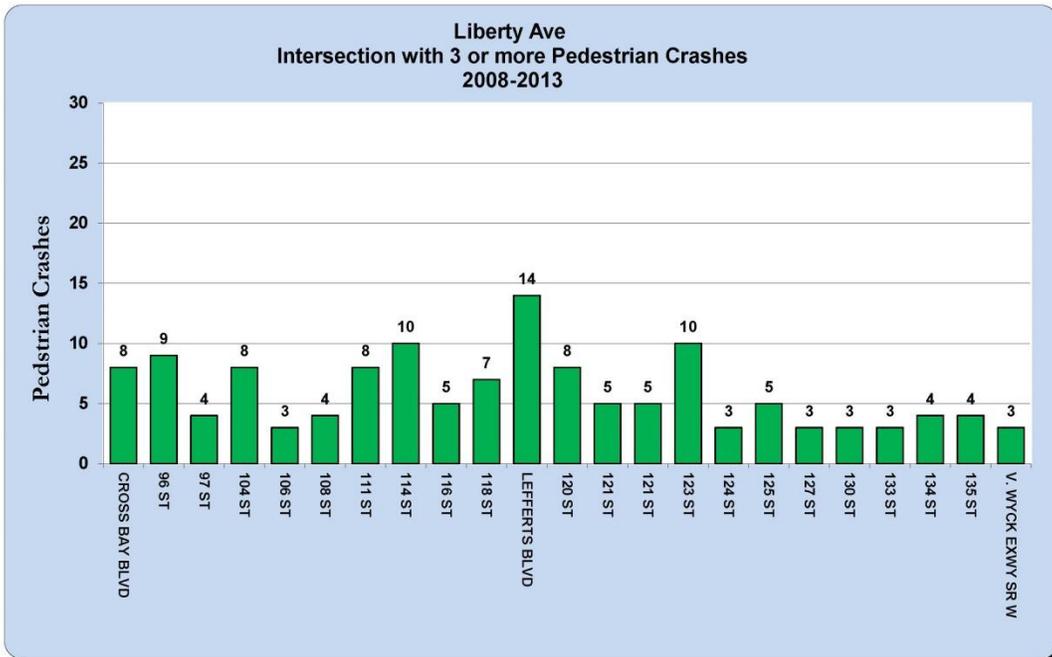


Figure 21: Liberty Avenue Pedestrian Crashes

Crashes involving pedestrians were the predominant type along the corridor with 149 crashes, accounting for 28% of all crashes. The highest number of pedestrian crashes occurred at the intersection of Lefferts Boulevard, 123rd Street and 114th Street (10 crashes), followed by 96th Street (9 crashes), Crossbay Boulevard, 104th Street and 120th Street (8 crashes each) (Figure 21).

Vehicular collisions classified by crash type are shown in Figure 22. The highest frequency of vehicular crashes was rear-ending collisions accounting for 11.1% of all crashes followed by right angle crashes (10.9%), right angle (8.2%). Most crashes (55.6%) were classified as “other” or “unknown”.

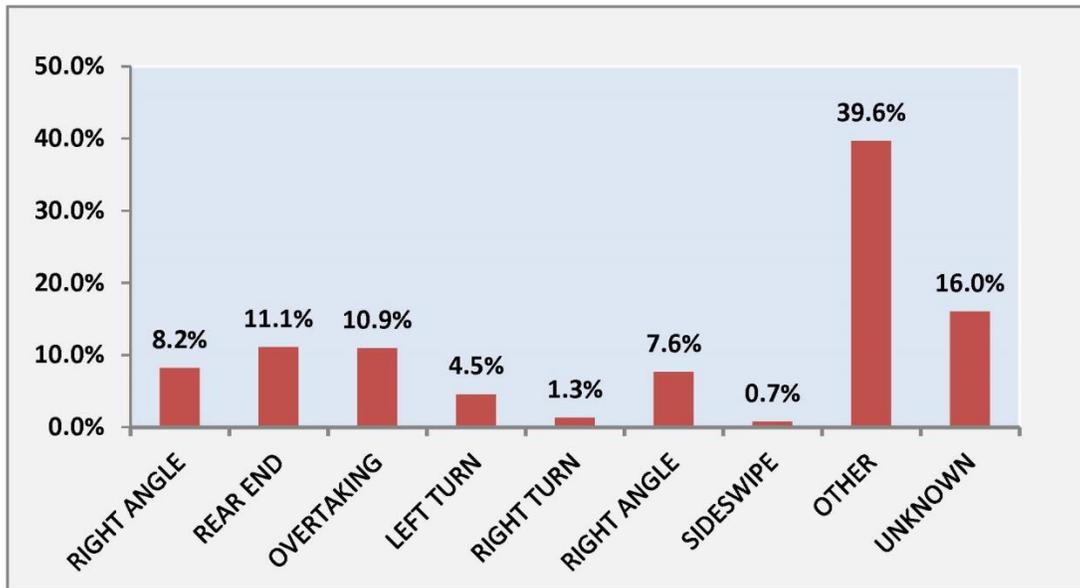


Figure 22: Liberty Avenue crashes Classified by Type

3.7 GOODS MOVEMENT

Figure 23 illustrates the truck routes in the study area. As indicated in the NYC Truck Routes Map Liberty Avenue between Woodhaven/Cross Bay Boulevard and Van Wyck Expressway East Service Road is not a designated as a truck route. Liberty Avenue becomes a local truck route east of Van Wyck Expressway Interchange. Woodhaven Boulevard and Rockaway Boulevard are designated as local truck routes.



Figure 23: Truck Routes

The land use along the study area includes retail, restaurants and a whole variety of small businesses, 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.



Photograph XX: 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:

- Liberty Avenue btw. 96th and 97th Streets (looking west)
- Liberty Avenue btw. 108th and 109th Streets (looking east)
- Liberty Avenue btw. 110th and 111th Streets (looking east)
- Liberty Avenue btw. 112th and 113th Streets (looking east)
- Liberty Avenue btw. 117th and 118th Streets (looking west)
- Liberty Avenue btw. 118th and Lefferts Blvd (looking east)
- Liberty Avenue btw. 118th and Lefferts Blvd (looking west)
- Liberty Avenue btw. Lefferts Blvd and 120th Street (looking east)
- Liberty Avenue btw. Lefferts Blvd and 120th Street (looking west)
- Liberty Avenue btw. 122nd and 123rd Street (looking east)
- Liberty Avenue btw. 122nd and 123rd Street (looking east)
- Liberty Avenue btw. 122nd and 123rd Street (looking west)
- Liberty Avenue btw. 124th and 125th Street (looking east)
- Liberty Avenue btw. 124th and 125th Street (looking west)

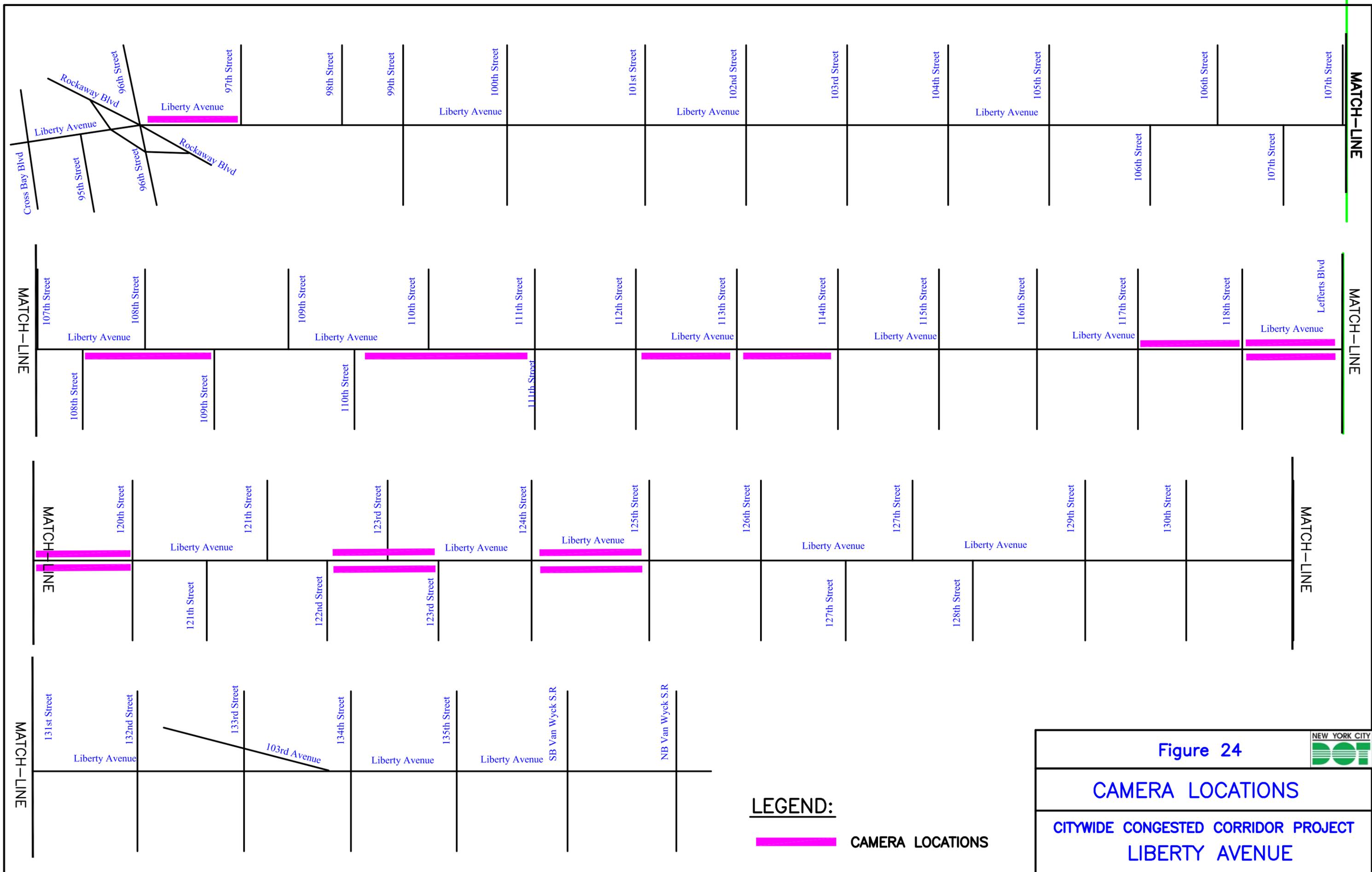




Figure 24

CAMERA LOCATIONS

CITYWIDE CONGESTED CORRIDOR PROJECT

LIBERTY AVENUE

LEGEND:
 CAMERA LOCATIONS

3.8 TRANSIT

Liberty Avenue along with Atlantic Avenue and Jamaica Avenue to the north are important cross-town transit corridors in the central portion of Queens. Liberty Avenue throughout the length is used by Q112 bus service. In addition, several bus routes cross Liberty Avenue along Rockaway Boulevard (Q7), 111th Street (Q37), Lefferts Boulevard (Q10), 127th Street (Q41) and Van Wyck Expressway Service Road (Q63 and Q9). Detailed bus lines and travel routes within the study area are illustrated in Figure XX.

The “A” train runs along Liberty Avenue, with stops at Rockaway Boulevard, 104th Street, 11th Street, Ozone Park/Lefferts Boulevard (the last stop for “A” train).

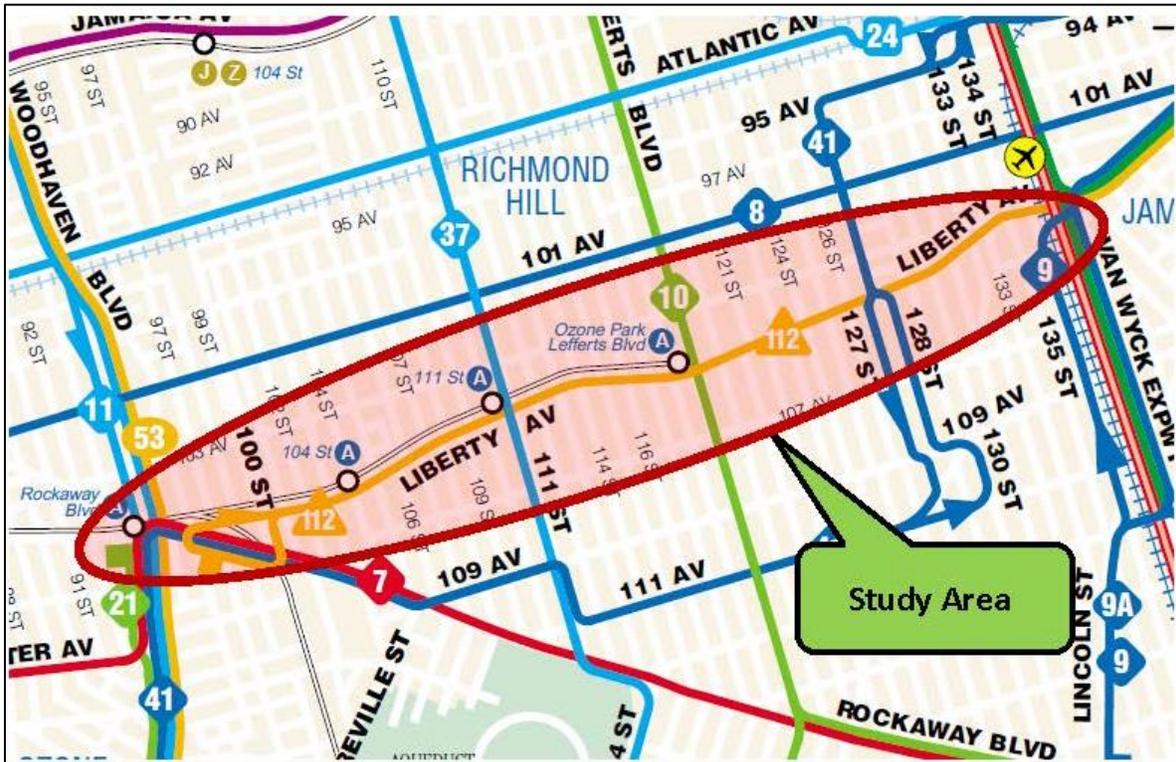


Figure 25: Transit Routes

3.9 EXISTING CONDITIONS TRAFFIC ANALYSIS

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 percentages, etc.) were developed from TMC and ATR data. Geometry, pedestrian, parking and bus data information as well as multiple field observation and travel time and delay runs were utilized to calibrate the existing conditions model.

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) by lane group for each peak hour evaluated. Control delays include stopped delay as well as delays associated with acceleration, deceleration, and queue move-up time at the intersection.

LOS A, B and C generally represent extremely favorable to moderate levels of traffic operations. At LOS “D”, delays are more noticeable. In urban areas, mid-LOS D or better is considered acceptable service. Level of service worse than mid-LOS D considered unacceptable. Table 6 shows the relationships between average control delay and LOS for signalized intersections.

TABLE 4: LOS CRITERIA

LOS	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

Source: 2000 Highway Capacity Manual.

All intersection on Liberty Avenue between Rockaway Boulevard and Van Wyck Expressway Service Road have been included in the Synchro model, however 8 busiest intersections have been studied in detail for the existing condition for weekday AM, PM and Saturday midday peak hours. Results for the rest of the intersections are not shown in LOS Tables. Table 5 shows the volume to capacity (v/c) ratios, delays and LOS for each lane group of the intersections that were analyzed.

TABLE 5: EXISTING CONDITIONS LOS ANALYSIS

Intersection Approach ¹	Mvmt ²	Weekday AM Peak			Weekday PM Peak			Saturday MD Peak		
		v/c Ratio	Avg Delay	LOS	v/c Ratio	Avg Delay	LOS	v/c Ratio	Avg Delay	LOS
1. Liberty Avenue and Rockaway Blvd/96th Street										
EB - Rockaway Blvd	L	0.41	35.1	D	0.54	14.3	B	1.05	109.5	F
	T	0.18	0.4	A	0.30	8.4	A	0.29	31.1	C
WB - Rockaway Blvd	T	0.43	33.4	C	0.36	32.2	C	0.43	33.3	C
NB - 96th Street	LTR	0.43	42.6	D	0.31	39.8	D	0.50	44.5	D
SB - Liberty Avenue	TR	1.02	78.5	E	0.67	39.3	D	0.70	39.6	D
Overall Intersection			41.9	D		22.2	C		47.9	D
2. Liberty Avenue and 104th Street										
EB - Liberty Avenue	TR	0.59	12.4	B	0.53	21.8	C	0.46	22.2	C
WB - Liberty Avenue	LT	0.77	15.3	B	0.44	9.3	A	0.46	8.9	A
SB - 104th Street	LTR	0.78	33.4	C	0.87	41.8	D	0.77	32.0	C
Overall Intersection			18.9	B		25.0	C		21.0	C
3. Liberty Avenue and 111th Street										
EB - Liberty Avenue	LTR	0.55	12.9	B	0.52	12.9	B	0.63	14.9	B
WB - Liberty Avenue	LTR	0.53	5.3	A	0.46	5.9	A	0.52	7.4	A
NB - 111th Street	LTR	1.04	78.0	E	0.79	34.3	C	0.96	58.9	E
SB-111th Street	LTR	0.53	21.1	C	0.71	27.3	C	0.68	25.5	C
Overall Intersection			31.6	C		20.0	B		26.8	C
4. Liberty Avenue and Lefferts Blvd										
EB - Liberty Avenue	LTR	0.61	9.7	A	0.73	15.5	B	0.63	11.1	B
WB - Liberty Avenue	LTR	0.58	13.1	B	0.71	19.0	B	0.66	13.2	B
NB - Lefferts Blvd	LTR	0.80	30.0	C	0.74	26.9	C	0.68	23.4	C
SB-Lefferts Blvd	LTR	0.55	18.6	B	0.80	31.1	C	0.83	34.8	C
Overall Intersection			18.7	B		23.2	C		20.9	C
5. Liberty Avenue and 121st Street										
EB - Liberty Avenue	T	0.32	2.4	A	0.41	2.7	A	0.39	2.8	A
WB - Liberty Avenue	T	0.36	9.4	A	0.39	10.0	A	0.49	9.5	A
SB - 121st Street	L	0.08	15.0	B	0.12	15.4	B	0.16	15.8	B
NB - 121st Street	R	0.20	16.4	B	0.56	23.5	C	0.61	27.5	C
Overall Intersection			7.8	A		10.8	B		11.2	B
6. Liberty Avenue and 133rd Street										
EB - Liberty Avenue	TR	0.89	32.00	C	0.82	24.50	C	0.83	26.8	C
WB - Liberty Avenue	LT	0.44	18.60	B	0.66	23.70	C	0.95	53.1	D
NB - 133rd Street	LR	0.15	16.10	B	0.10	15.40	B	0.04	14.8	B
SB - 133rd Street	L	0.44	25.40	C	0.58	28.00	C	0.49	25.8	C
SB - 133rd Street	TR	0.11	11.80	B	0.11	11.40	B	0.14	12.0	B
Overall Intersection			24.90	C		23.70	C		35.3	D
7. Liberty Avenue and Van Wyck SB Service Road										
EB - Liberty Avenue	TR	0.99	102.4	F	1.00	112.1	F	0.82	94.3	F
WB - Liberty Avenue	L	0.79	19.4	B	0.90	28.1	C	0.99	54.5	D
	T	0.60	4.5	A	0.64	7.4	A	0.73	25.8	C
SB - Van Wyck Service Road	LTR	0.47	17.9	B	0.59	19.8	B	0.58	19.7	B
Overall Intersection			44.0	D		44.2	D		43.6	D
8. Liberty Avenue and Van Wyck NB Service Road										
EB - Liberty Avenue	L	1.04	84.1	F	0.97	61.4	E	1.04	79.6	E
	T	0.75	18.9	B	0.55	10.5	B	0.58	21.7	C
WB -Liberty Avenue	TR	1.02	69.1	E	0.99	64.7	E	0.91	52.2	D
NB - Van Wyck Service Road	LTR	0.98	40.1	D	1.05	57.9	E	0.47	18.0	B
Overall Intersection			45.1	D		52.4	D		34.8	C

Notes: ¹Intersection approaches: EB=eastbound, WB=westbound, NB=northbound, SB=southbound
²Intersection movement: L=left turn, T=through, R=right turn, LT=left-through, TR=through-right

The following is a summary of the findings:

- The Liberty Avenue and Rockaway Boulevard/96th Street experiences some congestion during the AM Peak in the southbound direction (Liberty Avenue) and during the Saturday midday peak in the eastbound direction (Rockaway Boulevard). During the AM peak the southbound approach operates at LOF E incurring 78.5 seconds/vehicle; and, during the PM peak operates at LOS F incurring 109.5 seconds/vehicle.
- The Liberty Avenue and 111th Street intersection experiences moderate delays in the northbound approach during AM and PM peak hours. During both the AM and PM peak hours it operates at LOS E; incurring 78.0 seconds/vehicles during the AM and 58.9 seconds/vehicle during the PM peak hour.
- The eastbound approach at the intersection of Liberty Avenue and Van Wyck Southbound Service Road operate at LOS F during all three analyzed periods with delays of 102.4 seconds/vehicle in the AM peak, 112.1 seconds/vehicle in the PM peak and 94.3 in the Saturday midday peak.
- The intersection of Liberty Avenue and Van Wyck Southbound Service Road experiences moderate congestion. In the AM Peak Hour operates at LOS E in the eastbound and westbound direction. During the PM Peak Hour the eastbound, westbound and the northbound approaches operate at LOS E. During the Saturday midday peak hour, the eastbound direction operates at LOS E.

4.0 FUTURE CONDITIONS WITHOUT IMPROVEMENTS

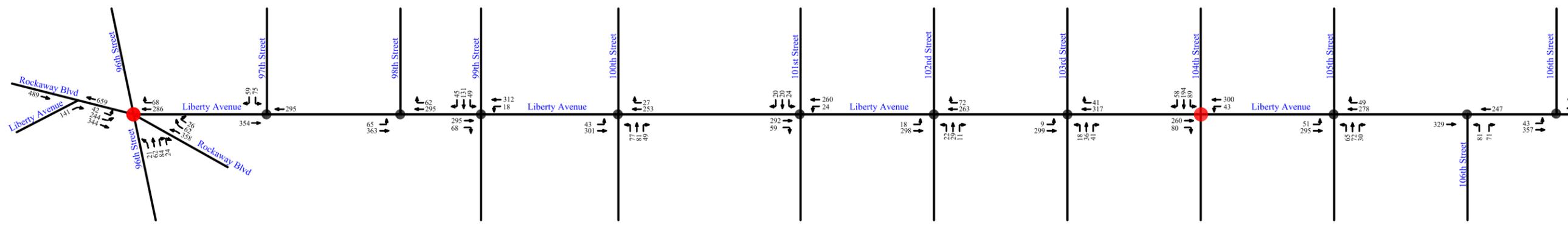
This section presents quantitative assessments of future traffic conditions that could be expected in the study area without recommended improvements from this study, but includes other projects and improvements that have already been planned for implementation. For analysis purposes, the future horizon year for this study is 2020.

A thorough research was conducted in identifying any projects in the vicinity of the study area, and no projects and/or proposed improvements have been identified which were expected to be implemented before 2020.

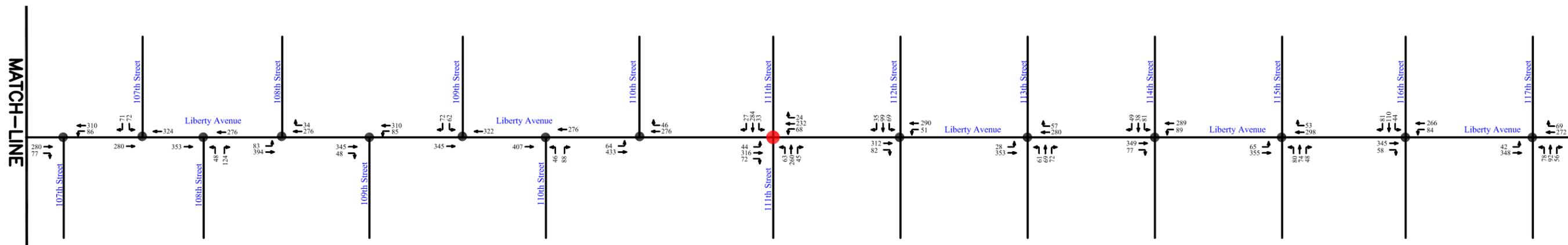
4.1 TRAFFIC VOLUMES

The 2020 Future without Improvement traffic volumes consists of an annual background increase, which is calculated based on the City Environmental Quality Review (CEQR) guidelines for the borough of the Queens, and additional traffic volumes generated by the proposed developments in the area. The CEQR Manual specifies traffic growth rates of 0.5% per year for the first five years and 0.25% per year after five years. The resulting cumulative rate of background growth compounded over a 10-year period (2010 – 2020) is calculated to be 3.5 %. However the growth has been rounded at 5% to include any unknown traffic pattern changes that may occur in the next 10 years. The calculated background growth is applied universally throughout the study area.

Future without Improvement volumes are presented in Figure 26 through 29.

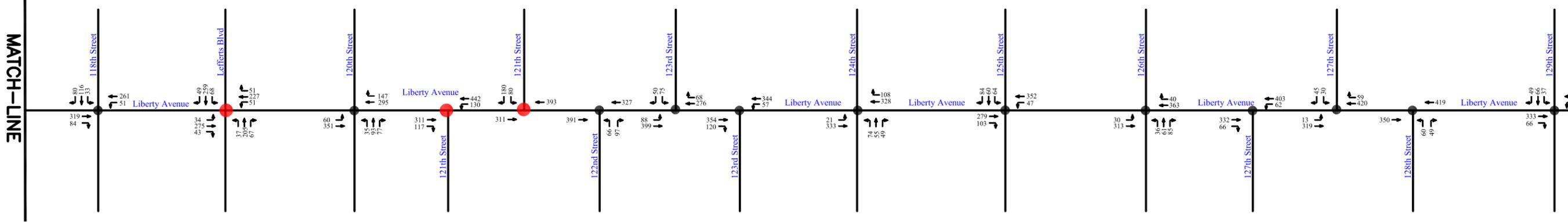


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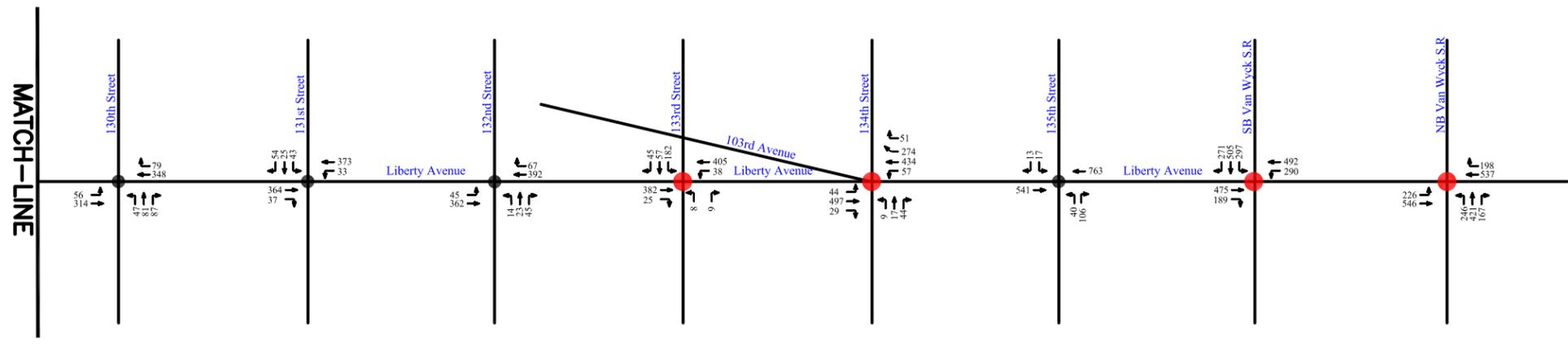
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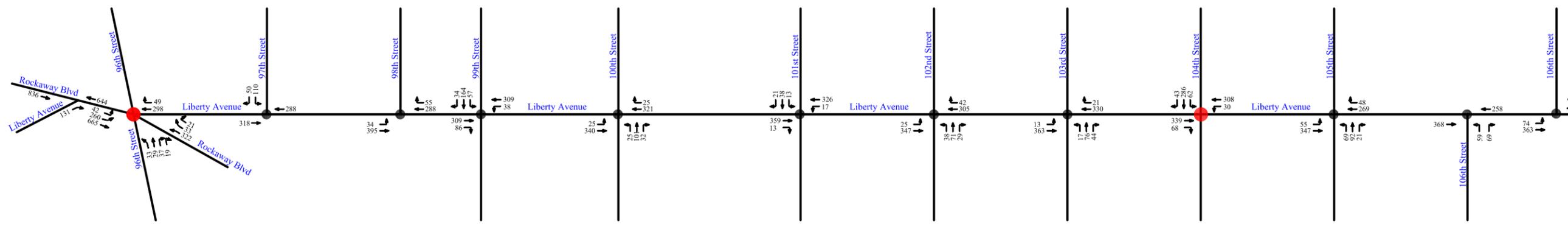
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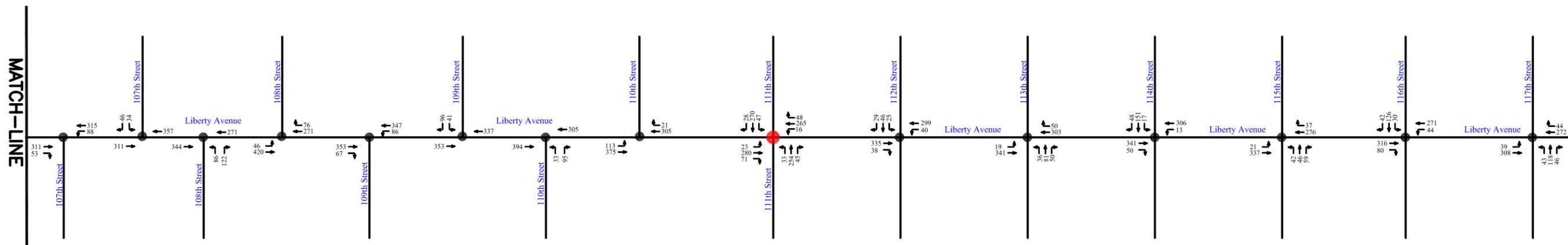
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Figure 28
NO IMPROVEMENT VEHICULAR VOLUMES
SATURDAY MD PEAK HOUR
CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE



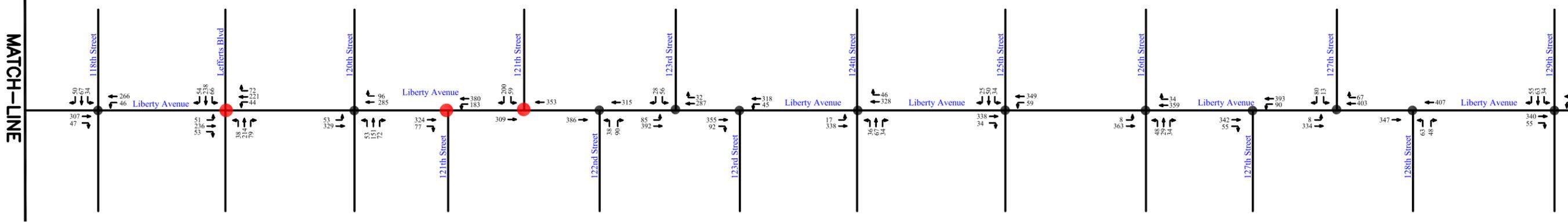


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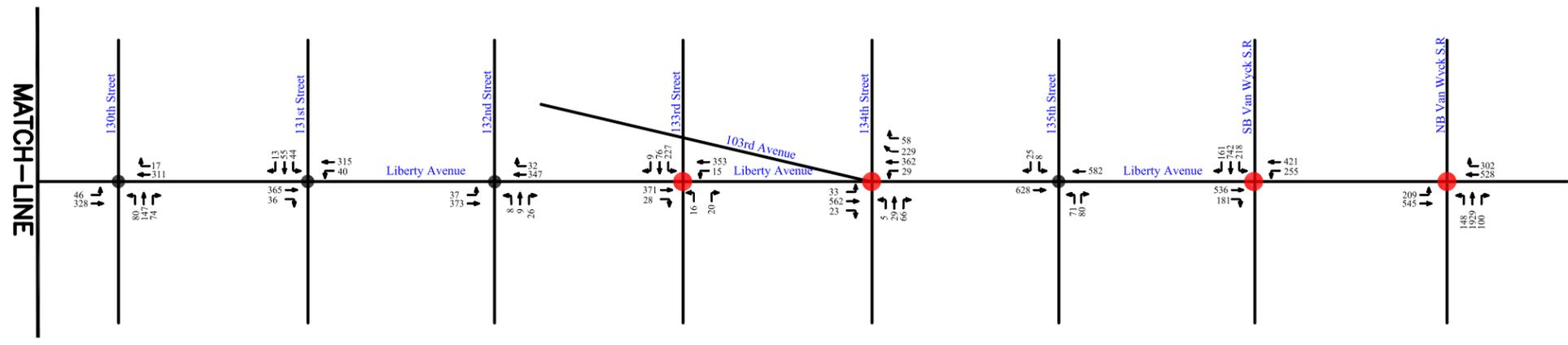
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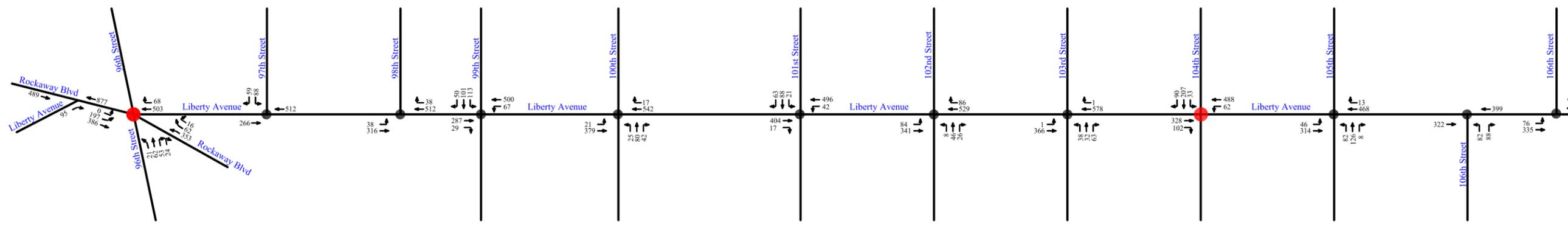
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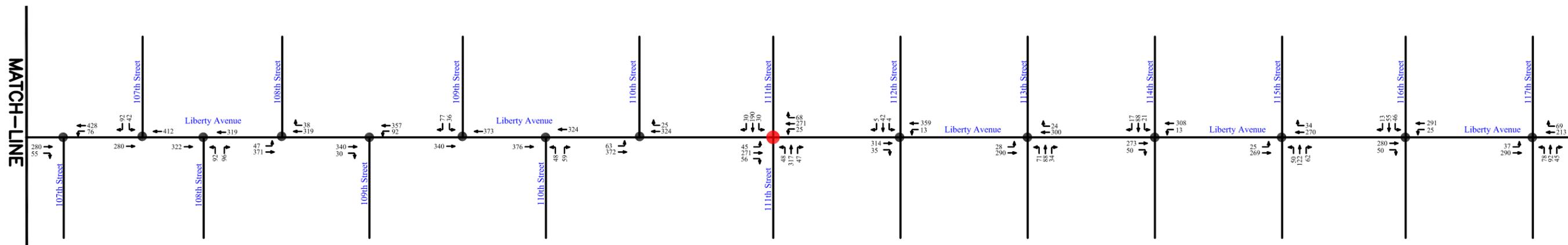
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Figure 27
NO IMPROVEMENT VEHICULAR VOLUMES
WEEKDAY PM PEAK HOUR
CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE



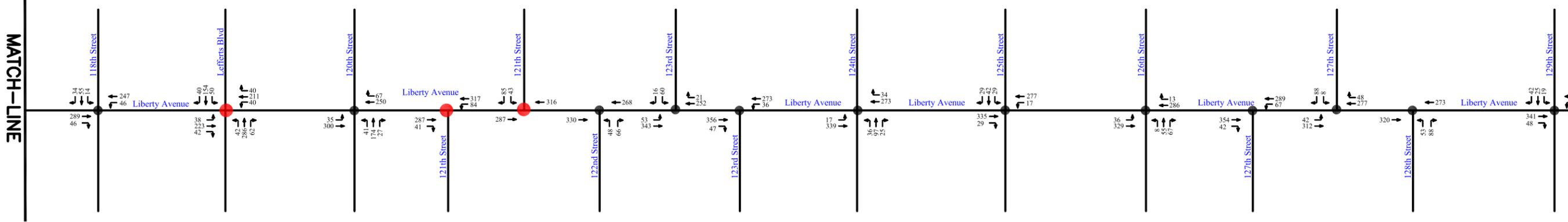


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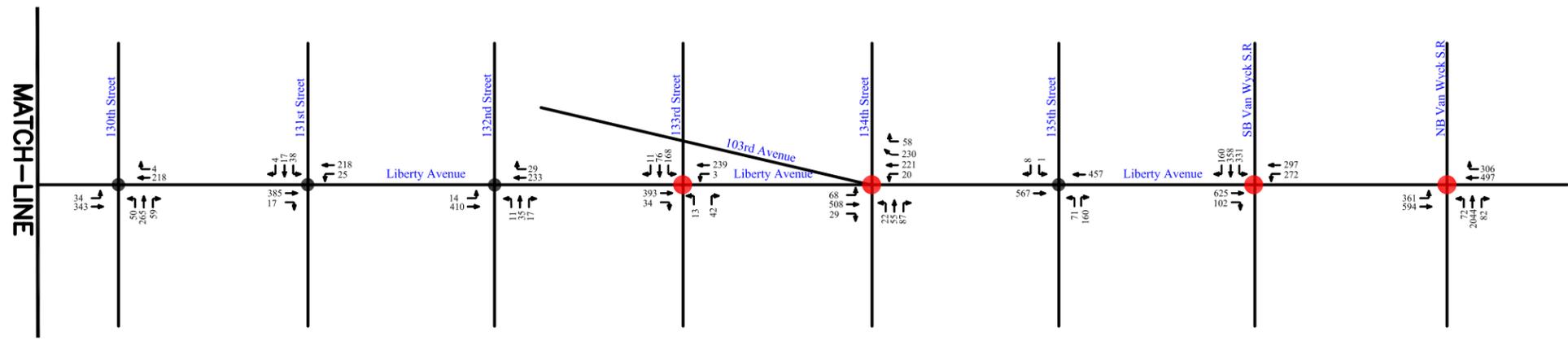
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Figure 26

NO IMPROVEMENT VEHICULAR VOLUMES
WEEKDAY AM PEAK HOUR

CITYWIDE CONGESTED CORRIDOR PROJECT
LIBERTY AVENUE



4.2 INTERSECTION LEVELS OF SERVICE

Projected traffic volumes for year 2020 were used to update the Synchro analysis. No signal timing, roadway geometry or any other input parameters were changed or adjusted, except for the traffic volumes as described in the preceding section. Table 8 presents the LOS results for the signalized intersections for the future conditions without improvements.

TABLE 6: 2020 FUTURE WITHOUT IMPROVEMENT CONDITIONS LOS ANALYSIS

Intersection Approach ¹	Mvmt ²	Weekday AM Peak			Weekday PM Peak			Saturday MD Peak		
		v/c Ratio	Avg Delay	LOS	v/c Ratio	Avg Delay	LOS	v/c Ratio	Avg Delay	LOS
1. Liberty Avenue and Rockaway Blvd/96th Street										
EB - Rockaway Blvd	L	0.43	35.2	D	0.59	15.7	B	1.15	142.3	F
	T	0.19	0.4	A	0.32	8.5	A	0.31	31.3	C
WB - Rockaway Blvd	T	0.45	33.8	C	0.38	32.5	C	0.45	33.7	C
NB - 96th Street	LTR	0.45	43.0	D	0.33	40.2	D	0.53	45.1	D
SB - Liberty Avenue	TR	1.07	92.4	F	0.70	41.3	D	0.73	41.6	D
Overall Intersection			46.6	D		23.0	C		53.9	D
2. Liberty Avenue and 104th Street										
EB - Liberty Avenue	TR	0.62	12.4	B	0.55	22.2	C	0.48	22.5	C
WB - Liberty Avenue	LT	0.81	17.1	B	0.46	9.3	A	0.49	9.1	A
SB - 104th Street	LTR	0.82	36.5	D	0.91	47.9	D	0.80	34.9	C
Overall Intersection			20.4	C		27.2	C		22.1	C
3. Liberty Avenue and 111th Street										
EB - Liberty Avenue	LTR	0.57	13.6	B	0.55	13.4	B	0.66	15.9	B
WB - Liberty Avenue	LTR	0.56	5.8	A	0.48	6.3	A	0.55	7.8	A
NB - 111th Street	LTR	1.09	93.2	F	0.83	38.1	D	1.01	73.5	E
SB - 111th Street	LTR	0.56	21.9	C	0.75	29.7	C	0.72	27.5	C
Overall Intersection			36.5	D		21.7	C		31.3	C
4. Liberty Avenue and Lefferts Blvd										
EB - Liberty Avenue	LTR	0.64	10.7	B	0.77	17.6	B	0.66	12.3	B
WB - Liberty Avenue	LTR	0.61	14.0	B	0.75	20.5	C	0.70	14.3	B
NB - Lefferts Blvd	LTR	0.84	34.2	C	0.78	30.2	C	0.72	26.2	C
SB - Lefferts Blvd	LTR	0.58	19.5	B	0.84	36.1	D	0.88	43.7	D
Overall Intersection			20.7	C		26.2	C		24.6	C
5. Liberty Avenue and 121st Street										
EB - Liberty Avenue	T	0.34	2.5	A	0.43	2.7	A	0.41	2.8	A
WB - Liberty Avenue	T	0.37	9.7	A	0.41	10.0	A	0.52	9.6	A
SB - 121st Street	L	0.08	15.0	B	0.13	15.5	B	0.17	15.8	B
NB - 121st Street	R	0.21	16.5	B	0.59	24.4	C	0.64	29.2	C
Overall Intersection			8.0	A		11.1	B		11.6	B
6. Liberty Avenue and 133rd Street										
EB - Liberty Avenue	TR	0.93	38.40	D	0.86	28.80	C	0.87	31.60	C
WB - Liberty Avenue	LT	0.46	19.00	B	0.70	25.20	C	1.06	83.80	F
NB - 133rd Street	LR	0.16	16.20	B	0.10	15.40	B	0.04	14.80	B
SB - 133rd Street	L	0.47	25.60	C	0.61	29.00	C	0.52	26.40	C
SB - 133rd Street	TR	0.12	11.80	B	0.11	11.40	B	0.15	11.90	B
Overall Intersection			27.80	C		25.90	C		48.90	D
7. Liberty Avenue and Van Wyck SB Service Road										
EB - Liberty Avenue	TR	1.04	101.4	F	1.05	109.3	F	0.86	96.1	F
WB - Liberty Avenue	L	0.83	21.3	C	0.95	32.9	C	1.08	76.0	E
WB - Liberty Avenue	T	0.62	4.7	A	0.70	8.5	A	0.80	46.2	D
SB - Van Wyck Service Road	LTR	0.49	18.3	B	0.62	20.3	C	0.61	20.2	C
Overall Intersection			44.0	D		44.2	D		50.7	D
8. Liberty Avenue and Van Wyck NB Service Road										
EB - Liberty Avenue	L	1.09	98.1	F	1.00	65.7	E	1.13	108.8	F
	T	0.80	21.2	C	0.61	11.0	B	0.64	23.3	C
WB - Liberty Avenue	TR	1.07	84.9	F	1.04	81.1	F	0.96	65.6	E
NB - Van Wyck Service Road	LTR	1.03	52.9	D	1.10	77.1	E	0.49	18.3	B
Overall Intersection			56.9	E		67.5	E		41.8	D

Notes: ¹Intersection approaches: EB=eastbound, WB=westbound, NB=northbound, SB=southbound
²Intersection movement: L=left turn, T=through, R=right turn, LT=left-through, TR=through-right

As expected, delays are projected to experience minor increases at all intersections due to higher traffic volumes. No significant exacerbation of traffic conditions is expected. The following list presents traffic movements where the increase in average delays is greater than 10 seconds/vehicle:

AM Peak Hour

- Liberty Avenue and Rockaway Boulevard/96th Street southbound delay increases from 78.5 to 92.4 seconds/vehicle.
- Liberty Avenue and 111th Street northbound delay increases from 78.0 to 93.2 seconds/vehicle.
- Liberty Avenue and Van Wyck Expressway northbound Service Road eastbound left-turn delay increases from 84.1 to 98.1 seconds/vehicle and westbound from 69.1 to 84.9 seconds/vehicle.

PM Peak Hour

- Liberty Avenue and Van Wyck Expressway northbound Service Road westbound delay increases from 64.7 to 81.1 seconds/vehicle and northbound from 57.9 to 77.1 seconds/vehicle.

Saturday MD Peak Hour

- Liberty Avenue and Rockaway Boulevard/96th Street eastbound left-turn delay increases from 109.5 to 142.3 seconds/vehicle.
- Liberty Avenue and 111th Street northbound delay increases from 58.9 to 73.5 seconds/vehicle
- Liberty Avenue and 133rd Street westbound delay increases from 53.1 to 83.8 seconds/vehicle.
- Liberty Avenue and Van Wyck Expressway southbound Service Road westbound delay increases from 54.5 to 76.0 seconds/vehicle.
- Liberty Avenue and Van Wyck Expressway northbound Service Road eastbound delay increases from 79.6 to 108.8 seconds/vehicle.
- Liberty Avenue and Van Wyck Expressway northbound Service Road westbound delay increases from 52.2 to 65.6 seconds/vehicle.

4.3 EMISSIONS

Vehicular traffic emissions are demonstrated to be one of the significant sources of air quality degradation. 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. Traffic analysis conducted for the Liberty Avenue corridor has shown that the congested traffic conditions during the weekday AM, midday, PM, and Saturday midday peak hours contribute to the higher emission rates of CO, VOC and NOX (Table 7). During these peak hours, the CO emission rates range between 11.8 in midday to 10.2 kilograms per hour; the VOC emission rates range between 2.4 to 2.7 kilograms per hour; and, NOX emission rates range between 2.0 to 2.3 kilograms per hour.

TABLE 7: 2010 EXISTING CONDITIONS EMISSIONS

Intersection Approach ¹	Mvmt ²	AM Peak				PM Peak				Saturday Midday Peak			
		Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)	Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)	Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)
1. Liberty Avenue and Rockaway Blvd/96th Street													
Emissions		23	1656	322	385	17	1143	221	265	26	1772	345	411
2. Liberty Avenue and 104th Street													
Emissions		13	855	167	198	12	890	173	207	11	739	144	171
3. Liberty Avenue and 111th Street													
Emissions		17	1252	243	291	15	1031	200	239	17	1242	241	287
4. Liberty Avenue and Lefferts Avenue													
Emissions		13	988	192	230	16	1137	221	264	16	1066	207	247
5. Liberty Avenue and 121st Street													
Emissions		3	238	47	55	6	396	78	92	5	403	80	94
6. Liberty Avenue and 133rd Street													
Emissions		10	683	133	158	11	767	149	177	14	975	190	226
7. Liberty Avenue and Van Wyck SB Service Road													
Emissions		24	1642	319	381	29	2050	399	476	28	1965	382	455
8. Liberty Avenue and Van Wyck NB Service Road													
Emissions		62	4299	837	997	62	4399	855	1019	29	2015	392	467
TOTAL EMISSIONS (kg/h)		165.0	11.6	2.3	2.7	168.0	11.8	2.3	2.7	146.0	10.2	2.0	2.4

In the 2020 Future without Improvements conditions, the CO emission rates for the weekday AM, midday, PM, and Saturday midday peak hours are projected to degrade to about 11.5 to 13.5 kilograms per hour. VOC emission rates are projected to degrade to about 2.7 to 3.1 kilograms per hour, and NOX to about 2.2 to 2.6 kilograms per hour. Any recommendations proposed for this project in reducing traffic congestion are expected to improve air quality of the study area. Please note that future projected emission rates do not account for improved emission standards or alternative fuels for new vehicles.

TABLE 8: 2020 FUTURE WITHOUT IMPROVEMENT CONDITIONS EMISSIONS

Intersection Approach ¹	Mvmt ²	AM Peak (7:45 - 8:45)				PM Peak (5:15 - 6:15)				Saturday Midday Peak (1:00 - 2:00)			
		Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)	Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)	Fuel	CO (g/h)	NOx (g/h)	VOC (g/h)
1. Liberty Avenue and Rockaway Blvd/96th Street													
Emissions		27	1857	362	430	18	1227	239	285	29	2010	391	466
2. Liberty Avenue and 104th Street													
Emissions		13	925	181	214	14	972	189	225	11	793	155	183
3. Liberty Avenue and 111th Street													
Emissions		21	1420	276	329	16	1119	219	260	20	1396	272	324
4. Liberty Avenue and Lefferts Avenue													
Emissions		15	1012	197	234	19	1260	245	292	17	1198	233	278
5. Liberty Avenue and 121st Street													
Emissions		3	252	49	58	7	419	82	97	7	429	83	100
6. Liberty Avenue and 133rd Street													
Emissions		11	744	145	172	12	846	165	196	18	1248	244	288
7. Liberty Avenue and Van Wyck SB Service Road													
Emissions		26	1859	361	431	33	2312	449	537	31	2193	426	508
8. Liberty Avenue and Van Wyck NB Service Road													
Emissions		75	5164	1004	1196	77	5366	1043	1243	33	2279	444	528
TOTAL EMISSIONS (kg/h)		191.0	13.2	2.6	3.1	196.0	13.5	2.6	3.1	166.0	11.5	2.2	2.7

5.0 IMPROVEMENTS

Liberty Avenue has a curb-to-curb right-of-way of 60 feet throughout most of the study area. Existing roadway geometric constraints, surrounding land uses, and traffic and parking demand do not provide an opportunity for significant roadway improvements that would increase roadway capacity. Operational improvement strategies include the following categories:

- Signal Timing and Offset
- Parking Regulations
- Street Directions
- Curb Extensions
- Turn Prohibitions
- Pavement Markings Changes

5.1 SIGNAL TIMING AND OFFSET

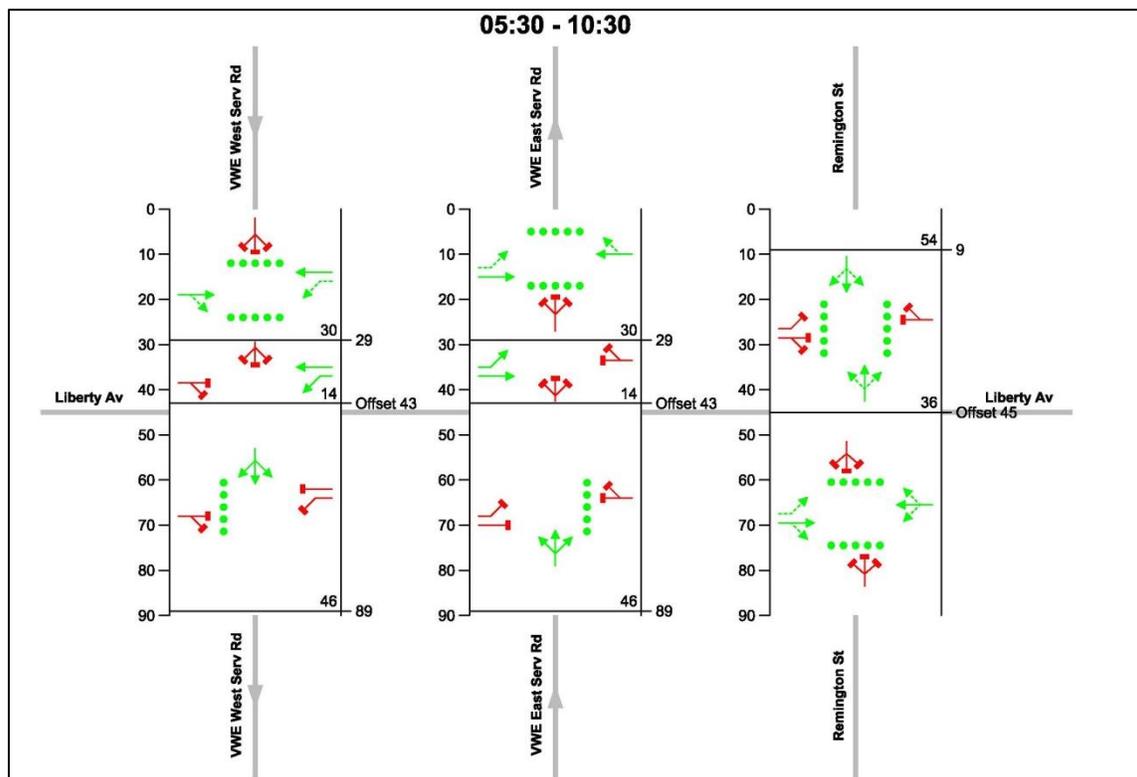
Table 9 presents a summary of recommended signal and offset improvements.

TABLE 9: SIGNAL TIMING AND OFFSET IMPROVEMENTS

<i>Location</i>	<i>Peak Hour</i>	<i>Existing Timing</i>	<i>Change to</i>
Liberty Avenue and Rockaway Blvd/96 th Street	Weekday AM	E=42/W=44/N=34 sec.	E=48/W=44/N=28 sec.
	Weekday PM	---	---
	Saturday Midday	E/W=44/N=34 sec.	E/W=52/N=26 sec.
Liberty Avenue and 111 th Street	Weekday AM	N/S=24 / E/W=36 sec	N/S=30 & E/W=30sec
	Weekday PM	---	---
	Saturday Midday	N/S=24/ E/W=36 sec	N/S=30 & E/W=30 sec
Liberty Avenue and Lefferts Boulevard	Weekday AM	N/S=30 / E/W=30 sec	LPI= 6 sec.
	Weekday PM		
	Saturday Midday		
Liberty Avenue and Van Wyck SB. Service Road	Weekday AM	S=46 /E/W=30/14/44 sec	S=30/E/W=46/14/60 sec
	Weekday PM	S=46 /E/W=30/14/44 sec	S=32 /E/W=44/14/58 sec
	Saturday Midday	S=46 /E/W=30/11/44 sec	S=34 /E/W=44/12/56 sec
Liberty Avenue and Van Wyck NB. Service Road	Saturday Midday	N=46/E/W=11/44/30 sec.	N=36/E/W=16/54/38 sec.

5.2 SIGNAL TIMING ON LIBERTY AVENUE NEAR VAN VYCK EXPWY INTERCHANGE

Figures 29 through 31 present the previous signal timing and coordination along Liberty Avenue between the Van Wyck Expressway service roads and Remington Street, which is immediately east of the Van Wyck Expressway, for the AM peak period, PM peak period, and all other times, respectively. Although there is good progression between the Van Wyck Expressway service roads, there is poor progression between the service roads and Remington Street. When the signals display the green for Liberty Avenue at the service roads, it displays red for Liberty Avenue at Remington Street, and vice-versa. This poor progression has caused congestion and spillback. This condition was improved in June, 2014. The offsets were changed at the Liberty Avenue and Remington Street intersection to provide better progression. Figures 32 through 34 present the improved signal timing and coordination. Note that the signals display green for Liberty Avenue at all three intersections at approximately the same time.



**Figure 29: Previous Signal Timing at Liberty Avenue near Van Vyck Expwy –
5:30-10:30 AM**

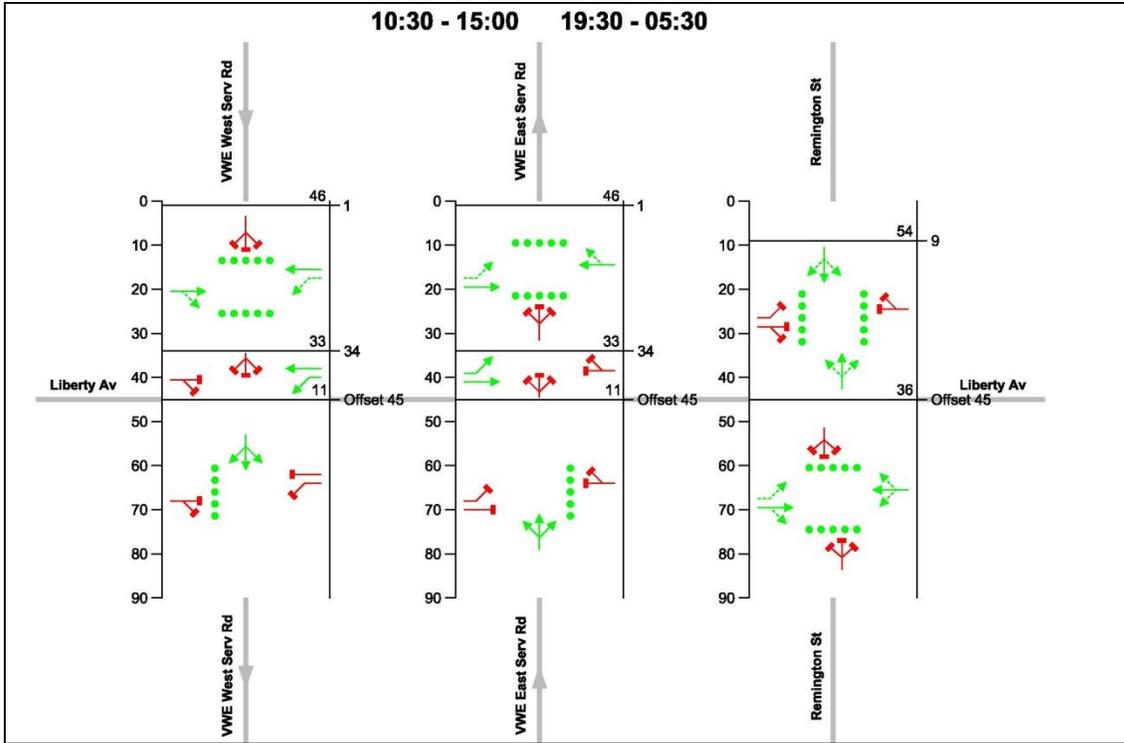


Figure 30: Previous Signal Timing at Liberty Avenue near Van Vyck Expwy – 5:30-10:30 AM and 19:30 PM – 5:30 AM

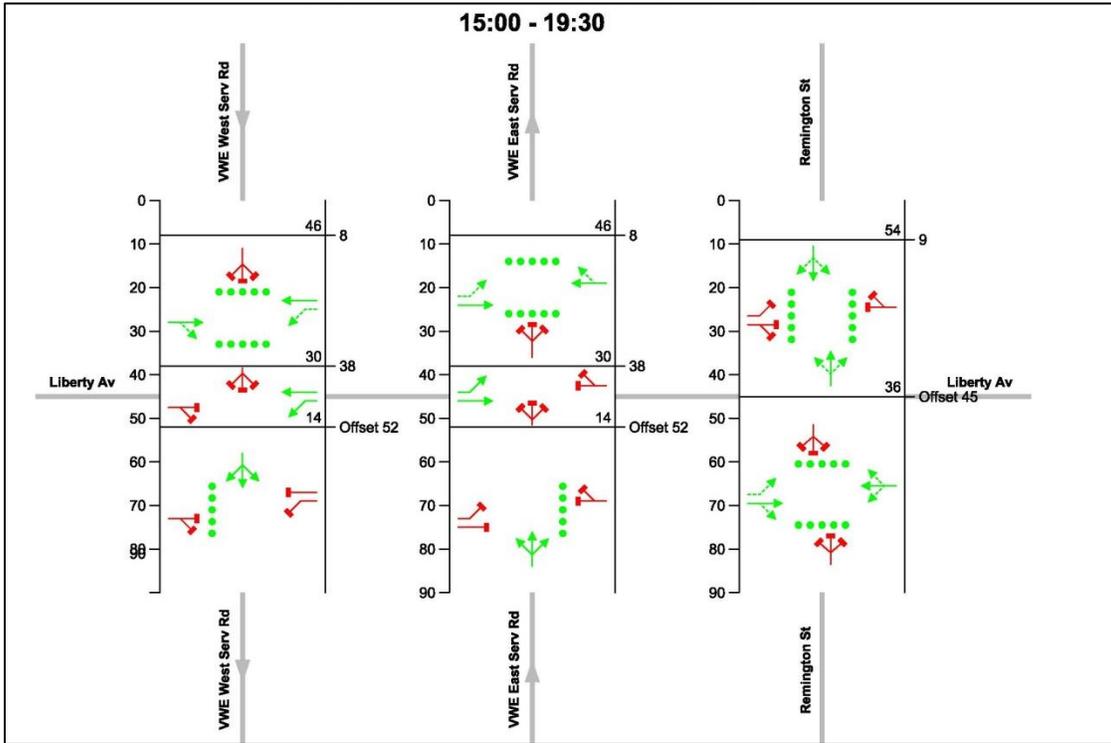


Figure 31: Previous Signal Timing at Liberty Avenue near Van Vyck Expwy – 15:30-19:30 PM

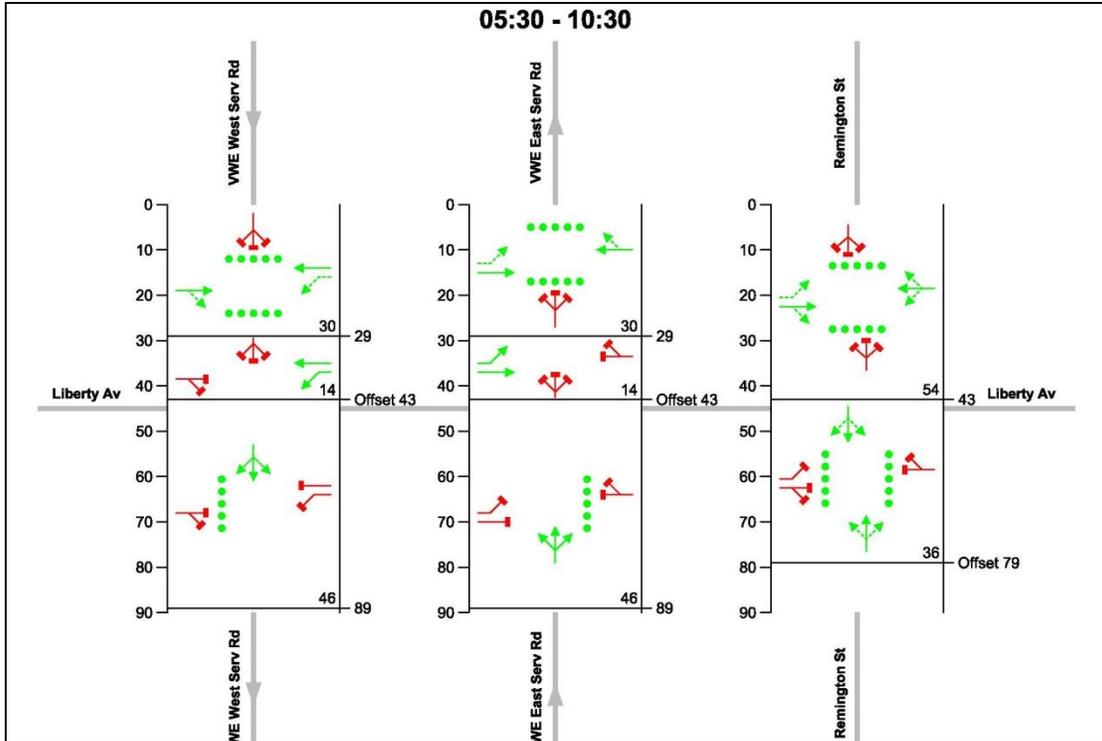


Figure 32: Improved Signal Timing at Liberty Avenue near Van Vyck Expwy – 5:30-10:30AM

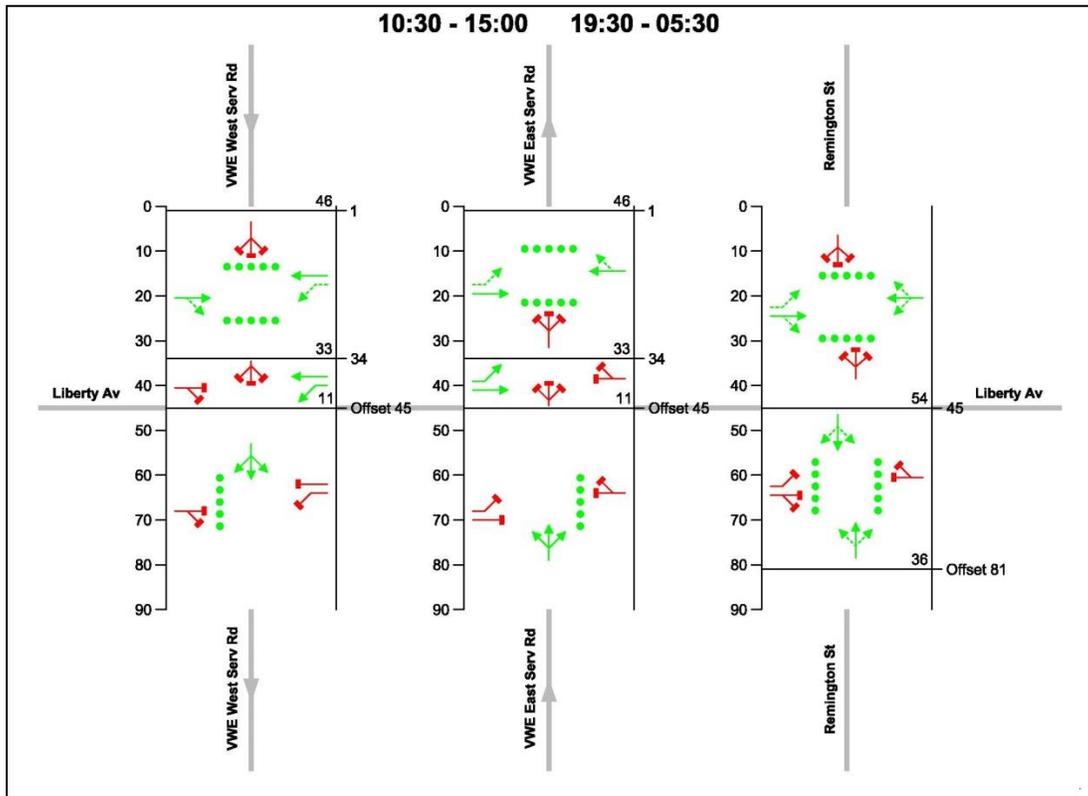


Figure 33: Improved Signal Timing at Liberty Avenue near Van Vyck Expwy – 5:30-10:30 AM and 19:30PM – 5:30AM

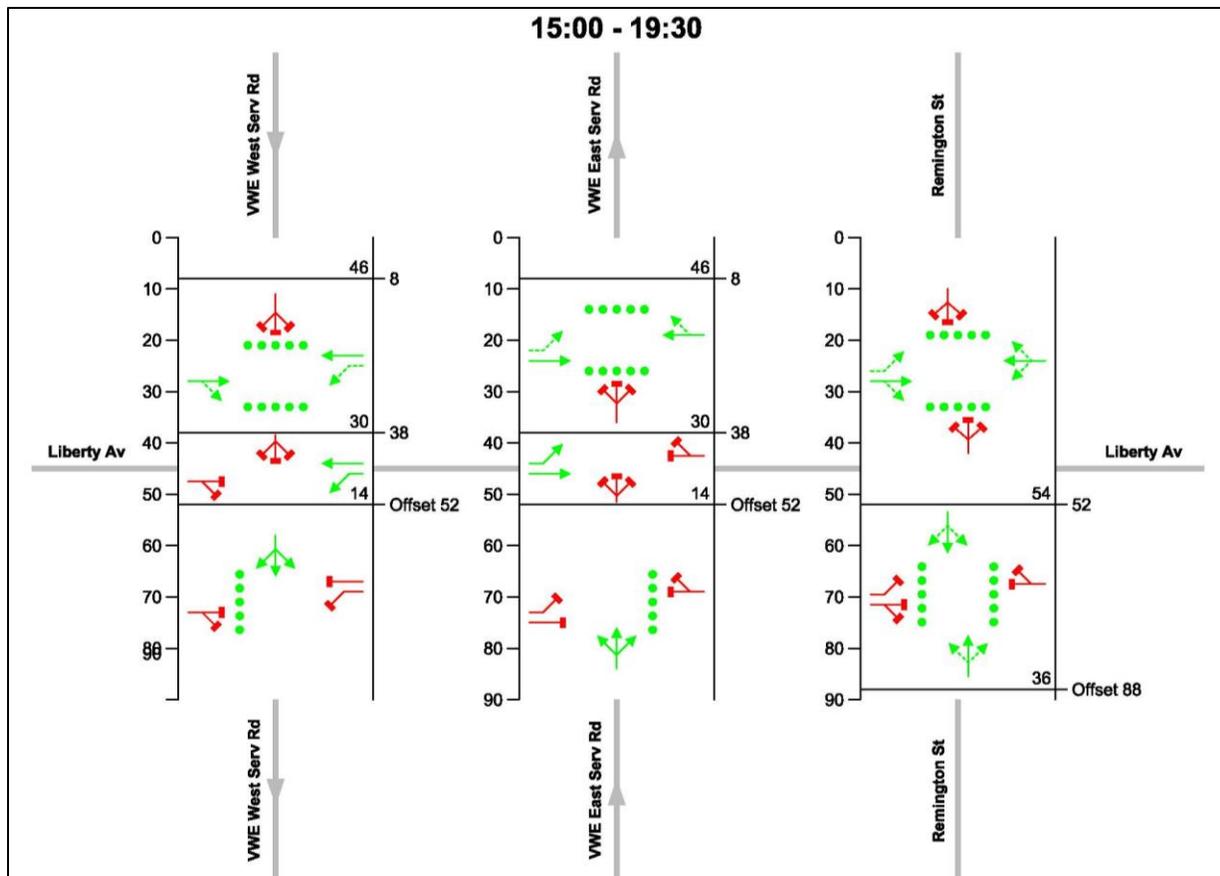


Figure 34: Improved Signal Timing at Liberty Avenue near Van Wyck Expwy – 15:30-19:30PM

5.3 LOADING/UNLOADING ZONES

As described in Section XX a comprehensive study has been conducted using time-lapse cameras to determine curbside activities and truck loading and unloading operations at multiple blocks along Liberty Avenue. Based on time-lapse observation of the ten studied delivery windows are recommended at 5 locations, **Table 10**.

TABLE 10: SIGNAL TIMING AND OFFSET IMPROVEMENTS

Location	Cross Streets	Recommendation	Time Frame	Length
#1	96 th and 97 th St	Install a Delivery Window on North Side	7AM – 1PM	55'
#2	108 th and 109 th St	Install a Delivery Window on South Side	7AM – 1PM	55'
#3	110 th and 111 th St	Not possible to analyze	-	-
#4	112 th and 113 th St	No need for a Delivery Window	-	-
#5	113 th and 114 th St	No need for a Delivery Window	-	-
#6	117 th and 118 th St	Install a Delivery Window on North Side	8AM – 1PM	55'
#7	118 th and Lefferts Blvd	No need for a Delivery Window	-	-
#8	Lefferts Blvd and 120 th St	No need for a Delivery Window	-	-
#9	122 nd and 123 rd St	Install a Delivery Window on South Side	8AM – 1PM	55'
#10	124 th and 125 th St	Install a Delivery Window on Both North and South Side	8AM – 1PM	55'



Figure 35: Location No.1 Delivery Window



Photograph XX: Location 1 – Time Lapse Photograph

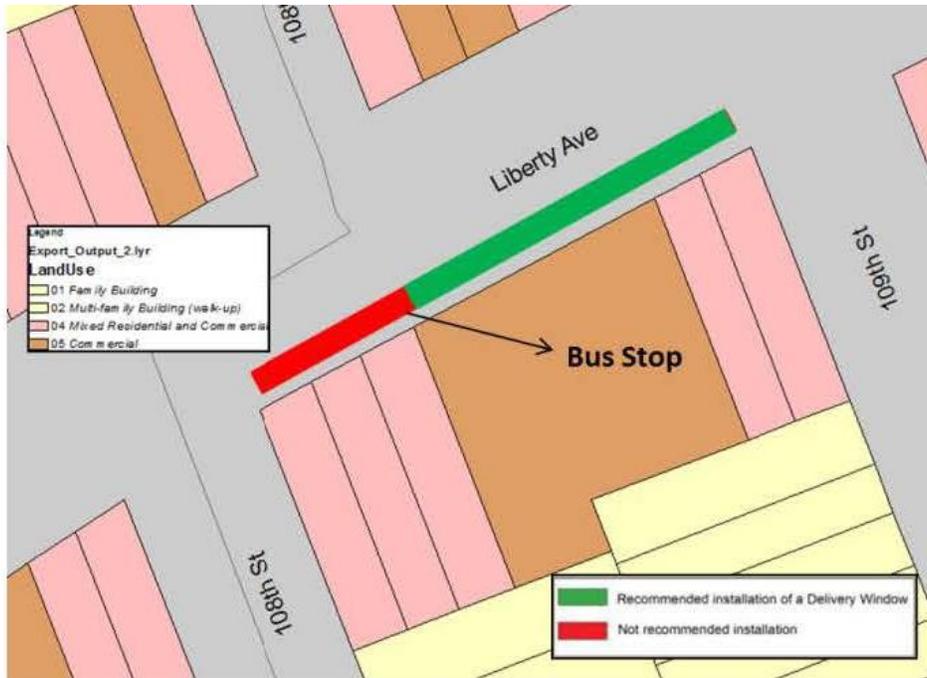


Figure 36: Location No.2 Delivery Window



Photograph XX: Location 2 – Time Lapse Photograph



Figure 37: Location No.6 Delivery Window



Photograph XX: Location 6 – Time Lapse Photograph

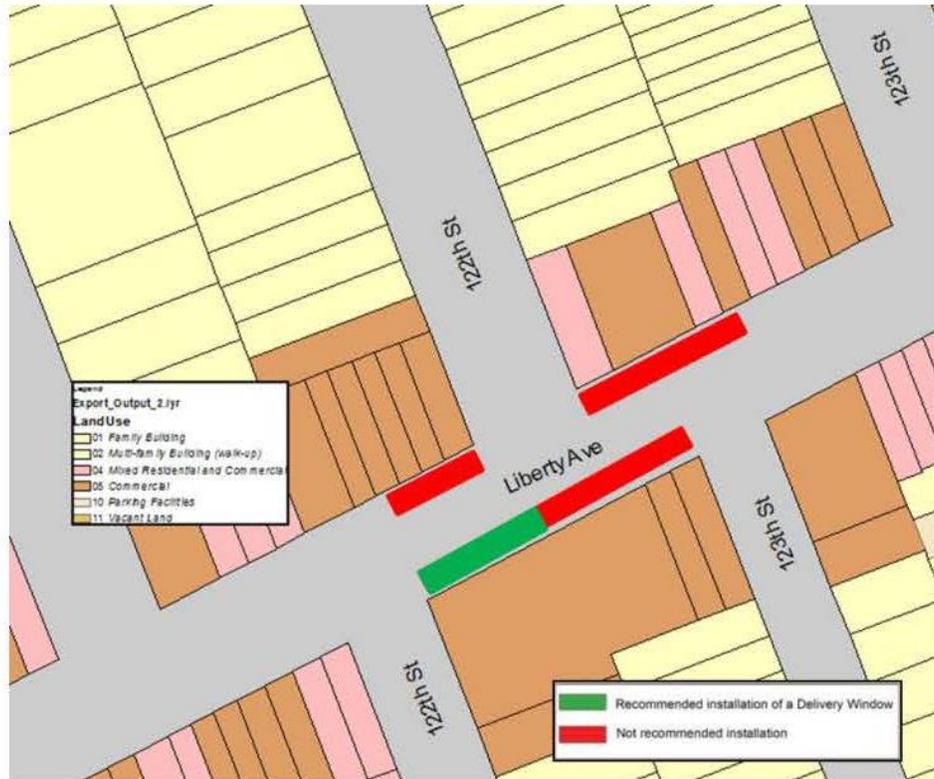


Figure 38: Location No.9 Delivery Window



Photograph XX: Location 9 – Time Lapse Photograph



Figure 39: Location No.10 Delivery Window



Photograph XX: Location 10 – Time Lapse Photograph

5.4 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.

5.4.1 LIBERTY AVENUE AND 133RD STREET

This is a complicated six-legged intersection with a small and substandard triangular concrete island at the eastern leg of the intersection, Figure 40. The north-south crossing is long and somewhat offset. Also, crosswalk across the south leg of the 133rd Street is long. It is recommended that the concrete island is expanded to create additional pedestrian space and shorten the pedestrian crossing. In addition, it is recommended that a curb extension is constructed at the southwest corner of the intersection to shorten the crossing distance.

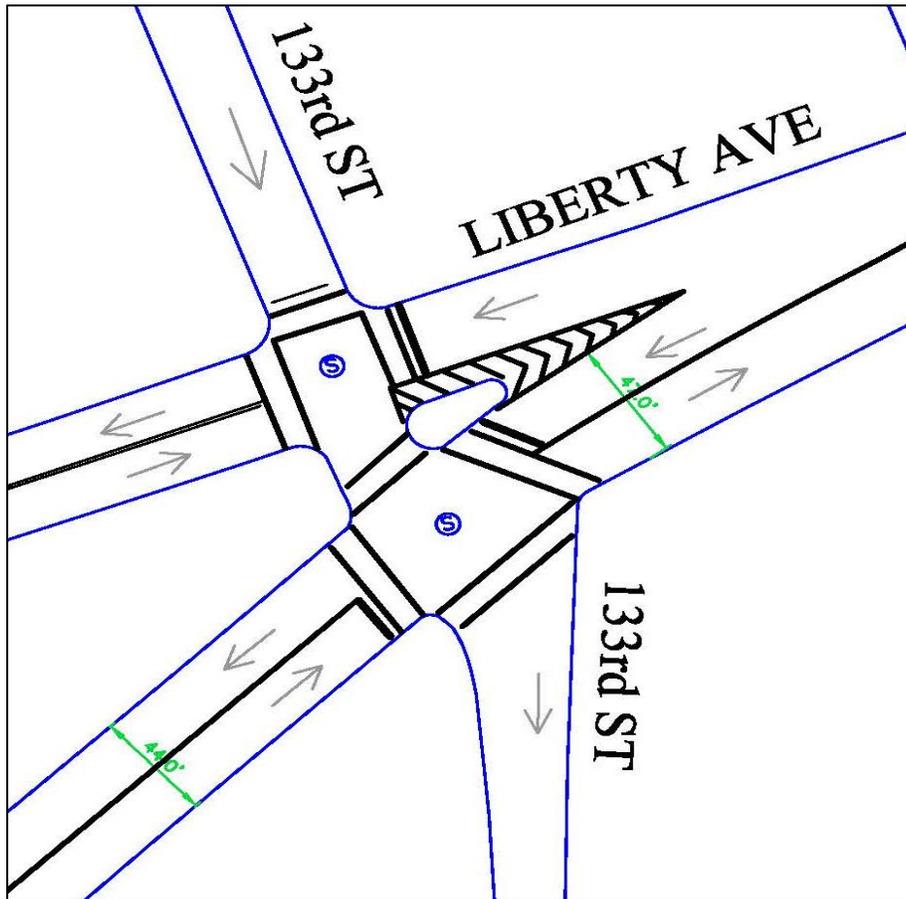


Figure 40: Liberty Avenue and 133rd Street Existing Conditions

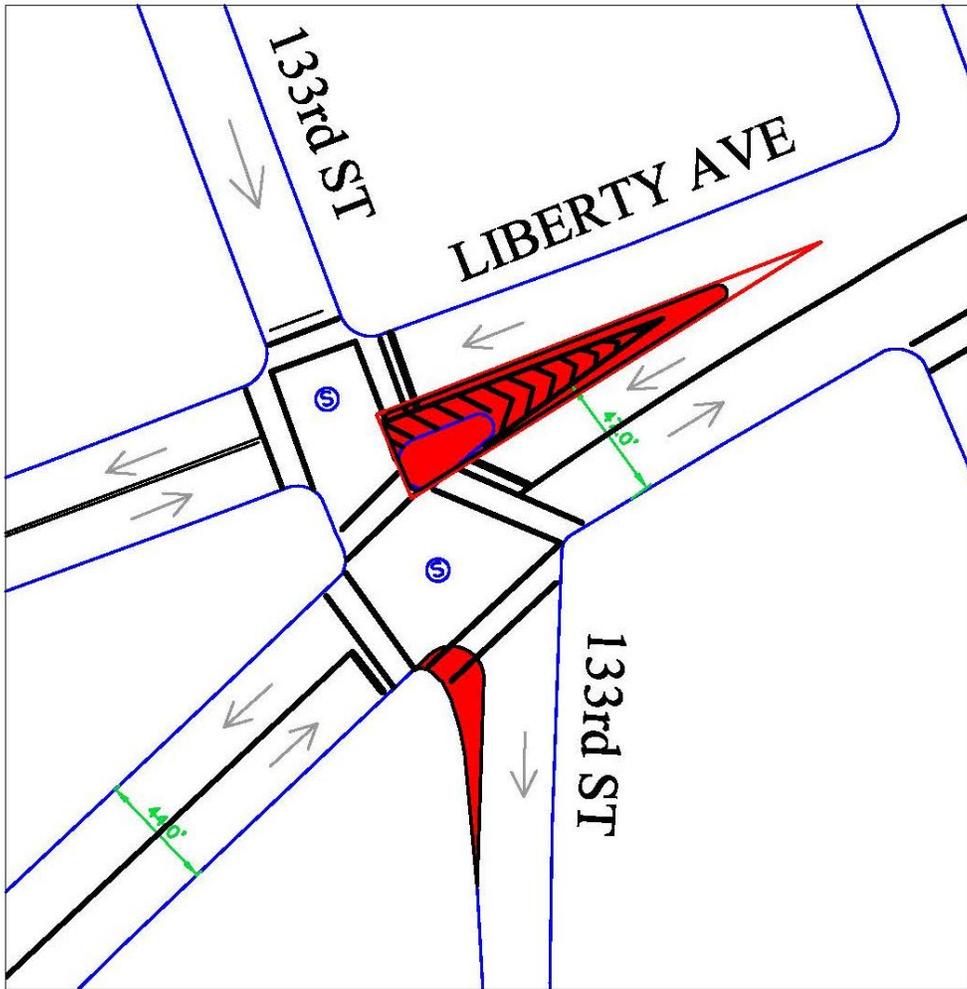


Figure 41: Liberty Avenue and 133rd Street Proposed Conditions

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 11 and Figures 42 and 43 present a comparison of projected travel speeds on the entire study corridor of Liberty Avenue between Woodhaven Boulevard and Van Wyck Expressway Service Road. 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 20.2%, 9.6%, 15.6% and 4.5%, respectively. In westbound direction, the projected improvements are 14.6%, 11.3%, 8.8% and 14.3%, respectively.

TABLE 11: PROJECTED TRAVEL SPEEDS ON LIBERTY AVENUE

	Eastbound			Westbound		
	2020 W/O Improvement	2020 With Improvement	Change	2020 W/O Improvement	2020 With Improvement	Change
	(mph)		%	(mph)		%
Weekday AM	10.4	12.5	20.2%	8.9	10.2	14.6%
Weekday MD	13.5	14.8	9.6%	12.4	13.8	11.3%
Weekday PM	9.0	10.4	15.6%	10.2	11.1	8.8%
Saturday MD	8.9	9.3	4.5%	9.8	11.2	14.3%

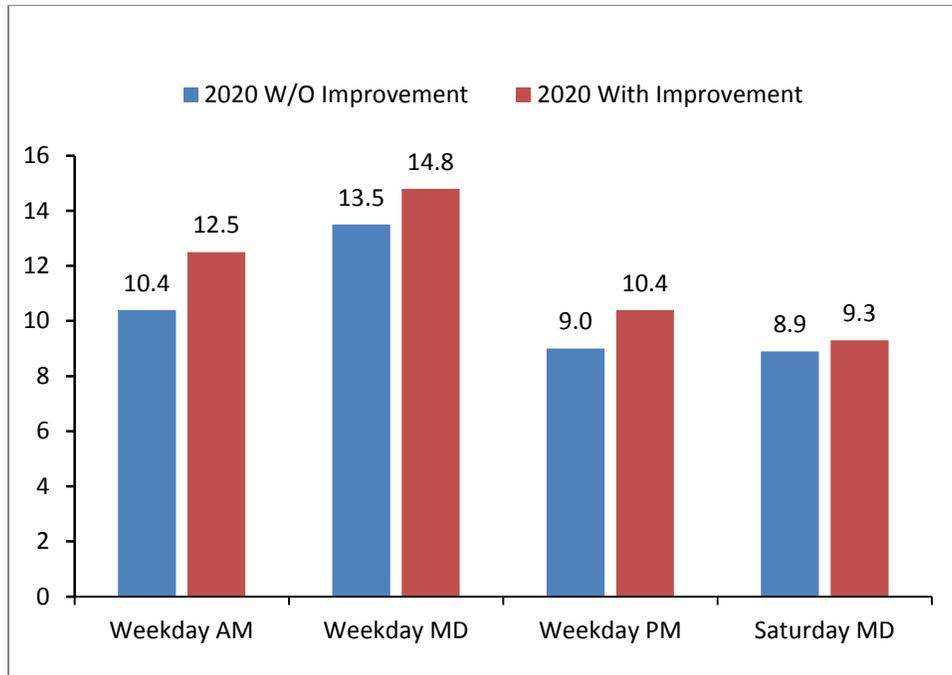


Figure 42: Eastbound Peak Hour Travel Speeds for Liberty Avenue

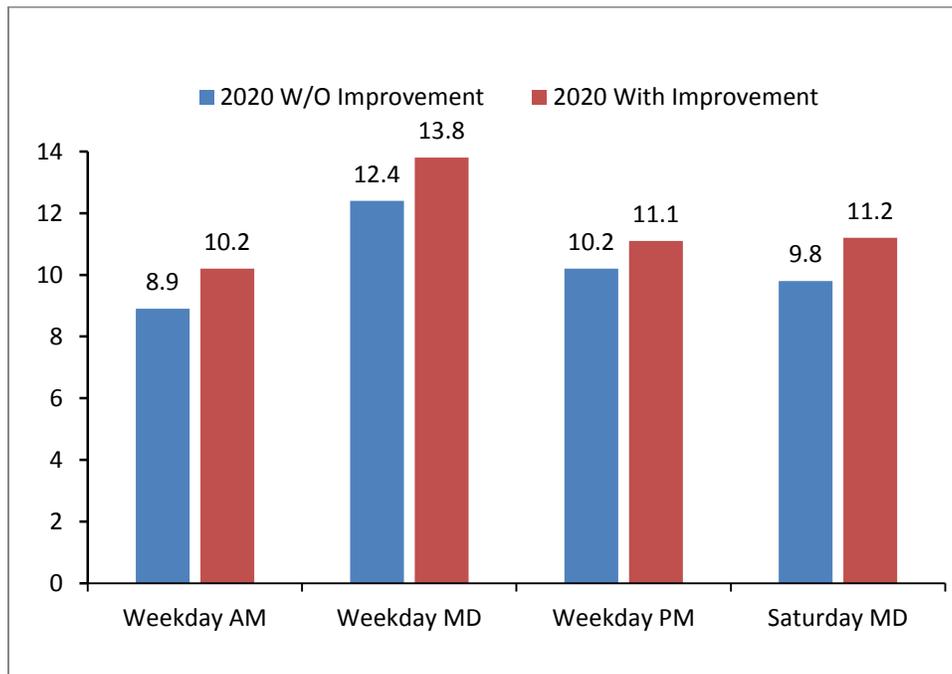


Figure 43: Westbound Peak Hour Travel Speeds for Liberty Avenue

6.2 INTERSECTION LEVEL OF SERVICE

To further assess the improvements, Table 12 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. As indicated in the Table, re-allocation of green time and signal progression changes will improve overall operations and eliminate or improve level of service along the corridor.

TABLE 12: FUTURE CONDITION WITH IMPROVEMENTS LEVEL OF SERVICE

Intersection Approach ¹	M _v , m ²	Weekday AM Peak						Weekday PM Peak						Saturday Midday Peak						
		Future W/O Improv.			Future with Improv.			No Build PM Peak			Build PM Peak			No Build Saturday MD Peak			Build Saturday MD 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	v/c Ratio	Avg Delay	LOS	v/c Ratio	Avg Delay	LOS	
1. Liberty Avenue and Rockaway Blvd/96th Street																				
EB - Rockaway Blvd	L	0.43	35.2	D	0.34	33.0	C	0.59	15.7	B	0.53	13.8	B	1.15	142.3	F	0.86	56.7	E	
	T	0.19	0.4	A	0.16	0.1	A	0.32	8.5	A	0.30	8.3	A	0.31	31.3	C	0.23	23.7	C	
WB - Rockaway Blvd	T	0.45	33.8	C	0.42	33.1	C	0.38	32.5	C	0.35	32.0	C	0.45	33.7	C	0.35	26.7	C	
NB - 96th Street	LTR	0.45	43.0	D	0.52	50.1	D	0.33	40.2	D	0.30	39.7	D	0.53	45.1	D	0.62	53.6	D	
SB - Liberty Avenue	TR	1.07	92.4	F	0.87	45.3	D	0.70	41.3	D	0.65	39.3	D	0.73	41.6	D	0.68	33.3	C	
Overall Intersection			46.6	D		31.3	C		23.0	C		22.1	C		53.9	D		36.0	D	
2. Liberty Avenue and 104th Street																				
EB - Liberty Avenue	TR	0.62	12.4	B	0.57	11.8	B	0.55	22.2	C	0.51	21.2	C	0.48	22.5	C	0.44	21.7	C	
WB - Liberty Avenue	LT	0.81	17.1	B	0.74	13.3	B	0.46	9.3	A	0.43	9.0	A	0.49	9.1	A	0.45	8.8	A	
SB - 104th Street	LTR	0.82	36.5	D	0.75	31.2	C	0.91	47.9	D	0.85	38.5	D	0.80	34.9	C	0.75	30.6	C	
Overall Intersection			20.4	C		17.3	B		27.2	C		23.5	C		22.1	C		20.3	C	
3. Liberty Avenue and 111th Street																				
EB - Liberty Avenue	LTR	0.57	13.6	B	0.65	18.5	B	0.55	13.4	B	0.50	12.8	B	0.66	15.9	B	0.76	27.7	C	
WB - Liberty Avenue	LTR	0.56	5.8	A	0.63	8.8	A	0.48	6.3	A	0.45	6.0	A	0.55	7.8	A	0.61	15.7	B	
NB - 111th Street	LTR	1.09	93.2	F	0.77	26.6	C	0.83	38.1	D	0.77	32.5	C	1.01	73.5	E	0.70	22.5	C	
SB - 111th Street	LTR	0.56	21.9	C	0.40	14.0	B	0.75	29.7	D	0.69	26.2	C	0.72	27.5	C	0.51	15.8	B	
Overall Intersection			0.00	36.5	D	0.00	17.6	B		21.7	C		19.3	B		31.3	C		21.0	C
4. Liberty Avenue and Lefferts Blvd																				
EB - Liberty Avenue	LTR	0.64	10.7	B	0.77	26.6	C	0.77	17.6	B	0.71	14.1	B	0.66	12.3	B	0.76	24.6	C	
WB - Liberty Avenue	LTR	0.61	14.0	B	0.74	21.9	C	0.75	20.5	C	0.69	17.5	B	0.70	14.3	B	0.81	21.2	C	
NB - Lefferts Blvd	LTR	0.84	34.2	C	0.77	27.7	C	0.78	30.2	C	0.72	25.8	C	0.72	26.2	C	0.69	24.8	C	
SB - Lefferts Blvd	LTR	0.58	19.5	B	0.53	18.1	B	0.84	36.1	D	0.78	29.8	C	0.88	43.7	D	0.85	36.7	D	
Overall Intersection			20.7	C		24.2	C		26.2	C		21.9	C		24.6	C		27.2	C	
5. Liberty Avenue and 121st Street																				
EB - Liberty Avenue	T	0.34	2.5	A	0.31	2.8	A	0.43	2.7	A	0.40	2.6	A	0.41	2.8	A	0.38	2.9	A	
WB - Liberty Avenue	T	0.37	9.7	A	0.34	9.6	A	0.41	10.0	A	0.38	9.8	A	0.52	9.6	A	0.48	9.3	A	
SB - 121st Street	L	0.08	15.0	B	0.08	14.9	B	0.13	15.5	B	0.12	15.3	B	0.17	15.8	B	0.15	15.7	B	
NB - 121st Street	R	0.21	16.5	B	0.19	16.3	B	0.59	24.4	C	0.55	23.0	C	0.64	29.2	C	0.59	26.5	C	
Overall Intersection			8.0	A		8.0	A		11.1	B		10.6	B		11.6	B		11.0	B	
6. Liberty Avenue and 133rd Street																				
EB - Liberty Avenue	TR	0.93	38.40	D	0.86	27.90	C	0.86	28.80	C	0.80	23.00	C	0.87	31.6	C	0.81	25.2	C	
WB - Liberty Avenue	LT	0.46	19.00	B	0.42	18.30	B	0.70	25.20	C	0.64	23.00	C	1.06	83.8	F	0.92	48.1	D	
NB - 133rd Street	LR	0.16	16.20	B	0.15	16.00	B	0.10	15.40	B	0.10	15.30	B	0.04	14.8	B	0.04	14.7	B	
SB - 133rd Street	L	0.47	25.60	C	0.43	24.60	C	0.61	29.00	C	0.57	27.50	C	0.52	26.4	C	0.48	25.3	C	
SB - 133rd Street	TR	0.12	11.80	B	0.11	11.70	B	0.11	11.40	B	0.10	11.40	B	0.15	11.9	B	0.14	11.8	B	
Overall Intersection			27.80	C		22.80	C		25.90	C		22.80	C		48.9	D		32.7	C	
7. Liberty Avenue and Van Wyck SB Service Road																				
EB - Liberty Avenue	TR	1.04	101.4	F	0.58	36.4	D	1.05	109.3	F	0.63	84.7	F	0.86	96.1	F	0.57	41.3	D	
WB - Liberty Avenue	L	0.83	21.3	C	0.48	7.2	A	0.95	32.9	C	0.58	9.5	A	1.08	76.0	E	0.64	15.0	B	
WB - Liberty Avenue	T	0.62	4.7	A	0.39	2.2	A	0.70	8.5	A	0.41	3.2	A	0.80	46.2	D	0.48	14.5	B	
SB - Van Wyck Service Rd	LTR	0.49	18.3	B	0.74	33.9	C	0.62	20.3	C	0.88	39.0	D	0.61	20.2	C	0.80	33.4	C	
Overall Intersection			44.0	D		26.7	C		0.00	44.2	D		42.8	D		50.7	D		29.6	C
8. Liberty Avenue and Van Wyck NB Service Road																				
EB - Liberty Avenue	L	1.09	98.1	F	0.91	66.9	E	1.00	65.7	E	0.94	74.5	E	1.13	108.8	F	0.61	18.6	B	
EB - Liberty Avenue	T	0.80	21.2	C	0.77	30.7	C	0.61	11.0	B	0.54	17.6	B	0.64	23.3	C	0.42	15.2	B	
WB - Liberty Avenue	TR	1.07	84.9	F	0.98	60.7	E	1.04	81.1	F	0.96	55.8	E	0.96	65.6	E	0.76	31.0	C	
NB - Van Wyck Service Rd	LTR	1.03	52.9	D	0.95	34.2	C	1.10	77.1	F	1.02	49.6	D	0.49	18.3	B	0.61	26.6	C	
Overall Intersection			56.9	E		41.0	D		67.5	E		47.4	D		41.8	D		24.5	C	

6.3 AIR QUALITY

Table 13, Figures 44 through 46 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 7.6% to 17.8%, depending on type of emission and peak hour. The highest rates of decrease of hazardous emissions are projected to occur during the weekday Saturday MD peak hour at approximately 17.8%.

TABLE 13: FUTURE CONDITION WITH IMPROVEMENTS EMISSIONS

	Carbon Monoxide (CO)			Oxides of Nitrogen (NOX)			Volatile Organic Compounds (VOC)		
	Without Improvement	With Improvement	% Change	Without Improvement	With Improvement	% Change	Without Improvement	With Improvement	% Change
AM	13.2	11.0	-16.9%	2.6	2.2	-16.5%	3.1	2.6	-15.1%
PM	13.5	12.5	-7.6%	2.6	2.2	-16.4%	3.1	2.7	-15.5%
Saturday	11.5	10.5	-9.1%	2.2	2.0	-13.3%	2.7	2.2	-17.8%

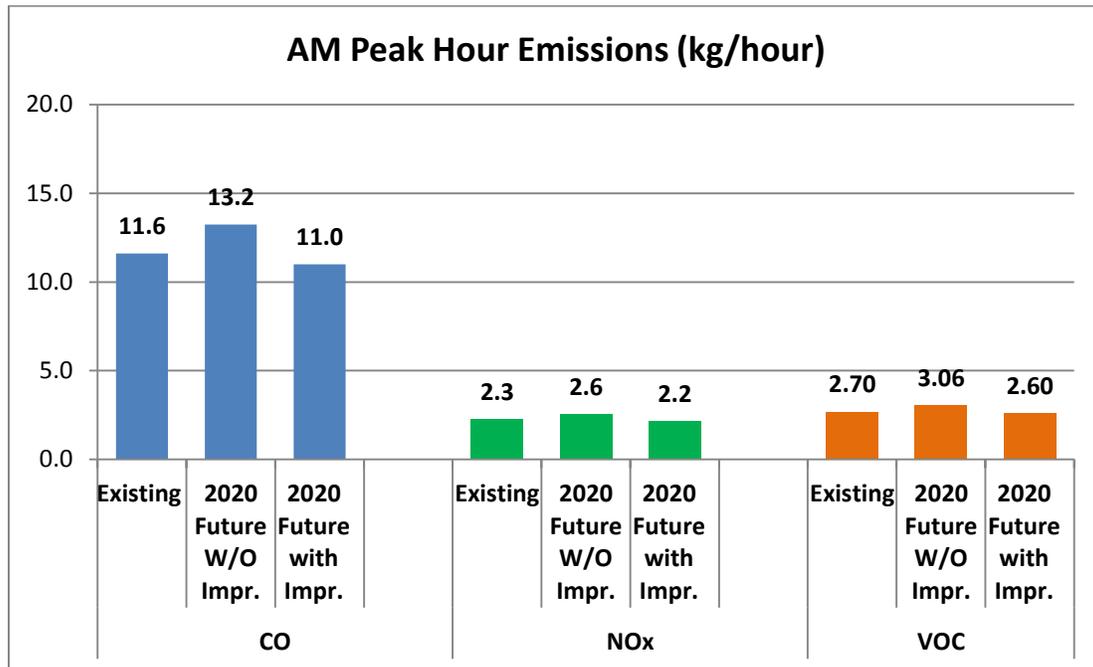


Figure 44: Emissions Reduction in the Weekday AM Peak Hour

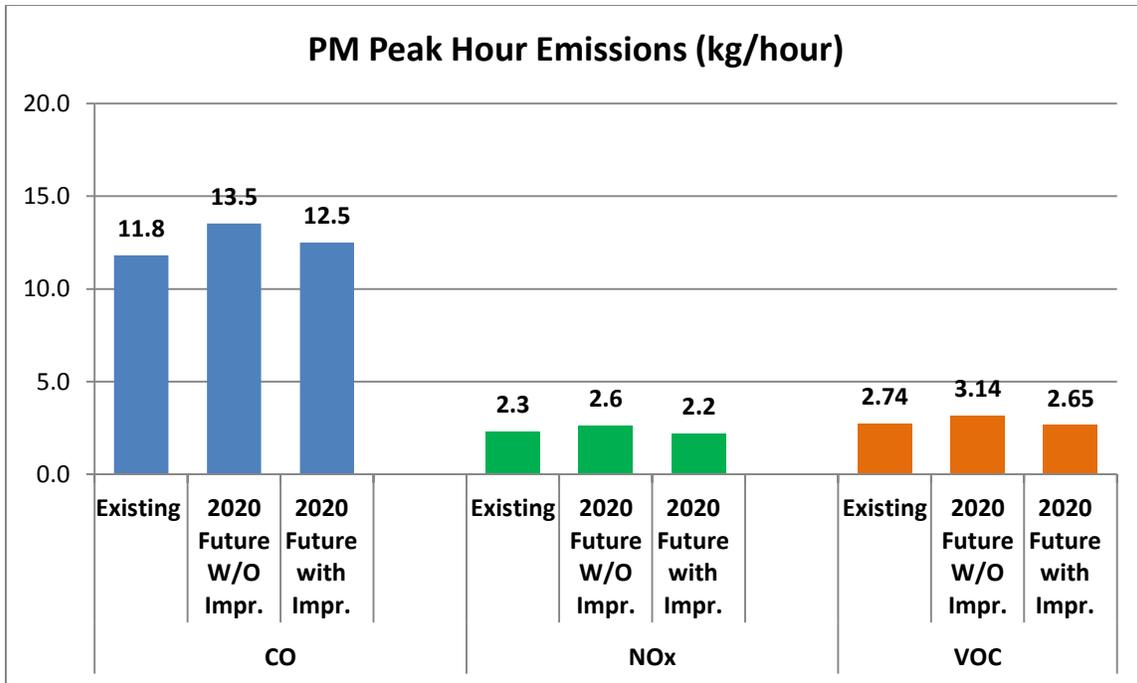


Figure 45: Emissions Reduction in the Weekday PM Peak Hour

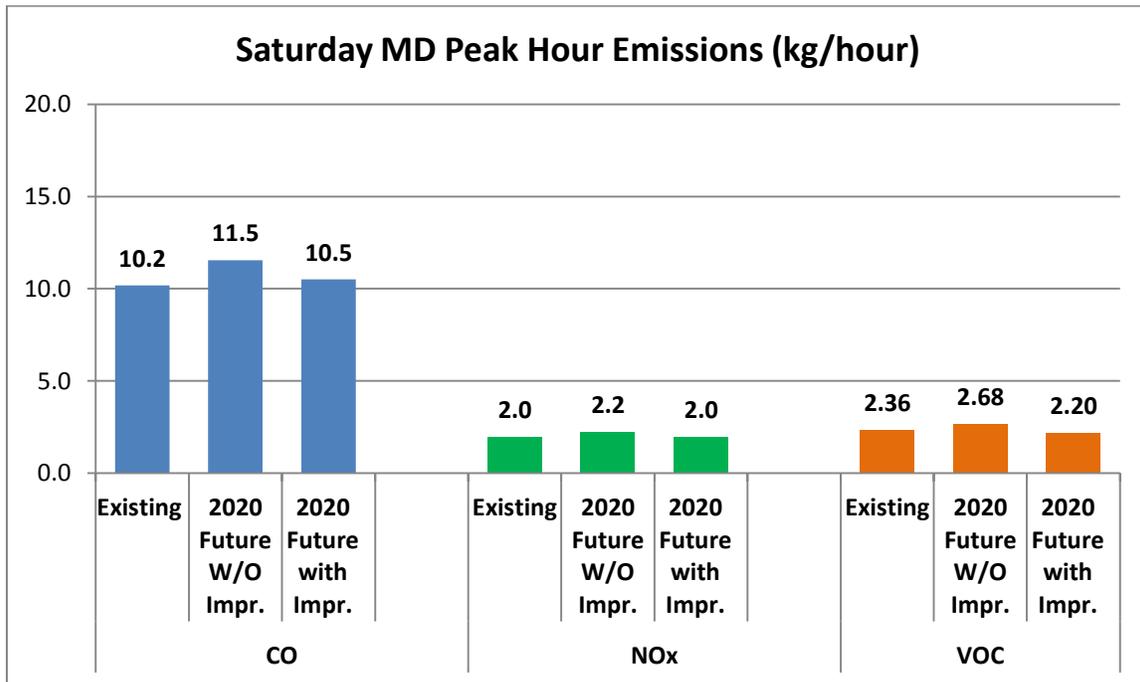


Figure 46: Emissions Reduction in the Saturday MD Peak Hour